

Cesarean versus Vaginal Delivery: Whose Risks? Whose Benefits?

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Am J Perinatol 2012;29:7–18.

Abstract

Keywords

- ▶ cesarean delivery
- ▶ labor and delivery complications
- ▶ informed consent
- ▶ obstetric quality and safety

We reviewed the risks and benefits of vaginal and cesarean delivery to help frame the inherent trade-offs that should be considered as part of the informed consent discussion between patients and providers. We performed a targeted literature review for common complications of childbirth. Approximately 30% of women will experience a maternal or neonatal complication during childbirth. Both cesarean and vaginal delivery is associated with well-known measurable short- and long-term maternal and neonatal complications and benefits. Childbirth is not risk free. There are data available that can guide the informed consent process with objective quantifiable data that patients and providers can use to weigh risks and benefits of delivery methods.

The ability to perform a cesarean delivery, and have both mother and infant survive, is considered one of the most important developments of modern medicine. When first conceived, there was significant risk. The maternal mortality rate (MMR) associated with the procedure in the 19th century was 85%.¹ Evolving medical and surgical techniques such as sterile aseptic technique, reliable methods of anesthesia, suture materials, antibiotics, the safety and rapid availability of blood products, and the popularization of the low transverse uterine incision collectively lowered the mortality and morbidity from the procedure.¹ The rates of cesarean delivery in the United States have increased exponentially from 4.5% in 1965, when it was first measured, to 32% in 2007—most recent estimates.^{2,3} This is the highest rate it has ever been, and evidence suggests that it will continue to climb due to increasing prevalence of comorbid conditions associated with risk for cesarean delivery (advanced maternal age, obesity, multiple gestation, diabetes, and hypertension/preeclampsia). As demonstrated in **Table 1**, there does not appear to be an association

between high cesarean rate and improved maternal or neonatal mortality. Although initially conceived as a lifesaving procedure for mother or baby, expanding indications for cesarean delivery make the risk-benefit trade-off harder to interpret. Some maternal conditions would be associated with improved maternal outcomes and increased neonatal risks, and vice versa. Although an ideal outcome would be no adverse events for either mother or baby—in reality, this is not always possible given the inherent risks of labor, delivery, and cesarean birth, thus making quality measurement and recommendations about optimal patient safety difficult. Recognizing that one in three women will experience a cesarean delivery, the high frequency has contributed to a sense of confidence about the safety and a blasé regard about the risks such that the informed consent mantra of “the risks, benefits, alternatives were discussed in detail, including but not limited to . . . blah, blah, blah” is taken for granted. But perhaps the time has come to be clearer about what these risks and benefits are when discussing delivery options, especially because the perspective upon which these risks

received
June 1, 2011
accepted
June 6, 2011
published online
August 10, 2011

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Tel: +1(212) 584-4662.

DOI <http://dx.doi.org/10.1055/s-0031-1285829>
ISSN 0735-1631.

Table 1 State-Specific Cesarean, Neonatal, and Maternal Mortality Rates

State	Cesarean Rate, 2007 ⁴	Neonatal Mortality Rate per 1000 Live Births, 2007 ⁵	Maternal Mortality Rate Deaths per 100,000 Live Births
Alabama	33.8	6.27	11.6 ⁶
Alaska	22.6	3.17	3.2 ³
Arizona	26.2	4.74	7.5 ³
Arkansas	34.8	4.33	16.0 ³
California	32.1	3.55	14 ⁷
Colorado	25.8	4.17	10.9 ³
Connecticut	34.6	5.06	7.5 ³
Delaware	32.1	5.34	10.3 ³
District of Columbia	32.6	9.7	38.2 ³
Florida	37.2	4.42	14.3 ⁸
Georgia	32	5.07	20.9 ³
Hawaii	26.4	4.23	13.9 ³
Idaho	24	4.52	15.0 ³
Illinois	30.3	4.78	7.8 ³
Indiana	29.4	4.79	2.9 ³
Iowa	29.4	3.3	8.2 ³
Kansas	29.8	5	7.1 ³
Kentucky	34.6	4.06	8.1 ³
Louisiana	35.9	5.35	17.9 ³
Maine	30	4.46	1.2 ³
Maryland	33.1	5.8	20.5 ⁹
Massachusetts	33.5	3.42	4.8 ³
Michigan	30.4	5.56	21.0 ³
Minnesota	26.2	3.8	5.0 ³
Mississippi	36.2	5.89	19.0 ³
Missouri	30.3	4.99	12.7 ³
Montana	29.4	3.62	10.1 ³
Nebraska	30.9	4.86	9.0 ³
Nevada	33.1	4.03	10.0 ³
New Hampshire	30.8	3.25	9.2 ³
New Jersey	39.3	3.44	16.5 ³
New Mexico	23.3	3.89	16.5 ³
New York	33.7	3.7	21.4 ¹⁰
North Carolina	30.7	5.7	12.3 ³
North Dakota	28.4	4.86	10.3 ³
Ohio	29.8	5.18	7.2 ³
Oklahoma	33.6	4.78	20.1 ³
Oregon	28.2	3.95	6.5 ³
Pennsylvania	30.1	4.98	10.1 ³
Rhode Island	32.2	5.41	5.2 ³
South Carolina	33.4	5.66	12.0 ³
South Dakota	26.6	4.16	9.0 ³
Tennessee	33.3	5.19	11.0 ³

Table 1 (Continued)

State	Cesarean Rate, 2007 ⁴	Neonatal Mortality Rate per 1000 Live Births, 2007 ⁵	Maternal Mortality Rate Deaths per 100,000 Live Births
Texas	33.7	3.86	22.2 ¹¹
Utah	22.2	3.39	9.9 ³
Vermont	26.8	3.07	2.6 ³
Virginia	33.5	5.35	8.3 ³
Washington	29	2.85	9.0 ³
West Virginia	35.2	4.68	10.4 ³
Wisconsin	25	4.03	10.9 ³
Wyoming	26.9	3.67	17.0 ³

and benefits are being considered matters. The concept of the stakeholder perspective is particularly pertinent in obstetrics where the clinician and patient are interpreting this discussion in reference to two patients—the mother and the fetus. The balance of the clinical decision making is influenced by who is sick (mother or fetus), who will potentially benefit from the intervention (or lack thereof), and who will suffer or be potentially at risk for an adverse outcome. The discussion/decision is further compounded by the values of the population, physician, patient, and not infrequently, the patient's partner.

Over the past several decades, research regarding the risks and benefits of cesarean delivery as compared with vaginal delivery has proliferated, yet which delivery method is best, and for whom, is still unresolved. The purpose of this article is to review the maternal and neonatal risks (short and long term) and benefits of cesarean delivery and to propose a cogent concise standard for consideration when providing informed consent for this procedure. Before expanding on these risks and benefits, the authors acknowledge that there are certain absolute indications where cesarean delivery would be considered best for mother, baby, or both (e.g., placenta previa, or perimortem). In addition, there are certain “relative” indications (e.g., breech presentation, active herpes, high HIV viral titers) where cesarean delivery is considered best for baby and are rapidly evolving as standard of care in the United States. Furthermore, there are acknowledged risks of attempting vaginal birth, including failure and resultant cesarean delivery. Studies consistently suggest that cesarean delivery after labor is associated with small but measurable increased maternal risks and neonatal risks when compared with successful vaginal delivery or cesarean delivery without labor. These risks include infection, transfusion, injury, death of mother or infant, fetal asphyxia, and/or developmental delay of infant.^{12–15} That said, for the average woman or clinician, if given a choice regarding cesarean delivery, it is important to make the risks and benefits of the procedure widely known and readily available in a context that is clinically meaningful and (hopefully) easily interpretable.

Risks

Maternal Short-Term Risks of Cesarean Delivery

In the past decade, the National Institute of Health (NIH) sponsored two consensus meetings on cesarean delivery where the short- and long-term risks were well characterized.^{16,17} Studies suggest that complications in childbirth are not rare and are more likely with cesarean delivery.^{14,15} Complications from childbirth can be minor or severe and can occur immediately (short term) or have long-standing implications. Liu et al, in a Canadian population-based study on composite severe maternal morbidity defined as hemorrhage requiring hysterectomy or transfusion, uterine rupture, anesthetic complications, shock, cardiac arrest, acute renal failure, assisted ventilation venous thromboembolic event (VTE), major infection, or in-hospital wound disruption/hematoma, reported that 2.7% of women with planned cesarean delivery experienced severe morbidity as compared with 0.9% for women with planned vaginal delivery.¹⁵

Short-term risks of cesarean delivery include increased risk of infection, anesthetic and surgical complications (including death), and lower likelihood of breast-feeding (see Maternal Benefits of Vaginal Delivery).^{1,8} Postoperative febrile illness has been reported to be 2 to 5%, but is less than 1% in cesareans that occur without labor.¹ Wound infections and/or hematomas occur in ~3% of cesarean deliveries and may be increasing due to increased prevalence of obesity—a significant risk factor for both cesarean delivery and wound complications.^{1,18–20} Urinary catheterization is associated with postcesarean bacteriuria and has been reported to be as high as 11%.²¹

Anesthetic complications are exceedingly rare, occurring in ~0.5% of pregnancies, and include problems with intubation, drug reactions, aspiration pneumonitis, and complications from high spinal.²² Increased regional anesthesia and subspecialization has contributed to lower rates of anesthesia complications over time. Based on administrative data from the Nationwide Inpatient Sample from Agency for Healthcare Quality and Research (AHRQ), the overall composite risk of severe anesthesia complications is greater for cesarean

deliveries (0.13/1000 repeat cesareans, 0.29/1000 primary cesareans) than for vaginal deliveries (0.06/1000 deliveries).²³ Regional anesthesia is the preferred method of pain relief unless contraindicated due to markedly increased safety (case fatality rate of 32/1,000,000 for general anesthesia versus 1.9/1,000,000 for regional anesthesia).²⁴ The risk of death from general anesthesia during cesarean delivery has decreased markedly over the past 30 years from 16.8 to 6.5 deaths per million general anesthetics. However, the risk of death attributed to general anesthesia during cesarean delivery is approximately twofold higher than death attributed to regional anesthesia.²⁵ Unlike general anesthesia, it is important to note that complications from regional anesthesia are not unique to cesarean delivery. Most complications are regarded as mild or annoying such as transient neurological symptoms, pruritus, fever, maternal hypotension, fetal heart rate abnormalities, and postdural headache.^{24,26} However, more serious and potentially lethal complications include high neuraxial block resulting in respiratory arrest or cardiac arrest, local anesthetic toxicity, or infection.²³

Surgical complications include hemorrhage requiring transfusion or hysterectomy, bowel or bladder injury, postoperative ileus, amniotic fluid embolism, air embolism, thromboembolic disease, and maternal death. The rates of hemorrhage associated with cesarean delivery have been reported to range from 1 to 8%, but are difficult to clearly characterize because some of the increased risk is associated with trial of labor.¹⁶ In general, studies suggest that the risk of hemorrhage is less in planned cesareans as compared with unplanned cesareans, but higher in cesarean as compared with vaginal birth.^{16,27} Furthermore, hemorrhage is significantly increased with history of prior cesarean or abnormal placentation (see Maternal Long-Term Risks of Cesarean Delivery). Hysterectomy occurs in 0.2 to 5/1000 births and is commonly associated with cesarean delivery with risks reported to be 10- to 20-fold higher in cesarean as compared with vaginal deliveries.²⁸⁻³⁰ Bowel injury is associated with adhesions and is more common with prior surgery. Urinary tract injuries occur in 1 to 2/1000 deliveries and are more common in cesarean as compared with vaginal deliveries.¹ Amniotic fluid embolism and air embolism are rare events that occur in 3.3 to 7.7/100,000 pregnancies, with a case fatality rate of 22 to 35% of pregnancies.³¹⁻³³ They cannot be predicted, and it is unclear if they can be prevented. They appear to occur more commonly in cesarean deliveries with an approximately sixfold increased risk (odds ratio 5.7, 95% confidence interval 3.7 to 8.7).³³

There has been increased national attention focused on the prevention of VTEs in hospitalized patients as evidenced by both AHRQ and The Joint Commission noting the "preventability" of VTE.^{34,35} Only recently has this effort been directed specifically at the obstetric patient where the risk of deep venous thrombosis (DVT) and pulmonary emboli (PE) is well recognized and known to be increased in postcesarean patients relative to vaginal delivery.^{36,37} The incidence of DVT is ~1 to 2/1000 and of PE is 1.3/10,000. The case fatality rate for PE has been reported to range from 1 to 3.5%.³⁶

After declining consistently since the early 1900s, the MMR plateaued in 1982 and appears to be on the rise in the United States.³⁸ It is currently estimated to be 13.3/100,000 live births nationally.³⁹ The MMR ranges widely by state and demonstrates significant racial/ethnic disparity (►Table 1, lowest: Maine [1.2/100,000]; highest: Texas [22.2/100,000] or District of Columbia [38.2/100,000]).^{6-8,38-41} The leading causes of maternal death in the United States are thromboembolism, hemorrhage, and hypertensive disorders.³⁸ Two of the conditions (hemorrhage and embolism) are more prevalent with cesarean delivery. Cesarean delivery itself is a significant risk factor for maternal mortality. It is hard to attribute its true risk due to confounding illnesses and/or whether the cesarean occurred with or without labor. However, estimates suggest that the MMR is two- to threefold higher in women undergoing elective scheduled cesareans (without labor) as compared with vaginal delivery, and fourfold higher in emergent cesarean delivery (with labor).^{42,43}

Maternal Long-Term Risks of Cesarean Delivery

The risk of uterine rupture in subsequent pregnancies has been reported as 0.5 to 1.0%.¹ The rate is higher for women attempting trial of labor as compared with planned repeat cesarean delivery. Because of the risk of uterine rupture and the potential for maternal or neonatal death or significant neonatal compromise, as well as the inability to guarantee prompt delivery in the advent of an adverse event, many clinicians recommend and/or patients opt for repeat cesarean. Hence, the most recognized long-term risk of cesarean delivery is the risk of recurrent cesarean delivery. Currently in the United States, 92% of women with a prior cesarean delivery undergo repeat cesarean delivery.⁴⁴ The risk of abnormal placentation including previa/accreta has been reported to increase in a dose-dependent fashion.⁴⁵⁻⁴⁷

Although the U.S. national debate on cesarean delivery has centered on patient choice cesareans and the availability and risks of vaginal birth after cesarean (VBAC), other countries have provided longitudinal population-based data emphasizing other adverse reproductive outcomes that should be considered. For example, Hemminki in a review of eight cohort studies evaluating the long-term reproductive risks of cesarean delivery suggested that a cesarean delivery was associated with decreased subsequent fertility, increased likelihood of ectopic pregnancy and/or miscarriage, and increased risk of abnormal placentation including abruptio and placenta previa, both of which potentially impact the health of the next infant.⁴⁸ These risks have been corroborated by subsequent investigators.^{49,50} Although problems with placentation are well recognized, Kennare et al evaluated risks of adverse outcomes in the next birth following a cesarean delivery as compared with vaginal delivery in a population-based study in Australia and found additional increased pregnancy complications including malpresentation, prolonged labor, emergency cesarean, uterine rupture, preterm birth, low birth weight, small for gestational age, and stillbirth.⁵¹ A Scottish study also reported increased risk of stillbirth after prior cesarean delivery and that the risk of

unexplained stillbirth at 39 weeks was double the risk of stillbirth or neonatal death associated with uterine rupture.⁵² Although these are European studies where longitudinal studies and linkage to neonatal outcome are feasible, it is reasonable to assume these findings can be extrapolated to the United States. However, the rates are likely to be even higher in the United States due to higher overall cesarean rates, less utilization of certified nurse midwives, and more patient comorbidities. Collectively, this suggests that U.S. clinicians may be missing the mark by focusing attention on VBAC or labor-related complications (uterine rupture and maternal or neonatal death during labor) instead of including broader reproductive issues.

Maternal Risks of Vaginal Delivery

Labor is not risk free. Approximately 10% of women who plan and achieve a vaginal birth will experience some type of complication.¹⁵ Furthermore, as mentioned previously, this rate is significantly higher in planned vaginal births that fail. Maternal morbidity is increased in a dose-dependent fashion with failed labor cesarean, followed by emergency cesarean. Both maternal and neonatal mortality is increased in cesarean after labor when compared with vaginal delivery or elective cesarean.^{13,53}

Subsequent discussion will be limited to successful vaginal deliveries. Reservations regarding vaginal delivery are largely focused on concerns about the perineum. Many researchers argue that vaginal delivery contributes to the risk of pelvic floor dysfunction and urinary, fecal, or flatal incontinence. Without controversy, vaginal delivery is associated with increased risk of third- and fourth-degree lacerations—both of which set the stage for fecal incontinence. Epidemiological data consistently demonstrate increased risk of urinary incontinence 3 and/or 6 months after delivery in women with vaginal delivery as compared with cesarean delivery.^{54–56} However, it is unclear if this trend persists long term and/or the extent to which other factors such as age, obesity, parity, or obstetric interventions contribute to pelvic floor dysfunction.^{56–59} For example, Nygaard et al in a 30-year follow-up of fecal incontinence found age was as important as obstetric events.⁵⁸ Buchsbaum and colleagues found no difference in the incidence of urinary incontinence in nulliparous as compared with parous postmenopausal women, and Connolly et al in a U.S. population found increased risk of incontinence in women delivered vaginally as compared with cesarean or nulliparous women but no difference in incontinence among women who have never been pregnant when compared with women delivered via cesarean.^{60,61}

Neonatal Risks of Cesarean Delivery

Although some argue that cesarean delivery may be the safest, most atraumatic method of delivery for the baby, it can be associated with significant short-term risks such as asphyxia if the uterus is hypoperfused due to conduction anesthesia, scalpel lacerations, and neonatal respiratory morbidity.¹ Furthermore, emerging population-based studies are suggesting altered physiological adaptation that may have long-term immunologic implications.

The exact incidence of fetal asphyxia due to conduction analgesia is unknown and presumably rare given widespread knowledge about the importance of volume expansion prior to conduction analgesia and the importance of avoiding the supine position while in labor. Fetal laceration at time of cesarean occurs in ~1 to 2% of cesarean deliveries, and is probably underreported.⁶² Although most injuries are mild, affect the skin only, and heal without significant sequela, deeper lacerations causing damage to muscle, nerves, or bones are possible. Even superficial lesions can elongate and cause emotional distress or require cosmetic alteration.

The association of increased respiratory morbidity after cesarean delivery at all gestational ages, including term deliveries, has been well recognized but not well publicized to the lay public until recent interest surrounding elective deliveries near term. The physiology of why newborns born by cesarean are at increased risk for respiratory compromise is not well understood; however, several studies have corroborated a gestational age-dependent increased incidence of neonatal respiratory morbidity in infants delivered by cesarean delivery as compared with vaginal delivery.^{63–66} In addition, it appears that labor may have a protective effect in that neonatal respiratory morbidity is higher in infants delivered before labor as compared with infants delivered after labor has started (1.2% versus 3.5%, respectively), suggesting that labor is associated with crucial physiological changes necessary to optimally prepare the neonate for extrauterine life.⁶⁷ Although respiratory morbidity at term can be as severe as respiratory distress syndrome (RDS), more often it is mild transient tachypnea of the newborn (TTN). Neonatal respiratory distress, even TTN can result in neonatal intensive care unit (NICU) or special care observation nursery admission, and the associated concomitant increased cost and family anxiety.

Labor is associated with physiological changes in the neonate that don't occur or manifest differently in babies born via cesarean. In addition to the clinical syndromes of RDS and TTN, cesarean delivery is associated with altered stress response in the neonate as measured by nitric oxide synthesis, β endorphin levels, corticotrophin-releasing hormone, and norepinephrine. These differences are noted to persist for weeks.⁶⁸ The immune system may be impacted as reflected by lower hematocrits, lower leukocytes, polymorphonuclear cell, monocytes, and natural killer cells. There are functional differences in phagocyte activity that persists for 6 months and altered red cell metabolism affecting peripartal defense against free radical formation.⁶⁹ Colonization of the gut flora is different and more likely to reflect environmental genus instead of maternal inhabitants, and this has been inconsistently correlated with increased gastrointestinal symptoms.^{70–74} Finally, there are longitudinal data to suggest cesarean delivery is associated with increased rates of asthma, food allergy/sensitivity, and atopy.^{75–78}

Neonatal Risks of Vaginal Delivery

Neonatal risks typically ascribed to vaginal delivery include birth trauma, namely shoulder dystocia and its sequela. Newborn complications include asphyxia from delay in

delivery or, more commonly, birth trauma from manipulations used to deliver the fetus. Injury to the brachial plexus, phrenic nerve, or fracture of the clavicle or humerus has all been described. Shoulder dystocia occurs in 0.2 to 2.0% of vaginal deliveries, and brachial plexus injuries occur in 10 to 20% of shoulder dystocia incidents; however 80 to 90% of brachial plexus injuries resolve without longer sequela. Long-term permanent sequela occurs in ~1 to 2/10,000 births.^{79–83} Although shoulder dystocia may be unique to vaginal delivery, “fetal dystocia” and birth trauma can also occur during cesarean delivery. Specifically, brachial plexus injuries have been described in infants born via cesarean and have been reported to occur prior to the onset of labor.^{83–85}

Using data from studies focused on women with prior cesarean delivery, babies born after planned (repeat) cesarean have decreased risk of neonatal asphyxia and encephalopathy compared with operative vaginal delivery or emergency cesarean delivery after attempted vaginal birth, but not spontaneous vaginal delivery.¹⁶ The rate of hypoxic ischemic encephalopathy after uterine rupture was estimated to be ~1/2000 (0.005%).⁸⁶ Whether this rate can be extrapolated to first time cesareans, or all cesareans, has not been determined. Whether or not this number has meaningful significance to a lay person is also unknown.

Benefits

Maternal Benefits of Cesarean Delivery

Perineal preservation is the prevailing biological argument suggesting maternal benefit of cesarean delivery. Several studies suggest a short-term benefit with decreased urinary incontinence after cesarean delivery but consistent corroboration and/or long-term population studies have not confirmed this to be absolute (see Maternal Risks of Vaginal Delivery).

Fear of pain (tocophobia) and the need to be in control or have autonomy over the birth process are the prevailing psychological arguments suggesting maternal benefit of cesarean delivery. Ethicists have addressed these issues from the patient, provider, and population perspective, and a clear consensus has not yet evolved.^{87–90} Despite the lack of consensus about the ethical or clinical issues of “what to do when,” patients and physicians are voting with their practice patterns and processes of care. Clearly, the data speak for themselves as evidenced by the growing number of publications regarding cesarean on demand, and the increased national scrutiny including the previously mentioned NIH consensus meetings, as well as repeated calls for administrative and billing codes to document and monitor the incidence of cesarean without medical indications.^{16,90}

Maternal Benefits of Vaginal Delivery

Despite the frequency and relative safety of cesarean delivery, it is still considered major surgery. Hence, the avoidance of major surgery and the risks described is the primary maternal benefit of vaginal delivery. Other benefits include quicker recovery time, shorter hospital admission, and increased rates of breast-feeding.

Neonatal Benefits of Cesarean Delivery

Neonatal benefits of cesarean delivery include timed delivery and avoidance of potential for birth trauma (see Neonatal Risks of Vaginal Delivery). There is less risk of labor-related asphyxia—exact number unknown but extrapolating from VBAC literature is ~0.005%.⁸⁶ There is also a theoretical decreased risk of stillbirth associated with expectant management waiting for the onset of labor.⁹¹

Neonatal Benefits of Vaginal Delivery

Neonatal benefits of vaginal delivery include “natural” physiological adaptation to the external environment relative to respiratory, hematologic, and immunologic systems. This results in decreased RDS, TTN, and respiratory-related NICU admissions, theoretically less infections, and potentially improved immune function as it relates to short- and long-term bowel function and allergic responses. Although there have been population-based longitudinal studies demonstrating persistent differences in biomarkers in vaginal-born as compared with cesarean-born neonates, the long-term implications are unknown and further research is needed.

Conclusion

►Table 2 attempts to collate and summarize the risks and benefits for mother and baby by method of delivery. This has some merit for clinicians, but is somewhat unwieldy for patients because the units for comparison are not the same, and the difference in magnitude for the prevalence of the condition varies widely (0.005% for hypoxic ischemic encephalopathy versus 20 to 30% for urinary incontinence). The trade-off between mother and baby and the balance of risks and benefits is not clear-cut. Becoming pregnant and delivering a baby is not risk free, and studies suggest that ~30% of mother-baby dyads will experience some type of complication to the mother, baby, or both.⁹² Because of widespread variation in “ideal delivery” rates (in which no mother-baby dyad experienced a complication), Gregory et al have suggested the “ideal delivery rate” may be a mechanism to monitor childbirth-related quality and safety in a way that is easily interpreted by patients.⁹² Although the prevailing literature suggests that cesarean is safer for the baby and riskier for the mom, one could argue that the risk to the baby is in equipoise whereas for the mother the choice is risk versus riskier. When faced with an option, the decision to be made is: which rare adverse outcome is the least acceptable given that there are risks inherent in childbirth and “not treating” is not an option. In light of the above, we suggest there is an ongoing need for objectively measuring and quantifying both maternal and neonatal short- and long-term complications of childbirth to gain insight into what measures best reflect quality and safety. Furthermore, we suggest the following considerations should be included as part of the informed consent statement as a starting point for conversation:

Having a baby is very common and approximately 70% (the majority of mothers and babies) will not experience any complications. However, it is important to bear in mind

Table 2 Possible Outcomes of Vaginal and Cesarean Delivery

Risks/Benefits (Possible Outcomes)			
		Vaginal Delivery	Cesarean Delivery
Neonatal	Lacerations	Not applicable	1–2%
	Birth trauma	Shoulder dystocia 0.2–2.0%	Shoulder dystocia (not applicable)
		Brachial plexus injury 2–5/1000	Brachial plexus injury 2.1/1000
		Fractures 1–2%	Fractures 1–2%
	Physiological adaptation	Normal adaptation	“Altered” adaptation
		Respiratory morbidity < 1% (term)	Respiratory morbidity 1–4% (term)
		Immune system	RDS, TTN, NICU admission (↑)
Gastrointestinal flora		Changes in hematologic system	
		Altered gut flora	
		Colic, diarrhea, atopy (↑)	
Maternal			
Short-term (immediate)	Surgical complications	Severe morbidity (see text) 0.9%	Severe morbidity (see text) 2.7%
		PPH 1–5%	PPH 1–8%
		Hysterectomy 2–5/1000	Hysterectomy (10- to 20-fold ↑) relative to vaginal delivery
		AFE 3.3–7.7/100,000	AFE 15.8/100,000 (2- to f-fold ↑)
		VTE <1/1000	VTE (2.2↑)
		Maternal death 3.6/100,000	Maternal death 13.3/100,000 (5–7↑)
		Other complications: not applicable unless failed labor, then increased related to cesarean without labor	Other complications Bowel injury ↑ Bladder injury 1–2% (↑) Postop ileus
	Anesthesia complications	Regional 0.06/1000 procedures	Regional 0.13–0.29/1000 procedures
		General: not applicable	Risk of death 2× higher relative to vaginal delivery
			General case fatality rate for cesarean delivery 1.7 (↑) relative to vaginal delivery
	Perineal trauma	3rd/4th-degree lacerations 2–5%	3rd/4th-degree lacerations not applicable
		Urinary incontinence 21–32%	Urinary incontinence 0–10%
		Fecal incontinence 10–20%	Fecal incontinence 3%
Long-term (subsequent)	Infection	Fever 1–2%	Fever 2.5%
		Wound infection 0.05%	Wound infection 3%
			Bacteriuria 11%
	Avoid “major” surgery	Avoid potential complications	At risk for complications
		Shorter LOS/costs	Longer LOS/costs
	Surgical complications	Not applicable	Uterine rupture < 1%
		Abnormal placenta	Repeat cesarean 92%
		Abruption 0.74%	Abnormal placenta
		Placenta previa 0.38%	Abruption 0.95% (1.3-fold ↑)
			Placenta previa (1.5- to 3-fold ↑)
	Fertility outcome	Not applicable	Fertility (↓)
			Ectopic/miscarriage (↑)
			Stillbirth (↑)

(Continues)

Table 2 (Continued)

Risks/Benefits (Possible Outcomes)			
	Perineal preservation		Uterine rupture (†)
			Repeat cesarean 8%
	Infant bonding	Breastfeeding more likely	Breastfeeding less likely
	Pregnancy complications	Not applicable	“Other” complications (e.g., preeclampsia, low birth weight, malpresentation) (†)

APE, amniotic fluid embolism; LOS, length of stay; NICU, neonatal intensive care unit; PPH, postpartum hemorrhage; RDS, respiratory distress syndrome; TTN, transient tachypnea of the newborn; VTE, venous thromboembolic event.

that delivering a baby is not risk free, and even in the best of circumstances there can be complications. For example, if you attempt to have a vaginal delivery:

1. You may not be successful and need a cesarean delivery and have all the risk of complications associated with cesarean delivery.
2. You could have an infection, hemorrhage requiring transfusion, hysterectomy, or death.
3. You could experience a tear in your perineum and/or rectum that could cause you to be incontinent, or pass gas or stool without control. This happens in ~20% of cases, usually gets better with time, but can persist or get worse as you age, increase weight, or have more children. This is more likely to happen if you tear or have an operative vaginal delivery, but it can also happen if everything goes perfectly.
4. Your baby could experience shoulder dystocia, which rarely (less than 1% of all cases of shoulder dystocia) may cause permanent nerve damage or be associated with a humerus or clavicular fracture.
5. You will be able to move around immediately after delivery, not require a daily injection to prevent DVT, and can breast-feed and care for your baby immediately.

If you decide to have a cesarean delivery, or require a cesarean because of complications in labor:

1. You could have an infection or a hemorrhage requiring transfusion, need a hysterectomy, or die. Your risk for these events is higher with cesarean delivery as compared with vaginal delivery and even higher if it is an emergency cesarean.
2. You could have other intraoperative surgical risks including bowel or bladder injury.
3. You are at risk for bowel adhesions and amniotic fluid embolism and clots in your legs or lungs postoperatively. To help decrease the risk of complications, you will be asked to wear inflatable boots and/or take a twice-a-day injection of heparin to thin your blood and hopefully prevent you from clotting. There is a small risk of bleeding or wound breakdown with heparin.
4. Your risk of incontinence is lower with cesarean delivery, ~10% for involuntary loss of urine and less than or equal to 3% for uncontrollably passing gas or stool during the

immediate postpartum period. This may increase with time as you age, gain weight, or decide to have more children.

5. Your risk for pregnancy complications may be slightly increased in subsequent pregnancies including decreased fertility, increased pregnancy loss (miscarriage and ectopic), and increased risk of abnormal placentas that may cause hemorrhage requiring transfusion, hysterectomy, or other complications.
6. Your baby could be injured at the time of the cesarean. For example, he or she could get a small nick with the scalpel in 1 to 2% of cesareans. For reasons that are not clear, the baby could also have a nerve injury similar to that caused by shoulder dystocia even though the baby comes out easily.
7. Your baby may experience some difficulty breathing and occasionally may have to spend a few days in the NICU.
8. Your baby may experience increased gastrointestinal symptoms or symptoms of allergies that can persist for several years.

Although this language may appear daunting and overwhelming, it is a fair representation of the evidence at the current time, and it is information that women should be made aware of. We contend that this information as suggested is less detailed than the average discussion of risks and benefits for an academic Institutional Review Board consent for participation in scientific research. Although delivery is not research, it can be viewed as an “experiment” because both the process and outcome are uncertain. In truth, we are hypothesizing (hoping) that the outcome will be good, but we never know how childbirth is going to turn out. The suggested commentary gives full disclosure for a motivated patient to make an informed decision.

Disclosure

Opinions expressed are those of the authors, not those of the editors or their organizations, or that of the Journal.

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