

Review

Caesarean section in countries of the Eastern Mediterranean Region

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العمليات القيصرية في بلدان إقليم شرق المتوسط

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الخلاصة: تستعرض هذه الورقة المعطيات العالمية حول العمليات القيصرية، مع التركيز على بلدان إقليم شرق المتوسط والتي استقصيت هذه المعطيات فيها. وتقترب هذه المعدلات في إقليم شرق المتوسط من نسبة 10%. ولو أنها لا تمثل القطر بأكمله، لأنها تركز على المعلومات المستقاة من المستشفيات أكثر من المعلومات الواردة من المجتمعات. كما تشمل الدراسة الاتجاهات العالمية والإقليمية للعمليات القيصرية، ومرتسماتها، وما ينجم عنها. وقد تم استعراض الآراء المخالفة والموافقة لاستطبابات العمليات القيصرية، كما ألقى الضوء على تكلفة المعدلات المتزايدة لها، ومشاركة المرأة في اتخاذ القرارات، ودور العاملين الصحيين، ونوعية المعطيات والسماح القانونية لها، إضافة إلى مناقشة الهدف من خفض المعدلات المتفاوتة الارتفاع للعمليات القيصرية والعمل على تعزيز الجودة العالية لرعاية الأمومة.

ABSTRACT This paper reviews global data on caesarean section (CS) focusing on Eastern Mediterranean Region (EMR) countries for which data could be obtained. CS rates in the EMR tend to average around 10%. The data, however, are often not representative of the whole country, being mostly hospital rather than community based. Global and regional CS trends, determinants, and outcomes are presented. Controversies and consensus over the indications for CS are reviewed. The cost of rising CS rates, women's involvement in decision-making, the role of health workers, data quality and legal aspects are highlighted, with discussion of the aim of reducing unduly high CS rates and promoting high-quality maternity care.

La césarienne dans les pays de la Région de la Méditerranée orientale

RÉSUMÉ Ce document examine les données mondiales relatives à la césarienne, en particulier dans les pays de la Région de la Méditerranée orientale pour lesquels des informations ont pu être obtenues. Les taux de césarienne dans cette Région tournent en moyenne autour de 10 %. Cependant, ces données ne sont pas souvent représentatives de l'ensemble du pays, car elles sont essentiellement obtenues en milieu hospitalier, et non pas dans les structures de proximité. Le document présente les tendances, les déterminants et les résultats en matière de césarienne aux niveaux mondial et régional. Il évoque les controverses et les consensus à propos des indications de césarienne. Le coût de l'augmentation des taux de césarienne, la participation des femmes à la prise de décision, le rôle des agents de santé, la qualité des données et les aspects juridiques sont mis en lumière et accompagnés d'un débat sur l'objectif de réduction des taux inutilement élevés de césarienne et de promotion de soins maternels de qualité.

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Introduction

The increasing rates of caesarean section (CS) delivery have been debated globally for over 2 decades, especially during the 1980s, when a peak was reached in industrialized countries [1]. Professional deliberations continued on such themes as evaluation of CS rates, management of difficult childbirth and labour, management of labour after previous CS and strategies for reducing CS rates [2–4]. This led to guidelines from the relevant United Nations (UN) agencies that CS rates in a country should be between 5% and 15% and encouragement of further research on the issue [5–7]. Reducing maternal mortality by three quarters by the year 2015 became an important Millennium Developmental Goal in the Millennium Declarations [8]. A suggestion that the rate of CS can act as a proxy indicator of maternal mortality (i.e. rising rates of CS indicate improved maternal care) has been questioned [9], as good obstetric outcomes may be associated with low rates of CS [10].

The objectives of this paper are to review: the rates, indications and outcomes of CS; the role of health workers in influencing the frequency of CS; the costs of CS; women's concerns and involvement in decision-making to have CS; and the legal and professional implications of performing CS, with special reference to countries of the Eastern Mediterranean Region (EMR) of the World Health Organization (WHO), mainly Sudan, and other international data.

The information sources used for this review included: peer-reviewed journals, both regional and international; the Internet (press releases, online magazines, official reports, online debates, clinical practice guidelines and expert consensus pages websites provided several references, sometimes web-lists, for different sources);

international conference reports on obstetric and gynaecology, statistical reviews, CS rates, evaluations, policies, strategies, monitoring and other managerial issues; survey results and statistical reports, mainly from Sudan and Saudi Arabia; thesis abstracts [11]; textbooks [12–14]; official data from ministries of health; WHO documents, clinical guidelines and workshop recommendations; and Royal College of Obstetricians and Gynaecologists (RCOG) green-top guidelines [15].

After the topic of CS was chosen, the subtopics were defined, mainly debatable issues and developments in CS rates and trends. The above objectives were then set. EMR country information, mostly from Sudan, was compiled and reviewed. Only one randomized controlled trial of a Canadian multicentre collaborative group on management of breech birth was identified [16]. The majority of references were retrospective, case-controlled studies published in peer-reviewed journals. Textbooks, though generally weaker sources of information, are mostly reliable. Public health aspects of CS were emphasized. Similarly, health financing, women's issues, data quality and outcomes were specifically addressed. Throughout the review, international data are presented initially, followed by regional data with comments.

Worldwide trends in caesarean section rates

Sir John Peel in the 1960s pioneered the survey of rates of CS and of vaginal birth after CS (VBAC) [17]. In the 1980s, a marked increase in CS rates in developed countries prompted studies on CS from hospital records, fertility data, births, deaths and insurance claims. Most industrialized countries then had CS rates of 10%–13%, the

lowest in Japan (7%) and highest in Brazil (32%). Brazil's rate remained the highest, even though it was based on all deliveries and not on hospital deliveries alone [1]. The denominator for CS rates was mostly from hospital-based deliveries of at-risk women.

CS rates in several countries worldwide are shown in Table 1. In Scotland in the United Kingdom (UK), CS rates increased from 5% to 20% in 30 years from 1971–2001; the overall UK rate also increased from just 4% to 20%–24 % [18]. The rate in the United States of America was similar at 23.5% [19]. Chile's rate in 2001 was 40% and in Brazil in the same year it was 80% of hospital deliveries [20]. There is a great disparity between country rates, however. Extremely low CS rates, such as < 1%, may indicate substandard maternity care whereas for VBAC, if cases are not well-selected and carefully followed-up during labour, more scar dehiscence will result.

In Sub-Saharan Africa, CS rates of < 5% are quoted. In Niger, for instance, it is

as low as < 1%. The exceptions are Kenya and Ghana with rates of up to 22% [21]. CS rates comparing rural with urban locations in some African countries are shown in Table 2 [22].

For New Zealand the most recent CS rate from 2000–01 was 22.1%, the operative vaginal delivery rate was 10.3%, with hospital births < 70%. The CS rate increased from 18.2% to 20.8% between 1997 and 2000 similar to developed countries trends [23]. Hopefully, these are not benchmarks for developing countries.

Trends in caesarean section rates in the Eastern Mediterranean Region

There are a number of reports of the CS rates in countries of the EMR. These are summarized in Table 3. In Jordan, the CS rates at Queen Alia Military Hospital rose from 4.8% to 8.5% between 1991 and 1997,

Table 1 Examples of international caesarean section (CS) rates

Country	CS rate (%)	Comment	Reference
Brazil	32	Out of all births	[21]
	80	Hospital data	
Chile	40		[21]
Ghana/Kenya	22		[22]
Japan	7		[1]
Niger	< 1		[22]
New Zealand	22.1		[23]
United Kingdom	20–24	Increase from 4% 30 years previously	[20]
Sub-Saharan Africa	5		[22]
United States of America	23.5		[19]

Table 2 Single live birth by caesarean section (CS) in sub-Saharan Africa in 3 years before the health survey by place of mother's residence

Country	Year	Births by caesarean section (%)		
		Total	Rural	Urban
Burkina Faso	1992/99	1.1/1.1	0.5/1.0	4.7/2.5
Cameroon	1991/98	2.3/2.6	1.7/2.3	3.3/3.3
Ghana	1993/98	4.4/4.1	2.9/2.8	8.4/8.0
Kenya	1993/98	5.4/6.7	4.1/5.7	13.9/11.1
Madagascar	1992/97	0.9/0.7	0.8/0.3	1.5/2.3
Niger	1992/98	0.8/0.6	0.6/0.3	2.1/2.1
Tanzania	1992/96	2.6/2.2	2.1/1.5	4.6/5.0
Zambia	1992/96	2.6/1.6	1.4/0.8	4.0/3.0

Reference: Buekens P, Curtis S, Alayón S [22].

with an average rate of 7.7% over the period. The rate of forceps deliveries was 3% and the vacuum extraction (VE) rate was 0.88% [24]. From 1990 to 2001 the CS rate in Jordan overall increased from 8.0% to 10.9% [25].

This study and others in Jordan also looked at trends in the indications for CS. Breech presentation and fetal distress increased significantly from 1990 to 2001 as

indications for CS, while dystocia and previous CS scar decreased [25]. Fetal distress became an important indication because of limited use of fetal scalp sampling. However, intrapartum fetal heart monitoring may unnecessarily increase CS rates due to incorrect interpretation of tracings and diagnosis of fetal distress [26].

A statistical comparison of CS rates in 3 hospitals in Irbid showed a statistically

Table 3 Caesarean section (CS) rates in some Eastern Mediterranean Region countries

Country	CS rate (%)	Comment	Reference
Jordan	10.9	Increased from 7.7% (August 1991–July 1999) Forceps 3%, vacuum extraction 0.88%	[24]
Oman	10		[32]
Saudi Arabia	10.0	Hospital data	[30]
	8.1	National survey	
Sudan	8	State hospital	[11]
	23	Khartoum Civil Hospital	
	35.8	University hospital	

significant difference in the number of, and indications for, previous CS, but not of complications, between the 3 hospitals [27].

A study of indications for CS in Princess Badea hospital in Irbid revealed a 14-fold increase in the risk of having a caesarean hysterectomy in patients with placenta praevia and previous CS, compared with patients with placenta praevia but no previous CS [28].

Again in Jordan, comparing 150 forceps deliveries in 1995–99 with 420 vacuum deliveries, serious neonatal morbidity was rare when CS followed promptly on failure of delivery. Forceps were more injurious to the mother, while VE caused greater fetal morbidity. VE was recommended instead of forceps, as it can achieve rotation of the vertex [29]. It is a useful technique in remote areas, but the spare parts need to be readily available, and proper training of midwives is required.

The author, while working in Saudi Arabia, undertook a calculation of the annual CS rates from Ministry of Health annual health reports from 1979 to 1999 (M. Baldo, unpublished report). The CS rate started at 3.9%, increased to 6.0% in 1983, levelling off at about 6.5% until 1991, then gradually increasing to 11.5% in 1999. Another, published, study calculated the CS rate to be 10% in Saudi Arabia, reaching 20% in tertiary centres; it was suggested that cultural and regulatory factors lead to either early or too late interference in delivery [30]. Another Saudi hospital-based review of indications for primary CS on 207 records of grandmultiparas (1988–92) gave a CS rate of 0.96%, with dystocia being the commonest indication [31]. Dystocia and obstructed labour in grand multiparas are possibly due to the baby's size or secondary pelvic contraction.

In 1997 the Saudi Arabian Ministry of Health, in collaboration with the WHO

Regional Office for the Eastern Mediterranean undertook a case-finding study on maternal mortality from all sources (S. Mawaideh 1997, unpublished report). Out of a total of 21 maternal deaths identified, 8 (38%) were associated with CS, 5 with eclampsia (24%) and 2 each (10%) with breech, placenta praevia and fetal distress and 1 (4%) each with ruptured uterus and aortic valve disease.

In southwestern Saudi Arabia, the rate of VE delivery was 10.8%, but with a high failure rate of 12.4%, and with a high rate of neonatal trauma, predominantly subgaleal haemorrhage [32].

The Saudi Family Health Survey 1996, a collaboration between the Ministry of Health, WHO and the United Nations Population Fund found a CS rate of 8.1%, higher for women 35 years or older than for younger women (11% versus 7%), for urban than rural (9% versus 5%) and for university graduates than illiterate women than (10.1% versus 6.7%).

A comparative study of active management of prelabour rupture of the membranes in a Saudi and a Sudanese maternity hospital gave rates of instrumental vaginal delivery of 13.1% and 10.8%, while CS rates were 16.0% and 15.8% respectively [11].

In Oman, the CS rate reached 10.2% in the year 2002, similar to that of Jordan [33].

In the Islamic Republic of Iran, the CS rates in 3 teaching hospitals increased from 35.4% to 42.3% between 1999–2003, explained by an increase in the rate of elective CS [34].

In Sudan, the Federal Ministry of Health statistical health report of 2005 gives CS rates for the years 2000–2005 as 42.2%, declining to 24.2%, rising again to 32.2%, then decreasing to 28.8%, although the reliability of reporting may be questionable [35]. CS rates for a university hospital, a

teaching hospital and a provincial hospital in Sudan in the 1990s were 35.8%, 23.9% and 8.0% respectively [11]. Repeat CS, dystocia, breech presentation and hypertensive disorders were the main indications for CS. Of patients with primary CS, 96.0% had a second CS in the university hospital, compared with 80.1% of those in the teaching hospital. The latter also had more emergency CSs. The CS indications were relative rather than absolute; staff could be less conservative or the hospital received more referrals. At the university hospital, junior doctors had less chance to perform the operation.

Comparing active management of labour in primigravidas to non-interference, the CS rate in Sudan could be reduced from 9% to 1%. Instrumental delivery, however, was 16% in the study group and 14% in the controls [11]. In a Sudanese randomized controlled study, comparing forceps with vacuum deliveries (174 forceps and 112 VE) success was 89.3% for VE and 85.1% for forceps [11]. VE achieved more rotational delivery, fewer maternal complications and was recommended for use in rural areas. Perinatal mortality was higher for forceps than VE deliveries, with a ratio of 3:1.

Another determinant of rising CS rates has been suggested to be the sex of the fetus as male sex has been associated with higher CS rates [36]. Widespread use of ultrasound to determine fetal sex could be a factor.

Indications for CS

Breech presentation

A Canadian research group concluded that the safest method of delivery for breech presentations was via CS [16]. The breech CS births group had 4 times less mortality or morbidity in 6 weeks than the vaginal birth group (1.6%–5.0%). There was no

difference in risk to the mother (< 4%). The RCOG, too, has recommended planned CS for term breech delivery, but suggested that incidence be reduced by external cephalic version (ECV) for uncomplicated term breech presentations [37]. There was no statistically significant increased risk in maternal mortality in the planned CS group versus the planned vaginal delivery group (3.9 versus 3.2 per 100 000) [16]. The mother's risk became significant with a policy of elective CS, however. Unfortunately, the increasingly common practice of CS for breech babies reduces physicians' experience in breech delivery, but is still advisable, because most bad outcomes are the result of sub-optimal care [37]. In developing countries, breech delivery may even take place at home, assisted by a midwife. The generally accepted practice is to allow spontaneous breech delivery in a health care facility with no contraindications for vaginal birth even for primigravidas, with precautions such as attendance of a paediatrician.

In 1988 a study showed that ECV after 36 weeks gestation could be successfully performed without major complications in 82% of 56 women, even breech cases with 1 or 2 previous scars; 65% delivered vaginally [38]. Larger confirmatory studies were suggested.

In India during 1994/96, the incidence of breech deliveries was 3.95%; pre-term breech deliveries were 1.9% [39]. The CS rate for breech babies was 31%. Live births were 81% of vaginal versus 86% of CS births. Many obstetricians, however, viewed pre-term breech delivery as risky, best managed by primary CS.

In Jordan 80% of obstetricians prefer CS for breech presentations. However, there were reservations about performing CS for babies of less than 30 weeks gestation due

to lack of suitable neonatal care facilities [40,41].

The perinatal outcomes of singleton breech presentations of 112 nulliparous mothers delivered after 37 weeks, either vaginally or by CS, were published in Saudi Arabia [42]. Out of 96 breech trials 67% had a successful vaginal delivery. Women delivered by CS were significantly older than those delivered vaginally ($P < 0.0001$) or by emergency CS ($P < 0.004$). CS births were heavier than those delivered vaginally ($P < 0.0001$). There were no significant differences in 5-minute Apgar scores or perinatal mortality. It was concluded that with proper selection of nulliparous breech pregnancies for vaginal delivery, CS was mostly avoidable without compromising perinatal outcome.

Another study showed that the frequency of Saudi breech deliveries was 2.8%, with 82% being delivered by CS; 94.4% of the latter were primiparas [43]. Possibly the decision was left to individual obstetricians. Ensuring the standard practice of “grand rounds”, audits and discharge clinics will ensure teamwork and appropriate decisions.

In a study in Sudan of vaginal delivery versus operative delivery involving 76 primigravidas with singleton breech presentations, the CS rate was 71%, 36.8% being emergency operations [11]. In another study with 83 term breech deliveries, 65.1% were multigravidas [11]. The overall CS rate was 44.6% (65.5% in primigravidas, 33.3% in multigravidas). It was concluded that vaginal delivery for selected term breech cases was safe. Routine CS is not justified even in primigravidas.

Twin pregnancy

CS is of no advantage in the majority of cases of twin pregnancy, particularly if both

are presenting by the vertex [44,45]. A Saudi study gave a CS rate for twins of 32.2% compared with 3.6% for single babies [46].

In Sudan, at Omdurman Maternity Hospital in October 2000, the total deliveries were 11 218 with 2082 CSs and the CS rate for twin with complications was 5% [11]. Primary CS was recommended for twins if the first one is transverse. Even when the first one is in the breech position, its size is usually reasonable and delivery can be spontaneous. The after-coming head needs to be protected by forceps as well as in vertex presentations.

Prolonged pregnancy

For an uncomplicated prolonged pregnancy the CS rate in Sudan was 7.9% for the study (126 cases) and 15.8% for controls (256 cases) [11]. For Jordan, comparing the CS rates for postdate pregnancies, with induced or spontaneous labour, the overall CS rate was 9.4% with no statistically significant difference. The assisted vaginal delivery rate was 7%, higher for the induced group, but not statistically significant. Induction of labour was justified in the interest of the baby [47].

Preterm births

A study of the perinatal mortality rate of preterm births born by CS in Jeddah, Saudi Arabia in 1988 showed the preterm birth rate was 9.3%. The perinatal mortality rate was 40.8/1000, with 14.2% delivered by CS [48].

In a tertiary hospital in Saudi Arabia, the survival of babies < 1000 g in weight was 71.4% for CS births compared with 46.7% born vaginally. Accordingly CS improved the survival chances of babies between 500–1499 g. CS was recommended for breech babies with weight < 1500 g if the neonatal technology was available. For

multiple pregnancies, elective CS is indicated for preterm babies or the first breech twin [49].

In Sudan the pre-term CS rate was 11.6% for cases and 13.0% for controls, while it was 41% in the university hospital [11]. The university hospital CS rates for preterm babies could be influenced by research considerations.

Previous CS

The old dictum “once a CS always a CS” has been invalid since the 1980s. Indeed in one study 70%–80% of women with previous CS proceeded to have a successful vaginal birth [50].

In Jordan a study of antenatal computed tomography to assess the pelvis showed that it was of limited value for 100 cases and 119 controls of women with previous CS. The success rate was 49.0% for cases and 78.2% for controls [51]. In the UK in 1999, the repeat CS rate was 54% [52]. In Colombo, Sri Lanka, 63.2% of cases of “trial of scar” (attempted vaginal delivery after previous CS) succeeded [53]. In contrast, in Australia, only 25.3% had successful VBAC [53]. The incidence of scar dehiscence was 3.7% in Colombo, only 0.3% in Australia. The specialists participated in the decision on CS in 37.5% of cases only [53]. With high CS rates after previous CS, the cost and mother’s obstetric future need to be considered as well.

In developed countries the main reason for increasing CS rates is repeat CS. One study showed that this was responsible for 40% of all CS, a 68% increase between 1979 and 1982 [54]. However, more than one previous CS is believed not to contraindicate a subsequent vaginal birth without risk [55]. In 1989 the CS rate in the United States of America (USA) was 23.8%, 81.5% were repeat CS, vaginal births being 18.5% [56]. Around 25% insisted on having or

were keen to have CS. The high CS rates in the USA are possibly the result of litigation or financial gain; repeat CS is the commonest indication for CS.

In Jordan, a 75% success rate of VBAC was achieved, compared with 50% in Europe and 25% in the USA [57]. Repeat CS decreased in Jordan from 1991 to 1999, the latest rate being 19% [24]. During 1989–93 the rate of successful vaginal delivery after 1 or 2 CSs among 310 Saudi hospital deliveries was 62.6%, demonstrating that in the absence of contraindications, a “trial of scar” could be safely allowed [58].

A Saudi study conducted during 1990–98 concluded that the rate of CS after previous CS could be reduced [59]. In 2578 cases of previous CS out of 61 060 births, 37.5% of them had a repeat CS. The VBAC group included 1% assisted breech deliveries. A total of 15 patients with previous scars suffered from a ruptured uterus, but with no adverse outcome; hysterectomy was not required. The ratio of ruptured uterus in women with previous trial of scar was 1:172. The occurrence of ruptured uterus in VBAC indicates substandard care. Involvement of senior staff in deciding on CS and judicious use of oxytocin for managing dystocia have been emphasized [59,60]. A previous study done in the same Saudi hospital during 1979–85 reported 13 cases of ruptured uterus, 8 of which had a previous CS scar and 3 were induced by prostaglandin E₂. Two of the 5 cases with intact uteri were similarly induced. There were 5 perinatal deaths and 1 maternal death [60]. The ratio of ruptured uterus in women with previous trial of scar were not compared for these studies, however.

Table 4 summarizes the results of 3 data sets of emergency postpartum hysterectomies (EPPHs) from 2 Saudi hospitals and 1 Canadian centre. It shows the CS and EPPH rates and the proportions of CSs out

of EPPHs and maternal deaths. The Taif hospital's CS rate increased from 8%–10% in 1990 to 15.1% in 1998. Reducing it would probably avoid CS hysterectomy. Atonia, ruptured uterus and placenta accreta were the commonest indications for hysterectomy, but with varying order [61–63]. Although hysterectomy was the usual practice, repair of the uterus was followed by pregnancy in Saudi Arabia [64].

Scar dehiscence is rare, mostly asymptomatic and without complications. Vaginal delivery is considered the safest route in most of these patients. However, in Bahrain the CS scar was the commonest cause of uterine rupture, rupture of the intact uterus being more serious. The overall CS rate was 7.6% over 2 decades, 5.9% and 9.95% respectively for the 1st and 2nd decades [65]. The study suggested that a postdelivery check on the previous scar per vaginam is necessary, especially in cases of unexplained bleeding.

A 5-year study in Yemen reported a 1.1% incidence of uterine rupture (60/5547 births); 28.3% were after a previous CS,

14.0% were caused by oxytocin, 2.3% by misoprostol [66]. Hysterectomy was done for 55% of cases, while 3.3% had vesicovaginal fistulae. Contributory factors included no prenatal care (93.3%), obstructed labour (95.0%) and grand multiparity (69.8%). Indiscriminate use of oxytocin by midwives at home and injudicious use of both oxytocin and misoprostol at hospital level were incriminated. Family planning was stressed as a preventive measure.

A report of 2 studies on uterine rupture from Sudan and Yemen showed that 33.9% of women from Yemen and 35.5% from Sudan had a previous CS scar [11]. In Sudan, 70.6% were less than 35 years old and 61.8% were of low parity, had no antenatal care and/or had prolonged labour at home. In Sudan the rate of vaginal birth after primary CS was 80.8% and the uterine rupture rate was 1.9% [11]. Those with non-recurrent indications were 85.0% compared with 66.6% with recurrent indications. Although no mothers died, this was still an unfortunate situation as the women's obstetric future has been jeopardized. In Sudan, repeat

Table 4 Postpartum hysterectomies from 2 Saudi centres and 1 Canadian centre

Variable	Jeddah, Saudi Arabia 1990–97	Taif, Saudi Arabia 1990–98	Canada 1983–93
No. of deliveries	18 842	74 200	59 839
No. (%) of CS	2 449 (13.0)	1130 (15.1)	10 472 (17.5)
No. (%) of EPPH	23 (0.12)	25 (0.03)	25 (0.04)
No. of CS/EPPH (%)	8/23 (75)	13/25 (52)	19/25 (76)
No. of deaths/EPPH	1/23	2/25	Nil
<i>Indications for hysterectomy (%)</i>			
Atonia	43.5	24.0	24.0
Uterine rupture	30.4	40.0	28.0
Placenta accreta	26.1	36.0	36.0

References: [61–63].

CS = caesarean section; EPPH = emergency postpartum hysterectomy.

CS up to 4 times was as safe as 2 or 3 times when performed under appropriate conditions; 13% of induced labours ended in CS at Omdurman Maternity Hospital [11]. Prostaglandins were necessary, at least for cases with low Bishop scores, although this is a dangerous practice. Globally, the risk of uterine rupture with vaginal births after CS is given as 1:200 (0.22% overall and 0.18% in developed countries) [55]. From Sudan too, out of 207 cases of obstructed labour, the incidence of uterine rupture was 2.9% [67]. Fifty cases of vesicovaginal fistula were reported from a vesicovaginal fistula centre in Sudan. Obstructed labour caused 28% of the latter, forceps delivery 14%, CS 16% and hysterectomy 24%. At least 54% were a result of poor medical competencies, requiring retraining, audit and supervision of medical staff [68].

Sexually transmitted infections

HIV/AIDS and sexually transmitted infections are indications for CS. A European case-control study showed that CS significantly lowers the risk of mother-to-child-transmission (MTCT) of HIV without increasing the risk to the mother [69]. As to active herpes, however, the RCOG advises that the risks to the baby are slight and are to be weighed against the mother's risk of CS. Even recurrent herpes infection is not an indication for CS [70]. Vertical transmission of hepatitis C (HVC) is more common with forceps delivery, greater in the presence of simultaneous HIV infection. The role of CS in reducing MTCT of HCV and breastfeeding increasing it are confirmed [71]. In Saudi Arabia the MTCT is 5%, and 0.5% of screened pregnant women tested positive for HIV [72]. The Sudan HIV/AIDS prevalence in pregnancy assessed by a serological survey was 1% [73]. Seropositivity for HIV at a teaching hospital antenatal clinic was 0.4% [11].

Maternal mortality rates after CS

In general, although CS has a mortality rate < 1%, in many developing countries maternal mortality is 10–20 times greater with CS than with normal births [74]. The increased risk of CS mortality exists even with elective CS, with no pathology. Maternal mortality ratios of 500/100 000 live births are generally associated with CS rates of 5% or less, but low maternal mortality ratios can coexist with a wide range of CS rates, possibly associated with high levels of normal vaginal delivery. Thus the CS rate is not a good indicator of the quality of obstetric care.

In Egypt in 1989, CS was the 4th direct cause of maternal mortality at 10%. Overall 6.2% of maternal deaths were associated with CS [75]. In Libya, out of 14 maternal deaths 6 followed from CS; 3 of the deceased had previous CS, 1 had 2 previous CS, complicated by placenta praevia. The overall maternal mortality ratio in Libya was 17.5/100 000 live births [76].

Previous CS and placenta praevia are a particularly dangerous combination. Abdominal delivery significantly increases the risk of subsequent placenta praevia [77]. In 1988–91 the incidence of major placenta praevia in a Saudi hospital was 0.73% (96/13032), all delivered by CS [78]. In Oman, the incidence of placenta praevia was 0.6% compared with the usual figure of 0.5%; 72.2% were of major degree [33]. The Jeddah study proposed that data from “near-miss” cases was a measure of progress in maternity care, with maternal mortality becoming so rare [62]. Obstetric risks such as placenta praevia constitute a small percentage of pregnancy risks, but can have catastrophic outcomes (Pareto effect).

Poor anaesthetic practice in CS, for example due to empty gas cylinders or

incorrect intubation practice, is a cause of dramatic maternal deaths. Epidural anaesthesia increases CS rates, as the mother is unable to push, but can be a significant factor in successful VBAC [79].

A Saudi hospital study estimated the CS rate at 8.1% and maternal mortality ratio at 17.6/100 000 live births [80], similar to Libya [76]; it is almost equal to that of the Sudan survey [11]. CS contributed to 37% of deaths (29/79), 82% of deaths after emergency CS, 18% after elective CS, but not all were attributable to the CS. Thromboembolism caused 17% of maternal deaths, 7% from amniotic fluid embolism. Haemorrhage caused 27% and problems with anaesthesia just 1%. Emergency obstetric care, basic or essential, needs strengthening. Maternal mortality after an elective CS should not occur.

The elective CS rate in Sudan is 44.3%, the emergency rate is 55.7%. The frequency of elective versus emergency CS (1168 cases) was higher at university than other teaching hospitals. Maternal deaths following CS were 4 out of 1168 CSs. At the maternity hospital, maternal mortality was given as 8% of 1078 primary CSs [11]. In the same maternity hospital, 381/2032 CSs were primary CSs, total deliveries being 11 218. Six maternal deaths occurred, after emergency CSs. In Sudan the main causes of post-CS mortality were infection, incorrect intubation and eclampsia. Post-CS antibiotics are routine, except at the university hospital. Anaesthesia is given by medical assistants, except at the university hospital, where it is given by anaesthetic registrars. Consultants anaesthetize just 7% of obstetric patients. Spinal anaesthesia is increasingly used. Epidural anaesthesia is being introduced at the university hospital [11]. Anaesthetic accidents, the result of incorrect intubation or the oxygen cylinders being empty, are cases of sheer negligence.

Infection is the commonest cause of morbidity after CS, with rates of 13%–65%, and are a major cause of mortality [11]. The reduction of endometritis by two-thirds and wound infection by three-quarters justifies giving prophylactic antibiotics for non-elective CSs [81]. From Saudi Arabia the incidence of post-CS infection is reported to be 4.5% [82]. For Jordan it is 8.1%, mainly caused by *Staphylococcus aureus*. Prophylactic antibiotics reduce post-CS infections and costs [83]. No significant difference was found on using a specific antibiotic for elective CS and nonelective ones; the most effective antibiotic has to be decided [84]. Recently nonclosure of the visceral or parietal peritoneum, or both, reduced operation time, postoperative morbidity and use of analgesics [85]. Infection may be caused by *Clostridium tetani* or an anaerobic organism with septicaemia that can be fatal. In Sudan in 1999, coverage of pregnant women with tetanus toxoid was only 52% [86].

Elective CS, ethical and legal issues

In the UK the rise and variability in CS rates generated a public debate about audit of CS rates and quality of care. Rates are as low as 13%–15% and as high as 25%–30% in different hospitals in the UK. Of women allowed VBAC, 70% usually succeed in a vaginal delivery [87]. Apart from the medical determinants, the health providers themselves may contribute to the increase in CS rates. In London, 31% of female obstetricians and 8% of male ones would choose elective CS for a normal term pregnancy [88]. In the USA, 50% and up to two-thirds of obstetricians in Florida are females. Older obstetricians in the USA, mostly males, are leaving the profession because of increasing litigation. Legal claims

against obstetricians for negligence, for example, are increasing, possibly encouraged by lawyers. In the USA, the average number of claims per 100 physicians tripled between 1980 and 1985. More than 70% of the obstetricians have been sued at least once [89]. The rise in malpractice claims has been accompanied by a 2300% increase in the number of awards over \$US 1 million. Insurance companies levy higher premiums on obstetricians than other doctors [89].

The Royal College of Midwives has found that CS births are highest among minority groups and older women, and argue that CSs are unwanted, unnecessary and a financial drain on the health care system. More than 10% of women in the UK felt that the decision about their mode of delivery was entirely theirs and 50% of them would opt for a CS [90,91].

A study in the UK showed that high percentages of women favoured CS for relatively minor indications to avoid urinary and sexual problems after vaginal delivery [92]. Operative vaginal delivery especially can cause perineal tears of varying severity and, if not repaired properly, may cause immediate or late incontinence of faeces and flatus.

The nurse midwife's role in achieving a lower CS rate was reported from Jordan [24,25]. In developed countries, where delivery by qualified midwives predominates, CS rates are generally lower [93]. In the USA, the birth assistant, called the doula, lends professional support during childbirth, but has no clinical tasks. Doulas have been shown to reduce the CS rate in the USA by 10%, presumably by reassuring and achieving relaxation of mothers, whereas epidural anaesthesia is associated with increased CS rates due to immobilization and failure to push in the second stage [94,95]. In Sudan, village midwives assist home births, which

are around 86% of all births, in addition to shouldering environmental, social and child health tasks.

Without informed consent, especially when a tubal tie is needed, and without proper preparation, CS can lead to serious psychological morbidity of the delivered woman [96,97]. In Saudi Arabia the felt needs of delivered women are not met by professional caregivers—CS was described as an unpleasant experience—and may be followed by severe psychological problems [98]. In Australia, although more than 80% of women having elective CS, and 50% of those having emergency CS, reported involvement in the decision, 20%–50% of those delivered by CS were not completely satisfied. More information before CS might contribute to reducing the rate [99].

CS on request or by court order in the baby's interest is raising ethical and professional questions about whether obstetricians should respond passively to patients' demands. If a CS is refused, the physician may be at-risk of being sued, but not if it is done unnecessarily early for fear of litigation, when a spontaneous delivery is expected, or waiting too long to avoid doing the CS for at-risk cases.

Educating health workers and creating regional tertiary centres for managing perinatal problems in cases referred from inadequately equipped hospitals are good interventions. Over-medicalization and commercialization lead to increasing malpractice suits and a tendency towards defensive obstetrics [1]. The flourishing private care even at government institutions, or the widespread introduction of health insurance schemes, encourages CS births.

The occurrence of cerebral palsy after delivery is a problem for the family and the obstetrician, despite the widespread use of electronic fetal monitoring and rising CS rates [100]. It is not the result of birth

trauma, and probably occurs during pregnancy or after delivery. Intrapartum events account for no more than 10% of cases of cerebral palsy [101,102]. In the US the interests of a viable fetus can be legally preserved in cases of conflicting maternal–fetal interests. In the UK, however, a woman has no legal choice to have CS, while the fetus has no legal status on CS [103]. For developing countries congenital anomalies are considered priority problems.

In the UK there is concern about rising CS rates and there are questions about whether balanced information is provided to women. Although only 1% of elective CSs are actually performed solely on maternal request, rising CS rates make women less confident in their ability to have a spontaneous birth. Maternal mortality has been given as 6 times greater for CS than for spontaneous vaginal delivery, being 3 times greater for elective and 9 times for emergency CS. The increased costs as a result of rising CS rates are also a concern for a publicly-funded national health service.

In both Sudan and Saudi Arabia, health insurance has been introduced, but it may have the effect of increasing CS rates. Cost-recovery in Sudan is almost universal, particularly for surgical operations. The poor and disadvantaged groups are particularly harmed by such policies.

Quality control and audit

Positive action can control rising CS rates. The RCOG advocates development of evidence-based rather than opinion-based guidelines, and ensuring their implementation through evaluation processes [104].

Quality control, audit and clinical governance are means of sustaining excellence. Leadership and peer-led efforts in the United States have succeeded in reducing CS from 40% to 21.2% in 5 years by setting

targets, implementation and conducting 5 evaluations [79]. A study in 5 Latin American countries involving 23 hospitals and 149 206 deliveries hypothesized whether a mandatory second opinion before every non-emergency CS could reduce their number. Second opinions, however, tended to confirm the first opinion [105].

Demographic and Health Survey data from 6 developing countries showed higher CS rates than hospital data suggest [106]. The CS rates of Saudi Arabia are not comparable to those of Sudan, as 91.4% of Saudi births are hospital-based compared with 14% in Sudan. In Saudi Arabia, hospital and community maternal mortality rates are similar, 11.5% and 8.1%, while for Sudan the discrepancy is greater 18% and 2% respectively, as only at-risk cases deliver in hospital (14%).

The RCOG classified the urgency of CS into 4 grades: emergency, urgent, scheduled and elective to be adopted, considering legal aspects [103]. The RCOG emergency classification can be utilized by developing countries. Complete and accurate CS reports are to be compiled regularly.

Conclusion

CS rates are still increasing worldwide, but are levelling off in a few countries. A proportion of CSs may be unnecessary or unwanted. Maternal mortality can be 10 times greater after CS than vaginal delivery in developing countries, while in developed countries it is 2–4 times. Accordingly, international concern has been aroused. Unfortunately, data sources are exclusively hospital-based and not routinely reported. CS rates in developed countries reached 23%–24% while for some EMR countries rates are mostly around 10%, although the data are mostly from Saudi Arabia, Sudan and Jordan.

The determinants of rising CS rates are obstetric, medical, professional and individual-related. The main obstetric determinants are less use of operative vaginal delivery and VBAC, breech presentation, twins and preterm delivery. Vaginal delivery is now encouraged for these, in the absence other contraindications, but quality of care is required. The baby is no longer sacrificed for the sake of its mother, but a mother still decides on behalf of her baby. Dystocia and fetal distress are common manageable reasons for unnecessary CSs. Medical indications include communicable diseases such as AIDS. Professional reasons for greater use of CS include financial gain and/or fear of litigation. Decision-making about birth at the level of the individual woman is a right.

In summary, poor safe motherhood programmes, because of lack of access, improper referral, or reluctance to accept referrals by patients and relatives or lack of means of transportation, all lead to delays in doing CSs, leading to increased mortality and morbidity. Midwives may use oxytocin at home, causing ruptured uterus and death. Intrapartum fetal heart tracing is recognized to increase CS rates unnecessarily, as tracings may be subject to legal scrutiny. Very

low CS rates signify substandard care or negligence or unavailability of physicians. In Africa nurses are trained to undertake CSs instead [107]. Improper handling of deliveries, too frequent vaginal examinations, lack of hygiene and prolonged labour, all lead to endometritis.

To reduce increasing CS rates, operative vaginal delivery has been suggested, although this too is not without risk [108]. The RCOG considers the vacuum extractor the instrument of choice [52]. A low forceps for a vertex or breech presentation, properly applied, protects the fetal head, especially for preterm babies.

The leadership role of senior staff, peer-led efforts, regulating private care, effective guidelines, problem-solving strategies and a team approach are important strategies to pursue. Peer-reviewed journals, including electronic ones, provide evidence-based information for quality care [109]. The consent of wife and husband, though more controversial in developing country situations, is essential, especially for elective operations. More research on CS is needed, for example, on the need for a second opinion and on the benefits of reducing or increasing CS rates.

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