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Stillbirth and perinatal death

The Royal Australian and New Zealand College of Obstetricians and Gynaecologists

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Stillbirth and perinatal death

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From the President

Prof Michael Permezel
President

The College enters a new era following the departure of Dr Peter White, after more than 11 years with the College and eight years as CEO. He leaves to assume a senior position with the Australian Medical Council (AMC). I am very pleased to announce, after a rigorous selection process, the Board had appointed Mr James McAdam as the new CEO. James comes to RANZCOG from the Royal Australasian College of Surgeons, where he has held a senior position for several years. We all wish James a long and rewarding tenure as CEO of the College.

Selection of the new Trainees

Following on from the New Zealand selection process in May-June, the Australian process took place in August-September. Never has the number or quality of applications been so high. Many a Fellow, Trainee and (not surprisingly) unsuccessful applicant cannot understand how the superb Dr X has missed out on a training position.

How could Dr X possibly have missed out? The simple answer is, although Dr X may well be very good, others have scored even better in the selection process. As the infamous 'tsunami' of medical students move into PGY1, PGY2 and beyond, such tales will become even more common. To succeed in an application for FRANZCOG training, Dr X does not just have to be extremely good, Dr X has to score better than his/her extremely good fellow applicants.

What counts towards selection?

In any appointment process, criteria for selection can be broadly divided into references, résumé and an interview. To my knowledge, psychometric testing is used by only one of the 14 specialist medical colleges and there is, as yet, no usable test of fine motor skills that might predict future surgical aptitude.

Within the résumé, academic performance was previously regarded as important, but can now only be used in a very limited way given that some medical courses no longer grade candidates or give honours. Clinical experience and research output are easily assessed – but should research be the key determinant of entry to a surgical clinical discipline? Should persistence in non-accredited positions of a lower ranking applicant be rewarded by eventual entry to training?

What discriminates?

The key to understanding selection is that the determinant with respect to who gets selected and who does not will be not be particularly influenced by a category awarded a large number of selection points if nearly all applicants score similarly in that category; in contrast, a selection item that may not be worth a large number of points, but which differs substantially between applicants (for instance, research), may prove to be an important discriminator.

Criteria for the diagnosis of GDM

For over 20 years, the diagnosis of gestational diabetes mellitus (GDM) in Australia has derived from an ad hoc 1991 consensus, which resulted from the very limited data available at that time. The landmark observation trial (HAPO 2008) and two randomised controlled trials (RCTs) (Crowther et al 2005; Langdon et al 2009) have led to recommendations for new criteria for the diagnosis of GDM. The new criteria have been endorsed by the World Health Organisation (WHO), the Australasian Diabetes in Pregnancy Society (ADIPS) and the Australian Diabetes Society (ADS), but not the Endocrine Society or Society of Obstetric Medicine of Australia and New Zealand. The result is there are currently two sets of criteria in use – causing significant confusion.

What is different?

The first key recommendation is to replace the two-step process at 28 weeks gestation of glucose challenge test (GCT) then glucose tolerance test (GTT), with a universal GTT. This prevents a significant proportion of GDM being missed and also avoids up to 30 per cent of patients having to be chased for a second test.

The other key recommendation is to change the diagnostic criteria from a fasting glucose >5.5 or two-hour >8.0 to fasting >5.1, one-hour >10.0 or two-hour >8.5. This aligns the values at similar risk ratios (1.75) for the development of pregnancy complications. The former ad hoc criteria were not aligned to the risk of complications with the fasting value being set to a much higher risk than the two-hour value.

Why the objection from some physicians?

The College finds itself faced with two opposing camps of physician opinion. Those that oppose the WHO criteria are concerned that more women may be diagnosed with GDM. Numbers will vary according to the ethnic mix, but resource implications could be significant in some centres. A second objection comes from those physicians with a rigid view of what constitutes evidence. The new WHO-endorsed criteria are the product of observational data and two RCTs that use parallel, but not identical, threshold criteria. Are limited research resources best allocated to yet another RCT exploring threshold criteria?

A way forward

Representatives of key colleges and professional societies were invited to a meeting at College House on 1 November 2013 to address the issue. Valuable contributions came from all in attendance, including representatives of the College of Midwives and diabetic educators. Among the suggestions that will be put to the Women's Health Committee will be that from July 2014, the College recommend a 28 week universal GTT in place of the two-phase process beginning with the GCT. This will have the aforementioned advantages of a single-step process and also provide health services with the opportunity to assess projected GDM numbers on WHO criteria. This should enable a later recommendation to adopt the WHO criteria, albeit no earlier than 1 January 2015.

Education and training

AMC accreditation

For the first time in a decade, the College hosted an Australian Medical Council (AMC) accreditation visit in the first week of September. A team of clinicians from various disciplines and a community representative interviewed committee chairs and key College House staff, supplementing the written information previously provided to the AMC team with respect to the College's performance against the AMC accreditation standards and the site-visits conducted in the last week of August. The College has received some early feedback that acknowledges many positives in

the College training programs, but also a number of suggestions with respect to areas for improvement. The College has already addressed many of these and others are in process. The final report is expected before the end of the year.

The Revised Training Program

The revised FRANZCOG Training Program is central to the College vision for our future Fellows and is now ready to be rolled out for Trainees commencing from December 2013. The quintessential feature is more formal structuring of Advanced Training (formerly Elective Training). As now, all Trainees will have to attain the core knowledge, skills and attributes that comprise a minimum of four years of Core Training (formerly the Integrated Training Program). However, in the revised training program, the last two years of training will consist of a series of selectives known as Advanced Training Modules (ATMs). The ATMs acknowledge that not all Trainees will leave the training program with the same scope of practice. However, all Trainees awarded the FRANZCOG will have a scope of practice that includes complex obstetrics and emergency gynaecology. The necessity of maintaining currency will require some ongoing experience in the core scope of practice while undertaking ATMs and/or any subspecialty training undertaken prior to Fellowship.

Other features of the revised training program include enhanced flexibility for Trainees with both fractional and shorter periods of training, the introduction of an academic stream to facilitate completion of a PhD within the Training Program and, also, measures to assist in the earlier identification of the Trainee that is perhaps unsuited to a career in obstetrics and gynaecology.

Special Interest Groups

The need to develop curricula for the ATMs has underpinned the establishment of Special Interest Groups (SIGs) within the College. The Reproductive & Sexual Health (R&SH) SIG will be chaired by Dr Kirsten Black and has terms of reference that extend to reviewing the Core Training component of the FRANZCOG Curriculum in the area of interest and advising the Women's Health Committee on matters pertaining to R&SH. SIGs to develop ATMs in both pelvic floor surgery and laparoscopic surgery will be established soon. It is hoped that the former will see collaboration with the Urogynaecological Society of Australasia (UGSA) and the latter with the Australasian Gynaecological Endoscopy and Surgery society (AGES), with whom discussions have begun.

eLearning and Climate

The Climate program has been in place now for over 12 months and has had good feedback from Trainees. eLearning is appropriately an increasing focus of College activity, with further opportunities to use this platform for continuing professional development (CPD) activities. The use of online modules for the provision of patient information is being explored and could be a valuable future resource for Fellows in consenting patients for various surgical procedures.

Online CPD

Online CPD is now with us and available to the Fellowship. While optional at present, all those commencing a CPD cycle from January 2014 will be enrolled in the online program. The new CPD program is not just about being available online and delivered in a web-based format. Alignment to the FRANZCOG Curriculum will mean there are now three domains in which Fellows obtain CPD points: clinical expertise, academic abilities and professional qualities. The latter category is new for CPD and will allow Fellows to claim a broad range of activities in areas such as management, health leadership and advocacy.

ASM in Sydney

Many Fellows, Diplomates and Trainees enjoyed a highly successful RANZCOG 2013 Annual Scientific Meeting (ASM) in Sydney. Congratulations to A/Prof Jason Abbott, Dr Stephen Lyons and Ms Kylie Grose from College House on their outstanding leadership with the ASM. The next College ASM will be a combined meeting with the Royal College of Obstetricians and Gynaecologists in March 2015 in Brisbane. This will be a memorable College event and I encourage all Fellows, Diplomates and Trainees to attend.

Summary

Halfway through my term as President of RANZCOG, it is timely to reflect on the challenges ahead: issues arising from the AMC report to be addressed, the new CPD program and implementation of the revised FRANZCOG Training Program with development of the ATMs. All this and very much more requires an effective College staff and a massive pro bono contribution from an engaged membership. I look forward an increasing number of the Fellows, Diplomates and Trainees becoming involved in College activities.

From the CEO

James McAdam
CEO

Being asked to write your first article for *O&G Magazine* within two days of assuming the CEO's position is a somewhat daunting task. I am cognisant of the fact that, for now, I sit in the shade of the substantial shadow cast by my predecessor, who has quite rightly been described in glowing terms for the effective role he played as your CEO over the last eight years. It is my hope that I will see further by standing on the shoulders of giants.

I thought this article would be best served by providing members with an understanding of my background and also some of my views on the important role the specialist medical colleges play. It would be presumptuous on my part to even consider providing any advice or vision after such a short tenure, but perhaps my view on the colleges will provide some hint as to the role I think the staff can play in providing all RANZCOG members with as good an experience of their College as possible.

If ten years ago you had suggested I would be the CEO of a specialist medical college, I would have been more than a little surprised.

A qualified teacher by background, I was lured away from teaching before I ever stood in front of a classroom by Dr Michael Wooldridge. Thus began a more than ten-year odyssey as a political staffer in Melbourne, Canberra and Adelaide. I have worked as both an adviser to politicians as well as a senior campaign strategist. For a time, I was even a political pollster.

My journey in politics ended in South Australia, where I served as Chief of Staff to Dr Michael Armitage (who now heads Private Healthcare Australia, the peak body for private health insurers).

Dr Armitage was, among many responsibilities, the Minister for the Information Economy so it was a relatively painless transition from the world of politics into that of lobbyist for the information and communications technology (ICT) industry.

ICT does not seem a natural precursor to education and healthcare, but after five years developing industry policy and strategy for the ICT industry I was offered the position of Director, Relationships & Advocacy at the Royal Australasian College of Surgeons (RACS).

At RACS I had a broad remit covering governance, the regions, workforce, human resources and payroll, the Foundation for Surgery and the RACS' Skills and Education Centre. However, the area where I felt I had the most to give – given my background – was in advocacy, media and communications.

My six years at RACS has, I believe, prepared me well to serve as your next CEO. I have had broad coverage across many aspects of a specialist medical college's business and bring with me many

of the skills I have acquired. I also believe I have much to add in raising the profile of RANZCOG as an advocate for the concerns of Fellows and for women's health more broadly.

I have also learned a great deal about the essential role of the specialist medical college to our health system and our community, and come to the realisation that I would like to continue my career making my own contribution to these important activities.

> 'The College needs to be responsive to your needs and to advocate on your behalf to governments and regulatory authorities in both countries.'

The specialist medical colleges demonstrate the true meaning of professionalism – the right to govern your own affairs and to set the standards and ethical behaviour that you see fit for your profession. Against the face of what I think will be greater and greater intrusion by government regulators, the colleges and their membership must hold onto this important right, as it is the bulwark against the diminishing standards that political expediency will ultimately demand.

I have also come to understand and respect the pro bono contribution made by Fellows of the College – not just to the College itself, but to the health sector more broadly. Without this valuable contribution, the next generation of obstetricians and gynaecologists would not receive the world-class training of their predecessors and Australian and New Zealand women would be the poorer for it.

Additionally, the College serves an important role providing fellowship and collegiality as well as a raft of important services, not the least of which is continuing professional development.

While this may surprise some, I hope you hear less of me in *O&G Magazine* rather than more. I have a strong view that the College exists for its Fellows. The role of the staff is to ensure that the strategy determined by the Board is enacted and to provide a high level of service to the membership. To that extent, the staff should be relatively low profile. Highly visible in terms of service delivery, but otherwise doing our best to ensure you can get on with your important role as a medical practitioner as seamlessly as possible.

I would like to ensure that the College is available and engaged with its members, wherever you may practice. The College needs to be responsive to your needs and to advocate on your behalf to governments and regulatory authorities in both countries.

Engaging with the College should be quick and simple. We need to continue to make best use of our online presence, but look at ways to expand this to put access to the services and information you require at your fingertips. And we need to always look to provide new services that deliver ever-greater value for your subscription dollar.

I am looking forward to the challenges ahead. It is a great privilege to have been appointed as your CEO. I look forward to meeting and working with you into the future.

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Editorial

A/Prof Stephen Robson
FRANZCOG

On lonely journeys I think of it all,
Birth of death, exhumation for burial.
A wreath of small clothes, a memorial pram,
And parents reaching for a phantom limb.
– Seamus Heaney, Elegy for a Stillborn Child

The unexpected death of a baby during the latter part of pregnancy is a devastating event for a couple. Pregnancy is usually a time of joy and expectation, and such a loss can have prolonged emotional consequences. In her book, The Anatomy of Bereavement, psychiatrist Prof Beverley Raphael tells us that death of a child is the most painful of all bereavements.[1] Anybody involved in the diagnosis and management of stillbirth can attest to that sentiment.

During the period of grief and adjustment after stillbirth, most couples seek an explanation for the death of their baby and will then ask an important question: 'Will this happen again?' For the majority of couples, investigation will reveal a cause (or causes) for their loss and many of these causes will have reasonably well-defined risks of recurrence. For example, if the stillbirth resulted from placental abruption, the odds for a placental abruption in the next pregnancy are almost 17 times greater.[2] By contrast, if the stillbirth resulted from a viral infection, the risk of the next pregnancy being lost is no greater than for any other woman. Unfortunately, for as many as one couple in five, no cause will be found for the death of their baby.

According to Cote-Arsenault and colleagues[3]:

> 'Women who have experienced a previous pregnancy loss have omnipresent worry and anxiety during a subsequent pregnancy, and seek reassurance that this pregnancy and baby are okay. …frequent calls and visits to healthcare providers for this now represent the most frequent and comforting way of coping with these worries.'

I spent several years undertaking studies with women who had endured stillbirth and almost always heard the same agonising stories:

> 'We planned to place a birth notice in the paper, not an obituary. We were to be receiving congratulations cards, not sympathy cards. We were to be awake at night feeding our baby, not comforting each other after hours of sobbing. We were to be pushing our baby in a stroller and swing, not removing them from our home and storing them elsewhere. We will continue to move forward knowing that we will never 'get over' what has happened, but we will 'get through' it. I thank you for taking the time to listen to my story.' (Study participant, 2006)

In this summer issue of *O&G Magazine*, we embark on a journey through the painful world of stillbirth. We have gathered authors from across Australia and New Zealand, individuals and groups who are making it their business to reduce the burden of stillbirth. The articles examine the reasons for stillbirth and what measures we can employ to help reduce the risks of fetal loss. To our contributing authors we offer, as always, enormous thanks for sharing their expertise and experience.

The *O&G Magazine* editorial team look forward to hearing from our readership as you read these articles over the festive season. We wish all of you the best for a happy Christmas and a year full of hope.

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The stillbirth scandal

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The scope of stillbirth has been overlooked by many, in part, because there is a tendency to have a fatalistic view: if a baby dies before birth 'it was God's will'.

Few would estimate that, in high-income countries, late stillbirths (pregnancies 28 weeks or later) occur twice as often as death owing to HIV/AIDS; are ten times more common than deaths owing to Hepatitis B; twice as common as deaths owing to congenital anomalies; twice as common as deaths owing to preterm complications and ten times more common than sudden infant death syndrome (SIDS).[1] The above conditions are not unfamiliar to the obstetric provider who spends considerable time and resources to review benefits of screening for HIV and hepatitis B, and to offer an ever-expanding menu of options for screening for inherited conditions, congenital anomalies and chromosomal abnormalities. However, all of these conditions occur less commonly than late stillbirth. Rarely is the risk of late stillbirth discussed and, until recently, there were few references to stillbirth in the lay press.

It is not unexpected that the unfortunate members of the 'stillbirth club' have begun to demand answers to the question why did their baby die and have looked to other bereaved parent groups. More than 30 years ago, sudden infant death syndrome (SIDS) parents pressed researchers to find answers and, as a result, resources were procured and researchers began the study of SIDS, including a complete death scene analysis, comprehensive history and complete autopsy. From this research, multiple modifiable risk factors for SIDS have been identified (prone sleeping, smoking and co-sleeping, among others). Since 1994, with parental education, there has been more than a 60 per cent decline SIDS deaths.[2]

Thirty years later, we are starting to unravel the puzzle pieces of stillbirth and research has led to some important observations that help reveal some of the potential causes of stillbirth and some previously under-appreciated risk factors for stillbirth. Currently, in high-income countries, the chance after a woman reaches 20 weeks of gestation that her pregnancy might end in a stillbirth is 1/160.[3,4]

For mothers and families there are many downstream consequences of stillbirth, the most significant and long-lasting being experienced by mothers. Women who experience stillbirth are at an increased risk of multiple maladies including depression, anxiety and post-traumatic stress disorder, somatisation disorder and family disorganisation.[5]

Trends in stillbirth rates

The study of trends in the reduction of stillbirth can be seen in historical cohorts and among developing countries. These studies identify factors that affect stillbirth rates and are therefore most amenable to change. Vallgarda reviewed stillbirths in Denmark from 1938 to 1947 (defined as fetal death after 32 weeks gestation) and found that during this time period, stillbirths were reduced from 24.9 to 16.3 per 1000 births (a 35 per cent reduction). This correlated with a reduction in the numbers of women having births at home (reduced from 50 per cent of births to 35 per cent of births).[7] In addition, in 1945, Denmark introduced a law that provided free antepartum care, which was widely used by women (70 per cent of women initially attended prenatal care and by the 1960s this had risen to almost 100 per cent).[7] In developing countries, the addition of trained birth attendants, the availability of antibiotics and to timely access to caesarean section has greatly reduced the risk of intrapartum fetal deaths.[8] In developed countries, the types of stillbirths most noted to have decreased have occurred where there have been specific strategies implemented to reduce risk. As a result, fetal deaths related to asphyxia in labour, Rhesus disease, congenital malformations and disease of the mother have been reduced.[9] Currently, the most common types of late fetal death are related to diseases of the placenta (causing fetal growth restriction and, more acutely, placental abruption) and some cord accidents, but unfortunately a large proportion are unexplained even after a thorough evaluation.[10,11]

The stillbirth evaluation

Without a thorough and thoughtful analysis of each stillbirth, the counselling of the stillbirth patient and her family on the recurrence risk will be sadly inadequate. Until recently there has been little evidence on the utility of the multitude of potential tests that can be ordered in an attempt to determine the cause of death. Thankfully, there is good evolving evidence that has highlighted the key components of the stillbirth evaluation: review of the patient's obstetric, medical, social and family history; before delivery, an invasive cytogenetic analysis (amino of chorionic villous biopsy); blood test for fetal-maternal haemorrhage; and serum for selective analysis given the fetal and maternal history.[12] Kortweweg et al, in an evaluation of 1025 fetal deaths, found the most valuable tests for the determination of the cause of death include a pathological evaluation of the placenta (96 per cent), of the baby (73 per cent), and a cytogenetic evaluation (29 per cent).[12] Unfortunately, in spite of the evidence, less than half of women in developed countries are offered or accept an autopsy. This may be due to lack of knowledge, resources or the awareness of cultural traditions surrounding death.

Definition

The terms fetal death, fetal demise, stillbirth and stillborn all refer to the delivery of a fetus showing no signs of life. In the lay press most parents prefer the term stillbirth. The World Health Organisation (WHO) defines stillbirth as a 'fetal death late in pregnancy' and allows each country to define the gestational age at which a fetal death is considered a stillbirth for reporting purposes.[1] The gestational age that divides what is considered a miscarriage from a stillbirth is often legally defined within a country, and may or may not include terminations of pregnancy related to congenital anomalies or spontaneous preterm losses that are induced to reduce the risk of sepsis to the mother.[6] In Australia and New Zealand, a stillbirth is defined as a fetal demise after 20 completed weeks of gestation and if the gestational age is not known, a fetus that weighs 400g or greater.[4]

Somehow we have failed to make the case for the value of even a partial autopsy and finding some potential closure for the parents the as well as estimating recurrence risk of stillbirth.

The study of stillbirth reduces stillbirths

Perinatal audit is the key to identifying potentially modifiable factors that contribute to stillbirth: a higher than expected intrapartum deaths should trigger a review of labour and delivery procedures; a higher than expected number of losses of multiples should trigger a review of advanced reproductive technologies services.[13] The reduction of the number of multiple pregnancies by opting for single embryo transfer has been shown to significantly reduce perinatal mortality. Smoking has a direct effect on a number of important pregnancy outcomes, including placental abruption and fetal growth restriction (especially for older women), as well as a reduction of stillbirth. The opportunity to specifically address smoking cessation should not be missed.[13]

Stillbirth prevention strategies in developed countries share some similarities to those in developing countries, for example, ensuring that poor and less-educated women have access to contraception and timely access to good prenatal care. The most demonstrable effect of early prenatal care is the accurate dating of the pregnancy, screening for infection and the prenatal screening for chromosomal and congenital anomalies. In a setting where there is the availability of abortion for affected pregnancies, the number of stillbirths related to anomalies can be reduced significantly.[6]

Suboptimal care has been shown to occur in 10–60 per cent of stillbirths in developed countries. The most common errors are failure to identify emerging clinical disorders (such as fetal growth restriction), failure to use updated best-practice protocols and poor communication or non-compliance of the members of the team (including those responsible to follow-up with patients when appointments are missed). There are maternal behavioural factors that represent suboptimal 'self-care' such as smoking, excessive weight gain or alcohol and drug abuse. Among ten European countries, approximately ten per cent of stillbirths were attributed to smoking resulting in fetal growth restriction, abruption or both.[14,15]

In general, in settings where access to care is good and the medical conditions of hypertension and diabetes are well managed with close follow-up, stillbirth rates can be minimised to that just above the 'normal population' although rates of preterm delivery are also typically elevated as a result.[16]

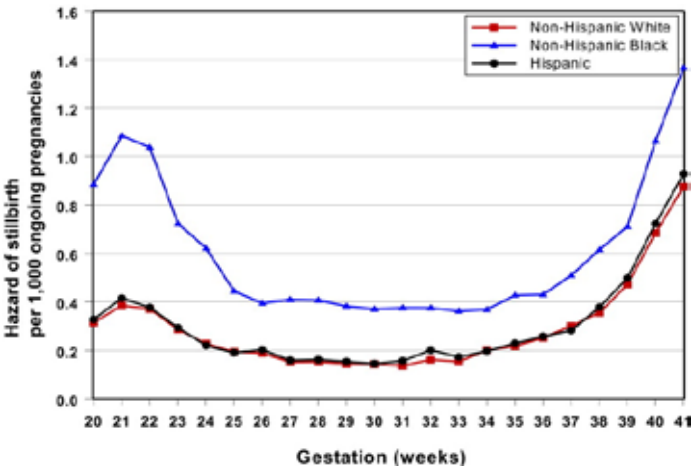

Figure 1. The hazard risk of stillbirth in singleton gestations without congenital anomalies throughout gestation stratified by maternal race from Willinger et al.[21]

What we have not fully grappled with is a 'comprehensive risk assessment' that includes assessing the risk of stillbirth in women who have not traditionally been treated as high risk and how to manage the risk versus benefit of increased late surveillance and its downstream consequences.

Common and under-appreciated risk factors for stillbirth

In a comprehensive review of risk factors for stillbirth in high-income countries, Flenady et al found, globally, the potentially modifiable risk factors of obesity (BMI of 25kg/m^2), advanced maternal age (35 years or greater) and smoking contribute to an estimated 15 000 stillbirths annually.[17] Clearly obesity is becoming an increasing issue with an estimated 30–40 per cent of women starting pregnancy in the 'obese' range, and is associated with multiple adverse outcomes including stillbirth. The mechanism for this increased risk is unknown, but there is a clear 'dose response' with the heaviest women having the highest risk of stillbirth with the risk increasing late in pregnancy.[19] In a Large Danish cohort, the hazard-ratio between 28 and 36 weeks of gestation for women with a pre-pregnancy BMI of 40kg/m^2 or greater was 2.1 above their normally weighing cohort, but at 40 weeks this risk increased to 4.6.

Racial/minority disparities on average can increase the risk of stillbirth two-fold, the reasons for which are clearly multifactorial. Inequities in education, access to care, late registration, socioeconomic status, stress, underlying health status and health habits have all been implicated in the increased risk. In a large US study, black women were found to have a higher rate of medical, pregnancy and labour-related complications, with risk higher both early in gestation (20–24 weeks) and late in pregnancy (39 weeks+).[21] Despite the increased risk experienced by black women late in pregnancy, they are 30 per cent less likely to undergo an induction of labour compared to their white counterparts (see Figure 1). This suggests providers are unaware of this risk difference, have a differential practice pattern for minority women or as providers we have failed to make the case to black women that there is enough risk late in pregnancy to warrant induction.

Both maternal age and parity are significant risk factors in the rates of late pregnancy loss. In a large US study by Reddy et al, they found the most notable difference between younger and older women occurred after 38 weeks gestation (see Figure 2).[23] At 39 weeks, the risk of stillbirth for women 40 years of age or older was the equivalent to that of younger women (less than 34 years of age) who reached 41 weeks of gestation. This effect was modified by primiparity, with the risk of a stillbirth after 37 weeks of pregnancy with multiparous women young than 35 having the lowest risk 1.29/1000 per ongoing pregnancies, whereas the risk for a primiparous women 40 years of age or older was 8.65/1000 ongoing pregnancies (a 6.7 fold difference) (see Table 1).

Table 1. Management and perception of risk.

Maternal Age at Delivery	Risk of Trisomy 21	Risk of Any Chromosomal abnormality	Risk of Stillbirth after 37 weeks Multipara	**Risk of Stillbirth after 37 weeks Primipara**
20	1/1667	1/526	1/775*	**1/269***
30	1/952	1/385	1/775*	**1/269***
35-39	1/378	1/192	1/502	**1/156**
40+	1/106	1/66	1/304	**1/116**

Hook EB. JAMA 1983;249 and Hook EB. Obstet Gynecol 1981, and adapted from Reddy et al 2006 Am J Obstet Gynecol
*data only given for those less than 35.

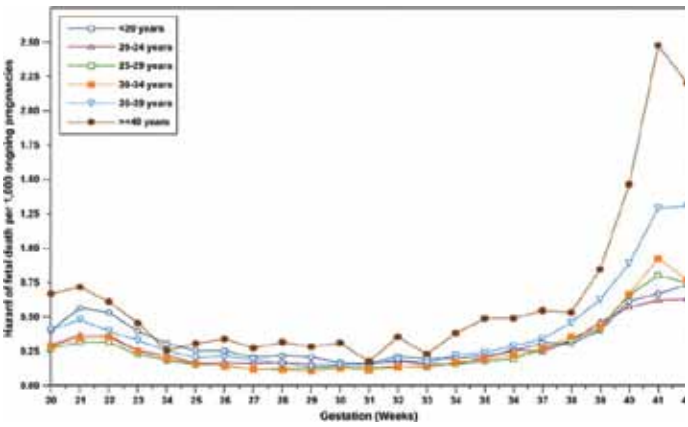

Figure 2. The hazard risk of stillbirth throughout without congenital anomalies gestation stratified by maternal age from Reddy et al.[23]

Evolving research

By focusing some light on the problem of stillbirth, there has evolved a number of new and potentially helpful observations. The appreciation that advanced maternal age, racial minority (specifically, within the USA, non-Hispanic black status) and severe obesity all are associated with an increased risk of stillbirth after 39 weeks gestation, providers have the opportunity to either increase fetal surveillance or offer induction, thus treating these women as post-dates sooner than their low-risk peers.

In a large 'before and after design' study of instituting a 'standard work flow' for the management of pregnancies presenting with the complaint of decreased fetal movement (DFM) was associated with a 30 per cent reduction in the overall stillbirth.[24] The presentation of DFM movement should not merely be managed with a non-stress test and 'out-the-door' mentality, but an appreciation that DFM is associated with a less-than-optimal outcome on approximately 26 per cent of pregnancies, (with unsuspected growth restriction being the most common finding at evaluation).[25] By instituting a comprehensive review of the presenting complaint, assess possible maternal or fetal risk factors (including fetal growth) we will not miss a potentially important message that the mother and baby are trying to make.

Other interesting recent observations that may modify stillbirth risk are that the habit of left-lying during sleep may reduce the risk of late pregnancy loss[26]; significant maternal stress has been associated with an increased risk of stillbirth[27]; and the evolution of genetic testing to include the evaluation of microarrays (which detect a single-nucleotide polymorphism or duplications or deletions of 500kb or greater) is more sensitive than standard karyotype to a detect potential cause of stillbirth.[28]

Hopefully, with ongoing research, we will develop a greater understanding of the elephant in the room and fewer parents will end up in the 'stillbirth club'.

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Prevention is cure

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Fetal surveillance and timing of delivery in the prevention of stillbirth.

Stillbirth is a global human tragedy, with approximately three million stillbirths occurring each year.[1] While the majority of these occur in the developing world[2], even in Australia, one in 130 families will experience the devastating outcome of stillbirth (defined as death before or during birth after 20 weeks gestation or ≥400 grams). Of further concern, rates of stillbirth in Australia have remained constant, at approximately 7.4/1000, for over a decade. Late stillbirths are generally defined as those occurring after 28 weeks. The risk of late stillbirth has also remained constant, at approximately 2.9/1000 in Australia and 3.5/1000 in New Zealand.[3] Most stillbirths in the developed world occur in the antenatal period and leading contributors include fetal growth restriction, fetal infection, structural or genetic abnormality and maternal medical disease (see Box 1).

A significant proportion of stillbirths are classified as 'unexplained', meaning that there is no obvious fetal, placental, maternal or obstetric aetiology, which compounds the frustration and despair felt by families and those caring for them. Important inroads are being made into reducing the number of stillbirths classified as 'unexplained' with improvements in investigation, classification and reporting using guidelines such as the Perinatal Society of Australia and New Zealand (PSANZ) Clinical Practice Guideline for Perinatal Mortality (Version 2.2).[5]

Box 1. Causes of stillbirth using the PSANZ classification of perinatal death[4]

1. Congenital abnormality, including structural, chromosomal, genetic
2. Perinatal infection, including
   - Bacterial, particularly group B streptococcus, E. coli, listeria, spirochaetal
   - Viral, particularly parvovirus, CMV, HSV, rubella
   - Protozoal, particularly toxoplasmosis
3. Hypertension in pregnancy
4. Antepartum haemorrhage, most commonly placental abruption
5. Maternal conditions, other than hypertension, most commonly:
   - Diabetes
   - SLE
   - Obstetric cholestasis
   - Trauma
6. Specific perinatal conditions, including:
   - Fetomaternal haemorrhage
   - Antepartum cord accidents
   - Twin to twin transfusion syndrome
7. Hypoxic peripartum death, including:
   - Intrapartum complications (uterine rupture, cord prolapse, shoulder dystocia), non-reassuring fetal status
8. Fetal growth restriction
9. Spontaneous preterm
10. Unexplained antepartum death
11. No obstetric antecedent

Reducing the risk of stillbirth

Interventions to reduce the global burden of stillbirth have been identified (see Box 2). While many of these interventions are specific to low-income settings, some are equally applicable to high-income settings, where the prevalence of other risk factors is increasing, such as obesity, primiparity, maternal age >35 years and multiple gestation. In such settings, pre-pregnancy weight reduction in obese women, avoidance of delaying childbearing, reducing the risk of iatrogenic multiple pregnancy, smoking cessation and optimising underlying maternal medical conditions should be encouraged. In addition, improved detection and management of fetal growth restriction should be prioritised, which is the focus of this article.

Fetal growth restriction and stillbirth

Fetal growth restriction (FGR) is a leading contributor to stillbirth, with the rate of stillbirth in pregnancies complicated by FGR at least four-times higher than in pregnancies with normal growth.[7,8] Importantly, antenatal detection of FGR is associated with a reduction in the risk of stillbirth.[7,9] In a cohort of over 92 000 pregnancies, Gardosi et al reported an overall stillbirth rate of 4.2 per 1000, but only 2.4 in pregnancies without FGR. In pregnancies with antentally detected FGR, the stillbirth rate was 9.7 per 1000, increasing to 19.8 per 1000 when it was not detected.[7] Detection and management of FGR thus remains one of the leading priorities in the prevention of stillbirth.

Clinical detection of fetal growth and wellbeing

Assessing fetal size

One of the goals of routine antenatal care is identifying poor fetal growth. Abnormal serum analytes from first and second trimester aneuploidy screening, such as low PAPP-A (<0.4 multiple of the median [MoM]), are associated with an increased risk of both FGR and stillbirth, but while they indicate pregnancies that warrant closer surveillance in late pregnancy, their sensitivity and positive predictive value for FGR is low. Clinical detection of fetal size is the mainstay of surveillance for FGR.

Fetal size is most commonly assessed with measurement of the symphysiofundal height (SFH). While SFH measurement reduces inter-observer variability compared to palpation alone, it still only has a sensitivity of 17 per cent and positive predictive value of 20 per cent for the detection of term FGR.[10] In addition, the accuracy of SFH may be further compromised in late pregnancy, where the head descends into the pelvis, and in obese women. In an attempt to overcome some of these difficulties, customised fundal height charts have been created, where an optimised fundal height curve is generated, taking into account maternal characteristics. The introduction of customised SFH charts appears to improve detection of FGR.[11,12]

Assessing fetal wellbeing

Fetal hypoxia as a result of placental insufficiency results in a reduction in non-essential fetal activity and, so, maternal perception of fetal movement is a simple method for monitoring fetal wellbeing. All pregnant women should be advised at each antenatal visit to monitor fetal movements. A report of decreased fetal movements should be investigated with attention to the presence of risk factors for stillbirth, such as FGR, hypertension, diabetes or advanced maternal age; performance of a CTG for fetal wellbeing; and assessment of fetal growth (by abdominal palpation and/or ultrasound). A comprehensive guideline for the management of decreased fetal movements has been developed by the Australian and New Zealand Stillbirth Alliance that provides useful recommendations to assist patients and practitioners.[13]

Ultrasound detection of fetal growth restriction

Although routine growth scanning has not been shown to be of value in low-risk pregnancies, late pregnancy ultrasound has superior sensitivity for detection of both FGR and macrosomia compared to SFH measurement.[14] Standard biometric measures are used in a multiparameter regression equation to derive an estimated fetal weight (EFW) and fetal weight centile for gestational age. The reported centile will depend on which chart is used as the reference range. Traditionally, population or livebirth charts, such as Roberts and Lancaster[15], have been used to generate a weight centile, but the limitations of population charts need to be recognised. At preterm gestation, the use of livebirth charts will result in comparing the growth of in utero fetuses to those who have had an indicated, or spontaneous, preterm birth. The risk factors for both spontaneous and indicated preterm birth are associated with important fetal growth decrements (for example, pre-eclampsia and placental abruption) so population charts will always be 'left skewed' at preterm gestation, resulting in an under-diagnosis of FGR (EFW<10th centile) and an over-diagnosis of macrosomia (EFW >90th centile).

For this reason, intrauterine growth charts should be used, so that fetal size is being compared to a 'like' population of ongoing healthy pregnancies. A further refinement in the use of an intrauterine growth chart is the generation of a customised fetal weight, where the fetal centile is individualised for maternal characteristics, such as height, weight, ethnicity, parity and fetal gender. Customisation is associated with improved detection of FGR and a significant proportion of unexplained stillbirths are found to be growth restricted when customised charts are used.[5] Nevertheless, much of this improved sensitivity can be attributed to the use of an intrauterine growth curve alone, with a more modest contribution from the adjustment for maternal characteristics.

Box 2. The top-ten interventions strongly recommended to reduce the global burden of stillbirth[6]

- Periconceptual folic acid supplementation
- Prevention of malaria
- Detection and treatment of syphilis
- Detection and management of the hypertensive disorders of pregnancy
- Detection and management of diabetes in pregnancy
- Detection and management of fetal growth restriction
- Routine induction to prevent post-term pregnancies (≥41 weeks)
- Skilled birth attendant
- Availability of basic emergency obstetric care
- Availability of comprehensive emergency obstetric care

When a fetus is confirmed to be small, structural, genetic and infective causes should be considered, although the majority of FGR will be 'deprivational' in origin, owing to placental insufficiency.

Management of early-onset (<34 weeks) FGR

In the absence of any clearly effective therapy, the mainstay of management following the diagnosis of FGR is close surveillance and timely delivery. In early-onset FGR owing to placental insufficiency, the risks of prematurity need to be weighed against the risks of antenatal hypoxia, acidosis, asphyxial injury and stillbirth. For this reason, once FGR is diagnosed, increased fetal surveillance is required. Integrated fetal testing, involving cardiotocography (CTG), biophysical profile score and arterial and venous fetal Doppler studies, allows the most accurate assessment of fetal wellbeing. Doppler studies of the umbilical artery (UA), middle cerebral artery (MCA) and ductus venosus (DV) have been demonstrated to improve perinatal outcome in high-risk pregnancies, both decreasing obstetric intervention and reducing the risk of perinatal death.[16]

In the setting of hypoxia owing to placental insufficiency, the fetus undergoes a sequence of adaptive behaviours to compensate for reduced oxygen supply.[17] Increased resistance to umbilical artery blood flow reflects increasing resistance in the placental bed and is reported as an increased systolic to diastolic (S/D) ratio and/or increased pulsatility index (PI), followed by absent and ultimately reversed end diastolic flow (see Figure 1). Blood is preferentially redistributed toward the fetal brain in an attempt to maintain cerebral oxygenation and maximise survival.[18] Dilatation of the fetal cerebral vessels results in an increase in blood flow during diastole and a fall in the MCA-PI (see Figure 2). The lower the MCA-PI, the greater the hypoxia. Amniotic fluid volume decreases when fetal cardiac output is diverted away from the kidneys. Following this, changes in the fetal venous system occur, with a reduced 'a wave in the DV (see Figure 3). A pulsatile umbilical vein is a preterminal sign.

Early-onset FGR follows a fairly predictable sequence in response to placental insufficiency (as described above) from the arterial to venous circulations, before biophysical abnormalities occur.[19] At extremely preterm gestation, advancing gestation is crucial. While the GRIT study found no difference in short- or long-term outcomes according to immediate or deferred delivery for severe preterm FGR[20,21], the search for the best ultrasound parameter to use as the final trigger for delivery continues. The TRUFFLE trial randomised 503 women with severe early-onset FGR to delivery according to the results of ductus venosus waveform analysis, or CTG short-term variability monitoring. While the final outcome (infant development at the age of two years) is still pending, preliminary data on the cohort has been published, confirming 92 per cent survival and 70 per cent survival without major morbidity. These outcomes are better than that reported in similar historical cohorts, which suggests outcomes in severe early-onset FGR are optimised when there is a standardised management strategy until 32 weeks.[22]

Management of late-onset (>34 weeks) FGR

In late-onset FGR, the ultrasound features supporting a diagnosis of placental insufficiency seen at earlier gestation – in particular an abnormal umbilical artery Doppler – are generally absent. Deviations in growth trajectory picked up clinically (with slowing fundal height) may not be detected with ultrasound unless serial assessment of growth has been performed, as is recommended in high-risk pregnancies. This makes the diagnosis of late-onset FGR challenging. In addition, 96 per cent of all births occur after

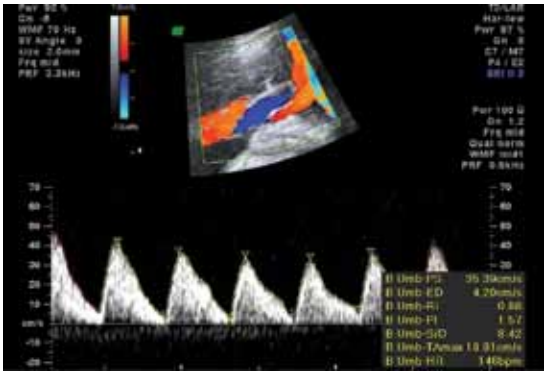

Figure 1. Elevated umbilical artery pulsatility index.

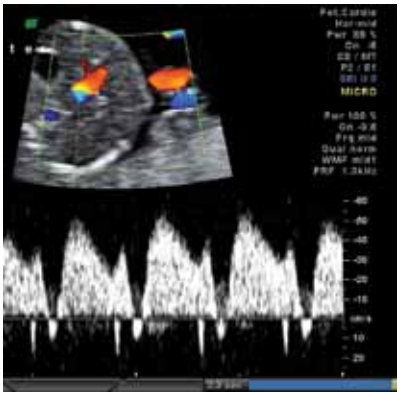

Figure 3. Reversed 'a' wave in the ductus venosus.

34 weeks, meaning the burden of FGR in absolute numbers is greatest in the late preterm/term period, with the risk of stillbirth becoming less tolerable as gestation advances and the perinatal risks of prematurity recede.

Fetal doppler may still be useful for surveillance in late-onset FGR, where, among SGA fetuses, centralisation of circulation (evidenced by a low MCA-PI and falling cerebroplacental ratio) is associated with an increased risk of caesarean section, caesarean delivery for fetal compromise and neonatal acidosis.[23] In practical terms, fetuses with late-onset FGR should be under close surveillance. In the face of severe FGR (<3rd centile), abnormal uterine artery dopplers or evidence of adaptive fetal behaviours (reducing amniotic fluid, increased cerebral blood flow), delivery should be expedited. In less severe cases, expectant management with close surveillance may be reasonable, although the DIGITAT trial has provided useful evidence that a policy of induction for suspected FGR beyond 36 weeks is not associated with an increase in caesarean section, operative delivery or adverse neonatal outcome.[24] The DIGITAT trial did not confirm any reduction in stillbirth, but as it was inadequately powered to do so (with only approximately 320 patients in each arm) induction to minimise the risk of stillbirth remains a reasonable management strategy.

Induction of labour at term to prevent stillbirth

Induction of labour post-term (≥41 weeks) is recognised to be a useful intervention to reduce stillbirth.[6] Induction of labour at 41 weeks of gestation results in improved perinatal outcomes without increasing the caesarean section rate.[25] The National Institute for Health and Care Excellence (NICE) guideline recommends induction of labour from 41 weeks to prevent late stillbirth.[26] In ongoing pregnancies, fetal surveillance (with CTG and AFI) twice weekly after 41 weeks is recommended for post-dates surveillance, with delivery before 42 weeks. The presence of oligohydramnios

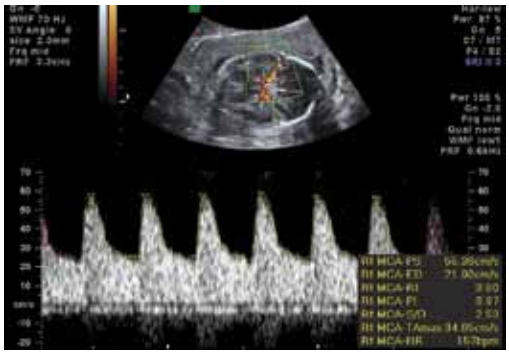

Figure 2. Centralised MCA doppler.

(AFI <5th centile), which may be associated with an increased risk of adverse outcome, should be a trigger for earlier delivery.[27]

More controversial is the place of 'routine' induction at 39 weeks to minimise the risk of late pregnancy stillbirth. In the last two years, there have been several studies which have suggested – contrary to widespread belief – a policy of liberal induction at 39 weeks does not increase the caesarean section rate.[28,29] Indeed, a recent meta-analysis including 31 trials determined that induction of labour was associated with a reduction in the risk of caesarean section (OR 0.83, 95 per cent CI 0.76–0.92)[30], with one large study also reporting a significant reduction in perinatal mortality.[29] Further study in this area is needed, but these data suggest that routine induction of labour may be able to reduce the risk of stillbirth, without an attendant increase in the risk of operative or caesarean birth.

Management of risk factors other than known FGR

Obesity

Obese women pose a significant challenge, given they are at a significantly increased risk of stillbirth[31], although the reasons for this are not completely understood. Given their high rates of co-morbidities, including hypertension and diabetes, and that FGR can be clinically difficult to detect, it is recommended that obese women have an ultrasound evaluation of fetal growth and well-being in late pregnancy.[32]

History of previous stillbirth

Women with a history of stillbirth have an increased risk of pre-eclampsia (OR 3.1, 95 per cent CI 1.7–5.7), placental abruption (OR 9.4, 95 per cent CI 4.5–19.7), fetal distress (OR 2.8, 95 per cent CI 1.7–4.5), extreme preterm birth (OR 4.2, 95 per cent CI 1.8–9.9), and a 12-fold increased risk of intrapartum stillbirth (95 per cent CI 4.5–33.7), as demonstrated in large retrospective studies.[33] Surveillance in the subsequent pregnancy will mostly be dictated by the underlying cause for the previous stillbirth. In women with a history of unexplained stillbirth, ultrasound surveillance of growth in late pregnancy is recommended and increased surveillance, using CTG and/or BPP is often commenced arbitrarily two weeks before the gestation at which the previous stillbirth occurred. Elective delivery is often undertaken by 39 weeks.

Advanced maternal age

Advanced maternal age is independently associated with an increased risk of stillbirth.[31,34] Women aged 40 years or older have a similar stillbirth risk at 39 weeks of gestation to 25–29 year olds at 41 weeks of gestation. In view of this, induction of labour at 39 weeks for women of advanced maternal age should be considered to reduce the risk of late pregnancy stillbirths.[35]

Conclusion

Stillbirth remains a challenge for all maternity care providers in 2013, with the rates of stillbirth remaining static for over a decade. Improved classification systems have reduced the number of unexplained stillbirths and interventions to reduce the global burden of stillbirth have been identified. In high-income countries, obesity, increasing maternal age, primiparity and multiple pregnancy are recognised as potentially modifiable risk factors for stillbirth. Detection of FGR is associated with important reductions in stillbirth rates, owing to the dual interventions of increased surveillance and timely delivery. In women with risk factors other than FGR, increased surveillance of fetal wellbeing in late pregnancy is recommended as well as timely induction at term.

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Looking for answers

The aetiology of stillbirth and neonatal death in New Zealand.

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Perinatal death, the death of a baby from 20 weeks gestation in utero through to the first 28 days of life, is a tragic event that is unfortunately far too common. The devastation associated with a perinatal loss cannot be overstated; firstly for the family, but also for the caregivers involved. Despite our best efforts, perinatal death occurs in around one in 100 babies born in New Zealand (NZ). This rate is comparable to other first-world countries, with rates of neonatal death slowly dropping over time with better neonatal interventions, while international rates of stillbirth seem to have remained static.

When the unthinkable happens, we strive for answers – why? All too often the answer seems to be 'I don't know'. In 2006, in acknowledgement of the lack of audit into perinatal and maternal mortality in NZ, the Perinatal and Maternal Mortality Review Committee (PMMRC) was created.[1] Their annual reports provide an in-depth analysis of known causes and associations with perinatal death in NZ. This valuable tool can highlight areas in need of further research or areas of care that can be improved, with the ultimate aim of reducing perinatal death.

NZ data are consistent with international data and show that the leading cause of perinatal death is congenital abnormality (see Figure 1).[2] This is followed closely by spontaneous preterm birth (accounting for 25 per cent of all neonatal deaths) and unexplained stillbirth (accounting for 28 per cent of all stillbirths). Two further primary causes are antepartum haemorrhage (15 per cent of all stillbirths and neonatal deaths) and fetal growth restriction (12 per cent of all stillbirths).

Perinatal death has strong demographic associations with extremes of maternal age (see Figure 2), Maori, Pacific and Indian ethnicity (see Figure 3) and low socioeconomic status (see Figure 4). Additionally, half of perinatal deaths occur among overweight and obese mothers (a quarter occur in women who are obese, BMI ≥30). Smoking and vaginal bleeding in pregnancy are each overrepresented among perinatal deaths (33 per cent and 31 per cent, respectively), against a background rate where

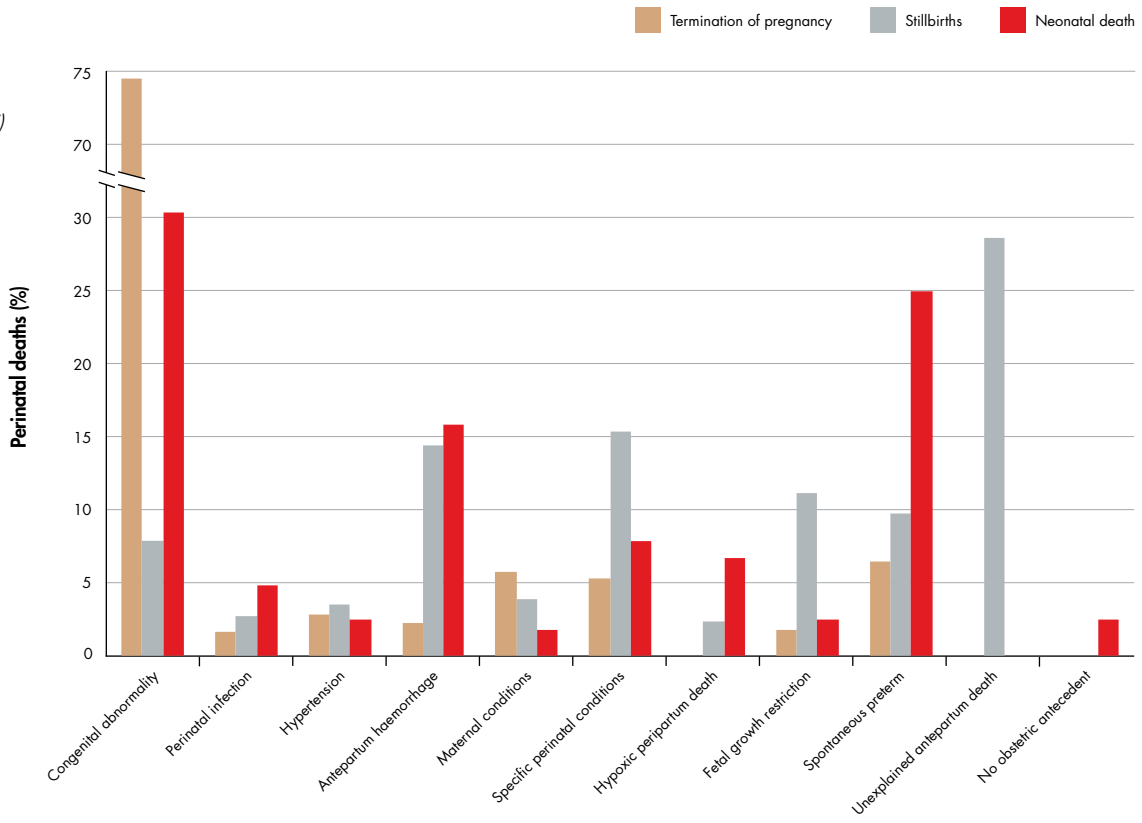


Figure 1. Relative distribution of fetal and neonatal deaths by perinatal death classification (PSANZ-PDC) 2011.[2]

approximately 15 per cent of all pregnant women smoke (although this varies substantially by ethnicity) and five per cent experience an antepartum haemorrhage (vaginal bleeding >20 weeks of pregnancy) during pregnancy.[2,3] Importantly, obesity, ethnicity, smoking and low socioeconomic status are strongly interrelated. NZ research suggests, in late stillbirth, obesity remains a significant risk factor even after accounting for other socio-demographic factors including ethnicity and socioeconomic status.[4]

Unfortunately, over a quarter of all stillbirths are still classified as unexplained.[2] This high rate can be partly explained by the low uptake of postmortem examinations; despite being offered to 90 per cent of families who experience a perinatal death, only 37 per cent agree to a postmortem and in approximately ten per cent of cases postmortem is not offered. The PMMRC have assessed postmortem usefulness and found that information gained from this investigation changed the clinical diagnosis and subsequent parental counselling in 24 per cent of assessed cases, highlighting the importance of postmortem in perinatal death assessment.

Excluding congenital abnormality, the most common antecedent in neonatal deaths is preterm birth: 46 per cent of all neonatal deaths occur among babies born <24 weeks gestation and 69 per cent among babies born at <28 weeks gestation (see Figure 2). Importantly, the highest rate of perinatal death due to preterm birth has been observed among women <20 years of age, highlighting again the high-risk nature of teenage pregnancies. Ongoing research into the aetiology and prevention of preterm birth is complex, but has the potential to substantially reduce perinatal mortality rates.

The association between young maternal age and perinatal death is likely confounded by high teenage smoking rates, where smoking is consistently associated with fetal growth restriction, preterm birth, placental abruption and perinatal death.[2,5,6] Additionally, smoking rates vary substantially by ethnicity: one-third of Maori women smoke during pregnancy compared with ten per cent of NZ European and one per cent of Asian women.[7] Smoking is one of the few modifiable risk factors for perinatal death.

Antepartum haemorrhage is the primary attributed cause of 15 per cent of neonatal deaths and stillbirths, but is reported in a quarter of stillbirths and over a third of neonatal deaths. When there has been vaginal bleeding after 20 weeks gestation, there is also an increased risk of both fetal growth restriction[3] and preterm labour.[8] These pregnancies should be considered high risk and monitored closely for signs of preterm labour as well as fetal growth and wellbeing.

An area where intervention has the potential to change stillbirth rates is antenatal identification of growth-restricted fetuses. In infants without congenital abnormalities, 40 per cent of singleton stillborn infants born after 24 weeks gestation are small for gestational age (SGA) defined as a birthweight <10th customised birthweight centile. However, less than a quarter of these SGA stillborn infants are identified antenatally. Antenatal detection and timely management and delivery of SGA fetuses has been shown to reduce perinatal morbidity and mortality.[9]

Recent NZ Maternal Fetal Medicine guidelines on the management of suspected SGA have recommended the use of customised antenatal growth charts to aid in antenatal detection of SGA pregnancies.[10] Customised birthweight centiles that account for maternal characteristics (such as height, weight and ethnicity) have been shown to better identify babies that are at increased risk of perinatal morbidity and mortality compared with standard population birthweight charts.[11,12] The implementation of antenatal customised growth charts in Adelaide, South Australia, led to a 50 per cent increase in antenatal detection of SGA pregnancies among low-risk nulliparous women (from 25 per cent to 50 per cent).[13] Recent data from the UK have shown in the regions with widespread use of antenatal customised growth charts, there has

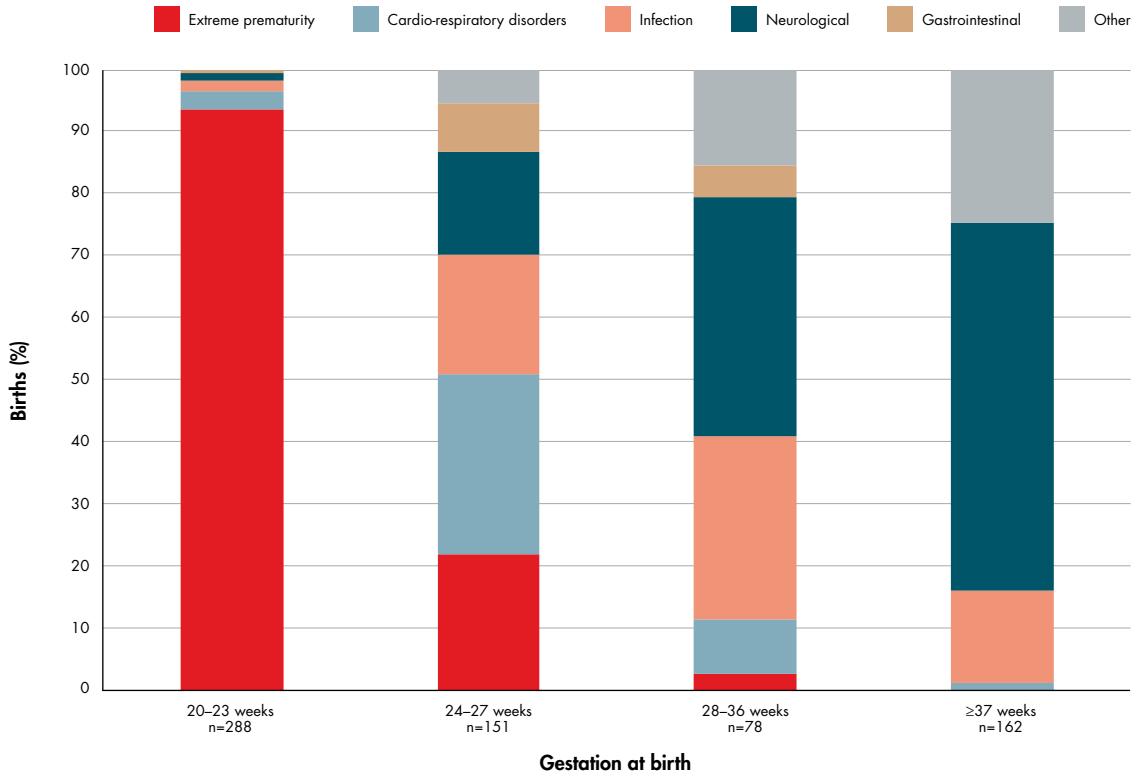


Figure 2. Distribution of neonatal death classification (PSANZ-NDC) among neonatal deaths without lethal congenital abnormality by gestational age group 2007–11.[2]

Figure 3. Perinatal related death rates (per 1000 births) by maternal age (with 95 per cent CIs) 2007–11.[2]

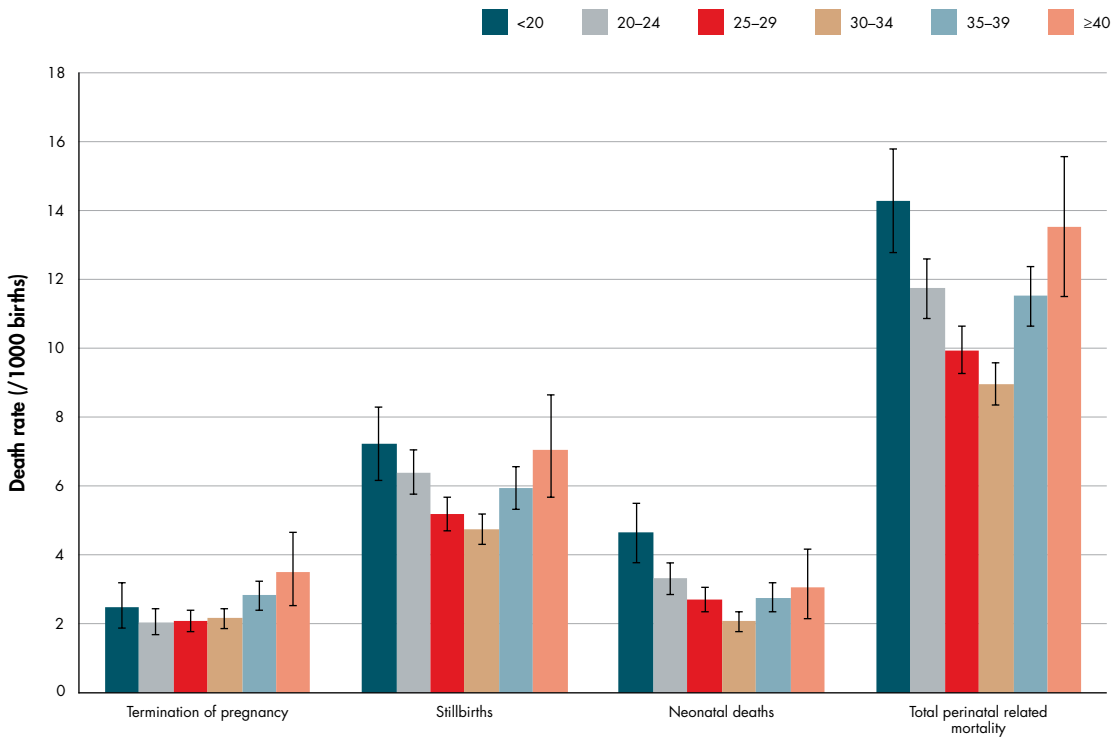
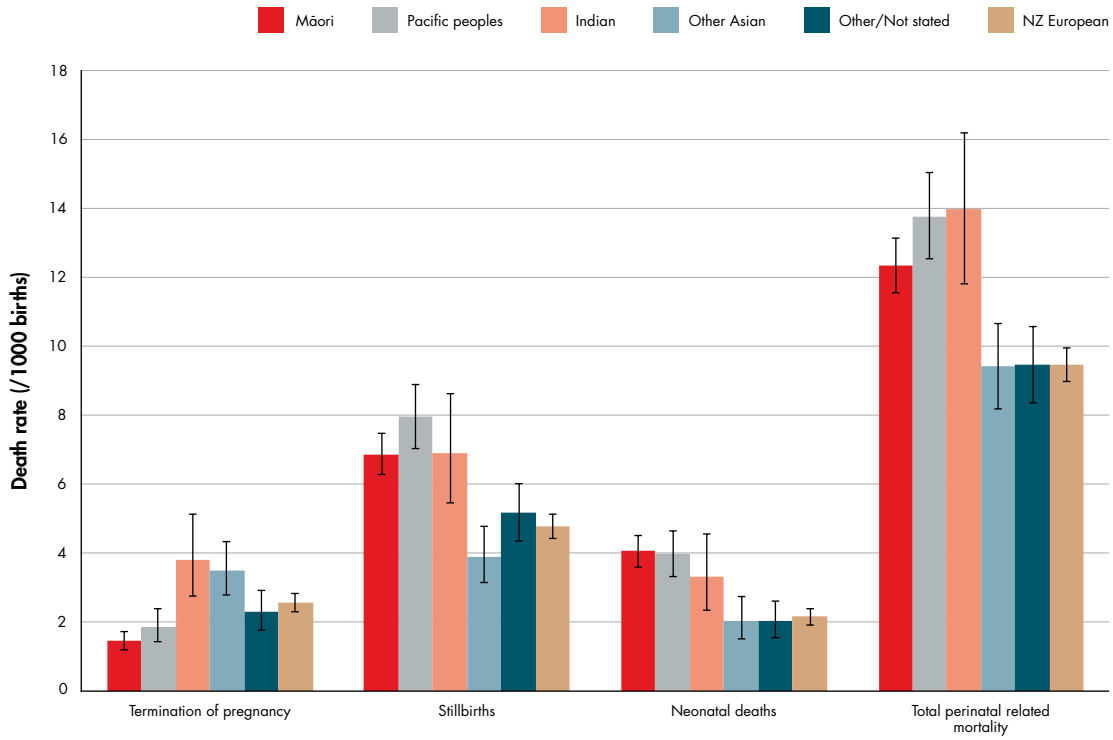


Figure 4. Perinatal related death rates (per 1000 births) by maternal ethnicity (prioritised) (with 95 per cent CIs) 2007–11.[2]



been an increase in antenatal detection of SGA infants from 28 per cent to 33 per cent and there has been a significant reduction in SGA stillbirths.[14] This trend has not been observed in areas that do not routinely use customised antenatal growth charts (see Figure 6). These observational data suggest that use of customised antenatal growth charts may be of benefit, but data from randomised controlled trials are required to confirm this.

Reasons for the association between obesity and stillbirth are unclear. It has been observed that obesity has an association with SGA as well as LGA infants when using customised birthweight centiles.[3,15,16] This is a clinical challenge as SGA is more difficult to detect among obese women.[17] Other associations suggested for higher stillbirth rates among obese women include possible reduced perception of fetal movements. Maternal perception of reduced fetal movements in late pregnancy is associated with an increased risk of stillbirth and obese mothers may be less able to assess movements due to increased abdominal girth.[18]

Maternal sleep practices have also been investigated as a possible risk factor for stillbirth. An Auckland case-control stillbirth study that was the first to investigate maternal sleep position showed women

Figure 5. Perinatal related death rates (per 1000 births) by deprivation quintile (NZDep2006) (with 95 per cent CIs) 2007–2011.[2]

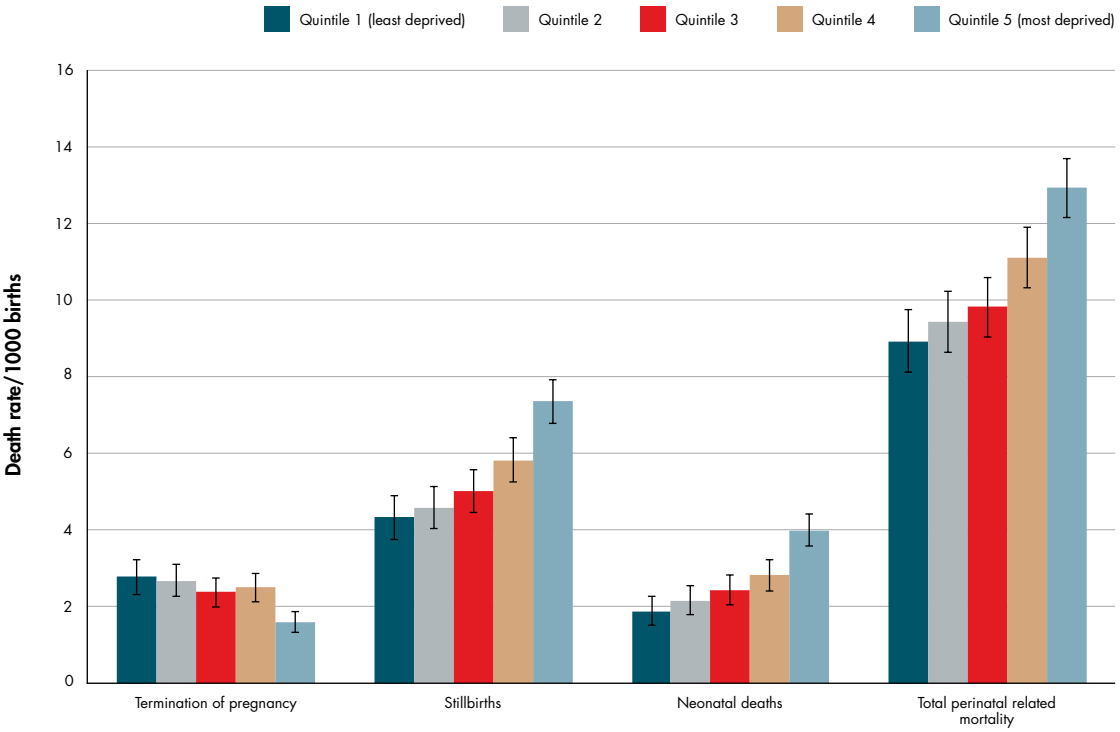
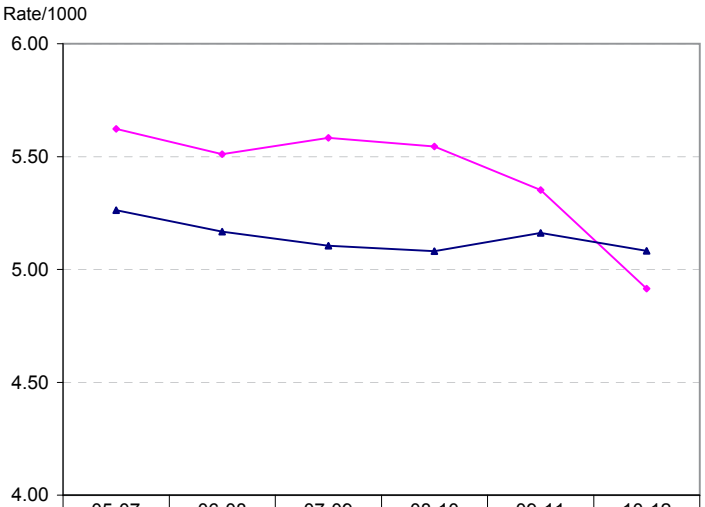


Figure 6. Stillbirths in the West Midlands and the rest of England and Wales. Program of routine antenatal customised growth surveillance implemented in 2009 (3 yma = three year moving average).[14]



	05-07	06-08	07-09	08-10	09-11	10-12
West Midlands	5.62	5.51	5.58	5.55	5.35	4.92
E&W without WM	5.26	5.17	5.10	5.08	5.16	5.08

who went to sleep in a non-left lateral position had a 2.3-fold increase in risk of late stillbirth.[19] The pathophysiology of this finding may involve compression of the great vessels of the abdomen by the gravid uterus, especially in the supine position. Multicentre studies are currently in progress in NZ and the UK to confirm or refute these findings. If confirmed, a public health message promoting going to sleep in the left lateral position has the potential to reduce late stillbirth rates.

Perinatal death is a tragic and all-too-common complication of pregnancy. In NZ, there are some strong socio-demographic associations whereby women at higher risk of perinatal death can be identified. We will never be able to completely eliminate this devastating event, but we can continue to strive towards reducing perinatal death in our populations by better understanding modifiable risk factors.

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A major public-health issue

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Although much has been done to raise awareness of stillbirth over the last decade, it remains a major public-health problem. Healthcare providers need to understand the current rates, primary risk factors and aetiologies of stillbirth as well as how to mitigate them.

Over the past decade there have been only minor fluctuations in the rates of stillbirth in Australia and New Zealand (see Figure 1). Indeed, this plateau can be traced back to 1995, when a consensus was established between the two countries regarding the definition of stillbirth.[1] The Australian Institute of Health and Welfare (AIHW) and the New Zealand Ministry of Health define perinatal death as:

> 'The complete expulsion or extraction from its mother of a baby of at least 20 weeks gestation or weighing at least 400 grams at birth whether born alive or stillborn, where the births included were at least 20 weeks gestation or, if gestation was unknown, the birth weight was at least 400 grams. Stillbirths include termination of pregnancy after 20 weeks.'[2]

The accepted definition of stillbirth is now the absence of a heartbeat at birth. As such, the rate of stillbirths per 1000 in 2009 was 7.6 and 7.5 for Australia and New Zealand, respectively.[3,4] However, according to the World Health Organisation (WHO), which defines stillbirth as: 'a baby born with no signs of life at or after 28 weeks' gestation', the rates of stillbirth per 1000 are 2.9 and 3.5 for Australia and New Zealand, respectively.[5] This variation in definition is important in understanding the static nature of the stillbirth rates in both countries. Advancements in science and technology have improved outcomes for numerous risk factors and disorders, but also allowed for greater identification of abnormalities that may affect termination rates, which after 20 weeks will count as stillbirths. As such, it is important healthcare providers understand current rates, primary risk factors and aetiologies of stillbirth in Australia in conjunction with how to mitigate them.

Risk factors for stillbirth

According to the Australian Mothers and Babies Report 2010, there were 2206 stillbirths in Australia, with rates ranging from 5.8 per 1000 births in New South Wales (NSW) to 11.3 per 1000 births in the Australian Capital Territory (which includes many high-risk pregnancies and terminations from residents of surrounding NSW, which therefore inflates the rate).[2] Analysis of these data indicates the major non-modifiable risk factors for stillbirth in Australia include maternal age, early gestation, plurality, pregnancies conceived with assisted reproductive therapy (ART), primigravid women, grand multiparous women and women identifying as Aboriginal or Torres Strait Islander. Pre-existing hypertension and diabetes also feature prominently and, in addition, there are some lifestyle related risk factors, of which maternal overweight/obesity and smoking are considered the most important.[6]

Women under the age of 20 had the highest age-related stillbirth rate of 14.4 per 1000, followed by women over the age of 40, with a rate of 10.4 per 1000. Rates were also higher for babies of first-time mothers (6.6 per 1000 births) than those whose mothers had at least one previous birth (6.3 per 1000 births). However, for grand multiparous women (women who have had four or more previous births), the rate was much higher at 10.9 per 1000 births. The fetal death rate of twins (18.9 per 1000 births) and higher-order multiples (40.0 per 1000 births) was significantly higher than that of singleton babies (7.0 per 1000 births). The fetal death rate was 12.2 per 1000 births for women giving birth after ART treatment. Most stillbirths were preterm (82.0 per cent of the total). Women identifying as Aboriginal or Torres Strait Islander had a higher rate at 11.1 per 1000 compared to 7.1 for non-Indigenous women.[2] Meta-analysis indicates maternal overweight and obesity increases the odds of stillbirth by 23 per cent and 60 per cent, respectively. Any smoking during pregnancy increases the risk by 36 per cent. Indeed, the population-attributable risk (PAR) for overweight and obesity, smoking and maternal age is about 30 per cent of all stillbirths.[6] The increased risk of stillbirth for women with pre-existing diabetes is three times and for pre-existing hypertension the risk is increased 2.6 times.[6]

The aetiology of stillbirth

The Perinatal Society of Australia and New Zealand (PSANZ) created a classification system to ensure homogenous reporting of fetal death (see Box 1).[7] Following this classification system, the most common causes of stillbirth in Australia are: congenital abnormalities (25.8 per cent); unexplained antepartum death (22.5 per cent); spontaneous preterm (15.3 per cent); specific perinatal conditions (nine per cent);

Box 1. PSANZ Perinatal classification

- Congenital abnormality
- Perinatal infection
- Hypertension
- Antepartum haemorrhage
- Maternal conditions
- Specific perinatal conditions
- Hypoxic peripartum death
- Fetal growth restriction
- Spontaneous preterm
- Unexplained antepartum death
- No obstetric antecedent

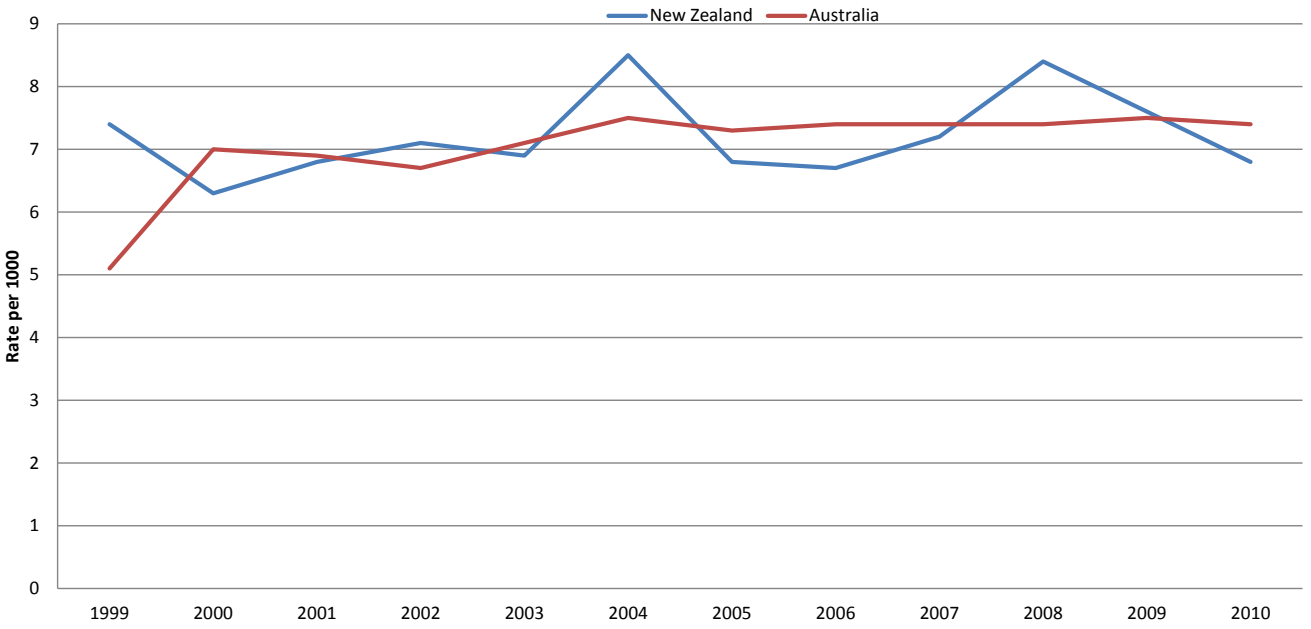

Figure 1. Stillbirth rate per 1000 from 1999–2010 in Australia and New Zealand.
Source: Australia's Mothers and Babies 1999–2010, AIHW; Fetal death rates 1999-2010, Statistics New Zealand.

fetal growth restriction (8.8 per cent); antepartum haemorrhage (4.4 per cent); hypertension (3.2 per cent); perinatal infection (3.1 per cent); maternal conditions (three per cent); hypoxic peripartum death (1.3 per cent); and no obstetric antecedent (one per cent).[2] The pathophysiology of some of the above aetiologies is complex. While congenital abnormalities are the leading cause of stillbirths, the specific syndromes and chromosomal abnormalities responsible vary widely. They are generally grouped into systems (such as the cardiovascular), chromosomal and metabolic abnormalities. There are over 90 disorders within these categories – some incompatible with life, but others causing major handicap – and no single diagnosis accounting for more than two per cent of all occurrences. The more common of these are jugulolymphatic obstruction, trisomy 21, Turner syndrome and anencephaly. Spontaneous preterm birth is another leading cause, defined as commencement of labour or membrane rupture <37 weeks. At times the labour may occur too early for the birth to be compatible with extra-uterine life and sometimes there is associated heavy bleeding leading to fetal death, while extended periods of membrane rupture increase the risk of chorioamnionitis.[8]

Box 2. Investigations at diagnosis

- Comprehensive maternal and family history
- Ultrasound scan to detect possible fetal abnormalities and to assess amniotic fluid volume
- Amniocentesis (where available) for cytogenetic and infection investigation
- Low vaginal and peri-anal swab to culture for anaerobic and aerobic organisms
- Blood tests:
  - Full Blood Examination
  - Serology for Cytomegalovirus, Toxoplasma, Parvovirus B19
  - Rubella and Syphilis if not already undertaken in this pregnancy
  - Blood group and antibody screen if not already undertaken in this pregnancy
  - Kleihauer-Betke test
- Renal function tests, including uric acid
- Liver function tests and bile acid
- Thyroid function tests
- HbA1c
- Anticardiolipin antibodies
- Lupus anticoagulant
- Activated protein C (APC) resistance

Investigations

Once fetal death has been confirmed and plans have been made for the birth, PSANZ recommends a number of core steps to determine the cause. These investigations are divided into those undertaken at diagnosis (see Box 2) and those undertaken following birth (see Box 3).[7] Each investigation has some merit in the diagnosis of cause of stillbirth, but the yield of each test will vary based on the clinical details. For example, external visualisation of the child after birth can demonstrate external abnormalities, some of which may have been missed by chromosomal analysis. Similarly, a karyotype may reveal trisomy 21 in a baby who has not been sent for autopsy. These investigations are important to establish the cause of stillbirth to provide answers and ensure appropriate management of future pregnancies. At present, the stillbirth autopsy rate across the country is only about 40–50 per cent, and a higher rate 'may reduce the numbers of stillbirths which are classified as unexplained.

Box 3. Investigations post birth

- External examination of the baby (by a perinatal pathologist, neonatologist or paediatrician where possible)
- Clinical photographs
- Surface swabs (ear and throat) for microbiological cultures
- Postmortem examination
- Blood samples from the cord or cardiac puncture for investigation of infection
- Blood samples for chromosomal analysis
- Routine Guthrie test
- Detailed macroscopic examination of the placenta and cord
- Placental microbiological cultures
- Placental and amnion biopsy for chromosomal analysis
- Placental histopathology

Managing the next pregnancy

One of the many important uses of a clear diagnosis of the cause of stillbirth is the guidance it may give about the next pregnancy, especially if there is some chance of recurrence such as with inherited congenital anomalies. On the other hand, it is known that after unexplained stillbirth there is at best a modest increased risk of stillbirth in the next pregnancy of about 1.5 to two times, although some authors report no increased risk.[9] Even taking the worst estimates, this may mean the absolute risk of a recurrence is extremely low. The management of the next pregnancy is always a compromise between what is medically indicated (in terms of the recurrence risk) and dealing with the inevitable anxiety couples will experience up to the point a healthy baby is born. A survey of Fellows from a few years ago produced some interesting results when they were faced with the conundrum of managing the next pregnancy after an unexplained term stillbirth.[10] Almost all would initiate increased levels of fetal surveillance, most would consider early induction of labour, with the most common time for this around 38 weeks, and some would opt for elective caesarean section. Whatever the birth plan for an individual woman, it is a good practice point to discuss the pregnancy and birth plan early on (even pre-pregnancy in some cases to allow for interventions to reduce any modifiable risk factors) and stick to an agreed approach. Uncertainty fuels anxiety and this can make the next pregnancy extremely challenging for all concerned.

Summary

Stillbirth remains a major public health problem, with 2206 stillbirths reported in Australia in 2010. The first-ever comprehensive report on stillbirth will be released by AIHW in the next few months. In 2011, the *Lancet* released a series of articles on stillbirth that grabbed much media attention.[11] Despite an increased focus, there is little sign the rate is reducing and indeed some of the risk factors for stillbirth are increasing in our population. At present there is also much attention on the importance of fetal movement monitoring and maternal sleeping position as two possible areas of intervention to reduce the risk of late term stillbirth. Hopefully, the next decade will see some significant inroads into better management of this tragic adverse outcome of pregnancy and some significant reductions in the rate.

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Improving outcomes

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An overview of the first eight years of New Zealand's Perinatal and Maternal Mortality Review Committee.

The Perinatal and Maternal Mortality Review Committee (PMMRC) was established, in 2005, to review and report on all maternal deaths and all deaths of infants born from 20 weeks gestation to 28 days after birth. Now in its eighth year, the committee has established a nationally recognised system of data collection and reporting and made recommendations that have had a positive impact on the quality of maternity care in New Zealand. This article summarises the achievements of the PMMRC and highlights some of the key findings of its latest report released earlier this year.

The PMMRC was initially established as a ministerial committee of the Ministry of Health. In 2011, it was transferred to the Health Quality and Safety Commission, a crown entity with the overarching objective of monitoring and improving the quality and safety of health and disability services and assisting providers across the sector to improve these services. The PMMRC's role has been clearly defined in the New Zealand Public Health and Disability Act 2000. The committee's task is to produce strategic plans and methodologies designed to reduce mortality and morbidity in its reporting area.

The PMMRC and its working groups' members represent the spectrum of maternity care, including obstetrics and gynaecology, midwifery, paediatrics, neonatology, Maori and Pacific health, and consumers. The working groups include the Maternal Mortality Working Group, the Neonatal Encephalopathy Working Group and the Australasian Maternity Outcomes Surveillance System (AMOSS) Working Group, who work jointly with the University of New South Wales to collect maternal morbidity data.

The current chair of the Committee is Dr Sue Belgrave, the clinical director of obstetrics at Waitemata District Health Board. Dr Belgrave officially took up this position in June 2013, following on from the founding chair Prof Cindy Farquhar, in the Department of Obstetrics and Gynaecology at the University of Auckland, who has been largely responsible for the development of the work of this committee.

Under the New Zealand Public Health and Disability Act 2000 and Section 88, Lead Maternity Carers are required to provide information to the PMMRC. PMMRC local coordinators within each district health board (DHB) identify perinatal deaths and oversee the collection of the required data. The coordinators are also responsible for initiating local clinical reviews of each case, including assigning classification codes for causes of death, determining contributory factors and potentially avoidable deaths.

An annual report and workshop highlight areas where improvements could be made to the overall maternity system using aggregated national perinatal and maternal mortality and morbidity data. These data analyses have resulted in a number of recommendations on how to improve outcomes for New Zealand mothers and babies over seven annual reports. Some of the achievements of the PMMRC are highlighted below:

- In 2006, a national process was established for clinical data collection from all 20 DHB for all perinatal and maternal deaths. Prior to 2006, perinatal and maternal mortality analysis was solely based on routinely collected administrative data. A network of local DHB coordinators remains central to the success of this committee. This methodology led to an increase in ascertainment of deaths. While this led to accurate and robust reporting, it also led to an increase and apparent deterioration in rates compared to jurisdictions relying on routine data collection.
- There is now a well-established methodology for reporting potentially avoidable perinatal and maternal deaths that is multidisciplinary and can be used to identify areas for improvement in clinical care. The three domains are: management and organisation of services; knowledge and skills of personnel; and barriers to accessing or engaging with care.
- The committee has consistently raised awareness of the poor state of maternal and perinatal mental health services and, as a result, a review was undertaken by the Ministry of Health and in 2012 a report, Healthy Beginnings[1], recommended a number of measures to improve these services. New funding for the recommendations of this report was announced in the 2013 Health Budget.
- A detailed external review was undertaken of the maternity services in Counties Manukau DHB, which was found to consistently have a perinatal mortality rate above the national average. This review resulted in ten wide-ranging recommendations that are currently being implemented.[2]
- The Ministry of Health's maternity quality and safety program, launched in 2011, and the establishment of the National Maternity Monitoring Group in 2012, were informed by the work of the PMMRC. The quality and safety program addresses many aspects of maternity care, including improving maternity records, developing a national electronic maternity record, establishing standards for provision of healthcare, developing clinical governance processes and a requirement for DHBs to improve access to maternity care for all women.
- National guidelines have been commissioned by the Ministry of Health including referral guidelines, management of massive blood loss, gestational diabetes and observation of the newborn.

Report findings

The latest annual report (published in June 2013)[3] analysed perinatal mortality over five years (2007–11) and maternal mortality over six years (2006–11). In addition, the PMMRC is increasing its work in the area of morbidity, with analysis of neonatal encephalopathy (2010–11) and maternal morbidity (2010–11).

The maternal mortality ratio was 15.7 per 100 000 maternities in the years 2009–11, not significantly different from 18.2 per 100 000 in 2006–08. From 2006 to 2011, the most common causes of maternal death in New Zealand were pre-existing medical conditions (23 per cent) and suicide (22 per cent). Thirty-five per cent of maternal deaths were identified as potentially avoidable, with similar contributions from organisation and management factors, personnel factors and barriers to access, and engagement with care.

The 2012 report noted a reduction in the perinatal related death rate using the World Health Organisation (WHO) international definition of birthweight ≥1000g, when lethal and terminated congenital abnormalities are excluded.[4] Further, there was a significant reduction in term intrapartum deaths and hypoxic peripartum deaths from 2007–11.

There has, however, been a significant increase in perinatal related mortality of babies born in multiple births, from 32 per 1000 births in 2007, to 53 per 1000 births in 2011. The committee has recommended all women having assisted reproduction, such as in vitro ferilisation, be offered transfer of a single embryo, rather than two or more.

In 2011, aggregation of data from local DHB mortality review showed 19 per cent of perinatal deaths were potentially avoidable. The most common contributing factors to these deaths were barriers to access or engagement with care – most commonly, late or infrequent access to antenatal care. These were followed by personnel factors – most commonly, failure to follow recommended best practice.

Maori, Pacific and Indian mothers as well as women from areas of socioeconomic deprivation were significantly more likely to experience a perinatal death. The risks of losing a baby from potentially avoidable causes were higher for Maori and Pacific mothers, and for women from areas of socio-economic deprivation.

An audit of babies who died in 2010 at 20 weeks or beyond with screen-detectable congenital abnormalities, found that one woman in four who sought care with a primary healthcare provider before 20 weeks gestation was not offered first- or second-trimester antenatal screening. The PMMRC has recommended that all GPs and midwives should be adequately informed to be able to offer antenatal screening.

While there was poor documentation of whether women took folic acid around the start of pregnancy, it appears not all pregnant women are taking folic acid to prevent birth defects. The PMMRC data suggest that as many as 15 deaths in one year associated with neural tube defects, such as spina bifida, could be prevented with folic acid. Therefore, the PMMRC recommends the fortification of bread with folic acid.

Establishing a national committee and a robust methodology for ascertainment and data collection of perinatal and maternal mortalities has resulted in an accurate estimate of the burden of perinatal and maternal mortality in New Zealand, and a greater understanding of the contributors to mortality and will lead to further improvements in outcomes.

New report available

The Health Quality and Safety Commission has released its report on serious adverse events reported by DHBs and a number of other providers in 2012–13. The report looks at events affecting health and disability consumers that reach the threshold for reporting as Severity Assessment Criteria (SAC) events SAC 1 and 2. It is the first report by the Commission that includes events reported by providers other than DHBs. The full report and a summary are available on the Commission's website at: www.hqsc.govt.nz/our-programmes/reportable-events/publications-and-resources/publication/1190/ .

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Obesity and stillbirth

Dr Simon Craig
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Recently, it has been recognised that there is an increased rate of stillbirth in obese women. This association persists even after allowing for the confounding effects of diabetes and hypertension in obesity.

Obesity is a major medical problem and is becoming more prevalent. Indeed, obesity is now so common in the developed world that it is recognised as one of the most significant contributors to poor health. This recognition applies over all areas of health, including obstetrics. The Australian Bureau of Statistics found, in the period 2011–12, 63 per cent of Australians over the age of 18 were classified as overweight or obese. Obesity, including maternal obesity, is even more common in rural and remote regions compared to metropolitan areas. Some cultural groups, including Indigenous Australians, have higher rates of obesity than the population average.

It has long been recognised that obesity is a risk factor for adverse perinatal outcomes. The incidence of virtually all pregnancy complications is increased for both the obese mother and her fetus. Significant risks exist at each stage of pregnancy and also in the puerperium.[1] It is established that maternal obesity is associated with increased rates of gestational diabetes, pre-eclampsia and large-for-dates infants, among other risks.

Obesity is a problem at all stages of reproduction, beginning with increased rates of infertility and subsequent higher spontaneous early and recurrent early miscarriages compared with women in the healthy weight range. In pregnancies achieved with the assistance of reproductive technologies, obese women have greater rates of pregnancy loss in the first six weeks than normal BMI controls (22 per cent versus 12 per cent; p= 0.03).[2]

In later pregnancy, numerous studies have demonstrated an increased incidence of antepartum stillbirth in obese women, even after excluding diabetic or hypertensive pregnancies. Sebire and colleagues studied 287 213 completed singleton pregnancies in London in 2001.[3] Of these women, 176 923 were in the normal weight range (BMI 20 to 25), 79 014 had a BMI of 25 to 30, and 31 276 had a BMI greater than 30. After accounting for confounding factors, the risk of intrauterine death was 1.10 (99 per cent CI 0.94–1.28) in the overweight group, and 1.40 (99 per cent CI 1.14–1.71) in those with BMI greater than 30.

A meta-analysis by Chu and colleagues published in 2007 estimated the odds for a stillbirth were 1.47 (95 per cent CI 1.08–1.94) and 2.07 (95 per cent CI 1.59–2.74) higher in overweight (BMI 25–30) and obese (BMI >30) women, respectively, compared with normal weight (BMI 20–25) controls, again after allowing for maternal medical conditions during pregnancy.[4] More recently, examining the obese group in more detail and breaking the BMI> 30 group into Class I (BMI 30–35), Class II (BMI 35–40), and Class III (BMI >40) has shown an increasing risk of stillbirth with increasing level of obesity.[5] If pre-pregnancy obesity is also combined with excessive weight gain during pregnancy there is even higher risk of adverse pregnancy outcomes. When obese women have excessive gestational weight gain (using the Institute of Medicine criteria), there is a doubling of caesarean section rates compared to obese women who have normal gestational weight gain.[6]

It is essential that weight gain in pregnancy is monitored, although programs to control intra-pregnancy weight gain have shown limited success. A small Australian study was able to reduce gestational weight gain and gestational diabetes with relatively simple interventions[7], although others have not been able to show success with similar programs.

While excessive intra-pregnancy weight gain is associated with increased adverse perinatal outcomes, weight gain between pregnancies has also been associated with increased risk. Villamor and Cnattingius investigated inter-pregnancy weight gain between the first and second pregnancy.[8] Even modest BMI gains after the initial booking visit in the first pregnancy until the booking visit during the second pregnancy were associated with increased rates of adverse pregnancy outcomes. These risks were present even in women who were considered in a normal BMI group in both pregnancies.

Villamor and Cnattingius found the risks for pre-eclampsia, hypertension, gestational diabetes and large-for-gestational age infants started to rise with inter-pregnancy weight gains of between one and two BMI units, and continued to increase progressively thereafter. The odds of stillbirth were 63 per cent higher in women who had inter-pregnancy weight gain of three or more BMI units, compared to those who had inter-pregnancy weight gain of less than one BMI unit. This association remained after adjustment for other co-morbidities. When term (37 weeks and beyond) and preterm (before 37 weeks) stillbirths were examined separately, there was a significant linear association between increasing inter-pregnancy weight gain and term stillbirth, but this association was not noted for preterm stillbirth.

Even among obese populations it appears there may be women who are at even greater risk for stillbirth. Salihu found an increased risk of stillbirth in black obese women compared with white obese women.[9] In both racial groups, the risk of stillbirth increased progressively with increasing BMI. However, at all levels of obesity there was a disparity in black-white comparison, with black women having increased risks of obesity-related stillbirth compared with white women. In contrast, a study from Auckland noted that while Pacific women had an overall increased risk of stillbirth compared with European women, there was no racial difference in stillbirth rates after adjusting for other confounders such as poverty.[10]

It is recognised that there is an increased rate of stillbirth in adolescent populations (<18 years), owing to a variety of health, socioeconomic and behavioural issues. However, the obese adolescent pregnant patient may be at even greater risk, with a recent study showing a relative risk stillbirth of 1.8 for obese (>30 BMI) adolescents when compared with normal and overweight adolescents.[11]

In multiple pregnancy, obesity is associated with higher rates of stillbirth, with the rates of both partial loss (one fetus) and complete

loss (both fetuses) being elevated when compared to normal weight mothers with a twin gestation. The risks appear to be amplified in triplet gestations, with obese women (BMI >30) having a four-fold risk of stillbirth compared with normal weight mothers with triplets.[12]

The pathophysiological mechanisms leading to stillbirth in obese women are unclear. It is known that obesity increases the risk of gestational diabetes and hypertensive disorders, and these are established risks for stillbirth. However, most studies suggest the increase in stillbirth with obesity cannot be fully explained by these conditions. Several biological pathways have been suggested to explain the observed increase in stillbirth rates. Perinatal obesity may increase hyperlipidaemia, leading to reduced prostacyclin secretion and enhanced thromboxane production with resultant vasoconstriction, platelet aggregation and decreased placental perfusion. The addition of insulin resistance decreases fibrinolytic activity with possible increased rates of placental thrombosis and further decreased perfusion. Thus, the increased rate of stillbirth may result from feto-placental dysfunction with consequent impaired placental blood flow.[4,5,13] Studies have also reported that obese pregnant women have more sleep-related disordered breathing episodes, including snoring, apnoea-hypoxia events and oxygen desaturation events, when compared to non-obese pregnant women.[14] These respiratory changes may lead to increased pregnancy-related hypertensive disorders, fetal growth restriction and fetal loss.

It has been proposed that a proportion of the increased risk of adverse perinatal outcomes in obese women relates to a lack of perception of reductions in fetal movements and consequent delayed attendance for monitoring.[4] The association of maternal obesity with stillbirth may also reflect differences in socioeconomic status; and quality, availability and uptake of antenatal care between obese and non-obese women. All investigations, including cardiotocography (CTG) and ultrasound, are technically more difficult and potentially more difficult to interpret in obese mothers. These difficulties, combined with a reluctance to induce labour in morbidly obese women owing to known high failure rate, may lead to hesitation in attempting to deliver women, thus increasing the risk of late stillbirth.

In view of the association between obesity and stillbirth, it is clear the most important intervention for these women is weight loss prior to becoming pregnant. Limiting intra-pregnancy and inter-pregnancy weight gain is also of paramount importance. Unfortunately, for many people, traditional weight-loss programs with alteration of diet and increased exercise frequently fail. Bariatric surgery, in appropriately counselled patients, has been shown to be effective in weight loss and subsequent reduction of medical morbidity.[15] However, in Australia, bariatric surgery is largely confined to metropolitan areas and the private sector. Many patients are geographically and financially unable to access this treatment.

In our specialty, obstetricians will appreciate the opportunity for pre-pregnancy counselling of obese patients and early referral once pregnant. Obstetricians will be even more grateful if our fertility colleagues do not use assisted reproductive technology in obese patients. The obese patients who present in pregnancy should be strongly encouraged and supported to adhere to the Institute of Medicine guidelines for weight gain in pregnancy.

Acknowledgment of the increased stillbirth risk will lead to a greater level of vigilance, an appropriate level of obstetric care and increased fetal monitoring in the third trimester. What this increased monitoring should entail is not universally agreed upon. One group has suggested starting CTG monitoring at 32–34 weeks and serial fetal growth assessments by ultrasound in the third trimester.[16] Although such an approach seems intuitive, there is no evidence, as yet, to support such a policy.

Given that one suggested pathophysiological mechanism of stillbirth involves early feto-placental dysfunction, there is a role for research into early intervention in this group of women. Should all obese pregnant women be treated with low-dose aspirin? Another possible cause relates to increased sleep apnoea: do all morbidly obese women need sleep studies and possibly CPAP? Should all pregnant women with BMI of greater than 40 be delivered electively by caesarean section at 39 weeks if they have not laboured prior to this? There are many unresolved questions.

Stillbirth is a tragic occurrence and the association of stillbirth with obesity is a further reason that we need to urgently address the epidemic of overweight and obesity in our society. Obesity is a complex area with multiple contributing causes for each individual and many causative factors in our communities from food production, packaging and advertising, through to issues such as the physical layout of our towns, schools and workplaces. Significant reductions in obesity rates, leading to better outcomes in all areas of medicine including obstetrics, will ultimately require major societal change.

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Older mothers

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Is there now enough evidence to change how we manage the pregnancies of older mothers to reduce the risk of stillbirth?

I met with a 41-year-old woman this afternoon. Six weeks ago, she came to my hospital at 40 weeks and one day, concerned because she hadn't felt her baby move for some hours. On arrival to hospital no fetal heartbeat could be heard and the ultrasound scan confirmed the baby had died. We talked today for some time about the list of stillbirth investigations that had been undertaken, in accordance with our hospital protocol (derived from the Perinatal Society of Australia and New Zealand Clinical Practice Guidelines) and the rationale behind these tests. They were all normal. She asked me if anything could have been done to prevent this. If I was asked this question five years ago I would have said I don't know. I still told her that I don't know, but I think there is now a little evidence and some guidance around timing of birth for older women.

> 'Induction of labour at term presents as a potential strategy to reduce the risk of stillbirth for older women.'

More than one in five women giving birth in Australia are aged older than 35 years. As women age, fertility declines and pregnancies are associated with higher rates of antenatal and intrapartum maternal complications. Stillbirth is also more common as women get older. When the risk of stillbirth is expressed as a proportion of ongoing pregnancies at a given gestation, it is evident that the risk is greatest among term and post-term pregnancies.[1] In very large retrospective cohorts, the risk of stillbirth is twice as common in women aged older than 35 years[2], and three times as common in women aged 40–44 years[3] compared to women aged 25–29. Recent Australian data[4] published from my own hospital showed that women aged 40 years or more accounted for 3.5 per cent of all births yet 8.5 per cent of term stillbirths. Even when adjusted for modifiable risk factors, such as obesity and smoking, maternal age remains an independent risk factor for stillbirth.

It is not entirely clear why stillbirth is more common as women get older. Older women are more likely to be overweight and associations have been demonstrated between increased BMI and stillbirth. There are data showing that fetal growth restriction (FGR) increases with maternal age and there are also proven associations between small for gestational age (SGA)/FGR and stillbirth. However, the rate of FGR in the stillborn babies of older mothers is not greater than in younger mothers.[5] Presently, there is no evidence to support routine ultrasound scanning for fetal growth or umbilical artery and uterine artery Dopplers in older women.

Induction of labour at term presents as a potential strategy to reduce the risk of stillbirth for older women. More generally, there is Level 1 evidence that induction of labour for post-term pregnancies reduces perinatal mortality without increasing the caesarean section rate. Contrary to many clinicians' opinions, there is also data showing improved perinatal outcomes and no difference in caesarean section when induction of labour is routinely performed prior to term. In the Hypitat trial, for example, induction of labour after 37 weeks for pregnancies complicated by a hypertensive disorder was associated with no difference in mode of birth compared to those women randomised to expectant management. Inferences can therefore be drawn from studies of induction of labour among women of all ages, that induction of labour in older women at, or prior to, term may hold the promise of preventing some stillbirths, without increasing the woman's chance of birth by caesarean section.

Earlier this year, the Royal College of Obstetricians and Gynaecologists published 'Induction of Labour at Term in Older Mothers'.[6] In this paper they modelled that if all UK women aged 40 years or older with a singleton pregnancy were induced at 39 weeks instead of 41 weeks, 17 stillbirths could be prevented. This equates to inducing an extra 550 women to prevent one stillbirth. Inducing at 40 weeks instead of 41, would prevent seven stillbirths and require an extra 679 inductions to prevent one stillbirth. And, in a similar analysis, Fretts[7] hypothesised that among women aged 35 years or older, a more modest figure of 71 additional inductions at 39 weeks would be required to prevent one unexplained stillbirth. The underlying reason to recommend induction of labour in the setting of a post-term pregnancy is to prevent stillbirth. While the number needed to treat may appear large, it is noteworthy that the absolute risk of stillbirth at 38 weeks in women aged 40 years or older is still greater than the absolute risk of stillbirth at 41 weeks in younger women.[8] There is currently no prospective study specifically assessing the maternal and neonatal outcomes of older women undergoing induction of labour at, or prior to, term compared to expectant management. There is a need for data to demonstrate this benefit and to also quantify the likelihood of additional obstetric intervention (if any) and its associated cost.

The risk of stillbirth in high-income countries has shown little or no improvement in the past 20 years. The recent *Lancet* stillbirth series[9] has articulated the need for resources to prioritise stillbirth research and prevention strategies. Maternal overweight and obesity, and smoking are the most important potentially modifiable risk factors for stillbirth. It is not possible for any of us to become younger, yet the stillbirth risk associated with maternal age is able to be somewhat addressed through increased awareness and careful consideration as to the most appropriate time to have children. Based on the available data, induction of labour

at or near term for older mothers is likely to be associated with a reduction in stillbirth risk without increasing the likelihood of birth by caesarean section.

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- **Wednesday 5 March 2014**: Opening Session 5pm to 6 pm
- **Thursday 6 March 2014** and **Friday 7 March 2014**: 9am to 5.30 pm

Social events

- **Wednesday 5 March 2014**: Welcome function at Millennium Hotel Queenstown
- **Thursday 6 March 2014**: Mercia Barnes Research Trust fund raising auction and networking function at Skyline
- **Friday 7 March 2014**: ASM Conference Dinner at Jack's Point
- **Saturday 8 March 2014**: Golf round at Jack's Point with Prof Wayne Gillett

The registration website will be released in November 2013. If you have any questions or would like to be informed when the website is available, please contact Ms Makiko Wimbush, ASM secretariat, RANZCOG NZ Office (event@ranzcog.org.nz, +64 4 472 4608).

Diabetes and stillbirth

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This article explores the risk factors for stillbirth in diabetic pregnancy, the underlying pathophysiology of diabetes in pregnancy relating to potential mechanisms of fetal death and the important roles of optimised glycaemic control as well as careful fetal surveillance in reducing stillbirth risk.

Diabetes is now a common problem in pregnancy, with Australian data revealing that 1.7 per cent of pregnancies are complicated by pre-existing diabetes and 6.9 per cent have a diagnosis of gestational diabetes (GDM).[1] As both pre-existing diabetes and GDM are associated with increased adverse outcomes for both mother[2] and baby[3], and now almost one pregnancy in ten is affected, diabetes imposes a very heavy burden on providers of maternity care. The increased rate of stillbirth and neonatal death in the offspring of mothers with pre-existing diabetes is well recognised, with rates of stillbirth increased by up to five times compared to non-diabetic pregnancies.[4-11] Although an area of controversy, GDM may also be associated by an estimated 25 per cent increase in stillbirth.[12]

Stillbirth risk factors in pre-existing diabetic pregnancy

In the UK, the offspring of women with type 1 and type 2 diabetes were five times more likely to be stillborn, with 80 per cent of the stillborn babies being structurally normal.[6,11] Together with congenital malformations, the occurrence of pregnancy complications such as intrauterine growth restriction, pre-eclampsia, umbilical cord problems, acute asphyxia, placental abruption and intrauterine infections explain about 50 per cent of the stillbirths, with 50 per cent being unexplained.[7] Diabetic nephropathy, smoking and low socioeconomic status have been reported to be risk factors.[7] In a French study of perinatal mortality of 289 women with type 1 diabetes, those who received preconception care had a perinatal mortality rate of 0.7 per cent compared to 8.1 per cent for those that did not, suggesting glycaemic control at conception and during the first trimester are critically important.[10] Other European studies have revealed that the better the glycaemic control in pregnancy, the lower the risk of perinatal death.[5,13,14] For example, the mean HbA1c was higher in women with pregnancies complicated by stillbirth, compared to uncomplicated diabetic pregnancies.[5] For this reason, it has been concluded that, 'the single most important factor to reduce the risk of stillbirth is to achieve and maintain good glycaemic control during pregnancy.'[5]

Gestational diabetes and stillbirth

GDM and type 2 diabetes share the same underlying mechanism – failure of the islet beta-cells to compensate for insulin resistance – and can be considered different phases of the same condition.[15] As type 2 diabetes is clearly associated with increased stillbirth rates, one might expect that GDM would be as well, although, evidence to show this is not strong. The well-known Hyperglycemia and Adverse Pregnancy Outcome (HAPO) study did not show any increase in perinatal mortality with hyperglycaemia of lesser magnitude than overt diabetes.[16] Also, large population-based studies have generally provided reassurance, reporting that the risk of stillbirth in pregnancies affected by GDM is not increased. However, it has recently been suggested that such analyses may be flawed. This is because, although most pregnancy outcome cohorts begin at 20 weeks gestation, the pregnancy must continue beyond 28 weeks for the screening procedures for GDM (as compared to types 1 and 2 diabetes, which are almost always diagnosed by 20 weeks). When national data from the USA were re-analysed and the analysis was restricted to pregnancies that progressed beyond 28 weeks gestation, the authors found that GDM was indeed associated with an increase in the odds for stillbirth (adjusted OR 1.25, 95 per cent CI 1.11, 1.41).[12] In light of this new evidence that GDM may be associated with a significant increase in the odds for stillbirth and in view of the increasing incidence of GDM, especially since the diagnostic criteria for GDM are in a state of flux, it is important to review this important question. In doing this, other non-glycaemic factors that may also impact on adverse outcomes in GDM pregnancy such as obesity, hyperlipidaemia and inflammation also need to be considered.[15]

Box 1. Aims of pre-pregnancy care for diabetes

- The use of effective contraception, until glycaemic control yields optimal HbA1c levels.
- A multidisciplinary approach to diet and lifestyle, including maintenance of healthy weight range and regular exercise.
- The use of diet, lifestyle and medications (oral hypoglycaemics and/or insulin) to optimise glycaemic control.
- Advice on smoking cessation and moderation in alcohol use, if necessary.
- Supplementation with folic acid.
- Careful medication review, to avoid mediations such as ACE inhibitors, statins and diuretics.
- Substitution of antihypertensive medications with labetalol or alpha-methyl dopa.
- Screening for, and management of, diabetic complications such retinopathy, renal disease or cardiac complications.
- Check routine pregnancy investigations such as rubella immunisation, vitamin D status Pap cytology, etc.

Adapted from Temple (2011).

Box 2. Potential risks to the newborn following a diabetic pregnancy

- Congenital abnormalities
- Intrauterine growth restriction
- Intrapartum hypoxia-ischaemia
- Macrosomia and birth injury
- Polycythaemia and jaundice
- Hypoketonaemic hypoglycaemia
- Hypocalcaemia and hypomagnesaemia
- Hypertrophic cardiomyopathy
- Complications of preterm birth
- Separation of mother and baby after birth
- Use of formula, reduced breastfeeding and over-feeding

Adapted from Hawdon (2011).

It should also be noted that HAPO demonstrated an almost linear relationship with increasing levels of hyperglycaemia and a range of other adverse pregnancy outcomes.[16] The results of other large studies have shown the diagnosis and management of gestational diabetes is associated with improved outcomes.[15,17]

Pathophysiology of maternal diabetes on the fetus

The pathophysiology of diabetic effects on the fetus in later pregnancy are summarised by the 'Pederson hypothesis': maternal hyperglycaemia results in fetal hyperglycaemia, which in turn overstimulates the fetal pancreatic beta cells to cause fetal hyperinsulinaemia.[18] Glucose is the main source of energy for the fetus. It crosses the placenta by non-insulin mediated, but concentration gradient dependent, diffusion processes facilitated by hexose transporters. In addition to transferring intact glucose molecules, placental glycolysis yields lactate, which is another source of fetal energy substrate. The placenta has limited capacity to buffer glucose transfer by metabolism into glycogen.

Fetal hyperinsulinaemia, together with the enhanced fetal nutrient supply, drives high rates of fetal growth, deposition of subcutaneous fat and storage of glycogen in the liver. These quite marked effects are associated with increased metabolic rates that may provoke fetal hypoxia. A chronic hypoxia could be further aggravated later in pregnancy with placental changes induced by diabetes. Hypoxic fetuses have been found to have elevated levels of erythropoietin (EPO) in blood and amniotic fluid, just as happens in adults.[19,20] Supportive of the concept that hypoxia occurs in fetuses of diabetic mothers is a strong correlation between maternal HbA1c levels in late pregnancy and umbilical cord EPO concentrations.[21]

In pre-existing type 1 diabetic pregnancies, neonatal echocardiography reveals signs of cardiomyopathy (with septal hypertrophy and heart enlargement) in up to 40 per cent of newborns.[7] Although the cause of this fetal/neonatal diabetic cardiomyopathy is unknown, increased nutrient supply and hyperinsulinism are likely to be involved. An almost certain consequence will be increased myocardial oxygen consumption that, in the setting of fetal hypoxia, may increase the susceptibility of the heart to arrhythmias.

Further evidence implicating the heart in stillbirth of diabetic pregnancy is provided by studies of the peptide B-type natriuretic protein (BNP), a known product of cardiac muscle cells in response to stress. In the fetus, BNP is known to be a vasodilator in placental vessels, among other functions.[22] Studies of cord blood BNP levels, as well as Troponin T (a marker of myocardial damage) correlate with poor maternal glycaemic control in pregnancy.[7]

Management of diabetes in pregnancy

Since maternal diabetes is so strongly associated with stillbirth, strategies of pre-pregnancy care, multidisciplinary pregnancy care, timing of delivery and intrapartum care are vital in optimising neonatal outcomes and reducing perinatal mortality.[23]

Diabetes is perhaps the foremost example of the benefits of pre-pregnancy care on perinatal outcomes.[24] Elevated HbA1c levels in early pregnancy are strongly associated with adverse outcomes of pregnancy, including pregnancy loss and fetal malformations.[25] The principles of pre-pregnancy care have been well described by Temple[25] (see Box 1). While the evidence is convincing that pre-pregnancy care reduces the risk of congenital malformations and there are very good indications it also reduces perinatal mortality,[10] the same benefits have not been demonstrated for other adverse outcomes, such as premature delivery and pre-eclampsia.[25]

For the majority of women with pre-existing diabetes – either type 1 or, increasingly, type 2 – good-quality pregnancy care in a multidisciplinary team will minimise the risk of perinatal complications (see Box 2).[3] Optimised glycaemic control will help to reduce stillbirth and other complications, however, even the tightest glycaemic control the risk of stillbirth and neonatal death remains increased.[7] Additional important principles of diabetic care in pregnancy include: regular fetal surveillance by ultrasound, both to detect congenital abnormalities in the mid-trimester and to screen for growth restriction or macrosomia in the third trimester; and, attention to patterns of fetal movement including kick charts, with recourse to cardiotocography (CTG) assessment if indicated. Taking such an approach the stillbirth rate has been reduced from two per cent (1993–99) to 0.7 per cent (2000–09) in a centre of expertise in diabetic pregnancy in Denmark.[7]

Conclusions

Diabetes is a common and important cause of stillbirth and perinatal death, among other adverse outcomes of pregnancy. Both pre-pregnancy care and close attention to the optimisation of glycaemic control during pregnancy are critical to reducing the risk of stillbirth. This will require a multidisciplinary approach and include careful fetal surveillance and timely delivery. There are new data to suggest that GDM, previously supposed to have little effect on stillbirth, may actually increase the odds for this important and distressing complication. Similar principles apply to the management of GDM as apply to pre-existing types 1 and 2 diabetes, but the screening criteria for GDM are evolving and further study will be required over coming years.

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Managing multiples

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Twin pregnancies are high risk and require regular antenatal surveillance and discussion regarding time and mode of delivery, especially in uncomplicated twins.

The rate of multiple births varies from country to country, with twin pregnancies accounting for just over three per cent of all births in Australia during 2008. Twin pregnancies are associated with complications for both the mother and the fetus. From the maternal perspective, there are increased risks of hyperemesis, preterm delivery, premature rupture of membranes, gestational diabetes mellitus and pre-eclampsia. The twins themselves face increased risks of perinatal mortality, predominantly related to prematurity, as well as complications related to chorionicity/amnionicity and complications occurring during birth.

The rates of delivery before 32 weeks are approximately two per cent for singletons compared to 12.5 per cent for twins. The risk of infant death is even greater: 29.8/1000 for twins and 59.6/1000 for triplets, compared with 6/1000 for singletons. Rates of cerebral palsy have also been estimated to be four to eight times higher in twins when compared to singletons.[1]

Twins can be classified as either monozygotic (originating from the fertilisation and subsequent division of one egg) or dizygotic (originating from the fertilisation and development of two eggs). Twins can be further classified by their chorionicity: dizygotic twins are always dichorionic, diamniotic (DCDA). In relation to monozygotic pregnancies, DCDA twins result if the fertilised egg splits in the first three days after fertilisation. Monochorionic diamniotic (MCDA) twins result if the split occurs at days between days four and eight, and monochorionic monoamniotic (MCMA) twins result if the split occurs after the eighth day post-fertilisation. Conjoined twins occur with division 13 days or later; this is extremely rare.

DCDA twin pregnancies are usually monitored by ultrasound scans every four weeks after the morphology scan and more frequently if there is evidence of discordant growth. Given consistent evidence of increasing risk in twin pregnancies extending past 38–39 weeks, planning elective delivery at 38 weeks in well-dated, uncomplicated dichorionic twin pregnancies is a rational management approach.[2,3] The timing of twin delivery is, however, highly debated. According to findings of multiple population-based studies worldwide, the lowest risk for perinatal mortality and morbidity for twin births appears to be between 36 and 38 weeks gestation. This debate unfortunately could not be answered by the randomised trial by Dodd and colleagues, but showed a trend for lower risk in the group delivered electively at 37 weeks group.[7]

MCDA twin pregnancies are considered high-risk pregnancies owing to the twins sharing a single placenta. The incidence of monochorionic twinning is approximately one in 400 and is fairly constant. MCDA twin pregnancies are characterised by placental vascular anastomoses and resulting inter-fetal transfusion. MCDA twins are considered high risk by virtue of their three-to-five-fold increase in perinatal morbidity and mortality compared to dichorionic twin pregnancies.

Twin to twin transfusion syndrome (TTTS) complicates about 15 per cent of MCDA twin pregnancies, with discordant intrauterine growth restriction complicating an additional 25 per cent. Furthermore, in the event of intrauterine fetal death (IUFD) of one twin, there is a 20–25 per cent risk of death or neurological damage in the surviving twin from acute inter-twin transfusion. These complications are the result of significant neurological damage secondary to hypotension occurring in the live twin at the time of demise of the other.[1]

Frequency of ultrasound surveillance for MCDA pregnancies varies in different centres, although the Society for Maternal and Fetal Medicine has published recommendations for the diagnosis and management of TTTS.[2,3] All women with MCDA pregnancies are offered routine first-trimester screening, cervical length screening at later visits and most centres recommend fortnightly ultrasound from 16 weeks onwards. Early nuchal translucency discordance, with a difference of 20 per cent or more between nuchal thicknesses of the two fetuses, imparts a higher risk of TTTS. Regular ultrasound scans are undertaken to identify problems such as: TTTS; twin reversed arterial perfusion (TRAP); early-onset fetal growth restriction; the presence of congenital malformations (especially cardiac abnormalities)[4]; selective fetal growth restriction (defined as a difference in weight of 25 per cent or more between twins); and twin anaemia and polycythaemia sequence (TAPS). When such findings are evident, appropriate referral to a tertiary centre with a maternal-fetal medicine unit is recommended.

TAPS is diagnosed by performing fetal middle cerebral artery peak systolic velocity (MCA PSV) in both fetuses: MCA levels above 1.5 multiple of the median (MoM) (anaemia) in one twin and less than 0.8 MoM (polycythemia) in the other are diagnostic. In these twins, there is usually a large inter-twin discordance of haemoglobin levels without an amniotic fluid discordance. This is seen in both uncomplicated MCDA twins and in MCDA twins treated with laser photocoagulation. The vessels involved are usually very small and deep, hence treatment with laser photocoagulation may not correct the process. Antenatal treatment remains a difficult decision in these twins and it is vital to alert the treating neonatal team when TAPS is suspected before delivery.

Thanks to frequent monitoring and standardised criteria, early recognition and management of complications in MCDA pregnancies has improved in recent times and enhanced efforts are now directed towards the monitoring of uncomplicated monochorionic twins. There has been ongoing debate on the timing and mode of delivery of uncomplicated MCDA twin pregnancies. This is important because of an increased incidence of unexplained

stillbirth in uncomplicated MCDA twins and acute intrapartum TTTS. Most complicated MCDA twins are delivered before 36 weeks gestation. For otherwise uncomplicated MCDA twins, the risk of stillbirth rises steadily with gestational age. This was demonstrated by a recent meta-analysis in which the rate of stillbirth per 1000 uncomplicated MCDA twin pregnancies increased steadily from 32 to 37 weeks. When compared to uncomplicated dichorionic pregnancies, the odds ratio for stillbirth per pregnancy at 32, 34 and 36 weeks gestation were found to be significantly higher. This information should be weighed against the risk of prematurity when planning timing of delivery in uncomplicated MCDA twins.[5]

MCMA twin pregnancies occur rarely, representing about one per cent of cases of monozygotic twins. It is generally believed that monoamniotic twins are at high risk of fetal death and neonatal morbidity, secondary to umbilical cord entanglement, prematurity and congenital anomalies. They undergo ultrasound surveillance fortnightly and debate continues as to whether inpatient management improves perinatal outcomes. It is estimated that the risk of sudden, unexpected stillbirth in monoamniotic twins remains somewhere between five per cent and ten per cent after 32 weeks gestation. Because of this continuing risk, elective delivery after the administration of antenatal corticosteroid therapy is recommended by 32 weeks gestation.

One of the important causes of fetal death in MCMA twins is cord entanglement. Medical amnio-reduction with Sulindac has been studied in a small number of patients with the intention of stabilising fetal lie and, hopefully, preventing cord accidents.[6] However, a recent systematic review of cord entanglement in MCMA twin pregnancies revealed that the increased risk of neonatal morbidity and mortality in these pregnancies was owing to multiple factors such as TTTS, prematurity and congenital anomalies, not only cord entanglement.[1]

Intrauterine death of one fetus in a multiple gestation during the second or third trimester complicates between 0.5 per cent and 6.8 per cent of twin pregnancies and can have severe sequelae for the surviving fetus. Monochorionic twins are at a several-fold increased risk for a single fetal death compared with dichorionic twins. The aetiology of IUFD in a multiple pregnancy may be owing to genetic or anatomic anomalies, placental insufficiency or cord abnormalities, such as a velamentous insertion. In monochorionic pregnancies, 25–35 per cent of IUFDs are associated with TTTS.

Single IUFD in a multiple gestation can cause multicystic encephalomalacia and/or multi-organ damage in monochorionic pregnancies, preterm labour and delivery in both dichorionic and monochorionic twins; as well as maternal consumptive coagulopathy.[1] Aside from the chorionicity of a twin pregnancy, the gestational age at which a single IUFD occurs is important. In MCDA and MCMA twin pregnancies, single IUFD causes significant neurological sequelae when the death happens in the second trimester. Owing to a 20 per cent risk of neurological sequelae in the survivor if delivery occurs at this gestation, immediate delivery is not recommended. Follow-up ultrasound scan and fetal MRI two to three weeks after the event helps in counselling and appropriate management. The goal is to optimise the outcome for the survivor, while avoiding prematurity and its potential adverse sequelae.

Infants from a twin pregnancy are at a higher risk of death in the peripartum period than are infants from a singleton pregnancy. Some of this increased risk is owing to a higher risk of preterm birth. In addition, the second-born twin has an increased risk of a poor perinatal outcome compared with the firstborn twin. A policy of planned vaginal birth for women with a twin pregnancy in a hospital setting is associated with a 30–40 per cent rate of emergency caesarean section. Among those twins in which the first twin is born vaginally, there is still a risk of emergency section for the birth of the second twin. It is possible that some of the adverse outcomes may be avoided by appropriately timed delivery by caesarean section.[8] However, a recent randomised twin birth study has shown that there is no difference in the neonatal mortality or serious morbidity between delivery by caesarean section and vaginal delivery. The study had a strict protocol that was adhered to and among the group randomised to vaginal delivery only 56.2 per cent delivered vaginally and 39.6 per cent had caesarean section.[9]

Women with multiple pregnancies need introduction to support systems in the antenatal period. Mothers of multiple births face higher rates of postpartum depression and twin births may be associated with longer term parental divorce.[10]

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Investigation and management of stillbirth

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Stillbirth is one of the most emotionally devastating pregnancy outcomes for patients, their families and healthcare providers.

In 2006, in Australia, stillbirth occurred at a rate of 7.4 per 1000 births.[1,2] The management of stillbirth involves providing compassionate care, investigating for identifiable causes, managing delivery and providing postpartum care with ongoing support.

Antepartum management

Clinical history

Identification of a cause for stillbirth can help provide closure to grieving patients and their families, and can aid in the planning and management of future pregnancies.[3,4] Thorough clinical history is a vital component of stillbirth evaluation. This includes past obstetric history, maternal medical history and antenatal history, noting any medical conditions complicating the pregnancy, anomalies identified on ultrasound, infections, abdominal trauma and exposure to toxins.[3] Family history should include recurrent pregnancy losses, thromboembolic disorders, congenital abnormalities, hereditary conditions and consanguinity.[3] An ultrasound scan is recommended to confirm the diagnosis of fetal demise, look for fetal anomalies and measure amniotic fluid volume.[1,2]

Karyotype

Fetal karyotyping should be encouraged. Abnormal karyotype is detected in 8–13 per cent of all stillbirths[4] and in more than 20 per cent of those with structural anomalies or intrauterine growth restriction.[4] Samples obtained antenatally via amniocentesis are more likely to yield viable cells for successful culture, than samples obtained from the placenta, cord or fetus after delivery (85–100 per cent versus 13–35 per cent).[5] Amniocentesis can also provide a sample for microbiological culture. If amniocentesis is not possible, samples for karyotype can be taken from the placenta below the cord insertion site including the chorionic plate, an umbilical cord segment closest to the placenta, or fetal cartilage from the costochondral junction or patella.[3,4] Fetal skin samples are suboptimal.[4]

Maternal investigations

Maternal investigations taken prior to delivery may help to exclude many causes of intrauterine fetal demise. Recommended maternal blood tests are listed in Table 1. Low vaginal/peri-anal swabs should also be taken for culture.

Delivery

Environment

Where practicable, bereaved parents should be offered a private room away from other postnatal and antenatal patients. Continuity of care by midwifery, medical and support staff may also be helpful.

Timing

Timing and mode of delivery are dependent on gestational age, obstetric history, maternal preference and clinical circumstances.[3,4] In most cases, there is no necessity for urgent delivery, however, a majority of patients prefer early delivery to expectant management. Around 80–90 per cent of patients will labour spontaneously within two weeks of fetal demise.[4] Consumptive coagulopathy associated

Table 1. Maternal blood tests recommended for all stillbirths.

At diagnosis of fetal death	Additional thrombophilia studies at 8–12 weeks postpartum*
• Full blood examination and smear for nucleated red cell count • Blood group and antibody screen • Kleihauer • Renal function tests, including urate • Liver function tests, including bile acids • Thyroid function tests • HbA1c • Cytomegalovirus, toxoplasma and parvovirus B19 serology • Rubella and syphilis serology (if not already done antenatally) • Thrombophilia studies – Anticardiolipin antibodies – Lupus anticoagulant – APC resistance	• Anticardiolipin antibodies (repeat if positive at diagnosis) • Lupus anticoagulant (repeat if positive at diagnosis) • Factor V Leiden mutation (if APC Resistance positive at diagnosis) • Fasting homocysteine • MTHFR3 gene mutation (if fasting homocysteine positive, or in presence of cleft lip/palate, neural tube defects or congenital cardiac defects) • Protein C & S deficiency • Prothrombin gene mutation 20210A • Antithrombin III * Required in presence of: fetal growth restriction, pre-eclampsia, maternal/placental thrombosis, maternal/family history of thrombosis, positive thrombophilia testing at diagnosis of fetal demise or unexplained stillbirth.

Adapted from: Perinatal Society of Australia and New Zealand Perinatal Mortality Audit Guideline; Second edition, Version 2.2, April 2008. Section 5: Investigation of Stillbirths; Appendix 1.

with prolonged fetal retention is due to thromboplastin release from the placenta. It is an uncommon occurrence[3,4], particularly in the first four weeks after fetal demise.[6]

Mode of delivery

In general, vaginal delivery is preferable to caesarean section, as maternal risk minimisation is the main priority and fetal welfare is no longer an issue.[3,4,2] However, patients should be managed on a case-by-case basis.

A 2010 Cochrane review compared vaginal misoprostol to other induction methods for termination of pregnancy in the second or third trimester for fetal demise or fetal anomalies. Vaginal misoprostol was as effective as other prostaglandin preparations and more effective than oral misoprostol in inducing labour and achieving vaginal birth within 24 hours. There were fewer maternal gastrointestinal side effects, but information on rare adverse outcomes, such as uterine rupture, was limited.[7]

Prior to 28 weeks gestation, vaginal misoprostol is generally the accepted method of induction. It has been shown to be 100 per cent effective in achieving vaginal delivery within 48 hours.[8] Regimes vary between institutions, but are typically 200–400mcg vaginally every 4–12 hours.[3] In patients with a prior uterine scar, evidence supports the use of vaginal misoprostol.[3] Many institutions use a reduced dose protocol; however, as uterine rupture is such a rare event, data on the optimum dose and administration route are limited.[3]

Early stillbirths (less than 24 weeks) may be suitable for dilatation and curettage, however this requires an experienced operator and may limit the efficacy of autopsy for detecting gross fetal anomalies.[3]

After 28 weeks, either misoprostol or syntocinon are acceptable induction agents. Syntocinon dosing is in accordance with standard labour protocols and may be preceded by cervical ripening with misoprostol or dinoprostone (in patients without a uterine scar) or transcervical catheters (in patients with a uterine scar) where required.[2] There is limited evidence regarding patients with previous classical caesarean section and such patients should be managed on an individual basis.[3]

Postpartum management

Placenta

Macroscopic and microscopic examination of the placenta, cord and membranes may reveal abruption, umbilical cord thrombosis, velamentous cord insertion or vasa praevia.[4] Umbilical cord knots should be interpreted cautiously as most true knots are associated with live births.[4] Swabs should be also taken for culture. Histology specimens should be submitted fresh and unfixed[1], accompanied by appropriate clinical details.

Autopsy

Autopsy is perhaps the single most important investigation in the workup of a stillbirth.[4] In 26–51 per cent of cases, it yields new information which influences counselling and future pregnancies.[4] Autopsy findings can alter the estimated risk of

recurrence of stillbirth and may change recommendations for future preconception, antenatal and neonatal management, as well as aid in the grieving process.[9] When discussing autopsy, compassion and sensitivity are paramount. Its potential benefits should be discussed, while acknowledging and respecting the family's personal, religious and cultural beliefs.[4] This discussion should be provided by a senior clinician with sufficient understanding of the procedure involved.[1] Many parents are not comfortable with a full autopsy and options for limited or step-wise autopsy should be discussed. This may include examination by a pathologist, clinical photography, full body X-ray, ultrasound scan or magnetic resonance imaging (MRI).[2] Ample time should be allowed for consideration and written information may be helpful. If desired, parents should also be given as much time as possible with their baby before autopsy. Written consent must be provided and should accompany the autopsy request, along with comprehensive clinical and obstetric histories and copies of the death certificate and ultrasound reports.

Regardless of whether or not an autopsy is requested, a detailed examination of the baby should be undertaken and any abnormalities photographed. Surface swabs (ear and throat) should also be obtained for culture.[1] Cord or cardiac blood samples should be taken for microbiology, full blood count and Guthrie test.[1]

Counselling and support

Bereavement support officers are available in most hospitals and can serve as an individual point of contact to assist and support patients and their families in the early stages of grief.[10] They can also provide advice on what to expect in hospital, legal requirements, funeral preparations and arrange support after discharge from hospital.[10]

There is a legal obligation to arrange a burial or cremation for all stillborn babies that are, by definition, born after 20 completed weeks of gestation or weighing 400g or more and showing no signs of life at birth.[2] Birth registration is also required and social workers can assist patients in completing documentation and accessing government entitlements. They can also link patients with support groups, such as Sands, which provide support and information to parents and their families.[11] All patients should also be offered psychological counselling.

Memories

For many parents, creating memories of their baby can assist in the grieving process.[1] If desired, they should be allowed to parent their baby by holding, bathing and dressing them. Some parents may wish to take their baby home for a period of time and every effort should be made to accommodate this request. Cultural and religious beliefs should be respected and pastoral care referral offered if appropriate. Some families may wish to hold a baptism/ blessing while in hospital.

If a name has been chosen, health workers should refer to the baby by name.[3] Special mementos such as cot cards, blankets, hand/ footprints and photographs can also be helpful in the grieving process.[1] If parents do not wish to keep such mementos, they may be stored in the health record and parents advised that they can access them in the future, should they change their minds.[2] Organisations such as Heartfelt offer free photographic memories to parents of stillborn babies.[12]

Follow-up

Where medically appropriate, early discharge with midwifery home follow-up should be offered.[2] Lactation suppression and contraception are vital postpartum considerations, which should be discussed with all patients.[2]

Arrangements should be made for a follow-up consultation for results and counselling. This appointment should ideally take place within the first six to eight weeks.[2] Patients should be made aware that even with thorough investigation, a cause for the stillbirth may not be identified.[3,4] Referrals for genetic counselling and psychiatric services should also be considered where indicated.

The general practitioner should be advised of the death as early as possible and should be provided with a comprehensive clinical summary and results of investigations when available.

Risk of recurrence

The risk of recurrent stillbirth in future pregnancies will depend on the clinical circumstances and investigation results. Low-risk patients who have suffered an unexplained stillbirth, have a risk of recurrence of 7.8–10.5 per 1000.[3] This rate may be higher for women with medical conditions or previous obstetric complications. Advice regarding management of future pregnancies should be individualised and is beyond the scope of this article.

As obstetricians, we will all encounter stillbirths during our careers. By providing appropriate medical advice and treatment, along with sensitive care and support, we will hopefully offer some comfort to vulnerable patients and their families during what is likely to be one of the most difficult experiences of their lives.

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Reporting and investigating

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Chief Coroner of New Zealand

Infant and youth deaths and the role of the Coroner – an inside perspective from New Zealand.

Some of the most troubling cases that New Zealand Coroners encounter in their daily working lives are deaths of infants and children. These cases are particularly sensitive due to the understandably high levels of emotion and grief involved at the same time as coronial processes and the beginnings of investigations must start to take place. Furthermore, there is often also a strong public interest in the deaths, owing to the vulnerability of infants and children.

The Coroner's role is to help prevent deaths and promote justice through the investigation of the causes and circumstances of sudden or unexplained deaths, or deaths in other special circumstances. Coroners also have an important role to play in the prevention of death, with the duty to make recommendations or comments where necessary that may prevent future deaths in similar circumstances. Deaths without known cause or for which no doctor's certificate is given must be reported to the Coroner. Similarly, deaths occurring during medical treatment, or while the woman concerned was giving birth must be reported. Coroners will make a decision as to whether to accept jurisdiction upon looking at the circumstances of the case and after having taken account of any concerns expressed by medical professionals or family members involved.

The jurisdiction of Coroners is not confined by the narrow definitional scope of perinatal death. In fact, most Coroners' cases fall outside the ambit of perinatal deaths, which is defined as deaths occurring from 20 weeks gestation, or a birth weight of at least 400g, until 28 days old. Between 1 July 2007 and 30 June 2013, New Zealand's Coroners dealt with 216 perinatal deaths, which included deaths resulting from natural causes, Sudden Unexpected Death in Infancy (SUDI) and deaths from other external causes.

Under the Coroners Act 2006, Coroners do not have jurisdiction over stillbirths. The most common cause of infant death that does come before Coroners, SUDI, usually falls within the period of one month to one year after birth. Coroners' jurisdiction is not constrained by any age differentiation, as infancy merges into childhood which then merges in turn into youth. Therefore, generally the scope of youth deaths will cover from birth to full legal age (generally being 18 years old). This means that the causes of deaths for youths that come before the Coroner can range from SUDI to suicide, as well as a large number of other natural and external causes.

Perinatal deaths made up about 22 per cent of those cases before Coroners of children aged five and under. Information from Coronial records (see Table 1 and Figure 1) shows the breakdown of causes of death in persons aged five years old and under (including perinatal deaths) for the period 1 July 2007 and 30 June 2013.

SUDI and unsafe sleeping arrangements

Along with many other comparable jurisdictions, there has been a dramatic drop in the death rate in New Zealand in the category of SUDI deaths. It would appear that the 'back to sleep' initiatives of people such as Prof Ed Mitchell, Auckland University, Safekids and others have been a substantial background factor.

Unfortunately, SUDI deaths in New Zealand have been very much a phenomenon among Maori babies, and of the approximately 60 or so deaths that come to attention each year, many occur in a co-sleeping situation. Between 1 July 2007 and 30 June 2013, Coroners dealt with close to 380 deaths of infants where there was no ascertained cause of death and a finding of SUDI was made. About 65 per cent of these involved unsafe sleeping arrangements or co-sleeping situations. Coroners have made a number of recommendations in this area. These have primarily been directed at health agencies, and those services providing information and support to parents with young infants. In recent years preventing parents from bed sharing has been met with resistance from both cultural aspects and also because it promotes breastfeeding (which is considered protective for SUDI). More detail on the many recommendations made by Coroners in this area can be found on the Coroners' Court's online database of recommendations found at: www.nzlii.org/nz/cases/NZCorC/ .

Table 1. Perinatal death categories (1 June 2007 – 30 June 2013).

Categories of perinatal death	Number of perinatal deaths
Natural causes/complications from childbirth	157
SUDI	53
Homicide/assault	3
External causes (other)	2
Total	**215**

Source: Data from the Office of the Chief Coroner.
Includes provisional data where final cause of death may not be determined.

As stated above, a Coroner's primary function is to ascertain the true circumstances of death and, where appropriate, to make recommendations or comments. While Coroners conduct investigations, gather evidence and present the facts, it is largely left to the experts to reach an analysis from those facts. Much effort has been put into investigating the potential role of cardiac inherited diseases in SUDI deaths, with the active encouragement of Dr Jon Skinner of Auckland Starship Hospital, and the support of ADHB LabPlus in Auckland with the Auckland Forensic Pathologists. Currently, with the assistance of a Health Research Council grant, there is an intensive nationwide case-control study of SUDI deaths under the direction of Prof Mitchell. The Office of the Chief Coroner cooperates with the study in order to contribute to a much more in-depth investigation of the surrounding circumstances of SUDI deaths.

Deaths shortly after birth

There has been a number of emotionally charged coronial investigations in this area. The most difficult cases typically occur either after a termination where the fetus displays signs of life, or a natural or induced live birth where the baby is in a perilous state and dies shortly afterwards. Unsurprisingly, this can be a particularly fraught situation as a Coroner's necessary involvement (whether it be in the form of making enquiries or directing a postmortem) may be perceived as an unwelcome interference at such a difficult time. Although Coroners have the jurisdiction to order a postmortem in these types of case, if it is established that a death was in fact a stillbirth the Coroner ceases to be involved.

Where the death does not fit within the definition of stillbirth, there will sometimes be a rather intensive inquiry or investigation in order to determine if the fetus did show any independent signs of life. The recent case of Coroner Matenga's into the death of baby Adam Barlow provides a stark example of the complexities of this type of situation. Adam Barlow was a term baby who was born by emergency caesarean section in October 2009. He had been born floppy and unresponsive; however, aggressive attempts were made to resuscitate him. He died shortly after birth owing to intrapartum asphyxia. He was pronounced as a stillbirth by the paediatrician in attendance.

In December 2009, Adam's parents felt that the midwifery care the mother had received contributed to the death of their son and they requested a coronial inquiry to be opened. Despite the paediatrician's conclusion at the time that Adam was a stillbirth, the Coroner received evidence that Adam had been assessed by nurses as having a faint heartbeat when born. This is a sign of life and therefore Adam could not be classed as a stillborn child. The Coroner concluded that Adam's death should have been reported to the Coroner as at the time of his birth he was undergoing resuscitation (a medical procedure under section 13(1)(c)(i) of the Coroners Act 2006). Therefore, in February 2010, the Coroner determined that he had jurisdiction to open an inquiry and consider the circumstances of baby Adam's death.

Conclusion

The category of perinatal deaths forms only a small part of the Coroner's wider responsibilities. Coroners play an important and necessary role in investigating the causes and circumstances of death, and the prevention of future deaths in similar circumstances. In the case of infant and youth deaths, the Coroner must discharge these duties while also traversing jurisdictional issues and being sensitive to the views of families at a time of tremendous grief and loss.

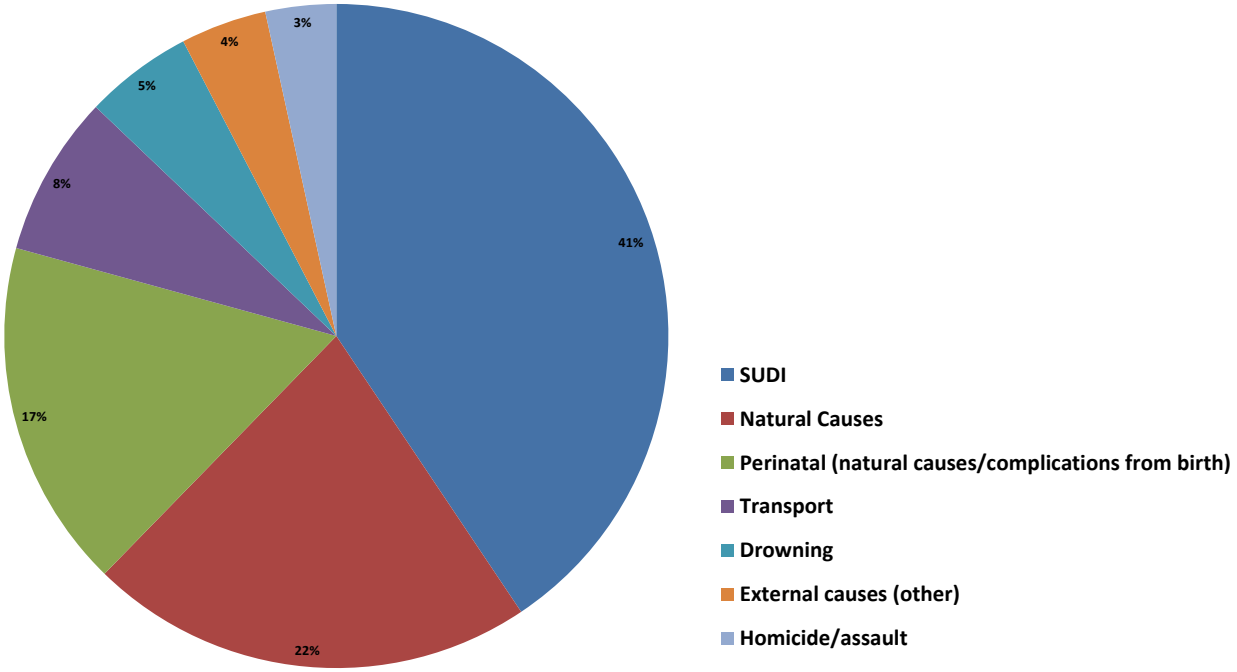

Figure 2. Categories of death for five year olds and under from 1 June 2007 to 30 June 2013 (n=931).
Source: Data from the Office of the Chief Coroner. Includes provisional data where final cause of death may not be determined.

A pathologist's perspective

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The practical applications of pathology in cases of perinatal death or termination of pregnancy for fetal anomolies.

The death of a baby or termination of pregnancy for fetal anomalies is a difficult time for many families. In this situation, pathology provides important information for the family, clinical team and even the wider community. However, not all clinicians are familiar with the perinatal pathology system. These are some of my comments and observations, after several years working in perinatal pathology.

Legalities and preliminaries

One of the first things that we tell our pathology trainees, on hearing about an autopsy, is to check the paperwork – consent, perinatal death certificate and clinical notes. Although this sounds fairly routine, there are unexpected traps for the less experienced. For example, signed consent is not legally required for fetuses less than 20 weeks gestation. However, many pathology laboratories request signed consent for fetal autopsies at any gestational age. In some laboratories, this will also need to be signed by a 'designated officer' of the hospital. Each hospital has its list of designated officers, usually from medical or nursing administration. An error that sometimes occurs is for the doctor seeking consent to sign as the designated officer.

Sometimes parents are unable to consent to a full autopsy, but agree to a partial autopsy. Partial autopsies, postmortem imaging or multiple needle biopsies do not provide the same information as full autopsies and prior discussion with the perinatal pathologist is helpful to clarify their likely limitations and usefulness. Specific consent may be required for dissection of organs/tissues not included in the standard autopsy procedure; for example, removal of limb bones in cases of skeletal dysplasia. Consent forms and information about autopsy consent and procedures can be obtained from perinatal pathology laboratories. A perinatal death certificate is required for fetuses of 20 weeks gestation or older. If these documents are not provided, the autopsy will be delayed until they are received. As degenerative changes occur after death, delay of the autopsy examination may limit its usefulness.

Lack of adequate clinical information can be another cause of delay; the clinical notes of both mother and infant are required. Scan reports, laboratory test results, discharge or clinical summaries and birth summaries can supply much information and copies of these should accompany the consent form. Phone discussions with the pathologist prior to the autopsy are often helpful. Some of the clinicians in our institution also send emails prior to the deliveries, giving brief details about impending autopsy cases. This is much appreciated by pathologists, as it gives an opportunity to plan ahead and also allows time for discussion about any special tests or procedures that may be required; for example, muscle biopsies or metabolic tests, which must be collected as soon as possible after death (preferably within two hours).

Scope of pathological findings

The autopsy and placental examinations often provide information to guide management of future pregnancies. The autopsy findings may suggest the sequence of events that led to fetal death, give information about fetal nutrition and growth, complications of medical care, occurrence of trauma, haemorrhage and infection. The degree of maceration in a stillborn infant may suggest an approximate time of fetal death in utero, but many factors affect the changes that occur after death, so that an exact time of death cannot be given. Congenital anomalies can be documented, some of which are associated with a familial or recurrence risk. This is helpful for counselling for later pregnancies. Negative findings are also important in this context. However, in about a third of cases, careful examination of the placenta and fetus at autopsy fails to reveal a specific cause of death, especially for fetal demise after 35 weeks gestation.[1] Fetal autopsies provide an audit for clinical policies and practices and information for regional and national statistics. Research opportunities should not be overlooked.

> 'Fetal autopsies provide an audit for clinical policies and practices and information for regional and national statistics. Research opportunities should not be overlooked.'

Procedures

Clinical photographs, babygram X-rays, external examination and measurements are done before opening the body cavities. In some cases, tissue is removed for genetic studies and stored, so that material will be available for genetic testing if required in the future. It is preferable to send the fetus fresh (not in formalin), as dissection is easier and material can be obtained for microbiology, genetic studies or other ancillary tests as required. The standard autopsy procedure involves opening the thoracic and abdominal cavities and head. The incisions are placed so that they will be covered when the baby is clothed, if the parents wish to view the baby later. The body structures and organs are examined and the major organs weighed. Fetal weights and measurements are compared to normal values obtained from standard biometric charts, such as those published by Phillips et al.[2] The organs are replaced and the body is reconstructed after the examination is completed and samples have been removed for further tests. The brain is soft and pathological examination is very limited if cut in the fresh state. The pathologist may therefore wish is to retain the brain for fixation for a few days, before examination and dissection, after which the brain can be replaced in the body. This may delay completion of the autopsy for one or more days, but can be discussed with the pathologist before the autopsy.

Autopsy reports
Some laboratories issue a preliminary autopsy report within one to seven days of the autopsy, listing the macroscopic findings. The final autopsy reports often include other ancillary tests, such as genetic screening tests, radiology, microbiology results and clinico-pathological correlations, and are not usually available for one or two months.

Placental examination

Indications for placental examination
The placenta gives an indication of what happened during pregnancy. The placenta can provide information needed for early neonatal care, reproductive planning, risk assessment for infant neurological outcome and medico-legal issues.

For practical reasons, not all placentas can be examined. Indications for placental examination include maternal issues (pre-existing disease, infection/fever, gestational hypertension, haemorrhage, biophysical or biochemical monitoring abnormalities); fetal/newborn issues (intrauterine fetal demise or growth restriction, hydrops, prematurity, congenital anomalies, suspected infection, haematological abnormalities); or gross placental abnormalities. This information should be included in the placental request form.

Pathological examination of the placenta
Pathological examination of the placenta is essential in the investigation of stillbirths. One study found that the cause of fetal death could be explained by placental examination alone – without autopsy – in 48.1 per cent of cases, while 69.2 per cent of cases showed placental changes that could explain fetal/infant death and only 16.3 per cent of deaths could be explained by autopsy alone.[3]

Gross examination of the placenta may suggest clinical correlates (see Table 1). Gestational age should always be stated on the pathology request form so the pathologist can correlate this with measurements, including placental weight and microscopic findings such as villous morphology. Details of labour are also useful for clinicopathological correlation. For example, histological subchorionitis (acute inflammatory cells in the fibrin layer beneath the chorionic plate) evolves within hours following membrane rupture, which may occur when membrane rupture precedes delivery by six or more hours, even in the absence of clinical chorioamnionitis.[4] Much clinical information is present in the birth summary and it is useful to attach this to the placental request form. If special studies are needed, for example, injection of fetal vessels for assessment of vascular anastomoses in monochorionic twin placentas, this should be discussed with the pathologist before sending the specimen.

Placental pathology report
The placental report often indicates the presence and severity of the lesions and risk of recurrence. Schemata exist for specific lesions, for instance, the duration (stage) and intensity (grade) of both maternal and fetal inflammatory responses in cases of acute chorioamnionitis. Studies have found an association between some placental abnormalities and fetal neurological compromise,

Table 1. Gross findings and their significance.[5]

Cord length		**Placental weight**		**Discoloured placenta**
Short or flat umbilical cord	• Poor fetal activity • Neuromuscular compromise • Oligohydramnios • Associated with limb/body wall complex, gastroschisis	Light placenta (<10th percentile for gestational age)	• Chronic uteroplacental insufficiency • Chromosomal anomalies • Maternal tobacco use • Congenital infection	Brown: hemosiderin Green: meconium Yellow: chorioamnionitis
Long or hypertwisted umbilical cord	• Increased fetal activity • Polyhydramnios • Heart failure (increased distance to pump) • Increased risk of cord accident	Heavy placenta (>95th percentile for gestational age)	• Hydrops placentalis/fetalis • Macrosomia, infant of diabetic mother • Beckwidth-Weidemann syndrome • Triploidy	

Table 2. Placental findings and their relative timing to delivery.[5]

Findings associated with chronic in utero compromise (>48h, usually weeks)	**Findings associated with acute in utero compromise (<18 h)**
• Placental trimmed weight: <10th or >99th percentile for gestational age • Short or long umbilical cord (expect 40–70cm at term) • Hypertwisted or hypotwisted umbilical cord (normally one twist per 3cm) • Amnion nodosom • Multiple or large placental infarcts (>5% of placental mass) • Decidual vasculopathy • Chronic abruption • Maternal floor infarction • Necrotising funisitis • Chronic villitis • Fetal thrombotic vasculopathy	• Normal placental weight • Acute villous edema • Intravillous hemorrhage • Acute abruption • Meconium not involving umbilical cord (if <40wk) • Findings associated with subacute in utero compromise (18–48h) • Chorangiosis • Normoblastemia • Necrotising acute chorioamnionitis • Meconium in umbilical cord and/or meconium myonecrosis

such as diffuse severe acute villous oedema and cerebral palsy and marked chorionic plate vasculitis and other forms of neurological compromise.[5] The significance of some findings such as umbilical cord coiling may not be fully understood[6], but such findings are still included in pathology reports, as currently available studies suggest they are probably significant and further studies may indicate their full relevance. Placental findings may have medicolegal implications, for example, the presence of chronic placental abnormalities (such as infarcts or maternal decidual vasculopathy) suggest that fetal damage occurred antenatally rather than perinatally (see Table 2) and also document possible predisposing factors for poor fetal outcome.

Postscript

The best outcomes in perinatal pathology can be achieved only if there is coordination and cooperation between pathology and clinical teams. Good communication and organisation are essential for this.

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An essential investigation

The role of the perinatal autopsy in the new millennium.

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The perinatal death rate in Australia ranges between 8.4 and 10.6 deaths per 1000 total births, while the fetal death rate is 5.5 to 7.0 deaths per 1000 total births.[1] Across the world, it has been estimated that at least 2.65 million babies are stillborn each year.[2] In Australia, one in every 140 babies are stillborn, a figure that represented a loss to 2188 families in 2008.[3] Such a loss can be very difficult for parents, their families and the healthcare professionals caring for them to understand and accept.

The autopsy still remains the 'gold standard' in diagnostic evaluation of the causes of perinatal death.[4,5] Information gained from an autopsy provides an independent assessment of events surrounding the death of a baby for both the family and health professionals, often relieving the woman and her physician of blame. The autopsy can assist future pregnancy and delivery options by determining the magnitude of any recurrence risk, and helping point to different management strategies.[4-7] Studies show new information, unsuspected prior to birth, is gained from perinatal autopsies in between a quarter and a half of all cases.[4-7] Identification of the exact pathology and cause of death can advance medical knowledge by allowing clinicians to monitor and validate therapies, providing information that can eventually improve clinical practice through research. Studies continue to validate the autopsy as an important source of clinically relevant information, a teaching tool and a quality assurance measure.[8]

The classical complete perinatal autopsy involves a comprehensive assessment of the baby (external examination including standard measurements, internal examination with dissection, photographic documentation of external and internal features, histologic evaluation of tissue biopsies, radiology, DNA storage, cytogenetics +/- microbiology and metabolic screens), placenta (macroscopic, microscopic +/- cytogenetics and microbiology) and mother (history, examination, haematological, biochemical and microbiological tests). Between one-third and a half of the time, the cause of death will be placental[9] and in the remainder of cases, either a maternal and/or baby pathology will be to blame. Currently, about ten per cent of the time no cause of death will be found despite a classical complete autopsy examination[4], and this rises to 28–41.5 per cent in the stillbirth group, depending on whether an autopsy is performed.[3]

The classical complete autopsy examination needs to begin with a review of the clinical history, prenatal laboratory studies, any radiologic images and a discussion of the clinical questions with the clinical provider and/or genetic counsellor.[10] Guidelines have been developed by a multidisciplinary team within the Perinatal Society of Australia and New Zealand (PSANZ) with 'the purpose of providing a systematic approach to the investigation and audit of perinatal deaths across Australia and New Zealand and to enhance the provision of appropriate care for parents.' The guidelines are available on the website: www.psanz.com.au/special-interest/perinatal-mortality-group/psanzcpg . These guidelines have recently been updated and still consider the classical complete autopsy to be the gold standard.

There is increasing interest in noninvasive postmortem imaging studies, such as conventional radiography (X-rays), computed tomography (CT), and magnetic resonance imaging (MRI) as valuable alternatives and/or addition to the classical conventional autopsy.[10-13] The main value of these imaging techniques is they are non-invasive and the digitally stored data can be reviewed at any time. The main disadvantages are that, like a pathologist performing the dissection and histological assessment of tissues, these imaging techniques require special expertise for interpretation and there is limited access to MRI, and to a lesser extent CT, for live patients let alone postmortem ones.

X-rays are considered a standard part of the classical complete autopsy examination and are an essential tool in confirming or rejecting an antenatal diagnosis of a skeletal dysplasia, for example.[10] Plain X-rays also assist the pathologist in determining the gestational age of a baby and can provide important information in the advent of trauma. Identification of fractures, in the absence of trauma, can direct additional molecular diagnostic and/or biochemical studies toward disorders of collagen synthesis, such as osteogenesis imperfecta.[10]

Postmortem MRI has been used for nearly two decades, and its use and evaluation have expanded in recent years. MRI provides excellent visualisation of soft tissues and most organs, but has poor delineation of bony structures and in the detection of cardiac abnormalities.[10,12] MRI is particularly helpful in the evaluation of structural abnormalities of the brain and spinal cord[12], because of the difficulties of assessing perinatal brains owing to the rapid onset of softening and the difficulties in detecting small and subtle abnormalities.[11-12] Most studies have shown, apart from examination of the brain and spinal cord, MR imaging rarely provides more information than a classical complete autopsy.[12]

The UK Department of Health, in 2004, commissioned research into postmortem MRI. The results of those studies were published this year and have revealed that the cause of death, or major pathological lesion, detected by MRI alone was concordant with conventional autopsy in 79 of 185 fetuses born at less than 24 weeks (42.7 per cent, CI 35.8–49.9), in 58 of 92 fetuses born at more than 24 weeks gestation (63.0 per cent, CI 52.8–72.2) and 85 of 123 children (69.1 per cent, CI 60.5–76.6). Overall, MRI was concordant with conventional autopsy in 222 of 400 cases (55.5 per cent, CI 50.6–60.3), was non-diagnostic in 72 cases (18 per cent), discordant in 106 cases (27 per cent) and apparently false positive in six cases (two per cent), despite all radiographers and radiologists having extensive experience with postmortem MRI.

This group also evaluated the use of a minimally invasive autopsy [defined as a postmortem investigation with no incisions or dissection, but with postmortem blood sampling via needle puncture]. The procedure included a review of the cases' clinical history and a summary of the relevant antemortem information, external examination, postmortem MRI, and other postmortem imaging, genetic and metabolic tests (antemortem or postmortem blood sampling), and examination of the placenta or placental tissue. Cause of death or major pathological lesion detected by minimally invasive autopsy was much more acceptable, being concordant with conventional autopsy in 357 (89.3 per cent, 95 per cent CI 85.8–91.9) cases: 175 (94.6 per cent, CI 90.3–97.0) of 185 fetuses at 24 weeks gestation or less; 88 (95.7 per cent, CI 89.3–98.3) of 92 fetuses at more than 24 weeks gestation; and 34 (81.0 per cent, CI 67.7–90.0) of 42 newborns aged one month or younger. The results of these studies may well influence how we study the dead for many years to come.[13]

Postmortem CT imaging can be used to evaluate skeletal abnormalities in a baby. Postmortem visualisation of soft-tissue structures is, however, poor, precluding the use of postmortem CT scanning as a replacement for conventional internal autopsy examination.[10]

In the forensic setting, the use of Virtopsy has been evaluated over the past 15 years in Switzerland. Virtopsy consists of body volume documentation and analysis using CT, MRI and microradiology; and 3D body surface documentation using forensic photogrammetry and 3D optical scanning. These studies have included a small number of babies although the combination of techniques is not currently in routine use in perinatal pathology.[14]

There has been a significant change in public opinion about autopsy in general, and specifically about perinatal autopsy, over the past few years because of a series of high-profile cases in the UK.[12] Education of parents and health professionals about the value of autopsy assessment is thus vital. While the classical complete autopsy assessment is essential in the context of a stillbirth, a more a targeted autopsy can be considered if being performed to confirm or refute antenatal diagnoses, and the family is reluctant to give consent owing to social, religious or psychological reasons. These more targeted autopsies require particularly careful review of antenatal history, examination and investigations but, by their limited nature, can only report on the parts of the body that they access.

In summary, while there has been significant development in our understanding and management of diseases during the perinatal period, at this time, the classical complete autopsy remains the best investigation for a stillbirth or death of a baby in the perinatal period.

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Through tears and heartache

The role of midwives in cases of stillbirth and perinatal death.

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The role of the midwife is to provide support, care, advice and education to pregnant women across the continuum of pregnancy, labour, birth and the postnatal period. For the most part, definitions like this of midwifery conjure up images of joy and happiness not tears and heartache. Words such as death and dying are not usually synonymous with midwifery. Throughout their careers though midwives will be faced with the challenges of caring for women and their families who are experiencing miscarriage; or who find themselves giving birth to a baby that has died or who is not expected to survive once born. Despite the advances in prenatal and neonatal care over the past decade or so, pregnancy and infant loss still affects thousands of families across the country each year. Across Australia, approximately 9.3 per 1000 births each year result in perinatal death (this includes fetal and neonatal deaths)[1] and an estimated one in six diagnosed pregnancies results in miscarriage.[2] Often there will be a midwife at the forefront to provide physical, emotional and spiritual care to these women and their families, guiding them through this unexpected journey.

It may be in the emergency department, supporting a woman having a miscarriage at ten weeks gestation; in the birth unit, caring for a woman birthing a stillborn baby at 38 weeks gestation; or on the ward with a baby who requires palliative care – wherever it may be, midwives who are experienced at providing bereavement care can assist during these traumatic times and have a very important role to play in the journey of this woman, her baby and her family. However, the skills that midwives require to deliver effective bereavement care do not come as second nature to most of us. For the majority of midwives, caring for women and their families experiencing pregnancy or infant loss can be a very challenging and stressful experience. The ramifications of providing inadequate care and support for women and their families during such life events can potentially lead to maternal mental health problems[3] and can also impact on the mental health of all family members involved.[4]

When I reflect on my own nursing and midwifery training, I cannot recall exploring bereavement care in any great detail. This is reflected in studies that claim that the education that is provided to student midwives does not adequately prepare them to deliver effective bereavement care.[3] So, how do midwives develop skills to provide effective bereavement care? Often in maternity units there are midwives who have a particular interest in bereavement care who are a fantastic resource to student midwives and other midwifery colleagues. It important to have opportunities to observe experienced midwives and other healthcare providers at work with women and families experiencing pregnancy or infant loss, as this can be a valuable learning tool. Talking to colleagues experienced in providing clinical facilitation and opportunities for staff to debrief with colleagues, review cases and reflect on one's own clinical practice is very beneficial and should be encouraged. Self-directed learning, such as reading articles and attending courses about perinatal loss and bereavement care, can also be valuable in developing skills in this area.

It is important clinicians have an understanding of the grieving process[3] and acknowledge that individuals experience and display grief in different ways. This, in turn, assists midwives to tailor care to meet the needs of the individual. While having an understanding of the various grief models that exist is beneficial, parental grief is something that can only be fully understood by the parents experiencing it and often there is no end to this grief process. While parents will never get over the loss of a child, there are certainly strategies and supports that midwives can use and access to assist parents in the early stages to find some happiness and peace among all the sadness and trauma. Midwives require empathy to support women and their families throughout this process and an understanding of bereaved parents and the needs that they have. In some cases, midwives rely on their own personal experiences to achieve the level of empathy and understanding that is required, turning their own personal experience to positive use.

Good communication skills are essential for the midwife to provide high-quality bereavement care. Clear and open communication between the midwife, the woman and her family is paramount. This ensures the care provided to the woman and her family meets their needs, and is what is expected and anticipated by the woman and her family on a physical, emotional and spiritual level. It is important the woman and her family feel they are supported to make decisions that reflect their own wishes, morals and their cultural and religious beliefs, without feeling pressured to conform to what a particular clinician feels is the right thing to do. Allowing parents to be involved in the decision-making following pregnancy or infant loss can assist in helping parents feel a sense of control over the situation and help to give them a sense of purpose and meaning.

Being a good communicator also means being a good listener. Women and their families need opportunities to debrief with the staff involved in their care and midwives are in a perfect position to be able to do just this. Parents need be given the opportunity to talk and express their thoughts and feelings and to have reassurance that what they are thinking and feeling is perfectly normal and to know that help is available for them for the moments that they find themselves struggling with their thoughts and emotions. Often bereaved parents will feel more comfortable talking to a midwife about their experience owing to the relationship that has developed between them during this journey together.

In caring for women and their families who are experiencing or who have experienced pregnancy or infant loss, midwives have the opportunity to turn a devastating situation into a positive experience for the woman and her family. At the time, it may be difficult for the woman and family to acknowledge any positivity

surrounding the loss of a baby as parents often find themselves confused as to why this is happening to them. However, it is important parents are supported to find a positive meaning in their experience of perinatal loss as some research suggests failure to do this can result in parents remaining 'angry, emotionally distressed and unable to function normally for any period of time'.[4] As with any birth journey, often the care, compassion and support that a midwife can provide throughout this experience will stay with the woman and her family forever and can result in positive lifelong memories of the experience.

A large part of the midwife's role following the birth of a baby who has died is assisting in creating tangible memories and mementos for the family and this can be seen as a skill in itself. The making and sharing of memories following a stillbirth are associated with better maternal mental health outcomes and it is recognised that mothers value creating memories of their babies and most mothers wished they had more memories.[4] The ritual of creating memories and mementos for the family is not only beneficial for the woman and her family, but can also be very rewarding and beneficial for the midwife. This process can give the midwife a sense of purpose in a situation that can be very confronting, especially for the less experienced. As a midwife, it is reassuring to know that these rituals can have a positive effect on maternal mental health and that this ritual does make a positive difference in the lives of women and their families. Some of the rituals midwives undertake to assist in creating memories include taking footprints and locks of hair, taking photographs of the baby with his/her parents and assisting the new parents to bath and dress their baby. Memory boxes are often used in which to store these treasured memories and mementos.

While preparing to write this article, I came across the following quote from Ronald Reagan, proclaiming October as Pregnancy and Infant Loss Awareness Month in 1988: 'When a child loses a parent, they are called an orphan. When a spouse loses a partner, they are called a widow or widower. When parents lose their child, there isn't a word to describe them.'[5]

I'd like to think that as healthcare providers and as a society we can, together, recognise that a parent is still a parent regardless of whether a baby has lived or died. I feel very strongly that as health professionals we have a responsibility to acknowledge this for the women and their families that we care for and assist parents in acknowledging this important life event. As a midwife, congratulating the family on the birth of their baby can be an extremely powerful and positive statement to make. For some families, this acknowledgement of the birth of their baby from the midwife and other healthcare professionals will be the only time that they hear the word 'congratulations' during the days, weeks and months following the birth and loss of their baby. Many family members and friends simply don't know what to say or feel uncomfortable talking to the bereaved parents about their baby and their experience.

There is a lot in the literature on the impact stillbirth and perinatal loss has on women and their families, but very little on the impact that caring for these families has on the midwifery and medical staff. Stillbirth and perinatal loss has a profound effect on the woman and her family, but these moments in a midwifery and medical career can also dramatically impact our own emotional welfare. Often we are so busy and consumed with concern for the women and their families under our care, we neglect to care for ourselves. Regardless of the level of bereavement training or experience a midwife might have, training and experience often does not provide a defence for the midwife against the emotional distress that may be experienced when caring for women and their families who are experiencing pregnancy or infant loss.

On a finishing note, it is important to remember that providing effective bereavement care to women and their families should not be done in isolation from other health professionals. Our obstetrics and gynaecology colleagues and allied health workers, such as social workers, have an equally important role to play and a collaborative approach to bereavement care will ultimately result in the best care for the woman and her family. This collaborative approach will also ensure better support for the clinicians caring for the woman and her family.

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Care for grieving families

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Through Sands, there are a variety of services available to support individuals affected by reproductive loss. Health professionals, too, can positively influence how families meet and farewell their precious baby.

In 1998, Vicki was ten days overdue with her first baby and preparing to be induced when she was told that a heartbeat could not be found. She delivered an eight pound girl, Aster, whose stillbirth remains unexplained. Cathy's first baby, Megan, was stillborn eight years later in January 2006. She died in utero, most likely due to blood clots trapped in a true knot that had formed in the umbilical cord.

Both girls were wanted, loved and longed for. Dreams had been created. Bedrooms were ready. Homes were waiting. Their deaths were unexpected, traumatic, heartbreaking, life changing.

Each baby was delivered naturally, cared for, bathed, dressed, held, cuddled, introduced to family members, photographed and wept over. As a result of gentle persuasion from a midwife, Megan was flown to Wellington for an autopsy. From there she was cared for by a funeral director until her funeral – her parents had not realised that they could have had her at home. Aster, on the other hand, went home with her parents before she was farewelled and cremated.

Each year, versions of these stories repeat numerous times – around 700 babies die in New Zealand between 20 weeks gestation and one year after birth. Thousands more die prior to 20 weeks gestation – records are not kept on a national basis.

In the vast majority of cases, the parents are devastated. What was to be a time of hope and wonder is suddenly heavy with the deepest of heartaches. 'It wrecked me,' says one mother.

In the midst of the utter devastation, health professionals have an incredible opportunity to positively affect how the parents and whanau (family) meet and farewell their precious baby. Sometimes this may be through just a few words…acknowledging the immensity of the loss, encouraging the parents to look at and hold the baby or suggesting that the baby be given a name, especially if born before 20 weeks, when the birth is not registered. At other times it can be information, offered with clarity and kindness: what an autopsy is and why it might help, options about taking the baby home, physical responses that the mother might expect, such as her milk coming in, or taking some time to stop. One mother remembers a specialist gently pointing out the reality of the journey she and her partner were about to embark on: 'You and your husband are going to grieve differently, and that's okay. Be kind to each other. You have both lost your daughter.' For others, the fact that they were given choices is something they remember with gratitude.

Of course, in many instances, it is difficult to know what to say. There is concern that words might trivialise the depths of the parents' pain. Those of us who have experienced the death of a baby know this well: there is nothing that can be said to ease the immensity of the heartache. However, acknowledgement and care can steer the family in the direction of 'healthy' grief.

In time, many parents also reach out to others who have had to tread similar paths. It can be incredibly empowering to realise that so many of the feelings and emotional responses are ones that are commonly experienced. It is also important to many to realise that, while their baby (or babies) will never be forgotten, it is possible to once again live a full and meaningful, even happy, life – but that this takes determination, courage and time.

Sands New Zealand (www.sands.org.nz) helps connect and support bereaved parents nationwide and many hospitals have a relationship with their local Sands group. We are a voluntary, not-for-profit organisation that provides information and peer support. Our Sands Support Packs, funded by the Ministry of Health, include information on funerals, grief, children's grief, legal requirements, memory making and transportation. They can be obtained by emailing info@sands.org.nz. Sands is also active in Australia (see www.sands.org.au).

Sands volunteers offer a wide variety of support and services to bereaved families, without judgement, no matter what the age or gestation of the deceased baby or infant. Depending on the region, services include phone support, support meetings in the community, online support, newsletters and special events such as during Baby Loss Awareness Week (9–15 October each year) and at Christmas. As a national organisation we also have an active online community, with over 350 parents having joined a private forum available on Facebook. Most Sands groups provide local hospitals with support and memory-making items, such as candles, memory books and teddy bears. Some provide Moses baskets for the baby.

In many regions, Sands volunteers are available to visit families while they are still in hospital. Often it is helpful for bereaved parents to talk with someone who has been there. In some cases they may help the family collect a lock of hair, take photographs of the baby and make hand and footprints; and some offer a free service to create casts of the baby's hands and feet. With so few tangible memories, each of these becomes a special memento for the family in the months and years ahead.

Health professionals, too, can play an important part encouraging families to consider doing some of these things themselves. For example, while photographs are routinely taken for medical purposes, health professionals can encourage the taking of photographs of the

baby with family members or close-ups of the baby's hands or feet or button nose. No one has ever said that they have too many pictures. In cases where the mother is unconscious, health professionals might suggest to a family member that the baby be placed with the mother and photographs taken – in this way she might feel she was able to care for her baby even in her unwell state. Many parents express later a wish that they had opened their baby's eyes.

Health professionals also have an important role to play during a pregnancy after a loss and sometimes later pregnancies as well. These women are often extraordinarily concerned about their baby's wellbeing and understandably so: they know that babies can die. Respecting the pregnant mother's emotional distress, no matter how illogical it may seem, can help her to feel supported and heard.

The death of a baby changes so much: who we are, who we become and how we recreate our futures. It places immense stress on relationships, including those with wider family and friends. In many cases, others do not know what to say or do and parents can end up feeling isolated. In cases where early delivery has been induced for medical reasons, the feelings of isolation can be particularly severe, with parents not always feeling able to share with others what has happened.

Offering dignity and respect to the baby and parents, during each interaction, is critical if the parents are to go on to once again embrace life while, at the same time, gently carrying the memory of their baby or babies with them.

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About the authors

Vicki Culling (PhD) is the principal trainer for Vicki Culling Associates, a NZ company that specialises in perinatal and infant loss training for health and caring professionals. She has worked in the area of bereavement support and perinatal and infant loss for over ten years, primarily through Sands, an organisation that supports parents and families following the loss of a baby or infant. She was a member of the New Zealand Perinatal and Maternal Mortality Review Committee (PMMRC) for six years. She is a bereaved parent whose daughter's stillbirth changed the course of her life in an unexpected yet inspiring way.

Cathy Buntting (PhD) is the immediate past Chair of Sands New Zealand and active in her local Sands group. She sees her work with bereaved parents as a very special part of the legacy of her first child, Megan. She also believes that she is a better mother to her two living children, Carrie and Jayden, because of the lessons about life that Megan was able to teach. Professionally, she works as an education researcher at the University of Waikato.

Reduced fetal movements

How should we manage this common clinical conundrum?

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Most women report initially feeling fetal movements at some time between 18 and 20 weeks gestation and movements are typically experienced earlier in multiparous women compared with women in a first pregnancy. 'Movements' have been defined as any discrete kick, flutter, swish or roll[1], and the first perception of movement has traditionally been called 'quickening'. These fetal movements should continue to be felt following the initial perception of activity and, while the type and nature of movements may change, there is no evidence supporting a reduction of movements as the pregnancy advances.[2]

Fetal movements are reassuring to women and, conversely, a reduction in fetal movements commonly is a cause for concern. Reduced or absent movements have been associated with a poor perinatal outcome[3,4] with a majority of women who have had a stillbirth describing reduced fetal movements prior to the diagnosis.[5] Studies from Norway have shown that an inappropriate clinical response to reduced fetal movements was a common contributing factor in stillbirths.[6]

> 'There is currently no evidence to support a policy of ultrasound assessment for all women presenting with reduced fetal movements...'

Normal fetal movements

Fetal activity indicates a healthy integrity of the fetal central nervous and musculoskeletal systems. A normal healthy fetus will demonstrate periods of both activity and sleep, with fetal movement usually being absent during the sleep phase. It is rare for a sleep phase to exceed 90 minutes in a healthy fetus.

Various methods for counting movements have been proposed, including the perception of at least ten movements over 12 hours of normal maternal activity and the perception of at least ten movements over two hours when the mother is resting and focused on counting. The most vigorously tested definition of reduced fetal movements comes from Moore and colleagues[7], who recommended the definition: 'Less than ten movements within two hours when the fetus is active.' This is also the definition currently used by the American Congress of Obstetricians and Gynecologists (ACOG).

Everybody providing maternity care needs to confront the question: should fetal movements routinely be counted? A recent Cochrane review involving a total of 71 370 women across four trials concluded there was insufficient evidence to support formal fetal movement counting for all women.[8] As mentioned previously, there is a broad range of fetal activity patterns that can be considered 'normal', and the practice of asking all women routinely count movements can be associated with an increase in maternal anxiety.[9] Despite widespread advice to the contrary, there is no evidence to support the advice that a fetus will respond with movements following the mother eating something sweet or drinking a cold drink.

Clinical assessment of reduced fetal movements

The initial aim of those responding to women reporting reduced fetal movements should be to exclude a fetal death and then, subsequently, to exclude fetal comprise and identify pregnancies at risk of a poor outcome. With this in mind, it is important to be aware of the association between reduced movements and fetal growth restriction, placental insufficiency and congenital malformations. Hence, when assessing any woman presenting with reduced movements, a relevant history needs to be taken. This should address any risk factors for growth restriction or placental insufficiency, including previous pregnancy complications and outcomes, and general maternal health. The history should include the duration of the reduction in movements, whether there have been any periods of absent fetal movement and whether this is the first episode the woman has experienced.

A hand-held Doppler can confirm the presence of a fetal heart rate immediately and, once fetal viability has been confirmed and the history has confirmed a reduction in fetal movement, a cardiotocogram (CTG) should be performed to exclude fetal compromise if the pregnancy is over 28 weeks gestation. A normal CTG indicates a functioning fetal autonomic nervous system and usually a healthy fetus.

There is currently no evidence to support a policy of ultrasound assessment for all women presenting with reduced fetal movements, but ultrasound should be performed if the perception of reduced movements continues despite a reassuring CTG tracing, or if there are other concerns about fetal growth restriction, for example, from past pregnancy history or where the fundal height is small for dates. If an ultrasound is to be performed, it should ideally be done within 24 hours of the presentation and should include an assessment of fetal size, amniotic fluid volume and fetal morphology if not already done. There may also be a role for biophysical profile (BPP) scoring to be performed in some cases of reduced fetal movements. The exact place of a BPP is uncertain and the Cochrane review did not support the use of BPP as a test for fetal wellbeing in high-risk pregnancies[10] although there is evidence suggesting fetal demise is rare in women with a normal BPP.[11]

The possibility of a feto-maternal haemorrhage should always be considered, as occasionally reduced fetal movements may be the only indicator of the condition. A sinusoidal pattern on the CTG tracing is a diagnostic, but late, finding and may not be present in

all cases, hence a test for evidence of a materno-fetal haemorrhage such as a Kleihauer-Betke test should be considered.

Management of reports of reduced fetal movements

Concerns about reduced fetal movement are common and most women who have a single episode of reduced fetal movements will have an uncomplicated pregnancy and can be given reassurance following assessment of the fetus. At this point, there are still no data to suggest formal kick charts are of any benefit in this scenario. However, if a woman presents with recurrent episodes of reduced fetal movements, she should be carefully reviewed and an ultrasound performed to exclude fetal growth restriction and any other complicating factor. These women may be at an increased risk of a poor perinatal outcome and the need to deliver should be considered even if the CTG and ultrasound assessments are normal, provided that she is at or near term.

If a woman presents with reduced fetal movements under 24 weeks gestation, then the presence of a fetal heart should be confirmed with a Doppler device, as it should between 24 and 28 weeks gestation, although an ultrasound should also be considered in this group, as early-onset placental insufficiency can occur at this gestation.

Finally, it is important to document the details of any assessment and management of women with reduced movements and to also record advice about follow up and when and where to present if further episodes of reduced fetal movements were to occur.

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After stillbirth, what next?

Management of the subsequent pregnancy after an unexplained stillbirth.

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Stillbirth is, sadly, a common outcome of pregnancy and across the world more than two-and-a-half million babies are stillborn in the third trimester every year.[1] Although record keeping is limited in many parts of the world, it is likely that about 98 per cent of these deaths occur in low- and middle-income countries. However, the rate of stillbirth in Australia is 7.4 per 1000 births and 2206 stillbirths were recorded in 2010.[2] In Australia, the risk of stillbirth is highest in women under 20 years of age and women 40 years or more; for Indigenous women it is more than twice as likely than for non-Indigenous women.[2]

Careful investigation to determine the causes of a stillbirth is important, since knowledge of the aetiology of fetal death may allow informed counselling about risks women and their babies may face in subsequent pregnancy and planning of management strategies.[3,4,5] Unfortunately, no cause for a stillbirth can be found in as many as one-third of cases where the fetal death has occurred antenatally.[2] This distressing situation is usually referred to as 'unexplained stillbirth' or, in the PSANZ classification, 'unexplained antepartum death'. In the strict sense, stillbirth should only be classified as 'unexplained' if a thorough investigation has failed to yield a likely cause. However, for various reasons, investigation of antepartum fetal death is incomplete in many cases, and the term 'unexplored' stillbirth is probably more appropriate.[6]

When perinatal deaths are classified using the PSANZ perinatal death classification (PDC), unexplained stillbirth accounts for almost 16 per cent of all perinatal deaths and is the largest single diagnostic category after congenital abnormalities and early preterm births are excluded.[2] Unexplained stillbirth remains an enigma. A number of large studies have identified risk factors for this condition (see Box 1), yet extensive efforts over many years have not been associated with reductions in the rate of unexplained stillbirth. Many of the risk factors for unexplained stillbirth are difficult to modify: lower socioeconomic status, increased maternal age and Indigenous status, for example. Risk factors such as maternal obesity, smoking and diabetes are routinely addressed during antenatal care and have been for many years. Since the rate of stillbirth does not seem to be falling, a common issue facing providers of maternity care in this setting is how to manage the next and subsequent pregnancies after a woman and her family experience an unexplained fetal death.

Overall, the odds ratio for recurrence of stillbirths from all causes is almost five[7], but studies of pregnancy outcomes subsequent to truly unexplained stillbirth have not reported any significant increase in the adjusted risk of perinatal death compared to women who have not suffered a stillbirth.[8-12] These statistics should provide reassurance for women and their families. However, those studies did find that pregnancy after stillbirth is characterised by increased rates of induced labour; elective and emergency caesarean section; and adverse pregnancy outcomes such as preterm birth and low birthweight. Changes in the timing and mode of delivery may be an example of a phenomenon known as the Hawthorne effect: when a severe adverse outcome (such as stillbirth) occurs, clinicians will be exceptionally cautious in the next pregnancy, usually maintaining intense surveillance and demonstrating a low threshold to intervene. The management of subsequent pregnancies is often very different and it can be difficult to compare this with management of the first pregnancy.

An Australian study of women who have suffered an unexplained stillbirth found that they want high levels of surveillance and early delivery in their next pregnancy.[13] Although early delivery would be expected to reduce the rate of stillbirth at a population level, it increases the potential for iatrogenic complications such as prematurity, failed induction, instrumental delivery, emergency caesarean section and postpartum haemorrhage. While these are preferable to intrauterine death, they are still adverse.

Pre-pregnancy care

It is common for women and their partners to try for another pregnancy soon after stillbirth and older studies have found that almost half of such couples are pregnant within six months.[14] It is important to recognise that the grief associated with a stillbirth, especially when no explanation for the loss can be provided, is almost unique. The extensive excitement, preparation and

Box 1. Risk factors for unexplained stillbirth

- Increasing maternal age
- Smoking
- Obesity
- Indigenous status
- Socioeconomic disadvantage and lack of access to healthcare resources
- Increasing parity
- Previous growth restriction
- Diabetes, either pre-existing or gestational
- Maternal anaemia
- Fetal long QT-associated mutations

the interest of family and friends, all make the devastation of stillbirth so much worse. For these reasons, timely consultation with the couple before attempting pregnancy again is very important. Pathological grief responses can be difficult to pick and, if there are any concerns, formal assessment of the couple using instruments such as the Spielberger State-Trait Anxiety Inventory might identify those who could benefit from more formal psychological assessment and support.

Many stillbirths that are thought to be 'unexplained' are actually incompletely investigated, sometimes because couples found decision-making difficult and did not consent to investigations such as perinatal autopsy. If possible, a careful review of any investigations performed at the time should be undertaken and the couple informed about knowledge gaps and areas of uncertainty. In some cases, enough investigation was done to exclude aetiologies with a risk of recurrence. However, in many cases, the level of investigation makes it impossible to provide an accurate prognosis.

Whatever the previous results have shown, maternal conditions that increase the risk of stillbirth should be identified. These include hypertension, diabetes, thyroid disease, thrombophilia, lupus, blood group antibodies and hyperhomocysteinaemia. If any such conditions are identified, they obviously should be stabilised before attempting pregnancy. Very rarely, chronic infectious conditions associated with stillbirth are diagnosed, the commonest being toxoplasmosis, syphilis and, possibly, chlamydia.[15] There is some evidence that periodontal anaerobes might be associated with adverse pregnancy outcomes, including stillbirth, so dental review is advisable.[16] Women in adverse social circumstances can be offered additional social supports, although strict evidence of the effectiveness such interventions is lacking.[17] Obesity and smoking are important modifiable risk factors for adverse outcome in the next pregnancy.

The inter-pregnancy interval may have an effect on prognosis and it is recognised that conception within 12 months of a perinatal loss is associated with increased levels of depression and anxiety.[18] These emotional states have the potential to influence pregnancy outcome, since management of maternal anxiety and depression may reduce the risk of preterm birth and possibly other adverse pregnancy outcomes.[19]

Early pregnancy management

There is little evidence to guide management in early pregnancy after an unexplained stillbirth. However, early ultrasound can be used to establish the gestational age accurately: the most effective intervention for reducing the rate of stillbirth is likely to be timely delivery, once the fetus is mature, probably no later than 39 weeks gestation, especially for older mothers.[3,20-22] Induction of labour is likely be offered in many of these pregnancies and adverse outcomes (emergency caesarean section, instrumental delivery and postpartum haemorrhage) are related to either attempted induction at an early gestation or in older age groups.[23] Accurate determination of gestational age with ultrasound as early as possible reduces the risk of inadvertent premature delivery and failed induction.[24]

Abnormal fetal karyotype may have remained undiagnosed even with careful work-up at the time of a stillbirth and failure of cell culture is common when there has been a delay between death and delivery. Fortunately, this situation is becoming less common with the use of DNA microarrays.[25] The commonest conditions associated with fetal death are trisomies 21, 18 and 13, and these may impart an empirical recurrence risk between five and 15 per cent, depending on the age of the woman.[26] Invasive fetal karyotyping increases the risk of pregnancy loss, so careful counselling is required for younger women. Fortunately, the advent of non-invasive prenatal screening (NIPS) using cell-free fetal DNA obtained from a maternal blood specimen, although expensive, may provide a low-risk method of screening where the recurrence risks are higher.

Management in late pregnancy

Many women who have suffered an unexplained stillbirth request 'increased fetal surveillance' and 'early delivery' in subsequent pregnancy.[13] Such a management plan is commonly made by obstetricians as well.[27] The methods of surveillance commonly undertaken are regular ultrasound for fetal wellbeing, cardiotocography (CTG) and fetal movement surveillance.

Growth restriction is a factor in many stillbirths[28] with failure to identify growth restriction a common factor.[29] Antenatal measurement of symphysio-fundal height, though almost universal, is of limited value in screening for growth restriction.[30] For these reasons, regular ultrasound might be offered, since growth restriction is a final common pathway for many pathological processes. Uterine artery flow measurement by Doppler has been shown to be a useful predictor of stillbirth related to growth restriction up to 32 weeks gestation, but such testing is of limited value in later pregnancy.[31]

Ultrasound estimates of fetal weight may be falsely reassuring.[32] The use of customised centile charts has been found to be a better predictor of fetal growth restriction and stillbirth, but there is no evidence yet that prospective use of such charts reduces the rate of perinatal death in screened populations.[33] Screening of high-risk populations using Doppler cord flow studies is the only strategy associated with a trend toward improvement in perinatal mortality.[34] However, the optimal frequency of such ultrasounds remains uncertain.

Regular CTG testing to establish 'fetal wellbeing' is very commonly practised, yet there is scant evidence to support the practice: the only study of CTG surveillance in pregnancy after stillbirth showed no effect on perinatal mortality.[35] On the basis of current evidence, routine CTG testing undertaken as a screening strategy, in the absence of specific clinical concerns such as reduced fetal movement, is unlikely to benefit the woman.[36]

A time-honoured method of fetal surveillance is formal fetal movement charting, commonly aided by 'kick charts'. This should be no surprise, since many cases of intrauterine fetal deaths are preceded by a decrease in fetal movements, often for up to 24 hours beforehand, and a wide variety of adverse pregnancy outcomes seem to be associated with reduced fetal movements.[37] Unfortunately, the use of 'kick charts' in prospective studies has failed to demonstrate any effect on the rate of perinatal mortality.[38] Reduction in fetal movements is a very common symptom, with as many as 15 per cent of pregnant women presenting with it.[39] Guidelines for management of reported changes in frequency of fetal movements are provided by the Australia and New Zealand Stillbirth Alliance.[40]

Delivery

Women will very commonly request early delivery in their next pregnancy after a stillbirth[13] and such management is very commonly undertaken.[27] The risk of stillbirth, using undelivered fetuses as a denominator, increases almost exponentially after 39

weeks gestation.[41] Management and timing of delivery in these circumstances must be individualised. Fortunately, the majority of pregnancies after an unexplained stillbirth will be uncomplicated. Many authors report that the single most important aspect of management of uncomplicated pregnancies after an unexplained stillbirth may be early delivery, usually by 39 weeks, but sometimes earlier.[3,4,7] When delivery is delayed beyond this gestation, careful surveillance should be maintained.

The few studies that guide management in pregnancies after unexplained stillbirth leave many questions unanswered and there is thus an urgent need for a large prospective study in this setting. Because unexplained stillbirth is a relatively uncommon outcome, with only about 2000 such losses each year in Australia, and because stillbirth death is so traumatic it is unlikely that controlled trials of antenatal management will ever be undertaken.

Conclusion

Those involved in the care of a couple who have had an unexplained late fetal death commonly find it distressing and challenging. Many couples will try to become pregnant again and will seek guidance on the risks they face and whether anything can be done differently the next time. Careful surveillance and early delivery play an important role in optimising the outcome. Women and their families must be provided with reassurance and support.

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Interventions that save lives

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A project in a Papua New Guinean hospital has changed the way staff manage the second stage of labour and reduced the perinatal death rate.

Papua New Guinea (PNG) is one of the countries in the world that still is experiencing high maternal mortality, currently 230 per 100 000 live births. PNG was ranked in the bottom 20 of 161 in the recent index of health workers' impact of the countries that were surveyed. It is well documented that PNG will not meet the UN's 2015 Millennium Development Goals. UNICEF is also warning that the country may fail to meet targets on reducing infant mortality.

Although postnatal and child mortality rates have declined dramatically in many developing countries in recent years, neonatal mortality rates remain high in many developing countries and PNG is one of those countries. These deaths either occur at home or at a health facility and most are attributable to infections, birth asphyxia and injuries, consequences of prematurity, low birthweight and congenital anomalies.

St Mary's Hospital

Saint Mary's Hospital at Vunapope, East New Britain in PNG is a Catholic-church-run health facility. Established in the 1930s by German missionaries, St Mary's has been delivering health services for more than 80 years to a population of more than 100 000 living in the Gazelle Peninsula and the nearby provinces. After the twin volcanic eruption, in 1994, a large portion of the population was shifted to the surroundings at Kokopo; and this has greatly impacted on the current service delivery in the hospital. The town itself is rapidly growing and, just recently, the government of PNG announced the town will become the tourist city. In coming years the town will truly experience an economic boom.

The hospital functions as the second referral hospital in the province, catering for referrals from 19 health facilities in the surrounding region. St Mary's has 200 beds, however, most of the time it has more patients than its capacity, just as in other areas in PNG where provincial hospitals are overcrowded.

The Churches Medical Council established and approved a staff ceiling of 40 nursing officers and 41 community health workers in 1995 and, to date, the ceiling has remained in place, despite the tremendous increase in workload.

Obstetrics and gynaecology is the busiest unit in the hospital. There has been an increase in the number of deliveries in the last five years owing to a variety of reasons: the influx of people into Kokopo for business or other activities and because the hospital has a good reputation in providing quality healthcare in the region, therefore more patients choose to come to St Mary's.

The maternity wing is a complex and a busy department in the hospital, with a capacity of 74 beds. The postnatal section has a total of 30 beds, gynaecology has 20 beds, the surgical section four beds, full nursing care has three beds, the labour ward has seven beds and the special care nursery has ten baby cots and is taken care of by the maternity ward staff. There is also a bed in the consultation clinic.

The maternity department needs to provide a high-quality care service to the majority of the women in the province. To this end, standard medical equipment must be available and appropriate adaptations

and applications of inexpensive simple methods to improve antenatal, obstetric and neonatal care are needed to assist clinical nursing and obstetrics and gynaecology medical staff with the procedures to save lives. Currently, clinical staff are functioning with whatever resources are available to save the lives of women and babies, especially in cases of obstetric complications and emergencies. The wing also needs a mini clinical lab where ongoing clinical training can be conducted onsite. This includes mannequins, updated library books and an office space to do clinical presentations and teachings.

The mission

A project is currently being carried out to find a way to reduce the number of stillbirths and perinatal deaths that occur in the labour ward. It has been discovered that improving on the management of second stage of labour makes a difference. This project is being conducted by a team consisting of two medical doctors and three midwives. The mission is to reduce the number of neonatal deaths as a result of improved management of women during the second stage of labour.

Key interventions

As part of the project, a number of key interventions have been instituted: a labour ward inventory checklist and neonatal emergency trolley checklist; regular training of students and staff; neonatal death reviews; case study exercises; debriefing; regular in-service training on the use of the partogram; active management of second stage of labour; and neonatal resuscitation.

Outcome

From January to September 2012, 110 perinatal deaths were recorded. From October to December 2012, after improving on the management of second stage of labour and preventative measures – such as neonatal resuscitation, delaying in cutting umbilical cord when baby cries immediately, breastfeeding the baby within an hour of delivery and exclusively breastfeeding the baby – the stillbirth and perinatal death rate decreased by 30 per cent. From January to June 2013, there was a big improvement in the reduction of stillbirths and perinatal deaths where we saw only about ten per cent of the total deaths.

With limited resources available, normal nursing duties are performed, but not to always to the total satisfaction of patients' expectations. The clinical staff, regardless of their qualifications, can perform deliveries competently and are able to detect problems and act accordingly before complications arise.

A number of measures are in place to maintain the improvements in practice in the labour ward; these include ongoing education and training, understanding of the documentation of protocols and guidelines used in the PNG Standard Management Manuals; and strengthening the current systems to guide practice. A number of future plans are underway to strengthen services and networks for hospital medical and nursing staff, including the provincial family health service coordinator.

To maintain our practice, there is ongoing training and education of clinical staff by the specialist obstetrician and gynaecologist, Dr Tanmay Bagade (WHO-UTS), assisted by the registrar and the midwives. All documentation of protocols and guidelines for clinical staff are maintained and taught to junior nurses.

The hospital has started another pilot project to train community health workers, these community health workers to have the midwifery skills. This project is also contributing in training the nurse assistants to identify problems and refer or report immediately to keep perinatal and neonatal death statistics low.

In conclusion, this project saw that improved management of the second stage of labour lowered the stillbirth and perinatal death rate in our hospital.

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The power of audit

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What does the stillbirth rate tell us about the quality of clinical maternity care?

Stillbirth rates remain high in many of the Pacific island countries. Compared to rates of 2.9 and four per 1000 births for Australia and New Zealand, the rates for Tonga, Fiji and Samoa are nine, 13 and ten, respectively. The World Health Organisation reports a steady decline in stillbirths in the Western Pacific region from 17.2 to 10.2. This progress is promising, but not good enough. Fiji, Vanuatu and the Solomon Islands have higher rates than the regional average. In 2011, the Lancet's Stillbirths Steering Committee concluded that the causes of stillbirths are inseparable from the causes of maternal and neonatal deaths. They suggested that many of the third trimester stillbirths and neonatal deaths could be prevented by scaling up care for mothers and babies at the health system level.

The Steering Committee recommended that emergency obstetric care has the greatest effect on reducing maternal and neonatal deaths and stillbirths. Syphilis detection and treatment has moderate effect, but is of lower cost and is highly feasible. Advanced antenatal care – including induction of post-term deliveries and detection and management of hypertensive disease, fetal growth restriction and gestational diabetes – will further reduce mortality, but at a higher cost. The committee notes that in settings with stillbirth rates of between 15 and 24.9 per 1000 births, the priority to increase coverage of advanced antenatal care services and high-quality comprehensive emergency care. They go on to say that the interventions are best packaged and provided through linked service delivery methods tailored to suit existing healthcare systems.

Many of the health systems in the Pacific are seriously challenged by limited resources and this has been exacerbated by political uncertainties. There are major issues in obtaining regular essential supplies of consumables, health infrastructure is inadequate and there are major human resource shortages.

There are several high-impact initiatives that are feasible in this uncertain context. One of the specific interventions recommended by the Lancet expert panel is the improvement of the skills and knowledge of healthcare providers. This is required throughout the

Comprehensive audit programs can have a positive impact on healthcare systems and, in turn, decrease the maternal and neonatal mortality rate as well as reduce the number of stillbirths.

health system in order to reduce delays in the provision of quality life-saving care. This up-skilling is required in a range of clinical areas, including family planning counselling, advocacy for early booking and antenatal, intrapartum and postpartum care. The sophistication of clinical skills required will vary, but should include skills in ultrasonography as dating of pregnancies and recognition of growth restriction are significant causes for morbidity and mortality.

We wish to provide initial reports from two clinical audits being undertaken. One is from Vaiola Hospital in Tonga, which is the major referral hospital in the country and where most of the deliveries occur. The hospital delivers about 2500 babies per year and has a stillbirth rate of nine per 1000 births. The other is from Fiji: the second-largest referral hospital in the country delivers about 4100 babies per year and has a stillbirth rate of 15 per 1000 births. This hospital has a local catchment area of about 100 000, but provides tertiary-level care for approximately 40 per cent of Fiji's population. About 5000 deliveries occur in five subdivisional level hospitals. All high-risk cases are transferred to the referral hospital.

These audits have highlighted several issues. Most of the stillbirths in both institutions occur late in the third trimester and in the pre-partum period. Clinical notes are poor and relevant data for review difficult to retrieve. No uniform criteria are used for classifying the stillbirths.

Given the proven benefits of perinatal reviews in improving maternal and neonatal care, there is an urgent need in the Pacific to develop a standardised reporting mechanism to record all perinatal deaths. A systematic review of these deaths may provide more reliable information about the best-value interventions to improve the quality of maternal and neonatal services in the Pacific. The tool developed by the Perinatal Society of Australia and New Zealand (PSANZ) could be modified for this purpose.

The PSANZ tool may not be uniformly applicable throughout the Pacific. It would be easier to capture data from health institutions. In the larger countries, such as Fiji, Samoa and Tonga, most deliveries occur in health facilities, whereas in countries such as the Solomon Islands and Vanuatu the situation is different. Capturing data for babies not born in health facilities would pose an almost impossible challenge. However, there are tools available for capturing critical data even in this situation.

A strong argument can be made to develop a standardised reporting package for stillbirths in the Pacific island countries. Such a package would include a uniform data collection sheet, such as the one developed by PSANZ, but modified for use in the Pacific, and some centralised data processing unit hosted by either RANZCOG or the Pacific Society for Reproductive Health. The analysis of the data will provide valuable information regarding effective interventions to improve maternal and child health. Many international funding agencies have targeted the maternal and child health aspects of the Millennium Development Goals and the Post-2015 Development Agenda. There is recognition that monitoring and evaluation of progress requires good-quality data that demonstrate effectiveness of interventions and also help identify remaining challenges that need to be addressed.

Of Kell and kings

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Can the reproductive catastrophes of a long-dead king be explained by the presence of a minor antibody in pregnancy?

A fatal incompatibility between Henry VIII and his wives and mistresses could be the hidden reason behind the sad string of pregnancy losses experienced by the king's partners. Although it can never be proven, the culprit for this tragic story could well be a minor antibody of pregnancy: the Kell antibody. An unconfirmed theory is that Henry VIII was unfortunate enough to be Kell positive. In association with a Kell-negative woman, he therefore had a 50 per cent chance of conceiving a Kell-positive baby. The first child by his many partners therefore tended to be healthy and unaffected by this curse, irrespective of their Kell status. However, subsequent pregnancies could be affected by this aggressive antibody if that first child had been Kell positive. The offspring who regrettably inherited their father's Kell-positive status were at risk of attack by their mother's antibodies, resulting in what has been described as an 'atypical reproductive pattern' even in an age of such high infant mortality.[4] The tragic fact that only four of his 11 progeny survived infancy, of whom three were firstborn, supports this theory.[4,7]

Minor red blood cell antibodies, immunoglobulins, arise most commonly in response to foreign red blood cell antigens encountered. Generally, women are more prone to developing these antibodies during their reproductive years. This is usually via the multiple obstetric-related opportunities for exposure to such antigens (in other words, via a blood transfusion, feto-maternal haemorrhage or even contaminated needles). In more exceptional circumstances, the antibodies can evolve via a more passive, natural exposure to potential pathogens such as bacteria or viruses.[2] For those Trainees in the midst of exams, the blunt, but helpful, expression 'Kell kills, Duffy dies, Lewis lives' has simplified remembering some of the more frequently encountered minor antibodies.[8] In reality, minor antibodies in obstetrics are far more complicated than this simple phrase implies. These rarer antibodies are not often detected, but can still have a significant impact on a woman's opportunity to produce a healthy infant, as perhaps indicated by the unfortunate plight of Henry VIII. The identification of these antibodies is doubly important in that donor blood for transfusion to an affected mother is required to be compatible, a possibility obviously not available in the time of the Tudor king.

In the years following the reign of Henry VIII, haemolytic disease of the newborn remained a significant contributor to the rates of fetal loss and neonatal mortality. It was not until the 1950s, that the link between poor fetal and neonatal outcome and maternal antibodies was made.[1] As research has progressively shed light on antibodies in pregnancy over the last few decades, more has been able to be done to prevent the potentially catastrophic consequences of these conditions.

Fetal anaemia owing to these minor antibodies is cell-mediated and evolves in the same manner as the more commonly encountered antibodies: via transplacental passage of a maternal IgG antibody against a fetal red blood cell antigen. The exception is the pathogenesis of fetal anaemia by Kell antibodies in which an additional mechanism is employed and erythrocyte production is suppressed at the level of the progenitor cell.[2] It is thought this erythroid suppression is, in fact, the predominant mechanism in producing fetal anaemia in the case of the presence of Kell antibodies.[3,8]

The introduction of routine screening for maternal antibodies in the 1970s, in order to allow the early identification of those babies at risk and therefore allowing the opportunity for treatment, has led to an impressive decline in the incidence of fetal loss related to haemolysis.[6] At this point, guidelines suggest repeated screening throughout pregnancy in Rhesus-positive women with no abnormal antibodies detected is not cost-effective given the incidence of late-onset alloimmunisation is extremely low.[2]

The Family of Henry VIII, c.1543-1547. Unknown artist, after Holbein. Left to right: 'Mother Jak', Lady Mary, Prince Edward, Henry VIII, Jane Seymour, Lady Elizabeth and Will Somers.

Table 1. Examples of red blood cell antibodies and their clinical significance.[6]

Clinically significant	Sometimes clinically significant	Usually not clinically significant	Not considered clinically significant
Kell (K, k, Ku)	MNS (U, Vw, Mur)	Lutheran (Lua, Lub)	Chido/Rodgers (Cha, Rga)
Duffy (Fy^a, Fy^b, Fy3)	Vel	Lewis (Lea, Leb)	JMH
Kidd (Jka, Jkb, Jk3)	Ge	MNS (M, N)	Bg
Diego (Dia, Dib, Wra)	Hy	P1	Csa
MNS (S, s)	Yta		Xga
A1			

The approach to discovering an unusual antibody on a routine group and screen should be systematic and stepwise. The potential impact on the baby's condition depends on the antibody type, their circulating levels in the maternal blood and the red blood cell antigens the fetus has inherited. If the antibody identified has not been indicated to be responsible for haemolytic disease of the newborn then generally no further evaluation is required (see Table 1).[2] However, given the presence of antibodies hints at the possibility of exposure of the fetal blood to the maternal circulation, on-going consideration should be given to the possibility of fetomaternal haemorrhage, even if the antibody itself is not potentially harmful. If the antibody could result in an affected neonate, a thorough history should be obtained in order to better clarify the potential severity of impact on the current pregnancy. Important components include information regarding previous pregnancies and whether or not they were affected, and the defining of the mother's transfusion history or the use of any illicit drugs.[2] Paternal red blood cell antigen status and his zygosity for the antigen is extremely helpful in order to determine the next appropriate step.[5] If the father is antigen-negative and his paternity can be guaranteed, then no further evaluation is required as this ensures the fetus will also be negative.[2] If the father is antigen positive or his status is unknown, the fetus must be considered to be at risk.

It is generally advised, if these more unusual antibodies are detected in pregnancy, care should be the same as for women with Rhesus alloimmunisation.[2] If clinically significant red blood cell antibodies are detected, regular fetal surveillance and follow-up is required. The next step should be a quantification of the antibody with a titre or equivalent quantification determined by a standardised technique. However, the general consensus is that serial titres are unnecessary prior to 18–20 weeks, owing to the low risk of fetal anaemia at this gestation.[2] Titres should subsequently be monitored on a reasonable schedule; for example, repeated every four weeks until 28 weeks and then fortnightly until delivery.[5] The regular monitoring of titres aids the clinician in determining when to initiate more intensive fetal monitoring. Approaches include ultrasound monitoring of the middle cerebral artery peak systolic velocity (MCA PSV), free fetal DNA, amniocentesis or cordocentesis, depending on the access in the facility managing the patient's care.[3] A titre of 1:16 is considered to be the level at which fetal anaemia has occurred rarely in the past. A critical titre of 1:32 or higher necessitates an urgent evaluation for fetal anaemia with a referral to a maternal fetal medicine specialist.[2] An exception to this rule is Kell, in which the critical titre is far lower at 1:8.[2] If the patient has had a previous pregnancy affected by the antibody, it is important to remember the general rule is subsequent pregnancies are affected at a much earlier gestation.[2] The conventional approach is to begin monitoring ten weeks earlier than the gestation at which the previous fetus was affected, with some maternal-fetal medicine specialists omitting the use of titres altogether and monitoring MCA PSV directly.[9] Timing of delivery is dependent on the degree of fetal anaemia, the treatment required and the zygosity, with an attempt made to prolong gestation as close as possible to term.[9]

We now live in an age where obstetric intervention has thankfully all but prevented pregnancy loss owing to the Kell antibody, such as might have happened Henry VIII, and similar conditions. In its effect on this royal family 500 years ago, the Kell antibody may have played a covert, but important, role in history. Fortunately, despite these minor antibodies still being occasionally encountered in day-to-day practice, a precise and standardised approach to their management should ensure that a similar painful story will never happen again.

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Letters to the editor

A gravid issue: a case for the omission of a woman's gravidity from her antenatal record

Eliciting and documenting a thorough medical and obstetric history facilitates the provision of quality care to a woman during and after her pregnancy. However, we argue that a woman's gravidity should be deliberately omitted from any documentation in her antenatal record as it does little to guide our clinical management and may contribute to prejudice against certain patients.

For generations, obstetricians and midwives have discussed and documented a woman's obstetric history in shorthand: Room Three, Bed Four, or occasionally Mrs Real Name is coded as to her gravidity and parity, such as 'gravida 3, para 2', abbreviated to 'G3P2'. Despite their very precise definitions, these terms have been a perennial source of confusion.[1]

Gravidity is generally accepted to mean the number of times a woman has been pregnant. Specifically, this refers to clinical pregnancies, as distinct from biochemical pregnancies, as a significant proportion of these conceptions can be expected to progress to spontaneous miscarriages. Any clinical pregnancy, whether intra- or extra-uterine, singleton or multiple, viable or non-viable, raises the gravidity score by one, and only one.

Parity is defined as the number of times a woman has delivered a fetus (or in the case of a multiple gestation, fetuses) beyond the point of viability or potential viability: some define this as pregnancies beyond 24 weeks; others have proposed 20 weeks as the threshold beyond which a nullipara, on delivering her fetus (live or stillborn), becomes a 'para 1'. As with gravidity, each pregnancy (even a multiple gestation) may increase a woman's parity by a maximum of one. As such, a woman in labour during her first pregnancy is properly described as a 'nullip(ara)', not a 'primip(ara)': after the birth, she becomes a 'primip(ara)', not a 'multip(ara)', the latter term referring to a woman who is para 2 or more. However, proper technical usage of this terminology is at odds with the common parlance heard on many labour wards today.

Whereas a woman's parity has a significant bearing on the latter part of her pregnancy, particularly the progress and likely outcome of her labour, her gravidity has considerably less relevance. For example, a G3P0 (who has had two previous miscarriages) should not be expected to labour any differently to a primigravida, as both are nulliparous; and the intrapartum progress of a G4P3 should not vary from that of a G9P3 on account of their unequal gravidity alone. To those providing care for a woman during her pregnancy, the factors most relevant to their clinical decision-making are her parity and the details of her previous pregnancies, including gestational age at delivery, duration of labour, mode of delivery and birthweight of her infant(s). A woman's gravidity does not, and should not, influence our management of her pregnancy – so why should we continue to document this extraneous information?

Some may counter with evidence suggesting that a woman's gravidity may influence her pregnancy outcomes, independent of her parity. Some cohort studies have suggested that termination of pregnancy (TOP) may be associated with adverse outcomes in subsequent gestations. A systematic review[2], published in 2009, compared rates of low birth weight (<2500g) among women with a history of TOP, versus those with no prior terminations: the risk was higher for those with previous terminations, with an unadjusted odds ratio of 1.35 for one TOP, and 1.72 for two or more. Likewise, rates of preterm birth (<37 weeks) were higher among those with one or more previous TOPs (unadjusted odds ratio 1.36 for one TOP, and 1.93 for two or more). Of note, many of the studies included in this systematic review did not adjust for potential confounders. Moreover, one study even demonstrated a higher rate of post-term pregnancy in those with prior TOP, a finding the authors described as 'unexpected' and acknowledged may be a 'chance association'.[3] The Royal College of Obstetricians and Gynaecologists refers to 'a lack of consensus', with several studies unable to demonstrate any effect of induced abortions on preterm birth or low birth weight.[4] And the effect of spontaneous miscarriage on subsequent pregnancy outcomes? One retrospective cohort study demonstrated an association between miscarriage and preterm delivery in nulliparas: when comparing primigravidas to women with one previous spontaneous miscarriage, the latter group had higher rates of preterm labour after 34 weeks, with an odds ratio of 1.4.[5] The authors concluded, however, that such differences might not be of clinical significance.

In short, the influence of previous abortions (spontaneous or induced) on subsequent pregnancy outcomes remains controversial. Nonetheless, even if the proposed link between pregnancy loss and adverse outcomes in future pregnancies is both genuine and causative (as opposed to simply associative), we contend that the clinical significance of such a link is trivial and does not constitute justification for continuing the practice of documenting a woman's gravidity on her antenatal record. After all, if a history of miscarriages or terminations does not warrant any alteration in our clinical management of a pregnant woman, then this information need not – and should not – be included in her record.

Learning of a woman's gravidity from her antenatal record may lead to unwarranted bias by her caregivers. There are unquestionably those among us who, consciously or otherwise, think differently of a woman on learning that she has had multiple TOPs. But what gives the incidental observer the right to pass judgment on the social circumstances of any individual? Further complicating matters are entries in a woman's file stating 'previous TOP – husband does not know'. If her husband need not know, why must her obstetrician? Encumbering caregivers with such clinically irrelevant tidbits only provides opportunities for us to put our foot in it.

And of those women in progressing pregnancies after a series of miscarriages, should we think or act any differently? Too often, the

phrase 'a precious baby' is uttered in reference to such pregnancies, with the implication that caregivers should pull out all stops in their management of these women, as though they deserve better care or closer attention than those without such an unfortunate obstetric history. Every fetus, whether belonging to a primigravida or a woman who has had several previous terminations or miscarriages, is equally precious and should be treated accordingly.

While gravidity is of relevance to the diagnosis and management of infertility and recurrent miscarriage, it is not pertinent to the management of a woman with an ongoing pregnancy, particularly as it advances past the point of viability. Given that the documentation of a woman's gravidity may lead to prejudice against her, we recommend the deliberate omission of this information from her antenatal record. This is not change for the sake of change: it represents progress in the effective care of pregnant women.

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Vaginal birth after caesarean – meeting half way

The management of a woman considering a vaginal birth after two caesareans (VBAC-2) at home proposed in the Q&a answer in *O&G Magazine* Vol 15(3) misses the opportunity to facilitate the best clinical outcomes. Patients are more likely to take onboard medical advice when they trust the clinician. The key is to seek to build a relationship of trust and respect.

It can be assumed that the woman is striving for the best health outcomes for her child. Given her two previous caesareans, it would be better for the woman to birth in hospital where emergency facilities are available, should they be required. The woman has attempted to engage with the hospital, which suggests that her mind is not made up. There is therefore a narrow window of opportunity to gain her trust and respect.

The clinician should first attempt to understand and allay the woman's concerns about VBAC-2 in hospital. Listing the hospital's 'requirements' for management of labour will push the woman towards homebirth. Instead, the woman should be reassured that her legal right to refuse consent to any aspect of clinical management will be respected. The reasons why each aspect of management is proposed should be explained. The information provided and the woman's decisions should be documented. By respecting her choices, the chances of negotiating (potentially on a subsequent occasion) for her acceptance of appropriate clinical management are higher.

In addition to informing the woman about the risks of VBAC-2, the clinician has a duty to advise her: of the advantages of vaginal birth for baby and mother; of the risks of a third repeat caesarean; that there is insufficient evidence as to the safety of homebirth generally; and that most studies which attest to the safety of homebirth exclude woman with risk factors such as previous caesareans. Providing incomplete information will undermine the woman's trust in the clinician.

The Australian Medical Association's Position Statement on Maternal Decision Making reminds us that, '[t]he doctor must respect the woman's informed decision, even if it is not consistent with the doctor's advice, and continue to provide patient support.' The woman should not be forced to choose between a hospital birth managed according to 'requirements' of the hospital and a high-risk homebirth, when a middle ground exists. The clinician should strive to facilitate a hospital birth, even if it is managed in a way which the clinician believes to be sub-optimal.

Dr Rhonda Tombros
BA, LLB(Hons), LLM, DPhil (Oxon), Australian Legal Practitioner

Author's response

Thank you for the opportunity to respond to the letter 'Meeting half way' from Dr Tombros, a respected legal practitioner.

It is possible that many of Dr Tombros's comments might well be relevant if the contract between the clinician and the woman was solely on a one-to-one basis 'even if it is managed in a way which the clinician believes to be sub-optimal'.

However, I am conscious as a consultant obstetrician that when I am negotiating the management with a patient, particularly in the scenario of VBAC-2, I am doing so on behalf of a number of my colleagues who will be involved in the multidisciplinary management of the woman including obstetricians, midwives, anaesthetists and paediatricians who may not all share 'the suboptimal management view', but whose professional and ethical expectations nevertheless must also be respected.

Additionally, this contract must be made within the medico-legal and risk management requirements of the institution in which the woman wishes to deliver.

As a further aside in the case of a public hospital there would be no guarantee I would be the consultant on call when the woman came into labour to provide the necessary continuity in an effort to ensure the contract as negotiated was carried out.

Hence is it better to build a relationship of trust and respect by openly negotiating at the start the management likely to be followed in order to safely deliver the woman and her baby or, on the other hand, agree to possible sub-optimal management by

attempting to meet her halfway, which may or may not be agreed to or followed by the multidisciplinary group responsible for the care of the woman and her baby when she presents in labour?

Unfortunately, it would appear the 'middle ground' as proposed by Dr Tombros may not be a realisable reality under the clinical circumstances of a VBAC-2 with its uncommon, but real, potential of less-than-ideal outcomes sometimes even in the face of optimal management.

Thus it is my considered view that the woman must, after respectful discussion, make an informed decision for herself and her unborn child as to where she would wish to deliver with the clinician, as previously mentioned, being left to administer care for the mother and her baby as determined by her decision.

A/Prof John Svigos
FRANZCOG

Global challenges

I loved the Winter 2013 issue of *O&G Magazine*, which took global challenges as its theme, and there were good stories of great work. I thought it might be worth adding these points: limited budgets for donating, evidence for which charities are the best and discussing money. Almost everyone has a limited charity budget – so where should the money go? Peter Singer (among others such as Givewell and Givingwhatwecan) has a good list of best 'bang for your buck' (see www.thelifeyoucansave.org) where charities have been evaluated for many variables.

Somewhat unsexily, the top-three causes on the list are parasites – Against Malaria Foundation (save one life for $1865; they submit that malaria is the number-one killer of pregnant women), Schistosomiasis Control Initiative and Deworm the World. These seem a better use of money than giving to the local (first-world) school building foundation or for another wing in an art gallery. Or, for that matter, buying a bottle of water when ours is arsenic-free out of the tap for next to nothing, or tipping a waiter who is employed instead of funding, say, a couple of MMRs (this latter opinion always makes my friends cross – they have been waiters). Fortunately for our specialty, the Fistula Foundation, funding fistula repairs at $450 a woman, is also on the list. Check which charities are registered for income tax deductions in Australia.

On the environmental front, I remember Roger Short[1] once saying that he spent too much time trying to save animals and ecosystems directly when, in fact, the environment would have been better served with efforts in human education and contraception.

Second, randomised controlled trials to determine which charitable acts work best: people responsible for allocating huge sums of money take on projects that can be thought of as 'parachute medicine'.[2] For example, 41-year-old Esther Duflo at MIT runs randomised controlled trials in low-income countries to find which philanthropy works and which does not (see www.povertyactionlab.org/duflo). One trial involved incentives to boost child immunisation rates in rural India: control (six per cent); versus providing monthly clinics (18 per cent); versus the winner – immunisation with a bag of lentils (39 per cent).[3] No RCTs are needed to prove immunisation's effectiveness, but the money spent implementing the programs needs to be wisely allocated.

Finally, let us talk about money.

- The poor may best benefit from people in rich countries (us) earning lots of money and giving it to them rather than us going to work there (or even having chosen an altruistic career such as medicine in the first place). For example, the website 80000hours.org showcases the work of a group in Oxford that has done the maths for a working life in lucky countries. They estimate we will spend 80 000 hours on our careers, and give us a list of best professions to choose to either earn the most money to donate ('earning to give'), or to become employed in an organisation that has a huge budget to allocate so you can direct it to most effective interventions (for example, do a PhD in economics, work for the World Bank and allocate funds to Deworm the World – a high-impact career). This has made me feel better about being a specialist in Geelong and not working in Africa.
- Christian culture seems to be that of remaining modest about charitable donations (Matthew 6: 1-4: 'But when you give to the needy, do not let your left hand know what your right hand is doing, so that your giving may be in secret'). There is modern (research) evidence, however, that people want to keep up with the Joneses. So to truly benefit your chosen charity, you should sing it from the rooftops how much you give. Many recommend giving a percentage of your income – perhaps start with three per cent. There are plenty of online tithing groups – see www.boldergiving.org. There is a great TED talk of Peter Singer's on The Why and How of Effective Altruism: www.ted.com/talks/peter_singer_the_why_and_how_of_effective_altruism – happy effective altruism.

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Delivery dilemma in maternal spina bifida

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We report on a 32-year-old, female wheelchair user with spina bifida who underwent a successful vaginal delivery.

Advances in management options for women born with spina bifida are starting to result in these patients becoming old enough to conceive and undergo successful pregnancies. The role of obstetricians is changing from prevention and early diagnosis of neural tube defects, to managing the pregnancies of these complicated patients. While pregnancies in women with spina bifida have been reported since 1973[1], they are rare and historically result in caesarean section.[2]

Case report

The nulliparous patient, who will be named Jane here, was referred by her GP and seen in antenatal clinic at 19 weeks. She had been diagnosed with a coccygeal meningocele at birth, complicated by an abnormal spinal canal and L2-3 vertebral body fusion. After undergoing several corrective surgeries until the age of six, a sudden, overnight deterioration resulted in flaccid legs and incontinence. Her recovery was incomplete and Jane required a wheelchair and callipers for mobilisation. The resultant neurogenic bladder has been successfully managed with four-hourly self-catheterisation and a bladder augmentation at nine years of age; however, episodes of cystitis remain common. Thoraco-lumbar scoliosis was corrected at age 15 with anterior spinal fusion of T10-12. The patient was also diagnosed with polycystic ovarian syndrome in her teens and struggled with fertility. This was further limited by her partner's sub-fertility; however, conception was finally achieved through in vitro fertilisation.

Antenatal care was obstetrician-led, with hospital reviews every two-to-three weeks until 36 weeks and weekly thereafter. During the booking visit, several risks were identified relating primarily to her significant surgical history. These included her anaesthetic options, recurrent cystitis and moderate paraplegia complicated by significant hip deformity and range limitation.

Jane was aware of the high risk of caesarean section before the first meeting and had researched independently the delivery options for women with spina bifida. The treating team had long discussions with Jane and her partner about these options and their associated issues and it was decided that a vaginal delivery would be possible with appropriate risk management. The following areas proved to be the most challenging.

Delivery considerations

Vaginal deliveries have been reported in this population; however, the author was only able to identify a single case where the patient was a wheelchair user owing to spina bifida, similar to Jane. Arata et al[4], the largest series to date on pregnancy complicated by spina bifida, reported that only one of the five wheelchair-using patients delivered vaginally. Comparatively, ten out of 18 non-wheelchair-using patients were able to proceed to vaginal deliveries. Successful labour and vaginal delivery is known to be possible for patients with acquired spinal cord abnormalities.[5]

Anaesthetic considerations

Patients like Jane are often poor candidates for regional anaesthesia secondary to their significant vertebral abnormalities and the resultant corrective procedures. Regional techniques have been discussed for such patients[3]; however, these carry high risks and are technically difficult. Consultation with anaesthetic staff in our hospital revealed a hesitation to perform anything except general anaesthesia, ruling that a spinal or epidural anaesthetic would be inappropriate for our case. Jane was made aware of the risks of general anaesthesia to herself and the fetus, but she found these trivial compared with the subsequent loss of skin-to-skin contact with the baby that she had fought so hard to conceive. Guided by Jane's strong desire for vaginal delivery, the team worked hard to achieve this for her.

Mobility and positioning considerations

The greatest obstacle in achieving Jane's wish for a vaginal delivery was her significant mobility limitations from bilateral hip and lumbar spine flexion restriction. This was secondary to severe tonicity, moderate lower limb paraparesis and congenital vertebral dysfunction. Ellison[6] reported on a case where such limitations were deemed reason enough to abandon vaginal delivery in favour of caesarean section. Concordantly, there was doubt that the patient would be able to tolerate the significant mobility and logistical challenges present during labour and delivery without considerable improvement to this level of function.

In order to facilitate this, an orthopaedic assessment was requested and regular physiotherapy undertaken upon recommendation. Jane underwent lumbar spine and hip stretching

Learning points

1. Vaginal delivery in patients, although often complicated by many factors, can be achieved successfully with extensive patient communication and multidisciplinary team involvement.
2. Patient joint and limb mobility may be increased during the antenatal period to a level in which the positions required in labour and vaginal delivery can be successfully achieved. This can be augmented by orthopaedic and physiotherapy input and outcomes assessed in the labour ward prior to delivery.
3. Appropriate progression in labour, without augmentation, can be achieved in patients with congenital spinal abnormalities.

exercises to reduce tonicity and strengthening exercises aimed at increasing patient movement and independence. Following several weeks of this treatment during the second and third trimesters, a trial of comfort and mobility on the birthing bed and in stirrups was undertaken at 36 weeks. Unfortunately, for research sake, no comparison was made prior to the physiotherapy intervention with Jane's severe tonicity enough for the treating team to forego prior stirrup testing.

The two areas of most concern to the treating team were Jane's ability to maintain a lithotomy position for delivery and to successfully achieve a McRobert's posture with assistance in the case of shoulder dystocia. Both of these activities were achieved successfully during a trial at our birth suites.

Outcome

Jane's pregnancy was complicated by mild, asymptomatic pre-eclampsia and cystitis at 38 weeks, requiring admission and antibiotics. Spontaneous labour ensued one day later, with spontaneous rupture of membranes, appropriate progression of labour and strong contractions. Stirrups were used during the second stage without patient discomfort. Although she developed the urge to push, a forceps delivery and episiotomy were required owing to a non-reassuring cardiotocography trace and insufficient maternal effort. This resulted in a healthy, live infant and a very happy mother. Postnatal recovery was unremarkable with no bladder or bowel complications.

Conclusion

Pregnancy in this population, while high risk and potentially complicated, needs to be no less rewarding than for any other woman. We have shown that significant hurdles may be overcome to fulfil maternal desire for a vaginal delivery with the use of multidisciplinary team input and careful planning.

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Q&a

Q&a attempts to provide balanced answers to those curly-yet-common questions in obstetrics and gynaecology for the broader *O&G Magazine* readership, including Diplomates, Trainees, medical students and other health professionals.

Q *A 34-year-old primiparous teacher presents to the maternity unit at 29 weeks gestation with a 36-hour history of diarrhoea, vomiting and crampy abdominal pain. She has a temperature of 37.5C, a heart rate of 110 and a BP of 95/60. The cardiotocograph shows a baseline of 165bpm, with normal variability and reactivity and no decelerations. There is no evidence of contractions. Her husband has similar symptoms. How should her care be managed?*

Dr Brett Daniels
FRANZCOG

a Infectious gastroenteritis is a common condition during pregnancy that, in most cases, has a benign outcome. However, it provokes unpleasant symptoms and maternal concern regarding fetal wellbeing.

History should include symptoms such as blood or mucus in the stool, frequency and volume of diarrhoea and/or vomiting, fever, pain and oliguria. The ability to tolerate oral intake and contact with other infected people as well as contact with contaminated foods or water should be ascertained. Women should also be questioned regarding signs of preterm labour and fetal wellbeing, including fetal movements, uterine activity and vaginal loss.

Clinical assessment includes evaluation of the degree of dehydration, presence of abdominal signs suggesting an acute abdomen and signs of premature labour. Urinalysis for signs of dehydration, proteinuria or urinary tract infection should be performed.

Stool specimens are recommended to be collected in pregnant women with gastroenteritis, particularly if symptoms have been present for longer than 72 hours.[1] Urea and electrolytes may be performed to assess renal function and dehydration, while liver function tests and a full blood count may be ordered if the diagnosis of simple infectious gastroenteritis is unclear. Blood cultures are required if listeriosis is suspected.

At 29 weeks gestation the considerations with gastroenteritis in pregnancy involve both the mother and the fetus. Gastroenteritis can cause uterine irritability and in some cases threatened labour although preterm delivery is uncommon. Mild contractions often settle with treatment of maternal symptoms. A cardiotocograph will assess both uterine activity and fetal heart rate. It would be expected that the mild fetal tachycardia seen in this case would resolve with maternal rehydration.

In most cases, treatment of gastroenteritis in pregnancy primarily involves rehydration. In many women this can be achieved on an ambulatory basis, either with oral rehydration or with a short admission for intravenous fluids. Hospital admission may be required of women are unable to tolerate oral rehydration, are otherwise systemically unwell or there is evidence of fetal distress or preterm labour. In severely dehydrated women, normal saline or Hartman's solution are preferred over five per cent dextrose or hypertonic saline to avoid severe neurological complications such as Wernicke's encephalopathy or central pontine demyelination. Loperamide, often used to alleviate diarrhoea in non-pregnant patients, is a Category B3 drug and not recommended to be used in pregnant women. If admission is required then suitable infection-control measures should be used to prevent infection of staff and other patients.

Antibiotic therapy if required should be guided by results of microbiology or other evidence of likely causative organisms. Azithromycin can be considered for empirical treatment of traveller's diarrhoea.[2] Giardiasis may be seen in pregnant women, particularly those who have ingested water contaminated by animal or human faeces. Recommendations are mixed on treatment of giardiasis in pregnancy. If treatment is necessary then metronidazole may be considered after the first trimester.[1]

While most infectious gastroenteritis in pregnancy has no long-term adverse effect on the mother or fetus, *Listeria monocytogenes* infection is more serious. Listeriosis may present with nausea and vomiting in pregnancy, often associated with a fever and flu-like symptoms. Maternal listeriosis has a high rate of fetal loss with a fetal mortality of 40–50 per cent if contracted in the second and third trimesters.[3] Diagnosis is by maternal blood cultures, cerebrospinal fluid or amniotic fluid cultures. Treatment of serious infection is with intravenous amoxicillin/ampicillin and gentamicin, or oral amoxicillin/ampicillin for less serious cases. Neonatal listeriosis can present as fever, respiratory distress, neurological symptoms or with a skin rash. Some infants may present with granulomatosis infantisepticum with disseminated granulomas in the lung, skin, liver and other locations. Mortality rates for infected neonates can be as high as 50 per cent and prompt diagnosis and treatment is vital.

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When breastfeeding fails

Dr Brett Daniels
FRANZCOG

Although policies still promote this as an ideal, the majority of women do not exclusively breastfeed their infants until six months of age. Should clinicians take this into account?

Each of the public and private hospitals I have worked in over the past ten years has sought Baby Friendly Hospital Initiative (BFHI) accreditation. Among the benefits of breastfeeding listed on the BFHI website are: breastfed infants are less likely to suffer from diarrhoea, acute respiratory infections and other serious illnesses.[1]

Breastfeeding establishes and supports a baby's immune system and helps protect from chronic conditions later in life, such as asthma, allergies, heart disease, obesity and diabetes. Breastfeeding is also stated to support a baby's developing brain and nervous system, ensuring optimal intelligence. Hospitals accredited with BFHI are expected to provide information on these benefits both antenatally and postnatally. BFHI accredited hospitals are encouraged to adhere to a ten-point plan to successful breastfeeding, including a policy of no supplementation of breast milk unless medically indicated, 24 hour rooming in, no use of artificial teats or dummies and encouraging of feeding on demand. While BFHI-accredited hospitals comprise only 19 per cent of maternity facilities in Australia[1], similar information is widely available to expectant mothers.[1]

Media outlets report the positive benefits of breastfeeding, while negative studies may receive less publicity. For example, in 2013 Belfort et al's American study reporting increased intelligence in breastfed children at three and seven years of age was widely reported, despite not all measurements of cognitive performance in that study showing a significant difference[2], while Horta et al's larger study showing no consistent relationship between breastfeeding and educational attainment has received less publicity.[3] Walfisch et al this year reported a large systematic review of 84 studies of the association of breastfeeding and intelligence quotient (IQ).[4] They selected studies to only include healthy term babies, validated measures of cognitive development and a prospective or retrospective documentation and duration of breastfeeding. Many of the studies reviewed had adjusted for possible confounders such as socioeconomic status, maternal education, birthweight, gestational age, birth order and gender. Of the 84 studies included, 28 showed a significant positive association between breastfeeding that was maintained after adjustment for confounders, while 21 showed no association between breastfeeding and IQ. Thirty-five studies that showed a positive relationship prior to adjustment for confounders showed a reduced (17 studies) or no association (18 studies) after adjustment. The most common confounders were maternal intelligence and socioeconomic status. The size of the effect of breastfeeding on IQ in the included studies appeared to be five points or less.

IQ tests are designed to have a population median of 100 points with a standard deviation of 15 points. Most IQ measures have a standard error of measurement of about three points, with a person's true IQ 95 per cent likely to be within plus or minus about four points of their measured score. It could be reasonably argued that an effect size of about five points may not have a strong clinical significance.

The 2012 NHMRC Eat for Health guidelines on child and adolescent feeding recommend infants are exclusively breastfed until six months of age, with some breastfeeding to continue until 12 months and beyond if the mother and child wish.[5] The BFHI website also supports the World Health Organisation (WHO) statement that babies would be exclusively breastfed until six months of age.[1] Despite the benefits of breastfeeding being well known to most women, exclusive breastfeeding until six months is not the norm in Australia. The 2010 Australian National Infant Feeding Survey published the Australian Institute of Health and Welfare (AIHW) reported that only 39 per cent of infants were exclusively breastfed to three months and two per cent exclusively breastfed to six months.[6] The survey also found that nearly ten per cent of infants were receiving no breast milk by four weeks of age, although this was only a very small sample size of 33 respondents with children aged four weeks or less at the time of the survey. By three months of age 30 per cent of infants were receiving no breast milk.

These data indicate that, while breast milk is acknowledged to be the optimal food for babies, a substantial number of women do not persist with breastfeeding until the recommend ages. The AIHW survey reported four per cent of children aged 24 months had never been breastfed. Reasons cited by the women for never giving breast milk included a previous unsuccessful attempt at breastfeeding (38 per cent), so partners could share in feeding (29 per cent), a belief that formula was as good as breast milk (26 per cent), medical reasons for mother (20 per cent) and not feeling comfortable breastfeeding in public (16 per cent). For women who started breastfeeding but stopped before six months, the most common reason was not enough milk (56 per cent), baby was unsettled (24 per cent) and baby not attaching properly (25 per cent).[6]

There are some data linking unsuccessful breastfeeding and postnatal depression. For example Gugliardi et al administered the Edinburgh Postnatal Depression Scale (EPDS) to 592 women two-to-three days after delivery and then surveyed their feeding methods at 12–14 weeks post-birth. Their results indicated an association between a higher EPDS scale and an increased rate of bottle feeding at three months. The association was seen even with relatively low levels of depression as measured by the EPDS.[7] Steube et al propose that there is shared neuroendocrine basis to both failed breastfeeding and perinatal depression. Drawing from both animal and human studies, the authors propose a number of mechanisms that may lead to both unsuccessful lactation and perinatal depression. For example, low serotonin levels can inhibit prolactin release, as well as being associated with mood disorders, while differences in pain perception can lead to cessation of breastfeeding owing to pain and are linked to perinatal depression. They also review data showing infants born to mothers with depression have different suckling responses to babies born to euthymic women, which may then predispose to unsuccessful breastfeeding.[8]

The association between unsuccessful breastfeeding and perinatal depression is unlikely to be in one direction. In some women, failure to breastfeed may lead to feelings of guilt and anxiety, which then predispose to the development of postnatal depression. With such widespread support for women willing and able to continue breastfeeding until at least six months, there sometimes appears to be less consideration for women who do not continue to breastfeed. Flaherman et al conducted ten focus groups with American women who had milk supply concerns in the first month of their child's life.[9] While this was a small qualitative study, some of the responses of the women seem familiar. Women in the study, especially those who eventually ceased breastfeeding, reported feelings of pressure and guilt associated with milk supply problems and the introduction of artificial feeding. Interestingly, women reported that their interactions with nurses and lactation consultants regarding breastfeeding were more salient than those with paediatricians and obstetricians, suggesting our influence may be less than we think. The authors particularly focussed on the role of newborn weight measurements in women's decisions to continue with breastfeeding, suggesting they may provide an important focus for supporting women's feeding choices.

Labbok presents a thoughtful analysis of the physician's role in the development of guilt in women who don't breastfeed.[10] Where Flaherman et al report that women may have their guilt exacerbated by their interactions with healthcare workers, Labbok cautions that doctors need to ensure this doesn't lead to them failing to promote breastfeeding for fear of increasing guilt feelings in their patients. Rather she suggests we should equip ourselves to support women as much as possible in their feeding, while still advocating the best practice in infant feeding.

As always in clinical practice, studies and policies can only get us so far. The majority of women do not exclusively breastfeed their infants until six months of age, while many of our policies still promote this as an ideal. As clinicians we should be aware of this disparity and support our patients in their particular path through this sometimes difficult phase. We need also to be careful to critically assess the sequelae of both continuing and ceasing breastfeeding.

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Learning laparoscopy

What does the future hold for training in laparoscopic gynaecological surgery?

Dr Martin Ritossa
MBBS, FRANZCOG
Director of Gynaecology
Northern Adelaide Local Health Network
Board member and Treasurer
RANZCOG
Director
Australian Gynaecological Surgery and Endoscopy Society

In my roles within the College and Australian Gynaecological Surgery and Endoscopy Society (AGES), and in my working life I commonly hear discussion about both the quantity and quality of surgical training available in gynaecology. It is well known that Trainees and, for that matter, Fellows, particularly in the public system, have experienced a notable decline in the number of major surgical procedures with which they are involved. This decline may be due to a combination of: an increase in the number of practitioners; a decrease in the number of working hours; and new interventions that bypass the need for surgery. Decreasing exposure to surgical procedures has obligated us to look at new ways to deliver surgical training. This article will focus on laparoscopic surgical training and how we can maximise training opportunities within the limits of the current training environment.

What skills should a Trainee aim to acquire?
There is general consensus that the award of FRANZCOG no longer provides evidence that the new Fellow is equipped to perform every gynaecological procedure. During its deliberations, the Training Review Working Party (TRWP) recognised that not every Fellow could or should be able to perform every procedure, and the group carefully considered what skills a Trainee should obtain to be a Fellow of the College. Future Trainees and specialists will need to seek out training opportunities and obtain credentialing in the areas they wish to work. Laparoscopic surgery is one of those areas where extra training will be required. It is the College's position that a new Fellow will have the skills and experience they desire to work in their particular scope of professional practice as a specialist. The challenge is to marry the appropriate training experiences with the appropriate Trainee. It is the College's aim to guide training and accredit the appropriate training opportunities. The curriculum will guide the expectations of training outcomes and the Advanced Training Modules (ATMs) should provide the experience.

Not all people are born to be laparoscopic surgeons. Yet, up until now, Trainees were all expected to be able to perform like one. The new training program will mean that the ever-decreasing surgical training opportunities can be directed towards those Trainees who wish to pursue a career in gynaecological surgery. Those who do not have the interest or the aptitude can concentrate their learning in the areas of the specialty they find more rewarding and appealing.

The aim of the new training program is to ensure all Trainees can competently and confidently perform level two laparoscopic surgical procedures by the end of core training. These skills include basic diagnostic laparoscopy, laparoscopic sterilisation and treatment to minimal endometriosis. Ideally, most Trainees will have had enough experience to manage a tubal ectopic pregnancy laparoscopically. However, with the renewed interest in medical management of ectopic pregnancy, laparoscopic surgery to treat ectopic pregnancy may ultimately become an advanced procedure.

After completion of core training, Trainees will need to seek out ATMs to extend their skills in areas of interest. It is envisaged the College will develop and formalise a laparoscopic surgery ATM. The aim of this extra training will be to extend the Trainees' skills, allowing them to perform level four procedures such as laparoscopically assisted vaginal hysterectomy, total laparoscopic hysterectomy and excision of level three endometriosis. Those Trainees wanting to go further and perform laparoscopic sacrocolpopexy or to treat advanced endometriosis, may need to do additional post-Fellowship training. This training could be achieved by spending two years in an appropriate laparoscopic ATM, by joining the urogynaecological subspecialty training program or completing an AGES laparoscopic surgery fellowship.

> 'We live in a world where laparoscopic surgery should be the procedure of choice for most benign gynaecological conditions.'

What is the best way to approach training?
Trainees need to be engaged in, and motivated towards, their training. The best form of training involves structured task-based learning that is repetitive in nature and where a trainer is available to provide immediate and constructive feedback. Unfortunately, in the current work-based models of training, cases are often too complex and too infrequent to allow for structured repetitive training. Where once we relied on the volume of workload to train our Trainees, it is now incumbent on all of us to seek out new ways of training.

Maximise experience before patient contact

In recent years, a lot of research has been undertaken on surgical training techniques. Simulation is increasingly becoming an integral part of training. Surgical simulations involve many different techniques, including bench models, live animal workshops, cadaver workshops and virtual-reality trainers. The latter draw more interest than simple 'box' trainers, but are more expensive and labour intensive. The important thing is for training to be effective and learning sustained, it needs to be both deliberate and repetitive. The best thing a Trainee can do is obtain a basic box trainer and sit down on a regular basis with a mentor

– who could be a consultant, senior Trainee or layperson – who can provide direct instruction and feedback. The Trainee should practise tasks such as laparoscopic suturing and intracorporeal knot tying. By spending many hours practising these skills a Trainee can learn the visual and tactile cues required for working in the two-dimensional environment.

If a Trainee can comfortably tie a knot in a box trainer, chances are when they are given an opportunity to operate on a live patient they will do well. The worst thing you can do is attempt to do something laparoscopically and fail to demonstrate the basic skills. No one would expect to be able to attempt a caesarean section if they had not sutured an episiotomy. Likewise, one should not expect to do a laparoscopic operation unless they have demonstrated the ability to move instruments purposefully through the abdomen, grasp structures appropriately and hold a camera reliably. A simple box trainer can provide these skills.

Make every patient contact a learning experience

We have all heard the saying 'practice makes perfect'. Like everything these days, old is new again and Ericcson et al have given validity to this statement, demonstrating that 10 000 hours of practice is required to make one an expert.[1] Unfortunately, we are at the mercy of hospital budgets, bed closures, decreasing clinical material and decreased working hours: all of these are impediments to obtaining hands-on surgical skills.

Given these restrictions, new ways of acquiring skills are required to gain experience. Laparoscopic surgery lends itself to learning by assisting. Do not feel deprived if you cannot be the primary surgeon. Cases are becoming increasingly complex and the lists often run late. These factors, coupled with the expectation of more consultant input, make first operator experience more difficult to obtain. Consider assisting as a learning experience:

- Concentrate on following the operation with the camera.
- Zoom in and out as required.
- Follow specimens and needles up to the port sites.
- Follow the surgeon's instrument around the pelvis.
- Try to predict where the surgeon wants to go next: assist actively. Bring your instrument into the surgical field.
- Be ready to grasp tissue when asked.

Being an active assistant enables you learn valuable skills and practise hand-eye coordination.

When given the opportunity to be a primary operator, break the operation down into steps. In more complicated cases do not expect to complete the whole operation on the first attempt – aim to learn the operation step by step. For example, at laparoscopic hysterectomy the first step you may learn is suturing the vault. When you can do that in a timely fashion you can gradually move on perform the rest of the operation, which by now you have had the chance to observe on several occasions.

Learn as much about the procedure as you can before the operation. Knowing the basic anatomy and what to expect during surgery will enable you to remember more during the operation. After the operation is finished, write down what you have seen so that you can refresh your memory before the next case.

What is the value of attending workshops?

When contemplating the acquisition of new skills, surgeons commonly look at attending conferences and workshops. Laparoscopic conferences should be inspiring. Attend the conferences to be impressed by the innovations, but always remember that the wonderful feats that impress you are not everyday practices and the real world is often very different. Back at home your practice will be restricted by equipment, case load, experience and what is in the best interest of your patients. Robotic surgery is a great example of this, with the American Congress of Obstetricians and Gynecologists stating quite clearly that its use is not justified in benign gynaecology at the moment.

Workshops, on the other hand, should be practical and pitched at a level that suits the participant. The best workshop is the one that meets your training needs. There is no point attending a workshop on laparoscopic sacrocolpopexy unless you are at an appropriate stage in your career, and have the caseload, to introduce it to your practice. Before you sign up to a workshop make sure the workshop has clearly stated goals that are pitched at your level of experience. Make sure there is hands-on supervision: one trainer for every two participants works well with laparoscopic surgery. Make sure the hands-on component of the workshop accounts for the majority of the time you spend training. The best workshops will be run over a few days. This gives you the opportunity to repeat skills over several sessions, which will improve retention. Trainees should look for workshops that teach laparoscopic suturing, intracorporeal knot tying and vaginal vault closure. In addition, workshops can provide training on electrosurgical, ultrasonic and morcellation equipment.

Should laparoscopic surgery be a subspecialty?

We live in a world where laparoscopic surgery should be the procedure of choice for most benign gynaecological conditions. With gynaecological oncologists using laparoscopic surgery for the most complex of patients, the old excuses of it's too big, too hard or not safe are rapidly becoming myths. No patient should undergo a laparotomy because of the surgeon's lack of laparoscopic skills. The world of tomorrow will demand that you up-skill or refer to a tertiary service. The reality is that this work will become the work of those with special skills. However, I believe that all those practising operative gynaecology should have the skills to perform levels three or four laparoscopic surgery. A combination of seeking out advanced training positions that have the required training opportunities, regularly using surgical simulation as a training tool and attending workshops structured at an appropriate skill level will give today's Trainees who choose to practise operative gynaecology the skills they need to fully utilise laparoscopic surgery in their day-to-day practice.

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RANZCOG Research Foundation

Recipients for 2014

Prof Jonathan Morris
Chair, Grants and Scholarships Committee

Prof Caroline de Costa
Chair, Board of Research Foundation Directors

Arthur Wilson Memorial Scholarship, 2014–15

Dr Fiona Brownfoot
Treating Severe Preterm Pre-eclampsia with Pravastatin: An Early Phase Clinical Trial

Dr Brownfoot is a RANZCOG Elective Research Trainee (Level 5) at The Mercy Hospital for Women and a PhD student and Honorary Clinical Lecturer at The University of Melbourne. Dr Brownfoot has been awarded the Arthur Wilson Memorial Scholarship for her project that will examine the administration of pravastatin to women diagnosed with severe early-onset pre-eclampsia to determine whether the drug can stabilise or reverse disease progression, and to assess its safety. It is hoped the drug can reduce the disease severity, allowing the pregnancy to continue until the baby is ready to be born.

Fotheringham Research Fellowship, 2014–15

Dr Ryan Hodges
Fetal Therapy for Congenital Diaphragmatic Hernia: A Global Partnership to Translate Surgical and Cellular Innovation

Dr Hodges is an NHMRC Hamilton Fairley Postdoctoral Research Fellow at the Ritchie Centre. Dr Hodges has been awarded the Fotheringham Research Fellowship for his project that aims to test the hypothesis that human amnion epithelial cells (hAECs), when administered antenatally to fetuses with congenital diaphragmatic hernia (CDH), can reduce lung hypoplasia and abnormal pulmonary vasculature that leads to pulmonary hypertension, by promoting tissue regeneration and repair in utero.

Luke Proposch Perinatal Research Scholarship, 2014

Dr Cecelia O'Brien

Metformin and Dietary Advice to Improve Insulin Sensitivity and Promote Gestational Restriction of Weight in Pregnant Women who are Obese (GRoW Trial) - Effects on Fetal Growth

Dr O'Brien is a PhD student at the University of Adelaide and has been awarded the Luke Proposch Perinatal Research Scholarship for her study which aims to determine whether Metformin, a common medication used in diabetes, can help to change the outcomes for women with obesity and their babies. Using ultrasound, this study will assess baby growth patterns over the course of the pregnancy.

Mary Elizabeth Courier Research Scholarship, 2014

Dr Luke Larmour
Factors Influencing the Progression of High-grade Cervical Dysplasia to Invasive Carcinoma

Dr Larmour is studying towards a Doctor of Philosophy Degree at Monash University and has been awarded the Mary Elizabeth Courier Research Scholarship for his project examining how pre-cancer of the cervix of the uterus progresses to cancer. Dr Larmour plans to use new technologies to find changes in the sequence of genes and their effects on pre-cancer and cancer cells. The importance and interaction of these genetic changes will be studied in a new mouse model of cervical cancer that will be developed. It is hoped that this will lead to identification of new targets for urgently needed new treatments for cervical cancer.

Robert Wrigley Pain Research Scholarship, 2014

Dr Jason Chow
Quality of Life Outcomes Following Pudendal Nerve Release Surgery in Patients with Pudendal Neuralgia

Dr Chow is a Pelvic Pain Fellow at the Women's Health Research Institute of Australia and Royal Hospital for Women in Sydney. Dr Chow has been awarded the Robert Wrigley Pain Research Scholarship for his study that will evaluate changes in quality of life and pain in patients who suffer pain from the pudendal nerve and undergo surgery to release the nerve. Dr Chow's project aims to compare quality of life factors using an SF-35 item health survey in patients with pudendal nerve entrapment before and after surgical release at three-, six- and 12-month intervals.

RANZCOG Fellows' Clinical Research Scholarship, 2014

Dr Ruchi Singh

Vaginal Dimensions in Women with Pelvic Organ Prolapse, Using Vaginal Casts

Dr Singh is a urogynaecology fellow and VMO in the Pelvic floor Unit at the Royal Women's Hospital, Melbourne, and has been awarded the RANZCOG Fellows' Clinical Research Scholarship for her project that will use vaginal casts to study vaginal dimensions in women with pelvic organ prolapse (POP) and selectively evaluate women who are at increased risk of pessary failure owing to a previous surgery. It is hoped that understanding how POP alters vaginal dimensions and shape will inform the development of novel pessaries purpose-designed for women with POP, which may increase the efficacy and acceptability of these devices resulting in significant implications for women in Australia, as well as in developing countries, where POP is common and surgical options are limited.

Brown Craig Travelling Fellowship, 2014

Dr Carin Black

Dr Black is currently a Maternal Fetal Medicine Accredited Trainee/Level 6 RANZCOG Trainee at the Royal Women's Hospital in Melbourne. Dr Black will visit St Thomas' Hospital in London with the intention that the clinical skills gained from fetal and maternal medicine clinics and labour ward sessions will enrich her practice on return to Australia.

Scholarships continuing in 2014

Ella Macknight Memorial Scholarship, 2013-14

Dr Kjiana Schwab

Gene Profiling Endometrial Stem/Progenitor Cells in Eutopic Endometrium from Women with Endometriosis

Dr Schwab is a research fellow at the Richie Centre and her project will examine the gene profile of endometrial stem cells (epithelial progenitors and mesenchymal stem cells) and their non-stem cell counterparts in women with and without endometriosis to identify gene pathways that confer survival or self-renewal of stem cells shed into the pelvic cavity. It is hoped that this may provide new molecular targets in endometrial stem cells for new medical treatments; leading to changes in the way endometriosis is treated and minimising the need for invasive procedures

Glyn White Research Fellowship, 2013–14

Dr Mary Tolcos

Using Diazoxide to Promote Oligodendrocyte Differentiation and Myelination in the IUGR Brain

Dr Tolcos, a senior research officer at the Ritchie Centre, Melbourne, was awarded the Glyn White Research Fellowship for her project Using Diazoxide to Promote Oligodendrocyte Differentiation and Myelination in the IUGR Brain. Intrauterine growth restriction (IUGR) is associated with a delay in the development of oligodendrocytes, the myelin producing cells in the brain. Using their established sheep model of IUGR, Dr Tolcos' team will test the ability of diazoxide, a drug currently used in infants with high insulin, to promote oligodendrocyte development and restore myelin within the developing brain.

For further information about the work of the Research Foundation, please contact:

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Staff news

New appointments

Anna Snell started with the College in mid October in Assessment Services as an examinations administrator. Her qualifications include a bachelor degree in fine arts and a bachelor degree in psychology (Hons).

Anna comes to the College from a 15-month contract position with the Murdoch Childrens Research Institute, where she worked on a longitudinal study.

Bradley Fry started with RANZCOG in late August as a financial accountant. Working within the finance team, his role is across most areas of accounting within the College, including assistance in implementing new financial systems. His previous roles include; a finance manager for a book publishing firm and an accountant within a statutory planning body for outer Victorian communities.

Brad has a bachelor's degree in accounting and completed his CPA earlier this year.

Departures

Frances Gileard, Research Foundation coordinator, left the College in September after 15 years with RANZCOG. We wish her all the best for the future.

Kate Hutchinson, administrative assistant, events, education and training in the NSW Regional Office resigned in November to take up a new position. We wish Kate all the best in her new role.

Annie Robertson, project manager diagnostic, imaging and quality, left the College in November after nearly 13 years with RANZCOG. We wish her all the best for the future.

Notice of Deceased Fellows

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

A/Prof Robert Sholto Planner, Vic, on 25 July 2013
Dr Robert Ernest Mazzucchelli, WA, on 8 August 2013
Dr Peter Charles McLeod Wilson, NSW, on 1 October 2013.

Obituaries

Dr John Roger Doig
1946 – 2013

John Doig was born on 26 July 1946, in Christchurch, New Zealand. His secondary education was at Christchurch Boy's High School, after which he attended Canterbury University, graduating with a BSc in zoology in 1969. That year John commenced his medical studies at Otago University, graduating MB ChB in 1973. He spent his house surgeon years working for the North Canterbury Hospital Board hospitals. Initially, John thought he would pursue a career in paediatrics, before eventually deciding on a career in obstetrics and gynaecology.

His specialist training was conducted partly at Christchurch Women's Hospital, but he also spent two-and-a-half years working at the Queen Mother's Hospital in Glasgow. At this time he gained his MRCOG in 1979. John enjoyed his time in Scotland as he was always immensely proud of his Scottish ancestry. He became a Fellow of the Royal New Zealand College of Obstetrics and Gynaecology in 1982.

On returning to Christchurch, John took up the position of tutor specialist in O and G at Christchurch Women's Hospital and, in 1983, was appointed visiting part-time consultant in O and G. Throughout his time on the visiting staff of Christchurch Women's Hospital, John undertook lectureship duties for the University of Otago in various roles from 1984 onwards.

Whenever John saw a need within our specialty he approached it in a business-like and methodical manner. The first example of this was in recognising the lack of new fertility technologies for infertile couples in the Canterbury, Nelson and Marlborough region. Along with Michael Laney, he initiated a fundraising project to seek capital support from the community and local commerce that proved successful enough to establish the Christchurch Women's Hospital IVF Unit, opening within the confines of the old Christchurch Women's Hospital in 1991. In 1996, John, with five other professional colleagues, developed The Oxford Clinic Day Hospital and therapeutic centre in Christchurch, specialising in advanced laparoscopic surgery and gaining a reputation for excellence throughout the country. As a further extension of his commitment to advanced laparoscopic surgical techniques, John, with the blessing of the Board of Directors of The Oxford Clinic, drove the establishment of a Fellowship to enhance such gynaecological training. It was run as a joint venture between the Canterbury District Hospital Board and The Oxford Clinic. John was elevated to Fellowship of the Royal College of Obstetricians and Gynaecologists in 1992.

One of John's main surgical and clinical interests was in the management of endometriosis. He was a regular speaker at endometriosis support group meetings from 1988 onwards, culminating in him being a founding member of Endometriosis New Zealand that was set up as a charitable trust in 1994. John served on the Board of Endometriosis New Zealand until his retirement. In 2011, John was awarded the RANZCOG Distinguished Service Medal for his work in both endometriosis and advanced endoscopic surgery. The award also recognised John's huge contribution to the lead-up and eventual amalgamation of the Australian and New Zealand Colleges to form RANZCOG and for his service as Chair of the New Zealand National Committee of RANZCOG from 1999 to 2001.

Outside of medicine, John pursued many varied interests, including horse breeding, fishing, singing with the Kilmarnock Edition, with whom he made four commercial recordings during a performing career of 25 years, and sport. It was John's warm, caring personality and beaming smile that endeared him to all who came across his path, both professionally and in leisure. John was always willing to help when asked but also ready to ask if help was needed.

John passed away on 23 July 2013. He is survived by his wife Susan and his four children Roger, David, Stephen and Katherine and three grandchildren. He will be greatly missed by his wife and his extended family as well as colleagues, staff, patients and citizens alike. The stories about John will live on long after his passing.

Dr Michael East
FRANZCOG
Christchurch, New Zealand

Asia Pacific Committee

Involved in a developing country? We'd love to hear from you!

The APC is keen to be kept informed about activities and involvement of our Fellows in all developing countries, but particularly the Asia Pacific region. From this information we will be able to increase valuable networks and build a more comprehensive picture of the involvement of College Fellows in the region, either under the auspices of the College or via other avenues or personal connections you may have.

Please send one paragraph outlining details of any activities/projects/consultations you have been involved in over the past year or details of activities you will be involved in for the coming year to:

Carmel Walker, Senior coordinator, Asia Pacific Services
(e) cwalker@ranzcog.edu.au

A/Prof Kenneth Margolis
1936 – 2013

Kenneth Margolis was born in Cape Town, South Africa, on 1 May 1936. He excelled as a medical student at the University of Cape Town and also played rugby for the Western Province under-21 team. A few years after graduating, he set up a GP practice with his twin brother Frank. General practice was satisfying, but after ten years he yearned for greater challenges and moved to Durban to train as an obstetrician and gynaecologist at King Edward VIII Hospital. The hours were long, the work was tough and the stresses were great, but Kenneth survived all this to qualify as a specialist obstetrician and gynaecologist in 1973. He loved teaching medical students of the University of Natal and the students loved his tutorial sessions. He went on to become the head of the obstetrics and gynaecology department at the University of Natal.

Kenneth now needed new challenges and this prompted him to go into private specialist practice with his brother Frank in Durban. After many successful years of private practice, the love of teaching made him go back to academia and he joined the staff of the University of Stellenbosch. He decided to come to Brisbane, in 1994, for a six-month sabbatical. He was offered a position as director of obstetrics and gynaecology at Logan Hospital and a professorship by the University of Queensland in 1995. He held this post until his retirement in 2002. Although retired, he still continued his passion, teaching second- and fourth-year medical students at the Queensland Medical School until ill health forced him to stop in 2006.

Kenneth passed away on 12 July 2013 at the Wesley Hospital. He was very much a family man in addition to being a doctor and a teacher. He was married to his wife June for 40 years and, following his exceptional example, all of his children obtained tertiary qualifications.

I had the good fortune of knowing Kenneth as he was one of my teachers when I was at medical school and one of the consultants when I was training in gynaecology. As fate would have it, I followed him to Brisbane and worked as his deputy at Logan Hospital. Kenneth embodied enthusiasm, dedication and hard work. In everything that he did, his keenness and enthusiasm were palpable. He was a wonderful mentor and team player. A more sincere and dedicated doctor would be difficult to find. May God bless him and may his soul rest in peace.

Mahomed Khatree
FRANZCOG
Queensland

Dr John Warwick Newman
1928 – 2012

John (known as Warwick) Newman was born on 2 February 1928 at Cullen Bullen near Lithgow in New South Wales, where his father was the mines manager. He attended Sydney Church of England Grammar School (Shore) and commenced medicine at the University of Sydney in 1948. In his second year of medicine, he developed severe type 1 diabetes and needed to take two years off from his course. During this time, he took up surveying.

After graduating in 1956, Warwick became a resident medical officer at Sydney Hospital and then at St Vincent's Hospital, Darlinghurst. Assisting the plastic surgeons at St Vincent's stimulated his future interest in microsurgery and reversing tubal ligations. He then worked at the Royal Alexandra Hospital for Children in Camperdown, where he learnt how to perform an emergency tracheotomy.

Warwick trained in obstetrics and gynaecology at the Royal Hospital for Women, Randwick. He then took up a one-year research fellowship at the White Memorial Medical Center in Los Angeles, where he helped to construct a fetal heart rate monitor, which he brought back to the Royal Hospital for Women.

In 1962, he travelled to London as a ship's surgeon and delivered two babies on the way. He gained membership of the Royal College of Obstetricians and Gynaecologists and developed his interest in fetal blood pH and gas analysis.

On returning to Australia, he worked at the Queen Victoria Hospital in Melbourne and then moved to Monash University, where he continued working on fetal heart rate monitoring and fetal blood analysis and specialised in colposcopy.

Warwick achieved Fellowships of the Royal College of Obstetricians and Gynaecologists in 1978, and the Royal Australian College of Obstetricians and Gynaecologists in 1980.

On retiring, Warwick and his wife Anne moved back to Sydney and lived at Avalon. During his retirement, he played golf and was well known for his psychic bids in bridge.

Warwick died on 19 August 2012 following complications from his diabetes. He is survived by Anne and their children Peter, David, Gregory and Emma.

Roche JB. John Warwick Newman MB BS, FRCOG, FRACOG. *Med J Aust* 2013; 199(4):295.