Review article

Management and clinical implications of multiple pregnancies: A focus on zygosity, chorionicity, and monochorionic twin complications

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Abstract

This comprehensive review explores the multifaceted phenomena of twin pregnancies, tracing their historical significance from ancient cultures and mythologies to modern scientific investigations. It delves into the genetic and environmental factors influencing the occurrence of twins, distinguishing between monozygotic (identical) and dizygotic (fraternal) twins and discussing the implications of zygosity and chorionicity on pregnancy management and outcomes[1]. Highlighting the unique challenges of twin pregnancies, such as increased risks of preterm birth, low birth weight, and specific complications like Twin-Twin Transfusion Syndrome (TTTS), the article emphasises the need for specialised, multidisciplinary care. It presents a case study of a monochorionic diamniotic twin pregnancy, illustrating the complexity of managing such pregnancies, especially in remote settings with limited access to healthcare resources[2]. The review advocates enhanced prenatal care, early determination of chorionicity, and tailored management strategies to improve outcomes. It concludes by addressing the heightened challenges in remote Australian communities, where socio-economic and logistical barriers further complicate the provision of care, underscoring the necessity of government initiatives and community-based programs to bridge these gaps and ensure equitable healthcare access.

Introduction

Twins have long been mentioned in ancient cultures and mythologies[2,3], reflecting a perennial fascination and reverence for their occurrence in human societies. They continue to hold a special place in the folklore and traditions of many cultures worldwide, often seen as bearers of good and bad luck.

Perhaps the most famous figures in ancient Roman mythology are Romulus and Remus[3], the legendary founders of Rome. They were the sons of the god Mars and the Vestal Virgin Rhea Silvia, abandoned to die and yet fatefully saved and nursed by a she-wolf. As an adult, Romulus founded Rome in 753 BCE and became its first king, marking the beginning of Roman civilisation.

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In Greek mythology, Apollo (god of the sun, music, and prophecy) and Artemis (goddess of the hunt, wilderness, and childbirth) were the twin children of Zeus and Leto and are among the most venerated deities. Apollo was associated with the sun, music, poetry, and healing and was often depicted as the ideal of youth and masculinity. Artemis, his twin sister, was the goddess of the hunt and childbirth, which speaks to her complex nature as a deity of both life-giving and taking, embodying the cycle of life and death in the natural world.

In recent times, Ronnie and Reggie Kray[4] have also come to represent giving and taking. They were Infamous British gangsters in the 1950s and 1960s, involved in murder, armed robbery, and racketeering before being imprisoned.

Characteristically, twins share a connection that is stronger than that of other siblings. Though perhaps less penitentiary than that of the Krays, there are numerous anecdotes of twins exhibiting a remarkable connection, such as feeling each other's pain or finishing each other's sentences. Some twins develop private languages, known as cryptophasia, which usually fades as they mature and use conventional language more frequently. The "Jim Twins"[4]: Separated at birth and adopted by different families, were reunited at age 39 and discovered astonishing similarities in their lives, including the names of their sons, their occupations, hobbies, and even the make and model of their cars. Even though they share the same DNA, identical twins may still have phenotypic differences, such as fingerprints, and, occasionally, have opposite features, like mirrored reflections. For example, if one twin is left-handed, the other might be right-handed, or they could have birthmarks on opposite sides. These differences can arise from intra-uterine factors and de novo mutations during development. Twin studies exploring these phenomena have broadened our understanding of the influence of genetics (nature) and environment (nurture) in shaping gene expression and, ultimately, human development, health, and behaviour.

Multiple pregnancies present unique challenges in obstetric care. Zygosity, or the genetic similarity between offspring, distinguishes between monozygotic (identical) and dizygotic (fraternal) twins and is pivotal for assessing the risk of hereditary conditions[2]. Chorionicity, indicating the type of placentation, is critical in managing and predicting pregnancy outcomes. This article explores the interplay between zygosity and chorionicity in multiple pregnancies, their prevalence, associated risks, and the clinical significance of chorionicity in monochorionic (MC) twin pregnancies.

Case presentation

This case reports a 31-year-old primigravida. She was a single mother who conceived through in vitro fertilisation (IVF). Her eggs were fertilised using anonymous donor sperm, and pregnancy arose from single embryo transfer. Early transvaginal ultrasound confirmed viability and a monochorionic diamniotic (MCDA) twin gestation of two baby boys.

Her first visit for established antenatal care occurred at 11 weeks. She was well and excited to be pregnant. She came supported by her mother. Her past medical history included Type 2 Diabetes Mellitus (T2DM) managed with oral medications, anxiety, depression, which were unmedicated, and several autoimmune comorbidities, including asthma, fibromyalgia and dermatitis managed conservatively. She was also noted to have underlying hypertension, which had not been treated previously. She was commenced on low-dose aspirin and high-dose folic acid supplementation with iron. Her baseline blood tests were normal.

The patient attended regularly for booked antenatal appointments and serial ultrasound (USS) examinations. Her diabetes was managed effectively using metformin and insulin from the second trimester. Her blood pressure required treatment and was controlled with Labetalol. Both she and her babies progressed well until 33 weeks gestation. At this time, a routine USS examination demonstrated a new onset of fetal growth discordance.

She was managed conservatively in collaboration with a tertiary Maternal Foetal Medicine Unit. High-level foetal surveillance was instigated, which included daily foetal movement counts, twice-weekly cardiotocograph (CTG), regular USS for amniotic fluid volume (AFI), and Doppler studies of umbilical and middle cerebral arteries. Her blood sugars remained well controlled despite steroid loading, and serial blood and urine examinations showed no signs of incipient pre-eclampsia.

At 33 weeks plus five days, she went into labour. The leading twin was cephalic and was the bigger of the

two twins. His fetal heart trace was non-reassuring, and an emergency lower uterine segment caesarean section (LUSCS) was conducted. Both babies were delivered in good condition and were transferred to an intensive neonatal care unit (NICU) for ongoing support.

Discussion

Historical perspectives

The exploration of twin pregnancies has its origins in antiquity[4]. One of the earliest documented examinations is attributed to Hippocrates, the physician of ancient Greece, who lived circa 460-370 BCE. Hippocrates and his contemporaries were instrumental in systematically observing and documenting twin pregnancies, distinguishing them from singleton pregnancies. Their work highlighted the unique considerations and implications of twin gestations for both maternal and fetal health.

Further advancements were made by Galen, a distinguished Roman physician, surgeon, and philosopher who lived from 129 to 216 CE. Galen's contributions were notable for his observations that twins do not invariably share identical characteristics[4]. He introduced the distinction between fraternal (dizygotic) and identical (monozygotic) twins. This differentiation was a significant milestone, declaring that twins could be genetically identical or distinct.

The study of twins gained considerable momentum during the Renaissance with the work of William Harvey (1578-1657), an English physician best known for his discovery of the circulatory system and the introduction of the compound microscope in the late 16th century, coupled with improvements in histological staining techniques. These enabled Harvey and his contemporaries to intimately study embryonic cells and tissues. Such observations facilitated a more profound understanding of cellular differentiation, embryonic development, and the biological processes that may lead to the formation of twins. Specifically, Harvey's contributions were pivotal in elucidating the distinction between identical twins, who originate from the division of a single fertilised egg[5], and fraternal twins, who result from the fertilisation of two separate eggs.

The exploration of twin pregnancies and their genetic underpinnings was further enriched by the work of Gregor Mendel (1822-1884), the Austrian monk and scientist often hailed as the father of modern genetics. Mendel's research laid an understanding of genetic predispositions, including the tendency to release multiple eggs during ovulation, which can lead to fraternal twinning, thus explaining why certain families may exhibit a higher propensity for twin births[6].

These historical milestones in the study of twin pregnancies exemplify the evolution of medical thought and scientific inquiry from empirical observations in ancient times to the application of genetic and scientific principles in the modern era.

The investigation of twin pregnancies has significantly advanced since then, particularly with the integration of genetic, epidemiological, and technological innovations.

The introduction of ultrasound technology in the 1950s and its widespread application in the subsequent decades revolutionised prenatal care and research. For the first time, it became possible to diagnose twin pregnancies early and accurately, monitor their progression, and identify complications specific to twin gestations[7].

The development of techniques for fetal intervention, such as laser therapy for Twin-Twin Transfusion Syndrome (TTTS) and amnioreduction, represents a significant milestone in the management of twin pregnancies. These interventions have improved outcomes for conditions that previously had high morbidity and mortality rates[8,9].

The introduction of 3D ultrasound and the application of Magnetic Resonance Imaging (MRI) in prenatal care have provided more detailed and comprehensive imaging options for twin pregnancies. These technologies have enhanced the ability to diagnose and manage intrauterine complications, further improving fetal and maternal outcomes.

Aetiological considerations – why do twins occur?

Reproduction, in its most simple form, manifests through binary fission in unicellular organisms, like bacteria, where one cell divides to form two daughter cells, each genetically identical to the original parent. This process, which might metaphorically be likened to the creation of twins, eliminates the original cell in favour of two clonal reproductions[3]. This process offers significant advantages. Under favourable conditions, it can drive efficient, exponential population growth, enabling swift colonisation of hospitable environments.

With the evolution of life, increased cellular complexity paved the way towards multicellular, eukaryotic life forms. Pivotal to their transition was the advent of sexual reproduction, a process distinguished from its asexual precursor by its ability to foster genetic diversity. This diversity, facilitated by an innovative amalgamation and rearrangement of chromosomal material, endowed offspring with a genetic reservoir capable of buffering against mutations and other genetic errors or damage that may otherwise lead to cellular dysfunction. It also injected a surge of novel genetic sequences[10], bolstering subsequent generations' resilience and evolutionary agility, establishing genetic variation as the bedrock of adaptive evolution and species survival amidst fluctuating ecosystems.

Sexual reproduction, however, brought its own set of challenges and was not devoid of cost. The prerequisite for two distinct genders introduced constraints on reproductive opportunities, necessitating the involvement of two partners for the conception of each offspring. A compensatory strategy to counterbalance these limitations was the production of numerous offspring per reproductive event. This strategy, prevalent among lower vertebrates such as fish, birds, and amphibians, allows the birth of multiple offspring en masse, adhering to the principle that environmental selection pressures will favour the survival of the fittest offspring. Whilst born of the same event, we tend not to call these twins.

The occurrence of identical twins in sexual reproduction presents an intriguing and rare exception. It appears as a natural deviation or biological tactic to amplify reproductive yield from a singular gestational occurrence. It represents a unique intersection where sexual reproduction momentarily reverts to a mode reminiscent of its asexual lineage through the division of a single zygote.

As organisms evolved towards greater biological complexity, mammals developed internal gestation – a strategy that, while increasing offspring survival rates, imposes significant energetic demands on the mother. This cost is offset in various ways across the mammalian kingdom, ranging from the multiple pregnancies of smaller mammals, which can result in litters of up to eight or ten offspring, to the more energetically demanding gestations of larger mammals, including humans, where typically only one offspring is born per reproductive event[11]. In smaller mammals, the uterine structure is adapted to accommodate the spatial requirements of multiple placentations, allowing for less complicated gestation and birth. Thereafter, postnatal competition among littermates ensures the survival of the fittest. Less commonly, grazing animals such as sheep, goats, and cattle can be found with twin pregnancies. In the latter, if the twins are mixed-gender, Freemartins may occur. This condition arises when female and male twin calves share placental circulation, leading to the exchange of male hormones between the two foetuses, which may inhibit the female's reproductive organs, leading to sterility.

In larger mammals, including primates and humans, twin pregnancies represent a departure from the norm. These pregnancies, rarer and associated with higher risks than singleton pregnancies, underscore an evolutionary bias towards quality over quantity where birth is typically followed by ongoing social structures that provide extended parental care essential for nurture and the development of sophisticated behaviours and survival skills[11,13]. Hence, within the human context and other large mammals, multiple pregnancies may be regarded as a less favourable deviation from the standard reproductive paradigm. Despite their rarity, constituting only 1 to 2% of all births, or approximately 13 of every 1,000 babies born, they are invariably linked to a heightened risk of adverse outcomes, as we shall describe later.

Zygosity and chorionicity

Zygosity, the cornerstone of genetic similarity, differentiates between monozygotic or identical twins arising from a single fertilised oocyte and dizygotic or fraternal twins arising from two separate oocytes, each successfully fertilised. Chorionicity describes placentation and further categorises twin pregnancies into monochorionic and dichorionic. Monozygotic twins can result in monochorionic or dichorionic pregnancies, while dizygotic twins always lead to dichorionic pregnancies[8,9].

Monozygotic twins originate from the fertilisation of a single egg by a single sperm. At some point after that, the entire zygote cleaves, resulting in two or more embryos, each developing into genetically identical individuals. The incidence of monozygotic twinning is relatively constant worldwide, at about 3 to 4 per 1000 live births, indicating that the rate of occurrence does not significantly vary across different populations or environmental conditions. The reasons why this type of twinning occurs have yet to be fully understood. They may arise as a programmed event or, more

likely, as a mistake or variant of normal development where mechanisms of normal cell adhesion within the early cell mass fail to keep the embryo intact. Current understanding suggests it is a random event not influenced by genetic or environmental factors. Normally, the original cell has divided multiple times by the time the zygote develops into a blastocyst on day five post-fertilisation[9]. This blastocyst consists of an inner cell mass of adherent cells that will become the embryo and an outer cell layer that becomes the placenta. The timing of cleavage divides influences the type of monozygotic twinning that occurs. Because the two or more rarely three or more ensuing embryos are formed by division of the total cell mass, they may have insufficient volume to survive. If they do, and separation is early, each twin will have its own placental circulation, reducing the risk of complications associated with shared structures in later separations. A later division during the blastocyst stage can result in twins sharing a placenta but having separate amniotic sacs[2,9]. Twins dividing later still may share both the placenta and the amniotic sac, and very late divisions, occurring after the twelfth day, can lead to conjoined twins where the division is incomplete.

Born in Siam (now Thailand) in 1811, Chang and Eng Bunker were conjoined twins who became internationally famous in the 19th century. They were joined at the chest by a band of cartilage, and their condition and lives inspired the term "Siamese twins". After touring with P.T. Barnum's circus, they settled in North Carolina, married sisters, and raised families[14], becoming naturalised American citizens. They lived to the age of 63. Conjoined twins are a rare phenomenon that occurs when twins are physically connected. This condition results from the incomplete separation of identical twins during the early stages of embryonic development, typically within the first two weeks after fertilisation. The connection can range from sharing a small amount of skin and soft tissue to having shared organs and complex anatomical structures, depending on the attachment point and the extent of the fusion[8]. The survival and separation possibilities of conjoined twins vary greatly and depend on the specifics of their shared organs and tissues.

Fraternal or dizygotic twins occur when two separate eggs are fertilised individually by sperm during the same menstrual cycle, making the twins genetically similar but not identical. They share about 50% of their DNA, the same as any other siblings. However, being born contemporaneously creates unique dynamics in their relationship and development. Some unusual examples can arise. A rare phenomenon called heteropaternal superfecundation occurs when the woman ovulates more than one egg and has relations with more than one partner within a short time frame, leading to twins with different biological fathers. Superfetation is an extremely rare condition where a pregnant woman continues to ovulate, allowing a second embryo to be conceived and implanted. This results in concurrent twins but at different chronological stages of development, depending on the time of secondary ovulation[15]. In biracial couples, fraternal (dizygotic) twins can inherit different genetic traits from their parents, resulting in twins with notably different skin colours, eye colours, and hair textures. Twin chimerism is a rare phenomenon that occurs when two embryos, typically in the case of fraternal (dizygotic) twins, merge very early in development, resulting in a single offspring with two different sets of composite DNA. The term comes from Greek mythology and refers to a creature born with parts from different animals. In the case of twin chimerism, the 'creature' is a single individual composed of different embryos. This fusion can manifest in several ways, such as having different blood types, patches of different skin tones, or even the presence of male and female sex characteristics in some cases.

The rates of dizygotic twin births vary significantly worldwide, exhibiting the highest rates in Central Africa and the lowest in Asia. This variation across regions highlights the influence of different genetic, environmental, and dietary factors in determining the likelihood of dizygotic twinning. Central Africa has the highest twinning rate, where more than 18 twins occur per 1,000 live births. This rate is particularly notable among the Yoruba people in Nigeria, who experience an astonishing 45-50 twin births per 1,000 live births[16]. In contrast, Asia and Latin America present lower rates, with figures closer to 8 twins per 1,000 live births.

Several factors contribute to the incidence of dizygotic twinning. A genetic predisposition for twinning is particularly influenced by the maternal lineage, where a tendency to hyperovulate – release more than one egg during a menstrual cycle – can be inherited. Maternal age also plays a significant role; women in their 30s to early 40s are more prone to have dizygotic twins, likely due to hormonal shifts that increase the probability of multiple eggs being released. The likelihood of having twins is not static across pregnancies either. The experience of previous pregnancies, especially a prior

dizygotic twin pregnancy, heightens the chances of another twin birth.

The use of assisted reproductive technologies (ART), such as in vitro fertilisation (IVF) and fertility drugs that stimulate ovulation, significantly boosts the odds of dizygotic twinning. These treatments can lead to the implantation of multiple embryos or stimulate the ovaries to release several eggs, thereby increasing the likelihood of multiple pregnancies. Body type also influences the chance of having dizygotic twins, with taller women and those with a higher body mass index (BMI) being more likely to experience such pregnancies[18]. However, the underlying reasons remain unclear. Finally, dietary factors, including the consumption of dairy products, might increase the probability of dizygotic twinning. This effect is likely related to traces of insulin-like growth factor (IGF) in these foods, highlighting the complex interplay of dietary intake, physiology and reproductive health[17].

Significance

Multiple pregnancies are significant because they are associated with a disproportionately high risk of maternal and perinatal harm[2], which may be as much as five times higher than in singleton pregnancies. Whilst this may reflect difficulties of delivery, it most often sequels complications that arise long before birth. These may include errors of normal placentation, preterm labour and prematurity, or insufficient maternal resources to tolerate the increased demand of pregnancy, leading to restricted growth support[15]. Perinatal mortality (death around the time of birth) and morbidity (incidence of disease or complications) rates are therefore higher in twin pregnancies, with estimates of around 20-40 per 1,000 live births for twins, compared to about 5 per 1,000 live births for singletons[18]. This increased risk is attributed to several factors, including birth before 37 weeks gestation. Approximately 50-60% of twin pregnancies (and up to 80% in triplets) result in preterm delivery before 37 weeks of gestation, compared to 10% in singleton pregnancies, possibly due to cervical insufficiency and increased uterine activity. Over 50% of twins are born with low birth weight (less than 2,500 grams), compared to approximately 7% of singleton births[2,4,8].

Vanishing Twin Syndrome occurs when one of the twins disappears during the first trimester. This can happen in up to 30% of multiple pregnancies. The fetal tissue of the vanished twin is usually absorbed by the other twin, the placenta, or the mother, leading to no visible signs of the twin at birth. When it occurs later in pregnancy, the complications of foetal demise to the surviving twin can lead to several immediate threats, including an increased risk of premature labour. This, in turn, can expose the surviving twin to the complications of prematurity, such as respiratory distress syndrome, intraventricular haemorrhage, and developmental delays. Another potential complication is transfusion syndrome, which may occur in monochorionic pregnancies where the demise of one twin can lead to a sudden shift in blood volume, putting the surviving twin at risk of heart failure or other circulatory problems, including anaemia[8,10,18].

Additionally, there is the risk of coagulation disorders. The death of a twin can release thromboplastin into the maternal bloodstream, leading to disseminated intravascular coagulation (DIC) in the mother, which can secondarily affect the surviving twin. Studies have suggested that the surviving twin may face a higher risk of neurological and developmental disorders. This is likely due to the combination of biological stress factors and the potential for reduced growth after the co-twins demise. The risk of infection is also elevated, as the deceased twin can become a source of infection, which may affect the surviving twin or the mother. Moreover, the loss of a twin is a profound event, and the family may experience a wide range of emotions, including grief, anxiety, and concern for the surviving twin[19].

Twin pregnancies present a heightened risk for maternal complications compared to singleton pregnancies. These include preeclampsia, gestational diabetes, and hypertension, underscoring the increased demands placed on the maternal body to support the growth and development of multiple fetuses simultaneously[17].

Preeclampsia is a condition characterised by high blood pressure and multi-system organ dysfunction, most notably of the liver and kidney. In twin pregnancies, the risk of developing preeclampsia is considerably higher, owing to the greater placental mass and foetal demand. This condition not only poses risks to the mother, such as the potential for long-term cardiovascular disease but also to the fetuses, increasing the likelihood of preterm birth and low birth weight, with its attendant risks to neonatal health and development[8,18].

Gestational diabetes mellitus (GDM) is another complication that is more prevalent in twin pregnancies. The increased hormonal interference from the placenta(s) in twin pregnancies can lead to insulin resistance, making it harder for the mother's body to regulate blood sugar levels. This condition can result in macrosomia (large for gestational-age babies), leading to complications during delivery and raising the risk of the children developing obesity and diabetes later in life[8].

Hypertension, or high blood pressure, is also more common in mothers carrying twins. The exact mechanisms are multifaceted, involving the increased blood volume needed to nourish two fetuses and the elevated levels of pregnancy-related hormones. Hypertension can lead to a cascade of risks, including enhancing the likelihood of preeclampsia, placental abruption, fetal growth restriction and preterm delivery[8,18].

Monochorionic twins face unique challenges during pregnancy, primarily due to their shared blood supply, which may predispose them to conditions such as Twin-Twin Transfusion Syndrome (TTTS) and Twin Reversed Arterial Perfusion (TRAP) sequence. These conditions are relatively rare, complicating 10-15% of monochorionic pregnancies, but they significantly heighten the risk of mortality and adverse morbidity outcomes for the twins involved[10,16].

Twin-Twin Transfusion Syndrome (TTTS) occurs when there is an imbalance in the blood flow between the twin fetuses through vascular connections in the shared placenta. This imbalance can lead to one twin (the donor) having too little blood, leading to underdevelopment and a lack of necessary nutrients. At the same time, the other twin (the recipient) receives too much blood, leading to overwork of the heart and potential heart failure. The condition is progressive and can rapidly worsen, leading to serious complications for both twins. Without timely and appropriate intervention, the mortality rate for twins affected by TTTS is startlingly high, exceeding 80%[10]. Twin Reversed Arterial Perfusion (TRAP) sequence is another serious complication unique to monochorionic pregnancies. It occurs in 1% of monozygotic pregnancies and 1 out of 35,000 pregnancies overall. It is characterised by an acardiac twin that lacks a properly functioning heart and relies on the other twin (the pump twin) to provide circulation. A common explanation for this condition is abnormal placental vascular anastomosis termed Acephalus Acardiac Anomaly, also known as the Twin Reversed Arterial Perfusion Theory (TRAP). In this condition, arterial-to-arterial and venous-to-venous anastomosis in the placenta permits twin-to-twin transfusion and reversal of the blood flow in the umbilical vessel and the aorta of the recipient twin[10]. The acardiac twin develops abnormally, often without essential organs, and cannot survive. Its heart is hypoplastic or absent, either by secondary atrophy or, more possibly, a primary pathology, though currently unknown. The pump twin may develop congestive heart failure with hydrops and polyhydramnios, leading to a risk of preterm delivery[10,16].

These conditions underscore the critical need for careful ultrasound screening to detect and initiate appropriate intervention. Treatments for TTTS include laser surgery to seal off the abnormal blood vessels in the placenta and amnioreduction, which involves removing excess amniotic fluid from around the recipient twin to reduce the risk of preterm labour and help balance the blood flow. Management strategies for the TRAP sequence may include selective fetoscopic laser photocoagulation to interrupt the abnormal blood flow to the acardiac twin, aiming to reduce the burden on the pump twin and improve the chances of a successful outcome[19].

Studies indicate that more than half of all twins may require NICU care immediately after birth, a rate substantially higher than that observed in singleton births[18]. This increased need for specialised care underscores the vulnerabilities and health risks associated with twin pregnancies and deliveries. Twins are more prone to being born with low birth weight and prematurity, with the associated risks of respiratory distress syndrome, hypothermia, and challenges with feeding – all of which require specialised care. Prematurity can predispose twins to necrotising enterocolitis (NEC), an intestinal disease leading to inflammation and sepsis of the intestinal wall, which, in severe cases, may result in intestinal perforation and surgical intervention. Twin babies are also at a higher risk of jaundice, characterised by yellowing of the skin and eyes due to high levels of bilirubin in the blood. While jaundice is common in newborns and often resolves without serious consequences, twins, particularly those born prematurely, may experience more severe forms requiring treatment with phototherapy or even blood transfusions in extreme cases[20]. Furthermore, the risk of infection is elevated in twins, especially if they require invasive procedures while in the NICU. The immature immune system of premature infants makes them more susceptible to bacterial and viral infections,

which can be life-threatening and require aggressive treatment with antibiotics and supportive care.

Another concerning post-delivery outcome for twins is the increased incidence of cerebral palsy. The rate of cerebral palsy among twins is estimated to be approximately four times higher than in singleton pregnancies. This higher incidence is often linked to the complications inherent to twin pregnancies, including prematurity and intrauterine growth restriction, which can affect brain development and lead to neurological impairment.

Recommendations for care: Antenatal care[20,21,22]

Inclusive care

Fundamental to management is taking the time to ensure that women and families are comprehensively informed of their pregnancy, the likely risks and outcomes and the choices available to them. This inclusion empowers them to actively participate in decision-making and to share in partnership with health care providers. Nutritional supplementation and lifestyle modifications are advocated to support optimal maternal health and fetal development. Recommendations include increasing caloric intake and ensuring adequate protein, iron, calcium, folic acid, and vitamin levels. Additionally, avoiding strenuous work and ensuring adequate rest are emphasised to support overall wellbeing.

Determining chorionicity

Assessment of chorionicity is critical in multiple pregnancies. A best practice statement by The Royal Australian and New Zealand College of Obstetricians and Gynaecologists (RANZCOG) released in 2021 emphasises the importance of early and accurate determination of chorionicity. Monochorionic twins face higher rates of fetal mortality and morbidity due to complications unique to their shared placental structure, such as twin-to-twin transfusion syndrome (TTTS), fetal growth restriction (FGR), and twin reversed arterial perfusion (TRAP) syndrome. These conditions are absent or significantly less common in dichorionic pregnancies, where each twin has a separate placenta. When present, early diagnosis and tailored management, including increased surveillance and intervention options such as laser therapy, may greatly optimise outcomes[21,22].

The RANZCOG statement recommends ultrasound to ascertain chorionicity in all twin pregnancies, ideally before 14 weeks of gestation. Thereafter, the ability to correctly identify chorionicity may be limited by fusion of the chorion and amnion layers, which typically occurs after 14 weeks. Fortuitously, if the pregnancy has fetuses of different genders, it must be dizygotic and, by extension, have dichorionic placentae[22].

When performed early, the T Sign in ultrasound imaging shows a T-shaped juncture between the membranes and the placenta, indicating a shared or monochorionic placental mass. The Lambda or "Twin Peak" Sign is indicative of dichorionicity. It is characterised by a triangular projection of placental tissue between the membranes, resembling the Greek letter lambda (λ) or a twin peak. Occasionally, the proximity of implantation sites in dizygotic pregnancies can result in a misleading appearance, where dichorionic twins mimic the visual characteristics of monochorionic twins.

Prediction of preterm birth

Measurement of cervical length by transvaginal ultrasound from 18 weeks is not helpful. However, combining these measurements with fetal fibronectin (fFN) testing may provide a more accurate predictor of PTB, according to a recent study involving 155 twin pregnancies. A meta-analysis found no benefits of routine cerclage[15].

Recommendations for care: birth and delivery

The question of how to deliver twins is critical for the best outcome. High-order multiple pregnancies such as triplets, monoamniotic twins and pregnancies associated with contraindications against vaginal birth such as placenta, or vasa praevia should be delivered by elective caesarean section (LUSCS). Otherwise, the decision may be pre-empted by maternal preference or by considerations that may arise antenatally, such as growth restriction or discordance, that confer an advantage of one mode of delivery over another.

For vaginal birth, there should be no prior obstetric or medical contra-indications. The first twin should present as a vertex[19]. The position of the second tends not to affect decision-making, as it may change by up to 20% right up to the time of delivery of the first. The expected fetal weight of both twins should be at least 1500 gm, with the second twin within 500 gm of the first. Gestation should be at least 32 weeks. Delivery of the second twin should occur soon after the first, but if the heart rate is normal, there may be

no need to rush. It is important to perform abdominal and vaginal examinations, including bedside USS if required, to determine presentation and lie. Where this is cephalic and longitudinal, amniotomy can be considered, followed by guided maternal pushes to encourage descent. External rotation may be necessary to correct an abnormal transverse lie, or more commonly, an internal podalic version to bring the presenting part to breech, followed by an assisted extraction. In each instance, the waters should be left intact until vaginal descent is required. This best ensures the success of each manoeuvre and, as far as possible, mitigates the risk of a prolapsed cord. The CTG should be monitored throughout, and if, for any reason, concerns arise, birth should be expedited by instrumental delivery, breech extraction or emergency caesarean section[24].

Special considerations

In remote centres, expectant management of vaginal twin births is challenged by limited access to surgical theatres for emergency caesarean sections, which may impact the ability to adequately respond to emergent situations that require emergency surgical intervention[22,22].

Additionally, limited expertise or familiarity with the manoeuvres described, particularly for delivering the second twin, can present additional risks and complications. This lack of experience can lead to delays in decision-making and effective intervention, further jeopardising the health and safety of both the mother and infants.

Recommendations for care: postpartum

Postnatal follow-up care is essential for ensuring twins' ongoing health and developmental wellbeing, addressing issues such as feeding difficulties, growth and behavioural milestones, and uptake of routine vaccination policies[23].

Conclusion

In remote Australian communities, particularly those serving indigenous and migrant populations from regions such as Eastern Europe, India, China, the Philippines, and the islands of the Southeast Pacific, the challenges of twin pregnancy are markedly heightened. These areas often grapple with birth and obstetric outcomes comparable to those found in underdeveloped countries where the effectiveness of health care is compromised by both a lack of service availability and low patient engagement. Such circumstances contribute to increased maternal and infant mortality rates, highlighting a disparity that starkly contrasts with the generally high standards of healthcare in Australia.

Indigenous communities, in particular, report higher incidences of preterm birth and low birth weight. These outcomes are driven by factors, including reluctance to access healthcare services and entrenched socio-economic disadvantages. Issues such as educational and employment inequities, inadequate housing, poor hygiene and sanitation, lack of dietary support, and exposure to lifestyle risks can significantly affect fetal growth and development. Moreover, linguistic, social, and cultural barriers may impede interaction with local healthcare services, and fear or reluctance to relocate for enhanced care can limit compliance with healthcare recommendations. The infrequency of routine check-ups, due in part to the remoteness of healthcare facilities, may result in the late detection of complications in pregnancy.

Despite better infrastructure in remote health centres in Australia compared to many underdeveloped countries, these facilities often need more resources and equipment typically found in metropolitan hospitals. Remote areas typically face a shortage of healthcare professionals, including specialists in maternal and neonatal care, which affects the availability of comprehensive prenatal and postnatal care as well as the capacity to manage complex pregnancies and deliveries.

Government health initiatives have acknowledged these challenges and implemented strategies to improve health outcomes in remote areas. These include leveraging telehealth and digital communication platforms to collaborate with tertiary centres, thereby sharing expertise and strengthening multidisciplinary care. The flying doctor service and patient transport schemes improve access to and from healthcare facilities. Additionally, outreach services embedded in the local community can develop culturally relevant care programs to enhance compliance with prenatal health, safety, and wellbeing programs. The effectiveness of maternity care depends on such engagement. Incentives to allay fear and create a trust that helps put aside misapprehensions can reach further into the community and create sustained and meaningful change.

This review addresses the disproportionate impact of twin pregnancies on maternal and fetal outcomes. It outlines recommendations for the best possible care regardless of challenges posed by isolation and demographic vulnerabilities. It underscores the importance of continuous, supportive antenatal care by known and trusted providers, recognising that maternal wellbeing and safety are the milieu for optimal fetal growth and pregnancy outcomes. Regular consultations, history-taking, and clinical examinations are vital for identifying signs of evolving morbidity and fetal compromise. The appropriate use of ultrasound investigations to detect and assess complications underlies decisions for care and intervention. The cornerstones of effective care include the upskilling of healthcare workers, collaboration with tertiary partners, and inclusive, patient-centred decision-making. They empower relationships and enable services to deliver equitable care across all demographics and geographical boundaries.

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