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Review article

To 'C' or not to 'C'?

Caesarean delivery upon maternal request: a review of facts, figures and guidelines

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Abstract

The last few decades have seen an unrelenting rise in caesarean section (CS) rates. In addition to an increase in numbers of CS performed worldwide, there has also been a change in the indications for CS, a reflection of changing times. A new dilemma facing obstetricians is the increasing demand for CS in the absence of any medical indication (caesarean delivery on maternal request – CDMR). The paucity of evidence either in favour or against, the poor understanding of long-term health and financial implications and the complex ethical issues surrounding CDMR make counselling extremely challenging. Needless to say, CDMR has generated enormous interest both in the media and among health-care providers, and many national and international bodies have now issued guidelines on the topic. In this editorial, we have aimed to explore the factors responsible for the increase in CDMR rates, assess the safety and cost implications of CS and review the recent guidelines and recommendations on CDMR.

Keywords: Caesarean; cost; ethics; evidence; guidelines; maternal request; risks.

Caesarean delivery – the unavoidable consequence of institutionalised childbirth

The evolutionary transformation of a quadripedal pre-hominid into a bipedal hominid five million years ago resulted in fundamental changes in the way childbirth occurred [103]. Approximately two million years ago, increasing cephalisation in the genus *Homo* resulted in childbirth becoming astoundingly more complex than in other primates, necessitating obligate midwifery and thereby transforming it from an individual to a social enterprise [102]. Childbirth in humans remains distinct and significantly more dangerous than that of non-human primates because of the constraints imposed by bipedalism, a large brain and "secondary altriciality" or the delivery of the infant in a relatively helpless state [88]. The art of obstetrics evolved with a view to making this process safer for both mother and baby and to this end, the last century saw rapid institutionalisation of birth. Although institutionalisation of childbirth was observed in most developed and developing countries, no where was it as emphatic as it was in North America in the 1940s where the number of hospital deliveries increased from 50% in 1938 to 99% in 1955 [15]. With institutionalisation came "medicalisation" and an increased utilisation of caesarean section (CS) as the universal solution to all obstetric problems.

Rising CS rates – Is the trend justifiable?

With advances in obstetric anaesthesia, surgical technique and the ready availability of blood products and prophylactic antibiotics, the attitude of medical professionals and the general public has changed significantly and CS rates worldwide have shown a dramatic increase. Canada has seen a 10% increase in CS rates since 1995, and one in four hospital deliveries is now by CS [14, 38]. In the UK between 20 and 25% of all births are by CS [72] and in the US this number is as high as 32.2% [61]. However, the myth that CS is "safe" is being shattered by recent reports of increased adverse maternal and fetal outcomes associated with CS. Recent reports have shown that maternal mortality rate in the USA has increased from 10:100,000 to 14:100,000 births [11] and that the rate is highest in states with a CS rate >33% [19]. It has also been consistently shown that CS rates >13–15% are not associated with improved perinatal outcome [44]. The rising CS rates with no evident improvement in maternal and perinatal outcomes has resulted in an expected backlash with a significant lobby suggesting the return to "natural" and family-centred births. However, despite concerted international attempts to curb numbers, CS rates have continued to rise, as has the list of indications for which they are now performed.

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Changing indications for CS – a reflection of changing times

The practice of obstetrics in the past few decades has been influenced considerably by a number of technological advances as well as professional, legal and cultural shifts (Table 1). These, in addition to the medical and general perception that a CS, especially when performed as a planned procedure is a safe operation, has led to rising numbers of these procedures being performed in in response to maternal request [72]. In fact, many European countries have seen the commonest indication for primary CS change from "uterine factor" and "abnormal fetal lie" to "psychosocial indications defined as maternal fear of childbirth or maternal request without any co-existing medical indication" [98].

Caesarean delivery on maternal request (CDMR) – Magnitude of the 'problem'

The term caesarean delivery on maternal request (CDMR) refers to elective delivery by CS at the request of a woman with no identifiable medical or obstetric contraindications to an attempt at vaginal delivery [13].

There is a marked variation in the incidence of CDMR worldwide. In British Columbia, Canada where maternal choice is tracked, <2% of primary CS were done because mothers requested them [35] and most requests in other Canadian provinces seem to be from women who had prior CS [114]. The incidence in the UK and Northern Europe is 6%–8% of all primary CS [72]. In the US, a rapid increase in the incidence of CDMR continues to be noted [61] and is currently estimated as 11.2% [62, 117]. In Australia, 17.3% of all elective CS and 3.2% of all births in 2006 were believed to be a result of CDMR [85]. In Brazil, this number in the private sector is as high as 80% [81].

Table 1 Some contributors to rising rates of primary CS.

1. Technological factors
   - Advances in obstetric ultrasound and Doppler surveillance
   - Better understanding of fetal and placental physiology
   - Electronic fetal monitoring
   - Advances in neonatal care and obstetric anaesthesia
2. Professional factors
   - The Term Breech Trial
   - Increasing reluctance to resort to operative vaginal delivery, especially forceps
3. Legal and ethical factors
   - Fear of litigation from adverse intrapartum events
   - Increased awareness of patient autonomy
   - Societal change towards joint decision-making in ethics and in law
4. Cultural factors
   - Older maternal age and decreased parity
   - Increased influence of the media and the internet
   - The changing role of women and their involvement in more active life-styles

Reasons for rising CDMR rates

Tocophobia

Tocophobia or the intense fear of vaginal childbirth is one of the commonest indications for requesting a CS. The incidence of primary tocophobia is 6%–10% [117] and there is often an association with social factors, trauma, abuse, depression and psychodynamic causes [42]. It may sometimes stem from self-doubt on the ability to physically achieve a vaginal birth or unresolved issues related to the genital area [72] and patients may often express this as fear of pelvic floor injury, of requiring an emergency CS, of losing the baby and of being left alone in labour. Secondary tocophobia often arises as a result of an adverse experience surrounding a previous labour and delivery [46].

Social, cultural and economic factors

There is a significant cultural and social bias in the demand for CS in certain Latin American countries. In Brazil, the demand for CDMR is approximately 80% both in the public and private sectors [81]. However, the CS rate in the public sector (25%–30%) is significantly lower than that in the private sector (70%) suggesting that policies in healthcare financing have a significant impact on the mode of delivery [70, 80]. The influence of the media in decision-making regarding the mode of delivery cannot be underestimated. In the past few decades, a large number of celebrities have had CDMR, but what is still uncertain is whether these trendsetters are inspiring new mothers to turn away from "old-fashioned" childbirth or whether they are merely holding a mirror to society.

The changing attitude of women to CS

Women now live longer and have fewer children, making quality of life issues, such as the long-term risk of incontinence associated with vaginal delivery more pertinent than the risks associated with having multiple CS [64]. Some women find a perinatal mortality rate of 1.4 per 1000 births after 39 weeks of gestation [106] and a cerebral palsy rate of 0.45–3 per 1000 births extremely high and although only 10% of these are felt to have an intrapartum origin [10], these numbers play an important part in women's choice for CS [110]. Other women find the unpredictability of a vaginal birth and the risks of instrumental vaginal deliveries and emergency CS unacceptable. An elective CS seems to magically ward off the unpredictability and danger of birth [113].

The changing attitude of clinicians to CS

According to a recent Canadian survey, 25% of obstetricians, family physicians and nurses believe that a CS will prevent urinary incontinence or sexual problems despite a lack of supporting evidence [48]. Young obstetricians seem to hold increasingly negative views of natural childbirth and a predilection for CS along with other medical interventions [49]. These findings have been echoed in other countries too.

A large survey in Australia [85] revealed that the likelihood of agreeing to perform CDMR was higher among specialists who were <10 years from qualification and the number was higher in private hospitals when compared with public hospitals. Two-thirds of trainees expressed the intention of performing CDMR in future practice and 7% of doctors practicing in private hospitals said they would "disguise" the indications for CS. In Brazil, healthcare providers have been known to persuade women to have CS in the absence of any medical indication [81].

"To C, or not to C, that is the question:"

There have been numerous reviews on the topic of CDMR with strong arguments being presented both in favour and against. The chief elements of the debate include safety, costs, autonomy and maternal satisfaction but many of the arguments tend to borrow from outdated and extrapolated evidence. Our understanding of the risks and benefits of a CS have undergone considerable changes in the past two decades. A CS has been shown to have some very obvious advantages that include scheduling benefits, fewer uncertainties, avoidance of difficult labour and perineal trauma and minimising the exposure of the baby to difficult manipulations, trauma and stress. However, some other implied benefits, especially the long-term protective effect on the pelvic floor and sexual function [64], as well as the universal reduction in the rates of (vertical) transmission of infections need to be revisited. The most recent evidence concerning these and other issues have been outlined below.

Safety

A recent WHO global survey on maternal and perinatal health [97], a large cross-sectional study conducted in 24 countries between 2004 and 2008 stated that CS is associated with an intrinsic risk of increased severe maternal outcomes and concluded that CS should only be performed when a clear benefit is anticipated, a benefit that might compensate for the higher costs and additional risks associated with this operation. However, like with most other studies, the risks of both emergency and elective CS were clumped together and this is therefore not relevant to the discussion of risks associated with CDMR. The maternal risks traditionally attributed to CS have been outlined in Table 2 and the most recent evidence has been summarised below.

Table 2 CS maternal risks.

Immediate risks:
- Infective morbidity: pelvic infections, endometritis, wound infections, UTI, thrombophlebitis, puerperal sepsis
- Haemorrhage requiring blood transfusion
- Injury to the uterus, cervix, bladder and ureter
- Miscellaneous complications from surgery: haematomas, bladder paralysis, ileus
- Re-laparotomy
- Admission to ITU
- Anaesthetic risks
- Death

Delayed risks:
- Thromboembolic disease
- Prolonged recovery
- Hospital readmission
- Post-operative adhesions/ pain
- Incisional hernias

Risks in future pregnancy:
- Abnormal placentation
- Uterine scan dehiscence and rupture
- Peripartum hysterectomy
- Infertility
- Early pregnancy loss
- Ectopic pregnancy
- Growth restriction and preterm birth
- Stillbirth
- Repeat CS and consequences thereof

Maternal morbidity Large trials in the 1990s have shown that maternal morbidity is only slightly higher with elective CS when compared with vaginal deliveries (3.9% vs. 3.2%) [36] and when compared with emergency CS, both major and minor complications are at least twice as fewer with elective CS [4, 9, 105]. Since the publication of these trials, the risks from an elective CS have reduced further with the universal use of prophylactic antibiotics, safer surgical and anaesthetic techniques, thromboprophylaxis, antenatal correction of anaemia and careful peri-operative planning in cases of placenta praevia and accreta. An important consideration when comparing elective CS with vaginal deliveries is that an unassisted vaginal birth can never be guaranteed, and the risks of complications from both instrumental vaginal deliveries (12.9%) as well as CS following labour (16.3%) are twice as high as those from primary elective CS (7%) [4]. Studies that have taken this into account have consistently shown lower complication rates with planned CS. A large retrospective cohort study that included almost 400,000 deliveries in Denmark between 2001 and 2008 [43] showed that when compared with a planned vaginal delivery, a planned CS is associated with a lower risk of severe post-partum haemorrhage (PPH) indicated by the use of blood transfusion in both nulliparous women and women with previous CS. Other recent reviews have shown that the incidence of early PPH and obstetric shock is lower with elective CS [72] and that the overall risk of blood transfusion in association with CS is low except when associated with pre-operative anaemia and placenta praevia [89]. Major and minor morbidity associated with elective CS has been reviewed systematically in the recent NICE document on CS [72], which concluded that there is very little good quality evidence to suggest that risks from elective CS are lower or higher than that of a planned vaginal delivery. A summary of these findings can be found in Table 3.

Maternal mortality Data from the 1990s suggested that the risk of death with CS is several times higher than that

Table 3 Comparison of risks. Elective CS vs. planned vaginal birth (After) [72].

May be reduced		No difference	Conflicting findings from studies
After elective CS	After vaginal birth		
• Perineal and abdominal pain during birth • Perineal and abdominal pain 3 days postpartum • Vaginal injury • Early PPH • Obstetric shock	• Length of hospital stay • Hysterectomy for PPH • Cardiac arrest	• Perineal and abdominal pain 4 months postpartum • Latrogenic/intra-operative surgical injury to bladder, ureter and cervix • Uterine rupture • Pulmonary embolism	• DVT • Maternal death • Blood transfusion • Wound and post-partum infection • Anaesthetic complications

associated with vaginal delivery [30, 57, 94]. However, many of these publications fail to differentiate between elective and emergency CS and the datasets tend to stretch back over many years, often sufficiently far back to include women whose care was provided according to an outmoded standard [64]. The risks associated with surgery have diminished over time and maternal mortality in the developed world is now extremely rare. This is particularly true for elective CS as reflected in the British Confidential enquiries into maternal deaths. In the late 1980, women in the UK were at least eight times more likely to die from CS when compared with vaginal deliveries [116]; in the late 1990s, this number had decreased to two [115]. Similar trends were noted in the US. Although an analysis of 250,000 primiparous women in the Washington State Health Database from 1987 to 1996 initially revealed an increased risk of maternal mortality with CS (10.3/100,000) when compared with women that delivered vaginally (2.4/100,000), in logistic regression, adjusting for maternal age and severe pre-eclampsia, this increased risk was no longer apparent [59]. The authors perhaps rightly concluded that there is a possibility that CS is a marker for preexisting morbidity, placing women at an increased risk for mortality, rather than a risk factor for death in and of itself. That there is no difference in maternal mortality between elective CS and vaginal delivery has more recently been confirmed in the largest dataset adjusted for pre-eclampsia and maternal age [26]. Towards the end of the century, a study from Israel showed a lower mortality rate from elective CS than from vaginal delivery [120] and a publication from the year 2000 estimated maternal mortality at one for every 78,000 elective CS performed [58].

While this sounds extremely encouraging, it must still be remembered that the risk of maternal death from a CS is not confined to the index pregnancy alone and that it does extend to subsequent pregnancies. A primary CS increases the incidence of uterine rupture, placenta praevia, placenta accreta, abruptio placentae and ectopic pregnancies, all of which are known to cause maternal deaths in subsequent pregnancies [27, 40].

Reproductive consequences

When it comes to performing a CS, it must be remembered that the first cut is not the deepest [51] and that when future reproductive outcomes are considered the risks from an elective CS clearly outweigh the benefits [26]. These risks are not merely related to the surgery, post-operative morbidity, adhesion development, adverse neonatal outcomes and repeat CS [104] but actually extend through the reproductive life of the woman and beyond [78]. CDMR should be therefore avoided if one is considering a larger family [6]. Even in the developed world, the average woman bears more than one child and a detailed discussion on reproductive outcomes following a primary CS should be discussed. Recent evidence on the subject has been summarised below.

Infertility Epidemiological studies show that women undergoing CS have significantly lower rates of future childbearing and a significant delay in subsequent conception [31, 39, 65, 69]. Although the cause-effect interplay between CS and subfertility is complex and hasn't been completely elucidated, biological explanations, such as scarring, adhesions and abnormal placentation [69] and psychosocial factors, such as a reluctance to get pregnant [26], have been suggested as possible contributors [69].

Early pregnancy loss Again, for reasons not completely understood, primary CS is associated with an increased risk of spontaneous miscarriage [17, 40].

Ectopic pregnancy In addition to the serious morbidity and mortality associated with tubal ectopic pregnancies, CS scar ectopic pregnancies pose insurmountable clinical challenges, often resulting in major fertility-compromising surgical interventions [91]. A very large retrospective cohort study showed the overall risk ratio (RR) of ectopic pregnancy following CS to be 1.28 ($P<0.05$) [40].

Abnormal placentation The most consistent and greatest impact of CS on future pregnancy outcome relates to abnormal placentation. Uterine scarring is believed to prevent normal implantation and migration of the placenta resulting in placenta praevia, accreta, increta, percreta and placental abruption [26]. Although the incidence of placenta praevia after primary CS is lower than once thought, a primary CS remains associated with an increased risk of placenta praevia (OR 1.60; CI 1.44–1.76) [29]. The association between placenta praevia and placental abruption after CS has been

demonstrated consistently in large retrospective cohort studies and this association persists even after correcting for maternal age [40, 59]. The joint effect of parity and prior CS appears greater than the effect of either factor alone [27] which implies that a woman requesting a primary CS increases her risk of placenta praevia with each subsequent pregnancy regardless of the mode of future delivery [41]. Placenta praevia although less likely to be associated with hysterectomies than once thought, is still associated with significant morbidity. Placenta praevia increased the risk of PPH from 9.7% to 17.5% (OR 1.91; CI 1.74–2.09), the risk of blood transfusion from 1.4% to 6.4% (OR 4.39; CI 3.76–5.12), and the risk of hysterectomy from 0.03% to 1% (OR 39.70; CI 22.42–70.30) [77].

Fetal growth restriction and preterm birth An association between CS and reduced fetal growth and preterm birth in subsequent pregnancies has been recently reported [17].

Stillbirth in subsequent pregnancies Women with previous CS, whether elective or emergency, are at an increased risk of unexplained stillbirths at or after 34 weeks of gestation, even after adjusting for smoking, maternal age, social deprivation and birth weight [96]. Abnormalities in uterine blood flow, abnormal placentation and subsequent rates of abruption have been postulated as potential etiologies.

Uterine scar dehiscence and rupture A prior CS is associated with poor scar integrity, which may be manifested as uterine scar dehiscence and in some cases uterine rupture in subsequent pregnancies. The risk of symptomatic uterine rupture among women undergoing trial of labour is estimated at 0.7% [52].

Peripartum hysterectomy Placenta praevia-accreta increases the likelihood [50] and is the leading cause [20] of peripartum hysterectomy. Even in the absence of placenta praevia, a prior CS is associated with an increased risk of peripartum hysterectomy. Not only is the hysterectomy rate higher due to scar complications in those attempting vaginal births after CS, but the trend towards higher hysterectomy rates is also seen in those having repeat CS in the absence of labour [68].

CS and the pelvic floor

Prevention of pelvic floor dysfunction is one of the common reasons for requesting CS and almost two-thirds of obstetricians are willing to perform CDMR, citing decreased risk of pelvic floor injury and maintenance of good sexual function [111]. Pelvic floor dysfunction is a broad term that includes urinary and anal incontinence, pelvic organ prolapse and sexual dysfunction. The protective effect of CS on the pelvic floor has always been a controversial issue and the most recent evidence is discussed below.

Urinary incontinence It is well documented that in the absence of antenatal symptoms and if performed prior to the onset of labour, women who have planned CS do not suffer from urinary incontinence. However, this protective effect decreases with age, dissipates after further deliveries [75], and is abolished if the CS is performed after the onset of labour [111]. Also, the advantage of CS for pelvic floor protection does not exist after three consecutive CS and the rates of stress urinary incontinence (SUI) equals that after three consecutive vaginal deliveries [8]. Although there is undoubtedly a protective effect from a primary CS when compared with a planned vaginal birth, cohort studies and meta-analyses differ significantly in estimating the numbers needed to prevent one case of SUI [82]. Vaginal delivery on the other hand carries only a small risk (<1%) of initiating persistent SUI [107] and in most cases, symptoms resolve within 3 months. If however the symptoms persist at 3 months, there is a 92% risk of long-lasting SUI [108]. The Norwegian EPINCONT study [86], a community-based cohort questionnaire linked to birth registry studied the effect of nine delivery parameters on urinary incontinence and found very few statistically significant associations. It reported an increase in the incidence of SUI with epidural use (OR 1.2, CI 1.0–1.5), urge incontinence with a fetal head circumference >38 cm (OR 1.8, CI 1.0–3.3), any incontinence with a fetal birth weight >4000 g (OR 1.1, 1.0–1.2) and moderate to severe incontinence with functional delivery disorders (OR 1.3, CI 1.1–1.6). There was no association between incontinence and vacuum or forceps delivery. The authors concluded that the effects were too weak to explain a substantial part of the association between vaginal delivery and urinary incontinence. The same group [87] reported the general prevalence of incontinence among nulliparous women as 10.1% and showed that although this increased following a vaginal delivery (21%, OR 2.3, CI 2.0–2.6), it also increased after a CS (15.9%, OR 1.5, CI 1.2–1.9). In the age group of 50–64 years, where the issue of incontinence is of major concern, the baseline prevalence of urinary incontinence was found to be 15.2% and there was no association with the mode of delivery, the prevalence after CS and vaginal delivery being 28.6% and 30%, respectively. A National Institutes of Health (NIH) state-of-the-science conference in 2006 concluded that there was weak-quality evidence to suggest that CS prevented urinary incontinence and that there was not sufficient evidence to recommend CS for prevention [73].

Anal incontinence Reports in the 1990s showed that the incidence of anal sphincter defect on endoanal ultrasound was 35% in primips and 44% in multips following vaginal delivery [99], while that of fecal incontinence was 4% [60]. Only 39% of anal incontinence after delivery cleared in 10 months [21]. No sphincter defect or fecal incontinence was noted following elective CS [60, 99].

Pelvic organ prolapse A recent prospective cohort study of pelvic floor outcomes 5–10 years following delivery [33] showed that spontaneous vaginal birth was associated with a significantly greater odds of pelvic prolapse to or beyond the hymen (OR 5.6, CI 1.5–5.5) and that this risk increased further with operative vaginal birth (OR 7.5, CI 2.7–20.9).

Of these women 75% remained asymptomatic. However, CS whether performed electively, or in active labour did not increase the risk of pelvic organ prolapse. Another 25-year study [55] has shown that those that delivered vaginally were 9-fold more likely to have surgery for pelvic organ prolapse than those delivered solely by CS, but 135 women would need to be exposed to vaginal delivery to develop one case of surgically managed pelvic organ prolapse that they would not have if they had delivered by CS. While interpreting results of these studies, it must be remembered that most studies rely on surrogate measures of prolapse, such as symptoms or surgical treatment. But as symptoms correlate weakly with objective measures of prolapse and given that thresholds for surgical intervention vary considerably, these indicators are not reliable and the relative incidence of prolapse after vaginal birth and CS remains unknown [33]. Most women still deliver vaginally and do not have surgery for prolapse and although CS may decrease the risk of prolapse, it is not completely preventive. On the basis of current evidence therefore, CS cannot be routinely advocated for prevention of pelvic organ prolapse [76].

Sexual dysfunction The following mechanisms could be responsible for sexual dysfunction following childbirth.

1. Dyspareunia secondary to serious perineal lacerations.
2. Pudendal neuropathy, either from compression of the nerve or by stretch injury.
3. An alteration in general and sexual health resulting from the birth experience, fatigue, anxiety regarding the infant's health, changes in body image, marital satisfaction and the partner's reaction to the birth process.

The only randomised trial that examined sexual function after delivery [36] did not find any difference in sexual function 6 months after vaginal delivery and elective CS. Smaller studies have confirmed that there is no significant difference in sexual function 12–18 months after childbirth between women who underwent elective CS and those that delivered vaginally without episiotomy, perineal lacerations, or secondary operative interventions [47].

In summary, there is only weak-quality evidence to suggest a protective effect of CS on urinary incontinence; for other maternal outcomes related to pelvic floor function, including pelvic organ prolapse, faecal incontinence, other anorectal symptoms, and sexual function, weak-quality evidence does not favour either route of delivery [112]. Therefore, in women without previous disorders, there is insufficient evidence to justify an elective CS in order to avoid pelvic floor symptoms [24] and until we have a better understanding of the big picture from a societal perspective, routinely advocating CS to decrease pelvic floor disorders is ill-advised [76].

CS and the neonate

The main neonatal risks from CS are those of increased respiratory morbidity and stress, inadvertent prematurity, delayed bonding and the increased cost of care. Perinatal morbidity and fetal injury from CS is significantly lower.

Neonatal respiratory morbidity When compared with spontaneous vaginal deliveries, neonates born after elective CS have significantly higher rates of respiratory morbidity, neonatal intensive care unit (NICU)-admission and longer length of hospital stay [45, 56]. An elective CS increases the risk of transient tachypnoea of the newborn (TTN) by 3.1% (OR 2.8; CI 2.1–3.8); persistent pulmonary hypertension of the newborn (PPHN) by 0.37% (OR 4.6; CI 1.9–11); respiratory distress syndrome (RDS) by 0.2% (OR 1.3; CI 0.5–3.8) and combined respiratory problems by 3.7% (OR 2.8; CI 2.1–3.6) [56]. However, after 40 weeks of gestation, the incidence of neonatal respiratory morbidity is no different, suggesting that performing elective CS after 39 completed weeks of gestation would result in a significant reduction in neonatal respiratory morbidity [67]. More recent reviews have suggested that there may be no difference in assisted ventilation, intubation or neonatal respiratory morbidity between elective CS and planned vaginal delivery [67]. However, the respiratory implications of the mode of delivery may not be restricted to the early neonatal period alone. Studies have shown that CS increases the risk of allergic rhino-conjunctivitis (OR 1.37% CI 1.14–1.63) and asthma (OR 1.24% CI 1.01–1.53) in children [83] and that elective, but not emergency CS is associated with a 10% increased risk for hospital admission for bronchiolitis from birth to age 23 months [66].

Neonatal stress response Neonatal stress is related, at least in part to the mode of delivery. Salivary cortisol and the crying response to inoculation at 8 weeks are greatest in those born by assisted delivery (1120±506 nmol/L) and least in those born by elective CS (347±214 nmol/L) [100]. Similarly, cord blood cortisol levels, unaffected by the length of labour or method of pain relief, are lowest for babies delivered by CS, with no difference in maternal levels, confirming that the differences observed are derived from the fetus [28]. There is increasing evidence that the stress experienced by the fetus or neonate can have long-term effects on the function of the hypothalamic-pituitary-adrenal axis and it has been speculated that the stress caused by the mode of delivery may contribute to this [28].

Fetal injury The rate of fetal injury for all CS is 1.1% (0.5% for elective CS) and the most common injury is superficial skin laceration (0.7%) [3]. Fetal injury is associated with type of uterine incision (3.4% with 'T' or 'J', 1.4% with vertical and 1% with low transverse), and a skin-incision-to-delivery time of <3 min, but not with type of skin incision, maternal BMI, preterm delivery, or any other parameter [3]. Similarly the risk of fetal intracranial injury with elective CS is very low (1:2750) when compared with forceps delivery (1:664), vacuum delivery (1:860), CS in labour (1:907) and spontaneous vaginal delivery (SVD) (1:1900) [101]. This however cannot be used as a reason for performing elective CS. It has been shown that although the incidence of brachial plexus palsy from

shoulder dystocia is significantly lower from CS (0.0042% to 0.095%) than from vaginal deliveries (0.047% to 0.6%), approximately 10,000 CDMR would need to be performed to prevent one brachial plexus injury [34]. Again, although it has been shown that elective CS would result in an 83% reduction in the occurrence of moderate or severe encephalopathy [7], it is not proven to be protective of long-term neurologic injury in the form of cerebral palsy and/or seizure disorders; and the number of CDMR needed to prevent one case of cerebral palsy has been estimated at 5000 [34].

Sudden intrauterine death and perinatal mortality
The incidence of both explained and unexplained sudden intrauterine fetal demise (IUFD) with increasing gestational age is well documented [23, 25, 74, 121]. The sudden IUFD rate at term has been shown to increase from 1.3/1000 live births at 37 to 2.9 at 39 and 4.6 at 41 weeks of gestation [23]. It has been estimated that elective CS at 39 weeks would prevent two fetal deaths per 1000 living fetuses, which would translate into the prevention of as many as 6000 IUFD in the US annually; an impact that far exceeds any other strategy implemented for stillbirth reduction thus far [34]. Also, perinatal mortality from elective CS at 0.1:1000 is at least ten times lower than that from vaginal birth [95].

Psychological experience

Earlier reports that operative intervention, especially primary CS carries significant psychological risks and that women are more vulnerable to grief reaction or post-traumatic distress and depression [22] have not been confirmed by recent research. The main concerns that women have during childbirth are those of extreme pain and a sense of loss of control [92], and these issues are best addressed with good communication, allowing women to feel as much in control as possible and offering good pain relief [84]. A study that assessed psychosocial outcomes like stress, self-esteem and depression at 6 weeks postpartum found that there was no difference in these scores after a vaginal delivery, elective CS or emergency CS [16]. More recent studies show that maternal satisfaction from a planned CS is at least as high [119], if not higher [72] than a planned vaginal delivery and indeed, the only randomised trial that addressed this issue, showed no difference in postpartum depression whether delivery was vaginal or by elective CS [36].

Ethics

A health professional is guided by the four principles of medical ethics that include autonomy, justice, beneficence and non-maleficence.

Maternal autonomy

Maternal autonomy as a central tenet of obstetrical decision-making has been reinforced in both law and ethics [63]. Health professionals are obliged to respect a patient's autonomous decision-making and her moral right to self-determination regarding reproductive capacities [1]. It can be argued that declining to perform CDMR goes against the principle of autonomy, however, in respecting autonomy, there is a risk of devaluing expert clinical judgement. Yet, many health care professionals believe that free choice regarding the route of delivery belong on the list of women's civil and reproductive rights and argue that it would be unfair for the route of delivery to be dictated to a woman by the medical profession, especially when at least a third of female obstetricians would choose CDMR for themselves [5].

Justice

In a state-funded healthcare system, there is an ethical duty to society to allocate healthcare resources wisely to procedures and treatment for which there is clear evidence of a net benefit to health. On the other hand, the fiduciary duty to a woman is to favour her interest over the interest of others. These principles of justice make decisions surrounding CDMR even more complex.

Beneficence and non-maleficence

When taking a course of action, the health professional should be convinced that it has the greatest chance of benefit with the least risk of harm. In the absence of clear evidence it is difficult to conform to these principles of beneficence and non-maleficence.

Cost

A US study showed that although an elective CS costs more than a vaginal delivery without interventions, adding routine interventions like oxytocin and/or an epidural, could make a vaginal delivery more expensive [18]. Another study suggested that the average cost for vaginal delivery was only 0.2% less than the per-patient cost of an elective CS and that the adoption of a policy of CDMR should have little impact on the overall cost of obstetric care in the US [12]. However, in Canada a first-time CS costs approximately $2265 more than a vaginal delivery and it is estimated that Canada's healthcare system could save close to $25 million if the rate of first-time CS could be reduced to the 15% recommended by the WHO [37]. In the UK, a CS was estimated to be twice as expensive as a vaginal delivery both in terms of initial hospital stay as well as total health costs including hospital readmissions and community care [79]. The most recent cost-utility analysis [72] showed that a planned vaginal birth in the UK was at least £700 cheaper, implying that the NHS could save £4.9 million for every percentage point reduction in CS. However, a sensitivity analysis suggested that the inclusion of adverse outcomes could make the conclusion regarding cost-effectiveness less certain and that on balance, there was no strong evidence to refuse a woman's request for CS on cost-effectiveness grounds [72].

Interpretation of recent evidence

Although a decade ago performing CS for non-medical reasons was considered ethically not justified [93], recent guidelines seem much more supportive of women's choices. The truth is that there is currently insufficient data [73] and no evidence from randomised controlled trials (RCTs) upon which to base any practice recommendations regarding CDMR [53]. In the absence of studies on CDMR, the knowledge base rests chiefly on indirect evidence from proxies posing unique and significant limitations [109]. The guidance development group (GDG) for NICE, UK [72] agreed that the most important outcomes to consider were women's birth experience, mental health, satisfaction and experiences of care. From the evidence reviewed for CDMR, they concluded that although CS is associated with a longer hospital stay and a higher rate of women not breastfeeding at 3 months, it was associated with women having a significantly better birthing experience, both in the immediate postpartum period and at 3 months. A comprehensive assessment across many different outcomes suggests that although no major differences exist between primary CDMR and planned vaginal delivery, the evidence is too weak to conclude definitively that differences are completely absent [109]. Only a well-designed RCT will be able to assess the true risk/benefit ratio of CDMR [54]. In the meanwhile, various guidelines have attempted to interpret the best available evidence and the recommendations have been discussed below.

The Canadian Society of Obstetricians and Gynaecologists of Canada (SOGC) guidelines still suggest that a CS should only be reserved for those pregnancies in which there is a threat to the health of the mother and/or the baby [32]. The US American Congress of Obstetricians and Gynecologists (ACOG) guidelines state that CDMR is not recommended for women desiring several children but is much less critical than earlier guidelines [2]. The Australian guidelines [13] suggest that if after full discussion the patient persists with a request for delivery by CS, the obstetrician may choose to do one of the following: a) agree to perform the CS providing the patient is able to demonstrate an understanding the risks and benefits; b) decline to perform the CS in circumstances where the obstetrician believes there are significant health concerns for mother or baby if this course of action is pursued or the patient appears to not have an understanding sufficient to enable informed consent to the procedure, or c) advise the patient to seek the advice of another obstetrician for a second opinion.

The NICE (UK) document on CS [72] recognises that a better approach than counselling women requesting CS about the risks would be to explore, record and discuss the reasons for the request, thereby individualising cases and management [71, 72]. The most common reason for requesting a CS is tocophobia or the fear of childbirth. Counselling for secondary tocophobia should begin in the postpartum period with debriefing by the concerned obstetrician. Adequate exploration of the fears [117] along with counselling has been shown to result in at least half of these women ultimately choosing a vaginal delivery [90] and being extremely satisfied with their choice [118]. For counselling to be effective, there need to be multiple sessions held in clinics comprising an obstetrician, a midwife, a counsellor and a psychiatrist [72]. Although this has cost-implications, it has been estimated that the extra resource required in providing this support would be offset by resources saved when a CDMR was changed to a planned vaginal birth. A single, one-on-one counselling session has not shown to be beneficial and it has been suggested that this may in fact, be associated with post-traumatic stress disorder [71]. In situations where a woman persists in her request following provision of the opportunity to discuss and explore her reasons for the request, it was determined that the potential for psychological harm was sufficient to warrant this unacceptable in terms of the woman's health. It also has the potential to be costly in terms of long-term need for psychological support. It was concluded therefore that after adequate counselling sessions, if a vaginal birth is still not acceptable, these women should be offered CS for the overall benefit of mother and baby [72].

If a woman requests a CS when there is no other indication, the overall risks and benefits of CS compared with vaginal birth should be discussed and recorded, including a discussion with other members of the obstetric team. It is important to ensure that the woman has accurate information [72], to involve the partner and maybe the family and to provide support [71]. An obstetrician unwilling to perform CDMR should refer the woman to an obstetrician who will carry out the CS [72].

Conclusions

Requests for CS in the absence of medical indications are increasingly being encountered in clinical practice worldwide and CDMR is posing a medical, financial and ethical dilemma. There is currently no clear superiority of one mode of delivery over the other and prospective randomised trials are lacking. Although the immediate risks from CS are now very small, future reproductive consequences are significant and CDMR should be strongly advised against in patients hoping to have larger families. To avoid neonatal respiratory complications and iatrogenic prematurity, CDMR should not be performed prior to 39 weeks' gestation unless there is documentation of fetal lung maturity. The current approach of discussing the risks and benefits is being replaced by an attempt to explore and discuss the reasons behind the request and to individualise management. Patient autonomy and mental health must be taken into account when making a decision regarding the mode of delivery and if after a discussion, if vaginal delivery is not an option, the woman should be offered CDMR or at least referred to an obstetrician who would perform one.

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