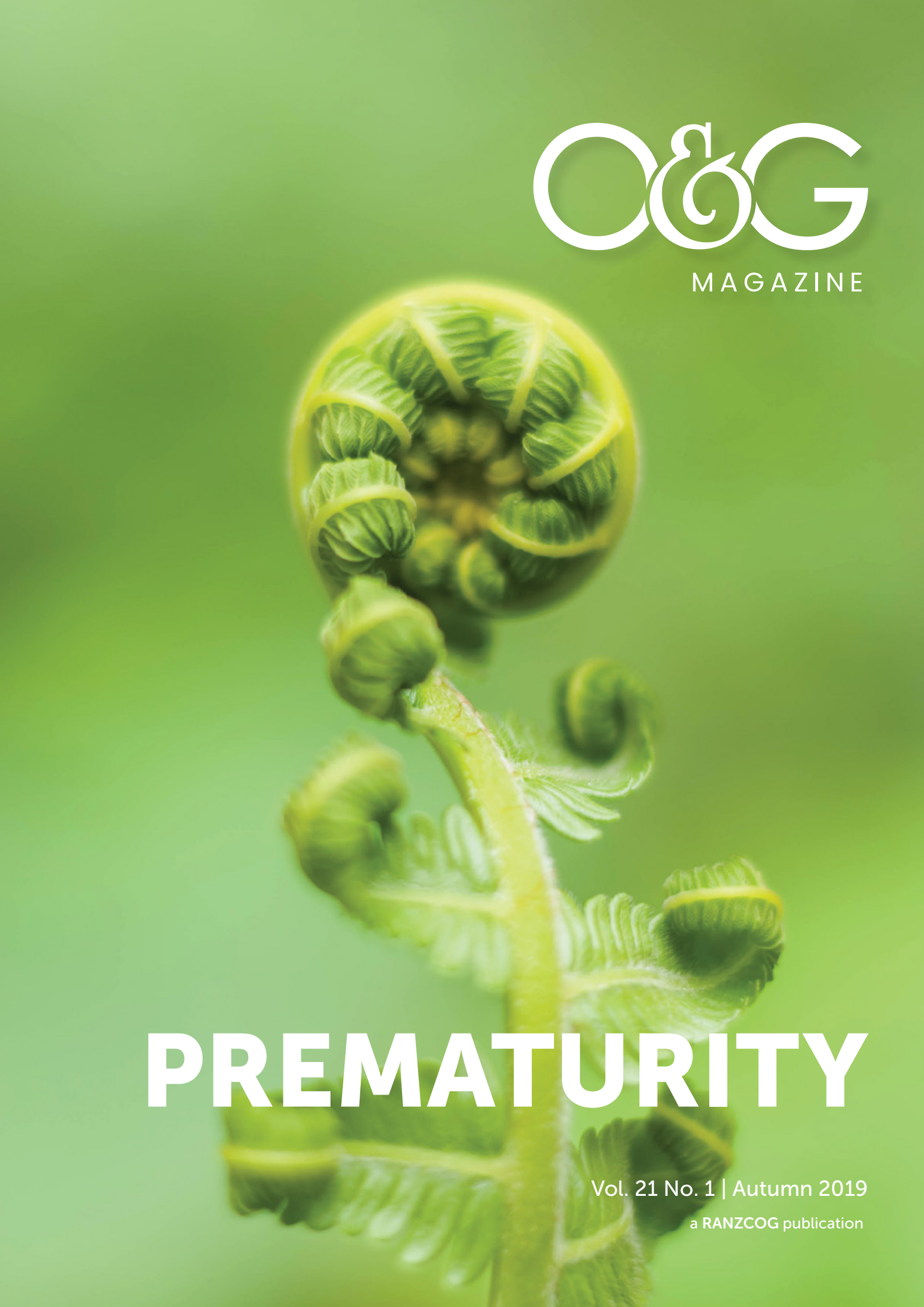

O&G MAGAZINE

PREMATURITY

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From the President

Dr Vijay Roach
President

This issue of *O&G Magazine* concentrates on the topic of preterm birth, an obstetric and neonatal circumstance that remains a leading cause of neonatal morbidity and mortality. The impact on the neonate, parents and the medical system is significant, affecting physical and emotional health and imposing a huge financial and workforce burden on society. The causes are multifactorial and, mostly, unknown. The quest to understand the aetiology and develop screening, diagnostic and treatment strategies is covered in depth in this issue and I would like to express my admiration and appreciation to the authors, researchers and clinicians who continue to pursue this obstetric Holy Grail.

After a wonderful summer of beaches, books, movies and time relaxing, Australia and New Zealand return to work! The College enjoyed a brief respite and the staff, Board and President are now back in full swing. The year ahead will be a busy one with business as usual – training, exams, CPD, some necessary compliance and revision; namely, AMC accreditation, continuing the implementation of the new Cervical Screening Program with the National Cervical Screening Register (NCSR) and an extensive review of the hospital training accreditation system. There are also some exciting new opportunities, with RANZCOG awarded a contract by the Department of Health to develop an Australian clinical practice guideline for the diagnosis and management of endometriosis in line with the National Action Plan for Endometriosis 2018. It is anticipated that the project will be for a duration of two years and the funding received for the project is $457,600.

In 2021, Australia and New Zealand will host the world at the FIGO conference in Sydney. The local organising committee has been appointed and Immediate Past President, Professor Steve Robson, has accepted the role of Chair. We met with FIGO in Sydney, toured the International Convention Centre and had preliminary discussions about the scientific and social program. The aim is to attract 7000 delegates to Sydney, an opportunity for RANZCOG to host our colleagues, showcase our leading clinical and research abilities and discuss our challenges, with a focus on Indigenous and Pacific region health. The College will be keeping our members up to date as we progress rapidly towards October 2021.

RANZCOG has always enjoyed excellent relationships with obstetric and gynaecological colleges and societies around the world. We are active members of AOFOG, the Asia & Oceania Federation of Obstetrics & Gynaecology. In this spirit, the RANZCOG Board has agreed to sign a memorandum of understanding (MoU) with Kolegium Obstetri Dan Ginekologi Indonesia (Indonesian College of Obstetrics & Gynecology) in Bali in May 2019. To our knowledge, this is the first MoU between our two Colleges. This offers RANZCOG many opportunities to work with our closest neighbour and, I hope, will be the beginning of renewed partnerships and friendship with other countries in the region. I am indebted to Prof John Svigos for facilitating the dialogue with the Indonesians and bringing the MoU to fruition.

For most of you, your daily work does not involve meetings with government, local and international meetings with stakeholders and consideration of what may seem esoteric issues. Your work is in research and writing papers, teaching medical students and training registrars, caring for women and their families with skill and compassion. As members of RANZCOG, you are also part of a broader picture, not necessarily a more important one, but one where we have the opportunity to implement change on a macro scale. I encourage you to remain engaged with the College's work and take ownership. Be confident that your opinions and contribution are highly sought and valued.

Finally, in 2019, we welcome our incoming CEO, Vase Jovanoska, and wish her success and happiness as she joins the RANZCOG family. I would like to publicly express my gratitude to Brendan Grabau, who has guided the College as Acting CEO in the interval between appointments. To all of you, Fellows, Diplomates, trainees, PVOGS and staff, my thanks for your support as this new President starts to lose his training wheels and I look forward to working closely with you in the year ahead.

From the CEO

Brendan Grabau
Acting CEO
Director, Education and Training

I write this piece as the acting CEO; Alana Killen concluded her term as CEO at Christmas time. I wish to take this opportunity to thank Alana for her dedication and hard work at the College. We look forward to welcoming our new CEO, Vase Jovanoska, who will formally commence in the role in late February.

Facilities and buildings

The Queensland Regional Office has relocated to Suite 2, Level 2, 56 Little Edward Street, Spring Hill. Sylvia Williamson and Laura Grummitt can assist with any enquiries. Likewise, the Western Australian Regional Office has relocated to 34 Harrogate Street, West Leederville. Carly Moorfield will assist with any enquiries. A business case is currently well underway for the redevelopment of the College House site. It is anticipated that by mid-year, members will be able to view the plans and provide feedback for the design.

RANZCOG Women's Health Foundation

The new RANZCOG Women's Health Foundation Board membership has been established. Planning has commenced for 2019, and the finalisation of the Foundation's strategic plan will be available by March. On 31 January 2019, applications opened for the Liam and Frankie Davison Award for literary excellence in women's health.

Patient Information Pamphlets

The College has switched print providers for the sale and distribution of RANZCOG Patient Information Pamphlets. Following user testing, a new and improved print portal went live in December. The transition to the new portal has been seamless.

FSEP

The program is continuing to grow with 300 sessions already booked for 2019. An Educators Day was held on 25 January to review and prepare educator presentations, assessments and program content.

Endometriosis project

RANZCOG was awarded a contract by the Department of Health to develop an Australian clinical practice guideline for the diagnosis and management of endometriosis in line with the National Action Plan for Endometriosis 2018. It is anticipated that the project will run for two years. RANZCOG formalised the contract with DOH on 12 December 2018, and has already begun the ground work for the roll out of the project. An Expert Working group will be established to oversee the development of the guideline. The DOH has also provided a grant for the College to develop endometriosis online learning resources for primary care providers to raise awareness and improve the diagnosis and management of endometriosis, including the development of an online screening tool to assist practitioners in identifying the symptoms of endometriosis.

Training Support Unit

The TSU are developing a new workshop for trainees. The workshop, called Thrive, will be launched and delivered on 21 February in Melbourne. The series of workshops will be delivered to the regions over the course of 2019.

RANZCOG website

Substantial work is underway for improving the user experience on the RANZCOG website. The new website will include:

- Members-only content (authenticated via a single MyRANZCOG sign in). This addition revitalises member value as well as securing important assets.

- Forms are being converted to electronic versions where possible. This update has been utilised on the Trainee Classified listings and streamlines administration. The Specialist Employment list now also has a checkbox to highlight subspecialty positions.
- Prevocational Pathway (PVP) page, for prevocational doctors interested in a career in obstetrics and gynaecology, added to the site (www.ranzcog.edu.au/pvp).

Preparatory work is taking place to explore the site's capacity to house a payment gateway for Foundation donations. Work is scoping at this stage, and needs to be discussed further with finance and IT directorates before proceeding, but the addition may provide an uncomplicated and secure way to receive funds from non-members.

Events 2019

Annual Scientific Meeting

- 2018 ASM – Adelaide
  The post ASM accounts are being finalised. The budget is forecasting a surplus.
- 2019 ASM – Melbourne
  Arrangements for the 2019 ASM are progressing well. The ASM website went live in December and the Call for Abstracts opened on Tuesday 28 January.
- 2020 ASM – Hobart
  The Events Team conducted a site visit in December and booked the ASM venue for 2019, the Grand Chancellor Hobart.
- 2021 FIGO – Sydney

Of note, there is not scope to run Diplomates Days within the FIGO schedule. The events team will support the Regions to ensure that a range of Diplomates Days are available during 2021.

Equally, newly elevated Fellows will not be eligible for complimentary tickets, as they are at the ASM. The Events team will offer support at RSMs if an elevation ceremony is part of the program. Newly elevated Fellows may choose to wait until 2022, when the ASM program will include a Presentation Ceremony, and complimentary tickets will be available for new Fellows.

Roger Gabb

Roger Gabb was appointed as the inaugural Director of Education and Training at RANZCOG in 1986. He worked at the College for 10 years and implemented some major transformational changes to the College assessment processes, including the introduction of standardised criterion-referenced examinations, examiner selection and training, and the oral exam as it stands. Originally trained as a vet, Roger also held a PhD in reproductive physiology and master's degrees in education and public health. On his retirement from the College, he was made an Honorary Fellow (eundem) of RANZCOG. Dr Gabb passed away on 20 December after a brief illness. A memorial was held for him in early January and was well attended by College members, including former president Dr John Campbell and former Council members Prof Caroline de Costa and A/Prof Robert Bryce. We wish to acknowledge his great contribution to the College and express our sympathies to Roger's family. An obituary, written by Dr John Campbell, can be found on page 95.

LEADERS IN FOCUS

Dr Kirsten Connan
MBBS(Hons), FRANZCOG, DDU
MMedEd (Gender and Leadership)

This feature sees Dr Kirsten Connan in conversation with RANZCOG members in a broad range of leadership positions. We hope you find this an interesting and inspiring read.

Join the conversation on Twitter
#CelebratingLeadership @RANZCOG @connankf

Dr Kiarna Brown FRANZCOG

Dr Kiarna Brown is staff specialist and RANZCOG training supervisor at Royal Darwin Hospital and a VMO gynaecologist at Darwin Private Hospital. She is the Deputy Chair of RANZCOG's Aboriginal and Torres Strait Islander Women's Health Committee and one of the NT Clinical Leads for the National Preterm Birth Alliance.

Dr Brown was born and bred in Darwin, but her journey from schoolgirl to medical specialist has taken her around much of Australia. It took her from her home in Darwin to boarding school in Ballarat and then off to Perth at 19 for an Aboriginal pre-medicine program that was followed by a medical degree.

Her first job as a doctor was in Townsville, followed with obstetrics and gynaecology training further south in Queensland, before eventually returning back to Darwin.

Although from Darwin, her Indigenous heritage is more widespread. Her grandmother's heritage is from Pine Creek in the Northern Territory and her grandfather from the Torres Strait Islands, with family spanning to Cape York.

Dr Brown gave a plenary address on Closing the Gap in maternal and infant mortality at the 2018 RANZCOG ASM. Her interview with Croakey News following this address can be found at www.youtube.com/watch?v=7ulDhsKeQ6U.

Why did you choose O&G and your career pathway?
O&G always excited me, and it was something I was drawn to early. I actually thought I'd be a GP obstetrician in regional Australia, but once I did the DRANZCOG I knew that I only wanted to do O&G. I've never been sorry that I chose this career path; every day is varied and there is still so much to learn.

What have been the highlights of your professional career?
Definitely coming back to my hometown to work! Clinically, I have a tough but very rewarding job. I love doing outreach to remote NT communities and I love the variety up here.

What have been the biggest challenges during your career?
There have been a few; getting through exams, moving frequently for training posts and the anxiety of wondering if my training had been adequate to become a good specialist. I've been lucky though, I had a supportive partner through my training, I made some great lifelong friends to study, work and socialise with, and I've had amazing mentors along the way.

Would you describe yourself as a leader, and why?
I would not readily describe myself as a leader. However, I am aware that owing to my background, my experiences and my clinical interests, I am called upon to provide leadership in particular areas.

I am one of five Aboriginal FRANZCOGs. I have a very strong passion and commitment to improving health outcomes for Aboriginal women, babies and communities. I am involved in groups and organisations that provide leadership in this area, so I guess that may make me a leader.

How did your leadership journey occur?
It was certainly an informal journey and something that's developing over time. I have had many wonderful formal and informal mentors. Towards the end of my training, I made a point of seeking attributes in colleagues that would shape the type of specialist I aimed to become, but I am always finding inspiration in other people.

What is one of your current leadership goals?
In my working lifetime I want to see some success in closing the health disparity gap that exists for Aboriginal and Torres Strait Islander people. I am determined to witness change!

What do you feel are essential characteristics as a leader?
Passion, knowledge, resilience and insight.

What do you feel have the biggest challenges/ barriers to your leadership journey?
Perhaps my own apprehension to describe myself as such.

What future leadership goals do you have?
I'm really excited to be part of the new Australian Preterm Birth Prevention Alliance. I truly believe that reducing preterm birth rates in Aboriginal and Torres Strait Islander communities is an achievable goal and something that will have significant impacts for short- and long-term health outcomes for communities.

What role do you feel RANZCOG should play with regards to leadership?
I think, for future strong leadership, RANZCOG needs to nurture leaders. We need to have good mentors. We need to have supportive staff. We need opportunities to grow and appropriate conditions in which to flourish.

What role do you feel RANZCOG should play with regards to closing the gap?
As the peak body that trains women's healthcare providers and advocates for women's health, RANZCOG plays a vital part in closing the gap.

Aboriginal and Torres Strait Islander women's health has been, and should always be, on RANZCOG's agenda. It should also be something that the whole membership feels motivated to contribute to change.

How do you balance your personal and professional life?
Often with great difficulty. There are many things I would love to do in my professional life, but in reality, I am a wife and a mother of two small children. I know that my children will be grown in a flash, so I am dedicated to being a good mother so that I can grow them as strong leaders for the future.

Dr Kiarna Brown.

What advice would you give to a trainee at the beginning of their career?
Don't be afraid to ask for help.

Do you have any regrets about your career?
The funny thing about our life journey is that we don't know what we don't know until we know it. I certainly could have studied harder, worked more and tried to obtain more qualifications. But in reality, I was a kid who came from a family of strugglers. I've exceeded any expectations most had of me (probably including myself) and that's good enough for me.

Do you feel that the College is heading in the right direction?
I certainly feel as though there are very passionate people in key leadership roles within our College. I think that the College objectives are inclusive of all women. I was involved in the National Women's Health Summit in 2018, which I thought was amazing and gave me really good insight into how RANZCOG can influence policy and change in women's health.

What would you tell your younger self if you had the chance to go back in time?
Take better care of your health.

What three words best describe your life?
Busy, busy and busy! Probably like most people.

A/Prof Rosalie Grivell FRANZCOG, CMFM, PhD

A/Prof Rosalie Grivell is the head of O&G at Flinders Medical Centre, Southern Adelaide Local Health Network, and academic head of O&G for Flinders University, Chair of RANZCOG's Research Assessment Subcommittee, and an Associate Editor for *ANZJOG*.

A/Prof Grivell has received a number of professional awards and scholarships, including the RANZCOG Research Foundation scholarship and NHMRC Early Career Fellowship (Australian Clinical Research Fellowship). She has numerous publications, speaks both nationally and internationally, and engages in regular undergraduate and postgraduate teaching and research supervision. A/Prof Grivell has also been a convenor for the Bali International Combined Clinical Meeting, held annually in Denpasar, Indonesia, and key member of the organising group since its inception in 2011.

A/Prof Grivell has recently completed two terms as a SA/NT Councillor, and in February 2019, completed a six-year term as SA/NT TAC Chair, having previously been the trainee rep and the ITP coordinator. In recognition of her significant contribution and commitment to the College, especially her support of the College's activities and initiatives related to training, A/Prof Grivell will be the very worthy recipient of the RANZCOG Distinguished Service Medal in March 2019!

A/Prof Rosalie Grivell.

Why did you choose O&G and your career pathway?
At medical school I did not consider O&G until my fifth-year clinical attachment at Flinders. I was lucky to have a great time in the department, particularly supported by a great mentor (Prof Judy Searle) who was a clinical academic. I really valued her teaching in the clinical arena and also her academic support. From that time onwards, I knew I was going to be a clinical academic. I have her to blame and thank!

What role has the College played in your career?
Aside from training towards FRANZCOG and CMFM, since my time as a senior registrar, I have held formal positions in the College. These roles have always challenged and pushed me to learn and develop both personally and professionally. The networking opportunities that have arisen from these positions have been crucial and added to my own professional development.

I particularly valued and learnt a lot from the relationships I have had with College staff members. So many people have worked for the College and imparted great knowledge, while both truly understanding and advocating for our trainees.

What role do you feel RANZCOG should play with regards to leadership?
I strongly believe that in the last two years of training, the College should increasingly focus on skills such a leadership development. These non-procedural skills are very underdone in our current training program and I feel this leaves our trainees under-equipped for their professional roles.

What do you see as the current challenges for RANZCOG?
The biggest challenge we have at the moment is the gender imbalance in our leadership. Changing this might be challenging, but is absolutely necessary.

What do you see as the current challenges for RANZCOG trainees?
Balancing part-time training with good quality training is still a real challenge. It is still a challenge to support trainees returning to work after extended leave, and I feel we could do this better. We also need to better mentor our trainees to see the 'big picture' of specialist practice, as well as improve our support with their transition into this role.

Would you describe yourself as a leader?
Until being in a formal leadership position, I would never have considered myself as a leader; more an advocate and supporter.

Now that I do hold a formal leadership position, I acknowledge that I continue to learn how best to lead on a daily basis.

How did your leadership journey occur?
I have had a very informal journey; I had no formal leadership training. Not ideal and something I feel RANZCOG could actively focus on, now and in the future. A formalised leadership journey with formal leadership training/mentorship would have served me better (and, I suspect, most trainees and specialists).

During my leadership journey, I have had a few fabulous leadership mentors and for that I am truly grateful! Disappointingly, this has been sometimes contrasted with negative influences.

How do you sustain your leadership drive?
Two aspects sustain my everyday leadership journey. Firstly, the belief that I am doing small things that will make a difference to the patients we serve, and, secondly, the encouragement and support of the multi-disciplinary leadership team I work with in the hospital setting.

What do you feel are essential characteristics of a leader?
Whatever your leadership style, I think it is important to see the 'big picture' and help others to see it too. I also think it's important to be able to develop individual relationships so all team members can be supported.

In O&G service provision, given the multi-disciplinary nature of our work, one of the most essential characteristics is recognising the value of your team and being a team player yourself.

What have been the highlights of your professional career?
Without a doubt, the professional relationships I have developed. Some have been medical colleagues, but most have been non-medical (although often healthcare) colleagues.

My biggest supporters (with a few exceptions) have been women of non-medical backgrounds (senior midwives and academics mostly) and I would not be where I am without them.

What have been the biggest challenges during your career?
I think my biggest challenge has been managing myself. Coping strategies have been different at various career stages, but it is always important to have a strong support network, both inside and outside of work.

During my leadership learning, developing and maintaining relationships with all of my professional supporters and colleagues has been what's kept me vaguely sane!

Have you seen workplace culture change during your career?
The aspect that I think has changed positively in many places is that of supporting trainees on a daily basis. Gone are the days (I hope) of trainees phoning

for help in the middle of the night and not being sure if someone would come and help them. This certainly happened to me, but I really hope it doesn't happen anymore.

A vastly female workforce at all levels (both trainee and now specialist) creates a very different workplace than a balanced one, and I think presents us with a challenge in how to make our workforce more balanced.

How do you balance your personal and professional life?
At the moment, not very well, but I am working on it!

What advice would you give to a trainee at the beginning of their career?
I would encourage all trainees to interact with the College as an institution and to make the most of the opportunities provided while in training. Possibilities are endless and often more than is apparent.

What three words best describe your life?
Grace, justice, determination.

Are you willing to be contacted by trainees for career advice/mentoring?
Yes, particularly in the area of clinical academia.

The Royal Australian and New Zealand College of Obstetricians and Gynaecologists

Excellence in Women's Health

Introducing the **New Fellow Resource Guide**

This handy guide contains everything New Fellows need to know as they take the next step in their journey. The Membership team will provide a copy to all New Fellows upon elevation.

For further information contact: **membership@ranzcog.edu.au**

www.ranzcog.edu.au/members

Editorial

Dr Fiona Langdon
FRANZCOG

This issue of *O&G Magazine* returns to a core topic of O&G management, that of premature birth – why it happens, how we manage it and the complications that can occur. It also touches on fascinating ground-breaking technologies we hope to see in the future that may revolutionise the management of those babies born on the cusp of viability and who face such a precarious course postnatally. We have a touching patient perspective of the daunting and overwhelming journey of being a 'NICU parent' from a couple who have brought about so much good from their months sat perched next to a tiny cot. I hope you enjoy the breadth of articles, whatever type of practice you are in, as we aimed to make this issue informative as well as interesting to ensure the messages contained within reach a wide audience.

Premature birth is the biggest issue facing the clinical practice of obstetricians. Prematurity is the leading cause of death and disability in children under five. It is still frighteningly common and the importance of trying to reduce the rate of preterm birth is being recognised by health policy makers with more research and health programs focusing on reducing the rate by identifying and treating preventable causes.

As clinicians, what we also need to recognise is the role we may play in the iatrogenic or non-medically indicated late preterm and early term deliveries. Data continue to emerge about the effect of being born prior to 39 weeks gestation as more studies look at the long-term developmental outcomes of these children. Until recently, long-term outcomes of children born after 36 weeks were thought to be similar to children born close to, or at, their estimated due date. Indeed, when outcome measures focused only on mortality and major markers of morbidity, it did seem that there was little difference. Now, however, there is clear evidence of higher rates of speech delay, attention problems in childhood and poorer primary school performance for children born between 36 and 38 weeks compared with 39 weeks. As someone who has only recently completed my training, I draw the comparison of length of a pregnancy with the six years of FRANZCOG training. By the end of the fifth year of training, most trainees feel ready to finish. Clinically, they are competent and can manage most aspects of the job fairly independently. If they were to head out into the world at this point, the vast majority would perform adequately. A few would hit trouble fairly quickly, like the occasional 37-week infant who ends up intubated in the nursery, but most would fly under the radar and cope. In the long term, however, the loss of 12 months not spent in a training environment means the nuances of the unexpected complication or how to interact with the difficult patient (or colleague) may start to show. It is the finessing of these finer details of being a professional that occur in the last year of training that are similar to the neural connections and pathways being made in utero in those final weeks that can result in a 39-weeker having an improvement in long-term neurodevelopmental outcomes. As clinicians, we must ensure that we give every baby the opportunity to be in the best environment possible when this brain development is occurring, and when there is no medical indication otherwise, this environment should be the uterus.

Finally, I'd like to recognise the previous issue of *O&G Magazine*, which took LGBTQIA as its theme. The response we had from such a broad range of readers was phenomenal and just a little overwhelming. We have included some of the written responses in this issue, showing just how powerful this publication can be and what an inclusive and progressive College we all belong to.

A history: antenatal corticosteroids

Prof Jane E Harding ONZM
MBChB, FRACP, DPhil, FRSNZ
Liggins Institute, University of Auckland, NZ

Prof Caroline A Crowther
MBChB, DCH, MD, FRANZCOG, CMFM
Liggins Institute, University of Auckland, NZ
School of Medicine, University of Adelaide

Arguably the greatest contribution to the improvement in health outcomes for babies born preterm over the last 50 years has been the use of antenatal corticosteroids. This article provides a brief overview of the history of this remarkable breakthrough, with a particular focus on the contribution from Australia and New Zealand. More detail can be found in the Wellcome Witnesses to Twentieth Century Medicine report.[1]

Liggins' original observations

In the 1960s, Dr (later Professor Sir) Graham (Mont) Liggins, an obstetrician working at National Women's Hospital, Auckland, was studying the initiation of labour in sheep. His hypothesis, novel at the time, was that the fetus, rather than the mother, provided the key trigger for the onset of labour, and that fetal glucocorticoids were that trigger. He showed that inhibiting fetal glucocorticoid production by fetal hypophysectomy or adrenalectomy prevented the onset of labour, whereas administration of a glucocorticoid to the fetus, either directly or via the ewe and placenta, resulted in labour, independent of gestation length.

Lambs born preterm die, with immature lungs that do not inflate. Liggins's key observation was that a lamb born preterm after glucocorticoid administration was alive and breathing and had lungs that did inflate. The conclusion of his paper, published in 1969, noted that 'Partial aeration of the lungs was observed in lambs born vaginally... after receiving dexamethasone... this may be the result of accelerated appearance of surfactant activity'.[2]

Liggins, Howie and their randomised trial

Liggins reasoned that if glucocorticoids accelerated lung maturation in sheep, they should also do so in human babies. At the time, most preterm babies died of lung disease due to surfactant deficiency (respiratory distress syndrome [RDS]), and the first infant ventilators were just being introduced. At National Women's Hospital, the only neonatologist able to ventilate babies was A/Prof Ross Howie. With remarkable speed, Liggins and Howie devised a randomised, placebo-controlled trial of antenatal corticosteroids and began recruiting women in 1969.

The first report of this trial, with outcomes from 282 women, was published in *Pediatrics* in 1972,[3] having been rejected by *Lancet* on the grounds that 'it lacked general interest'.[1] The findings were indeed miraculous. Early neonatal mortality was reduced from 15 per cent to three per cent, and RDS from 26 per cent to 9 per cent. Although this is the most widely cited publication from that trial, recruitment actually continued until February 1974, with 1142 women randomised along with 1248 babies. The earlier beneficial findings were confirmed in the larger study.[4]

Several other important observations were made in that first trial. The greatest benefit was seen in babies born between one and seven days after corticosteroid administration; doubling the dose of corticosteroids did not further improve outcomes; and there was no evidence of increased risk of infection for mother or baby.[4]

Subsequent trials and data synthesis

Many subsequent trials were undertaken. All were consistent with the initial findings, showing a reduction in the incidence and severity of RDS. Most also showed a reduction in mortality, although as neonatal ventilation, continuous positive airway pressure (CPAP) and then artificial surfactant became more widely available over the next two decades, overall mortality continued to decrease.

The first systematic synthesis of the evidence from randomised trials of antenatal glucocorticoids in 1981, led by Patricia Crowley, already included four trials. When updated in the landmark book *Effective Care in Pregnancy and Childbirth*,[5] it included 12 trials and clearly showed that antenatal glucorticoids given to women at risk of preterm birth approximately halved the risk of death and of RDS in their babies, and also the risk of periventricular haemorrhage and necrotising enterocolitis, without altering the risk of infection.

As techniques for systematic review and meta-analysis further developed, the UK Cochrane Centre in 1992,

and subsequently the Cochrane Collaboration, adopted as their logo an image of the meta-analysis of seven randomised trials of antenatal corticosteroids. Sir Iain Chalmers related that this image was selected because 'We wanted to show that within ten years of the Liggins and Howie trial, there had been crystal-clear evidence that this was a very important way of reducing neonatal deaths....This...information had been available more than a decade earlier, yet it was still not being acted upon sufficiently in practice.... tens of thousands of babies had suffered and died unnecessarily...because information had not been assembled in a systematic review and meta-analysis to show the strength of the evidence".[1]

By 2006, the Cochrane systematic review of antenatal corticosteroids by Devender Roberts from Liverpool and Stuart Dalziel from Auckland included 21 studies (3885 women and 4269 infants).[6] It not only confirmed consistent benefits of antenatal glucocorticoids for infants without adverse effects on the mother, but also included other analyses that addressed many clinical debates still ongoing some 30 years after the original trial. These included that the benefits were similar regardless of the decade in which the trials were undertaken, and hence independent of other improvements in antenatal and neonatal care; were similar in women with ruptured membranes, pregnancy-related hypertension syndromes and multiple pregnancy; independent of gestational age at birth; and present even in babies born less than 24 hours after the first dose. The limited available data on longer term outcomes showed no effect on growth in childhood, reduced risk of developmental delay and no adverse effects into adulthood. The authors concluded that 'A single course of antenatal corticosteroids should be considered routine for preterm delivery with few exceptions'.[6]

Dissemination and uptake

Despite the remarkable benefits of antenatal corticosteroids, uptake of this treatment was variable. In Australia and New Zealand, the majority of eligible women were receiving this treatment in the 1980s, but in the early 1990s the estimated rate in both the UK and the US was still only 10 to 20 per cent.[1,7]

This finally began to change after active implementation strategies following the publication of an NIH Consensus Statement,[7] which concluded that 'Antenatal corticosteroid therapy is indicated for women at risk of premature delivery with few exceptions and will result in a substantial decrease in neonatal morbidity and mortality, as well as substantial savings in healthcare costs.'

Usage subsequently rose around the world. In 2016, 89 per cent of mothers of babies born before 34 weeks and admitted to NICU in Australia or New Zealand received antenatal corticosteroids.[8]

Long-term concerns

Part of the reason for the relatively slow uptake related to concerns about the long-term safety of antenatal exposure to drugs with such diverse actions as corticosteroids. In the 1990s, there was considerable focus on the findings of David Barker, from Southampton, that events in early life could have lifelong effects on cardio-metabolic health. Animal studies demonstrated that early exposure to excess glucocorticoids permanently altered blood pressure and glucose tolerance in the offspring. The underlying mechanisms were elucidated in laboratory animals and increasingly supported by observational studies in human pregnancy.

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PREMATURE DELIVERY OF FOETAL LAMBS INFUSED WITH GLUCOCORTICOIDS

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SUMMARY

Dexamethasone caused premature delivery when infused into foetal lambs at rates of 0·06–4·0 mg./24 hr. but it had no effect when administered to pregnant ewes at the rate of 4·0 mg./24 hr. Infusions into the foetus of deoxycorticosterone or corticosterone were ineffective; mixtures of dexamethasone and deoxycorticosterone did not cause parturition more rapidly than dexamethasone alone. Thus, the ability of corticosteroids to cause premature parturition appears to depend on glucocorticoid rather than mineralocorticoid activity.

Parturition induced by dexamethasone was not delayed by administration of 100 mg. progesterone/24 hr. to the ewe or to the foetus. This suggests either that withdrawal of inhibitory effects of progesterone on the myometrium can occur independently of the progesterone concentration in peripheral plasma, or that the mechanism of parturition provoked by corticosteroids in the foetus can override any regulatory influence of progesterone on myometrial contractility.

Partial aeration of the lungs was observed in lambs born vaginally at 117–123 days of gestation after receiving dexamethasone. It is suggested that this may be the result of accelerated appearance of surfactant activity.

INTRODUCTION

The onset of parturition in the ewe has been shown to be profoundly influenced by the foetus (Liggins, 1968). Destruction of the foetal pituitary or hypothalamus leads to marked prolongation of gestation (Liggins, Kennedy & Holm, 1967) and conversely, stimulation of the foetal adrenals by corticotrophin (ACTH) or infusion of cortisol into the foetus leads to premature parturition (Liggins, 1968). Thus it appears likely that the foetal lamb affects myometrial contractility through a pathway which includes the foetal hypothalamus, pituitary and adrenals, and that the activity of the adrenal cortex in this particular function is mediated by a corticosteroid. However, the means by which a corticosteroid in the foetus may influence the myometrium remains obscure.

Cortisol has both mineralocorticoid and glucocorticoid activity. The present experiments were designed to determine which of these components was responsible

Figure 1. First page of Liggin's original research paper.[2]

At the same time, with the increased use of antenatal corticosteroids following the Consensus Statement, the pendulum swung, from underuse to overuse. There began to appear case reports of women given multiple, repeat doses of corticosteroids and adverse outcomes, including death, in the infant.

In part to address these concerns, there were renewed attempts to evaluate the long-term effects of exposure to antenatal corticosteroids. Observational cohort studies provided conflicting and low-quality evidence, particularly as women at risk of preterm birth who received corticosteroids were inevitably different from those who did not. However, some studies did support concerns about possible adverse effects on later growth, health and behaviour.

Much higher quality evidence was required from follow up of participants in the early randomised trials. A Dutch study in 2000 reported no adverse effects in a small cohort of 20 year olds.[9] Liggins and Howie generously gave permission for Jane Harding in Auckland to use the original trial records, and Stuart Dalziel used these to undertake 30-year follow up. Remarkably, although the records only showed the name of the mother and the date of birth and sex (but not name) of the baby, 72 per cent of the cohort were traced and 534 were studied. There were no differences between corticosteroid and placebo exposed groups in a range of health and wellbeing outcomes, including body size, blood pressure, blood lipids, lung function, bone density, cognitive function, psychiatric morbidity and health-related quality of life.[10,11] Those exposed to corticosteroids had a small increase in insulin response to an oral glucose tolerance challenge, raising the possibility of a small effect on insulin sensitivity of no clinical significance. These data have provided crucial reassurance about the long-term safety of antenatal corticosteroids.

Repeat antenatal corticosteroids

In the original trial, Liggins and Howie noted that 'Time relations of therapy were important; it was effective only if delivery could be delayed for at least 24 hours, and no longer than seven days ... This suggests that if very premature delivery has not occurred within seven days, and again threatens, therapy might need to be repeated at intervals of not less than seven days ...'.[4] This observation resulted in repeat courses of corticosteroids being given from the 1970s to many women in Australia and New Zealand, although without any substantial supporting evidence. The pendulum swing to widespread administration in the late 1990s was accompanied by many studies in laboratory animals demonstrating adverse effects of repeat antenatal corticosteroids, particularly on growth and neurological development of the offspring. Sheep studies, led by John Newnham and Alan Jobe in Perth, were particularly influential. Concerns about possible adverse consequences led to calls for randomised trials to provide the urgently needed high-quality evidence about the effects of repeat courses of antenatal corticosteroids in women.

One of the largest and earliest studies was the Australian and New Zealand collaborative trial, ACTORDS, led by Caroline Crowther from Adelaide, that recruited 982 women from 23 hospitals in Australia and New Zealand.[12] Findings from this and, now, nine other randomised trials have been incorporated into a Cochrane Review of data from 4733 women and 5700 babies.[13] The authors (all from Australia and New Zealand) report that, in women who remain at risk of preterm birth after an initial course of corticosteroids, babies exposed to additional doses have less RDS and major neonatal morbidity, but a small reduction in size at birth. The number of women needing to be treated to prevent one case of RDS is actually similar for both single (12; 95 per cent confidence intervals 7–14) and repeat courses of corticosteroids (17; 11–32). Importantly, follow up of the ACTORDS trial participants into mid-childhood has shown no effects on neurodevelopment or growth,[14] and more detailed physiological studies by Dr Chris McKinlay, from Auckland, have shown no effects on cardiovascular and metabolic risk factors.[15] The 2015 Australian and New Zealand Guidelines on antenatal corticosteroids therefore recommend that repeat antenatal corticosteroids should be used in women at risk of imminent, preterm birth at less than 33 weeks, not less than seven days following a single course of corticosteroids.[16]

Remaining uncertainties

Although the effects of antenatal corticosteroids have been studied in thousands of women and babies over the last 50 years, many questions remain unanswered. The Clinical Practice Guidelines[16] included 12 recommendations for further research; some of which are being addressed in studies planned or in progress in Australia and New Zealand.

The clinically recommended dose of corticosteroid is still based on that chosen by Liggins and Howie, although current sheep studies in Perth are exploring other dosing schedules.

Betamethasone and dexamethasone are both recommended, with little evidence regarding whether one is safer or more effective. The A*STEROID Trial, a collaborative randomised trial led by Caroline Crowther, has recently completed recruitment of 1346 women from 14 Australian and New Zealand centres comparing the two drugs and will help answer this important question.[17]

The multicentre C*STEROID Trial, led by Dr Katie Groom, Auckland, will assess use of antenatal betamethasone compared to placebo prior to planned caesarian section late preterm and at term on RDS and neonatal hypoglycaemia.

The planned collaborative PRECeDE Trial, led by A/Prof Jo Said, Melbourne, will assess whether antenatal corticosteroids prior to elective caesarean section in women with diabetes prevents RDS.

Concerns also remain about the very long-term effects of antenatal glucocorticoid exposure. Follow up in Auckland of the original Liggins and Howie cohort into old age, and of the ACTORDS cohort into adulthood, may help address these in the future.

New Zealand and Australian researchers and clinicians continue to make an enormous contribution to the worldwide efforts to improve outcomes after preterm birth by optimising the use of antenatal glucocorticoids.

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Controversy: antenatal corticosteroids

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The impact of antenatal corticosteroids in improving neonatal outcomes for preterm infants has been heralded as one of the greatest medical advances of the 20th century; so much so that the logo for the Cochrane Collaboration represents the forest plot of the Crowley systematic review of the benefits of antenatal corticosteroids[1] with the Cochrane Collaboration stating that 'this simple intervention has probably saved thousands of premature babies'.[2] Strong evidence exists for the benefit of a single dose of antenatal corticosteroids in reducing the rates of neonatal death, respiratory distress syndrome (RDS), intraventricular haemorrhage, early neonatal sepsis and necrotising enterocolitis in preterm infants.[3] However, for an intervention that is used almost daily across maternity units in Australia and New Zealand, controversies exist for its use in many common situations such as, the use of repeat doses, the use of antenatal corticosteroids in the late preterm period and the use of antenatal corticosteroids in special populations, such as in women with diabetes.

Repeat doses of antenatal corticosteroids

The ACTORDS trial, an Australasian trial that randomised women who had already received a single dose of antenatal corticosteroids and who remained at risk of preterm delivery to either repeated doses of antenatal corticosteroids or placebo, demonstrated that neonates exposed to repeated doses of antenatal corticosteroids had lower rates of RDS, required less need for, and duration of, oxygen therapy and had a shorter duration of mechanical ventilation.[4] Although z scores for birthweight and head circumference were significantly lower at birth in those exposed to repeated doses of antenatal corticosteroids, no differences were seen in anthropometric measurements or z scores at hospital discharge. In contrast, the National Institute of Child Health and Human Development (NIHCD) study, which investigated the impact of repeat doses of antenatal corticosteroids, was terminated early due to statistically significant reductions in birthweight and an increase in the rate of small for gestational age babies in those exposed to repeated courses of antenatal corticosteroids.[5] Despite this, in the 495 patients that were enrolled in the trial, repeated courses of antenatal corticosteroids were associated with significantly reduced rates of mechanical ventilation, pneumothoraces and surfactant administration.[5]

The Cochrane review, which included 10 trials, confirmed the reduction in the risk of RDS and combined serious neonatal outcome with repeated doses, but did note reductions in mean weight, head circumference and length that were not seen when adjusted for gestational age.[6] This review found that there was no evidence of either significant benefit or harm at two to three year follow up, concluding that treatment with repeat courses of antenatal corticosteroids should be considered and that women should receive detailed counselling regarding the benefits, risks and limited information on long-term outcomes.[6]

The long-term data, reporting outcomes at age six to eight, has been largely reassuring. No differences have been elicited in neonatal hypothalamus-pituitary-adrenal axis suppression, cardiometabolic outcomes, functional residual capacity of the lung, or bone mass in those exposed to antenatal corticosteroids compared to those who were not.[7-11] Concerns have been raised in the two-year follow up of the ACTORDS trial, with children exposed to repeat doses of corticosteroids more likely to require assessment for attention problems.[12] Follow up of the NIHCD study also revealed a non-significant increase in cerebral palsy in neonates exposed to four to five doses of antenatal corticosteroids and born after 34 weeks, compared with neonates exposed to only one dose of antenatal corticosteroid.[13]

While these data do not detract from the significant benefits of antenatal corticosteroids in terms of reductions in neonatal death and need for mechanical

ventilation in preterm infants, they do raise a note of caution with respect to the overuse of antenatal corticosteroids in cases at lower risk of preterm birth.

International guidance for clinicians regarding the use of repeat doses of antenatal corticosteroids varies, with the ACOG guidelines recommending a single rescue course of antenatal corticosteroids in women who are greater than two weeks from their initial treatment, less than 32 weeks of gestational age and judged to be likely to give birth within the next week, while the NICE guideline recommends not routinely offering repeat courses unless deemed appropriate by the treating clinician.[14,15] The Australia and New Zealand guideline recommends the use of repeat doses when preterm birth is planned or expected within the next seven days in a woman who has received a course of antenatal corticosteroids more than seven days ago and remains less than 32^{+6} weeks gestational age.[16]

Given these contradictory findings, it is not surprising to find that clinical guidelines used in Australian and New Zealand hospitals vary significantly.[17] Uncertainty also remains with respect to the duration of coverage of corticosteroids, given the Australasian guidance of repeating doses every seven days contrasts with the US guidance suggesting that repeated doses are not required before 14 days. Although, the bulk of evidence for the beneficial effects of corticosteroids is seen when corticosteroids are administered within seven days of delivery, some beneficial impact is seen up to 14 days after administration.[18]

Antenatal corticosteroids in the late preterm period

The bulk of evidence for the benefits of antenatal corticosteroids exists for the early preterm period, although the majority of preterm deliveries, and eight per cent of all deliveries, occur in the late preterm period from 34^{+0} to 36^{+6} weeks gestation.[19] The 'Antenatal Betamethasone for Women at Risk of Preterm Delivery' (ALPS) study reported short-term benefit in infants exposed to antenatal corticosteroids, with a 20 per cent risk reduction in the composite primary neonatal outcome, which included neonatal respiratory support, stillbirth or neonatal death up to 72 hours after birth.[20] Significantly decreased rates of transient tachypnoea, surfactant use and bronchopulmonary dysplasia were also seen in the betamethasone group, although the rate of neonatal hypoglycaemia was significantly increased in this group.[20] No differences were seen in the maternal outcomes between the two groups, including mode of delivery, rates of chorioamnionitis or endometritis.

Although these results seem promising, the potential benefits and the generalisability to our population remain uncertain. Firstly, there were no significant differences between the rates of RDS or NICU admission between the two groups; the majority of the respiratory morbidity reported was secondary to transient tachypnea of the newborn, a generally mild and self-limiting condition.[20] The trial excluded women with multiple pregnancies and pre-gestational diabetes; two groups in which the risk of late preterm delivery, and subsequent respiratory morbidity, is high.[21,22] The strict inclusion criteria of the trial led to over 80 per cent of the trial population, in both groups, delivering prior to 36^{+6} weeks gestation, a feat seldom reproducible in daily practice.[20] Furthermore, the trial has yet to report on the long-term outcomes and the impact of the increased rates of neonatal hypoglycaemia, which are especially concerning as even transient neonatal hypoglycaemia has been associated with long-term adverse outcomes, including decreased proficiency in literacy and mathematical achievement tests.[23]

Once again, international guidance on this issue varies. ACOG embraced the results of the ALPS trial and recommend a single course of betamethasone for a woman at risk of preterm birth within seven days between 34^{+0} and 36^{+6} weeks gestation, who have not received a previous course of antenatal corticosteroids.[14] The NICE guideline recommends consideration of a course of antenatal corticosteroids for a woman at risk of preterm labour or having a planned preterm birth up to 35^{+6} weeks gestation.[15] Currently, the Australia and New Zealand guideline only recommends antenatal corticosteroids up to 34^{+6} weeks gestation, except in circumstances of an elective caesarean section prior to 39^{+0} weeks when lung immaturity is known.[16] Defining lung immaturity antenatally is not a simple task and amniocentesis for lecithin sphingomyelin is rarely performed in Australia and New Zealand.

Conclusion

Despite the considerable data supporting the use of antenatal corticosteroids in the preterm period, controversies remain regarding the optimal frequency of administration, the latest gestation for administration and the role of corticosteroids in specific groups, such as women with diabetes. Moreover, while long-term data are mostly reassuring, subtle neurocognitive findings that are emerging from the ACTORDS and ASTECS follow-up studies suggest the need for a more cautious approach with respect to expanded indications and frequency of administration of antenatal corticosteroids, particularly in those who do not ultimately go on to deliver in the preterm period.[12,24] Further prospective research is required to understand the short- and long-term outcomes of antenatal corticosteroids in the preterm period in special populations such as multiple pregnancies, women with diabetes[25] and in the late pre-term period between 34^{+6} and 36^{+6} weeks.

Although the obstetric profession was previously criticised for not embracing the benefits of antenatal corticosteroids with enthusiasm, perhaps now is the time for a more considered approach regarding the expanding indications for administration. After all, as Greek philosopher Epictetus theorised, 'If one oversteps the bounds of moderation, even the greatest pleasures cease to please'.

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Short-term outcomes of preterm birth

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Preterm birth is defined by the World Health Organization as birth before 37 completed weeks of pregnancy. This can be subcategorised to late preterm (34–37 weeks), early preterm (<34 weeks), very preterm (28 to <32 weeks) and extremely preterm (<28 weeks).

In Australia, as per the Australian Institute of Health and Welfare in 2016, 8.6 per cent of babies were born preterm, with most of these births occurring at gestational ages between 32 and 36 completed weeks. That's about 25000 babies every year in Australia. The average gestational age for all preterm births was 33.3 weeks. The common neonatal complications in premature babies are described below.

Respiratory distress syndrome

Respiratory distress syndrome (RDS), or hyaline membrane disease, is almost exclusively a disease of premature infants. It is caused by deficiency of surfactant protein leading to atelectasis, ventilation perfusion mismatch and hypoventilation, with resultant hypoxaemia and hypercarbia. The incidence and severity of RDS are inversely related to the gestational age. Symptoms include tachypnoea, desaturation, respiratory distress and apnoea. Chest radiograph usually shows poor lung expansion, air bronchogram and reticulogranular/ground glass opacity. Advances in treatment, such as antenatal steroids, early use of CPAP, early administration of surfactant and availability of better neonatal care, have improved the survival of extremely premature newborns. Common differential diagnoses are infection, transient tachypnoea of newborn, aspiration syndrome and pulmonary air leaks.

Apnoea of prematurity

Apnoea of prematurity (AOP) is defined as the cessation of breathing for more than 20 seconds, or for less than 20 seconds if it is accompanied by bradycardia or oxygen desaturation. It is rare after 36 weeks of gestation. AOP can be central, obstructive or mixed apnoea. Periodic breathing maybe observed for 2–6 per cent of breathing time in healthy term neonates and as much as 25 per cent of breathing time in preterm neonates. The cause of AOP is the immaturity and/or depression of the central respiratory drive to the respiratory muscles. Younger gestational age at birth is associated with increased incidence of AOP. Extremely premature babies are routinely monitored during neonatal intensive care unit stay and treated prophylactically with caffeine citrate (intravenously or orally) until 34 weeks. Apnoea can be a symptom of infection, RDS, intraventricular haemorrhage (IVH) or hypoglycaemia and should be excluded. The common treatments include tactile stimulation, methylxanthine derivatives, oxygen, nasal CPAP and mechanical ventilation.

Transient tachypnoea of newborn

Transient tachypnoea of newborn (TTN) is a common cause of respiratory distress in neonates and is caused by delayed clearance of a fetal lung fluid. TTN is usually present with other signs of respiratory distress and increased oxygen requirements within the first few hours of life. TTN is more common in late preterm and mature neonates and is a self-resolving disorder with an excellent prognosis, usually over a 24- to 72-hour period. Caesarean delivery is associated with increased risk of TTN. The common differential diagnoses are sepsis, pneumonia, meconium aspiration syndrome, air leak, persistent pulmonary hypertension and cyanotic congenital heart disease. The characteristic x-ray findings include prominent perihilar streaking, which correlates with the engorgement of the lymphatic system with retained lung fluid and fluid in the fissures. The treatment is mainly supportive and includes intravenous fluids, supplemental oxygen, CPAP and escalation of respiratory support if needed.

Bronchopulmonary dysplasia

Bronchopulmonary dysplasia (BPD) is the most common cause of chronic lung disease in infants. It is defined as oxygen requirement at 28 days of age or at 36 weeks gestational age. The incidence is around 48 per cent in gestational age below 27 weeks. The aetiology is multifactorial, including lung immaturity, respiratory distress, oxygen therapy and mechanical ventilation. Gestational age and birth weight are the most important protective factor of BPD. Strategies that avoid excess oxygen and ventilation, better infection control and optimise nutrition are some of the steps to reduce the incidence and severity of BPD. Despite best efforts, BPD remains a problem. Even though lung growth continues to occur in early childhood, studies have showed that survivors have abnormal lung structure and function compared to term equivalents in childhood.

Persistent ductus arteriosus

Persistent ductus arteriosus (PDA) is the persistent communication between descending thoracic aorta and the pulmonary artery. Normally functional closure of the ductus arteriosus occurs in the first few hours of life in infants born at term. The cause of PDA in preterm infants is not fully understood, but contributing factors include the immaturity of the smooth muscle structure and the inability of the immature lungs to clear circulating prostaglandins. The decision to treat PDA is based on its

haemodynamic significance. The treatment options are prostaglandin inhibitors (ibuprofen, indomethacin, paracetamol) or surgical ligation.

Feeding intolerance

Feeding intolerance, leading to postnatal growth restriction and failure to thrive, is a major issue in preterm neonates, especially those of extremely low birthweight. Optimisation of feeding without increasing the risk of necrotising enterocolitis is the priority in treatment. Common strategies for this include exclusive use of expressed breastmilk, preferring donor breastmilk over formula where possible, slowing gradation of feeds not more than 20–30 ml per day and carefully monitoring for signs of feeding intolerance.

Necrotising enterocolitis

Necrotising enterocolitis (NEC) is the most common acquired disease of gastrointestinal system in premature infants and newborns, causing ulcerative inflammation of the intestinal wall. NEC has high mortality in premature infants of up to 40 per cent. The onset of NEC typically occurs during the first several weeks after birth, with the age of onset inversely related to gestational age at birth. Presenting symptoms may be subtle, nonspecific systemic symptoms or localised abdominally. Management depends on the clinical stage of the disease, measured by Bell's stages 1–4. Treatment options include nil by mouth, nasogastric decompression and intravenous antibiotics. Advanced-stage NEC needs fluid resuscitation, escalation of respiratory support and surgical intervention.

Intraventricular haemorrhage

The incidence of IVH is 15–20 per cent of neonates born before 32 weeks and is uncommon in term newborns. The important predisposing factors include ischemia/reperfusion, fluctuations in cerebral blood flow and increase in the cerebral venous pressures. Risk factors include maternal factors, such as infection/inflammation and haemorrhage; lack of antenatal steroids; and external factors, such as mode of delivery or neonatal transport. IVH is often clinically silent. Diagnosis is invariably made by head ultrasound; a routine practice for all preterm neonates under 32 weeks, in the first two weeks of life. Infants with large IVH may present with rapid clinical deterioration, drop in haemoglobin and neurological signs, such as seizures and altered neurological status. IVH is graded from 1–4 based on the severity. Management mainly consists of supportive care and prevention should be the primary goal. Serial monitoring – by regular head ultrasound and head circumference measurements – is required, with neurosurgical intervention necessary if any progression to post-haemorrhagic hydrocephalus. Several recent studies suggest that even infants with grade 1 and 2 IVH are at increased risk of neurodevelopmental impairment, when compared to those without.

Periventricular leukomalacia

Periventricular leukomalacia (PVL) is a distinctive lesion found in the immature white matter of premature newborns, likely resulting from the interaction of multiple pathogenetic factors. The two key features in the pathogenesis are hypoxia-ischemia affecting the watershed regions of the white matter and the particular vulnerability of periventricular white matter of the premature brain. PVL is a clinically silent lesion, evolving with few or no outward clinical signs until weeks to months later, when a spasticity is first detected, or even at a later age when present with cognitive disabilities in school. The diagnosis is usually made by head ultrasound in the newborn period. The ultrasound can underestimate the incidence of PVL. MRI is more reliable in identifying the abnormal signal intensity, although routine use of MRI to detect white matter injury is not recommended. There is currently no medication available for specific treatment of PVL. Management is limited to identification of cognitive or motor impairments and early intervention therapy.

Sepsis

Extreme preterm and very low birthweight (<1500 g) babies are at risk of late onset sepsis. The mortality rate is higher if there is a gram-negative infection. Nearly half of all late onset sepsis is caused by coagulase-negative staphylococcus.

Hypothermia

Preterm infants are more prone to hypothermia, compared to term babies, because of their high ratio of skin surface area to weight, highly permeable skin, decreased subcutaneous fat, less brown fat and reduced glycogen stores. Because of cold stress, they are prone to hypoglycaemia, metabolic acidosis and increased oxygen consumption. Maintaining a thermoneutral environment is very important in management of preterm babies. Extreme preterm babies should be placed in a polyethylene bag soon after delivery to prevent heat loss. Babies are nursed in heated incubators with humidification to reduce evaporative heat loss.

Hypoglycaemia

Hypoglycaemia is one of the most common pathologies encountered by preterm infants in the neonatal intensive care unit. Preterm, small for gestational age and intrauterine growth-restricted neonates are especially vulnerable. Nearly 30–60 per cent of these high-risk infants are hypoglycaemic and require immediate intervention. Preterm neonates are uniquely predisposed to developing hypoglycaemia and its associated complications due to their limited glycogen and fat stores, inability to generate new glucose using gluconeogenesis pathways, have higher metabolic demands due to a relatively larger brain size, and are unable to mount a counter-regulatory response to hypoglycaemia. They are usually managed with parenteral fluids in the initial days and feeds are introduced and graded up as per tolerance.

Jaundice

Jaundice is one of the most common conditions requiring medical attention in newborn babies. Approximately 60 per cent of term and 80 per cent of preterm babies develop jaundice in the first week of life. Hyperbilirubinemia occurs when there is an imbalance between bilirubin production, conjugation and elimination. The breakdown of red blood cells and haemoglobin cause unconjugated bilirubin to accumulate in the blood. Unconjugated bilirubin binds to albumin and is transported to the liver where it is converted to conjugated bilirubin. Conjugated bilirubin is water soluble and able to be eliminated via urine and faeces. Unbound unconjugated bilirubin is lipid soluble and can cross the blood-brain barrier. When jaundice has a high peak level, regardless of the cause, treatment is required to prevent brain damage. In addition, some underlying causes of hyperbilirubinemia are serious or even life-threatening illnesses that require urgent treatment. Jaundice is generally managed with phototherapy, optimisation of feeds and fluids, and, in severe cases, exchange transfusion.

Long-term outcomes of preterm birth

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There are approximately 25,000 preterm (less than 37 weeks gestational age) livebirths in Australia every year.[1] (Figure 1).

Children born extremely preterm

Before neonatal intensive care nurseries were able to provide effective assisted ventilation, which started in Australia in the early 1970s, very few babies born extremely preterm (EP) survived. Antenatal corticosteroids were introduced in Australia in the late 1970s and further improved survival rates by accelerating pulmonary surfactant production and reducing the severity of hyaline membrane disease (also called respiratory distress syndrome), the commonest cause of death in babies born preterm. The next major advance was the ability to give replacement surfactant therapy to preterm babies after birth, which became available from 1991 in Australia. In conjunction with an increased willingness to provide treatment for babies born EP both before and after birth, long-term survival rates rose, from less than ten per cent in the 1960s, to approximately 70 per cent on a whole population basis for those born 22–27 weeks gestation by the late 1990s.[2] Since the 90s there have been incremental improvements, but no major advances that have further affected survival rates.

The Victorian Infant Collaborative Study (VICS) group has been following cohorts of all babies born either below 1000g or before 28 weeks gestational age in the state of Victoria from the 1970s, 1980s, 1990s, and 2000s into school-age, and in some cases, into adulthood. At eight years of age, one-in-six survivors born EP have substantial neurosensory disability,[3] such as problems with thinking, hearing, walking, talking or vision, which would represent up to 160 children born EP every year in Australia. In contrast, when we assess children born at term, one-in-60 also have substantial disability using the same criteria,[3] which represents almost 5000 disabled children born at term every year in Australia. Thus, although the risk is higher in children born EP, a child in the classroom with substantial disability is at least 30 times more likely to have been born at term than born EP. In addition to substantial neurosensory disability, children born EP compared with those born at term have poorer school performance in reading, spelling and arithmetic, they have more problems with inattention, remembering things and organising themselves, and they are clumsier.

Considering other health problems, children born EP are disadvantaged as a group compared with children born at term in almost every area of health we have studied. They are a little shorter and lighter in body weight throughout childhood, but they narrow the gap in weight by adulthood.[4] They remain shorter by several centimetres on average, although, their parents are shorter on average than the parents of children born at term.

Blood pressure is higher by 2–4 mmHg in childhood and early adulthood,[5,6] which may not sound like an important difference; however, each 2 mmHg rise in blood pressure is associated with an increased risk of cardiovascular events, such as stroke or heart attack, in later life.[7] Whether survivors born EP will have higher rates of cardiovascular disease in later adulthood remains to be determined.

The airways in the lungs grow through pregnancy and early life, peaking in the early 20s, after which there is a gradual decline with age. In most of us the decline with age is not a concern because we will die from something other than lung disease before our lung function declines to a level that cannot support life; though smokers are one obvious exception. Compared with the very low oxygen exposure of the lungs in utero, exposure to even air after birth is too much oxygen for the immature lungs of babies born EP. Also, most babies born EP need assisted ventilation and higher concentrations of oxygen than air after birth, sometimes for many weeks or months,

both of which damage the lungs and interfere with lung growth and development. Consequently, it is not surprising that the breathing ability of children born EP is reduced when they have lung function tests later in life compared with children born at term.[8] Of long-term concern, it is clear that adults born EP are not attaining the normal peak of lung growth that occurs in the early 20s, and more are destined to develop chronic obstructive pulmonary disease in adulthood, even if they do not smoke.

Despite the higher rates of problems described above, it is important to realise that most children and adults born EP are healthy and lead normal lives; they feel good about themselves, and report that their overall health is as good as people born at term.[9] Some have even grown up to be obstetricians and paediatricians!

Children born very preterm

Almost all babies born 28–31 weeks gestation today will survive long-term, particularly if they are born with the benefit of antenatal corticosteroids and in a tertiary level maternity hospital. However, children born very preterm (VP) have more of the health problems listed above than do children born at term, but not at such high rates as in those who were born EP. Like children born EP, those born VP are at high enough risk of adverse health problems that routine health surveillance and follow-up is recommended, at least through early childhood.

Children born moderate-to-late preterm

Most babies born preterm will deliver closer to term than further away from it. Consequently, individual obstetricians will be dealing with livebirths who are moderate-to-late preterm (MLP) far more frequently than those born EP, at a ratio of approximately 15 to one. Children born MLP were previously thought to have an excellent long-term prognosis, akin to those born full-term, and were not considered high enough risk to warrant additional health surveillance in childhood. However, it is now clear that being born MLP is associated with substantial increases in long-term health problems compared with children born at term, including all those outlined for children born EP, but at lower rates.[10,11] Compared with children born at term, those born MLP have higher rates of academic underperformance, lower IQ and more respiratory health problems. In childhood, they often require more hospitalisation than term children for a variety of health problems, most commonly respiratory illnesses including asthma and respiratory infections. In adulthood, they need more treatment for hypertension[12] and diabetes,[13] have more psychiatric problems,[14] require more economic assistance for health problems[15] and have lower academic achievement,[16] which leads to lower paid work and more unemployment than do those born at term. It is important, however, to bear in mind that most children born MLP do well, but their higher risks of health and developmental problems compared with those born at term highlight the importance

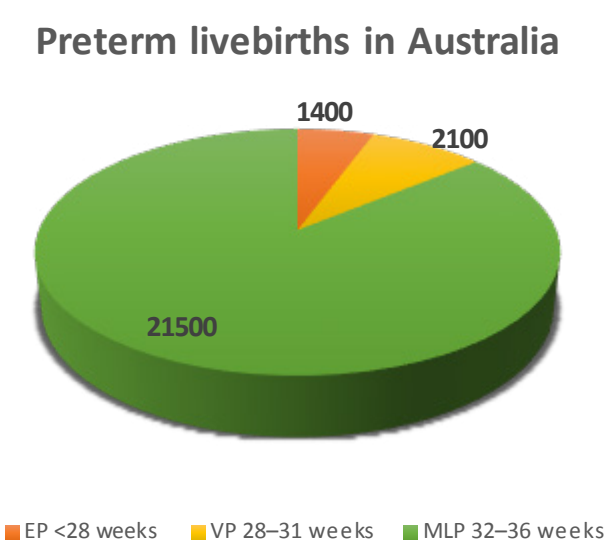

Figure 1. Approximate distribution of yearly preterm livebirths in Australia.[1]

of considering the indications for non-urgent delivery carefully, as well as the need for closer developmental and health surveillance long term for those born MLP.

What can obstetricians do for preterm babies?

The long-term outcomes for EP and VP babies are substantially improved if they are born in a tertiary maternity hospital with an onsite neonatal intensive care unit. Obstetricians have a key role in identifying those most likely to deliver EP or VP and organising transfer of the pregnant mother before birth to an appropriate high-risk tertiary maternity hospital, which may involve travel over large distances in some instances. In addition, obstetricians need to remember to give antenatal corticosteroids for those likely to deliver before 35 completed weeks of gestation. For obstetricians working in high-risk maternity hospitals, magnesium sulphate given to the mother before birth will help to reduce the chance of later cerebral palsy in babies likely to deliver before 30 weeks gestation.[17]

For babies where delivery might be contemplated between 32–36 weeks, consider delaying delivery, if possible, and resist requests for earlier delivery for 'social' reasons.

Acknowledgements

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Born at 27 weeks: parents' perspective

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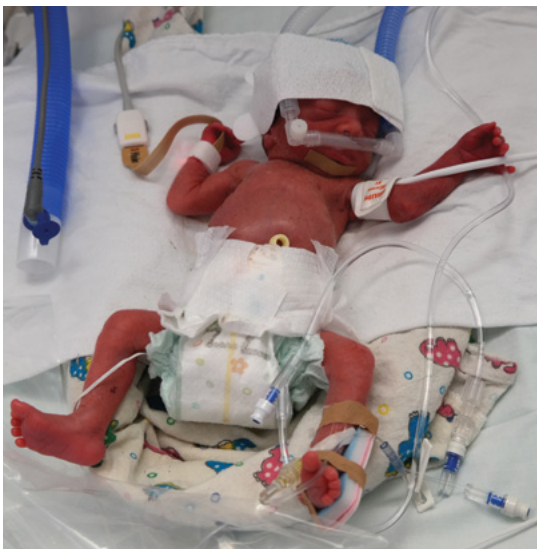
We are Joanne and Scott Beedie, co-founders of Helping Little Hands, a charity providing food, wellbeing and other practical support and advocacy services to families with premature babies at King Edward Memorial Hospital (KEMH) and Perth Children's Hospital in Western Australia.

Our mantra is 'the best way to look after a premature baby is to look after the whole family' because research shows the medical benefits for babies and parents when parents are involved in the care of their premies. However, we also know from our own personal experience how difficult it is in practice for parents to be able to achieve this and how much a rollercoaster the NICU can be. So, everything that Helping Little Hands does is to enable parents to be involved in care and to support families through their NICU journey.

We launched Helping Little Hands after our second son, Lewis, was born at 27 weeks at KEMH. Lewis was a twin, but his brother Logan was lost at 21 weeks due to twin-to-twin transfusion syndrome. This is our story.



Lewis Beedie in his NICU crib.

Joanne and Lewis Beedie, sharing their very first cuddle and valuable skin-to-skin time.

Joanne

It's Easter Sunday and I've had a few big pains. Another exam, I have some morphine and try to get some rest. I wake up 20 minutes later with a terrible pain in my back. In a blur, I think I need the toilet, but as I reach down I can feel the top of Lewis' head! I hit the alarm and scream for help and suddenly my sons are here. Lewis and Logan – they're entwined so much I can't understand what I'm looking at. So many faces, voices trying to calm me...and then they take my babies away.

Scott

I feel a relief he's here. I don't understand the risks of the NICU, but at least it's not weekly scans to see if he's still alive. I know this nightmare started months ago, but we've been so focused on just getting this far, we're not prepared for the NICU at all. As we enter the NICU for the first time, I'm pushing Joanne in a wheelchair, trying to steel myself for the unknown we're about to meet. The sights and sounds are so alien, the rows of beds, the constant beeping of machines. We approach Lewis's incubator and I feel displaced, like I'm watching another couple take this journey. Welcome to the sight of a 940g 27 weeker!

Joanne

I see Lewis underneath a mountain of tubes and wires, hidden by a CPAP hat and cradled in a towel nest. His head is the size of a tennis ball and there's not an ounce of fat on him. His arms and legs are

Joanne and Scott Beedie the in NICU with Lewis.

so small I could slip my wedding ring over them. His skin is like tissue paper. Staring down through the incubator it's more like looking at a science experiment than meeting my son.

Scott

His nurse performs his first cares. She places a wet cotton bud in his tiny mouth and pulls out little streaks of gunk, then swaps a sensor between his feet. Now she places one hand under his head, the other under his bum and flips him over. I feel a little bit sick, we leave him and retreat to the relative safety of the maternity ward. I then go home to be there for our two-year-old Archie when he wakes up. He's a big brother now, but it will be a long time till he gets to meet little Lewis.

Joanne

I can't really remember what happened last night. Did I visit Lewis first, did I hold Logan afterwards or did I have to express before any of that? I'm in a hospital room, alone, without either of my babies. The feelings of guilt are overwhelming. I haven't done a great job so far and now I'll be going home without them.

Scott

We meet Lewis' doctor. She sits with us and looks us in the eye. I'm not sure what she's saying, but just the tone of her voice assures me she's in control and will guide us through the biggest challenge of our lives. It's unspoken, but she seems to know we're in shock, to know we've been through months of fear and we just need someone to grasp onto as a way of coping.

Joanne

I suppose now we're into the routine of the NICU. Lewis is growing and starting to look like a 'real' baby. Every day I sit watching the monitor as I cuddle Lewis; his heart rate settles and his oxygenation improves. I can feel my own heart rate calm, my own breathing settle and muscles start to relax. Look, his monitor alarm has stopped beeping and if I close my eyes I can almost convince myself I'm relaxed. I'm a real parent, and this is normal. Well maybe for five minutes, until he desaturates and his alarms go crazy again.

Scott

Now that I'm back at work, I feel like I'm failing to give anyone enough of my time. But even if I can only grab an hour a day, getting support from the nurses and being made to feel responsible for cares helps me feel like a real parent. I don't feel so much like a bystander as I understand more of the medical jargon, what all the figures on his charts mean. We don't need much, just a few minutes a day to update us on how Lewis is doing. Not ignored during rounds, not the back of a white gown or language we can't understand.

Joanne

We've learned to celebrate mini milestones. Lewis reaching 1kg, a drop in oxygen, the caring nurses who take photographs or write in his journal. But there have also been some truly awful days: spikes in his bilurubin the doctors can't explain, blood transfusions, chronic lung disease, inconsistency between staff. One day I'm allowed to reposition the sats probe and the next I'm getting told off. The days when someone checks Lewis' name band and asks 'so where is Twin B?'

Scott

People don't seem to understand the need just to be with Lewis. My sister said 'well it's not like he knows you're there'. My mum wants me to take it easier on myself and play golf with my dad. I know they're doing their best, they flew in from Scotland to help, they're looking after Archie, putting food on the table, keeping the house somewhere near clean. But they just don't understand that time away from Lewis just

makes it worse, adds to the guilt, adds to the fear of what we'll find when we next see him. The support from our friends is dropping away too. I suppose people assume Lewis is fine, assume we've learned to cope. It feels like we're on this rollercoaster ride alone.

Joanne

So many parents have come and gone, new babies admitted, some just for a few days, others just starting their long-haul journey. We haven't really talked to any other parents, we just move around each other eight, nine, ten hours a day. I'm not here to make friends, this isn't a club I wanted to be in.

Scott

Waiting for our turn at rounds this morning, I heard the doctors discussing each baby's condition. I was trying not to look at a mum in the corner crying because she couldn't find a parking space and was late for cares. There was a nurse on the phone asking a parent why they haven't visited their baby for a week. I think they don't have childcare for the other kids, or dad's away on FIFO, or there's no money for petrol, or mum needs to save her maternity leave for when bubs comes home.

Joanne

I'm so hungry, but today I don't want to grab another soggy sandwich from the hospital café. It's painful seeing happy families arriving in with the balloons and flowers for the newly arrived 'term' baby. When we're struggling, the nurses seem to notice and our social worker pops by. When she first introduced herself, I thought, 'I don't need a social worker, we don't have family problems, it's not my fault that Lewis came early or that Logan didn't make it'. But that was before I understood the power of someone just caring, someone to talk to.

Joanne and Scott Beedie with Lewis, proudly wearing his first Scottish kilt.

Joanne, Scott and Archie Beedie, ready to take Lewis home from hospital.

Scott

Lewis' due date is in two weeks, so we've started to talk about maybe getting home. It seems like some impossible event, we've been here so long I can hardly remember our normal life. For the last few days he's been stuck on 26 per cent oxygen. It's just a little, but every time they try dropping it a fraction, his desats increase. Yesterday our nurse mentioned that babies are sometimes sent home on oxygen. But when we leave here, I want all the wires and tubes gone, there's no end to this if you make us go home with it.

Joanne

Today's the big day! I've got Lewis' coming home outfit ready – a little babygrow with a fox on the front and a white handknitted shawl given to me by a beautiful nurse 13 weeks ago when I was on bed rest. Archie meets Lewis for the first time and holds him, looking down making soft cooing noises. And then we get in the car and go home and everything seems calm and safe and good.

If you are interested to learn more about Helping Little Hands, please contact:
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Social determinants of preterm birth

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Preterm birth refers to a delivery that occurs before 37 weeks gestation and, globally, is the leading cause of death in children under the age of five years. Worldwide, the rates vary between five to 18 per cent.[1] The overall rate in Australia in 2014 was 8.6 per cent; however, 14 per cent of babies of Indigenous mothers were born preterm, compared to 8 per cent of babies of non-Indigenous mothers.[2]

Preterm birth is associated with perinatal mortality, admission to neonatal ICU, morbidity in the first weeks of life, long-term neurological disability and increased risk of chronic lung disease.

Significant associations have been found between preterm birth and social disadvantage (OR 1.27), previous preterm birth, pre-existing or gestational diabetes, current urogenital infections, alcohol consumption and smoking at first antenatal visit.[3] These conditions are all affected by the social determinants of health, which will be reviewed below.

Social determinants of health

The social determinants of health are the conditions in which people are born, grow, live, work and age. These circumstances are shaped by the distribution of money, power and resources at global, national and local levels. The social determinants of health are mostly responsible for health inequities – the unfair and avoidable differences in health status seen within and between countries.[4]

Recent evidence has led to the identification of key social determinants of health and wellbeing allowing collection of datasets to inform and support development of health policy. These key determinants are summarised in Box 1.

Social determinants and preterm birth

Poorer countries and regions with more social disadvantage have higher preterm birth rates. The global average of preterm birth rate in 2010 was 11.1 per cent.[5] There is wide variation between countries. Rates range from about five per cent in several northern European countries, to 18 per cent in Malawi. The highest rates of preterm birth in the world occur in low-income countries.[5] Not surprisingly, the lowest rates tend to occur in high-income countries.

However, high rates of preterm birth are also seen in many high-income countries, such as Australia. For example, in the Northern Territory (NT) the preterm birth rate is approximately seven per cent. In the Aboriginal population in the NT, the preterm birth rate is up to 14 per cent. Aboriginal and Torres Strait Islander people make up about 30 per cent of the NT population and more than 70 per cent live in regional and remote communities,[6] where social disadvantage is more common.

Spontaneous preterm birth is multifactorial with the precise cause being unidentified in up to half of all cases. Risk factors for preterm birth include; history of preterm birth, young or advanced maternal age, short inter-pregnancy intervals, low maternal body-mass index, multiple pregnancy, pre-existing non-communicable disease, hypertensive disease, infections and smoking.[7]

About 25–30 per cent of preterm births follow preterm premature rupture of membranes (PPROM).[8] The cause of membrane rupture in most cases is unknown, but asymptomatic infection is a frequent precursor and tobacco exposure also plays an important part.

All of these factors are more commonly seen in populations of disadvantage. Teenage pregnancies occur more frequently in lower socioeconomic populations and may be related to lower education rates, higher unemployment rates and less access to contraception. Body mass index and poor nutritional status is affected by education and income. Infections and chronic disease are more common in poorer populations. Smoking rates are higher in low socioeconomic populations. It remains a vicious cycle.

Box 1. Summary of key social determinants of health and wellbeing.

Key social determinants of health and wellbeing

Socioeconomic position has historically been defined by factors such as education, occupation and income. People who experience a lower socioeconomic position are at higher risk of illness and poor health outcomes, as well as a shorter life span. (This is also known as the social gradient and the lower your position on the social gradient, the more likely you are to experience adverse health outcomes.)

Education leads to a better understanding of the steps necessary for health and a better understanding and navigation of the healthcare system when illness does occur. A higher level of education leads to a more secure occupation and stable, higher income level. A higher income subsequently allows greater access to services that can provide health benefits, such as more nutritious food and better housing.

Early life the foundations of adult health are laid down as early as during pregnancy and the early childhood periods. The physical and emotional development of children during the first few years of life have flow-on effects for their future wellbeing. Children from lower socioeconomic backgrounds are more likely to perform poorly at school, thus adversely affecting their opportunities for employment and stable income in the future.

Social exclusion occurs where people experience social disadvantage, opportunity, participation and skills. This may occur due to prejudice based on race, religion, gender, sexual orientation, poverty, unemployment and discrimination. Social exclusion can lead, and contribute, to worsening of illness.

Social capital describes the benefits from the links that connect people within and between social groups. Social connectedness can provide resilience against poor health through social support and can also help in more tangible ways with increased access to employment and economic support.

Employment job security increases health, job satisfaction and wellbeing, while the converse is true for unemployment. Unemployment also increases the risk of premature death. Other aspects of work such as, control over work hours, conditions and satisfaction, also have an impact on physical and mental health.

Housing and residential environment safe and affordable housing is associated with better health, which increases participation in work and education. However, it is also a two-way relationship where ill-health can lead to unsuitable housing through unemployment and income loss. A favourable residential environment includes access to transportation and healthy affordable food, as well as mixed land usage promoting social interaction and physical activity.

The way forward

There is still much work to do to reduce the preterm birth rates nationally and globally. However, there will be little to gain unless we address the root cause of the problem. Babies will continue to be born preterm if we do not address the basic health needs of the mothers growing them. Health status cannot be fixed without addressing the social determinants. Without quality housing, food security, transport, access to good healthcare, education, income and social standing, health in disadvantaged populations will not improve. And we will continue to see high rates of poor outcomes. Unfortunately, there is no quick fix.

'Think of social determinants as the root-causes of health and disease. Imagine a bucket full of health. This bucket has a hole in the bottom and the health is dripping out (disease). We can mop up the floor below every hour, maybe even squeeze some of the health back into the bucket from the mop. But eventually, the health will be lost because we are not addressing the root of the problem. Instead, we can look for ways to prevent the hole and stop the leak from occurring.' Alessandro R Demaio 2012.

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Periviability: making difficult decisions

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Advances in neonatal care have pushed back the limits of just how premature a baby can be when we are able to successfully intervene. Currently available data suggest potential survival of infants born and resuscitated at 22 weeks gestation.[1,2] Survival needs to be balanced with the potential for severe lifelong complications among those who survive and the ability of a society or unit to provide appropriate care. Thus, at the edge of viability, decision-making about whether to resuscitate an infant is difficult and fraught with both clinical and ethical challenges. Prognostic uncertainty exists and it's therefore difficult to know what course of action is in the best interests of a particular neonate and family.

There are different definitions of periviability. In 2014, the Eunice Kennedy Shriver National Institute of Child Health and Human Development, the Society for Maternal-Fetal Medicine, the American Academy of Pediatrics, and the American College of Obstetricians and Gynecologists published an executive summary on periviable birth.[3] It defined periviability as the period from 20^{+0} to 25^{+6} weeks gestation; a time where infant morbidity and mortality can vary significantly, based over a few days. More commonly, it refers to the period of time between 22 and 25 weeks. The gestational age when active resuscitation is offered varies between countries and between units within countries.

Gestational age is the most important factor in both survival and survival without neurodevelopmental impairment, but obstetricians are well aware that ascertaining an accurate gestational age is challenging and that offering active management at a specific gestation does not reflect continuous growth and maturation. In addition to increasing gestational age, factors associated with survival are female sex, 100 g increments of birthweight at a given gestational age, use of antenatal corticosteroids and singleton birth.[4] Many other factors contribute to decision making, including counselling provided to women and their families.

Much of the literature on this topic is presented from the paediatric or neonatal perspective, with fewer reports taking into account the obstetric perspective. Obstetricians go through a complex decision-making process when faced with a woman at high risk of delivery in the periviable time period and their counselling is often influenced, not only by unit policies and changing outcome data, but also by ethical and worldview considerations. Clinicians have their own worldview, and this can influence the way information is presented to a family at high risk of periviable birth. Obstetricians and paediatricians have been demonstrated to underestimate newborn survival, as well as intact survival, with this error being greater nearer the limit of viability.[5] Obstetricians will consider a number of factors, including whether to transfer the woman to a tertiary centre, when corticosteroids should be offered, if magnesium sulphate should be given for neuroprotection, whether the baby will be resuscitated and whether delivery by caesarean section be offered for fetal indications, being aware of the implications of a classical caesarean section on the woman's future reproductive outcome and health.

In June 2018, the Perinatal and Maternal Mortality Review Committee (PMMRC) published a review of all neonatal deaths in New Zealand from 2007–2016. [6] Although there was a statistically significant reduction of neonatal deaths after 35 weeks, there was no reduction in deaths from 20–24 weeks or from 25–34 weeks. Significant reductions in neonatal mortality have been reported in several countries, including Australia, the UK and Scandinavia. The 12th PMMRC report highlighted important inequities of survival in babies born alive without congenital abnormality from 23–26 weeks. Survival was statistically significantly higher for babies born in tertiary, rather than secondary, units. Babies of Maori, Pacific and Indian women, and women under 20, are more likely to be born at extremely preterm gestations, which contributes to the higher rate of deaths in these groups; however, the report also highlighted differences in access to antenatal and neonatal care. There were differences in the level of unit at delivery, in whether resuscitation was attempted and whether corticosteroids were administered.

The reasons for these differences are complex, although, clinician bias is likely to be a factor. There is a large body of work in New Zealand describing inequities in access to care, quality of care and health outcomes for Maori and Pacific people. The PMMRC also reported statistically significant differences in survival rate by tertiary units at 23–25 weeks gestation. The Australian and New Zealand Neonatal Network (ANZNN) publishes annual reports of outcomes of babies admitted to neonatal intensive care units. The PMMRC data, however, comprise all babies born alive, including those who were not resuscitated and did not reach neonatal intensive care units. The numbers of deaths are therefore larger at early gestations and reflect obstetric as well as neonatal care.

Variations in the approach to infants who are born at the borderline of viability is illustrated in Scandinavia, where there are markedly distinct approaches in Sweden, Norway and Denmark. In each country, the prevailing approaches were developed after consideration of many factors, including public sentiment, professional preferences, reported outcomes, philosophical factors and considerations

of cost and cost-effectiveness. In Sweden, infants born at, or greater than, 22 weeks are routinely resuscitated if the family supports active intervention. Pregnant women are transferred to tertiary care centres and given antenatal corticosteroids and, if indicated, caesarean deliveries. In Norway, the cut off age is 23 weeks. In Denmark, it is 24 weeks. In New Zealand, the gestational age when active resuscitation is routinely offered has been 24 weeks in some units and 23 weeks in others. The transition to 23 weeks has occurred as outcomes have improved, but without public debate and without funding commitment from the Ministry of Health in terms of number of neonatal intensive care cots and staffing numbers. Resource allocation is a major factor in a unit deciding to lower the age when resuscitation and care is routinely offered. Socio-demographic variables are associated with preterm birth and the numbers of very preterm infants are higher in district health boards with higher needs populations.

Variations in practice within and between countries highlight the need for a consensus approach to management of periviable infants in each facility. There also needs to be consistent counselling that is not influenced by the clinician's world view. The guidelines need to be based on an understanding of local outcome data and resources, as well as the relevant ethical issues. A consensus guideline has been developed in New Zealand in an attempt to standardise periviable care across New Zealand.

Discussion is necessary with the entire health team so that appropriate management and consistent advice is given to women, and their families, who are likely to experience a periviable birth. Families need enough information about their baby's chance of survival or disability and be guided through what is a very complex decision-making process about their baby's care. Improving the care and outcome for babies at earlier gestations requires a societal commitment and adequate resourcing, with the aim of reducing inequities of outcome by ethnicity.

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Australian Preterm Birth Prevention Alliance

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The Australian Preterm Birth Prevention Alliance was born on 7 June 2018. This Alliance is the world's first national program aiming to safely lower the rate of early birth across its population.

Preterm birth is the largest cause of death in children up to five years of age and contributes greatly to long-term illness and disability.[1] Discovering how to prevent this major complication of pregnancy needs to be one of the highest priorities for our profession and our community. Until recently, implementation of a whole-of-population strategy was nothing more than a researcher's dream, but a variety of recent discoveries have made the assembling of an effective program possible.[2]

In 2014, Western Australia hosted a statewide program known as the Western Australian Preterm Birth Prevention Initiative, consisting of seven interventions, as shown in Box 1. Priority was given to avoidance of elective delivery before at least 38+ weeks gestation without medical or obstetric justification; routine measurement of the length of the cervix at all mid-pregnancy ultrasound scans; prescription of natural vaginal progesterone for shortened cervix or past history of spontaneous preterm birth; promotion of smoking cessation; and a dedicated new clinic in the tertiary-level perinatal hospital.

Implementation of the program was accompanied by an intensive social media campaign known as The Whole Nine Months, print material distributed across the state, and an outreach program consisting of workshops for healthcare practitioners across metropolitan and rural Western Australia. At the heart of the Initiative was a philosophy of providing education to the pregnant women of the state, in partnership with their healthcare providers.

In the first full calendar year after introduction (2015), the rate of preterm birth state-wide fell by 7.6 per cent and in the tertiary-level centre by 20 per cent.[3] The reductions extended down to the early gestational age groups. This early success led to a successful application to NHMRC for a Partnership Grant involving Western Australia, New South Wales and Victoria, awarded in April 2018. The funding was provided to extend the Initiative in Western Australia and to roll out various versions of the program across our two most populous states. A decision was then made by key representatives from each state and territory to apply the partnership across the nation as a whole and, in June 2018, the Australian Preterm Birth Prevention Alliance was established.

The Alliance has a single aim of safely lowering the rate of preterm birth across Australia. In essence, The Whole Nine Months social media program will now become national and with adaptations tailored for the special circumstances within each jurisdiction.

The organisation sits within the Perinatal Society of Australia and New Zealand (PSANZ) as one of its sub-committees. Each of our six states and two territories has two co-leaders; typically a senior obstetrician accompanied by a more junior clinician. Special expertise is provided by the Chief Investigators of the NHMRC Partnership Grant and members representing the fields of neonatology, midwifery, biostatistics, health economics; health policy; consumer representation; media and marketing; and philanthropy. Together the 30 members sit on a Steering Committee with six members comprising an Executive.

Each year, the Alliance will hold a dedicated workshop immediately before the PSANZ Conference, typically in March, which all registrants are welcome to attend. The progress for each state and territory will be presented, along with discussion of special initiatives under consideration.

Box 1. Key interventions included in the Western Australian Preterm Birth Prevention Initiative[3]

Key interventions to prevent preterm birth

- No pregnancy to be ended prior to 38+ weeks gestation unless there is a clear medical or obstetric justification
- Measurement of cervix length to be included in all mid-pregnancy morphology scans, conducted routinely at 18–20 weeks gestation
- Natural vaginal progesterone 200 mg to be prescribed nightly in any case in which the cervix is found to be <25 mm on transvaginal scan between 16 and 24 weeks gestation
- In cases in which the cervix is found to be <10 mm, management can include cerclage, vaginal progesterone, or both
- Natural vaginal progesterone 200 mg to be prescribed nightly in any case with prior history of spontaneous preterm birth (with or without pre-labour rupture of membranes) between 20 and 34 weeks gestation
- Women who smoke during pregnancy to be offered appropriate cessation strategies
- A new dedicated Preterm Birth Prevention Clinic established at the tertiary centre

Figure 1. Members of The Australian Preterm Birth Prevention Alliance, November 20, 2018.

The challenges facing the Alliance are clear and the opportunities are plentiful. The rate of preterm birth is rising progressively, largely as a result of intervention in the late preterm and early term age groups.[4] Evidence is accumulating that birth at these times may be associated with significant developmental, behavioural and educational problems at school age.[5] The consequences in later ages in terms of lifetime productivity and fulfilment are poorly understood, but likely to also be important. Consequently, the potential risks associated with increasing rates of birth in the late preterm and early term age groups are now clear. There may be consequences for individuals, families, communities and perhaps our nation as a whole.

Over recent decades it has become clear that events before and around birth may have lifelong consequences. This understanding has brought obstetric care to the forefront of healthcare. And it is in the field of preterm birth prevention that we obstetricians may have the greatest opportunity to play our part in creating a better community for tomorrow.

The Alliance will now play a central role in identifying prevention strategies that are effective and feasible for our healthcare system, assisting with implementation for our various communities, evaluating the benefits of their introduction, identifying appropriate research priorities, and mentoring the next generation of thought leaders. As the world's first such national program, the Alliance will also play an important role in facilitating the development of preterm birth prevention strategies elsewhere and partnering with the many potential agencies active in this important area of healthcare.

Every healthcare practitioner who works in the field of reproduction has a role to play in our goal to prevent early birth. The Alliance will provide a platform to lead and coordinate, but our collective success will require commitment from our entire workforce, in partnership with the community we serve, across the many and varied healthcare environments in Australia.

The Australian Preterm Birth Prevention Alliance
Executive Committee Members

John Newnham: Chair, Jonathan Morris: Deputy Chair, Euan Wallace, Kiarna Brown, Lindsay Edwards, Monika Skubisz

Steering Committee Members

Northern Territory Kiarna Brown: Co-Lead, Carina Cotaru: Co-Lead
Queensland David Elwood Co-Lead, Chris Lehner: Co-Lead, David Watson: Co-Lead (Far North)
New South Wales Natasha Donnolley: Consumer Representative, Jane Ford: Perinatal Epidemiologist, Jonathan Morris: Co-Lead, Michael Nicholl: Health Policy, Tanya Nippita: Co-Lead
Australian Capital Territory Boon Lim: Co-Lead, Maylene Pineda: Co-Lead
Victoria Jeanie Cheong: Neonatologist, Tanya Farrell: Health Policy, Stefan Kane: Co-Lead, Jeremy Oats: Health Policy, Euan Wallace: Co-Lead
Tasmania Amanda Dennis: Co-Lead, Lindsay Edwards: Co-Lead
South Australia Rosalie Grivell: Co-Lead, Paula Medway: Midwifery, Philippa Middleton: Perinatal Epidemiologist, Monika Skubisz: Co-Lead
Western Australia Catherine Arrese: Alliance Manager, Alicia Bauskis: Health Care Economist, Hugh Dawkins: Health Policy, Dorota Doherty: Biostatistician, Richie Hodgson: Marketing and Media, John Newnham: Co-Lead, Deb Portughes: Philanthropy, Scott White: Co-Lead

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AUSTRALIAN
Preterm Birth
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ALLIANCE

Development of an artificial placenta

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The need for a new life support system

Preterm birth remains the leading cause of neonatal death in Australia today, with some 8 per cent of all Australian babies being delivered prior to 37 weeks completed gestation.[1] Worldwide, an estimated 15 million preterm babies are born every year and, of these, around one million will die from complications of prematurity.[2] Rates of preterm birth are highest in socio-economically disadvantaged groups, such that highest rates of preterm deliveries are seen in regions of the United States, Africa and South-East Asia.[2] Here in Australia, the rate of preterm birth in Aboriginal and Torres Strait Islander populations is nearly double that of the non-Indigenous population.

Even in high-resource environments such as Australia, with socialised medicine providing ready access to excellent obstetric and neonatal care, being born too early conveys an increased absolute risk of developing a range of diseases affecting the respiratory, cardiovascular and sensory systems; as might be expected, the earlier one is born, the greater the absolute risk and severity of complications.[3] Due to profound advances in obstetric care and perinatal medicine, outcomes for almost all preterm babies have improved markedly over the past 50 years.

Although the majority of improvements in outcomes likely derive from advances in pregnancy and neonatal care in toto, the introduction of antenatal steroid therapy and exogenous surfactant, combined with the availability of increasingly sophisticated ventilation equipment have profoundly improved the chances of preterm babies being discharged home free of a major morbidity.

The one exception to this preterm birth success story is the small number of babies born extremely early at the border of viability – between 21 and 24 weeks completed gestation – a resistant rump of babies at high risk of death or the development of lifelong disease. In this particular demographic, the rates of death, or survival to discharge with a major morbidity, remain stubbornly high.[4] Data presented in 2015 by Stoll and colleagues in the *Journal of the American Medical Association* serve to demonstrate the challenges facing practitioners working with extremely preterm infants, some weighing as little as 400 g. Stoll's data show that over the period 1993–2012, approximately two-thirds of infants born at 23 weeks gestation died of complications associated with prematurity.[4] At less than 24 weeks' gestation, fewer than one in five babies survived to discharge without a major morbidity. There were only small improvements in mortality rates for these extremely preterm infants, and no improvements in rates of disease-free discharge for babies born at or below 24 weeks gestation.[4] In contrast, survival to discharge among all infants born at 28 weeks gestation – just one month later – was reported as 94 per cent, and disease-free survival to discharge as 56 per cent – a profound improvement.[4]

We believe that within the explanation for this marked difference in survival also lies the answer to improving outcomes for the babies born at the border of viability. Current neonatal therapies are, broadly speaking, based around two fundamental assumptions: i) that the preterm lung may be used for gas exchange and; ii) that given the initiation of pulmonary gas exchange, the preterm cardiovascular system must precociously adapt to life outside the uterus, closing the fetal shunts. As will be discussed in greater detail below, a number of investigators have proposed that the best way to save the lives of these extremely preterm babies is for them not to breathe at all, and to leave the fetal shunts patent as they normally would be in utero.

A physiological justification for such an approach is provided by a simple ontological assessment of fetal lung development. The canalicular phase of lung development occurs in humans over approximately an eight-week period between 16 and 24 weeks gestation. Respiratory bronchioles develop during this phase, which precedes formation of both alveolar ducts and sacs, and the production of pulmonary surfactant. As such (and ignoring a host of other developmental modifications occurring in the lung over this period) the surface area available for gas exchange is comparatively small and the compliance of the lung is comparatively low. Taken

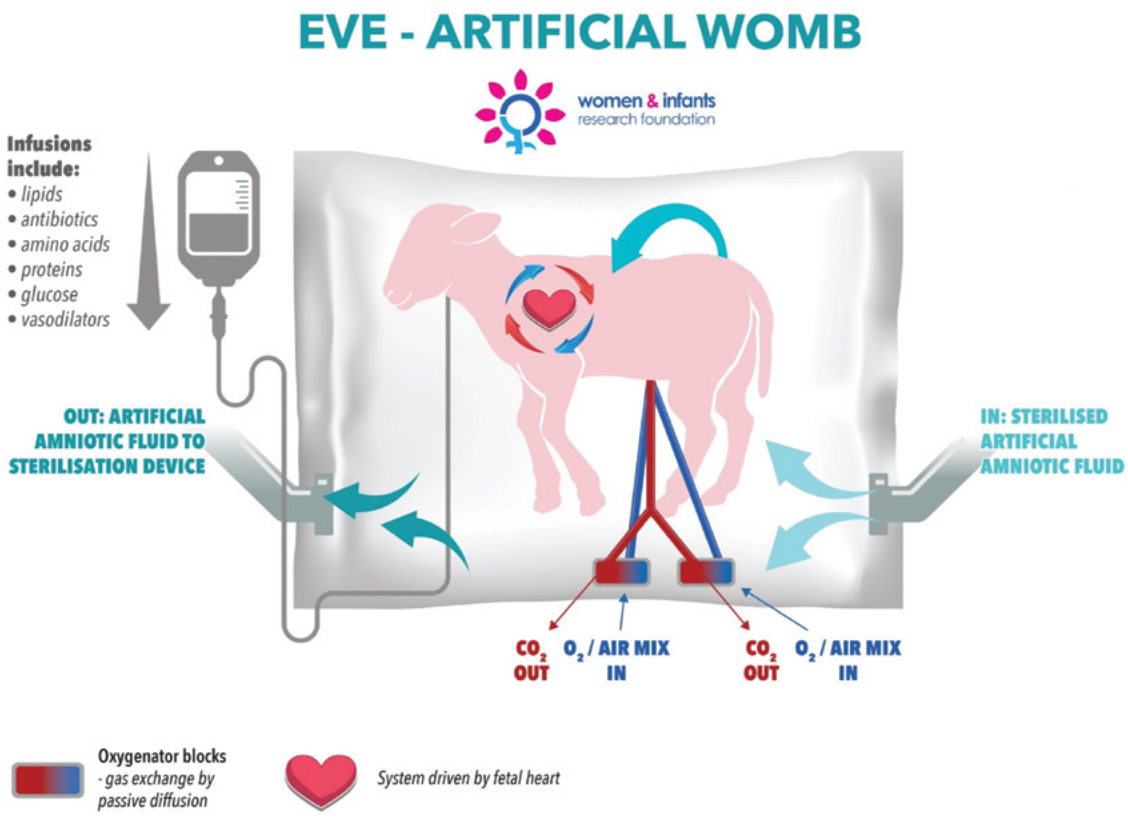

Figure 1. The workings of the artificial womb.

together, the efficiency of gas exchange is poor and requires additional and potentially injurious inspiratory pressure to obtain an appropriate tidal volume. Put another way, the preterm lung at 21–24 weeks gestation is poorly suited to performing gas exchange; a reality reflected in the poor outcomes seen among today's extremely preterm infants.

Acknowledging that current neonatal life-support technologies based on pulmonary ventilation have met an efficacy threshold when applied to patients below 24 weeks gestation, we have sought to extend the work of a number of investigators in Japan, Korea, Canada and the United States to develop a non-pulmonary life support platform for extremely preterm infants born at the border of viability. A key element of our approach in this domain is a change from treating these infants as small babies, to treating them as fetuses and working with, rather than against, their current developmental state.

What is an artificial placenta?

The human placenta performs a myriad number of essential functions to support fetal growth. In contrast, artificial placentas that have been developed for use in the treatment of extremely preterm infants are largely limited in function to performing gas exchange. Thus the artificial placenta may better be characterised as an extra-corporeal membranous oxygenation (ECMO) system. In our own centre,[5] this function is supplemented with intravenous administration of a cocktail of medicines, nutrients and fluids necessary to maintain key physiological variables within their respective reference ranges, and to maintain ductal patency, all contained within an artificial uterus filled with a sterile artificial amniotic fluid (Figure 1). As might be expected, there are a range of circuit configurations, with the most promising designs to date incorporating an arterio-venous circuit secured to the umbilical vasculature and driven by the fetal heart.

A (very) brief history of the artificial placenta

At first pass, the concept of maintaining an extremely preterm fetus on an artificial placenta, safely submerged in an artificial uterus replete with synthetic amniotic fluid and in the absence of pulmonary gas exchange, sounds like a futuristic proposition. As it happens, efforts to develop an artificial placenta to support extremely preterm infants have been a work in progress for over 60 years – although the target demographic today is almost certainly different (much smaller and more immature) than that envisaged prior to the adoption of antenatal steroids and exogenous surfactant. Among the first reported use of an artificial placenta to support pre-viable human fetuses is contained in a paper by Westin and colleagues published in *Acta Pediatrica* in 1958 – the same year that Qantas launched its round-the-world express service from Melbourne (via Nadi; Honolulu; San Francisco; New York; London; Rome; Athens; Karachi; New Delhi; Bangkok; Singapore; Jakarta; and Perth). Of work from groups in Canada,[6] Japan[7] and Korea,[8] perhaps the most important report was a landmark study by Unno and colleagues in 1993,[9] which reported the long-term survival of preterm goats treated for 21 days on an artificial placenta and a subsequent 30 days on mechanical ventilation. Interestingly, the authors noted that preterm goats failed to spontaneously breathe after the withdrawal of ventilation support, potentially due to the extensive use of the neuromuscular inhibitor pancuronium bromide throughout the experiment. More recently,

groups from the United States[10,11] have used preterm sheep to perform exciting pre-clinical studies demonstrating the potential clinical utility of the artificial placenta as a life-support platform for extremely preterm infants.

Bilateral Japanese-Australian development of the artificial placenta

In 2013, investigators in Perth (Profs John Newnham and Matt Kemp) and Sendai, Japan (Prof Masatoshi Saito, Dr Haruo Usuda, Dr Yuichiro Miura, Dr Shimpei Watanabe, Dr Takushi Hanita, Dr Shinichi Sato), with the support of Nipro Corporation (based in Osaka, Nipro Corporation is one of Japan's leading medical technology companies) and the Women and Infants Research Foundation (www.wirf.com.au; one of Australia's peak not-for-profits focused on preterm birth prevention and improved preterm outcomes) formed a bilateral consortium to develop a new life-support platform for extremely preterm infants, based on the use of an artificial placenta developed in preliminary studies at Tohoku University in Sendai, Japan. The collaboration draws on respective surgical, engineering and medical research strengths from each partner institution; the platform has also taken on something of an Australian identity, with members of the team taking inspiration from the unique reproductive cycle of marsupials, and naming it a 'Joey'. Since the consortium's establishment, and with support from the Channel 7 Telethon Trust, the Department of Health (WA) and the National Health and Medical Research Council, the team has undertaken an intensive series of experiments with preterm lambs to develop a high-efficiency, arterio-venous gas exchange system driven solely by the fetal heart (Figure 1). In 2014, we achieved variable survival for 48 hours on a prototype system; in 2015 we achieved stable maintenance of key physiological parameters for 48 hours.[12] In 2016, we achieved optimal maintenance of physiological parameters in preterm lambs for one week and successfully transferred a preterm lamb onto pulmonary ventilation.[5] Ultrasound and necroscopy data revealed a normal pattern of growth. All haematological parameters were normal, and all lambs were infection-free. In 2017, we extended this healthy survival period to two weeks. In 2018, in experiments currently under publication embargo, we were successful, for the first time, in adapting extremely preterm lambs to our next-generation artificial placenta system and maintaining them for an extended period of time.

Coming soon to a nursery near you?

There can be no doubt that the artificial placenta field, after a lengthy and iterative development process, is rapidly accelerating towards clinical application. However, unless there is a very significant body of experimental data that is not yet in the public domain, our assessment is that it will be many years of painstaking research before a life-support platform based on an artificial placenta is appropriate for clinical application. Noting that we would be happy to be proven wrong (such is the need for this technology) our view on this point remains that the experimental studies presented to date neither sufficiently inform nor justify the risk of current clinical application.

An assessment of the latest data from the field (including our own), against a likely clinical presentation for a putative 'first artificial placenta patient' serves to highlight the challenges yet to overcome, noting of course that any artificial placenta-based therapy must be demonstrably better (that is, better chance of disease-free survival) than any treatment it may replace. For example, against data presented by Stoll and colleagues,[4] this equates to at least a better than 50 per cent survival rate for a 23-week preterm infant. We presently have no short- or long-term outcome data for extremely preterm sheep or goats maintained on an artificial placenta platform – with published data in our possession being from moderately preterm sheep or goats (105–120 days gestation out of 150 days, and all >1000 g in delivery weight). We have no data from non-human primates. The data presented to date, of which we are aware, derives from fetuses delivered in an optimal state of health from a pregnancy that would have otherwise continued. Accordingly, investigators have not had to contend with the added complication of managing an extremely preterm fetus with limited cardiovascular compensation capacity and a host of other developmental challenges (such as adrenal insufficiency) in the setting of growth restriction, chorioamnionitis/funisitis, or systemic fetal infection – all common aetiological factors of extremely early preterm birth.

Sitting alongside these pragmatic considerations is the need for the scientific, medical, legal and wider community to embark on a discussion of the ethics of an artificial placenta – preferably well in advance of such a platform entering clinical practice. The use of an artificial placenta to maintain otherwise 'non-viable' fetuses raises a host of legal and ethical queries: when would such a baby be considered to have been 'born' and when would it obtain legal status as a person? A clearly articulated consideration of these issues, based on broad consultation, will form a critically important part of the journey of artificial placenta technology to the clinic.

For our own contribution, we eagerly anticipate working with our colleagues in Japan and Australia to drive this highly promising technology towards clinical application.

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Progesterone to prevent preterm birth

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Preterm birth (PTB) occurs in five to 18 per cent of pregnancies and is the leading cause of neonatal morbidity and mortality, and infant death. Although a previous spontaneous preterm birth is an important risk factor for a recurrent preterm birth, nearly 70 per cent of PTBs occur for women without an identifiable risk factor.

There is good biological plausibility for the use of progesterone to prevent preterm birth. Progesterone insufficiency is considered to be one of the main contributors to the process that triggers uterine contractility. Progesterone reduces myometrial sensitivity to oxytocin, blocks adrenergic receptors and prostaglandin synthesis and stimulates lymphocyte-associated synthesis of progesterone induced blocking factor, all of which facilitate uterine quiescence during pregnancy.

Meis et al,[1] in their landmark randomised trial in women with previous spontaneous preterm birth, reported a significant reduction in preterm birth with 250 mg weekly intramuscular injection of 17 hydroxy progesterone caproate. The study has been heavily criticised because of the very high rate of preterm birth in the control group and because the rate of preterm birth in the treatment group was similar to that in the general population. This study did, however, lead to a flurry of randomised controlled trials assessing the role of progesterone in reducing preterm birth.

There are two forms of progestogens available in Australia, 17 OH progesterone and the micronised progesterone as a 100 or 200 mg tablet. For the purpose of this article, we will only consider the use of the latter.

Although many randomised trials on progesterone for the prevention of preterm birth have been published, the results have been inconsistent owing to the selection of women randomised; with or without previous preterm birth, with or without known cervical length (CL) singleton and multiple pregnancies. As a result, the published systematic reviews have also been less informative and with possibly misleading conclusions. The 2013 Cochrane Review,[2] for example, has a general conclusion that vaginal progesterone is of benefit in women with previous history of preterm birth. There was no mention made of the CL. Others have selected women with singleton pregnancy[3,4] and with multiple pregnancy[5] with a short cervix and noted that the benefit is limited to this group only.

Paramount to determining the success of progesterone to reduce risk of preterm birth is therefore to identify women who will benefit. It is not efficacious for all women. For this reason, we have used data from papers and reviews that have used individual patient data analysis so that there is clearer patient selection and thus hopefully make clearer recommendations.

Efficacy of progesterone

Singleton or twin pregnancy with or without previous preterm birth *and* normal or unknown CL

Singleton pregnancies

O'Brien's study[6] excluded women with short CL, PROGRESS trial[7] with CL unknown/unspecified and OPPTIMUM[8] with mixed CL population, have all failed to show any beneficial effect of progesterone for the prevention of preterm birth.

Multiple pregnancies

In a review of non-selected twin pregnancies,[5] progesterone did not significantly reduced the risk of preterm birth overall at <34 or <37 weeks of gestation, the relative risk of preterm birth <34 weeks of gestation was 0.82 (95% CI 0.64–1.05). Another metanalysis of three trials, including the PREDICT study, reported that there was no significant effect of progesterone on the risk of preterm birth; pooled odds ratio, 1.07 (95% CI, 0.52–2.19).[9]

Currently, the use of vaginal progesterone cannot be recommended for these women.

Singleton or twin pregnancy with CL ≤25 mm, with and without previous preterm birth

A subgroup analysis in the metanalysis of trials on women with singleton pregnancy and a short cervix that also included selective women from the OPPTIMUM study[3] reported that the frequencies of preterm birth <36, <34 and <28 weeks of gestation were significantly lower in the vaginal progesterone group

There was also a significant reduction in the risk of respiratory distress syndrome, composite neonatal morbidity and mortality and admission to the neonatal intensive care unit (NICU); frequency of neonatal death was 1.4% in the vaginal progesterone group and 3.2% in the placebo group

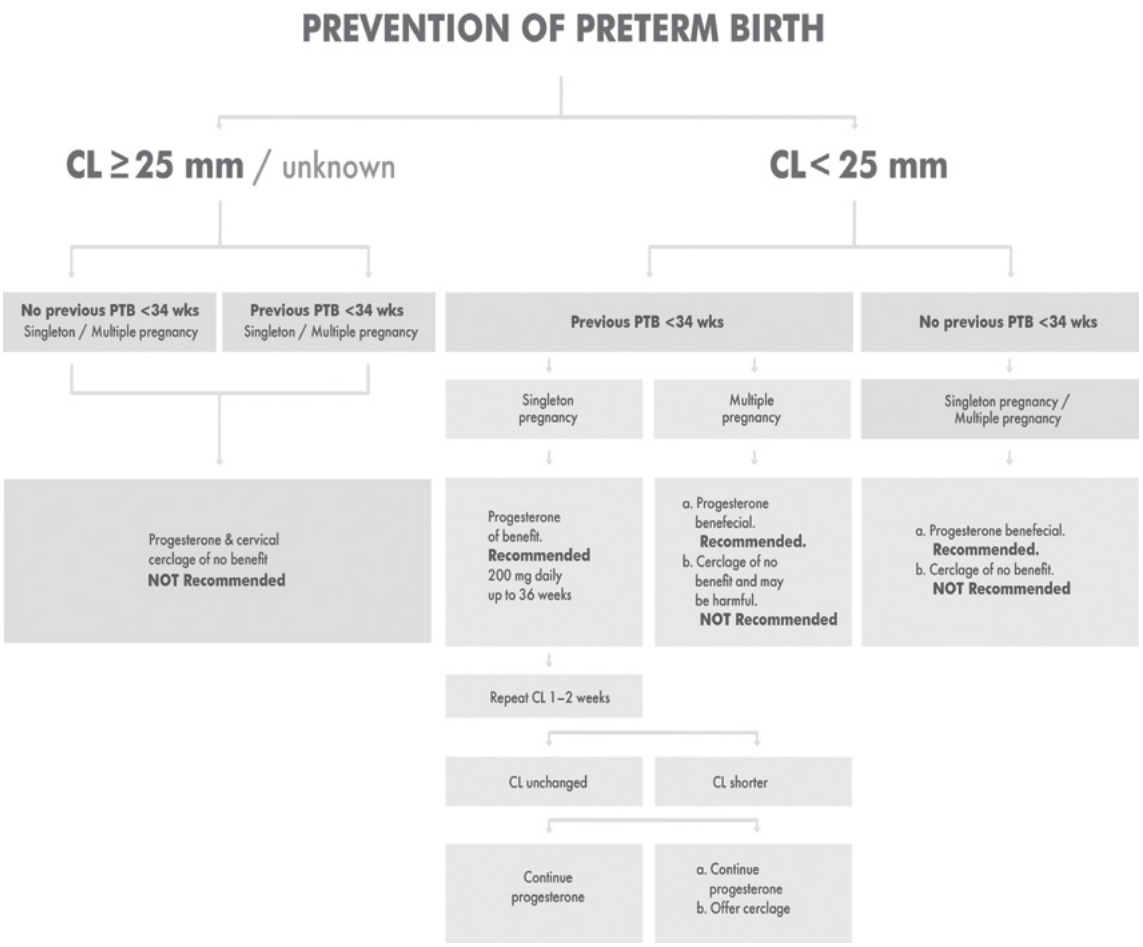

Figure 1. Flowchart for the use of progesterone to prevent preterm birth.

A review that included women with twin pregnancy and a short cervix[7] also concluded that vaginal progesterone significantly lowered the incidence of preterm labour before 34 weeks of gestation and another[10] showed a reduction in adverse perinatal outcome (15/56 versus 22/60; RR 0.57; 95% CI 0.47–0.70)

Currently, vaginal progesterone 100–200 mg daily is recommended from early pregnancy until 36 weeks gestation.

Singleton pregnancy with CL ≤25 mm *and* a previous spontaneous preterm birth

The beneficial effect of vaginal progesterone and cervical cerclage in this subgroup has been shown in a large systematic review.[11] Vaginal progesterone, compared to placebo, significantly reduced the risk of preterm birth <35 and <32 weeks of gestation, composite perinatal morbidity/mortality, neonatal sepsis, composite neonatal morbidity, and admission to the NICU (RRs from 0.29 to 0.68). Cervical cerclage, compared to no cerclage, also significantly decreased the risk of preterm birth <37, <35, <32, and <28 weeks of gestation, composite perinatal morbidity/mortality, and birthweight <1500 g (RRs from 0.64 to 0.70). There was no significant difference between the two interventions

A Cochrane review[12] also reported that there were no significant differences between the two interventions in the risk of preterm birth <37 weeks (RR, 1.16; 95% CI, 0.64–2.08), <34 weeks (RR, 1.01; 95% CI, 0.51–2.01), perinatal mortality (RR, 0.94; 95% CI, 0.36–2.48), and serious neonatal morbidity (RR, 0.49; 95% CI, 0.05–4.52).

Cervical cerclage placement is, however, associated with increased risk of rupture of membranes, chorioamnionitis, vaginal bleeding and cervical trauma, as well as the risks associated with the anaesthesia.

The choice of treatment therefore would be based on risk of adverse effects of an invasive procedure, cost-effectiveness as well as the woman's preference. The following practical recommendation is thus suggested:

Currently, in this subgroup, continuing vaginal progesterone is recommended as first-line prevention as stated above and repeat CL in one to two week:

- **if CL remains static continue progesterone only**
- **if CL shortens further, offer cervical cerclage in addition**

Multiple pregnancy with CL ≤25 mm *and* a previous spontaneous preterm birth

A systematic review[13] noted that although there were no significant differences between cervical cerclage and vaginal progesterone for this subgroup, in the risk of preterm birth, very low birthweight (aOR 2.22, 95% CI 1.07–5.73) and respiratory distress syndrome (aOR 3.88, 95% CI 1.09–21.03) were more frequent in the cerclage group.

Currently, in this subgroup, vaginal progesterone only is recommended. Cervical cerclage may be associated with harm.

Safety of progesterone

Regarding its safety, there is no evidence of any short- or long-term harm to either the mother or the newborn. The OPPTIMUM trial[8] reported on childhood outcomes at age two years using the Bayley Score of Infant Development and Vedel et al.[14] at an eight-year follow up; neither have noted any harmful effect of exposure to progesterone.

We should no longer consider the success of intervention only on birth before 37 or before 34 completed weeks of gestation. Studies need to address particularly on any effect on fetal neonatal short- and long-term morbidity.

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Practicalities of preterm delivery

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The advent of contemporary neonatal intensive care since the 1970s has not only improved the survival of preterm infants, but also progressively moved the viability goalpost towards an earlier gestational age. In Australia, 8.6 per cent of all babies, 14 per cent Indigenous, are born preterm.[1] These figures increase in multiple gestations, accounting for 63 per cent of twins and 100 per cent of higher order multiples. Three out of four preterm births occur spontaneously. Delivery of the preterm fetus is fraught with peril, due to the potential maternal and fetal morbidity and mortality. It is therefore vital that we are well-equipped to bring these tiny babies into the world in the safest way possible.

Due to the unpredictable nature of preterm labour, prompt decisions about the mode of delivery often need to be made. These are based on multiple factors, such as maternal and fetal wellbeing, lifelong morbidity of the preterm infant, the agreed gestation of viability between the parents and the treating team, parental wishes, future reproductive implications, contraindications to vaginal birth, and so forth.

In light of the paucity of evidence on the optimal mode of delivery, in the context of extremely preterm birth (less than 28 weeks) and very preterm birth (28–32 weeks), as defined by the World Health Organization,[2] we examine the various modes of delivery of the early preterm infant and their benefits and drawbacks.

Instrumental delivery

The indications, requirements and maternal risk factors of performing a preterm instrumental delivery are similar to their termed counterparts. Both forceps and vacuum deliveries are contraindicated at less than 34 weeks.

Vaginal breech delivery

Despite clear guidelines on vaginal breech delivery and its contraindications, there is no guideline on vaginal delivery of the preterm breech. RANZCOG and RCOG advise considering vaginal delivery only if the breech is in frank or complete position and that the woman birth in lithotomy with an epidural.[3,4] Spontaneous expulsion is preferable to breech extraction, with the use of specific manoeuvres, such as Lovsetts for the arms and Mauriceau-Smellie-Viet or Burns Marshall technique for delivery of the aftercoming head, if required.

There is a theoretical risk of entrapment of the aftercoming preterm breech head in a partially dilated cervix, due to the larger head-to-abdominal circumference ratio compared to that of a term or near-term fetus. Uterine relaxation with a beta-adrenergic agonist or nitroglycerin can be attempted, with the use of manoeuvres, for example, Durhssen's incisions, symphysiotomy and Zavanelli manoeuvre with caesarean delivery, as the last resort due to their potential fetal and maternal risks.

Excessive handling of the breech during such manoeuvres can result in trauma and injury. Ways to minimise this include avoidance of pulling on the baby, use of a gauze pack on the torso and abdomen, holding the breech by the legs and delivery en caul if possible.

Classical caesarean section

The decision for a classical incision on the uterus may be made due to the position of the fetus, multiple gestations, placental location and an absent lower segment. Other incisions, such as an upper transverse, can also be considered. Although a classical incision is more invasive than a lower segment, it is definitely preferable to a J or a T incision.

A large classical incision can facilitate an atraumatic delivery of the fetus, especially if delivery can be achieved en caul. Inserting your whole hand into the uterine cavity to carefully turn babies into

a deliverable position or performing a breech extraction is also easier with good access. Such access can aid a speedy delivery of the fetus and avoid hypoxia.

Evidence-based practice

There is currently a lack of strong evidence to suggest the benefits of one mode of delivery of the preterm infant over the other.[5] One large retrospective cohort study failed to identify a statistical benefit of caesarean over vaginal delivery of a preterm fetus, in terms of development of retinopathy, necrotising enterocolitis, respiratory distress syndrome, grade III–IV intraventricular haemorrhage and neonatal death.[6] As for maternal outcome, one retrospective cohort study found no difference in the incidence of postpartum haemorrhage, blood transfusion, operative and postpartum complications and chorioamnionitis, in either modes of preterm delivery between 23 to 34 weeks.[7]

Useful tips

As life is a succession of lessons, which must be lived to be understood, and the road of excess leads to the palace of wisdom, here are some words of wisdom from two experienced obstetricians from the sole tertiary obstetrics hospital in Western Australia.

Dr Anne Karczub MBBS FRANZCOG, Consultant Obstetrician and Dr Scott White MBBS PhD FRANZCOG CMFM, Consultant Obstetrician MFM Service.

What is your approach to interpretation of the preterm intrapartum CTG; what factor influences you to intervene?

Dr Karczub: I'm not looking for reactivity, I'm not necessarily looking for sustained accelerations. I'm looking for variability and the absence of sinister features. The point with the preterm fetus is that you've got a lower threshold for intervening soon because of the concern that you've got a fetus with less reserve, so you wouldn't watch something as long.

Dr White: They are less likely to be reactive, often have shorter accelerations and have accelerations of lower magnitude. They have often somewhat reduced variability, some of those are due to prematurity, some of those due to the drugs we give, such as magnesium sulphate or analgesics, that impact on the fetal heart rate. Ultimately, you interpret the preterm intrapartum CTG as you would a term CTG, the principles are the same. I guess the issue is having, before this woman is in labour, a plan for what you are and aren't going to act upon.

What is your top tip for the obstetrician at a preterm vaginal delivery?

Dr Karczub: Have a paediatrician present. Second top tip is to prepare yourself for the unexpected. At the very severe preterm, fetuses can turn themselves around as they are coming down the canal. So, with a woman pushing, you can get a baby that at 24 or 26 weeks was cephalic, but becomes a malpresentation, especially a shoulder presentation, as they can banana inside the birth canal.

Beware the preterm head, because the preterm head is that much bigger than the preterm body, so that when the cephalic presentation comes to the perineum, they can distend and distend and then the baby fly out like a champagne cork. Beware the champagne cork phenomenon.

Dr White: Expect the unexpected. Often, they'll present in unusual ways, shoulders, brows and faces. Also, you can deliver vaginally some presentations in extremely preterm gestations that you can't do at term.

What is your top tip for the obstetrician at a preterm caesarean delivery?

Dr Karczub: Be brave and do not be afraid to do a classical if that is what is needed to deliver the baby. Do not be tempted by a poorly formed lower segment that is not going to allow adequate lower segment incision to deliver the baby. With a classical incision, the body of the uterus is very thick, so you just have to be brave and have confidence that you are going to get there eventually. The trick is to open the full incision on the uterus, don't have a very small incision going down and down into a deep dark hole that's welling blood. Make a big incision. Once you're in, you can still extend with scissors, be brave.

Dr White: Always have a plan B, and probably a plan C and a plan D. These babies can be extremely difficult to deliver, you've got limited access to get your hand in to manipulate this fetus, all the while wanting to do it very gently. Having a thought in your

Table 1. Specific complications of instrumental deliveries in preterm gestations.

	Potential risks	Prevention
Vacuum	Intraventricular haemorrhage Cephalohaematoma Subgaleal haemorrhage Tissue and skin trauma/lacerations Neck injury	Vacuum delivery contraindicated at <34 weeks
Forceps	Skull fracture Skin lacerations Facial injury Neck injury Bruising Forceps slipping off the fetal head	Forceps relatively contraindicated at <34 weeks, use with caution Do not attempt rotational forceps in the preterm infant Only apply an instrument if certain of fetal position Use ultrasound intrapartum to assess fetal head position Use guided pushing and lithotomy position

Table 2. Management of head entrapment during vaginal breech delivery. .

Manouvres	Description	Risks
McRoberts position	Flexion of maternal knees so that the anterior aspect of the thighs are pressed against the abdomen	
Uterine relaxation	Beta adrenergic agonist (terbutaline 250 µg subcutaneous) Nitroglycerin General anaesthesia	Maternal tachycardia Uterine atony
Duhrssen's incision	1–2 fingers placed between the partially dilated cervix and the presenting part, with incisions made along the length of the undilated cervix at 6, 2 and 10 o'clock	Extension of incision to the lower uterine segment or broad ligament Injury to uterine vessels, ureter and bladder Severe haemorrhage Cervical incompetence in subsequent pregnancy
Symphysiotomy	Infiltration of the symphysis pubis and overlying skin with local anaesthesia Insertion of firm catheter into the urethra to displace it laterally Incision made over the symphysis to separate it just enough to deliver the head	Pelvic instability, requiring delayed orthopaedic repair
Zavanelli manoeuvre and caesarean delivery	Administration of tocolytic and attempt to replace the fetal body into the uterus, followed by caesarean section	Complications of caesarean section Cervical injury and subsequent cervical incompetence

mind as to what steps you'll take if you encounter difficulty is important. These are things like tocolysis, and making J or T incisions. Give yourself plenty of room: big baby, big hole; small baby, big hole.

With a preterm in breech position, what is the main factor that influences your decision for an attempt at vaginal delivery or caesarean section?

Dr Karczub: If fully dilated, the body of the preterm fetus is in the vagina (not just the feet in the vagina and the buttocks at or above the pelvic brim), then one would generally be considering a vaginal delivery. If the breech is on the pelvic floor, one does a vaginal delivery, with good analgesia, long scissors and Jackson's and Sim's retractors in the room, and being mentally prepared to incise the cervix if it traps the head. Have your instruments for cervical incision there, always. Have someone able to assist. Footling breech with high buttocks is at risk of cord prolapse with an incompletely dilated cervix. If the cervix is not fully dilated, asses as you would for any planned vaginal breech with consultation and counselling with the parents. Is the baby going to withstand vaginal birth? Keep membranes intact for as long as possible, as it buffers the baby against injury. Finally, always do the vaginal examinations yourself! People get the vaginal exams wrong in these circumstances.

Dr White: Several things; parental wishes are paramount. What they want. They should know that there is some evidence to suggest that for extremely preterm breech babies, you shouldn't be averse to doing a caesarean section if it's indicated. Another thing is obstetric experience. Given the low rate of breech vaginal births in contemporary practice, it may be that the obstetrician is more comfortable doing a caesarean section than a vaginal breech delivery. For the preterm breech, do continuous electronic fetal monitoring, have another experienced obstetrician or senior midwife with you, try and leave the membranes intact as you are less likely to get head entrapment, don't pull on it. Be gentle with your manoeuvres as membranes are very easy to break. Have available a Jackson's retractor and a pair of long scissors so you are prepared to do a cervical incision quickly if required.

In the setting of a cephalic presentation labour at less than 34 weeks, where the cervix is fully dilated but the vertex is not advancing, what do you advise if you need to expediate delivery?

Dr Karczub: If you need to put an instrument on, then you do. You just have to be really careful that when you pull, you pull gently as you can with the forceps over the baby's head. I've seen quite bad

trauma, like ripping off babies' ears and so forth. I have one time only, in the context of a second twin that was vertex and high and was basically at the pelvic brim, just put my whole hand in and grabbed the baby by the head and manually pulled the baby out. I have also done that in the setting of when babies banana inside the vagina, put my whole hand in and pulled the baby out. It's that group, too, that the forceps don't fit that well. With your hand you are probably doing less damage than forceps.

Dr White: I wouldn't do a vacuum extraction of a preterm baby, but I would use forceps. I think it's very reasonable if there is an indication to expedite delivery, even in a preterm fetus, to use forceps. You usually don't need to at extremely preterm gestations. But it's certainly not impossible, you are better off to do a straightforward gentle forceps delivery than to have an asphyxiated preterm baby.

You're performing a severely preterm caesarean section in the back down transverse position, please discuss your approach to delivery.

Dr Karczub: If you're having difficulty or have done a lower segment, for example, and the uterus is clamping down, do the usual things. Try to get uterine relaxation, glyceryl trinitrate (GTN), get your whole hand in and cradle the baby, try to bring the head around or bring the breech around. With your whole hand or arm inside the uterus, bring that baby around in a somersaulting position. Usually the head first. The breech is difficult as you've got to go through a longer rotation. Do what feels to be the right thing at the time. Make a big incision and don't be afraid to do a T if you don't have a classical.

Dr White: For a preterm transverse fetus, even if the lower segment seems appropriately formed, you should always think, 'should I be making a classical incision?' It enables your plan B, in that you have the access that you need to manipulate that fetus. Other things are having an experienced assistant, an experienced anaesthetist and having access to tocolysis, such as GTN. Try to find a foot. Also think about scanning the patient immediately before starting, so you know where the legs are, which way to rotate the fetus, and where the placenta is.

Conclusion

Early preterm delivery is often a daunting experience for both the medical team and the patient. The field of obstetrics is fraught with known knowns, known unknowns and unknown unknowns. Hence, preparation and anticipation of potential complications is the key to a safe delivery of a preterm infant.

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RANZCOG

Annual Scientific Meeting 2019

Melbourne

STOP. START. CONTINUE.

Sunday 13 October – Wednesday 16 October 2019 Melbourne Convention and Exhibition Centre

Call for Abstracts

Abstracts are invited for Free Communication (Oral) and Poster presentations for the **Royal Australian and New Zealand College of Obstetricians and Gynaecologists 2019 Annual Scientific Meeting (RANZCOG 2019 ASM)** being held in Melbourne, Victoria from Sunday 13 to Wednesday 16 October 2019. Abstracts are welcome on any of the areas of interest listed below; papers must not have been published elsewhere.

Abstracts may be submitted in the following areas of interest:

- General Gynaecology
- General Obstetrics
- Gynaecological Oncology
- Maternal-Fetal Medicine
- Obstetrical and Gynaecological Ultrasound
- Reproductive Endocrinology and Infertility
- Urogynaecology
- Other

The theme for the 2019 Annual Scientific Meeting is Stop. Start. Continue. In line with this theme, the Organising Committee would like all abstract authors to reflect on, from their own area of expertise, what O&G clinicians should stop, start and continue doing in order to deliver the best outcomes. You will therefore be required to select which category your abstract best fits into from the options of: **stop, start, or continue** as part of the submission process.

Key Dates

Monday 28 January 2019
Abstract Submission Opens

Friday 8 March 2019
ASM Registrations Opens

Thursday 16 May 2019
Deadline for receipt of abstracts

Friday 12 July 2019
Authors notified whether abstracts have been accepted

Thursday 8 August 2019
Early bird registration closes

Thursday 8 August 2019
Deadline for presenting authors to register*

*It will be assumed any presenter not registered by this date has withdrawn their abstract from the program.

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Presentation Type

Authors will be required to indicate the preferred presentation type when submitting an abstract from the following:

- Free Communication Oral presentation only.
- Poster presentation only.
- Free communication *or* poster.

Poster Presentations Format

- Free Communications will be allocated 12 minutes – 10 minutes for presentation and 2 minutes for discussion. Abstracts not selected for Free Communication may be eligible for Poster presentation.
- The top 20 Poster presentations will be prominently displayed in the meeting venue. All other abstracts will be displayed via the Meeting App and on electronic viewing platforms at the meeting venue.

Publication in ANZJOG

Abstracts accepted for Free Communication Oral, Poster and e-Poster presentations may be put forward for publication in ANZJOG (Supplement) following the conclusion of the RANZCOG 2019 ASM; consent or otherwise should be indicated for each submitted abstract during the abstract submission process.

Awards and Prizes

The presentations will be judged onsite during the ASM. Prizes will be awarded for the following:

Aldo Vacca Award – Best Free Communication

During the meeting, a prize will be awarded to the Best Free Communication presented. The Aldo Vacca Award has been established in honour of the exceptional contribution that Aldo Vacca made to both the College and to the health of women and their babies around the world.

Best Static Poster Award

A prize will be awarded to the best static poster displayed in the Exhibition Hall.

RANZCOG Early Career Researcher Award

A prize will be awarded to the Best Free Communication presented by an Early Career Researcher.

To be eligible, the presenting author must be a FRANZCOG trainee or a RANZCOG Fellow five years or less post-Fellowship at the date of the meeting.

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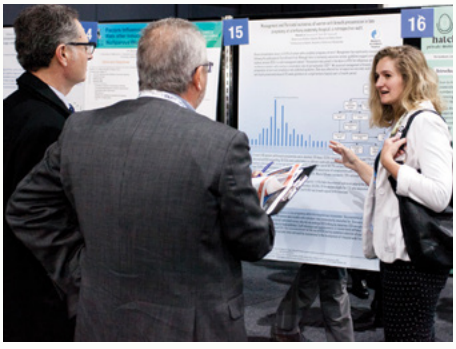

Threatened preterm labour out bush

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It has been a busy day. You finally crawl into bed listening to the sounds of the tropical storms in the distance and the air conditioner gently humming away on its never-ending battle against the humidity. You are hoping for a solid night's sleep; however, you concur with the alleged postulation that stormy weather seemingly brings on labour. Therefore, your phone is adjusted to the highest volume next to your bed, as you fall into a gentle slumber, despite the rumbles of the passing storms.

All too soon, you are abruptly woken by the symphony of the loud thunderclap and the blaring ringtone of the phone. Half dazed, you answer and recognise the voice of the night midwife. 'Sorry to wake you doc, but can I speak to you about a 26 weeker? She has come in contracting, about three in 10. No fluid loss or bleeding, the baby looks great on CTG, but we are definitely getting some activity with the toco. I don't have all her history yet as she is not booked with us, but did you want me to do a spec and any swabs?' Hearing this history, you thank him between the claps of thunder, but decide you better head in and see what is happening.

As you open the front door, hit by the humidity and the pelting rain, you start to think about the patient you are about to see. For the last three years, you have been the obstetrician in a rural country town, about twelve hours' drive from the city. You have a great team of five GP obstetricians, two paediatricians, never enough midwives and a level two nursery that can handle babies from 35 weeks of gestation. The closest tertiary hospital is nine hours away; if, and only if, there is a plane and a pilot (who hasn't exceeding their daily flight limit) hours within the region. As you drive in, it is the golden oldies hour on the radio and a song by The Clash grabs your attention, 'Should I stay, or should I go.' You chuckle as you realise it is the same question for this patient. Should she stay out bush with you or be shipped off to the big smoke? And more importantly, how will you answer that question?

Should they stay or should they go?

For patients presenting with threatened preterm labour (TPL) in a rural area, often the right and safest answer appears to be simply sending them to the closest hospital with an appropriate nursery should they deliver. Research has consistently demonstrated that in utero transfers are much safer and cost-effective, compared to the increased risks and resources required to transfer a preterm neonate.[1] A local paediatrician will have to accompany the preterm neonate, divesting the region of their expertise for days. The time-critical nature of the transfer mandates dispatch of the faster, but more expensive, jet.[2] The possibility of mother and baby separation should also be considered, if both cannot be transported on the same plane. With all this in mind, the answer seems quite simple, you have to get her out.

But, what if she's not actually in labour, but has a urinary tract infection, gastroenteritis or an irritable uterus? By transferring every patient with TPL 'just in case', there are considerable financial and resource implications that can potentially compromise other patients in the community. Each transfer can cost up to tens of thousands of dollars[3] and, even more concerning, there will be one less plane available for other local emergencies, such as an acute myocardial infarction or a cerebral vascular accident. Furthermore, once patients with TPL are evacuated from rural areas, there is an understandable reluctance for the medical team to facilitate the patients' return, until an appropriate gestation has been attained. This can result in patients being 'stuck' in metropolitan areas for weeks or months, and consequently missing work and income, as well as increasing stress from trying to coordinate family and childcare responsibilities back at home. Many rural patients describe feeling very lonely, depressed and isolated under such circumstances.[4]

You soon pull into the hospital carpark and brave through the warm rain to the labour ward. You know to make the right diagnosis and treatment plan for this patient, you are going to need to take into consideration her history, examination and potentially use bedside tests. You quickly run through these in your mind, and the evidence for their use.

Table 1. Factors to consider as part of workup for threatened preterm labour.

History	• Ascertain gestational age • Signs and symptoms of TPL • Risk factors for preterm birth (see Table 2)
Physical examination	• Maternal observations • Frequency, intensity and duration of uterine contractions • Fetal heart activity and cardiotocography • Uterine tenderness and firmness • Fetal position • Symphysis-fundal height
Speculum examination	• Estimate cervical dilatation* • Per vaginal bleeding (amount) • Assessment for preterm prelabour rupture of membranes (PPROM) • Swab for fFN testing
Ultrasound examination	• Fetal position • Placental site • Amniotic fluid (if PPROM is clinically suspected) • Cervical length (transvaginal ultrasound, if possible)

***In the absence of relative contraindications to a digital cervical examination, findings can add more clinical value to a speculum examination.**

Preterm labour (PTB) is commonly defined as regular uterine contractions (greater or equal to four every 20 minutes or greater than eight per hour) with a cervical length of less than 20 mm on transvaginal ultrasound, or, positive fetal fibronectin (fFN) and a cervical length between 20–29 mm on transvaginal ultrasound, between 20 and 36^{+6} weeks of gestation.[5] Factors to consider as part of TPL workup are listed in Table 1.

Risk factors

As you arrive on the labour ward, you are informed that the patient has had two previous deliveries at term. This singleton pregnancy has been uncomplicated to date and she has never had any gynaecological surgery before. With a limited on-call radiology service, you have a portable ultrasound machine in the labour ward and wonder about cervical length. You consider this in your diagnosis, and the other risk factors for preterm birth, summarised in Table 2.

You decide to examine the patient and take swabs at the same time to see if this will assist in your diagnosis. In the labour ward storeroom, there are a number of TPL tests that companies have sent for you to try, each with literature explaining why theirs is the best. You wonder if any has an advantage over the others. A device for quantifying fFN has also been purchased recently, and you wonder if it has any advantage over the cheaper bedside test.

There are three main commercial kits available to risk-stratify patients at risk of preterm labour. Studies regarding their efficacy are often industry sponsored, with published findings in Table 3.[6–8]

Often in rural areas, only one particular test kit may be available. Therefore, practitioners must ensure that they are familiar with the manufacturer's instructions for each test, as differences exist with collection and testing. Furthermore, the test is only one of the determining factors used in in the assessment of risk of PTL, taking into account the clinical context.

Upon completion of the patient's sonography assessment, the cervix was found to be only 10 mm in closed length. The midwife subsequently informs you that the fFN level is greater than 200 ng/mL and the patient is still experiencing mild contractions, despite attempts at tocolysis with nifedipine. Your clinical instinct tells you that transfer to a tertiary unit is warranted. You call the Royal Flying Doctor Service that provides your state medical emergency transport service. They answer, 'Yeah doc, we can get her out, but we need to move soon as cyclone Winston is headed your way and all planes will likely soon be grounded for a couple of days. I am sure the roads will also be cut.' As you quickly prepare the patient for evacuation and transfer, a number of thoughts cross your mind regarding transferring a patient with TPL from a rural area.

Transfer

Risk of delivery in the air

With the contractions only partially settling, you wonder about placing the patient on the plane. A preterm delivery can be difficult on its own, let alone at 20,000 feet. You wonder who should be sent on the plane.

While research has demonstrated that aeromedical transfers have not been associated with in-flight PTB,[9] deliveries outside hospital add further risks that must be contemplated and negated by considering the accompanying personnel; the need to carry delivery and neonatal resuscitation supplies and even cross-matched blood. Patients in active labour, at high risk of bleeding or with fetal distress, should not be considered for transfer except in extreme circumstances.

Steroids

With the delivery potentially occurring in the next few hours or days, you wonder about the benefits of steroid administration for acceleration of fetal lung maturation.

Table 2. Risk factors associated with preterm birth.

History	• Previous history of spontaneous PTB • History of multiple D&Cs • History of cervical surgeries, ie. LLETZ, cone biopsy • History of surgeries involving cervical dilatation, ie. D&E, hysteroscopic resection of fibroids or uterine septum or adhesions • Medical conditions, ie. diabetes, hypertension, renal disease • Limited antenatal care • Psychological stress • Infections • Vaginal bleeding
Others	• Mid-trimester cervical length of < 25 mm • Positive fFN > 50 ng/mL • Multiple gestation • Polyhydramnios

Table 3. Positive and negative predictive values of bedside tests for delivery within seven days.

Protein	Positive predictive values %	Negative predictive values %
Fetal Fibronectin (fFN) > 10 ng/mL > 50 ng/mL > 200 ng/mL > 500 ng/mL	 16.7 (95% CI 13.3–20.5) 23.7 (18–30.3) 37.7 (26.9–49.4) 47.6 (25.7–70.2)	 97.3 (95% CI 96.1–98.2) 95.6 (94.3–96.7) 94.7 (93.4–95.8) 98.2 (92.1–94.8)
Placental alpha microglobulin-1 (PAMG-1)	76–78	94–96
Phosphorylated insulin-like growth factor binding protein-1 (pIGFBP-1)	83–86	95–98

While it is well established that optimal timing for antenatal corticosteroid administration, to prevent respiratory distress syndrome (RDS), to delivery is between 48 hours and one week,[10] less evidence is known about the effects if delivery occurs within 24 hours. Some studies have demonstrated no significant effect in the prevention of RDS within this time period, but there is still a reduction in perinatal and neonatal deaths, without increasing maternal risks. Therefore, even if delivery is imminent within 48 hours, antenatal steroids should be considered up to 36^{+6} weeks of gestation.[11-13]

Magnesium sulphate

Although it is well established that antenatal magnesium sulphate administered to women at risk of PTB at gestations less than 30 weeks significantly reduces the risk of neonatal cerebral palsy,[14] administering the medication during the transfer adds another level of risk of magnesium toxicity. Is there any benefit of just giving a loading dose? Is the risk of the infusion worth the benefit at this gestation?

Numerous protocols exist, both in practice and research, for administration of magnesium sulphate for fetal neuroprotection. Depending on the medical evacuation provider, magnesium sulphate infusion may mandate the presence of a medical staff escort on the flight, rather than a nurse. Once again, this can delay a transfer or limit local medical resources from other patients. Therefore, the risks and benefits must be considered on a case-by-case basis.

Additional tocolytics

As the transport team arrives, the contractions persist, prompting the team to deliberate about commencement of another tocolytic. What tocolytic is available and what are the risks of giving it?

Despite the paucity of evidence between management of TPL with tocolytic agents and improved perinatal outcomes,[15] they might be useful in temporarily stalling labour in the transfer setting. In addition to nifedipine, intravenous salbutamol is another preferred alternative for a number of transfer providers, especially at more advanced dilatations. However, the increased maternal side effects and complications must be considered and planned for, especially with prolonged use, as evacuations from remote areas of Australia can take in excess of 12 hours.[16]

Soon the flashing lights of the ambulance fades from view as they head off to the local airfield. You start to relax for the first time today, knowing you made the right decision and appropriate management was underway. As a big gust of wind suddenly sweeps by, your heart skips a beat as you remember what the Royal Flying Doctor Service coordinator said – the cyclone is heading your way! You dash for your car to head to the nearest supermarket to grab bottles of milk and coffee pods, in preparation for the road blocks, as what good is an obstetrician without their morning double-shot flat white?

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Neurodevelopmental complications

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Infants born at 34^{+0} to 36^{+6} weeks gestation are referred to as late preterm (LP).[1] Over recent years, the number of infants delivered in this LP gestation has increased around the globe.[2] The reasons for this increase have been a subject of intense debate on how best to reduce LP births.[3] One should remember that all LP births are not preventable. Various medical conditions, such as presence of congenital anomalies, pre-eclampsia, gestational diabetes and growth concerns on serial antenatal ultrasounds, either spontaneously result in LP birth or prompt induction at this gestation to minimise further fetal compromise in utero.[3] Thus, the LP population is diverse and heterogeneous.

Very preterm infants (born earlier than 32 weeks gestation) and those with a birthweight of less than 1500g are often considered at high risk of developmental problems and a regular follow up at four, eight, 12 and 24 months of corrected age is recommended to identify developmental problems at the earliest.[4] LP infants, being slightly more mature, are considered to be of low risk. Hence, no formal developmental follow-up schedule is routinely in place for them. This leaves LP infants in a vulnerable situation with any problems only identified late in childhood. Gestational age is a continuum and recent reports have suggested a higher risk of neurodevelopmental abnormalities experienced by LP infants compared with infants born at term.[5] LP infants are at a higher risk of experiencing hospitalisation-related complications in the neonatal period and in early infancy.[2] However, one needs to be aware that the studies are heterogeneous and the results need to be interpreted with caution. Some of the complications are discussed below.

LP infants and developmental delay

Recent reports suggest that LP infants experience higher risk of developmental delay compared with term infants at various stages of childhood, including early infancy.[6] Assessment of developmental delay is generally carried out using parent-completed screening questionaries, such as Ages and Stages or standardised objective confirmatory testing, such as Griffith test, Baileys test, Welscher's intelligence scales and so forth. Morag et al reported that LP infants demonstrated low scores compared with term infants when tested at 12 months of actual age.[7] When tested at 12 months of corrected age, LP infants caught up with term infants.[7]

Nepomnaschay et al tested the cognitive abilities of 400 LP infants at two years of age using the short form of Baileys test and compared the results with 5050 term infants. The authors reported that the risk of LP infants experiencing scores of less than one standard deviation was comparable with term infants.[8]

Wolthaler et al tested 1200 LP infants using Baileys test at 24 months of age and compared the results with 6300 term infants. LP infants, compared with term infants, had lower mental (85 versus 89) and psychomotor development indices (88 versus 92) both P <0.0001 respectively. A higher proportion of LP infants experienced developmental delay compared with term infants with an adjusted odds ratio (95% CI) of 1.52 (1.26–1.82).[9]

At six years of age, using Welschers's scale of intelligence, Talge et al reported that LP infants were twice as likely to experience IQ scores of below 85, with a full scale IQ (95% CI) of 2.35 (1.20–4.61).[10]

Using linked data, Petrini et al studied more than 8000 LP infants and compared the diagnosis of developmental delay with more than 130,000 term infants. The observed risk of developmental delay diagnosed using ICD 9 code was 12.2 versus 9.2 per 1000 live births in LP versus term infants. The adjusted OR (95% CI) for developmental delay in LP infants was 1.36 (1.11–1.66). However, information on other contributing factors, such as the age at diagnosis, medical conditions at birth and neonatal comorbidities, were not reported.[11]

In a recent systematic review, Chan et al reported that LP infants demonstrated an increased risk of lower cognitive ability scores at school age.[5] The differences in cognitive outcomes persisted until adulthood, with term infants performing at five per cent higher of a standard deviation than LP cohorts.[5]

LP infants have also been shown to experience higher risk of delays in gross motor and speech milestones.[7,8] Morag et al studied the gross motor milestones at six and 12 months using Alberta infant motor scales and Griffiths test and compared them with term infants. The authors reported that LP infants consistently experienced lower scores when compared with term infants.[7] Similarly, speech evaluation using parent-completed screening questionnaires identified increased risk of speech delay under the age of 36 months.[8,12] Brown et al reported that, at five years of age, the rate of receptive vocabulary delay in four to five year olds was 13.1 per cent in LP and 12.7 per cent in full term, with an adjusted relative risk (95% CI) of 1.06 (0.79–

1.43).[13] Despite being statistically non-significant, it appears that LP infants experience increased speech and language difficulties in the early years of life.

LP infants and early intervention

With a higher need for therapy services arising due to early developmental delays, LP infants are more likely to need early intervention services. Shappiro-Mendoza et al reported on the need for early intervention services using data linkage from a birth cohort in Massachusetts.[14] The cohort that consisted of 554,974 singleton infants born during 1998 through 2005, and survived the neonatal period, were followed until the third birthday of each infant. The prevalence of early intervention program enrollment increased with each decreasing week of gestation before 41 weeks; 23.5 per cent of enrolments were LP, and 11.9 per cent of enrolments were term.[14] Kalia et al studied the early intervention enrolments in New York and compared the outcomes with very preterm infants born before 32 weeks. After controlling for comorbidities of prematurity, the authors found that LP infants requiring admission to the neonatal unit have the same risk of requiring interventional therapies as very preterm infants.[15]

LP infants also experience higher risk of cerebral palsy (CP) diagnosis as reported by Petrini et al at five years of age[11] and Hirvonen et al at seven years of age.[16] Petrini reported three times the risk[11] while Hirvonen reported twice the risk of CP when compared with term infants.[16] LP infants whose neonatal course was complicated by the need for resuscitation, presence of intracranial haemorrhages increased the risk of CP diagnosis.[16] Recent reports have also suggested that LP infants experience higher risk of attention deficit hyperactivity disorder (ADHD) diagnosed at school age using standard assessments.[17] However, more evidence is needed before any causal association between LP infants and ADHD can be established.[17,18]

Conclusion

Thus, studies that reported the cognitive, gross motor and speech outcomes of LP infants have provided inconsistent results, with some authors demonstrating a tendency to catch up by five to six years of age. While some LP infants seem to catch up, some infants continue to experience persistent developmental and cognitive delays beyond early childhood. It is not certain which category of LP infants experience persistent deficits. One needs to remember that various factors, such as the condition at birth, presence of congenital anomalies, growth status of the infant, neonatal course, presence of lesion such as intraventricular haemorrhage, contribute towards the developmental and cognitive outcome of the infant. Age at diagnosis, the type of test used and exposure to early intervention also affect the eventual result. Limited evidence suggests that it is not only the degree of prematurity but also the morbidities experienced in the neonatal period that contribute to adverse neurodevelopmental outcomes. Given the large number of patients in this category, it is not feasible to follow up all LP infants in neurodevelopmental follow-up clinics. Hence, more research is needed to understand the subgroup of LP infants who would benefit from close monitoring post discharge from the neonatal care unit.

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Causes of preterm birth

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Preterm birth (PTB) is the leading cause of morbidity and mortality in the developed world and affects 5–18 per cent of births globally. Spontaneous preterm labour (PTL) is the cause of 40–50 per cent of total preterm births with a further 20–30 per cent due to premature rupture of membranes (PROM) precipitating labour. The remaining 20–30 per cent of births are clinician initiated, due to maternal or fetal issues that complicate the pregnancy.

Spontaneous preterm birth is hypothesised to be via one of the following four pathways:

1. Premature activation of the maternal or fetal hypothalamic-pituitary-adrenal axis
2. Exaggerated inflammatory response or infection
3. Decidual haemorrhage
4. Pathological uterine distention

The purpose of this article is to review the risk factors that clinicians should be aware of, and screen for, preconception or early in antenatal care.

Reproductive factors

History of previous spontaneous preterm birth

This is the major risk factor for recurrence of PTB (15–30 per cent) and often recurrence at the same or earlier gestation.[1]

- The women who are deemed to be at highest risk are those with:
- No term pregnancy between the previous spontaneous PTB and the current pregnancy
- A history of multiple spontaneous PTBs

Short cervix

There is an inverse relationship between cervical length measured by transvaginal ultrasound at 16–28 weeks of gestation and gestational age at delivery. Cervical shortening (effacement) is one of the first steps in the processes leading to labour and can precede labour by several weeks.[2] Effacement begins at the internal cervical os and progresses caudally; thus, it can often be detected on ultrasound examination before it can be appreciated on physical examination. All women with a singleton birth should have a request to screen for cervical length as part of the anatomy scan. Clinicians should keep in mind the measurements of less than 35 mm transabdominally and less than 25 mm transvaginally as the limits that may warrant further intervention. For women with a previous preterm birth, the recommendation is that cervical length screening should start earlier.

Uterine abnormalities

Congenital uterine abnormalities and acquired abnormalities, such as fibroids, can result in PTB. Depending on the type and severity, they should be addressed preconception.

Uterine instrumentation and cervical surgery

A systematic review of almost one million women showed that women with a history of surgical evacuation for miscarriage or termination of pregnancy have a small, but statistically significant, increased risk of PTB in a subsequent pregnancy, compared with controls (5 versus 5.7 per cent).[3]

The new cervical screening test program is aimed at decreasing cervical surgery for low-risk women and the effects on their reproductive outcomes. Both cone biopsy and LLETZ procedures effect the integrity of the cervix, although the cervix is better preserved following ablation versus excision procedures. It is hypothesised that these treatments impact the cervical glands and stroma, affecting cervical mucous production and the collagen matrix, impairing cervical stroma and tensile strength. There is mixed data on the effect of LLETZ procedures on subsequent preterm birth; however, cone biopsy is associated with PTB in gestations of less than 28 weeks.

Assisted reproduction

Pregnancies conceived by artificial reproductive treatment (ART) have up to two-fold increased risk of PTB, even accounting for those affected by multifetal gestation. This increased risk is believed to be a direct result of the baseline maternal factors necessitating the couple to undergo ART.[4]

Maternal factors

Maternal medical issues

Chronic maternal medical disorders are frequently associated with maternal or fetal complications causing medically indicated PTB as well as an increased risk for spontaneous PTB. Examples frequently encountered include hypertension, renal insufficiency, severe respiratory disease, type 1 diabetes mellitus, autoimmune diseases, organ transplantation and severe pre-eclampsia .

Age

Similar to many other obstetric complications, extremes of maternal age place the women at risk of PTB.[5] The average age in Australia of first pregnancy is now over 30 and this is increasing every year.

Genetic factors

Although certain PTB genomes have been identified, this is still an area of much ongoing research. Epigenetic and environmental factors also appear to play a role.

Asymptomatic bacturia

It remains unclear if asymptomatic bacturia is an independent risk factor to increase a women's chance of PTB. What is known, however, is that treating

positive urinary cultures lowers the risk of a women developing pyelonephritis.[6] It is recommended that all women have a urine sample sent to be screened in first trimester and those women who are at risk of recurrent infections (such as diabetics, autoimmune disease) should be offered further screening throughout the remainder of pregnancy.

Genital tract infections

Multiple studies have reported an association between preterm labour/delivery with various bacterial genital tract infections including, *group B streptococci* (GBS) *Chlamydia trachomatis bacterial vaginosis, Neisseria gonorrhoea syphilis, Trichomonas vaginalis Ureaplasma* and *unencapsulated Haemophilus influenzae*. The causal relationship for genital infections and PTB is controversial; however, a positive culture in pregnancy correlates with the presence of histologic chorioamnionitis on postpartum examinations.[7] The current advice is to treat these infections if positive on swabs, although universal screening in the mid-trimester remains controversial with some studies showing benefit and others none.[7]

Current malaria infection causes PTB and this is an important risk factor which should be screened for in the group of women who may have recently travelled to, or migrated from, endemic areas.

Lifestyle and behaviour factors

Nutrition and weight

Women with better nutritional intake and healthy weight gain are less likely to have either spontaneous or iatrogenic preterm birth. Ideally, those women who fall in a range of unhealthy maternal weight should be optimised preconception. Extremes of weight and nutrition in pregnancy are often confounded by lower socioeconomic status and this may be an opportunity to provide extra support.[6]

Smoking

Smoking is clearly identified to place a women at risk of preterm birth. All women should be screened for cigarette smoking and offered support for smoking cessation.

Interpregnancy interval

Recommending women to space pregnancy intervals to at least 18 months and providing affordable access to effective contraception immediately postpartum has been shown to decrease the risk of subsequent PTB.[8]

Exercise

Exercise and its effect on pregnancy has been the subject of much research in recent years. Exercising in pregnancy has been shown to be protective in lowering rates of PTB and this is attributed to the exerciser effect (that is, healthy women who are at less risk of preterm birth are more likely to continue to exercise in pregnancy).[9]

Stress

Most women report at least one stressful event in the 12 months preceding birth. While it can be postulated by one of the aforementioned pathways that stress could precipitate PTB, the evidence does not consistently support stress as a strong risk factor for preterm birth. Clinicians should continue to counsel and support women experiencing high levels of stress in the pregnancy to enhance their overall health during both the pregnancy and postpartum period.

Fetal/placental factors

Multifetal gestation

May be related to increased uterine distention as well as increased sex steroid production contributing to PTB.

Polyhydramnios

Related to increased uterine distension.

Bleeding in early pregnancy

The association of first-trimester bleeding with preterm delivery before 34 weeks is related to either decidual haemorrhage causing rupture of membranes and PTB or iatrogenic resulting from of placental disease including PET, abruption, intrauterine growth restriction.[10] Women with persistent vaginal bleeding and bleeding in the second trimester are at higher risk of these complications than those with an isolated first-trimester event.

Biomarkers

There is much ongoing research in this field with more than 30 biomarkers currently listed in the literature. Fetal fibronectin (fFN) is available across most birth suites in Australia and NZ.

Quantitative fFN is not useful in predicting PTB in asymptomatic nulliparous women. It does however have a role in helping predict which symptomatic women may be risk of PTB when combined with the clinical presentation (contractions, effacement and dilatation) and ultrasound assessment of cervix. fFN is now incorporated as part of the QuiPP app (including cervical length, demographic information, obstetric history) to give a risk assessment for PTB within seven days.[11]

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Fish oil and preventing preterm birth

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Babies born too early are at higher risk of poor health and some may not survive. Very few interventions have been shown to prevent preterm birth, so new findings that omega-3 fatty acid supplementation during pregnancy can help prevent babies being born too soon are very important for pregnant women, babies and the health professionals who care for them.

A team of researchers, led by A/Prof Middleton and Prof Makrides from the South Australian Institute of Health and Medical Research Institute, are studying long-chain omega-3 fats and their role in reducing the risk of premature births – particularly docosahexaenoic acid (DHA) and eicosapentaenoic acid (EPA) found in fatty fish and fish oil supplements. On World Prematurity Day in November last year, we published a Cochrane review that included 70 randomised trials with nearly 20,000 women overall.[1]

We found high-quality evidence that increasing the daily intake of omega-3 long chain fatty acids during pregnancy lowers the risk of:

- having a preterm baby (less than 37 weeks gestation) by 11 per cent
- having an early preterm baby (less than 34 weeks) by 42 per cent

The proposed action of omega-3 fatty acids is by reducing the potency of prostaglandins, which can trigger preterm birth.

An increase in gestational length and in prolonged pregnancy was seen with omega-3 supplementation. There was a possibly reduced risk of perinatal death and of neonatal care admission, a reduced risk of low birthweight babies and possibly a small increased risk of large for gestational age babies with omega-3 fatty acids.

Very few differences between antenatal omega-3 fatty acid supplementation and no supplementation were observed in children's cognition, IQ, vision, other neurodevelopment and growth outcomes, language and behaviour, so we are uncertain of the effects of omega-3 fatty acid supplementation on these outcomes.

Most of the trials were conducted in high-income countries and included women mostly with singleton pregnancies, who were at either normal or high risk for poor pregnancy outcomes. The trials often used omega-3 supplements, though a few tested the effect of dietary changes, such as advice to eat more fish.

So while there is convincing evidence that omega-3 fatty acids can prevent preterm birth, we have a number of implementation challenges ahead. The first challenge has been to formulate some practical guidance for women and health professionals. On present evidence, we have suggested that the optimum dose of fish oil is a daily supplement containing between 500 and 1000 mg of long-chain omega-3 fats (containing at least 500 mg of DHA) starting at 12 weeks of pregnancy, for women with a singleton pregnancy. Currently available antenatal vitamin and mineral supplements usually contain less than 200 mg DHA+EPA, so they are not adequate on their own for preventing preterm birth.

Why not advise pregnant women to eat more fish?

Some women may want to do this, and this is encouraged. They would need to eat two to three serves a week of fatty fish, such as salmon, and this can be expensive and difficult for many women. Other pregnant women are concerned about heavy metal content in fish, but careful selection of species (for example, reducing shark and swordfish intake) addresses this concern. Others are concerned about sustainability of fish stocks, but some algal supplements are available. In fact, fish usually get their high omega-3 content from eating algae.

Table 1. Main results from 'Omega-3 fatty acid addition in pregnancy' Cochrane review.

Outcome	RR	95% CI	No. of RCT	No. of women	% change*	GRADE
Preterm < 37 weeks	0.89	0.81 to 0.97	26	10,304	13 to 11	high
Preterm < 34 weeks	0.58	0.44 to 0.77	9	5204	4.6 to 2.7	high
Prolonged pregnancy > 42 weeks	1.61	1.11 to 2.33	6	5151	1.6 to 2.6	moderate
Perinatal death	0.75	0.54 to 1.03	10	7416	2 to 1.5	moderate
Low birthweight	0.90	0.82 to 0.99	15	8449	16 to 14	high
Large for gestational age	1.15	0.97 to 1.36	6	3722	12 to 13	moderate

RR: risk ratio; CI: confidence interval; RCT: randomised controlled trial; *absolute

Can we optimise who should take omega-3 fatty acids in pregnancy?

There is emerging evidence that some women may benefit more than others from topping up their omega-3s. In a recent analysis from the Danish National Birth Cohort,[2] women with low concentrations of omega-3 fatty acids in early–mid pregnancy had the highest risk of preterm birth, while women with high omega-3 status did not appear to have reduced risk of preterm birth. It may be that low omega-3 status is a risk factor for prematurity. Indeed, earlier work has suggested that omega-3 supplementation may benefit women with the lowest intakes of omega-3 fatty acids.[3] Our research group has recently completed the ORIP randomised controlled trial of 5400 women who were supplemented with omega-3 fatty acids[4] and through the use of innovative dried blood spot technology to measure omega-3 fatty acid status, we will be able to add to knowledge about women's characteristics and differential responses to omega-3 fatty acid supplementation; including how to avoid any harm from prolonging pregnancy, for example.

It is now time to translate the evidence into action and we have begun the process of developing national clinical practice guidelines and an international statement. One of the challenges will be how health professionals and research translators (like us) can work together to implement nutrition solutions for preventing preterm birth, which calls for a 'social prescribing' approaches. We have begun to work with professional groups and hospitals to find and deliver the best strategies for using omega-3 fatty acids to prevent preterm birth – and to refine the strategies as we discover more about which women are likely to gain the most from omega-3 fatty acid supplementation.

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PPROM: what the evidence tells us

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Preterm prelabour rupture of membranes (PPROM) is a complication that occurs in 3 per cent of live pregnancies between 22^{+0} and 36^{+6} weeks gestation, with the majority of these pregnancies delivering within one week of membrane rupture.[1] Prematurity-related morbidity varies with gestational age and the three main causes of neonatal death associated with PPROM are prematurity, sepsis and pulmonary hypoplasia.[2]

The purpose of this article is to present a snapshot of the current evidence-based guidance for specifically the diagnosis, relevance of laboratory test monitoring for chorioamnionitis, prophylactic antibiotic management and timing of delivery for women with PPROM. Our aims of care should be to use an evidence-based approach to managing patient care to maximise the benefits of increasing in utero fetal maturity, while minimising both maternal and neonatal morbidity and mortality.

Diagnostic aids

The diagnosis of PPROM is primarily clinical and is made via visualisation of amniotic fluid from the cervix on sterile speculum examination. In cases of uncertainty, laboratory and point-of-care tests can be used to aid in the diagnosis of amniorrhexis.

- Nitrazine paper can be used to detect pH changes in vaginal secretions. This test is affected by alkaline fluids such as semen, blood and soap.[3]
- Placental alpha microblobulin-1 protein assay (PAMG-1 [Amnisure]) is a rapid slide test that uses immunochromatography methods to detect trace amounts of placental alpha micoglobulin-1 protein in vaginal fluid. It is a point-of-care test that provides results within 5–10 minutes of collection. This test is not affected by semen or trace amounts of blood.[4]
- Insulin-like growth factor binding protein 1 (IGFBP-1 [Actim PROM]) is secreted by decidual and placental cells and has a very high concentration in amniotic fluid. This test is not affected by the presence of infected vaginal secretions, urine, semen or small amounts of blood. It, too, is a point-of-care test providing results in 5–10 minutes.[5]

A 2013 meta-analysis of prospective observational or cohort studies investigating IGFBP-1 (Actim PROM) and PAMG-1 (Amnisure) for diagnosis of ruptured membranes concluded that PAMG-1 was more accurate than IGFBP-1 for diagnosis in all patient populations.[6] A subsequent randomised trial of 120 pregnant women with signs and symptoms of membrane rupture were evaluated with the PAMG-1, IGFBP-1 and nitrazine tests. Results identified sensitivity, specificity, positive predictive value and negative predictive value of PAMG-1 (100%, 100%, 100% and 100%) IGFBP-1 (93.33%, 98.89%, 96.55% and 97.80%) and nitrazine test (93.33%, 94.44%, 84.85% and 97.7%).[7]

Point-of-care tests are both highly sensitive and specific while being a practical aid in the diagnosis of PPROM.

Antenatal monitoring for chorioamnionitis

The RCOG Green-top Guideline 44 defines the diagnostic criteria of clinical chorioamnionitis as maternal pyrexia, tachycardia, leucocytosis, uterine tenderness, offensive vaginal discharge and fetal tachycardia. There is conflicting evidence in the literature regarding the accuracy or usefulness of laboratory tests indicating leucocytosis and raised C-reactive protein in the prediction of chorioamnionitis. It has a low sensitivity (less than 20 per cent) and high specificity (greater than 90 per cent) for chorioamnionitis and, as such, may only be useful in excluding infection.[8-9]

Routine antibiotics

Prophylactic antibiotics are known to prolong latency and reduce maternal and fetal infection following PPROM.[10] Prolonged rupture of membranes increases the risk of intrauterine infection, which carries adverse consequences affecting both the woman and her infant. Streptococcus agalactiae, or GBS, is the most frequent cause of early onset neonatal sepsis.[11]

There is a range of published data demonstrating erythromycin resistance in GBS isolates and, as such, 48 hours of intravenous ampicillin is the recommendation from Centers for Disease Control and the American College of Obstetricians and Gynaecologists for coverage until a rectovaginal swab has excluded GBS colonisation.[12]

Twenty-two trials involving more than 6000 women with PPROM before 37 weeks were included in a meta-analysis.[13] The use of antibiotics following PPROM was associated with a statistically significant

reduction in chorioamnionitis (RR 0.57, 95% CI 0.37-0.86). Ultimately, the data were insufficient to determine whether any antibiotic regimen (drug, dose, duration) was better than another, but amoxicillin-clavulanate was associated with an increased risk of neonatal necrotising enterocolitis (RR 4.72, 95% CI 1.57–14.23)[13]

There are two large randomised controlled trials investigating prophylactic antibiotic regimens in the setting of PPROM; the ORACLE 1 trial and the National Institute of Child Health and Human Development Maternal-Fetal Medicine Units Network Trial (NICHD MFMU).

The ORACLE 1 trial enrolled 4826 women with diagnosed PPROM and investigated the use of a combination of oral antibiotics versus placebo and concluded that erythromycin alone was associated with prolongation of the pregnancy and was safe and effective in improving rates of adverse perinatal outcomes.[14] A seven year follow-up study, the ORACLE Children Study, revealed that early improved outcomes for neonates did not make a substantial difference to the children's health and development long term.[15]

NICHD MFMU randomised 614 women with diagnosed PPROM to receive placebo versus 48 hours of intravenous ampicillin (2 g every six hours) and then five days of oral amoxicillin (250 mg every eight hours) and erythromycin (333 mg every eight hours). Therapy did prolong pregnancy and reduce neonatal morbidity.[16]

UpToDate prefers the single use of azithromycin 1 g orally on admission, in addition to ampicillin 2 g intravenously every six hours for 48 hours, followed by amoxicillin 500 mg orally three times daily for an additional five days. The rationale behind the use of azithromycin is its specific targeting of Ureaplasmas, an important cause of chorioamnionitis in this setting.[17] This is a similar regimen to that shown to be effective in the NICHD MFMU trial; however, azithromycin is given in lieu of a five-day course of erythromycin because of its ease of administration, improved gastrointestinal tolerance, favourable cost profile and similar efficacy. A retrospective study of prophylactic antibiotic regimes in women with PPROM concluded similar pregnancy and neonatal outcomes with ampicillin plus erythromycin or ampicillin plus azithromycin.[18]

In the setting of unknown GBS status, it is reasonable to administer 48 hours of IV ampicillin followed by a course of oral erythromycin and amoxicillin. The use of azithromycin is not currently supported by the RCOG or RANZCOG guidelines for management of PPROM and higher powered studies into its use in this setting are required.

Given the continual changes in bacterial sensitivities, it is important to recognise that we will require ongoing studies to determine optimal prophylactic antibiotic regimen required in the setting of PPROM.

Timing of birth

Expediting delivery of women with PPROM is indicated if evidence of intrauterine infection, placental abruption, non-reassuring fetal status or high risk of cord prolapse is suspected. In the absence of these risk factors and optimal dating, expectant management can be considered beyond 34 weeks of gestation. Patients should be counselled regarding the increased risk of chorioamnionitis compared with decreased risk of serious neonatal respiratory issues and admission to neonatal care units.

The point at which to augment labour following PPROM is dependent on the evaluation of potential benefits of advanced gestational age at delivery and the risks associated with prolonged rupture of membranes. A retrospective series examining neonatal outcomes following cases with PPROM between 32 and 36 weeks demonstrated that the optimal gestation for reduced morbidity was 34 weeks.[19]

The PPROMT multicentre and the PPROMEXIL-2 randomised controlled trials compared immediate delivery with expectant management of women with a singleton pregnancy and PPROM between 34 and 36^{+6} weeks gestation.[20] Comparison of neonatal outcomes between the groups demonstrated a similar risk of neonatal sepsis between the women who had been induced and those who had expectant management: PPROMT 2% vs 3% and PPROMEXIL-2 3% vs 4%.[21] Both trials concluded that induction of labour (IOL) did not reduce the risk of neonatal sepsis, and the PPROMT trial found that IOL increased the risk of respiratory morbidity.

Summary

- Point-of-care tests are highly specific and sensitive in aiding diagnosis
- Maternal CRP testing is not necessary as the sensitivity in detection of intrauterine infection is low
- Management with 48 hours of intravenous ampicillin (in addition to oral erythromycin) can be considered in the setting of PPROM to broaden the antibiotic coverage
- Expectant management should be favoured beyond 34 weeks gestation in the absence of signs or symptoms of chorioamnionitis

Further research, into not only these specific talking points but also the broader management of PPROM, will aid in standardising patient care on an evidence-based approach. A willingness to remain up to date with this evidence and adjust our management accordingly is essential in maintaining optimal care of our patients.

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Training Support Unit

RANZCOG recognises that trainees may experience periods of professional and personal difficulty, and that coping with the demands of a busy profession, developing skills, building knowledge as well as balancing family and personal commitments can be challenging. The College also recognises the importance of supporting training supervisors as they work to ensure trainees have vital training and learning opportunities; are taken through new procedures and given adequate time to develop their skills under supervision.

RANZCOG is committed to supporting trainees and training supervisors and has established the Training Support Unit. This is a safe, professional and impartial service for Trainees and Training Supervisors to contact and be guided and supported along the most effective response pathway.

Trainees are encouraged to contact Ms Paula Fernandez, Senior Coordinator, Trainee Liaison in times of stress, anxiety or poor health. Supervisors are encouraged to contact Ms Alana Gilbee, Senior Coordinator, Supervisor Liaison if they are concerned about a trainee they are supervising.

The TSU also manages trainee training complaints in a fair and responsive manner.

For further information visit:
www.ranzcog.edu.au/Training/TSU
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Q&A

For the broader *O&G Magazine* readership, balanced answers to those curly-yet-common questions in obstetrics and gynaecology.

Q Should I recommend salpingectomy over tubal ligation for women requesting permanent contraception?

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A

The relatively recent discovery of the central role played by the fallopian tubes in the development of epithelial ovarian cancers has increased the focus on bilateral salpingectomy as a potential preventative procedure. Several gynaecological organisations worldwide recommend offering women at average risk of ovarian cancer opportunistic salpingectomy at the time of hysterectomy for benign disease, and the majority of Australian gynaecologists appear to be following these recommendations.[1] RANZCOG has extended this recommendation to include offering salpingectomy as an alternative to tubal occlusion when women request permanent contraception.

Ovarian cancer has the highest mortality rate of any gynaecological cancer in Australia and as the currently available screening modalities for ovarian cancer have been shown to be ineffective and potentially harmful, it is natural that gynaecologists have been quick to embrace a promising preventative strategy. However, it is important to recognise that there are no randomised trials supporting the practice of risk-reducing bilateral salpingectomy. The most compelling evidence to date comes from retrospective population data showing a reduction in ovarian cancer risk following hysterectomy, tubal ligation and bilateral salpingectomy. The effect appears most pronounced in women having had a salpingectomy, with the risk reduction estimated at 65 per cent.[2]

The major weakness in this data is the low number of bilateral salpingectomies performed in the past due to the narrow indications for the procedure, which in one study included chronic inflammation, pelvic inflammatory disease and endometriosis. None of the women included in the study had a salpingectomy for sterilisation, and the fact that they required a rarely indicated operation may not make them representative of the average population in terms of ovarian cancer risk.

Most of the trials to date have focused on opportunistic salpingectomy at the time of hysterectomy. A recent systematic review concluded that there is insufficient evidence to conclude that opportunistic salpingectomy at the time of hysterectomy reduces the risk of epithelial ovarian cancer and emphasised the need for prospective trials to assess the impact of salpingectomy on ovarian cancer risk and ovarian endocrine function.[3] Prospective trials are currently underway, but it could be as much as 20 years before the impact on ovarian cancer rates become clear. One such study, a randomised controlled trial comparing standard hysterectomy to hysterectomy and opportunistic salpingectomy, is due to report on surgical complications and menopausal symptoms at one year in 2021. The final results relating to the impact on ovarian cancer risk may not be available until 2050.[4]

As the true impact of salpingectomy on epithelial ovarian cancer risk will not be clear for many years, there is a compelling argument to offer this surgery to women based on the current imperfect evidence. The evidence so far suggests that although salpingectomy adds around 15 minutes to a hysterectomy, it does not add to the complication rate. Surrogate measures of ovarian function, such as AMH, FSH, oestradiol and antral follicle counts, have also been shown to be unaffected by salpingectomy. However, a recently published study showed an increased risk of menopausal symptoms one year after surgery.[5] Attempts at estimating the cost effectiveness of salpingectomy are encouraging, but limited by imperfect estimates of the effect on ovarian cancer risk.

There is little evidence regarding ovarian cancer risk following salpingectomy for sterilisation in women at average risk of ovarian cancer, and the extrapolation of the above evidence from women undergoing hysterectomy is complicated by the age difference between the hysterectomy and sterilisation groups. One retrospective study looking at method of sterilisation and ovarian cancer risk found excisional methods superior to occlusion.[6] Again, the results were based on case-control data, and due to a low number of salpingectomies performed in the past, did not yield any meaningful results when trying to differentiate between partial and complete salpingectomy.

Sterilisation procedures are now generally performed laparoscopically or during a caesarean section. There are several small studies supporting the feasibility

of bilateral salpingectomy at caesarean section, but larger studies are required to confirm this finding, as common-sense-based medicine would suggest an increased risk of complications due to the engorged adnexa in the peripartum period. At laparoscopy, performing a salpingectomy rather than a tubal occlusion will usually require the insertion of an additional port, more expensive consumables and a slightly longer operating time, which is reflected in the approximate $300 difference in the Medicare rebate in Australia. There is also concern regarding ovarian function after salpingectomy, although the disruption to the ovary is less than when performed during a hysterectomy. As sterilisation procedures are generally performed on a younger population, any detrimental effect on ovarian function could have a greater negative impact.

The current evidence makes it difficult to make a clear recommendation of salpingectomy over tubal occlusion for sterilisation. Women should be informed of the potential benefits and risks of the different procedures, including the uncertainty around the effect of salpingectomy on ovarian function. If the sterilisation is performed during a caesarean section, the theoretical risk of increased bleeding should be discussed. The potential benefits of salpingectomy should not influence the choice of contraceptive method and non-surgical alternatives, or even male surgery, should be recommended unless contraindicated. It is worth noting that even with an optimistic estimate of the reduction in ovarian cancer risk, over 300 salpingectomies would be required to prevent one case of ovarian cancer. Time will tell if the benefits warrant subjecting women to the inherent risks of surgery.

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Case report

A tale of two pregnancies

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A 25-year-old, G8P1, presented with abdominal pain and vaginal bleeding at nine weeks gestation. Gynaecological history was significant for one normal vaginal delivery at term, seven years prior, and six previous dilatation and curettages (D&C): one for incomplete miscarriage, and five surgical termination of pregnancies. She had been treated for chlamydia many years prior, with no history of recent infection or pelvic inflammatory disease.

Upon examination, she was haemodynamically stable; abdomen was soft and non-tender with no active bleeding on speculum examination. Pelvic ultrasound showed heterogeneous material within the uterus, suspicious for incomplete miscarriage, a left ovarian cyst measuring 23x17x23 mm and moderate free fluid in the pouch of Douglas. (Figures 1 and 2)

The patient was managed through our outpatient early pregnancy assessment clinic for presumed incomplete miscarriage in the context of inappropriately rising bHCG levels: 4072 to 4652 mIU/mL in 48 hours. She was aware at the time that an ectopic pregnancy was unable to be completely excluded. She opted for D&C after misoprostol for cervical ripening, which was performed two days later. The uterus was confirmed empty on bedside transabdominal ultrasound and she was subsequently discharged from the hospital the same day.

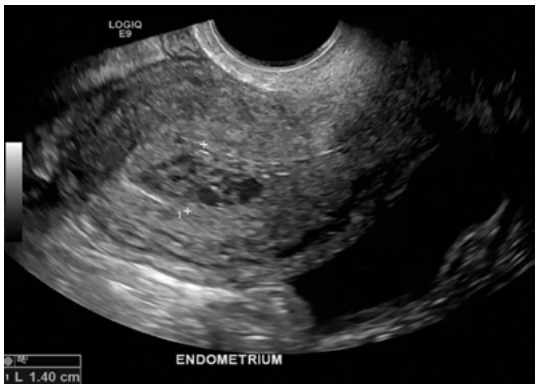

Figure 1. Heterogenous intrauterine material.

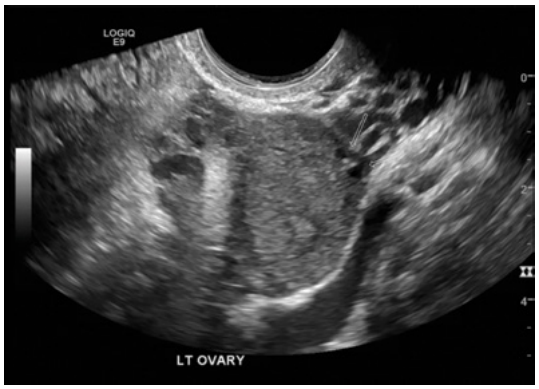

Figure 2. Left ovarian cyst and moderate free fluid in pouch of Douglas.

The patient represented to the emergency department day one post-operatively with severe lower abdominal pain. Repeat bHCG showed a rise to 7061 mIU/mL and repeat pelvic ultrasound revealed a left ectopic pregnancy and free fluid in the pelvis. (Figure 3)

She underwent an emergency laparoscopic left salpingectomy for a ruptured tubal ectopic pregnancy with 200 mL haemoperitoneum found on entry. (Figure 4) She recovered well post-operatively and was discharged home the following day with plans for outpatient follow up.

Histopathology confirmed the diagnosis of both an ectopic and intrauterine pregnancy. Endocervical swabs were negative for chlamydia and gonorrhoea. The patient was subsequently followed up with weekly bHCG levels, until negative, and counselled regarding the risk of recurrence, including the need

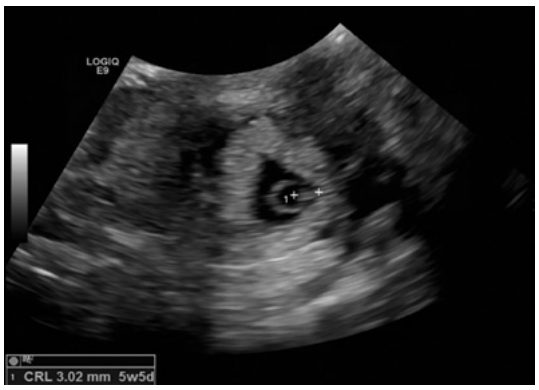

Figure 3. Left ectopic pregnancy, CRL 3.02 mm.

for early ultrasound in future pregnancies to ensure an intrauterine pregnancy (IUP).

Five months later, the patient presented to the emergency department with a serum bHCG of 1048 mIU/mL at 4^{+3} weeks gestation by last menstrual period, after missing four days of the combined oral contraceptive pill. She had no pain or bleeding but presented at the advice of her GP. Pelvic ultrasound (Figure 5) revealed a 27x27x27 mm round anechoic focus in the endometrial cavity, possibly an early gestational sac; however, no fetal pole or yolk sac was seen. There was no evidence of ectopic pregnancy and no free fluid in the pouch of Douglas. Plans were made for follow up with repeat bHCG and pelvic ultrasound in one week. The patient did not return for review and while away on holidays she presented to a different facility at 9^{+6} weeks with severe abdominal pain and a serum bHCG of 3000 mIU/mL. A left ectopic pregnancy in the cornual stump was found and she underwent an emergency laparoscopic removal of the ectopic pregnancy with 1.8 L haemoperitoneum found on entry. Due to plateauing bHCG at level 23–27 mIU/L five weeks post-operatively with an unremarkable pelvic ultrasound, she received a single dose of methotrexate and the bHCG soon returned to negative.

Discussion

A spontaneous heterotopic pregnancy is defined as multiple gestations arising from a natural cycle located in different implantation sites.[1] They are an uncommon occurrence, with incidence reported to be 1 in 30,000; however, with the increasing use of artificial reproductive technology, the total number of heterotopic pregnancies can be expected to rise.[2-4] The most common site of implantation is an IUP with an ectopic in the fallopian tube, yet implantations in the cervix, abdominal cavity and caesarean scars have also been reported.[1,3]

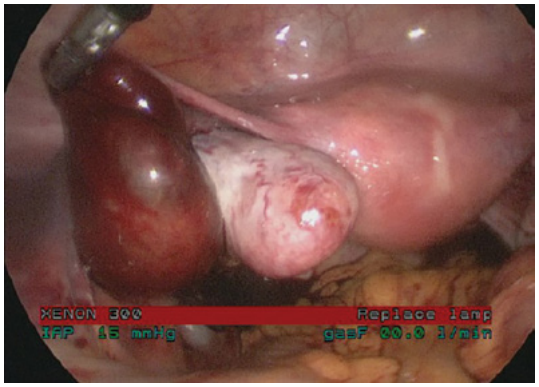

Figure 4. Intraoperative image of left ectopic pregnancy.

At presentation, women may be unaware of their pregnancy status and typically present with non-specific symptoms such as abdominal pain.[3] This case illustrates the difficulty diagnosing heterotopic pregnancies with high clinical suspicion required to correctly diagnose these uncommon pregnancies, even after the confirmation of an intrauterine gestation.[5] Risk factors for heterotopic pregnancy include, the use of assisted reproductive therapy, previous ectopic pregnancy, prior pelvic surgery or pelvic inflammatory disease.[3] Suspicion should be heightened in those presenting with symptoms such as abdominal pain, bleeding, an adnexal mass or haemodynamic instability in the presence of significant risk factors.[1,6] Diagnosis can be considered in symptomatic pregnant women ultrasound findings of free fluid in the pelvis or persistently high bHCG levels following termination of an intrauterine gestation.[2,6]

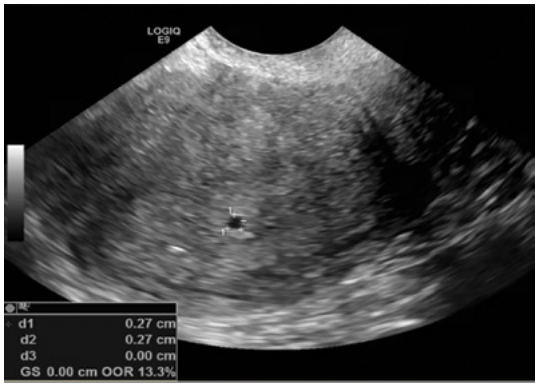

Figure 5. Possible early IUP, 4+6 size, MSD 27 mm.

Ultrasound remains the most reliable and convenient method for diagnosis of heterotopic pregnancy, though it can be challenging. The presence of an ovarian cyst on the first ultrasound may have made sonographic identification of an ectopic gestation challenging to the sonographer. For unclear cases with adnexal mass present on initial ultrasound, serial ultrasound is required while the patient remains clinically stable. On progress ultrasound, an ectopic gestation would be expected to increase in size and become visible.[6] Despite ultrasound being readily available to most acute medical care providers, more than half of heterotopic pregnancies are diagnosed at the time of surgery.[3]

Once diagnosed, options for management include expectant, medical or surgical management with most appropriate choice dependent upon the location of the gestations, size, potential for viability and the haemodynamic status of the patient.[3] Medical management can be delivered either locally or systemically to terminate the pregnancy with localised delivery preferred in the presence of a viable IUP. Surgical options include ultrasound-guided aspiration of products of conception, laparoscopy and laparotomy.[3] Aspiration can only be attempted with a clearly visible

gestational sac and often multiple attempts may be required.[3] Laparoscopic surgery (salpingectomy or salpingotomy) can be used for removal of the ectopic gestation and is often preferred over laparotomy with reduced recovery time and shorter length of stay.[6] Laparotomy may be preferred in unstable patients with large haemoperitoneum.[3] Literature comparing the different treatment modalities is limited, with no current published meta-analyses.

Conclusion

The diagnosis of an IUP does not exclude an ectopic pregnancy and suspicion should remain high in women with abdominal pain and pelvic free fluid.[1] We aim to alert clinicians to the possibility of this diagnosis in order to facilitate early recognition with the possibility for the minimally invasive management to preserve future fertility for these patients.

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WOMEN'S HEALTH

Journal Club

Had time to read the latest journals? Catch up on some recent research by reading these mini-reviews by Dr Brett Daniels.

Ulipristal for fibroids

Ulipristal is a progesterone receptor modulator that is clinically approved for the treatment of fibroids in Australia and New Zealand, and for emergency contraception in Australia. Two recent phase 3, double-blind, placebo-controlled studies examined the efficacy of ulipristal on the time to achieve amenorrhea, and rate of amenorrhea in women with symptomatic uterine fibroids. In the first study, 157 women were randomised to either ulipristal 5 mg daily, ulipristal 10 mg daily or placebo, for 12 weeks followed by a 12-week drug-free evaluation period. Amenorrhea was achieved by 47 per cent and 58 per cent of patients treated with 5 mg and 10 mg ulipristal respectively, compared with one of 56 (1.8 per cent) of women treated with placebo.[1] In the second study, 432 women with symptomatic fibroids were randomised to ulipristal 5mg daily, ulipristal 10 mg daily or placebo, for a 12-week treatment course followed by a drug-free interval of two menses, followed by a second 12-week treatment course. In the first 12-week course of treatment, 42 per cent of women in the 5 mg ulipristal group and 55 per cent of women in the 10 mg ulipristal group achieved amenorrhea, compared with zero per cent of women in the placebo group.[2] Both studies showed a similar pattern of improvement in both ulipristal groups on self-reported uterine fibroid symptom and quality-of-life scales. More hot flushes were reported in the ulipristal compared to the placebo groups in both studies.

A recent study reported a small case series of six women who received ulipristal 5 mg daily with the ultrasound diagnosis being adenomyosis without the presence of uterine fibroids. The authors reported that all patients showed increased ultrasound signs of adenomyosis and increased pelvic pain following the course of ulipristal.[3] A large systematic review of endometrial changes with ulipristal use analysed 10 studies including 1450 women. Endometrial hyperplasia was reported in six women, during or after ulipristal acetate use. Five were simple hyperplasia; one biopsy showed simple atypical endometrial hyperplasia that resolved into benign secretory endometrium by the end of the treatment. One case of endometrial adenocarcinoma was reported; however, this does not seem to be related to ulipristal acetate use since it was already present at the baseline biopsy. Most studies in the meta-analysis reported a transient increase in endometrial thickness that returned to normal a few weeks after finishing treatment. The authors concluded that 'based on the literature found in this systematic review, follow up after a maximum of four courses of ulipristal acetate did not report any non-reversible (pre-) malignant lesions of the endometrium'.[4]

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Delivery options in second stage

The rate of instrumental vaginal birth in Australia has risen from 22.8 per cent in 2004 to 26.0 per cent in 2016, while the rate of caesarean section (CS) has increased from 25.3 per cent to 28.5 per cent and the rate of vaginal delivery has decreased from 51.9 per cent to 45.5 per cent over the same period.[1] In the United States, the rates of instrumental vaginal deliveries have significantly declined from 9 per cent in 1990 to 3.3 per cent in 2013.[2]

A recent German study retrospectively analysed 1971 singleton births between 2004 and 2014, 149 forceps delivery, 393 vacuum deliveries and CS in labour. All births were at greater than 34 weeks gestation and transverse and breech presentations were excluded. Women who received an instrumental delivery had a significantly higher level of anaemia and haemorrhage compared to caesarean, while babies delivered by CS had a lower cord pH at birth but no difference in five-minute Apgar score. Forceps had a lower rate of vaginal tears and neonatal cephalohaematoma compared to vacuum delivery. The authors concluded that, if performed correctly, instrumental vaginal birth could be considered as an alternative to second stage caesarean section.[3]

A retrospective US study analysed 2531 singleton births at ≥37 weeks gestation in women with no prior vaginal delivery who reached a station of +2 or below and underwent an attempt at an operative delivery. Included in the analyses were 1382 vacuum deliveries, 1018 forceps deliveries and 131 CS deliveries. In comparison to the German study, these selection criteria include cases at a more advanced descent. The main maternal outcomes differed in postpartum infection (vacuum: 0.2%; forceps: 0.9%; CS: 5.3%), postpartum haemorrhage (vacuum: 1.4%; forceps: 2.8%; CS:3.8%), and severe perineal and vaginal lacerations (vacuum: 19.1%; forceps: 33.8%; CS:0%). There were no differences in neonatal outcomes.[2]

These data, however, provide only part of the decision of mode of delivery in the second stage. Maternal preference, urgency of delivery, training and experience must all be factored in to each clinical situation.

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O&G MAGAZINE

Women in Science: Professor Caroline de Costa

Despite being a completely qualified medical professional, Caroline de Costa wasn't accepted into specialist training in Sydney in 1974. Some women had been allowed to train in Sydney hospitals during World War II, while men joined the armed forces, but with the war over no women were admitted into training again until the 1980s.

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Volunteers building resilient communities: Dr Rangi De Silva

Dr Rangi De Silva believes the key to successful development lays in workforce capacity-building. Looking for ways to translate this into practice, Rangi participated in the Australian Volunteers Program; an Australian Government initiative delivered by AVI that supports skilled Australians to contribute to locally-driven, sustainable development overseas.

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Benchtop to bedside: Kirsten Palmer's research into predicting pre-eclampsia

Hypertensive disorders in pregnancy, such as pre-eclampsia, remain one of the leading causes of maternal mortality. While aspirin use from early pregnancy has been shown to reduce the development of early-onset pre-eclampsia, for those women who do develop pre-eclampsia, prognosis can be uncertain. Although some women remain stable while undelivered for days to weeks, others progress rapidly towards end-organ dysfunction. Can a pre-eclampsia prediction tool be developed?

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Dr Vijay Roach believes in a holistic approach to medicine, considering 'mental health to be as critical to pregnancy care as any physical aspect'.

'Perinatal anxiety and depression is not a condition that discriminates. It can affect any pregnant woman and the implications are profound. Mental healthcare in pregnancy is our responsibility', he says in his most recent article in O&G Magazine.

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Professor Martha Hickey was recruited to the University of Western Australia, in 2001, to establish a new research program in gynaecology. Since 2002, she has been a chief investigator on successful competitive grants totalling more than $5 million. Today she is Director of the Royal Women's Hospital's Gynaecology Research Centre, an NHMRC Practitioner Fellow and Professor of Obstetrics and Gynaecology at the University of Melbourne. How did she progress her career?

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The Maylard incision: Setthathirath technique

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Setthathirath Hospital is one of the university teaching hospitals in Vientiane, and the only one with a gynaecologic oncology unit. We receive tertiary referral patients from around the country and from the other central hospitals. In the last calendar year, we performed 196 elective gynaecological laparotomies, for 121 of which we used a Maylard incision, while the rest had vertical incisions. We started using Maylard incisions exclusively for elective gynaecological surgery (except in cases where a midline incision was clearly indicated) in December 2010, so we have extensive experience with the technique.

Maylard described his incision in 1907: he appreciated the benefits of transverse incisions, particularly their low dehiscence rates, but wanted better exposure, especially of the pelvic side walls. This exposure is extremely valuable for more complex cases, but enables safer surgery in all cases. In our cancer surgery, we use the Maylard incision for endometrial cancer procedures involving pelvic lymphadenectomies, but not for ovarian or cervical cancer.

Basic anatomy

The anterior abdominal wall below the umbilicus

The lateral part of the muscular abdominal wall on either side is made up of a layer of three muscles; the external oblique most superficially, overlying the internal oblique beneath which is the transversus abdominus. The tendons of these three muscles fuse at the lateral border of the rectus abdominus, which is a strap-like muscle running from the symphysis pubis inferiorly to the costal margins superiorly. The fused tendons of the lateral muscles form a sheath to surround the rectus muscles, fusing in the midline linea alba. Above the so-called arcuate line the sheath completely surrounds the rectus muscles, but below the arcuate line the posterior sheath is absent, replaced by the transversalis fascia, deep to which is peritoneum.

The inferior epigastric artery and vein

The artery arises from the external iliac artery, exits the abdomen through the inguinal canal and runs beneath the rectus abdominus in the rectus sheath, supplying the muscle with blood, anastomosing with the superior epigastric artery, which is the terminating portion of the internal thoracic artery, around the umbilicus. The artery is accompanied by a vein.

Potential nerve damage

With any transverse lower abdominal incision, there is the possibility of damage to spinal nerves that pass through the transversalis muscle as they curve forward and inferiorly from their origin in the spinal canal. The nerves most likely to be damaged are the

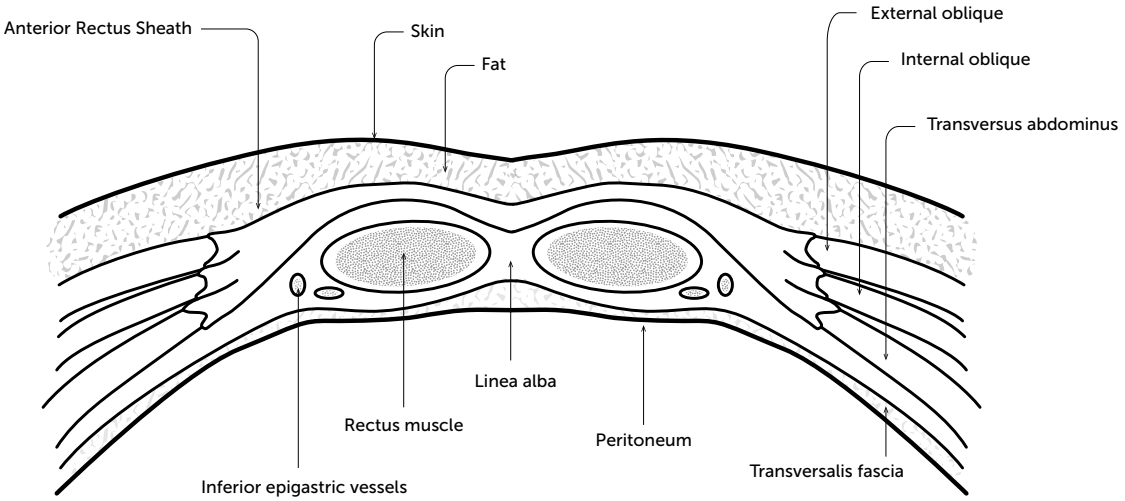

Figure 1. A cross section of the abdominal wall below the arcuate line.

iliohypogastric and ilioinguinal nerves, both branches of L1. This will usually only happen where the incision extends some distance into the fascia and muscles several centimetres beyond the rectus sheath. The symptoms vary, from paraesthesia to severe and intractable pain in the distribution of the nerve and is treated by either neurolysis or division of the nerves as they exit the fascia. We have not incurred this problem in our experience of more than 1000 consecutive cases, but have seen it in cases of repeat Pfannenstiel incisions, especially when surgery was difficult.

Technique

Incision site

We examine every patient under anaesthesia before making a final decision as to whether a transverse or vertical incision is most appropriate. We take particular note of the size and mobility of the uterus and the presence of adnexal masses. In general, a Maylard incision is best done a little higher than a Pfannenstiel, but the exact site will vary depending on the examination findings. Where the cervix is large or the uterus relatively immobile, the incision needs to be low enough to allow good access to the cervix.

Steps in the procedure

We use a straight incision about 2–3 cm above the symphysis pubis. A scalpel is used to incise the skin to the upper level of subcutaneous fat. Electrocautery is used to incise subcutaneous fat in the midline down to the anterior rectus sheath. Two small incisions in the sheath are made, one on each side of the midline. A large clamp is inserted beneath the sheath and above the rectus muscle and the fat and fascia divided to the lateral margin of the rectus on each side.

The clamp is then inserted beneath the rectus muscle, from the lateral to the medial border, running along the surface of the transversalis fascia. It is pushed through the rectus muscle about 1 cm from the midline. We deliberately avoid the midline at this stage. One corner of a clean dry surgical pack is inserted into the open jaws of the clamp and pulled back under the rectus muscle, exiting laterally. This pack is used to lift the rectus muscle from the transversalis fascia, reducing the risk of inadvertent damage to deeper structures. Electrocautery is used to divide the rectus in smooth strokes, beginning medially. No attempt is made to control small bleeders in the muscle. As the incisions in the muscle go deeper, care is taken to identify the inferior epigastric vessels, which are usually above the pack. They are typically together and have a small amount of fat surrounding them. When they are located, the surrounding muscle is carefully incised to allow the vessels to be clamped, divided and tied. In some cases, the inferior epigastric vessels will be left on the transversalis fascia at the lateral edge of the rectus sheath after the rectus muscles are divided. If that is the case, they are carefully elevated with artery clamps, clamped, divided and tied.

We believe the inferior epigastric vessels should be divided in every case to reduce the risk of inadvertent laceration or tearing during the operation or at wound closure.

Next, the transversalis fascia and underlying peritoneum on the right-hand side are grasped and elevated with artery forceps and the abdominal cavity opened. The right-hand side is chosen because, in general, adhesions are less common than on the left, though this may not be the case after appendicectomy. Under vision, and with

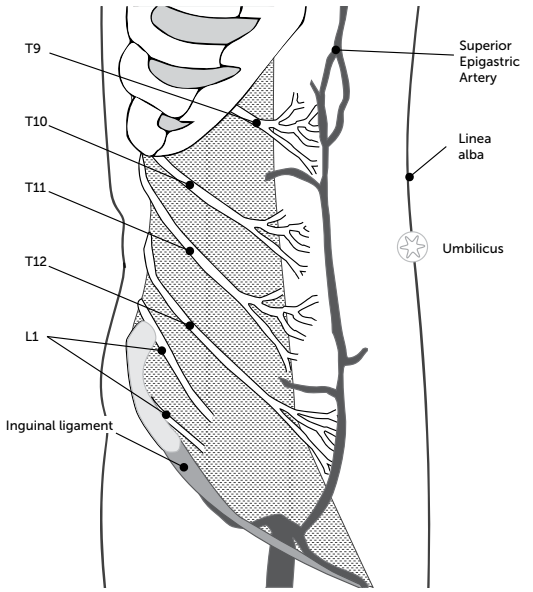

Figure 2. The main nerves supplying the anterior abdominal wall, and the course of the inferior and superior epigastric vessels in the rectus sheath.

the abdominal wall elevated with fingers, the transversalis fascia and peritoneum are incised toward the midline using electrocautery. When the lateral edge of the remaining rectus muscle is reached, the peritoneum and the layers above are divided to the linea alba and then on through the remnants of the left rectus muscle, together with the peritoneum, to the left-hand extent of the incision.

Occasionally, there will be bleeding from this central area, but it is easily controlled by electrocautery.

The peritoneum in the midline superiorly and inferiorly are sewn to the edge of the skin. In obese women, the peritoneum at the lateral ends of the incision can also be sewn to the skin to facilitate placement of a retractor.

On occasion, there will be bleeding from the belly of the rectus muscle after it has been divided. We make no attempt to secure the particular vessels, but rather place a large mattress suture through the fascia, muscle and peritoneum about 1 cm above the cut edges, taking it across the peritoneum about 1 cm and then passing it through peritoneum, muscle and fascia and tying it firmly on the fascial surface. The suture should be tight enough to stop the bleeding, but not so tight as to strangulate it and cause muscle necrosis.

The same technique can be used if the inferior epigastric vessels retract before they can be clamped. We do not drain the wound and have had no haematomas in our extensive experience.

Wound closure

The peritoneum and transversalis fascia are closed with a running suture of braided synthetic material. No attempt is made to secure the cut edges of the muscle to the fascia. The muscle adheres firmly to the sheath unless it is purposely freed.

We close the fascia with a continuous suture of number one, braided synthetic absorbable suture, running from one end to the other. If needed, a few fat sutures are inserted, and the skin closed with a subcuticular suture.

Other issues

Pain with a Maylard incision

Several authors assert that Maylard incisions produce more postoperative pain than Pfannenstiel incisions, but the evidence is the opposite, with a number of studies demonstrating either no greater pain or less pain with the Maylard incision. We believe this is because, apart from the incision of the muscles, there is minimal tissue disruption within the rectus sheath such as occasioned by stripping the rectus from its sheath to gain exposure in a Pfannenstiel incision.

Enlarging the incision

Exposure to the lower part of the abdominal cavity is excellent with this incision. On a number of occasions, the finding of unexpected upper abdominal disease has necessitated enlargement of the incision. We do this by dividing the fused tendons of the muscles lateral to the rectus sheath vertically, lateral to, and parallel with, the rectus sheath. Usually, no further skin incision is needed. We have performed hemicolectomies and even a splenectomy through these enlarged Maylard incisions. The fascia is closed with a running suture through to the peritoneum, running inferiorly to the lateral edge of the original incision of the rectus sheath, and the wound closed in the usual way.

Conclusion

The Maylard incision has been extremely effective in facilitating safe gynaecological surgery in Setthathirath Hospital. Although it takes a little longer than the Pfannenstiel incision, our operating times for simple hysterectomies are one hour or less. More complex surgery is both easier and safer with the improved exposure afforded by the incision. We believe there are compelling reasons for the use of this technique where a transverse incision is indicated in gynaecological surgery.

Further reading

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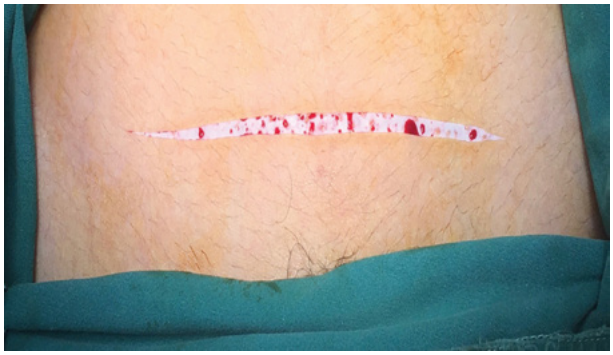
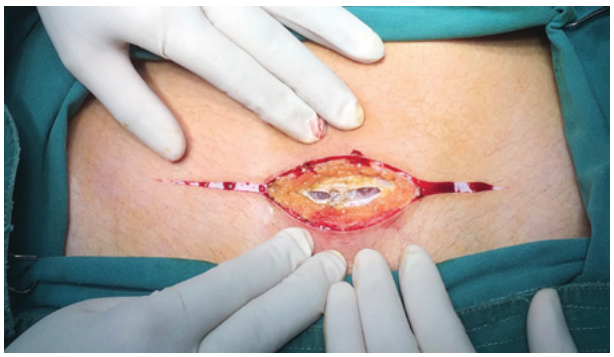
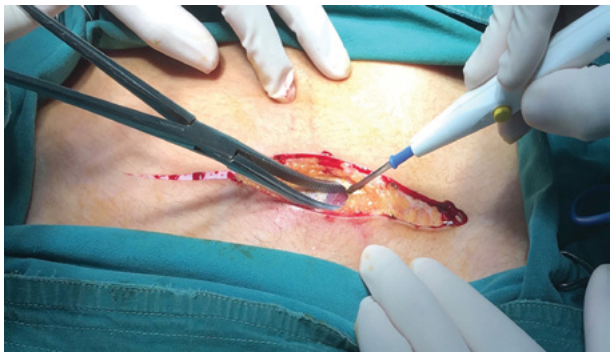
The Maylard incision: a step-by-step guide



Step 1. The placement of the incision is decided by both the examination under anesthesia and the expected pathology. In general, it is about three fingerbreadths above the symphysis pubis. The initial incision, with a scalpel, goes only through the skin itself.

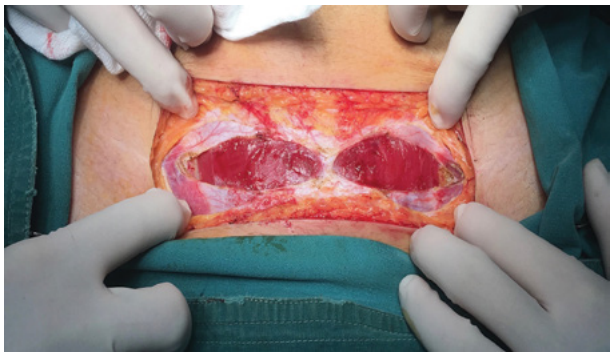
Step 2. Using electrocautery, the subcutaneous fat is incised in the midline to the rectus sheath. Small incisions are made on either side of the midline to reveal the rectus muscle. We do not divide the linea alba at this time.

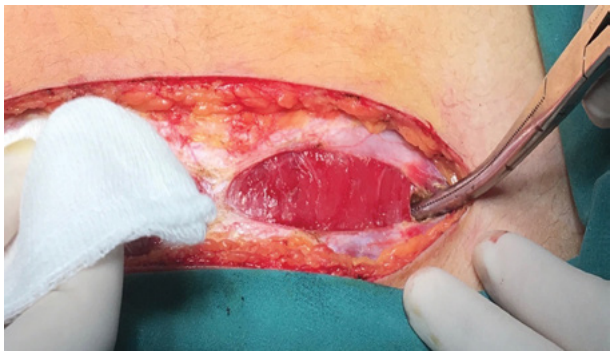




Step 3. A large clamp is inserted beneath the rectus sheath, elevating it from the muscle. The subcutaneous tissues and the sheath are incised on each side with electrocautery. The incision ends at the lateral border of the rectus muscle.

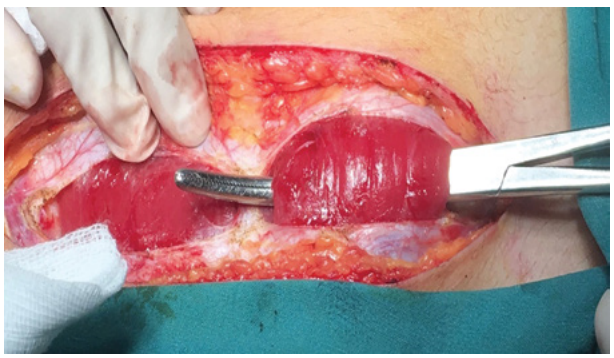
Step 4. Both rectus muscles are now exposed. There is usually a small amount of fat visible lateral to the muscles. If more exposure is needed, the incision can be extended into the fascia of the oblique and transverse muscles, though this slightly increases the risk of damage to the iliofemoral and ilioinguinal nerves.

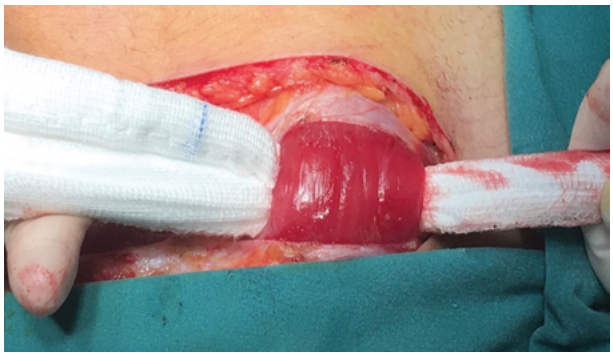




Step 5. A clamp is inserted under the rectus muscle and tracks on the surface of the transversalis fascia. It should initially be pointed in a perpendicular direction and then parallel to the muscle. We choose to start laterally as it increases the chance of elevating the inferior epigastric vessels with the muscle and reduces the chance of damaging the vessels.

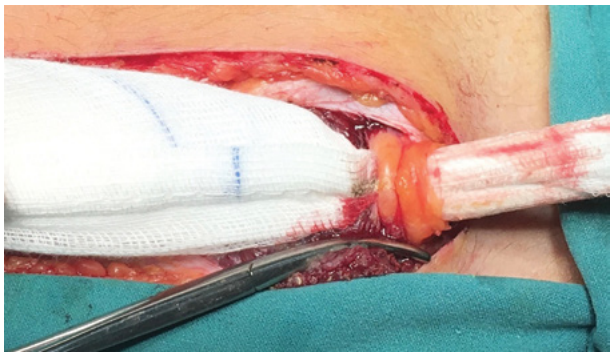
Step 6. The point of the clamp is brought out through the rectus muscle a centimeter or so lateral to the midline. Avoiding the midline at this stage allows the muscles to be divided without troublesome bleeding.

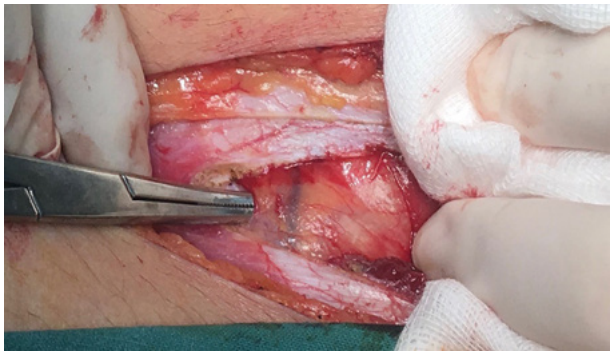




Step 7. The clamp is opened and the corner of a clean, dry laparotomy sponge grasped and pulled beneath the muscle, exiting laterally. The sponge must be dry to avoid transmission of current from the electrocautery. Elevation of the muscle allows easy and safe division to be performed. The muscle is cut with long steady strokes. Small bleeding points should be ignored and most will stop bleeding spontaneously. Do not 'chase' bleeders with diathermy as they will retreat into the muscle and bleed more.

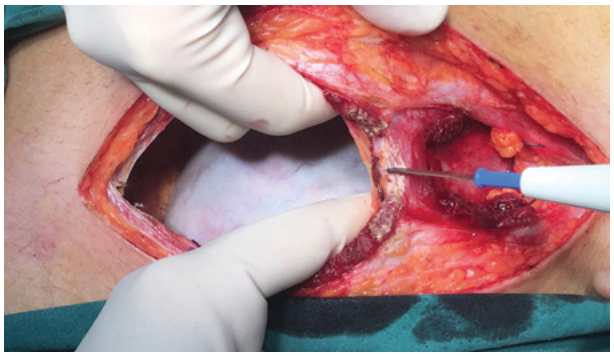
Step 8. In most cases, the inferior epigastric vessels will be seen with encircling fat toward the lateral margins of the muscle and can be grasped with artery forceps, cut and tied. Some texts suggest suture ligation, but that is not wise as the vessels can be easily damaged.

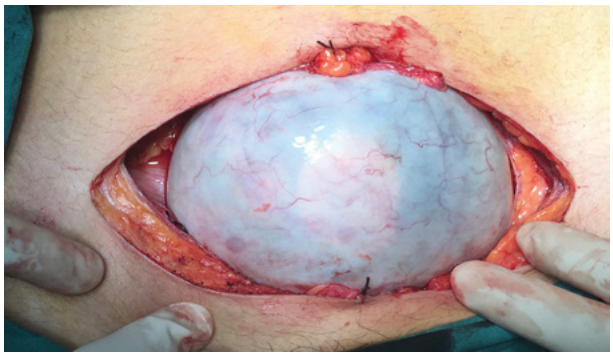




Step 9. In some cases, the vessels will be left lying on the surface of the transversalis fascia and they can be carefully elevated using artery forceps, clamped, divided and ligated.

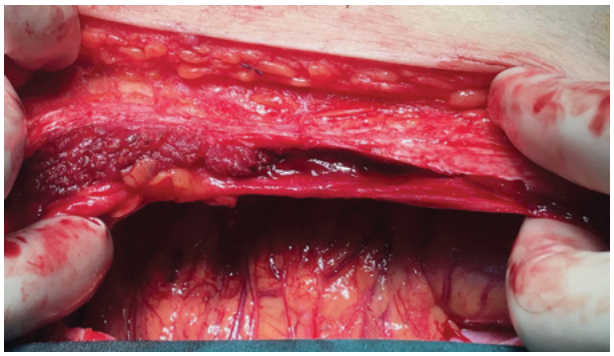
Step 10. The abdominal cavity is opened laterally on the right side and, under direct vision, the peritoneum. The medial portions of the rectus muscle and the linea alba are divided with the peritoneum. There is often a small amount of bleeding in the midline but it usually stops once the incision is fully opened.

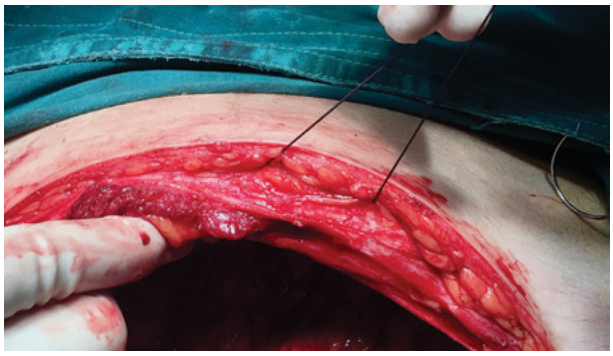




Step 11. The peritoneum in the midline superiorly and inferiorly is sewn to the skin.

Step 12. In this case, there is bleeding from the belly of the rectus. The muscle has retracted somewhat into the sheath and will do so to a greater degree if attempts are made to secure the vessels concerned.





Step 13. Instead of trying to find and control the vessels, a large mattress suture is passed through the fascia, muscle and peritoneum on one side of the bleeding area, across the peritoneum and then out through the peritoneum, muscle and fascia. It is tied firmly to stop the bleeding, but not so strongly as to strangulate the muscle.

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Oral misoprostol for induction of labour in resource-limited settings

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Induction of labour is a critical life-saving intervention that has been proven to have an immeasurable impact on reducing maternal and perinatal mortality and morbidity worldwide.[1] Current induction of labour regimes using intravenous oxytocin and prostaglandins, such as dinoprostone, are highly effective but often limited or unavailable in developing countries. dinoprostone, for instance, is widely used in developed countries but its high cost and instability at ambient temperatures limits its usefulness as a cost-effective agent, particularly in developing countries such as Papua New Guinea where the burden of obstetric and perinatal complications are unfortunately the highest in the Pacific region.[2]

Compared to other prostaglandins, misoprostol has several potential advantages. It is stable at room temperature, inexpensive and can be administered through the oral, vaginal, sublingual and buccal routes. Nevertheless, limited data currently exist concerning the safety, efficacy and feasibility of administering oral misoprostol in routine clinical practice in resource-poor settings.

With the support of a Global Health Research Scholarship provided by the RANZCOG Foundation, we conducted a clinical trial to investigate the safety and efficacy of two different dose regimens of oral misoprostol for induction of labour in Papua New Guinean women.

Background

Prior to the trial, we conducted a pilot observational study to investigate the safety and effectiveness of an oral misoprostol regimen that we have been using in this setting for the past decade.[3] Briefly, in this pilot study, more than 6000 labour ward admissions were screened prior to enrolling 209 women who fulfilled the study inclusion criteria and underwent induction of labour. Overall, 74 per cent of the 209 women delivered within 24 hours. Most (90 per cent) delivered vaginally, with 86 per cent having a good outcome for both the mother and baby. Of the 10 per cent who failed induction of labour and underwent caesarean section, a significant proportion of their babies were admitted to special-care nursery compared to babies delivered vaginally. However, their perinatal mortality rate was not significantly higher.[3] The only maternal death was not study related and occurred in a patient with post-partum haemorrhage that occurred 15 hours after delivery. Following this study, we concluded that the oral misoprostol regimen for induction of labour, commencing at 25 µg, (Figure 1) is safe, effective and logistically feasible to administer in a resource-limited setting.[3]

However, because our pilot investigation was an observation study and not a clinical trial, questions related to the oral misoprostol dose escalation nature of our study (Figure 1) as well as the limited safety data of such a regimen and its potential to cause dose-dependent adverse effects still remained. Therefore, we designed the current trial (trial registration ISRCTN10107246) and hypothesised that a regimen commencing with a lower dose of oral misoprostol administered at 12 µg per dose and gradually increased to a maximum of 50 µg per dose over 24 hours will have a non-inferior efficacy and a better safety profile in inducing labour in a developing country setting.

Study setting

The clinical trial was conducted at Modilon General Hospital; a provincial hospital on the northern coast of mainland Papua New Guinea. Modilon hospital has an average of 3000 deliveries per year and an average induction rate of three to five per cent. The hospital has two consultant obstetricians, two registrars and

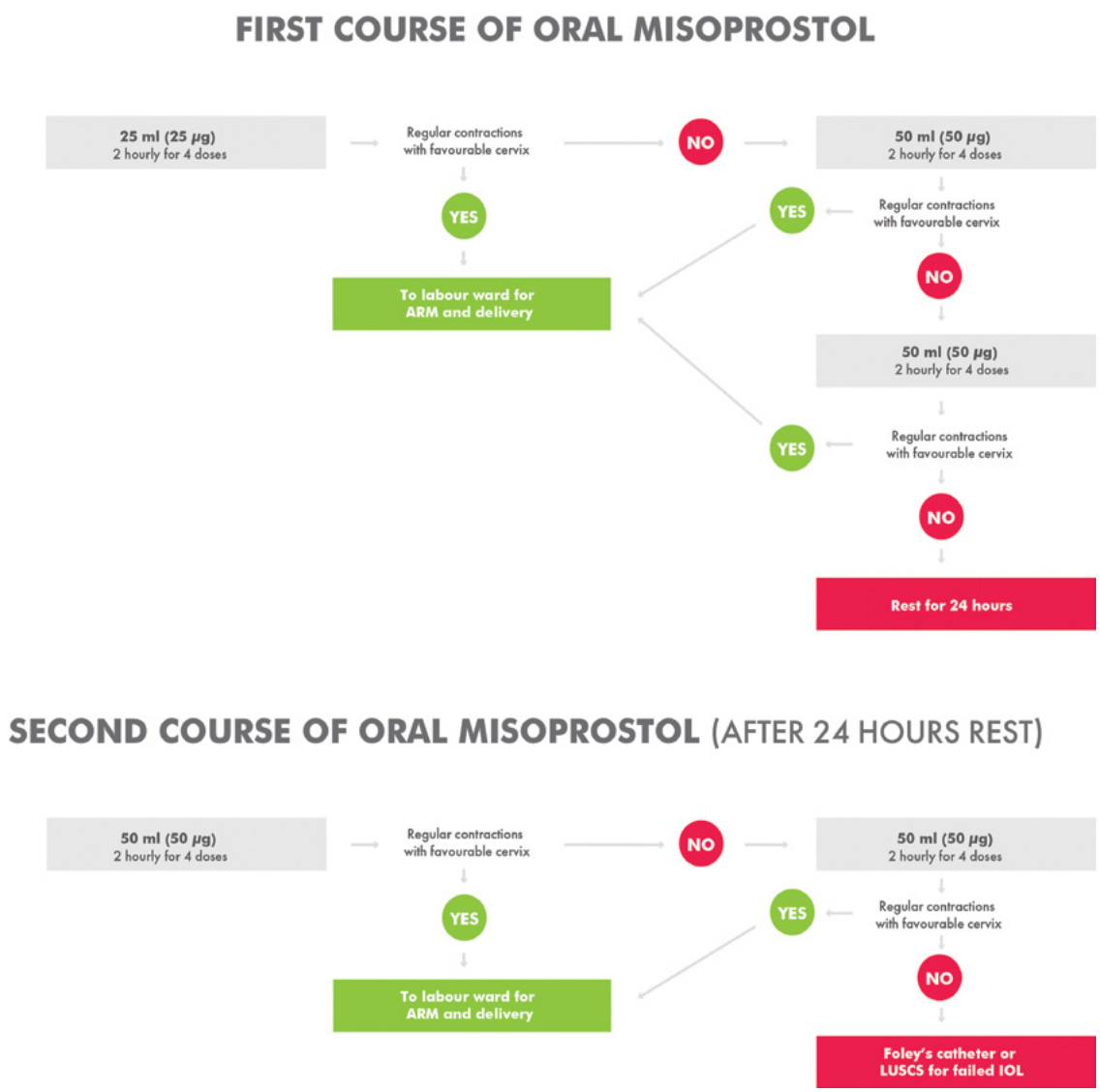

Figure 1. Standard treatment protocol for oral misoprostol induction of labour at Modilon Hospital.

nine midwives who assisted in this study, as well as an operating theatre facility that was used to perform emergency caesarean sections and/or other obstetric and gynaecologial operative procedures.

Study design

After appropriate ethics approvals, trial registration and the formation of a Data Monitoring and Safety Committee, we conducted an open-label randomised controlled trial of a lower dose versus a standard dose of oral misoprostol. Based on computer-generated block randomisation, eligible patients were allocated 1:1 to the standard treatment group commencing at 25 µg (see Figure 1) or a lower dose of oral misoprostol commencing at 12 µg (Figure 2). Allocated treatments were concealed in sealed numbered envelopes that were opened in sequence by study medical or nursing staff and the specified treatment administered.

Study endpoints

The primary outcome measured were the proportion of women who had a successful live vaginal delivery without any severe adverse event including: i) failed induction necessitating caesarean section, ii) maternal death, iii) retained placenta, iv) perinatal death, and/or v) neonatal admission to special care nursery. Secondary endpoints included the proportion of i) successful live births delivered vaginally within 24 hours, ii) the proportion of mothers requiring Foley's catheterisation, iii) the proportion of mothers requiring oxytocin augmentation, iv) neonatal Apgar Scores of seven or below at five minutes post-delivery, and v) reported maternal and neonatal adverse events at four weeks post-discharge.

Women who participated in the study

Women with an indication for induction of labour – such as post-date, pre-labour rupture of membranes, pre-eclampsia – or suspected fetal compromise, such as intrauterine growth restrictions, were considered eligible for enrolment if they fulfilled the study inclusion criteria, which included i) third trimester singleton pregnancies, ii) confirmed cephalic presentations, and iii) a Bishop's score of less than six.

Oral misoprostol study protocol

A solution of 1 µg/ml was made by dissolving a 200 µg tablet of misoprostol in 200 ml of water. The solution was measured and given in titrated doses as per the

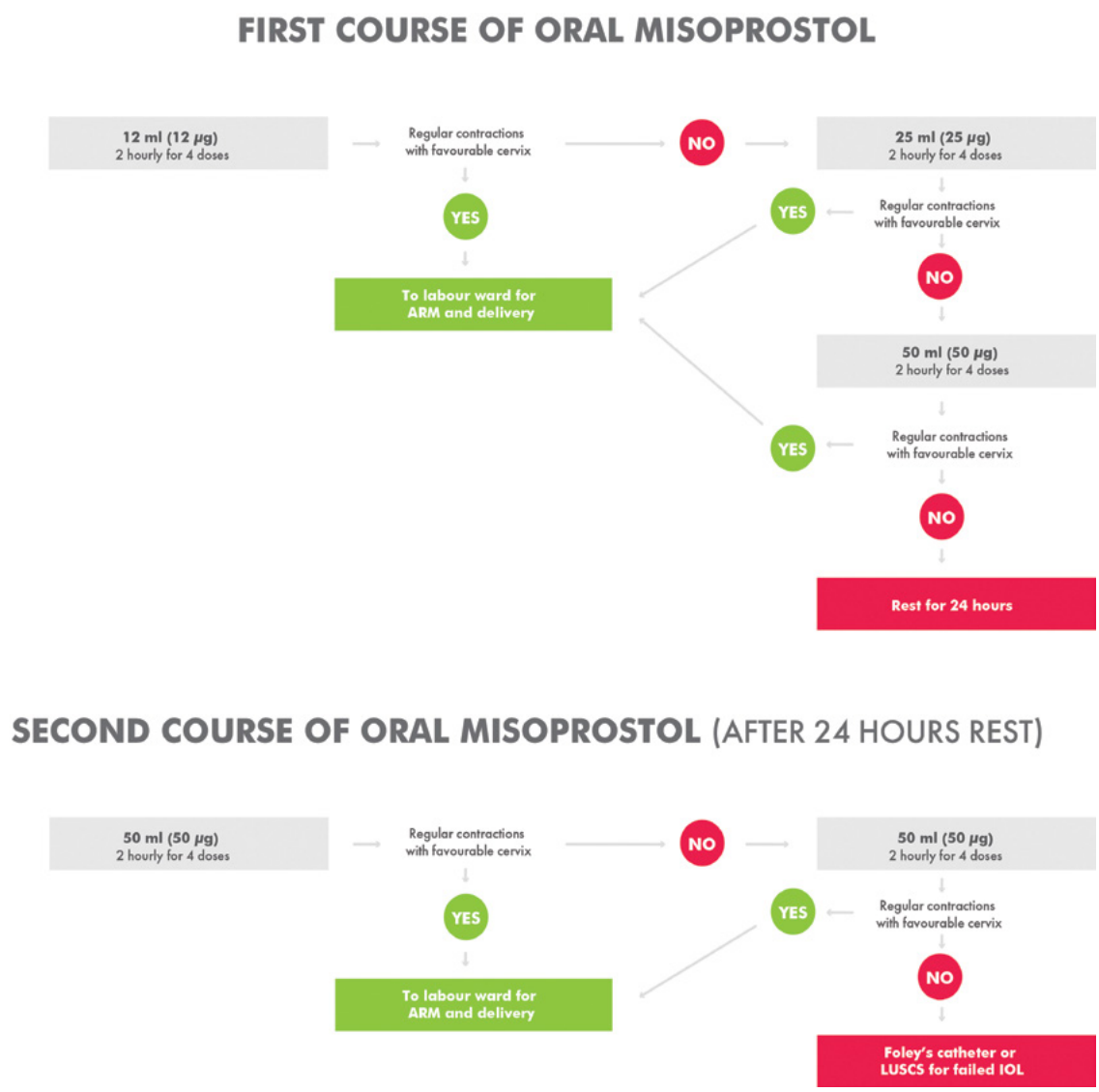

Figure 2. Intervention arm for oral misoprostol induction of labour at Modilon Hospital.

study arm requirements. The misoprostol solution was kept at the nurse's station at room temperature and discarded if not completed within 24 hours. Each dose, either commencing at 12 ml (12 µg/ml) or 25 ml (25 µg/ml) was given at an interval of two hours and doses incremented according to the study arm as outlined in Figures 1 and 2.

Study progress

After the first 60 enrolments (30 participants per arm), an interim analysis was performed that suggested no serious safety concerns and the study was allowed to continue. To date, 256 women have been enrolled as per the study protocol. Follow up at one month post discharge is ongoing, data entry has been completed and analysis of the trial will commence in February of 2019.

Conclusion

With the support of the RANZCOG Foundation Global Health Scholarship, we were able to investigate two oral misoprostol regimens with the aim of reducing maternal and perinatal mortality in our high-burden setting. Despite the simplicity and popularity of oral misoprostol as an induction of labour agent, particularly in developing countries, appropriate evidence is still required to ensure these settings can strive towards reducing the unacceptably high maternal and perinatal mortality rates without increasing the risk of misoprostol-induced adverse events.

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Bawa-Garba revisited

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It is just over six months since the senior paediatric registrar, Dr Hadiza Bawa-Garba, won her appeal against the General Medical Council (GMC) to have her medical registration reinstated.[1] So ended a seven-and-a-half-year travail for this British doctor, which started in February 2011 when Jack Adcock was admitted to the Child Assessment Unit at Leicester Royal Infirmary with sepsis, sadly to die later that evening.

The subsequent years were to see both Dr Bawa-Garba and nurse, Isabel Amaro, charged and convicted of Gross Negligence Manslaughter (GNM) in November 2015; Dr Bawa-Garba receiving a suspended two-year sentence. In contrast to this finding, the Serious Untoward Incident investigation performed by the Leicester Hospital – while identifying 17 contributory factors to Jack Adcock's death, and recommending 83 different changes to practice – could not identify any one single failing (or person) as the cause of death.[2]

In June 2017, in response to this criminal conviction, but mediated by knowledge of the complex circumstances in which Dr Bawa-Garba had been working, as well as her past training reports and excellent performance, the Medical Professional Tribunal Service (MPTS, a statutory committee of the GMC) imposed a sanction of 12 months suspension. The GMC took its own Committee to Court, and in January 2018, won the right to impose a lifetime erasure from the medical register on Dr Bawa-Garba.[3] The news went viral around the world.

As we all know, this decision was successfully appealed in July 2018. In particular, the Lord Chief Justice of England and Wales noted 'No concerns have ever been raised about [Dr Bawa-Garba's] clinical competency... she is honest and reliable and has complete insight... her deficient conduct in relation to the care and treatment of Jack Adcock was neither deliberate nor reckless and she does not present a continuing risk to patients'.[1]

Unfortunately, these glowing words from such an esteemed Law Lord in this particular Court, does not reverse or erase her criminal conviction.

What now?

This sequence of events raised significant concerns for doctors in the UK and Australia. The first, and most complex, is the difficult and contested intersection between healthcare safety issues; including medical error and criminal culpability. The second was the aggressive response of the GMC.

Medical error and criminal negligence

Australian prosecutions for criminal negligence

In Australia, the evidence that this is likely is simply not there. One study would suggest that there have been 33 prosecutions of doctors specifically for manslaughter in Australia between 1843 and 2012, with only four doctors found guilty.[4] A more recent study of all criminal charges against healthcare practitioners between 1989 and 2013, demonstrated that there have only been three prosecutions for manslaughter, with only one conviction.[5] Why this is, is conjecture. It may represent a societal lack of appetite to criminalise medical error, or it is felt by those chasing a doctor that there are other more appropriate (or lucrative, or punitive) avenues to pursue, or the various prosecution departments in every state feel that it is almost impossible to prove beyond doubt 'that a doctor had, and demonstrated, recklessness, involving grave moral guilt'.[6] In The Queen v Lavender (2005) the Court stated 'that criminal liability must not be imposed in the absence of moral fault',[7] and this is a high bar to get over. Simple error will not cut it.[8]

The UK response

As a result of the Bawa-Garba case, the then Minister for Health, Jeremy Hunt, commissioned a Rapid Policy Review into GNM in healthcare, led by Professor Norman Williams.[9] The terms of reference take a broad look at the factors that may lead a healthcare practitioner being charged with GNM, with a particular remit to review the role of the GMC and its right to appeal decisions made by the MPTS.

UK prosecutions for GNM

Despite concerns about a growing number of prosecutions of doctors within England and Wales (Scotland does not have the crime of GNM), the Williams report would indicate that there is not a torrential storm of activity. Between 2013 and 2018, out of 259,000 registered doctors, only five were prosecuted, resulting in one fleeing the country, one acquitted, two convictions overturned on appeal, and only one conviction standing (Dr Bawa-Garba).[10]

Going forward – the Williams report

However, in the next 25 pages of comment, evidence and recommendations, Prof Williams makes it clear that there is much wrong with the system. Since 2013, the Crown Prosecution Service (CPS) have undertaken 151 investigations involving all healthcare practitioners, resulting in only seven prosecutions.[9] After summarising the current principles in Common Law defining GNM (which unlike Australian practice, does not include the concept of moral culpability) he opines that the police force, the CPS and the coronial services need to understand what GNM actually is, to gain consistency of referral and prosecution, and a reduction in unnecessary and stressful investigations.

Prof Williams recommends the establishment of specialist investigatory police units that have a much deeper understanding of the systemic and human factors at work in complex healthcare services, with input from medical and quality experts. 'There will nearly always be factors in the delivery of healthcare beyond the actions of healthcare professionals... it is essential to establish a full understanding of all the causal factors'. Quoting Lord Mackay's comment in 1994, as to whether the breach of duty by the doctor was gross negligence (and therefore a criminal act) 'this will depend on... all the circumstances in which the defendant was placed when it occurred'.[11]

Prof Williams' final, scathing comment in this area of healthcare safety and adverse events was in relation to the complete failure of the NHS to learn from its mistakes. He reminded the UK Health Department that this point has been made time and again, from the Francis Report into the Mid Staffordshire Hospital failings[12] to the Morecambe Bay Investigation,[13] 'the NHS has proved resistant to change'.

While these recommendations are heartening, they skirt some fundamental questions. Should the legal (criminal) response to error depend solely on patient outcome, leaving other significant errors untouched? Is there any place at all for criminal charges where a inadvertent error has been made, as opposed to reckless and culpable intent?[14, 15] Paterson argues that 'manslaughter is an unhelpful form of accountability' and depending on the desired outcome, there are a number of different, more productive pathways: coronial, regulatory, civil.[16] As the Williams report notes, nearly all hospital related events are multifactorial, and prosecuting and imprisoning one doctor will not make 'the system' safer.

Finally, all of us working in hospitals expect the right personnel and functioning equipment to enable us to do our job. Is there a case for the crime of 'corporate gross negligence manslaughter' to be laid against hospitals who fail to provide this infrastructure – in effect, an extension and criminalisation of a hospital's civil non-delegable duty of care.[17] It was Kirby P's (as he was then) dissenting opinion in Ellis, that 'hospitals are under a duty to organise and ensure... a safe hospital system'.[18]

The regulatory case

Superficially, the medical regulatory framework in the UK is similar to Australia, with the Professional Standards Authority having a similar role to AHPRA, overseeing nine Councils – the GMC being one. However, in 2012, the GMC created the MPTS (reporting to it and the PSA) to undertake fitness to practice hearings, separating out the investigatory and adjudication functions of the GMC. Since 2015, the GMC has had the right to appeal decisions, often ones considered too lenient made by the MPTS, to the Courts. This has created an organisation almost at war with itself.

On the one hand, the GMC is concerned with public opinion, with a remit to 'ensure public confidence in the organisation' how ever they ascertain what this is. On the other hand, the MPTS's role is to assess a doctor's ability to continue practising safely. In a recent case where a practitioner was simply issued a warning following an insignificant single event, the GMC demanded full erasure. The response of the Court was peremptory 'the MPTS is well placed to make an evaluative judgment of nuances', and rapped the GMC on the knuckles for even bringing the case to the High Court.[19] It is little wonder that doctors in the UK are both angry and fearful and feel that the GMC is not fit for purpose, demanding radical change. It is also not surprising that the Williams report recommended succinctly that this right of appeal should be taken away from the GMC.

Conclusion

The Williams report promises much, yet fails to grapple with some of the real concerns of medical practitioners working in the grossly under-resourced environment of the NHS, a situation familiar to Australian practitioners in our public system. We can take more comfort in our legal and regulatory systems, but our public health system still leaves doctors, especially trainees, at risk.

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LGBTQIA: from personal experience

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FRANZCOG

I write in response to the recent LGBTQIA issue of *O&G Magazine*. I was unaware this issue was planned, and I could not conceal my astonishment when I saw it. It made me reflect on my own life, and I wanted to share my thoughts so that colleagues might understand the journey from outsider to belonging and hear the voice of a longstanding College Fellow who happens to be gay.

I grew up in Doncaster, which was, in the 70s, a standard outer suburban middle-class area with a lower socioeconomic status than it has today. Both of my parents left school at 14. I was the first person in my extended family to complete secondary school, let alone go to university and get into medicine. I had wanted to be a doctor for as long as I can remember because, in my tiny universe, that seemed to me to be the most noble and important thing anyone could become. Throughout primary and secondary school, I had a blinkered approach to achieving this goal, but pouring my life into study achieved something else. It shielded me from the environment I lived in, where I didn't fit or belong, and in the longer term it allowed me to escape from that world. I instinctively rebelled against the football-based male culture that was the sole reason for anyone's existence in those days. For his first child, my father proudly bought a pair of football boots and I went to one practice session aged eight. I hated it. I immediately put my foot down and after many tears and refusal on my part, and anger on my father's, I never played football again. As I had younger twin brothers who happily fitted into this culture, they became the focus of my father and he and I basically ignored each other from then on. Often my parents' friends and acquaintances were surprised to discover my brothers had an older brother. Last year I found an archived magazine of the local junior football club and found an article by my father proudly referring to his 'two sons' and the number of games they had played there. I avoided every contact I could with what I now regard as toxic male culture. To this day, football symbolises that world and my life as a child and the harm done, and I cannot engage with it.

High school was a nightmare until the last two years. Like most doctors, I had been a very bright polymath child who was good at everything academic. My primary school had been a fantastic experience, with two other kids from my year getting into medicine at Melbourne University as well as me. High school was not great. That curious, inquisitive and mostly happy child vanished after puberty. I was constantly the target of bullies who clearly knew I was a 'poofter' even before I knew what that meant. I was also targeted because I was clever and got good marks. So again, more avoidance, hiding in the library during recess and lunch, and walking different routes home from school to avoid getting beaten to a pulp. The last two years of school were much better because, in those days, most kids finished at 15 or 16 and these were the ones who bullied – girls as well as boys. Luckily, due to Gough Whitlam's policy, university was free for me, for which I am eternally grateful. I would not be here today without that policy. With my family's financial situation, even a HECS degree would have been unthinkable as we could barely afford the books I needed for study.

So, I achieved a good mark in HSC and, to everyone's surprise except mine, got into medicine. Having achieved this goal, I became lost. I didn't speak to anyone for three months until I found someone else who had gone to a high school. All around me were super rich, confident, private-school kids who were at least as smart as me, and mostly much smarter. Whatever I had felt was good about me rapidly disappeared into low self-esteem and self-hatred. I truly hated myself. I didn't want to be gay, AIDS was becoming apparent and this just shut me down into a place of emptiness and self-loathing. And of course, being gay was a crime – I was a criminal. I didn't do very well at university; not badly, but in the middle somewhere, like most of my friends. I eventually opened up to these friends that I was gay, and while they were supportive, I supressed doing anything about it. I am not sure where the shame and self-disgust came from; my family were completely non-religious. I think, though, that homophobia is a huge part of Australian toxic male culture and it pervaded all aspects of my life. On a high note, I loved O&G, got a good mark in it, and won a prize

as well, so I always felt my career would go this way. I think gay men seem to develop a lot of empathy for women, and I know I much prefer talking to, and being friends with, women rather than men. I guess that goes for patients, too.

I made a friend at university; the first male friend I ever had. Predictably, this ended in tears because I fell for him. This is a common story. I forgive myself and I forgive him for what followed because neither of us had the emotional intelligence or maturity to respond to the situation. A friendship was destroyed because of society's imposed views on homosexuality. I fell into a very deep depression, dealt with this by not eating, studying very hard, getting a part-time job and saving money for the traditional overseas elective, and I finished my last year of medical school. The last three years of university were a lot better than the first three and being at clinical school with my friends helped me though that time.

So, there I was, a newly qualified doctor, full of shame and self-hatred, feeling inferior to everyone around me. All I did for the next few years was work enormously long hours. I didn't try to meet anyone because of the ongoing shame. I decided to try and get into O&G after a six-month rotation for a Dip Obs, and I loved the work. I studied really hard for the first part and got into the program. There I worked even longer hours. During my first year of training, in retrospect, I became deeply depressed and I basically stopped eating and dropped to 57kg. All my uni friends took a year off and travelled overseas. I had a distant relationship with my family and I used work as an excuse to avoid them. My school friends dropped away. What got me through this was a well-timed break trekking through Nepal with my friend Virginia, and transferring to another hospital, which was also full of bullies, but at least they were different ones, and I had exams to pass. Emily Olive was very supportive during this time, and she was the only colleague I could trust. For the first three years of my training, which were in Melbourne, bullying was rife and only two consultants during that time were kind to me – Helen Andersen and Jacqui Smith. Other than these two women, bullying was how we were taught and treated, and male consultants would often make homophobic remarks, including one that I will always remember 'Faggots should be banned from doing surgery'. Even though I'm now 56 years old, there are still people who practice medicine in Melbourne that were such horrendous bullies that I feel I would vomit if I saw them, that's how visceral the feeling is. I bumped into one at a meeting recently and, out of nowhere, had a full-on panic attack and was rescued by the Northern private practice midwives who recognised my distress and intervened to get me out of that encounter. Thank you, Andrea and Hannah. It's not fair that I should react like this, and it's that encounter that made me want to write all of this down.

Finally, at aged 28, I met my future husband Mark, who worked in the operating theatre where I was working as a registrar. We have been together for 27 years. We moved to Cairns for my fourth and fifth years of training, and I spent from 1993 to 2013 in that paradise. My boss, Michael Humphrey, was very supportive to me and Mark, and stood up when senior medical staff made homophobic comments about me. However, that type of behaviour was rare, and I made wonderful friends who I love deeply. Of particular note is Liz McKenna, who has supported us in so many ways and been such a strong support in my life, I can never thank her enough. Thanks also to David Harley and Robyn Mathers who welcomed us into their lives from the time we arrived in Cairns. I'm so proud of the wonderful team of women specialists who now run the service in Cairns, and that I was able to encourage them and help them in their careers; they are all wonderful friends who I miss very much. The fantastic midwives are close friends too and I miss them also.

Behind the move to Cairns was the need to move away from my family and be far from them. Gradually, all of them except my father became aware of my sexuality and my relationship with Mark. My brothers were always supportive, even though they had journeys of their own to get there. My nieces came up for holidays and, to this day, they love their gay uncles. All of this was a secret from my father, however, who could not be told, and despite others suggesting he would have accepted me, I know this would not have been the case. My father died nearly 12 years ago, and it is sad to say that my life actually improved after he died because there was no more need for secrets. I did get along better with him after I left Melbourne, but it was never a close relationship and I blamed him, fairly or unfairly, for my unhappiness as a teenager and young adult. I also treated him appallingly once I was qualified as a doctor, as he was a bit of a coward and afraid of authority figures, which I apparently now was. So, I was rude, condescending, nasty to him, and he lapped it up and begged for more, which outraged me even further. I could not reconcile this behaviour with the verbal abuse, anger and rage directed towards me as a child and teenager; being ignored and left out, clearly one to be ashamed of and disowned. I certainly took revenge in my own later behaviour, but in the end, we reached a kind of steady state that worked for us, at a distance.

Mark and I returned to Melbourne for professional reasons at the end of 2013. By this time, I had been a consultant for a long time and was confident of my abilities and self-worth and regarded myself as equal to anyone. My new hospital was welcoming, supportive and proactive on LGBTQIA issues. For the first time, I entered a workplace proud of who I was and with no secrets from anyone. It wasn't perfect; I encountered a non-medical bully who made my life and others miserable, and sadly my

apparent newfound confidence and feelings of self-worth evaporated, and I responded like I always did when I was young – withdrawing into myself, not sharing with Mark, reverting to type. Fortunately, this situation was resolved, but I was shocked at how easily my self-esteem was destroyed. Mark and I got married in New York in 2014, because I feared marriage equality would never happen here, and as I got older, I started worrying about dying and leaving Mark without any legal support or protection. We had already made a will, which was very expensive because we had to make it ironclad and protect it from being challenged.

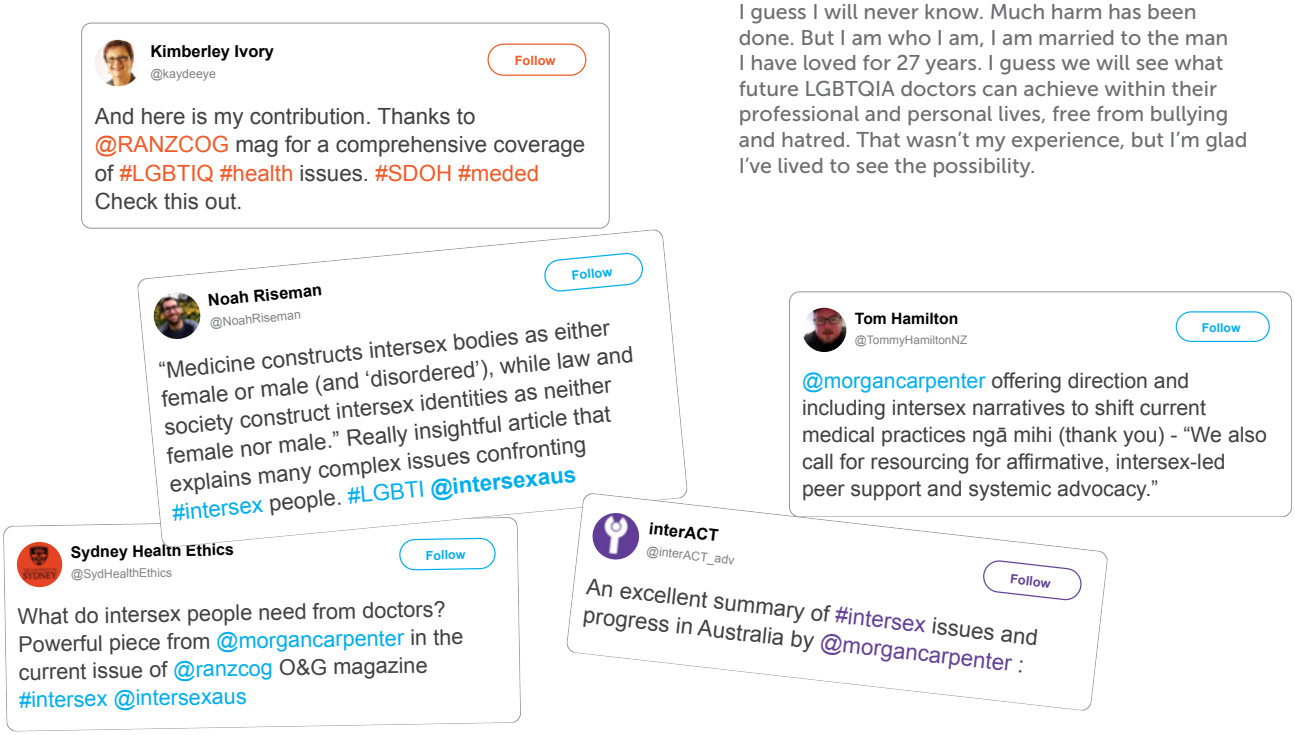
I have had a fair bit to do with the College professionally and was on the Queensland state committee for many years. I have to say that Queenslanders seemed much more accepting and egalitarian than Fellows in Victoria. I was apprehensive about returning, but things have fortunately changed for the better since I left. There are still issues though. At one OSCE exam, an actress played the role of a lesbian patient. The candidates did not do well. During the preparation, I pointed out that there was no LGBTQIA content in the curriculum (it is still pretty minimal) so how could we expect trainees to be competent at responding to such a patient's needs? I still remember a lot of the candidates responded 'Yes, yes, but where is your husband?' after she mentioned her female partner! It's pretty poor that we examined for content we did not provide or teach. Another time, a group called 'Australian doctors for the family' became prominent, stating homosexuality was a health hazard because male homosexuals lived shortened lifespans. No insight into the fact that societal disapproval and marginalisation creates inequality; this was purely religious hellfire, brimstone and damnation – the same old hatred dressed up as concern. Some of this group's members were Fellows and Diplomates. I raised my concern and distress at this to the College president at the time, Rupert Sherwood, who was very supportive, but when he raised this with the College Council and Board, they did not see it as an issue and declined to comment or respond.

The marriage equality debate was a horrible time for the LGBTQIA community. For me and Mark, there have been issues with family (still), and at work I encountered homophobia from people feeling entitled to speak out in horrible ways. Since then, I find it very hard to be anything other than frostily polite, because I know they think I am inferior, sinful, evil or disordered. Fortunately, most of my workmates, and most of Australia, support our relationships, but I wish we did not have to go through this awful toxicity. The Catholic Archbishop made appalling comments about sacking gay staff in schools and hospitals. Michael Rasmussen and Sue Walker contacted me immediately from the Mercy to check how I was feeling, and to say they would always care for me, that I would always be welcomed at the Mercy. I cannot say how much that meant.

A support group of O&G specialists and trainees grew on Facebook, concerned at the College's silence on marriage equality. It is a health issue, not a political issue. Some people could see that, most noticeably Steve Robson, who as president championed our cause. We're all very grateful to him for doing so. I know there are those within the College who probably think I will burn in hell, but I don't care, they are ignorant people who will be left abandoned by the tide of public opinion, and they don't matter to me. I'm happy to leave them to their small and narrow lives.

So, imagine my surprise when I saw an issue of *O&G Magazine* dedicated to LGBTQIA issues. I was astonished! I showed it to Mark. I showed it to other gay colleagues who were equally amazed. For the first time, I actually felt I truly belonged to our College, truly welcome, because I've never felt that way before. I didn't think this would affect me as much as it has.

I often wonder what my life would have been like if society had been completely open and accepting of me from the time I was born. Would I have achieved more? Would I have had a better relationship with family and friends? What would life have been like without the bullying and self-hatred? Maybe I would have ended up as an empathy-free narcissist and bully, of which there are many in the medical world. I guess I will never know. Much harm has been done. But I am who I am, I am married to the man I have loved for 27 years. I guess we will see what future LGBTQIA doctors can achieve within their professional and personal lives, free from bullying and hatred. That wasn't my experience, but I'm glad I've lived to see the possibility.



Letters to the Editor

A/Prof Clara Shek PhD, FRANZCOG

Prof Hans Peter Dietz PhD, FRANZCOG

We would like to comment on the *O&G Magazine* Vol. 20 No. 3 Spring 2018. This issue focused on women's mental health, and perinatal mental health issues constitute an important part of the discussion. It was, however, surprising to find that there was no mention of somatic birth trauma and its psychological consequences. In the past two to three decades, a wealth of research has shown that childbirth is more traumatic to mothers than commonly assumed.

The true incidence of obstetric anal sphincter trauma (OASI), a well-known complication of vaginal childbirth, may be as high as 20 per cent due to missed diagnosis and, possibly, occult trauma.[1] Levator avulsion, another major form of maternal birth trauma that is commonly occult and undiagnosed, has been reported in 10–36 per cent of primiparous women after vaginal delivery.[2,3] Both forms of birth trauma are associated with pelvic floor dysfunction, that is, anal incontinence, increased vaginal and pelvic floor muscle laxity[4] and pelvic organ prolapse.[5] There is also an association between physical and psychological morbidity. Women suffering from postnatal physical morbidity were found to experience higher levels of depression.[6]

In a recent qualitative study on 40 women with known levator trauma, 27 reported symptoms of posttraumatic stress disorder (PTSD).[7] In this study, Skinner et al found that participants experienced multiple barriers to help-seeking behavior and felt abandoned by a medical system that did not recognise or identify either somatic or psychological trauma. Healthcare providers were reported to be dismissive, and some apparently trivalised women's complaints. A lack of knowledge and understanding among health service providers may contribute to this attitude,[8] which may further adversely affect women's mental health.[7]

The findings of Skinner's study suggest that women who have sustained somatic birth injuries and resultant emotional distress could be greatly assisted by perinatal clinicians who acknowledge their concerns and provide relevant diagnostic and therapeutic services. Health service providers need to understand and recognise the significance of somatic birth trauma and its potential impact on women's physical and mental health. Unfortunately, this issue of *O&G Magazine* missed an opportunity to contribute to this goal.

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Dr Graeme Dennerstein FRCOG, FRANZCOG

In their article on chronic vaginal discharge, Bradford and Fischer[1] have highlighted an area of women's health that often fails to receive the attention it deserves. I believe the aspect of the subject that causes our colleagues the greatest difficulty is making an accurate diagnosis or diagnoses. It is common for our patients with vulvovaginal complaints to have more than one diagnosis; a feature that may complicate their management.[2]

Of all the diagnostic techniques applicable to female lower genital tract, the one I have found most useful is microscopy of the stained vaginal smear as described in The Vulva &Vagina Manual.[3] To put the subject in perspective, the following are the findings made on 1000 consecutive stained smears obtained from patients complaining of discharge and/or pruritus/vulvodynia and/or dyspareunia and as a means of assessing treatment response in my private practice between 2014 and 2018. Fifty per cent were considered normal (including cervical eversion). The remaining diagnoses were atrophy (menopausal, lactational and prepubertal) 15 per cent, Candida albicans 12 per cent, erosive vaginitis (desquamative inflammatory vaginitis and vaginal lichen planus) eight per cent, vaginitis requiring further investigation six per cent, atrophic vaginitis four per cent, bacterial vaginosis one per cent and non-albicans yeast one per cent. Three per cent of the slides revealed the following diagnoses: radiation vaginitis, ulcer, malignancy, graft versus host disease, herpes simplex, cervicitis and chemical vaginitis.

Treatment of these disorders is relatively simple and effective when diagnosed accurately. For example, when the excessive secretions have been confirmed physiological, the patient will almost certainly benefit from a change of contraception to depot

medroxyprogesterone acetate, which reduces physiological secretions by means of progestogen-only ovulation suppression. An additional bonus from its use is the prevention of candidiasis.[4]

The finding of no abnormality (the largest group above) included treatment follow up and symptomatic patients with sexual problems, physiological discharge and vulvar dermatoses who may have received inappropriate medication without the smear diagnosis. Our patients would benefit from increased emphasis on training in this relatively simple diagnostic technique as well as the management of vulvovaginal disorders in general.

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Dr Phil Watters
FRANZCOG

I applaud the recent magazine with the emphasis on LGBTQIA issues, but I was stunned to see you accepted an article from Brian Morris. This man is not a clinician, does not have a medical degree and has been roundly criticised in the past for his confirmation bias and conflict of interest. Promoting routine neonatal circumcision in the Australian context has no basis in rational science. It would be good to see someone from clinical paediatrics refute his quoted violations of academic integrity.

I took a conscientious objection to doing neonatal circumcisions in 1978. I have never regretted my decision. It's time unscientific (eg. religious) bias was removed from the ongoing debate. I'd suggest that if all males were not circumcised after birth, then offered the procedure at age 18 when they can give informed consent, the vast majority would decline.

I accept that around 1 in 500 males may need it for clinical reasons. Doing it to 499 helpless infants without solid evidence is child abuse.

Editor's note: an opposing view to run alongside Brian Morris' article was invited; however, our search was unsuccessful.

Further reading

http://arclaw.org/announcements/steven-svoboda-and-robert-van-howe-refute-circumcision-claims-aap-and-brian-morris-jou

www.circinfo.org/Circumcision_and_sand.html

www.circumstitions.com/morris.html

www.adelaidenow.com.au/news/south-australia/to-snip-or-not-to-snip-sydney-university-emeritus-professor-brian-morris-claims-circumcision-should-be-a-routine-procedure-for-boys/news-story/4489fbaafee69bcaec6e46b0d8f8bbff

http://mondofown.blogspot.com/2011/03/circumcision-poor-health-outcomes-in.html

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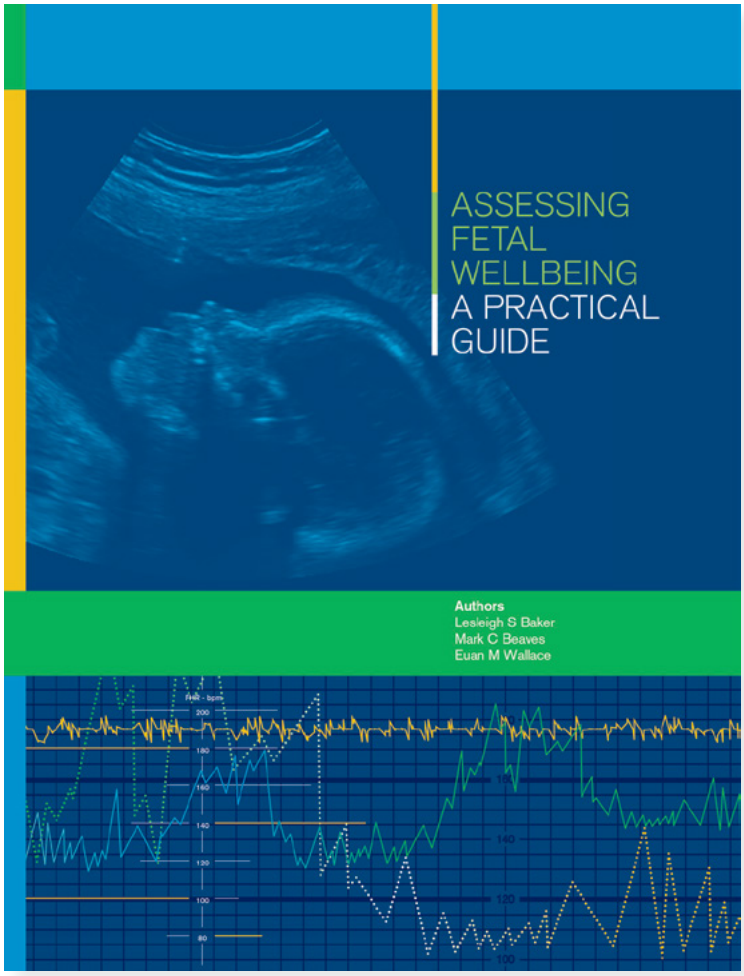
Assessing Fetal Wellbeing: A Practical Guide



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RANZCOG Women's Health Foundation

2019 Research Scholarships, Fellowships and Travel Grants

The RANZCOG Women's Health Foundation aims to foster clinical and scientific research in women's health, support global health projects, Aboriginal and Torres Strait Islander and Māori women's health initiatives.

Under the oversight of the Research Grants Committee, the College supports promising early-career researchers across Australia and New Zealand by annually awarding research fellowships, scholarships and travel grants to those practising in the field of obstetrics and gynaecology. The assessment process was once again very competitive this year, with 21 applications received across Australia and New Zealand.

The RANZCOG Women's Health Foundation is pleased to advise that the following applicants have been offered scholarships and fellowships for research and travel in 2019:

Ella Macknight Memorial Scholarship, 2019–2020

Recipient: Dr Monika Skubisz
Institution: South Australian Health and Medical Research Institute
Project: A randomised controlled trial to investigate the necessity of prenatal folic acid supplementation beyond 12 weeks of gestation.

Dr Skubisz is an O&G at the Women's and Children's Hospital in Adelaide and Postdoctoral Research Fellow at the South Australian Health and Medical Research Institute. Dr Skubisz's project will investigate whether ceasing folic acid supplementation after 12 weeks of gestation will still allow Australian women to maintain adequate blood folate concentrations throughout pregnancy, as measured between 36 and 37 weeks, while minimising blood levels of UMFA, a biomarker of excess folic acid intake. The study will be undertaken over two years and recruit 100 women in early pregnancy, with half receiving extra folic acid and the other half not. The blood levels of folic acid will be measured at the end of each pregnancy to help decide if pregnant women need folic acid supplementation beyond 12 weeks of pregnancy.

Glyn White Research Fellowship, 2019–2020

Recipient: Dr Roxanne Hastie
Institution: University of Melbourne/Mercy Hospital for Women
Project: Improved Characterisation of Eclampsia (ICE study).

Dr Hastie is a Mercy Perinatal Postdoctoral Research Fellow at Mercy Hospital for Women in the Department of Obstetrics and Gynaecology, University of Melbourne. Dr Hastie's project aims to improve prediction of eclampsia and identify a unique set of clinical signs and symptoms that occur prior to the onset of eclampsia. Over a two-year period, Dr Hastie will study women from countries where eclampsia occurs frequently and investigate the symptoms these women experience before they have a fit. By identifying these clinical signs and symptoms, it is hoped she will be able to develop a simple predictive algorithm for eclampsia that will enable appropriate and consistent prophylactic management.

Mary Elizabeth Courier Research Scholarship, 2019–2020

Recipient: Dr Daniella Susic
Institution: Royal Hospital for Women, University of New South Wales, Sydney
Project: The uterine microbiome in obesity-related endometrial cancer: identifying its composition and relationship with clinicopathological features and local and systemic biomarkers.

Dr Susic is an advanced FRANZCOG trainee and Clinical Research Fellow in O&G at St George Hospital. Dr Susic's project will be completed over two years and aims to investigate how the microbiome of the endometrial cavity is related to the development of endometrial cancer in obese post-menopausal women. Using tissue and blood samples collected from women with and without endometrial cancer, she will investigate the role of this microbiome in endometrial cancer. The clinical significance of this project is the potential to discover new information about how endometrial cancer, the most common gynaecological cancer in women, relates to the local microbial environment.

Norman Beischer Clinical Research Scholarship, 2019–2020

Recipient: Dr Carole-Anne Whigham
Institution: University of Melbourne/Mercy Hospital for Women
Project: Detecting circulating maternal biomarkers to predict fetal size: FLAG 2 (Fetal Longitudinal Assessment of Growth).

Dr Whigham is currently enrolled in a PhD at the University of Melbourne and is a RANZCOG trainee at the Mercy Hospital for Women. Dr Whigham's study aims to develop a blood test for on-the-day diagnosis of small for gestational age (SGA) and placental insufficiency, which are risk factors for stillbirth. Following from the FLAG study, which identified a number of biomarkers for SGA at 36 weeks, before the birth of a small baby at term, the aim of FLAG2 is to develop a test that will detect small babies in real

time on any given day. In doing so, it is hoped the test will indicate which babies need urgent delivery on that day, and, therefore, avoid their risk of stillbirth.

RANZCOG NSW Regional Committee Trainee Research Grant 2019 (four awarded)

Recipient: Dr Kata Kraljevic
Institution: Kolling Institute of Medical Research, Royal North Shore Hospital
Project: How and what do obstetricians discuss with pregnant women who have had a caesarean section regarding their next birth options, and is this consistent with the best available evidence?

Dr Kraljevic is a RANZCOG trainee and O&G registrar at the Royal North Shore Hospital. Her project aims to use a highly innovative method to evaluate the quality of clinical communication, the shared decision-making process and content of information provided by obstetricians to women who have had a previous caesarean section about subsequent birth options. Obstetricians will subsequently be educated on evidence-based VBAC counselling considerations and given opportunity for reflective feedback and practice. This research aims to lead to better patient-centred care that emphasises maternal choice and autonomy.

Recipient: Dr Sameer Mathur
Institution: Kolling Institute of Medical Research, Royal North Shore Hospital
Project: The use of cervical cerclage for women at risk of preterm birth: a survey of current clinical practice and predictors of cerclage success.

Dr Mathur is a RANZCOG trainee and year 1 O&G registrar at the Royal North Shore Hospital. His project aims to provide data on current clinical practice among Australian and New Zealand Fellows and maternal-fetal medicine subspecialists regarding the use of progesterone and/or cervical cerclage for women at risk of preterm birth and/or a shortened cervix. The research project will analyse cervical cerclage cases for patient characteristics and ultrasound features from a large population dataset and report on recurring themes associated with success or failure of the cerclage.

Recipient: Dr Russell Duncan
Institution: Royal Prince Alfred Hospital
Project: A potential role for the Ghrelin axis in endometriosis.

Dr Duncan is an advanced FRANZCOG trainee at Gosford Hospital and will be employed as a Provisional Fellow at Royal Prince Alfred Hospital in 2019. His project will examine a potential role for the Ghrelin hormone axis in endometriosis. Ghrelin has been shown to be increased in pelvic fluid in women with endometriosis. Dr Duncan will examine if the ghrelin axis is present in endometriotic nodules with immunohistochemistry. Fasting blood hormone levels will be measured, as ghrelin is a major regulator of appetite and influences weight. Dr Duncan will hypothesise that the ghrelin hormone axis has a direct role in endometriosis and influences body weight.

Recipient: Dr Nicole Stamatopoulos
Institution: Nepean Clinical School
Project: Factors affecting early pregnancy and miscarriage.

Dr Stamatopoulos is a RANZCOG trainee and Acute Gynaecology, Early Pregnancy and Advanced Endosurgical Fellow at Nepean Hospital. Her project will investigate for other possible causes of miscarriage and improve women's health prior to, or in, early pregnancy. One study aim is to see whether the presence or absence of gum disease has a link with miscarriage. The project will also investigate if there is any way to predict what will happen to a pregnancy in women who present with signs or symptoms of miscarriage. This can provide some idea as to the outcome of the pregnancy by the end of the first trimester.

Taylor-Hammond Research Scholarship 2019

Recipient: Dr Joseph Carpini
Institution: University of Western Australia
Project: Unlocking the 'Black Box': effects of cognitive and emotional demands on surgical performance in OBGYN.

Dr Carpini is an assistant professor at the University of Western Australia Business School in the Management and Organisations Department. The aim of his project is to examine the impact of cognitive and psychological demands on O&G surgical performance and examines task, environmental and personal antecedents of these demands. The multi-disciplinary project aims to inform understanding of how the psychological demands of surgery impact both technical and non-technical surgical performance. Using a mixed-methods design, including both experimental and longitudinal field studies, this study aims to provide important insights with implications for surgical practice and education. RANZCOG members will be invited to participate in the field study in mid-2019.

UroGynaecological Society of Australasia (UGSA) Research Scholarship 2019 (two awarded)

Recipient: Dr Zhuoran Chen
Institution: University of New South Wales
Project: Refractory Urge Incontinence: the role of cytokines a marker for persistent infection in these patients?

Dr Chen is a RANZCOG trainee, Urogynaecology Fellow at St George Hospital, NSW, and enrolled in a PhD at the University of NSW. Dr Chen's research project aims to investigate the fundamental mechanisms that underlie a debilitating and difficult to manage clinical condition, detrusor overactivity (DO). The research will investigate the level of urinary cytokines in patients with refractory DO who have had antibiotic therapy vs placebo. The aim of this project is to determine whether urinary cytokines are a marker for persistent infection in patients with refractory DO, and whether cytokine levels change after treatment. This study will apply laboratory-based scientific investigations (urinary cytokine levels) to help understand their relationship with clinical symptoms in patients with refractory DO post treatment with antibiotics.

Recipient: Dr Chin Yong
Institution: The Royal Women's Hospital
Project: Bilateral sacrospinous ligament flap for treatment of apical pelvic organ prolapse: a combined cadaveric study and magnetic resonance imaging study.

Dr Yong is a RANZCOG Fellow and Urogynaecology Fellow based at the Royal Women's Hospital. His research involves a combined cadaveric study and radiological analysis of sacrospinous ligament (SSL). The study objective is to develop a new native tissue surgical technique using SSL flaps to provide support for vagina apex for management of pelvic organ

Scholarship recipients (L to R) Dr Kata Kraljevic, Dr Daniella Susic, Dr Zhuoran Chen, Dr Chin Yong, Dr Rangi De Silva, Dr Roxanne Hastie and Dr Carole-Anne Whigham attended the 2018 RANZCOG Women's Health Foundation Scholarship awards ceremony.

prolapse. The proposed technique may address some of the limitations of the traditional vaginal sacrospinous ligament colpopexy or hysteropexy and, also, a suitable surgical option for women who wish to avoid using mesh augmented prolapse repair.

Miriam O'Connor Travelling Scholarship 2019

Recipient: Dr Rangi De Silva
Institution: Mercy Hospital for Women
Details: For the purposes of undertaking an observership at the National Referral Hospital, Honiara, Solomon Islands.

Dr De Silva is an advanced FRANZCOG trainee based at the Mercy Hospital for Women. Dr De Silva's volunteer placement involved clinical service delivery, clinical education, capacity development and policy development with key stakeholders. Ongoing placements will enable strengthening of the relationship with the obstetrics and gynaecology department, to encourage future collaborations and foster continuing research to improve perinatal outcomes in the Pacific region.

Scholarships/Fellowships continuing in 2019

Arthur Wilson Memorial Scholarship, 2018–2019

Recipient: Dr Natasha Pritchard
Institution: The University of Melbourne
Project: Novel therapeutic agents to treat pre-eclampsia in obese mice models.

Fotheringham Research Fellowship, 2018–2019

Recipient: Dr Maya Reddy
Institution: Monash University
Project: The cardiovascular toll of pre-eclampsia: determining impacts on the maternal, fetal and placental vasculature.

Support the Foundation

The RANZCOG Women's Health Foundation is grateful to those who have so generously supported its philanthropic work in the past year.

Donations to the Foundation, from individuals as well as organisations, enable the College to support not only clinical and scientific research, but initiatives in global women's health, Aboriginal and Torres Strait Islander and Māori women's health.

RANZCOG members can support the Foundation via the payments section of the my.RANZCOG Members Portal. To login and donate, please go to https://my.ranzcog.edu.au/login

For donation enquiries, please contact Ms Jessica Davey, RANZCOG Women's Health Foundation Coordinator on foundation@ranzcog.edu.au or +61 3 9412 2993.

2020 Foundation Scholarship applications open late April and close 30 June 2019.

The Liam and Frankie Davison Award 2019

For outstanding achievment in literary writing on an issue in women's health

Applications

Applications are now open for the 2019 Liam and Frankie Davison Award.

This $1000* award provides an exciting opportunity for students interested in medicine, science, health, sociology, politics or law.

Applications must submit an **original literary piece** (fiction or non-fiction) of not more than 2000 words on any topic of interest in women's health (for example: an opinion piece on a social issue, a short story or a report). Past submissions have covered topics such as endometriosis, postpartum depression, abortion, gender inequality and polycystic ovarian syndrome.

Eligibility Criteria

Applications will be open to students in their final three years of secondary school

(Generally Years 10, 11 or 12 in Australia and Years 11, 12 or 13 in New Zealand).

* Up to two awards offered; winning entrant(s) will receive $1000 in AUD or NZD as applicable, based on country of residence.

Applications close 30 April 2019

The Royal Australian and New Zealand College of Obstetricians and Gynaecologists
Excellence in Women's Health

Full Terms and Conditions of Entry, the application form and information for applicants will be available on the website from 31 January 2019:

www.ranzcog.edu.au/about/foundation/Liam-and-Frankie-Davison-Award

or contact the Foundation Coordinator **t: +61 3 9417 1699 e: lfdaward@ranzcog.edu.au**

Obituaries

Dr Geoffrey Jackel
1947–2018

Geoff Jackel was born in Rochester, Victoria in November 1947, the fourth of five children. He attended primary and secondary school in Rochester and was active in sports, especially Australian Rules and tennis, as well as being in scouting, where he excelled, becoming a Queen's Scout.

He made the decision as early as 12 years old to do medicine and became the first member of his family to go to university. He attended Monash University Medical School and financed, by picking tomatoes, his accommodation and the cost of his much-loved car (Austin A30), which (it's reported) he drove 'like a maniac' around the streets of Melbourne.

Following graduation in 1970, Geoff did two years of residency at Princess Alexandra Hospital in Brisbane and, in 1973, at Toowoomba General Hospital, where he took part in a program of rotating specialities in preparation for general practice.

After a term of obstetrics and gynaecology, he was inspired to change career direction and applied for a training position at the Royal Newcastle Hospital (RNH). His training supervisor at RNH, Dr Julian Ward, reported to Geoff that he had won the position on the toss of a coin between the two best candidates.

To further his clinical experience, he moved with his family to St Mary's Hospital, Portsmouth, UK from 1976–1977, where he gained MRCOG and returned to RNH as senior registrar the following year.

At completion of his training, for a short period, he joined the O&G practice of Drs Steele Fitchett and Leon Clark in Newcastle.

In 1982, Geoff moved with his wife, Virginia, and family to Dubbo to join in practice with Chris Halloway, with whom he'd previously worked at RNH. They were subsequently joined in 1984 by John Tooth and in 1990 by Tony Geraghty; both also trained at RNH. He worked in this practice before moving to a staff specialist position at Dubbo Base Hospital in 2007.

Geoff gave tireless service to the women and families of Dubbo and the region for over a quarter of a century. Despite long hours, he invariably remained patient and kind, prepared to listen to the concerns of those he was caring for, no matter the time of day or the disruption to his own schedule.

Geoff contributed to the establishment of DBH maternity service as a specialist training site, with ITP trainees rotation from Westmead Hospital, Sydney from 1997. He was also involved in Provincial Fellows activities, being the principal organiser of the Provincial Fellows Annual Scientific Meeting in Dubbo in 2000, as well as participating in Provincial Fellows CPD activities such as practice visits, perinatal audits and laparoscopic audits. He was also an examiner for the DRANZCOG.

Geoff was an enthusiastic teacher of students, midwives and trainees and was prepared to offer opportunities in procedural O&G to others without regard to the expense of his own time.

He had significant community involvement, especially through Dubbo schools, where all his children were educated, and he served a term as Chair of the Parents & Citizens Association at Dubbo High School. One of his sons, Bryce, who sadly died in 2017, was school captain there in the mid-1990s.

Geoff was obviously a great source of inspiration to his children, who only ever referred to him as 'Geoff.' Three of his sons graduated in medicine from Newcastle Medical School and his daughter has become a highly credentialed nurse. This is despite the belief, often expressed by Geoff, that none of his children would follow in his footsteps 'because they could see how hard I worked'.

Throughout his time in practice, he was supported by Virginia who, as well as working part-time in the practice, filled in the gaps created by Geoff's frequent absences. Together they created a highly effective team, bringing up their large family of five in a stimulating and loving environment.

Geoff was also an inspiration to his extended family, with his siblings and their families looking to him for support, advice and affection, which he willingly gave.

Geoff had many interests outside of work, including gardening. He had a large backyard vegetable patch alongside the chook run at the family home where he applied his sound agricultural knowledge developed during his childhood in rural Victoria.

He was a keen fisherman and escaped to the western rivers with his family whenever he was given the opportunity. He was a more than able tennis player and kept up his skills in the family backyard court.

At Dubbo golf club, he became a regular Wednesday competition player and, at the height of his powers, managed to get his handicap down to the mid-teens. However, he was ready to admit that he could play 'some shocking golf'.

Geoff will be remembered by those who knew him as someone of great modesty and humility. Despite his pre-eminence in the community, he was never given to grandiosity. To his friends and colleagues, he was a guide, mentor and font of wisdom. He was blessed with a sense of humour and was able to laugh at himself. He would self-deprecatingly refer to himself as 'one of the little fellas'.

Geoff died on 30 May 2018, among his family after a long illness, in Newcastle, where he had moved following retirement from practice in 2010.

By those who knew and loved him, he will be missed.

Dr Tony Geraghty
FRANZCOG

Prof Roger Gabb
1942–2018

Roger Gabb, our inaugural Director of Education at RACOG, was a man passionate about education, training, accreditation, quality assurance and continuing professional development.

At university, he initially obtained a veterinary science degree. This was followed by a PhD in reproductive physiology, a Master of Education and a Master of Public Health. After initial veterinary work, his love of education took him to an academic position as senior lecturer in animal physiology at Lincoln college, University of Canterbury, New Zealand. He became director of their educational services unit.

Some senior Fellows of our College had recognised the need for an educational expert at RACOG, and this led to the appointment of Roger Gabb in 1986, as the foundation Director of Education of RACOG.

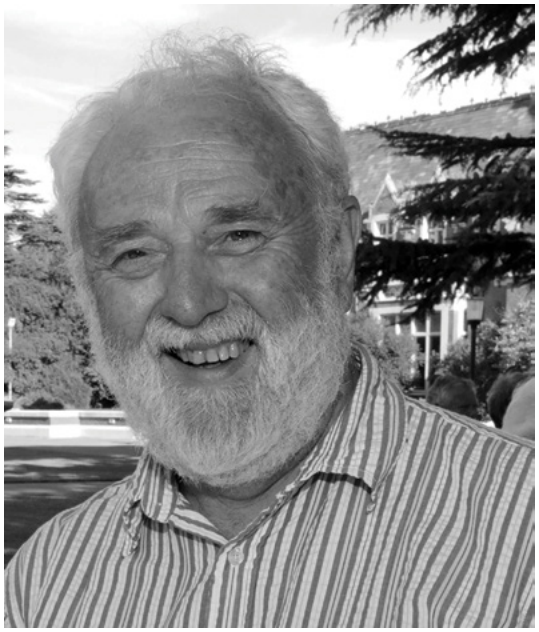
As he told us at a meeting of the board of examiners of the College in 1992, he spent his initial months at RACOG observing our systems. He found that there was little formal documentation of training and accreditation; no educational curriculum for our trainees; no standardisation or means of validation of our examinations for MRACOG; and no requirement for Fellows to have any record of CPD activities after completion of their training.

Roger firstly organised, educated and trained the board of examiners. We learned how to standardise and validate the exams we conducted. Most importantly, we learned how to assess our own performances as examiners. He showed us the format of structured oral examinations and gave us the framework for the development of standardised cases. This change meant that rather than each MRACOG candidate seeing different and random clinical patients, as had been happening for all previous years, each candidate was examined on the same eight cases. What is now normal practice was a revolution in exam practice in 1992.

He led the College in curriculum development and in formalising documentation of the training and assessment of our trainees. He created the framework to make RACOG the first specialist medical college in Australia to mandate a formal CPD program for all Fellows in order to maintain their specialist accreditation.

He published his work and presented it at O&G and educational conferences around the world. His achievements were noted, acknowledged and copied by the Royal College of Obstetricians and Gynaecologists London, and many other international colleges and societies. He was appointed educational advisor to both the Asian Federation of Obstetrics and Gynaecology (AOFOG) and the International Federation of Gynaecology and Obstetrics (FIGO). He was a leader in developing the Pacific Society for Reproductive Health to facilitate all aspects of education for O&Gs and midwives from that region. By the mid 1990s, Roger had taken RACOG to a position as a recognised world leader in O&G education and assessment.

The Singapore College of O&G was so impressed that they asked RACOG to conduct our examinations annually for their candidates in Singapore. It became a privilege and pleasure for each group of examiners



to travel with Roger to examine. It also provided Australian trainees with an alternate venue to sit their examinations.

Roger was always personable, compassionate and kind. He was an intellectual giant, while also extremely generous in sharing his knowledge and expertise. He loved travelling, good company, good food (particularly international cuisines which he enjoyed all around Asia and Oceania) art and music. He delighted in the Fellowship and friendship of very many O&Gs and academics around the world.

He left the College to become Professor and Director, Centre for Professional Development, Victoria University, Melbourne. It was a great loss to our College, but a great gain for them.

Our College motto could well describe Roger's contribution to RACOG. He took our College, in educational matters, *ab umbris ad lumina vitae* (from shadows to the light of life). In recognition of his service and achievements, Roger was made Fellow ad eundem of our College in 1999. He left a profound influence on all who worked with him and will be remembered with great affection.

Vale Roger!

Dr John Campbell
FRANZCOG

Notice of Deceased Fellows

The College was saddened to learn of the death of the following RANZCOG Fellows:

- Dr Diane Palmer, Vic, 14 November 2018
- Dr Robin Vernon Montgomery, NZ, 17 November 2018
- Dr Brian Fredrick Charles Smith, Qld, 17 January 2019

RANZCOG members awarded Honours on Australia Day

The College congratulates the following RANZCOG members on recently receiving an Australia Day Honours award:

Prof Kate Moore, for distinguished service to medicine, and to medical research, in the field of urogynaecology, and to professional groups, Officer (AO) in the General Division.

Dr Andrew Browning, for significant service to the international community through the provision of obstetric care to women in Africa, Member (AM) in the General Division.

Dr John Campbell, for service to medicine as an obstetrician and gynaecologist, Medal (OAM) in the General Division.

Dr Janet Duke, for service to medicine as an obstetrician and gynaecologist, Medal (OAM) in the General Division.

Prof Peter Dwyer, for service to medicine as an obstetrician and gynaecologist, Medal (OAM) in the General Division.

Dr Sujon Purkayastha, for service to medicine as an obstetrician and gynaecologist, Medal (OAM) in the General Division.

Dr Stanley John Menzies, for service to the communities of South West Victoria, Medal (OAM) in the General Division.

We would also like to congratulate our recently retired staff member, **Carmel Walker**, who received an Order of Australia Medal for her service to the international community of the Pacific Islands.

RANZCOG is proud to count with such distinguished individuals as part of its community.