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Twin Birth

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ABASTRACT

Observational epidemiological analyses have shown that there is a decreased risk of death and severe morbidity associated with cesarean delivery at term, but an increased risk at preterm gestational age. A multicenter international randomized controlled study compared planned cesarean delivery with vaginal birth and found no difference in the outcome. However, the trial included preterm and term births in approximately similar proportions. A subsequent reanalysis of the trial demonstrated that planned cesarean delivery was associated with an increased risk of adverse neonatal outcomes at preterm gestational ages but a reduced risk of perinatal complications at term, which is consistent with the epidemiological studies.

Therefore, when deciding on the type of delivery for twins, routine cesarean delivery should be discouraged for preterm deliveries. At term, the balance of risks and benefits will depend on the mother's priorities, her attitude towards managing the risks of unusual but potentially severe adverse events, and her plans for future pregnancies.

Obstetricians who care for twin pregnancies should be aware of the challenges that may arise during labor and delivery. With the recognition of these issues and proper training, obstetricians should be able to help women with twin pregnancies achieve a safe delivery for both mothers and their babies. With the use of breech extraction of the second twin and active management of the second stage of labor, women with twin pregnancies can achieve a high vaginal delivery rate for both twins.

Introduction

The incidence of twin pregnancies has increased over the past few decades and twins now represent 3.4%

of all alive newborns in the United States (1). In the United States, about 75% of twins are delivered by cesarean delivery (CD) (2). Reasons for the high cesarean delivery rate in the United States include incorrect presentation of the first or second twin, prematurity, maternal comorbidities, and patient wish. However, recent literature suggests that, for many women with twin pregnancies, vaginal delivery can be carried out without increasing maternal or neonatal morbidity.

It's necessary to assess whether the clinical risks related to the delivery of the second twin are associated with a real increased risk of newborn death.

EVENTS RELATED TO THE INTRAPARTUM PERIOD

Perinatal death is defined as stillbirth or the death of a newborn in the first week of life (many studies also include late neonatal deaths, understood as neonatal deaths between two and four weeks of life). Often fetal death occurs before the onset of labor and it isn't associated with complications during labor and childbirth. The main causes of neonatal death are preterm delivery and congenital abnormalities. Otherwise, these two conditions were observed not to be related to complications during labor and childbirth. Consequentially, a well-detailed collection of information about perinatal death reasons is necessary to establish if newborn death is related to complications of labor and delivery and, therefore, potentially preventable with planned cesarean section.

The term "perinatal death related to delivery" is commonly used to refer to intrapartum death or neonatal death, not due to congenital abnormalities and this is possible only if a large number of data about the cause of perinatal death is available.

However, perinatal death affects less than 1% of births and therefore analyses require large samples, that can be reached just through routine data collection. Collecting data from many births and having detailed information about the circumstances of loss is uncommon. An example is the National Health Service in Scotland in 1977 and 2012, which linked a national survey of perinatal death with its national register of obstetric data. However, many other sources of routine data cannot classify childbirth-related perinatal deaths.

Gestational age and associations with birth order

Another important factor that complicates the analysis of the risk of death in twins is gestational age. The definition of perinatal death related to childbirth includes neonatal deaths due to prematurity, and the degree of prematurity is one of the major determinants of the risk of neonatal death. This affects the analysis of twins in several ways. Firstly, twins are at greater risk of preterm birth; therefore, the percentage of twins who die due to premature birth is higher than the comparable percentage for single fetuses. Secondly, in most twin pregnancies, the interval between births is measured in minutes; therefore, both children are generally exposed to the same risk of prematurity. As a result, the baseline risk of neonatal death (that isn't caused by the complications listed above but rather by the degree of prematurity) is usually the same for both twins. One consequence of this is that if a fixed increase in the risk of neonatal death is assumed due to complications affecting the second twin after the vaginal birth of the first, such relative risk will be much lower at extremely preterm gestational age than that observed at term or near term. In the preterm period, the effects of prematurity dominate the risk of neonatal death. It's only in the advanced stage of gestation and particularly at term that relatively uncommon complications such as detachment or prolapse of the cord may impact the relative risk of death of the second twin compared to the first.

Type of delivery

The main goal of these analyses is to determine whether a planned cesarean delivery can reduce the risk of death for the second twin. To answer this question satisfactorily, the analysis must distinguish between cesarean delivery planned before labor and emergency cesarean delivery performed during or before labor. This important subclassification is possible in some but not all routinely used large-scale data sources. Another challenge is the analysis by intention to treat, specifically, knowing what the planned mode of delivery was. A woman who intends to attempt vaginal delivery may require an emergency pre-labor cesarean delivery or a woman who has planned a cesarean delivery may go into labor before the scheduled date and eventually give birth vaginally. Therefore, there is an issue with using observational data to gain insights into the clinical decision-making process and the planned mode of delivery. Analyses based on the planned mode of delivery usually require prospective studies.

First epidemiological studies on the effect of birth order on the risk of perinatal death

Four large-scale epidemiological studies published between 1981 and 2001 examined the effect of birth order and concluded that there was no increased risk of death for the second twin. However, all four studies compared the risk of death in the first and second twin using a non-paired statistical test, grouped births at all gestational ages and did not limit the analysis to perinatal birth-derived death. Therefore, until 2001, the opinion was that, despite the known risks that affected the second twin, there was no increase in the risk of perinatal death, but the studies that supported these conclusions were flawed.

The first studies reporting an excess risk of death of the second twin at term.

In 2002, a Scottish national data study compared the risk of perinatal birth-related mortality between first and second twins using matched statistical methods and stratifying the analysis by gestational age. Among women who did not give birth via scheduled cesarean delivery, there was no association between birth order and mortality risk among 1438 babies born at <36 weeks. However, there was a statistically significant excess risk of death for the second twin among 2436 births at 36 weeks or later. Among this latter group, there were no perinatal deaths related to the birth of the first twin, but there were nine deaths of the second twins (P = 0.004). The study included twins born in 1992-1997, and a follow-up study extended the range to the years from 1985-2001, analyzing over 8000 births (excluding scheduled cesarean delivery) at >36 weeks. An increased risk of second twin death was confirmed, showing that there was no excess risk of death in cesarean delivery before labor and that the risk of both babies dying from birth-related causes was lower in pre-labor cesarean delivery. The absolute risk of second twin death was 42 per 10,000 (95% confidence interval (CI) from 28 to 61 per 10,000), which was higher than other high-risk groups giving birth at term, such as vaginal birth after cesarean delivery (13 per 10,000; 95% CI ¼ from 8 to 20 per 10,000). A further investigation in the United Kingdom analyzed the data from 1377 twin pregnancies in England, Wales, and Northern Ireland from 1994 to 2003 in which one baby had died and the other survived. There was no association between birth order and preterm mortality risk, but there was an excess risk of second twin death at >36 weeks.

In 2011, a systematic review was published on the effects of birth order and mode of delivery. The risk of death in second twins included in the meta-analysis varied 40-fold between studies. However, a population-based study of Australian data collected detailed information on the cause of perinatal death and analyzed outcomes at term. In this analysis of 3,883 twin pregnancies delivered after the onset of labor, there was one perinatal death of the first twin and 14 perinatal deaths related to the delivery of the second twin (odds ratio 14, 95% CI 1.84 to 106). Consistent with the Scottish data analyses, there was no association between birth order and risk of death in 3,216 twin pregnancies delivered by cesarean delivery before labor, and there was only one perinatal death among 6,432 twins delivered by this method, yielding an odds ratio for death of one of the twins associated with pre-labor cesarean delivery of 0.08 (95% CI = 0.01 to 0.61). The absolute risk of death of the second twin associated with women with twins in labor in this study was 36 per 10,000 (95% CI = 20 to 60 per 10,000), which is remarkably similar to the absolute risk of Scottish data. A large-scale prospective study of twins born at 32 weeks conducted in France compared the risk of severe neonatal morbidity (Apgar score at 5 minutes less than four, neonatal trauma, encephalopathy, two or more seizures <72 hours after birth, endotracheal intubation >24 hours and <72 hours after birth, sepsis, bronchopulmonary dysplasia, intraventricular hemorrhage, periventricular leukomalacia or necrotizing enterocolitis) and neonatal death about whether a woman had a planned cesarean delivery or a planned vaginal delivery. Among low-risk women, the authors found that planned cesarean delivery was associated with increased risk of neonatal morbidity or mortality at 32-34 weeks, a non-significant trend toward increased risk between 35 and 36 weeks, but a trend toward reduced risk at 37 weeks, with an adjusted odds ratio of 0.37 but with a very wide 95% CI (0.08-1.67).

This study showed remarkably low rates of neonatal death among low-risk women, with only two losses among 6820 infants delivered via planned vaginal birth. The absolute risk of the primary outcome among term low-risk infants was 0.8% in women planning vaginal birth versus 0.3% in those planning cesarean delivery. Therefore, the French data were consistent with other studies in that there was no apparent protective effect of planned preterm cesarean delivery, and there was a trend toward reduced risk of complications with planned term cesarean delivery. The 95% CI for the primary outcome of planned term cesarean delivery had a lower limit ranging from 0.03 to 0.08 depending on the adjustment method; therefore, the data were consistent with a 10 to 30-fold reduction in risk, and the analysis was underpowered to exclude a protective effect of planned term cesarean delivery. A clear point of difference between the French data and the UK and Australian data related to the risk of neonatal death. Among low-risk women, there were two neonatal deaths among 6820 infants who had planned vaginal birth. This produces an absolute risk of 3 per 10,000 (95% CI 0.4 to 11 per 10,000). It is difficult to reconcile these data with those from the UK and Australia. This does not reflect the generally lower rates of perinatal death in France, as the country had a perinatal death rate >50% higher than that of the UK or Australia. In the UK, population-based data were used, and Australian studies are more representative of the country, while the French study recruited larger maternity units. There may also be differences in the completeness of ascertainment. But it is also possible that there are differences in the way intrapartum care is provided in France that reduce the risk of perinatal deaths related to childbirth, despite similar or higher rates of other types of perinatal deaths.

TWIN BIRTH STUDY (TBS)

The TBS recruited 2804 women with twin pregnancies between 32 ± 0 and 38 ± 6 weeks of gestational age and randomized them to planned cesarean delivery or planned vaginal delivery. The primary outcome of the study was a composite of severe neonatal morbidity or neonatal death. The study was conducted in 25 countries, but 95% of the births occurred in countries with a perinatal mortality rate of <20 deaths per 1000 births. The characteristics of both groups were comparable, and there was a minimal loss to follow-up. The composite primary outcome occurred in 2.2% of infants assigned to planned cesarean delivery and 1.9% of those assigned to planned vaginal delivery, with an odds ratio for planned cesarean delivery of 1.16 (95% CI 0.77 to 1.74). The rate of maternal death or severe maternal morbidity was 7.3% in the planned cesarean delivery group and 8.5% in the planned vaginal delivery group, producing an odds ratio for planned cesarean delivery of 0.86 (95% CI 0.65 to 1.13). The authors concluded that "planned cesarean delivery did not significantly decrease or increase the risk of fetal death or severe neonatal morbidity compared to planned vaginal delivery."

Just under half of the women in the study gave birth preterm, reflecting the early gestational age at which they were recruited for the study. Therefore, most of the perinatal mortality was due to the effects of preterm birth and could not be reduced by planned cesarean delivery. The paper reported a subgroup analysis limited to women who had been recruited at term. Among these women, the composite primary outcome occurred in 0.4% of infants assigned to planned cesarean delivery and 1.4% of infants assigned to planned vaginal delivery, yielding an odds ratio for planned cesarean delivery of

0.30 (95% CI 0.06 to 1.43). Therefore, the estimate indicated a 70% reduction in the risk of the primary outcome at term with planned cesarean delivery, and the 95% CI indicated that the observed result was consistent with a reduction of approximately 17 times the risk of primary outcome with planned cesarean delivery at term.

A letter published after the study called for a subgroup analysis based on the actual gestational age of delivery. The justification was that (i) observational data had indicated that any protective effect of cesarean delivery was likely to be observed only at term and (ii) such an analysis would require a larger sample that reduces uncertainty about the possible magnitude of any beneficial effect of cesarean delivery at term. Seven years later, an analysis was published that reported the association between the primary outcome and planned cesarean delivery, and a formal test of interaction between mode of delivery and gestational age was performed. The TBS reanalysis indicated that planned cesarean delivery was indeed harmful in the preterm period. However, at term, the composite primary outcome occurred in 0.7% of neonates assigned to planned cesarean delivery and 1.5% of those assigned to planned vaginal delivery, producing an odds ratio for planned cesarean delivery of 0.44 (95% CI 0.19 to 0.98, P = 0.03).

Comparison of observational and interventional studies

There is significant consistency between data generated from observational and interventional studies on the mode of delivery in twins. Observational data have indicated that associations between birth order and mode of delivery were only present at term. This did not suggest that second-born twins had the same risk of preterm complications; rather, it simply indicated that any additional risk was so small relative to the baseline risk of prematurity that it could not be considered irrelevant. Additionally, both the French observational study and the reanalysis of the TBS have indicated that at preterm gestational ages, planned cesarean delivery increased the risk of an unfavorable neonatal outcome. The likely explanation for this is that the decision to have a cesarean delivery will lead to the execution of the procedure anticipating the timing of spontaneous delivery. It is possible that in some cases, although vaginal delivery was thought to be imminent, the clinical situation would have changed, and the natural history would not have allowed for delivery. In the situation where vaginal delivery was planned, the pregnancy could continue, and the twins would be delivered at a later gestational age. In contrast, in the case of a twin pregnancy where cesarean delivery was the planned mode of delivery, the babies would be delivered assuming that vaginal delivery was imminent, with the effect that the babies would have a reduced duration of pregnancy. Since prematurity is cardinal in determining perinatal morbidity, it is plausible that this effect can explain the worse outcomes associated with planned cesarean delivery in the preterm period. It is also possible that cesarean delivery before labor exacerbates neonatal morbidity. One of the main causes of neonatal morbidity in premature infants is respiratory distress syndrome (RDS). It is well-recognized that early cesarean delivery increases the risk of RDS and transient neonatal tachypnea. The presumed mechanism is that the lungs are filled with fluid during fetal life and that hormonal and physical stimulation of labor results in the movement of fluid out of the alveolar space. Therefore, it is also plausible that planned cesarean delivery has a direct harmful effect in the context of prematurity, in addition to shortening the duration of pregnancy.

Planned Cesarean Section and Maternal Morbidity

It is well known that vaginal delivery is associated with a lower rate of maternal complications compared to cesarean delivery. However, this observation is sometimes mistakenly interpreted to suggest that planning a vaginal delivery is also associated with a lower risk of maternal morbidity. This misunderstanding is due to the conflation of ideas between planning a vaginal delivery and having a vaginal delivery. The women who plan a vaginal delivery will undergo different modes of delivery. Some will deliver vaginally, while others will have an unplanned cesarean delivery. In the latter group, some may be performed before the onset of labor. However, most will be emergency cesarean delivery performed during labor. In cases of twin pregnancies, a small proportion of them will undergo a cesarean delivery for the second twin after vaginal delivery of the first, a type of delivery associated with a particularly high risk of complications. When maternal morbidity is analyzed according to the actual mode of delivery, the hierarchy of increasing risk is represented by: spontaneous vaginal delivery, operative vaginal delivery, planned cesarean delivery, and emergency cesarean delivery. Therefore, among a population of women at high risk of emergency cesarean delivery who have planned a vaginal delivery, the overall risk of maternal morbidity may be increased compared to planning a cesarean delivery, since any benefit gained from lower rates of morbidity in women who have a normal vaginal delivery is counterbalanced by an increased risk of complications among those who attempted vaginal delivery but underwent an emergency cesarean delivery.

The problem here is, once again, the "intention to treat" analysis, which is one of the great strengths of an RCT. In the TBS study, 40% of women who had planned to deliver vaginally ultimately underwent a cesarean delivery. In this group, about two-thirds of the cesarean delivery were performed during labor. Although the intrapartum cesarean delivery rate was higher than that of the planned cesarean delivery group, the cesarean delivery in that group would have been performed because the woman was in labor. In contrast, in the planned vaginal delivery group, the procedure would have been performed because there was an indication for an emergency cesarean delivery. It is likely, therefore, that emergency cesarean delivery in the planned group was "less urgent" than those in the planned vaginal delivery group. There is direct evidence for this interpretation in the study: the proportion of women who delivered the first twin vaginally and had a cesarean delivery for the second twin was five times higher in the planned vaginal delivery group.

When analyzed by "intention to treat," the rate of maternal morbidity was lower in the planned cesarean delivery group (7.3%) compared to the planned vaginal delivery group (8.5%). The 95% CI indicated that a plan for cesarean delivery was associated with a risk reduction of maternal morbidity between 35% and an increase of 13%. A comparable observation was made in an international multicenter RCT on planned cesarean delivery for breech presentation [14], showing that the group randomized to planned cesarean delivery did not have an increased risk of maternal morbidity.

Cesarean delivery and long-term risks

Cesarean delivery is a procedure with extremely high short-term utility when used appropriately. Although the main concern in high-income countries is the overuse of cesarean delivery, the lack of safe and timely cesarean delivery is a major determinant of perinatal and maternal death in low-income countries. Although cesarean delivery is a highly useful procedure with extremely high short-term benefits when used appropriately, it comes at a long-term cost for women in terms of planning future pregnancies.

Firstly, although vaginal birth after cesarean delivery is widely performed, it is associated with an increased risk of adverse outcomes for both mother and baby compared to a scheduled repeat cesarean delivery and compared to a vaginal birth in multiparous women who have not had a previous cesarean delivery. In addition, about 25% of women end up undergoing emergency cesarean delivery, and these women will generally end up having a cesarean delivery for all future pregnancies.

Secondly, there is a direct proportional relationship between previous cesarean delivery and the spectrum of placenta accreta (PAS). Physiological invasion of the placenta involves the decidua and the inner third of the myometrium. There are several conditions (variously called PAS, abnormally invasive placenta, or placental adhesive disorders) where the depth of invasion is greater and this can occur through the entire thickness of the uterine wall with penetration into adjacent organs, such as the bladder. A population-based study in Northern Europe indicates that the risk of PA was more than seven times higher in women with one previous cesarean delivery and more than 50 times higher in those with three or more previous cesarean delivery. There are also weaker but potentially clinically important associations with the future risk of spontaneous abortion, stillbirth, and placenta previa.

It follows that a key element in the decision-making process is the individual mother's plans regarding future pregnancies. Overall, it is much more likely that planned cesarean delivery will cause serious long-term harm to a 20-year-old woman than to a 40-year-old woman.

Current guidelines

Currently, ACOG recommends attempting vaginal birth to reduce overall rates of primary cesarean delivery, stating that women in whom the first twin is cephalic "should be counseled to attempt a vaginal delivery," citing the lack of differences in perinatal outcomes in the primary publication of TBS. The UK's National Institute for Health and Care Excellence recommends "explain to women with an uncomplicated twin pregnancy planning their mode of birth that planned vaginal birth and planned cesarean delivery are both safe choices for them and their babies," making the statement contingent upon some requirements (for example the twin is cephalic, and the pregnancy has surpassed 32 weeks) (https://www.nice.org.uk/guidance/ng137). Based on the totality of the evidence, neither guideline is correct. Planning for cesarean delivery is associated with increased adverse outcomes in the preterm period but a small absolute reduction in the risk of an adverse event at term.

MODES OF DELIVERY AND SUCCESS RATES OF VAGINAL TWIN DELIVERY

Overall, the goal of a twin delivery is to provide a safe delivery for the mother and both babies. Regarding the mode of delivery, there are 3 potential outcomes:

- Vaginal delivery of both twins
- cesarean delivery of both twins
- Vaginal delivery of Twin A followed by cesarean delivery of Twin B (vaginal- cesarean delivery combination)

In general, vaginal delivery of both twins is the most desirable outcome because neonatal outcomes are similar regardless of the mode of delivery and it avoids the maternal morbidity associated with cesarean delivery for the current pregnancy and future pregnancies. Cesarean delivery of both twins is the next desirable outcome. The least desirable outcome is a vaginal-cesarean delivery combination. This type of delivery adds to the morbidity of labor, vaginal delivery, and cesarean delivery. Additionally, it is often associated with a complication between the delivery of the first and second twin. The rates for the 3 modes of delivery vary in the literature. In the United States, the overall cesarean delivery rate for twins is around 75% (2), and up to 10% of women who deliver the first twin vaginally may have an unplanned cesarean delivery of the second twin (3). In Ireland, the cesarean delivery rate for twins is 65% (23% for women in labor) with a rate of 3% for a vaginal-cesarean delivery combination (4). A French study of 657 women with twin pregnancies who had a trial of labor showed a cesarean delivery rate of 21.1% with a combined rate of vaginal-cesarean delivery of only 0.5% (5).

The different rates of cesarean delivery and the different rates of vaginal-cesarean delivery are mostly caused by differences in the management of a second non-vertex presenting twin. In the United States, the incorrect presentation of the second twin is often the cause of cesarean delivery because most modern-trained obstetricians do not have the knowledge and experience to perform a breech delivery. However, in France, where success rates were the highest, obstetricians were comfortable with delivering the second twin regardless of presentation because they routinely used active management of the second stage of labor, which consists of 2 essential tools: internal podalic version and extraction of the second non-vertex twin and extraction of the second non-vertex twin if not engaged. Studies in the United States are consistent with these approaches. For example, among 130 women with twin pregnancies who attempted labor, the cesarean delivery rate was 15.4% with 0% presenting with a vaginal-cesarean delivery combination (6). In a follow-up study of 286 women with twin pregnancies who attempted vaginal delivery, these rates were 17.8% and 0%, respectively (7). Active management of the second stage is used in a twin pregnancy for the delivery of the second twin with podalic extraction in all cases except when the second twin is in an engaged vertex presentation.

If there are no contraindications to vaginal delivery, patients with twin pregnancies who are in labor and have active management of the second stage should expect high rates of vaginal deliveries and very low rates of vaginal-cesarean delivery combination (5,6). Both retrospective studies showed similar short-term neonatal outcomes for twins regardless of the planned mode of delivery (5,6).

Delivery mode: Safety of vaginal delivery for twins

Most previous studies examining the safest delivery mode for twins were retrospective and compared twins born vaginally with twins born by cesarean delivery, or compared twins born with planned vaginal delivery with twins with planned cesarean delivery. The conclusions of the studies were mixed (5,6,8-11), with some finding benefits for cesarean delivery and others not finding differences in outcomes. However, all retrospective studies contain significant selection biases, and it is difficult to draw definitive conclusions from this type of analysis.

The Twin Birth Study was a randomized prospective study comparing planned vaginal delivery to planned cesarean delivery for twin pregnancies, and the results were published in 2013(12). This multicenter study from 2003 to 2011 in 106 centers across 25 countries included 2,804 women with twin pregnancies from 32 to 39 weeks of gestation who were randomized to planned vaginal delivery versus planned cesarean delivery. Inclusion criteria included an estimated fetal weight of 1,500g to 4,000g; the first twin had to be in a vertex presentation; both twins had to be alive, and there were no other contraindications to labor. Both dichorionic and monochorionic twins were included, but monoamniotic twins were excluded. The primary outcome was a composite of fetal and neonatal mortality or severe neonatal morbidity at 28 days of life and did not differ significantly between the two groups (2.2% in the planned cesarean delivery group vs 1.9% in the planned vaginal delivery group; P=0.49). There were no differences in any secondary outcome between the groups, including individual fetal or neonatal outcomes and overall maternal morbidity. Additionally, the primary outcome was not influenced by the position of the second twin, gestational age, chorionicity, maternal age, or perinatal mortality in the country of residence. Follow-up examination of the children at 2 years of age showed no differences in neurodevelopmental outcomes between the groups (13). Maternal outcomes also did not differ at 3 months postpartum (14). Based on the results of this randomized study, for women with twin pregnancies beyond 32 weeks with the first twin in vertex presentation, planned cesarean delivery is not associated with any known improvement in maternal or neonatal morbidity or mortality.

In the Twin Birth Study, among the 1,393 women in the planned vaginal delivery group, the cesarean delivery rate was 39.6%, while the combined vaginal-cesarean delivery rate was 4.2%. After excluding the 196 women who had a cesarean delivery before labor, for women who attempted labor, the cesarean delivery rate was 34.4% (412 out of 1,197) and the combined vaginal-cesarean delivery rate was 4.9% (57 out of 1,197). It was reported that all delivering obstetricians had experience in vaginal twin delivery, but no specific details were reported regarding experience in podalic extraction or internal podalic version.

Delivery mode: Conclusion

Patients with twin pregnancies over 32 weeks with the first twin in vertex presentation should be informed that planned vaginal delivery is not associated with adverse maternal or neonatal outcomes compared to planned cesarean delivery if the obstetrician has experience with twin delivery. If the mother attempts labor, the likelihood of vaginal delivery is about 65-75%, and the likelihood of a combined vaginal-cesarean delivery is about 3-10%. However, if the obstetrician is comfortable with active management of the second stage, including breech extraction and internal podalic version, the likelihood of vaginal delivery can be as high as 85%, and the combined vaginal-cesarean delivery rate may be less than 1%. Planned vaginal delivery of twins is currently encouraged in well-selected patients (15) (Figure 1).

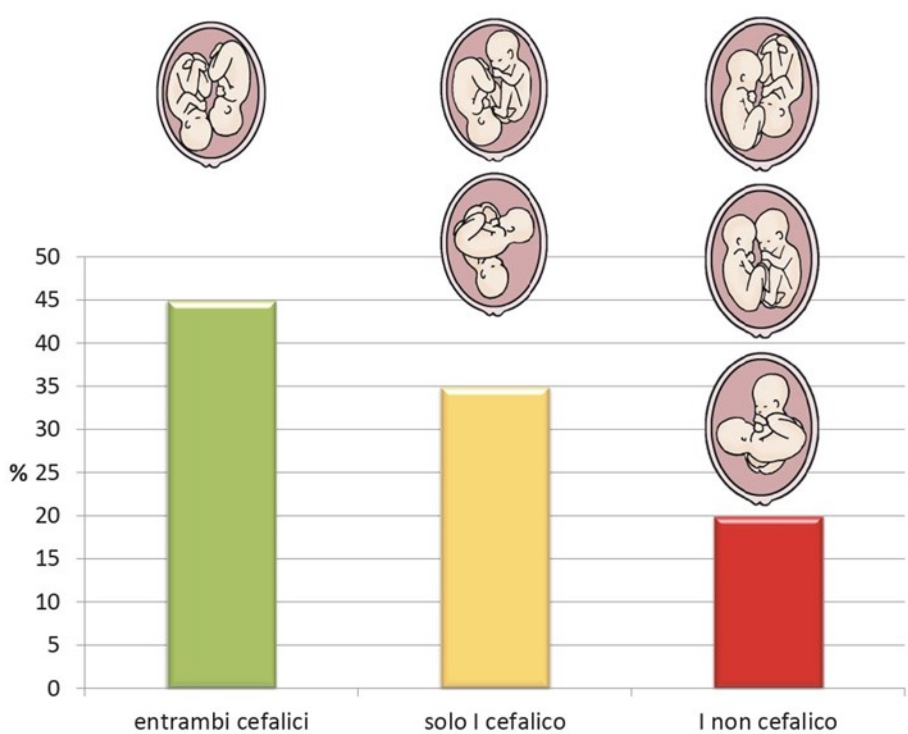

Figure 1a - Twin Presentation and Mode of Delivery

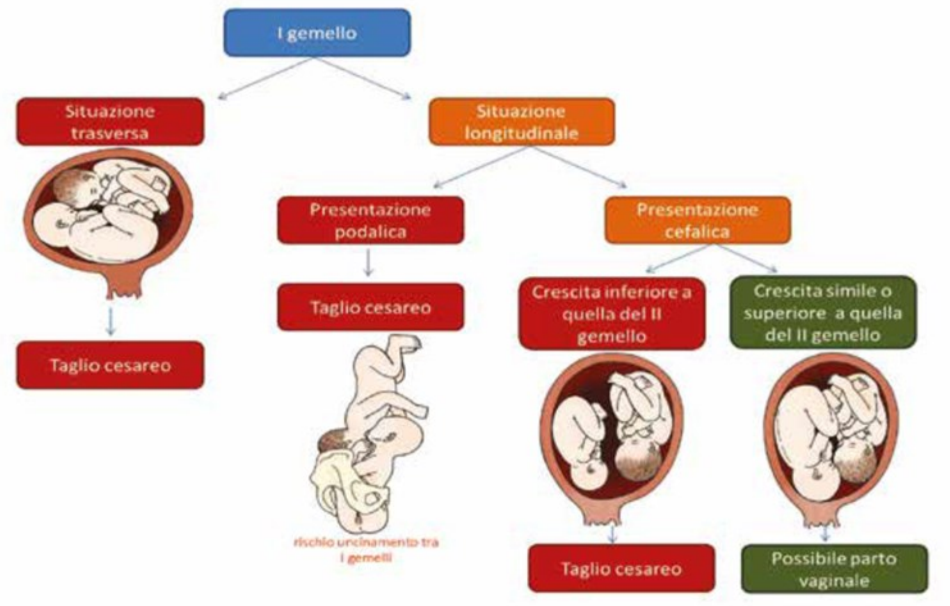

Figure 1b - If the first twin is in a transverse position, delivery should be done by cesarean delivery; if the first twin is in a longitudinal position but in a breech presentation, delivery should be done by cesarean delivery due to the rare possibility of the first twin becoming stuck in the birth canal and becoming locked with the second twin (locked twin), with a high risk of mortality for both fetuses; if the first twin is in a longitudinal position and a cephalic presentation, vaginal delivery can be assisted if there is no growth discrepancy between the twins or if the growth discrepancy is in favor of the first twin, or if the discrepancy is minimal (less than 20%) if it is in favor of the second twin.

Protocol for Twin Delivery

The protocol for vaginal delivery of twin pregnancies typically incorporates institutional guidelines for patient selection and management. While there are no specific approaches that have been thoroughly studied in all aspects, a specific protocol for twin pregnancies consists of several components.

Patient Selection

Not all women with twin pregnancies are suitable for attempting a trial of labor. The primary consideration is that the patient should have a preference for a vaginal delivery, and there should be no other contraindications to vaginal delivery. In addition to these factors, the following requirements are necessary:

- Twin A must be in a vertex presentation (head down position).
- The estimated fetal weight of Twin B should be over 1500 grams.
- If the estimated fetal weight of Twin B is greater than that of Twin A, the difference in weight, known as discordance, should be less than 20%. (Figure 2)

If Twin B is in a vertex presentation (head down position), the previously mentioned criteria for estimated fetal weight of Twin B are not applicable. These criteria were primarily aimed at reducing the risk of head entrapment during delivery. Head entrapment at the cervical level is believed to be more common in preterm infants with a larger head circumference compared to the abdominal circumference, or in cases where Twin B is significantly larger than Twin A. However, it is important to note that the available data supporting this concern are limited.

In cases where Twin B is in a vertex presentation, patients should be counseled regarding the increased risk of combined vaginal-cesarean delivery. This is because the option of breech extraction, which refers to delivering the second twin by pulling their legs first, may not be suitable in this situation. The decision regarding the mode of delivery should be made in consultation with healthcare providers based on individual circumstances and considering the potential risks and benefits for both the mother and the babies.

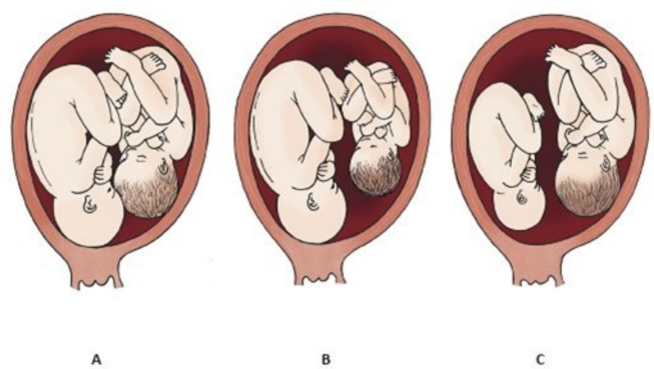

Figure 2 - Feasibility of vaginal delivery based on fetal size

A: Vaginal delivery possible for fetuses with concordant growth.

B: Vaginal delivery not possible for fetuses with discordant growth favoring the first twin, with the second twin estimated to weigh less than 1500g.

C: Vaginal delivery not possible for fetuses with discordant growth favoring the second twin.

Consultation in the Third Trimester

All patients with twin pregnancies considering vaginal delivery should undergo consultation in the third trimester, which includes:

- A dedicated counseling session with a designated obstetrician specialized in labor and delivery.
- An opportunity to accept or decline a trial of labor.
- Detailed documentation in the prenatal record.

During this consultation, patients will have the chance to discuss their options, ask questions, and receive information regarding the potential risks and benefits of vaginal delivery in their specific case. The obstetrician will provide guidance based on individual circumstances and help the patient make an informed decision regarding the mode of delivery. All discussions and decisions made during the consultation will be thoroughly documented in the prenatal record for future reference and continuity of care.

Delivery Timing

Due to the increased risk of intrauterine fetal death in twin pregnancies, uncomplicated twin pregnancies are delivered earlier compared to singleton pregnancies. The timing of delivery for twin pregnancies is commonly recommended at the following gestational ages, or earlier if other indications are present (16):

- Dizygotic twins with separate amniotic sacs and separate chorions: 38 weeks
- Monozygotic twins with shared amniotic sac but separate chorions: 37 weeks

These recommendations aim to balance the growing risk of stillbirth and the decreasing risk of prematurity as the pregnancy progresses, while also considering the small risks associated with early-term births.

Labor Induction

When a woman with a twin pregnancy has an indication for delivery or has reached the recommended gestational age for delivery, labor induction can be offered as an option.

Twin pregnancies can utilize the same approaches as singleton pregnancies for induction, such as cervical ripening with prostaglandins or transcervical balloon catheter.

Labor induction has a similar success rate in twin pregnancies as in singleton pregnancies, and the risk factors for failed induction are the same (primiparity, advanced maternal age, low Bishop score) (17). For example, in a study, among women with twin pregnancies undergoing labor induction, nulliparous women had a 27.9% probability of cesarean delivery, while multiparous women had a 5.1% probability of cesarean delivery (17).

Regional Anesthesia

For all women with twin pregnancies attempting labor, regional anesthesia (epidural) is recommended for several reasons:

1. Unplanned cesarean delivery: if a cesarean delivery becomes necessary during labor, having an epidural already in place can be beneficial. Placing an epidural in a woman with a twin pregnancy during an emergency may be more challenging, and general anesthesia (which is often used as an alternative) carries a higher risk of aspiration pneumonia.
2. Maternal comfort and fetal monitoring: Regional anesthesia provides effective pain relief, allowing the mother to be more comfortable during labor. This comfort can facilitate the continuous monitoring of both twins' well-being.
3. Breech extraction of the second twin: In cases where the second twin is in a breech presentation, regional anesthesia is crucial to enable a breech extraction. Performing this procedure without anesthesia would be difficult and uncomfortable for the mother.

Management of Labor

The majority of labor management for twin pregnancies is similar to that of singleton pregnancies. Patients are provided with a clear liquid diet, and intravenous fluids are administered at a maintenance rate (typically 125 ml/h). Continuous external monitoring of fetal heart rate is performed for both twins until delivery. However, monitoring both twins externally can be technically challenging. Therefore, if necessary, internal scalp electrode placement can be performed for Twin A, while leaving Twin B with external monitoring only. If continuous fetal heart rate monitoring is not achievable, cesarean delivery is recommended (Figure 3).

The assessment of the labor curve and the appropriate progress of labor do not differ for twin pregnancies compared to singleton pregnancies. Obstetric interventions during labor and the decision to perform a cesarean delivery for labor arrest or non-reassuring fetal heart rate follow the same indications as in singleton pregnancies.

The management of labor in twin pregnancies aims to achieve a safe and successful vaginal delivery whenever possible. The progress of labor, cervical dilation, descent of the presenting part, and the fetal heart rate pattern are monitored closely, just as in singleton pregnancies. Interventions such as augmentation of labor with oxytocin or assisted vaginal delivery may be considered when indicated.

However, it is important to note that the management of twin pregnancies during labor should consider the unique aspects of multiple gestations, such as the potential for twin-to-twin transfusion syndrome, placental complications, and the presentation and position of each twin. Close communication between the healthcare team and the patient is crucial to ensure appropriate decision-making and optimal outcomes for both the mother and the babies.

During labor, the patient remains in a regular labor room until the cervix is fully dilated, at which point she is transferred to a delivery room. Consideration may be given to delivering both twins in the operating room for several reasons:

- The operating room is the largest space for labor and delivery, allowing ample room for all attending personnel.
- Overhead lighting provides better visibility.
- Reduced delivery time if an emergency cesarean delivery is required.

For all twin deliveries, the following personnel should be present in the delivery room or operating room:

- Two obstetricians (ideally, one of them being a trainee, such as a resident or junior fellow).
- Two pediatric teams, one for each twin.
- Three nurses: one for the patient and one for each twin.
- An instrument nurse/obstetrician, in case of a cesarean delivery or to assist with instruments required for vaginal delivery.
- An anesthesiologist.

The patient pushes, during the second stage, in the delivery room or operating room, using the footrests attached to the delivery table and a large foam wedge placed behind her to allow her to sit at a 45° angle. Her partner is encouraged to be with her, as in a singleton vaginal delivery. Continuous monitoring of fetal heart rate is maintained for both twins during the second stage of labor.

All personnel in the delivery room or operating room must wear surgical gowns, masks, and head covers.

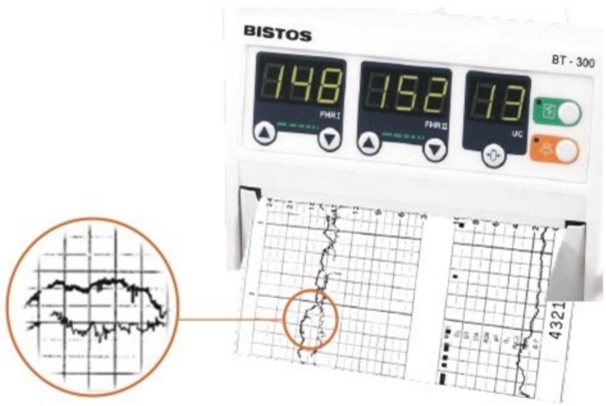

Figure 3 - Electronic monitoring of fetal heart rate, with simultaneous recording for both fetuses.

Delivery: Active management of the second stage

The delivery of Twin A proceeds as a vertex delivery in a standard singleton pregnancy, using operative delivery and episiotomy when indicated. After the first twin is delivered, the umbilical cord is clamped twice with two small plastic clips and cut, and Twin A is handed to the mother or waiting pediatricians. A single clamp is left on the cord of Twin A (to help differentiate the two placentas after birth).

After the delivery of the first twin is complete, a vaginal examination is performed to determine the presenting part of Twin B and the mode of delivery for the second twin.

Twin B: Cephalic and engaged

If Twin B is cephalic and engaged in the maternal pelvis, continuous monitoring of the fetal heart rate is continued until delivery, and the mother resumes pushing. Often, oxytocin is administered (or its dosage increased) to maintain regular contractions. As the maternal uterine contractions bring the fetus's head deeper into the pelvis, artificial rupture of membranes is performed simultaneously with the mother's pushing efforts to facilitate delivery. Operative delivery and episiotomy are performed for usual indications.

Twin B: breech or transversal

If Twin B is in a breech or transverse presentation, a complete breech extraction is performed. This extraction should occur within a few minutes after the birth of Twin A. Delivering Twin B before the cervix contracts reduces the likelihood of head entrapment in the cervical canal. To perform the breech extraction, the fetal feet are grasped at the ankles and pulled caudally while maintaining a good grip because the membranes typically rupture at this point. If the membranes do not rupture spontaneously, artificial rupture of the membranes is performed. If both feet cannot be grasped, it is advisable to pull up on one foot until it reaches the vaginal introitus, at which point the second leg and foot can usually be identified and extracted.

As the buttocks pass through the vaginal opening, the umbilical cord is gently elongated, and the baby is grasped with one hand on each side. The operator's thumbs should be positioned on the sacrum, and the hands should wrap around the sides, gripping the front of the baby with the index fingers on the anterosuperior iliac spines. Excessive or lateral pressure on the back could cause trauma to the kidneys or adrenal glands. By pulling caudally, the abdomen and chest of the fetus are released, with a simultaneous 180° clockwise rotation and another counterclockwise rotation to free a possible nuchal arm, if necessary. Once the fetal shoulder blades are visible, the arms are extracted. If the right shoulder blade is visible, the right hand of the assisting obstetrician is used, and the right thumb is placed on the right shoulder blade while the fingers are used to move the right arm downward and outward. The baby is then rotated clockwise, and the left arm is extracted in the same manner using the operator's left hand.

The head is extracted using the Mauriceau-Smellie Veit maneuver. The first and middle fingers of the dominant hand of the obstetrician are placed on the fetal mandible on each side of the fetal mouth, with the palm on the baby's chest. The non-dominant hand is positioned along the upper back with the middle finger on the occiput. By pulling downward on the jaws and pushing downward on the occiput, this maintains flexion of the fetal head. An assistant may also provide suprapubic pressure to aid in head flexion. When the body is lifted, the head is then extracted through the vagina. If further flexion of the fetal head is necessary, the Piper forceps can be used (Figures 4-5-6 a-6 b-7-8-9-10).

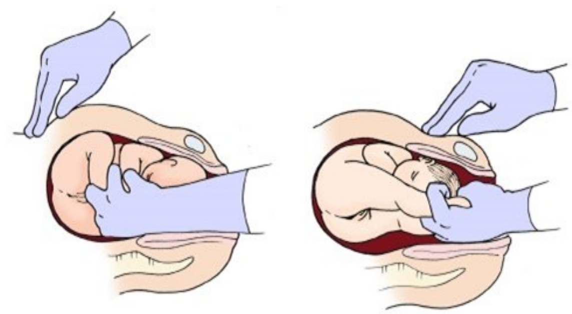

Figure 4 - Podalic version in case of non-engagement of the presenting part in the second cephalic twin. If the second twin is cephalic but the presenting part is not engaged, a podalic version can be performed: the hand is introduced into the vagina to reach the fetal head, then the head is gently pushed upward to allow the hand to be inserted into the uterus and reach the fetal feet, which are then grasped and pulled downward to achieve the rotation of the fetus. This allows for the assistance of a podalic birth/extraction.

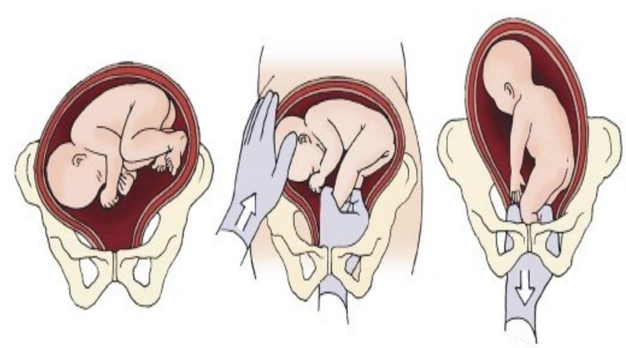

Figure 5 - Internal version in case of the second twin in a transverse or oblique position with intact membranes involves locating the fetal feet, grasping them, and pulling them towards the maternal pelvis while applying gentle pressure on the maternal abdomen with the other hand to push the fetal head medially and upwards towards the maternal sternum. Once the feet are at the level of the mid-pelvis, an amniotomy should be performed, followed by vaginal breech delivery.

On the left: view from the maternal perineum; in the middle: a sagittal section with a view from the fetal ventral side;
On the right: a sagittal section with a view from the fetal dorsal side.

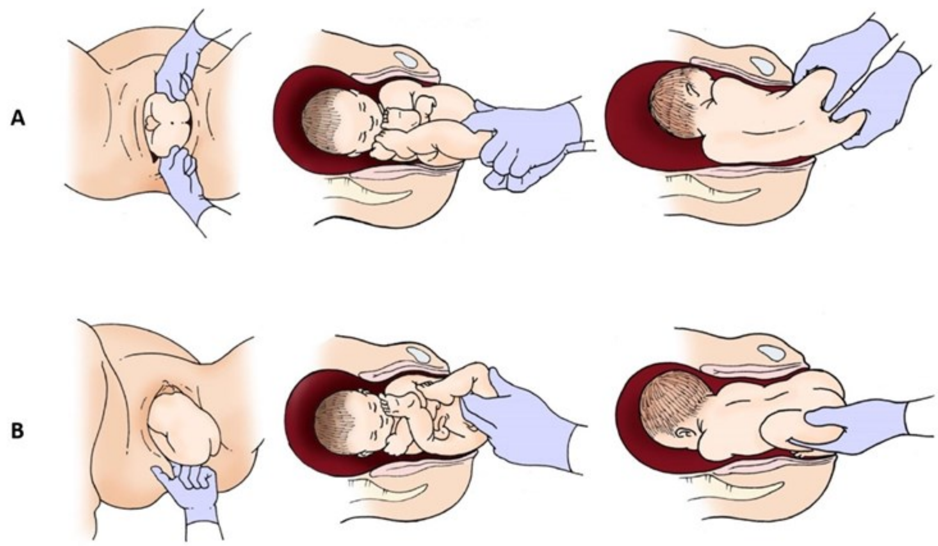

Figure 6A - Assistance to Breech Delivery: Engagement and Internal Rotation
Figure 6B - Assistance to Breech Delivery: Pinard Maneuver

The figure represents a fetus in a breech presentation. In A, the moment of engagement of the presenting part is shown: the sacrum represents the leading point of the presenting part, and engagement of the sacrum occurs with the fetal bi-trochanteric diameter along the oblique diameter of the maternal superior pelvic inlet. In B, the moment of fetal internal rotation is shown: during the descent of the fetus into the maternal pelvis, a 45-degree rotation occurs, with the fetal bi-trochanteric diameter aligning along the maternal anteroposterior diameter of the mid-pelvis. At the end of the rotation, the fetal anterior hip is under the maternal pubic symphysis and the fetal anogenital sulcus is along the maternal transverse diameter of the pelvis.

In Figure A, the mode of engagement of the buttocks is shown. In Figure B, the mode of pressure on the popliteal fossa is shown, to facilitate the expulsion of the legs.

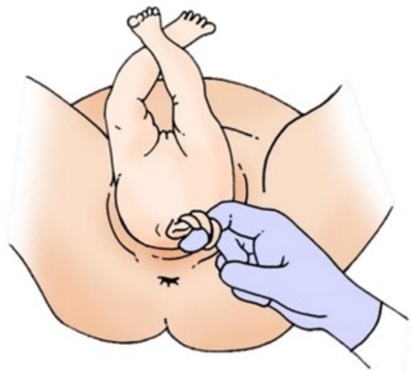

Figure 7 - Loop of Umbilical Cord Prolapse

Figure 8 - Lovset Maneuver

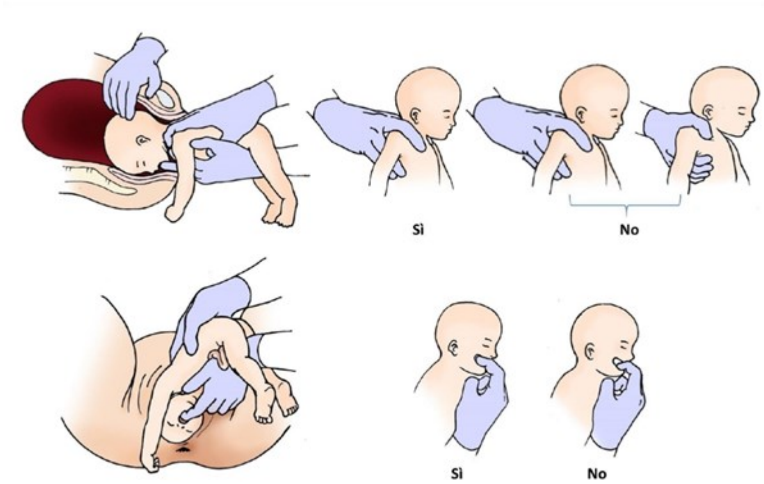

Figure 9 - Mauriceau-Smellie-Veit Maneuver

When performing the maneuver, it is essential to prioritize the safety of the fetus and take precautions to avoid causing any injury. The operator's hand should be positioned on the fetal back, with the fingers placed on either side of the neck. Specifically, the index and middle fingers should be on one side of the neck, while the ring finger and little finger should be on the other side. The thumb should remain in a neutral position and should not be used to apply pressure or pull on the fetus.

To prevent constriction or strangulation of the fetal neck, it is crucial not to pull the fetus by placing the operator's fingers on either side of the fetal neck with the thumb on one side and the index finger on the other.

Similarly, avoid pulling or grabbing only one arm of the fetus with the thumb at the level of the clavicle and the other fingers in the axilla. This technique can pose risks and should be avoided.

When inserting fingers into the fetal mouth, ensure that they are inserted deeply for a secure grip. Avoid pulling with the fingers resting solely on the fetal lower lip or gums, as this can cause trauma.

To insert the forceps branches, after disengaging the shoulders, it is necessary to raise the fetal trunk vertically. Then insert the branches horizontally on the fetal head, grasp the forceps handles, and exert traction to allow flexion and disengagement of the head.

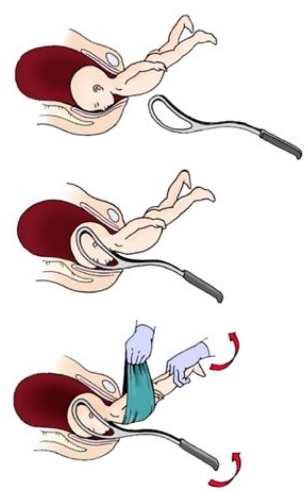

Figure 10 - Application of Piper forceps for head extraction.

To insert the forceps branches, after disengaging the shoulders, it is necessary to raise the fetal trunk vertically. Then insert the branches horizontally on the fetal head, grasp the forceps handles, and exert traction to allow flexion and disengagement of the head.

Twin B: not engaged If twin B is in the vertex or oblique presentation, but not engaged, it is possible to perform an internal podalic version of twin B. To perform this maneuver, one hand is placed in the vagina and the other on the maternal abdomen. The hand in the vagina should be opposite the side of the fetal back. So, if the fetal back is on the maternal right side, the operator's right hand is placed in the vagina and the left hand is on the maternal abdomen. The operator's internal hand first lifts the vertex higher in the uterine cavity and then reaches a fetal foot. The external hand then continues to lift the vertex, while the internal hand pulls the feet caudally, rotating the fetus to complete the breech presentation. The delivery then proceeds as a breech extraction, as described earlier (Figure 4-5). After the delivery of the second twin, the umbilical cord is clamped and cut and then labeled as twin B with two clamps (Figure 11). The baby is handed over to the mother or the second team of pediatricians. Umbilical cord blood gas analysis is performed, and then the placentas are extracted. Oxytocin is administered, as well as any additional uterotonic agents if necessary. Any lacerations are repaired, and the patient is returned to a supine position.

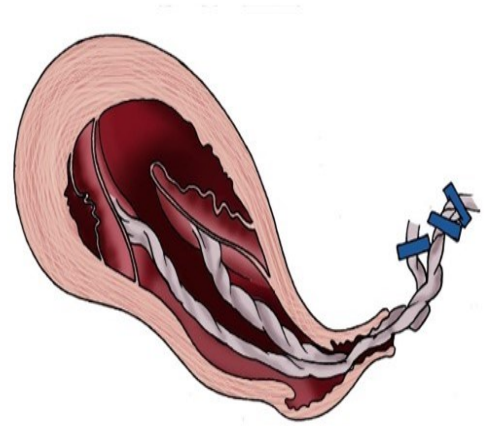

Figure 11 - Differentiated clamping of umbilical cords

Complications and management of twin delivery

Twin pregnancies are at higher risk of delivery complications compared to singleton pregnancies. There is an increased risk of uterine atony, postpartum hemorrhage, and difficult delivery. There are also potential complications associated with active management of the second stage, such as cord prolapse, hand presentation, nuchal arm, and head entrapment. With adequate patient selection and obstetrician training, most of these complications can be prevented or mitigated to achieve a safe delivery.

Uterine atony

An enlarged uterus (stretched by the twins) is a known risk factor for uterine atony and postpartum hemorrhage. Upon admission to the hospital, a blood sample should be sent to the blood bank for cross-matching at least 2 units of packed red blood cells for all twin deliveries. After delivery, routine active management of the third stage of labor (uterine massage and intravenous oxytocin) should be used and additional uterotonic agents should be promptly administered if necessary.

Difficult extraction

Regardless of the mode of delivery, delivering twins can sometimes be a challenge. Occasionally, it may be difficult during a cesarean delivery to extract Twin A in vertex presentation. If an unengaged (floating) vertex is noted at the time of the cesarean delivery, Twin B may be delivered first, instrumental delivery with vacuum or forceps may be used for Twin A, or an attempt may be made to deliver Twin A in a breech presentation. The pediatric team should be present in the delivery room for all twin deliveries in case of neonatal assistance or resuscitation if necessary.

Unengaged vertex of Twin B

If Twin B is unengaged and the vertex does not have time to descend, there is a risk that the cord or fetal hand may descend below the vertex while it is unengaged. A cesarean delivery may be necessary in this case because it is not safe to perform an operative delivery with an unengaged vertex and it may be dangerous to perform a breech extraction due to the risk of head entrapment if too much time has elapsed since the delivery of Twin A.

Complications of active management during the second stage

Uterine hypertonicity

After the delivery of twin A, the uterus may contract rapidly onto twin B. In case of malpresentation, it may be difficult to perform the necessary maneuvers to rotate and deliver the second twin. A single dose of Atosiban can be given.

Malpresentation

In skilled hands, internal podalic version and podalic extraction can be used (Figures 4-5-6a-6b-7-8-9).

Failed podalic extraction

If an attempt at podalic extraction of twin B is difficult, the obstetrician must know when to abandon the procedure and proceed with a cesarean delivery for twin B (combined vaginal- cesarean delivery). In general, most internal podalic versions and podalic extractions are performed within a few minutes of the delivery of twin A. If podalic extraction of twin B has not been achieved after 5 minutes, staff should be notified to prepare for cesarean delivery. Maneuvers to achieve breech extraction should continue while final preparations are made. In addition, cesarean delivery should be initiated after 8 to 10 minutes have elapsed from the birth of twin A. The operator should consider whether it is appropriate to use a mid-transverse or classical incision rather than a low-transverse incision, depending on the clinical context and maternal anatomy (fetal position, distended bladder, length of the second stage, etc.).

Prolapsed cord/hand presentation

Each of these conditions can be diagnosed after the delivery of twin A. Internal podalic version and breech extraction of twin B can be performed promptly, avoiding the need for cesarean delivery.

Nuchal arm

This condition occurs when the fetal arm is positioned behind the fetal head and neck during a podalic extraction. It can be alleviated by rotating the fetal body. For example, as soon as twin B is delivered, the sacrum is oriented anteriorly. If the left arm is extending and turning behind the fetal head towards the fetal right shoulder (that is to say, the left arm is between the fetal head and the maternal bladder/anterior uterine wall), the fetal body must be rotated clockwise until the arm passes in front of the head and can be extracted using standard maneuvers. A nuchal right arm is lifted by counterclockwise rotation of the fetal body. Whichever arm is nuchal, that shoulder must be rotated towards the 12 o'clock position (like windshield wipers) (figure 12 a-b).

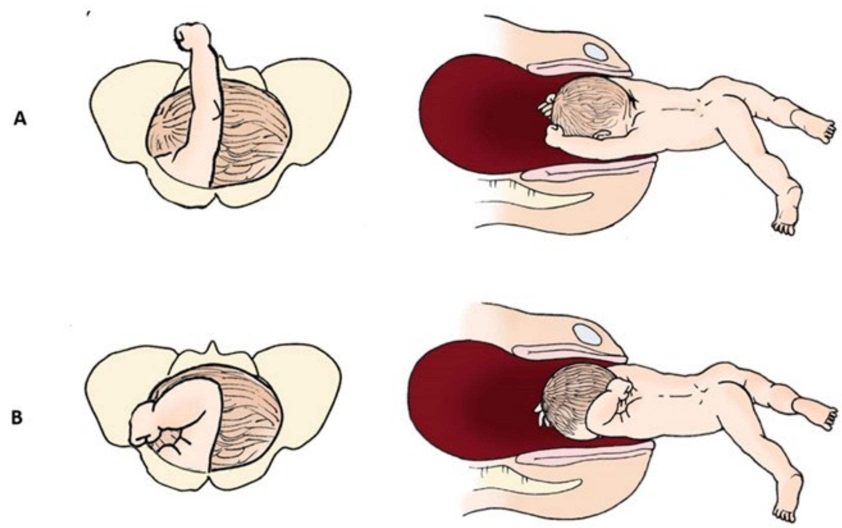

Figure 12a - Nuchal arm

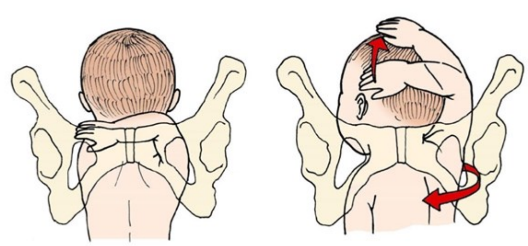

Figure 12b - Nuchal arm

Head entrapment

Head entrapment refers to the inability to release the fetal head during a podalic extraction because it cannot pass through a contracted cervix. This situation is most likely to occur:

1. When twin B is significantly larger than twin A
2. In some cases of prematurity (caused by a higher ratio of head size to abdominal circumference)
3. When podalic delivery is not performed promptly

When the cervix contracts, the fetal abdomen, and thorax can pass, but the cervix prevents the fetal head from being delivered. There are several maneuvers to assist in the delivery of the trapped fetal head. The anesthetist should ensure that the patient has good pain relief and administer a fast-acting uterine relaxant. The assistant should apply suprapubic pressure, which flexes the fetal head and may help in the delivery. Duhrssen incisions can be made on the cervix using scissors, cutting at 2, 6, and 10 o'clock. This technique increases the diameter of the cervix, allowing the fetal head to pass. In case of a negative outcome, a cesarean delivery is necessary (Figure 13).

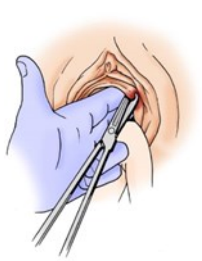

Figure 13 - Duhrssen incisions

Conclusion

Obstetricians who manage twin pregnancies should be well-informed about the potential complications that can arise during labor and delivery. With this knowledge and appropriate training, healthcare providers can effectively assist women with twin pregnancies in achieving a safe delivery for both the mother and the babies.

The use of second-twin podalic extraction, where the second twin is delivered in a breech position, is one technique that can be employed to facilitate the delivery of both twins. Active management of the second stage of labor, which involves interventions such as controlled cord traction, uterine massage, and administration of uterotonic drugs, can help optimize the delivery process and reduce the risk of complications.

By employing these techniques and closely monitoring the progress of labor, obstetricians can increase the likelihood of successful vaginal delivery for both twins. However, it's important to note that each pregnancy is unique, and the management approach may vary based on the specific circumstances and individual patient factors.

Ultimately, the goal is to ensure the safety and well-being of both the mother and the babies throughout the labor and delivery process. Obstetricians play a crucial role in providing appropriate care, making informed decisions, and managing any potential complications that may arise to achieve the best possible outcomes for women with twin pregnancies.

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