

REVIEW ARTICLE

Indications for and Risks of Elective Cesarean Section

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SUMMARY

Background: Rates of cesarean section have risen around the world in recent years. Accordingly, much effort is being made worldwide to understand this trend and to counteract it effectively. A number of factors have been found to make it more likely that a cesarean section will be chosen, but the risks cannot yet be clearly defined.

Methods: This review is based on pertinent publications that were retrieved by a selective search in the PubMed, Scopus, and DIMDI databases, as well as on media communications, analyses by the German Federal Statistical Office, and guidelines of the Association of Scientific Medical Societies in Germany (AWMF).

Results: The increased rates of cesarean section are thought to be due mainly to changed risk profiles both for expectant mothers and for their yet unborn children, as well as an increase in cesarean section by maternal request. In 1991, 15.3% of all newborn babies in Germany were delivered by cesarean section; by 2012, the corresponding figure was 31.7%, despite the fact that a medical indication was present in less than 10% of all cases. This development may perhaps be explained by an increasing tendency toward risk avoidance, by risk-adapted obstetric practice, and increasing media attention. The intraoperative and postoperative risks of cesarean section must be considered, along with complications potentially affecting subsequent pregnancies.

Conclusion: Scientific advances, social and cultural changes, and medicolegal considerations seem to be the main reasons for the increased acceptability of cesarean sections. Cesarean section is, however, associated with increased risks to both mother and child. It should only be performed when it is clearly advantageous.

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Scientific progress, social and cultural changes, and, in particular, legal change have led to a fundamental change in attitudes to cesarean section among patients and doctors. In fact, the consensus around the indications for cesarean section has changed in many countries, now including psychosocial factors such as anxiety about the delivery, or even the mother's wish to have a cesarean section in the absence of any medical indication (1). Nevertheless, the reasons for increasingly liberal attitudes toward cesarean section are diverse and not always easily discernable.

In recent years, a number of factors have been under consideration as possible influences on the rising cesarean rate. Changing risk profiles among increasingly older primiparae are often cited as a reason for the rise in cesarean deliveries (2–4). An increase in maternal request cesarean sections also plays a part (5, 6). However, the rise in cesarean section rates should not be viewed in isolation from changes in society. On the contrary, financial (7, 8), social (9–13), and cultural (8, 14–17) elements appear to play an important part. These factors—taken together with the public perception that a cesarean delivery is now an almost risk-free procedure—might well be contributing to the rise in the number of cesarean sections performed (18).

This perspective, however, overlooks the fact that a cesarean section is a surgical procedure with numerous potential complications for both mother and child. Apart from the intraoperative risks (i.e., infection, organ injuries, or the need for blood transfusion [19–27]), many side effects can occur post partum: thromboembolic complications, for example (19, 28–33). In particular, the complications relating to later pregnancies should be mentioned: uterine rupture (34–36), infertility (37–40), or even placental anomalies such as placenta previa, increta, or accreta (29–32, 40, e1–e3). In recent years a number of risks have also been described for babies delivered by elective cesarean section: the development of bronchial asthma (e4, e5), for example, or type 1 diabetes mellitus (e6) or allergic rhinitis (e4, e7). Existing data are unsatisfactory, however, and a focus of current controversy. Two review articles point to neonatal risk associated with elective cesarean section compared with vaginal delivery, including increased mortality, increased risk of respiratory disease, or type 1 diabetes

BOX 1

Absolute indications

(According to Association of Scientific Medical Societies in Germany [AWMF] guideline “Absolute and relative indications for cesarean section with discussion of cesarean delivery on maternal request” [015/054]) (www.awmf.org) (e22):

- **Absolute disproportion:**
 - Small maternal pelvis, making vaginal birth impossible
- **Chorioamnionitis (amniotic infection syndrome):**
 - Infection of the placenta and possibly of the fetus, requiring immediate delivery
- **Maternal pelvic deformity:**
 - Anatomical malformation, making vaginal birth impossible
- **Eclampsia and HELLP syndrome:**
 - Life-threatening complications of pregnancy, usually leading to cesarean delivery
- **Fetal asphyxia or fetal acidosis:**
 - Life-threatening situations for the fetus that can lead to fetal hypoxia
- **Umbilical cord prolapse:**
 - Prolapse of the umbilical cord between the head of the fetus and the vaginal opening, which can lead to fetal asphyxia
- **Placenta previa:**
 - Anomalous placental position, impeding vaginal delivery
- **Abnormal lie and presentation:**
 - Anomaly of fetal position that makes vaginal delivery impossible
- **Uterine rupture:**
 - Acute situation threatening the life of both mother and fetus, requiring immediate delivery by cesarean section

(e8, e9). Other authors, however, found no difference in neonatal outcome between elective cesarean and vaginal delivery, although they emphasize that only limited data are available (e10). The WHO stated, on the basis of a study of maternal and fetal complications between 2004 and 2008 in 24 countries, that cesarean sections are associated with an increase in risks for both mother and child compared to vaginal delivery and should therefore be performed only when significant advantages are expected (e11).

Incidence

Around the world, a rise has been seen in cesarean rates in developed and emerging countries (5, e12). In sub-Saharan regions the cesarean rate is only 3% (e13); in Central America it is 31% and in North America it is 24% (e14). The rate in Europe is around 25% of all deliveries (eTable) (e15, e16), while in the USA the rate is estimated at 32.2% (e54). In the year 2000 in the European Union, 221 cesarean sections were performed per 1000 live births; in 2011 the number had risen to 268 per 1000 live births (e15–e18). In Europe, births by cesarean section went up from 172.49 per 1000 live births in 1997 to 253.23 per 1000 live births in 2010 (e15–e18).

In the USA, mortality rates have now gone up from 1:10 000 to 1.4:10 000 births (e19). Interestingly, it turns out that a cesarean rate of more than 13% to 15% (as recommended by the WHO [e20]) is not accompanied by better outcomes for fetus and mother (e21).

In Germany, the percentage of deliveries by cesarean more than doubled between 1991 (15.3%) and 2012 (31.7%) (e17, e18). A slight fall by 0.4% was seen in comparison to the year 2011 (e17, e18). The number of other obstetric procedures also decreased slightly. The ventouse was used in 5.7% of deliveries, while the use of forceps declined to 0.5% (e17, e18).

Indications

The decision to perform a cesarean section is based primarily on the question of what is best for or may save the lives of the mother and child. The indications for cesarean section can therefore be divided into absolute and relative indications. Elective cesarean section, performed solely at the wish of the mother, without any medical indication, is considered a separate indication.

In the German-speaking countries—in contrast to the Anglo-American world—discussion of cesarean section revolves mainly around the validity of the medical indications and their division into absolute and relative indications (18, e22), especially in terms of the existing medicolegal background. Absolute indications (Box 1) are responsible for less than 10% of all deliveries by cesarean section in Germany (e23). Most cesarian sections are thus performed for relative indications (Box 2). The decision is often made on the basis of a risk assessment, after extensive discussion with the midwives and physicians involved, together with the pregnant mother and her family.

Maternal risk profile

Changes in the risk profile of mothers and fetuses have been cited in recent years as important factors contributing to the rise in cesarean rates (2–4), but the data are conflicting. For example, a rise has been observed in the cesarean rate in the USA despite the fact that maternal risk factors are declining thanks to improved treatment options (e24).

Increased maternal age

The increase in mean maternal age appears to have a substantial role in cesarean rates. For some years now, pregnancy in a woman aged over 35 years has been considered a high-risk pregnancy. In Germany, the percentage of women giving birth over the age of 35 is now 22% (e17, e18, e25, e26). As maternal age rises, so does the risk of fetal congenital malformations, hypertension, or even diabetes mellitus (2, e26–e32). Age is not in itself an indication for cesarean section; rather, it is the occurrence of specific risks in this age group that may lead to an indication for cesarean delivery.

Obesity and diabetes mellitus

Some pre-existing diseases in the mother increase the probability of risk factors that can necessitate a cesarean section. The first of these is diabetes mellitus or gestational diabetes (e33), which if untreated can result in the birth of children with a birth weight of over 4000 g (e34–e37). Since the prevalence of obesity is continually rising, and not just in Germany (e38, e39), the logical result is that the probability is also increasing that women with diabetes are becoming pregnant, or that gestational diabetes will develop. In addition, overweight and obesity are associated with other risks such as hypertension (e39). Since fetal macrosomia is regarded as a relative indication, this factor could be affecting the cesarean rate.

Fertility treatment

Another much-discussed reason for the observed increase in cesarean deliveries is the rise in assisted reproductive interventions (e40), which increasingly are leading to multifetal pregnancies. However, in Germany the percentage of multiple pregnancies after fertility treatment has declined over the past 10 years (e41–e43). Reproductive interventions in themselves lead to an increased cesarean rate (e44), but maternal anxiety about a healthy outcome for her child may also play an important part.

Previous pregnancies

Although a previous cesarean section does not necessarily mean a required cesarean delivery in subsequent pregnancies, the sense of security of physicians and mothers seems to be responsible for repeated cesarean deliveries (e43). In Germany, this reason is given in just under 24% of all cesarean sections (e23). The authors of one review conclude that with vaginal birth after previous cesarean delivery, there is a risk of rare but serious adverse outcomes (increased rate of perinatal

BOX 2

Relative indications

(According to Association of Scientific Medical Societies in Germany [AWMF] guideline “Absolute and relative indications for cesarean section with discussion of cesarean delivery on maternal request” [015/054]) (www.awmf.org) (e22):

- **Pathological cardiotocography (CTG):**
 - May provide indication of acute hypoxia or fetal asphyxia. If fetal acidosis occurs, the birth should be completed either as an instrumental delivery (suction and/or forceps) or by cesarean section
- **Failure to progress in labor (prolonged labor, secondary arrest):**
 - Delayed delivery or cessation of labor can result in an adverse outcome for the fetus or newborn
- **Previous cesarean section:**
 - It is widely assumed that having had one cesarean section makes it impossible to have a vaginal delivery in subsequent pregnancies

BOX 3

Urinary and fecal incontinence and sexual dysfunction after cesarean section

- Cesarean section once had the reputation of protecting against urinary incontinence (e107). However, studies are still controversial (e108), with little evidence for such a protective effect. At present, elective cesarean is not recommended for this indication (e109).
- After giving birth vaginally, 4% of women develop fecal incontinence; after elective cesarean section, this has not yet been observed (e110, e111). Despite this, because of the lack of sufficient studies, preventive elective cesarean is not recommended (e112).
- Genital prolapse appears to be more common after vaginal delivery than after cesarean section (OR 0.18 [0.16 to 0.20]), as shown by a study of 1.4 million women (e113).
- No differences have been demonstrated between sexual function after vaginal delivery and after delivery by elective cesarean, either at 6 months (e72) or at 12 to 18 months after delivery (e114).

TABLE

Complications of delivery by cesarean section*

	Complications	References
Intraoperative complications	Infections	(19–27)
	Organ injury (bladder, intestines, ureter, etc.)	(19, 21, 22)
	Risks associated with anesthesia	(19, 21, 22, e97)
	Need for blood transfusions	(19–22)
	Hysterectomy as a treatment for severe bleeding, e.g. from placenta praevia	(19–21, e98, e99)
Postoperative complications	Thromboembolic complications (embolism, thrombosis)	(28)
	Adhesions	(29–32)
	Persistent pain	(19, 33)
Risks for subsequent pregnancies	Intrauterine growth retardation and preterm delivery	(e100–e102)
	Spontaneous abortion	(e100–e102)
	Ectopic pregnancy	(40, e3, e102, e103)
	Stillbirth	(40, e104–e106)
	Uterine rupture	(34–36)
	Infertility	(37–40)
	Placenta previa, increta, or accreta and associated risks e.g., need for blood transfusion or hysterectomy	(29–32, 40, e1–e3)

* It is not possible to give accurate estimated prevalences owing to differences between patient groups studied, study endpoints, and various medical and socioeconomic factors

deaths and hypoxic brain damage), whereas with repeat cesarean the risks are more frequent but less serious (e.g., increased rate of children with impaired respiratory adaptation) (e45).

Legal aspects

Over the past decades, the mode of delivery has increasingly become a matter of risk-orientated, defensive obstetric practice. This must largely be seen as a consequence of the increase in guidelines and regulations (e46, e47). The costs of damage claims can at present—as in the USA—run to millions. These sums in turn result in an increase in doctors’ medical indemnity insurance premiums (in some cases a more than 1000-fold increase for obstetricians and gynecologists in comparison to other medical specialists) (e48).

Experiences in the USA show that because of the rise in premiums, many doctors are avoiding working in obstetrics, with the result that several large areas of the country are left without obstetric care.

Cesarean delivery on maternal request

Cesarean delivery on maternal request (CDMR)—an elective cesarean in the absence of any medical or obstetric contraindication for attempting vaginal delivery

(e49, e50)—is the most frequently cited reason for the increasing incidence of cesarean sections (5, 6). Certainly, recent years have seen an increase in mothers expressing a wish for cesarean delivery on the basis of assumed advantages compared to vaginal delivery (Box 3). Interestingly, data collected from a few institutions (seven hospitals in British Columbia, Canada [e51] and a maximum-care hospital in Switzerland [e52]) show a very low rate of cesarean sections (0.4% to 5%) carried out at the request of the mother (e51, e52). It may be seriously doubted whether CDMR is solely responsible for the worldwide increase in cesarean rates.

Although the rise in cesarean rates is often attributed to an increase in CDMR (e53), relatively few women want a cesarean delivery (e54–e56). In the UK and Northern Europe, around 6% to 8% of all primary cesarean sections were performed at the request of the mother alone (18), whereas in the USA the figure is about 11% (e57–e59). In Australia, the rate of CDMR is estimated at about 17% of all primary cesareans (e60). For Germany there are no reliable data on incidence of CDMR, but analysis of the ICD-10-GM (German Modification) coding shows that 13% of cesareans were carried out without any medical indication (e61). In the absence of the relevant documentation, it is not clear whether these figures include CDMR.

Although, for example, over 80% of women giving birth in public or private health facilities in Brazil desire a primary cesarean section (8, 15, 16), the rate of cesareans carried out is significantly lower in the public health sector (25% to 30%) than in private health care facilities (70%) (7, 8). This high rate of desire for a cesarean section can also be observed among Brazilian immigrants to Portugal (e62).

Tocophobia and anxiety states

The newly coined term “tocophobia” is mainly used in Scandinavia and the Anglo-American countries to describe strong fear of spontaneous childbirth. This is the most frequent reason for the request for an elective cesarean (10, e59). The incidence of this unfortunately named condition is cited as between 6% and 10% (9, 10, e59). A Scandinavian survey of 1635 pregnant women showed that 15.8% had an intense and 5.7% a very intense fear of vaginal birth (e63). Although in nulliparous women, tocophobia alone was the main reason for desiring an elective cesarean section, other factors contributed to the decisions of multiparous women to opt for a CDMR, such as a previous cesarean or instrumental vaginal delivery (e63).

No doubt there are systematic psychosocial differences between women who request a cesarean section and those wishing vaginal delivery (14). In addition to fear of giving birth vaginally, there is also an association with numerous other factors such as fear of complications for the child, previous traumatic births, depression, abuse, and other psychosomatic/psychiatric reasons (9–12). Since the number of children born per woman has markedly decreased, for some patients the

risk of perinatal mortality or intrapartum fetal asphyxia is too high, even at only 0.45 to 3 per 1000 births (e64–e67). Fear of lack of support, lack of self-confidence in the ability to make it through a vaginal delivery, and even unresolved psychosomatic or sexual conflict, along with the fear of losing control, may also play a part and reinforce the decision to elect for a cesarean (9–12, e68).

Cesarean section— an alternative to spontaneous delivery?

Today, cesarean section is regarded in some medical and legal specialist circles as an alternative to spontaneous delivery (e69). Nevertheless, a cesarean section remains a surgical operation, and as such it also has side effects (5, e14, e70, e71) (Table, Box 4). A primary section increases the incidence of uterine rupture, placenta previa or accreta, and even of ectopic pregnancy—all complications that can affect subsequent pregnancies (40, e3).

Although there is no evidence that maternal and fetal morbidity and mortality are affected by a cesarean section for which there is no medical indication, the incidence of CDMR continues to rise (5, e12). Maternal morbidity in elective cesareans is only slightly higher than that for vaginal deliveries (e72), and the operative risks are even half those associated with emergency cesarean sections (e73–e75).

Recommendations regarding elective cesarean section for term fetuses have also undergone several revisions in recent years. In neonates, after either spontaneous delivery or elective cesarean, morbidity and mortality are significantly associated with gestational age (e76–e79). The lowest complication rates were seen when a primary section was performed during the 39th and 40th gestational weeks (GW) (e76–e78). Cesarean deliveries before GW39+0, compared to vaginal deliveries, led to notably higher respiratory morbidity in the newborn, requiring intensive medical care (e80). For this reason, delivery should be no earlier than GW39+0 (e78, e79, e81).

Neonates born via elective cesarean section have a higher risk of respiratory complications such as respiratory distress syndrome or transitory tachypnea of the newborn (e76, e80). As a rule, the symptoms tend to be mild and self-limiting, although many babies have to be admitted to a neonatal ward for short-term observation.

Studies have now also investigated long-term medical effects of cesarean section. Interestingly, an association was found between cesarean section and the occurrence of autism (e82), bronchial asthma (e4, e5), type 1 diabetes mellitus (e6), various food allergies (e66), and allergic rhinitis (e4, e7). Although some possible pathophysiological explanations have been postulated, causality has yet to be definitively proven and is the subject of much controversy in specialist medical circles (e83).

Another complication that can occur after cesarean section is difficulty with breast-feeding (e84, e85). However, there are inconsistencies between the numerous studies that have now been carried out, as some of them report no association between cesarean section

BOX 4

Comparison of complications of elective cesarean section and planned vaginal delivery

The data are based on the NICE guideline (18), in which the few prospective studies that exist were evaluated according to the criteria of evidence-based medicine (EBM). However, as the guideline remarks, the quality of the evidence is low to very low. Further details and references are given in (18).

- **Risks reduced after elective cesarean:**
 - Abdominal and perineal pain during the birth
 - Abdominal and perineal pain 3 days after the birth
 - Vaginal injuries
 - Anesthesia-related emergencies (shock, bleeding)
- **Risks reduced after vaginal delivery:**
 - Duration of hospital stay
 - Hysterectomy due to postpartum bleeding
 - Cardiac arrest
- **No differences:**
 - Abdominal and perineal pain 4 months after the birth
 - Injuries to nearby organs (bladder, ureter, or cervix)
 - Uterine rupture
 - Pulmonary embolism

and breast-feeding (e84, e86–e88), whereas others show a clear negative effect (e89, e90). Probably a role is played by the delay to mother–child interaction caused when the child has to be admitted to a neonatal unit, or due to their spatial separation. However, this delayed mother–child relationship appears to have no influence on the frequency or duration of breast-feeding after discharge from hospital (e91), especially if the mother receives enough advice and support after the cesarean (e87, e92–e96).

Conclusion

A cesarean section is a surgical procedure which can lead to numerous complications in both mother and child. A WHO study of adverse maternal and fetal outcomes between 2004 and 2008 in 24 countries showed that cesarean sections are associated with increased risks for mother and child, and that therefore a cesarean section should only be performed when clear advantages are to be gained (e11). For this reason, cesarean section cannot be considered an equal alternative to spontaneous childbirth, and should be viewed with caution.

Conflict of interest statement

The authors declare that no conflict of interest exists.

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KEY MESSAGES

- In recent years the rate of cesarean sections has gone up worldwide. In Europe, cesarean deliveries went up from 172.49 cesareans per 1000 live births in 1997 to 253.23 in 2010.
- Changes in the risk profiles of mother and child and an increase in the number of elective cesarean sections performed are regarded as important causes of the rise in cesarean rates.
- Other factors such as the increased tendency to risk avoidance, risk-adapted obstetrics, and increasing media communications are regarded as playing an important part. In addition to the intraoperative and postoperative risks, complications that affect subsequent pregnancies must also be considered.
- Scientific progress and social and cultural changes, together with legal considerations, have led to a fundamental change in attitudes to cesarean section.
- Cesarean section is associated with increased risks for mother and child and should only be performed when clear advantages are to be gained. Thus, cesarean section should not be considered an alternative of equal value to spontaneous childbirth, and should be viewed with caution.

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**Supplementary material**

For eReferences please refer to:

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eTABLE

Cesarean rates in selected countries (as a percentage of all live births)

	2008 (%)	2009 (%)	2010 (%)	2011 (%)
Albania	22.70	28.10	29.70	30.00
Belgium	19.50	19.30	19.90	
Bulgaria	28.40	32.80	31.00	33.10
Germany	30.20	31.30	31.90	32.10
Estonia	20.00	20.70	20.30	20.20
Finland	15.80	15.00	14.90	14.70
France	20.60	20.70		
Georgia	24.50	28.00	31.10	34.70
United Kingdom	23.20	23.70	23.80	24.10
Ireland	25.60	26.40	26.60	
Israel	19.50	19.20	19.30	19.90
Italy	39.10	39.10	38.80	
Latvia	22.60	23.30	23.60	23.40
Lithuania	21.10	21.20	21.40	20.40
Luxemburg	26.80	26.10	25.80	27.40
Malta	30.10	28.80	31.20	33.50
Netherlands	14.30	14.80	15.60	
Austria	27.10	28.20	28.20	28.30
Poland	19.30	22.80	26.00	29.90
Rumania		30.30	33.80	36.30
Russian Federation	19.70	20.80	22.10	
Sweden	16.70	16.90	16.40	16.20
Switzerland	32.50			
Serbia	19.30	21.10	23.90	
Slovenia	17.00	17.90	19.10	19.60
Spain	24.70	24.90	24.90	24.90
Czech Republic	20.50	21.20	22.50	23.30
Turkey	41.10	44.50	46.70	47.70
Ukraine	15.60	15.90	15.80	15.80
Hungary	30.40	31.70	32.70	33.40
Cyprus	8.30	9.50	11.40	
Europa	23.00	24.00	24.80	25.30
EU	25.00	25.60	26.20	26.80

Source: WHO Euro Health for All Database (2014) (<http://data.euro.who.int/hfad/>)(53).
 As Germany is not included in this database, the figures from the Federal Statistical Office have been used (<https://www.destatis.de/DE/Startseite.html>) (e17, e18).