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Review

The role of caesarean section in modern Obstetrics

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Abstract

Caesarean section (CS) is a safe obstetric surgical procedure that contributes to reducing maternal and perinatal mortality and morbidity. Nevertheless, its advantages do not justify its continuous increase. During the last few years an average of 35% of deliveries have occurred by CS in Italy whereas an average of 20-25% is very common in other western countries. Although these percentages are very different, an important issue of modern obstetric Medicine is to ascertain whether the threshold of 15% proposed by the WHO in 1985 is actually adequate. Different medical, cultural, social, economic and medico-legal issues are of concern in the different countries and in contemporary society compared with the past. If we wish to discuss whether a new threshold should be proposed to reach the best balance between risks and benefits of CS in modern Obstetrics, it is mandatory to evaluate the reasons why these high percentages of CS occur in western countries and, in particular, in Italy. To reach this goal an optimal management of the delivery room should be pursued by implementing an organizational program, considering the objective delivery trend (Robson's ten group classification) and organizing continuous audit processes. The potential concern for the medico-legal issue, women's choice and the use of analgesia in childbirth must be taken into account.

Keywords

Caesarean section, ten group classification, audit, defensive Medicine.

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Historical notes

Since ancient times, there are stories in both Western and non-Western cultures about caesarean section (CS). In Greek mythology, Apollo removed Asculaepius, the founder of the cult of religious Medicine, from his mother's abdomen [1, 2].

The origin of the term "caesarean" is falsely attributed to Julius Caesar, who was thought to have been born with this modality in 104 BC. It is likely, however, that the first attempts at this procedure were subsequent to the Lex Regia of 715 BC. At that time, the operation was performed only when the mother was dead or dying, as an attempt to save the child.

Only in 1582, did François Rousset realize that CS could save the life of the mother. For this reason, he was acknowledged as the father of the CS [3, 4].

Most of the earliest successful CS's took place in rural areas without the help of medical staff. This was probably an advantage until the late nineteenth century. Surgery in hospitals was afflicted by infections passed between patients, often through the hands of medical staff.

The mode of delivery, virtually unchanged in living memory, started to change by the late 1800s. Even midwives were partially supplanted by the figure of doctor. More access to human cadavers and improvement in medical education allowed medical students to learn human anatomy by dissection training. This practical experience improved their understanding and prepared them to perform surgical procedures [5]. Most rural births continued to be attended by midwives in the late nineteenth and early twentieth centuries, but in the cities a large number of working class women usually delivered in hospitals because they could not rely on the support of the family living in the countryside. It was in these hospitals that new obstetrical and surgical skills began to be developed [6-12].

However, in the subsequent years CS was still rare. In 1937, at Boston City Hospital, the percentage of CS in 10 years of activity appeared to be 3.7% of all births [13].

Reduction of maternal and neonatal mortality and morbidity

As recently reaffirmed, "maternal mortality remains a major challenge to health systems worldwide" [14].

During the 20th century the discovery of antibiotics, improvements in anesthetic techniques and surgical procedures made CS safer than before. Moreover, technologies improved dramatically, thus allowing better management in obstetrical and perinatal care.

The determination of the balance between maternal and fetal risks for CS is difficult, mostly depending on fetal or maternal indications for CS. In 1937, the maternal mortality after cesarean delivery was 6%. Recently, maternal mortality after CS was estimated at about 0.006% (6/100,000) [15] of the overall maternal mortality rate (11/100,000), evaluated in Great Britain in the triennium 2006-2008 [16].

Perinatal mortality (stillbirths and deaths in less than a week of life per 1,000 live births) has also decreased in the last decades.

In Italy it dropped from 31.2 in 1970 to 8.1 per thousand live births in 1995, representing one of the most significant improvements in western Europe during the same period, even if still with differences in different areas of the country (it being higher in the center-south).

The risk associated with CS has progressively decreased, becoming easier for obstetricians and more acceptable for patients, the choice of surgical delivery even in situations in which the potential benefit did not imply life threatening risks. Nowadays, CS is a safe surgical technique with absolute benefits in selected circumstances for the fetus consisting of a reduced risk of trauma, hypoxic encephalopathy from meconium aspiration and cerebral damage for prolonged hypoxic status. CS also reduces the risks of operative vaginal delivery for the mother, mainly dependent on damage to the pelvic floor. On the other hand, CS presents potential risks and disadvantages, such as reduction in future reproductive capacity due to the major risk of placenta previa, placenta accreta and uterine rupture in the subsequent pregnancies in addition to the well-known post-surgical complications such as infections, hemorrhage and thrombotic events. Concerns have also arisen about short- and long-term effects for the neonate born by CS (particularly elective CS before the onset of labour). Short term differences between babies born by vaginal delivery and CS include impaired lung function, reduced thermogenic response of the newborn, altered metabolism, feeding and low blood pressure. It has recently been suggested that these phenomena may determine long-term consequences on health, probably mediated by changes in the immune system, metabolism and function of the central nervous system. Thus, the mode of delivery may be involved in programming adult health and disease [15].

Excessive increase in caesarean section rates in the modern era and its possible explanation

In 2007, Ecker and Frigoletto [16] analyzed data on total CS in the United States in the period from 1989 to 2005, showing increased rates from 22% in 1989 up to 30% in 2005. Over the last few years, the CS rate in the United States has reached 34% of single live deliveries [17]. A 2011 study found that half of the increase in CS was related to women who had undergone a previous CS [18].

In Europe, the trend showed a similar increase in CS, but with substantial differences in the various countries. In Italy, the use of CS rose from 11% in 1980 and 20% in 1990 to 38% in 2008 [19-21]. Italy has the highest rate of CS followed by Portugal with 33% [22]. Furthermore, in Italy the incidence varies from region to region with noteworthy differences between northern and southern areas, and also between public and private hospitals [23]. The rates tend to be lower in the northern regions than in the south, ranging from 23% in the Autonomous Province of Trento and Friuli-Venezia Giulia to 62% in Campania [24]. In 2010 the Society of Obstetrics and Gynecology of Lombardy (SLOG) showed a large variation in CS rates, ranging from 12% to 43% in different delivery settings with more than 2,000 deliveries/year. Higher rates were recorded in private hospitals with less than 1,000 deliveries/year. In our region, Sardinia, the percentage of CS was about 37.4% in 2007 and 38% in 2008, similar to the national trend.

In 1985 the World Health Organization (WHO) indicated the value of 15% as the ideal threshold of CS for maximum overall benefit for the mother and fetus [25].

As the CS rate in Italy is more than double this figure, starting from 1999 the Ministry of Health has promoted recommendations to reduce CS [24, 26].

However, in western countries the most important issue is that adverse outcomes are not accepted at all. In addition, no limits have been proposed for the cost of medical-legal conflicts in Italy where handicaps of the newborn, like those due to other accidents, are not cared for by the community. This contributes to increasing the gynecologist's fear of malpractice claims. The possibility that insurance companies and doctors may be charged with the costs of the handicap found in babies, even if the cause is not due to malpractice, is real. More than 90% of legal proceedings against obstetricians have assigned responsibility to them because they performed CS with delay.

Although many CS's are necessary to avoid a single neonatal adverse event, this mode of delivery often represents the lowest degree of risk that we can commonly consider acceptable [16].

Years of experience with operative vaginal deliveries associated with an increased risk of fetal damage and perineal trauma have led gynecologists to a greater willingness to choose CS instead of operative vaginal delivery [16].

Moreover, pregnancies and pregnant women are very different from the past and from developing countries: they are heavier (with higher risks related to obesity) and older thus with an increased risk of chronic disease preexistent to pregnancy and or pregnancy-related diseases such as gestational diabetes, hypertension, thyroid diseases and others.

The widespread use of electronic fetal heart monitoring also plays an important role in the increasing rate of CS for non reassuring fetal heart rate patterns "even though it has not yet been proved that it may reduce the rate of cerebral palsy" [27].

Despite the development in technologies and neonatal care, preterm birth still represents a major problem of mortality and morbidity. It is often related to the increasing number of twin pregnancies (121,246 in 2001 vs. 68,339 in 1980) [15], mainly due to the use of assisted reproductive technologies. CS has been considered for a long time the safest delivery route in preterm infants. Recent trials state that for vertex presentations mortality rates with spontaneous delivery are quite similar to elective CS [25].

In such a context, we cannot exclude planned CS for convenience (both of the mother and the practitioner) and to reduce medical-legal litigation. The increase in the CS rate enhances the number of CS's in subsequent pregnancies and the risks of vaginal deliveries [29].

In Italy, defensive Medicine plays an important role as one of the major causes of the increase in elective CS without medical or obstetric indications or on maternal request [30-33].

Current situation in Italy

Despite the claimed "protective power" offered by cesarean delivery by the supporters of defensive Medicine, the constantly increasing rate of CS appears to correspond neither to greater safety for the mother and the newborn nor to a reduction in the most feared intrapartum complication such as neonatal encephalopathy [24].

The Italian Project Aim Mother and Child (National Health Plan 1998-2000) emphasizes the concept of maternal and child health protection by choosing to promote vaginal delivery as a strategic undertaking of Italian socio-sanitary systems. This is a mirror of quality care for national health in the present and future population. Among the goals to be pursued the project refers to "ensuring care processes aimed at increasing humanization of the birth event, combining the ability to protect the safety of both mother and unborn child and respect for what women desire in this sensitive stage of their life cycle". One of the main goals of this project is to reduce the CS rate. This concept was confirmed and expanded with the 2002-2004 National Health Plan which defined the objectives to be achieved over the next three years: "to decrease the number of caesarean sections and reduce the currently existing high regional differences, within the three coming years, to a single national value of 20%, in line with the average of other European countries". This goal has not yet been reached and was strongly reaffirmed in the latest National Health Plan with recommendations and guidelines to reduce CS.

No action is obviously yet possible if the appropriate organizational and cultural conditions do not exist. The challenge of reaching the "ideal" threshold of CS rate should be pursued as a result of the identification of management and organizational models to ensure the uniformity of professional activity. Appropriateness of care, leading to clinical excellence based on medical evidence, in accordance with criteria of safety, efficiency, effectiveness and involvement of women in such a crucial event for their life are the key points of this process. As emphasized by Clark in 2008 [34], implementation of organizational programs improves patient outcomes, with a dramatic decline in litigation claims and reduction of the primary caesarean rate.

Proposals for appropriate use of caesarean sections in modern Obstetrics

As the first step in breaking down the apparently uncontrollable continuous increase in CS deliveries, Robson's CS classification [35, 36] could be indicated as a reference point to obtain useful clear information to better understand this phenomenon and to plan actions.

The aforementioned classification of CS (in ten groups, "all prospective, mutually exclusive, totally inclusive, easily identifiable and clinically relevant") [35, 36] allows the comparison of the CS rate at different times and/or between different delivery centers and the identification of any critical issue in the context of a process of clinical audit in the delivery room.

In collaboration with the Epidemiological Centre of the Sardinian Region, data were extracted from certificates of birth attendance (CedAP) starting from 2008. A high variability in the rate of CS in Sardinia from 19.8% to 61% was shown with higher peaks in the private hospitals. The average CS rate is about 38.6%, quite similar to the national average. Data for each group are shown in **Tab. 1**.

From this preliminary work, we conclude that:

- the largest number of CS's was performed in the first three groups;
- evaluating these three groups, rates of CS are extremely high in Sardinia;
- previous CS (Group 5) largely contribute to the number of CS's performed and they represent one of the most common indications to perform CS. This is a serious concern because it is inevitably destined to increase.

Starting from these considerations, we promoted an organizational model with the implementation of specific care pathways to improve appropriateness of assistance at birth based on basic principles similar to those proposed by Clark [37]:

1. uniformity of processes and procedures;
2. implementation of clear guidelines;
3. improved awareness and autonomy of each operator of the obstetric team;
4. continuous audit and peer review process;
5. CS evaluated as a possible option, not as an outcome or quality endpoint.

Moreover, to reduce the request for CS by women primarily due to fear of childbirth, we offer, even during pregnancy, standardized and validated information and support (such as one-to-one assistance, supplies for labor-pain control, including pharmacological and non-pharmacological methods), able to reassure the mother and to support her in decision-making [24, 32, 33].

Work is in progress to consider indications for CS and to analyze cultural, social and organizational obstacles contributing to the increase in the CS rate. A continuous process of collecting and evaluating quality of data is in progress to reach the gold standard for optimal management of the delivery room.

We believe that reduction of the CS rate, even if related to defensive Medicine, may be one consequence of this process [37].

Table 1. Classification in ten groups of caesarean sections. Sardinia – 2008. Overall CS rate: 38.6%.

Groups		Number of CS over total number of women in each group	Relative size of groups (%)	CS rate in each group (%)	Contribution made by each group to the overall CS rate (%)
1.	Nulliparous, single cephalic, ≥ 37 weeks in spontaneous labor	834/3,953	**31.6%** (3,953/12,513)	**21.1%** (834/3,953)	**6.7%** (834/12,513)
2.	Nulliparous, single cephalic, ≥ 37 weeks induced or CS before labor	1,138/1,827	**14.6%** (1,827/12,513)	**62.3%** (1,138/1,827)	**9.1%** (1,138/12,513)
3.	Multiparous (excluding prev. CS) single cephalic, ≥ 37 weeks in spontaneous labor	615/3,489	**27.9%** (3,489/12,513)	**17.6%** (615/3,489)	**4.9%** (615/12,513)
4.	Multiparous (excluding prev. CS) single cephalic, ≥ 37 weeks induced or CS before labor	97/602	**4.8%** (602/12,513)	**16.1%** (97/602)	**0.8%** (97/12,513)
5.	Previous CS, single cephalic ≥ 37 weeks	1,087/1,226	**9.8%** (1,226/12,513)	**88.7%** (1,087/1,226)	**8.7%** (1,087/12,513)
6.	All nulliparous breeches	288/310	**2.5%** (310/12,513)	**92.9%** (288/310)	**2.3%** (288/12,513)
7.	All multiparous breeches (including prev. CS)	153/169	**1.4%** (169/12,513)	**90.5%** (153/169)	**1.2%** (153/12,513)
8.	All multiple pregnancies (including prev. CS)	123/140	**1.1%** (140/12,513)	**87.9%** (123/140)	**1.0%** (123/12,513)
9.	All abnormal lies (including prev. CS)	17/17	**0.1%** (17/12,513)	**100%** (17/17)	**0.1%** (17/12,513)
10.	All single cephalic ≤ 36 weeks (including prev. CS)	480/780	**6.2%** (780/12,513)	**61.5%** (480/780)	**3.8%** (480/12,513)

Conclusions

CS has contributed to reducing maternal and perinatal mortality and morbidity. Nevertheless, these advantages do not justify its continuous increase in western countries. The threshold proposed by the WHO in 1985 needs to be reset in these countries where different medical, cultural, social economic and medico-legal issues are of concern compared with other countries. Rigorous management of pregnancy, improvement in skilled birth attendance and organizational programs represent the gold standard of modern Obstetrics. It appears reasonable to consider the threshold of 20-25% in western countries to reach the best balance between risk and benefits of CS in these contexts.

We completely agree with Robson [35] when he stated: "CS rates should no longer be thought of as being too high or too low, but rather whether they are appropriate or not, after taking into consideration all the relevant information".

In the meanwhile, further efforts and research are needed to gain a better understanding of the consequences related to the mode of delivery both for the mother and the baby.

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Declaration of interest

No conflicts of interest exist.

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