

SPECIAL ARTICLE

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The historical evolution of the cesarean section rate: from an exception in ancient times to a surfeit in present times

La evolución histórica de la tasa de la cesárea: de una excepción en la antigüedad a un exceso en la actualidad

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ABSTRACT

This nonsystematic review of the literature aimed to describe the changes that have occurred in the practice of cesarean section delivery from ancient times until today and to evaluate the consequences of these changes for the woman and for her newborn child. In ancient times, cesarean section was only performed *post mortem* or *perimortem* to preserve the life of the fetus or to separate it from its dead mother. Currently, this method of delivery is widely used not only in accordance with the adequate medical indications, but also to suit the convenience of the pregnant woman and/or her obstetrician. Such conduct, which has led to increasing numbers of elective procedures, may result in negative consequences for the woman and for her baby. This negative impact is contrary to what is expected when cesarean sections are correctly indicated, in which circumstances the procedure plays an important role as a life-saving intervention for the mother and her newborn infant.

Key words: Cesarean section, History, Maternal health, Child health.

RESUMEN

Esta revisión no sistemática de la literatura tuvo como objetivo describir los cambios que se han producido en la práctica del parto por cesárea desde la antigüedad hasta la actualidad y evaluar las consecuencias de estos cambios para la mujer y para su hijo recién nacido. En la antigüedad, el parto por cesárea solo se realizaba *post mortem* o *perimortem* para preservar la vida del feto o para separarlo de su madre muerta. Actualmente, este método de parto es ampliamente utilizado no solo teniendo una indicación médica adecuada, sino también para adaptarse a la comodidad de la mujer embarazada y/o la de su obstetra. Dicha conducta, que ha llevado a un número creciente de procedimientos electivos, puede tener consecuencias negativas para la mujer y para su bebé. Este impacto negativo es contrario a lo esperado cuando la cesárea es indicada correctamente, cuando este procedimiento es un factor importante en salvar la vida de la madre y de su hijo recién nacido.

Palabras clave. Cesárea, Historia, Salud materna, Salud infantil.

INTRODUCTION

According to historical documents, humans have carried out abdominal deliveries since the beginning of the second millennium. There are several descriptions of cesarean deliveries in Greek mythology, including the birth of Dionysius, God of the grape harvest, winemaking and wine, of Aesculapius, the God of medicine, and of Adonis, the god of love and beauty. It is possible, although not necessarily true, that such descriptions refer to practices that were uncommon in those days^(1,2).

The origin of the use of the word *cesarean* to refer to abdominal child-birth appears to be based on the erroneous idea that the Roman emperor Julius Cesar was thus born. This concept is, however, incorrect, since Julius Cesar's mother is known to have lived for many years following the birth of Cesar and in those times no woman would have survived a cesarean section, which was usually carried out *post mortem*⁽¹⁾. Another author has suggested that the word may be derived from the Latin verb *caedere*, meaning to cut. Therefore, the adjective *caesarean* could



be used to mean that the delivery of the infant was achieved by cutting⁽³⁾.

There are references, which may be mythical or folkloric, from diverse ancient societies, of babies who survived a cesarean section despite the death of their mothers⁽²⁾. In those ancient cultures, a cesarean section was performed by order of the king, who demanded separate burials for the baby and the mother. That policy justification relied on legal reasons related to inheritance or for religious reasons that required the baptism of the newborn infant to ensure its eternal life in heaven. According to Boss⁽⁴⁾, the *Lex Regis* of Numa Pompilia (715-672 BC) forbade the burial of a pregnant woman before the young had been excised: "anyone who does otherwise clearly caused the promise of life to perish with the mother". Boss added that such conduct was broadly practiced by the Romans and by the Indians in Vedic times and also by the Jews during the time of the Roman empire⁽⁴⁾.

This practice in ancient times of performing a cesarean section only when the pregnant woman was already dead or dying in order to save the life of the fetus continued until the advent of anesthesia in the second half of the nineteenth century⁽⁵⁾.

Starting around the time of the Renaissance, the purpose of a cesarean section began gradually to veer towards saving the life of both the child and the mother. Much later, during the second half of the nineteenth century, the progress achieved in surgical techniques and the advances made in asepsis, anesthesia and blood transfusion, meant that both the mother and the newborn infant could survive a cesarean section. This improved prognosis with cesarean delivery led to the rapid dissemination of the practice worldwide⁽²⁾.

DEVELOPMENT OF THE TOPIC

Today, at the dawn of the third decade of the twenty-first century, lifestyle changes appear to be playing a role in the increasing number of abdominal deliveries. Giving birth to a first child at a later age, often after 30 years of age, and a greater incidence of obesity and of weight gain during pregnancy are factors that increase both the prevalence of fetal macrosomia and emergency cesarean section rates⁽⁶⁾.

Furthermore, in more recent years, the concern of healthcare professionals is not restricted to the safety and health of the mother and the child, but also involves the mother's wishes and preferences and the child's rights. Women's preference for a cesarean section in a low-risk pregnancy appears to be associated with a fear of vaginal birth that is related to pain and to the safety of the baby⁽⁷⁾. Fear of childbirth often leads to requests for a cesarean section by women who are apprehensive regarding the uncertainties of spontaneous vaginal delivery⁽⁸⁾.

Fear of childbirth can be primary, during a first pregnancy as it reaches term, or secondary, following a traumatic or painful experience during an earlier birth. Primary fear of childbirth can be triggered by other women's traumatic experiences and/or may be related to anxiety disorders⁽⁹⁾.

In a study carried out in Australia, childbirth fear was classified as low, moderate, high and severe, with results showing a prevalence of 18.8% for a high level of fear and 4.8% for a severe level of fear. The proportion of participants with a high level of fear was much greater among nulliparas (24.4%) compared to multiparas (14.2%), as was the proportion of women with a severe level of fear: 6.4% and 3.6%, respectively⁽¹⁰⁾.

A study carried out in Norway found that the most important factors associated with a fear of childbirth were a previous negative birth experience and combined anxiety and depression⁽⁸⁾. Psychological conditions such as these should be respected as a legitimate indication for a cesarean delivery.

All these changes may help explain the increasing rates of cesarean section worldwide. According to Beltran et al., based on data from 150 countries, around one in every five births (18.6%) in 2014 occurred by cesarean section. The highest rates of cesarean section were in Latin America and the Caribbean (40.5%). By performing a trend analysis involving data from 121 countries, Beltran et al. found that the average global rate of cesarean section increased from 6.7% to 19.1% between 1990 and 2014. The largest absolute increases occurred in Latin America and the Caribbean, rising from 22.8% to 42.2% over that timeframe⁽¹¹⁾. Brazil is the country with the highest rate of cesarean sections in the world, with a



rate of 40% to 45% in the public healthcare sector and 80% to 95% in the private sector. Figures vary, however, according to the region/city⁽¹²⁾.

The World Health Organization concluded in 1985 that cesarean section rates of 10% to 15% at population level were associated with decreased neonatal and maternal mortality rates; however, a systematic review performed in 2015 showed that when the rate exceeds 9-16%, there is no correlation with decreased mortality⁽¹³⁾.

The convenience of the obstetrician, however, may also have played a role in the most recent increase in cesarean section rates. For the attending obstetrician, an elective cesarean section, which can be performed on a mutually agreed day and at a mutually agreed time, is far more convenient than spontaneous vaginal delivery, which could occur on any day and at any time of the day or night, hence potentially interfering with the physician's routine personal and professional activities. An elective cesarean section, however, can be scheduled for the day and time that is most convenient without interfering with any other items on the physician's agenda⁽¹⁴⁾.

Notwithstanding, women's spontaneous preference for giving birth by cesarean section may indeed be over-estimated. The Listening to Mothers II survey, for example, found that less than 2% of pregnant women having their first child reported requesting a cesarean section when there was no medical indication for the procedure⁽¹⁵⁾. In a sample of pregnant women in Buenos Aires, Argentina, 8% of women in the public healthcare sector and 6% in the private sector expressed a preference for a cesarean section⁽¹⁶⁾. Likewise, another study found that 9.6% of Norwegian women and 5.0% of Israeli women would have preferred a cesarean section⁽¹⁷⁾.

The tendency to recommend an elective cesarean section to pregnant women may be convenient from a social viewpoint; however, the procedure is associated with increased risks to the health of the newborn infant and to the mother⁽¹⁸⁾. In the case of the newborn, the risk may last into childhood and may even persist into adult life. A number of studies have found that during a vaginal delivery the infant gains gut microbiota that are determinant in the development of his/her immune system^(19,20), with a positive effect on health into adult life⁽²¹⁻²³⁾.

The human body harbors trillions of microbial cells whose coordinated actions are believed to be important for human life⁽²⁴⁾. Microbial colonization of the human gut is believed to be responsible for the concurrent programming of our immune system and the simultaneous development of the intestinal tract and associated metabolism. A continuous dialogue between the microbiota and the host must occur in order to orchestrate these physiological processes⁽²⁵⁾.

In infants born by cesarean section, the establishment of gut microbiota is delayed following birth, i.e. during a critical developmental window for the maturation of the newborn infant's immune system. This delay may favor the subsequent development of inflammatory and metabolic disorders during infancy. The positive effect of an early establishment of the infant gut microbiome on long-term health is therefore lost when the infant is born by cesarean section. Nevertheless, prolonged breastfeeding can partially or completely compensate for this disruption⁽²⁶⁾.

A study carried out in India tends to confirm this effect of breastfeeding. The focus of the study was on assessing short-term infant health, and results showed no statistically significant association between mode of delivery and respiratory or gastrointestinal health problems after adjusting for pre-delivery maternal factors. The authors concluded that in populations practicing universal breastfeeding for six months, the effect of mode of delivery on infant health appears to be less significant⁽²⁷⁾, as breast milk also has immune-boosting properties⁽²⁸⁾.

The longer-term effect was assessed in a large national population-based registry study of 2,672,708 children born in Denmark between January 1973 and March 2016. Of these, 85% were born by vaginal delivery and 15% by cesarean section. Results showed an increased risk of chronic inflammatory diseases such as inflammatory bowel disease, rheumatoid arthritis, celiac disease and diabetes mellitus in girls as well as in boys who were born by cesarean section compared to those born by vaginal delivery. This increased risk persisted for as long as 40 years after birth⁽²⁹⁾.

On the other hand, a register-based, data linkage cohort study conducted with a large sample of 87 500 Swedish sibling pairs studied the associa-



tion between mode of delivery and asthma. The results supported the hypothesis that cesarean section *per se* does not increase the risk of subsequent asthma; however, an explication for this association may lie in the reason why a cesarean section was performed in the first place, including factors related to maternal or child health⁽³⁰⁾.

With reference to maternal risks, a large, retrospective, population-based Canadian cohort study conducted using data registered between 1991 and 2005 found that the overall rate of severe maternal morbidity was 27.3 per 1 000 deliveries for women in the planned cesarean delivery group versus 9.0 in the group of women who had planned to deliver vaginally (adjusted odds ratio 3.1)⁽³¹⁾. Similar results have been found in several other studies in a variety of countries such as China⁽³²⁾, Brazil^(33,34), and the Netherlands⁽³⁵⁾.

If the current rising trend in the number of cesarean sections being performed with no medical indication whatsoever is to be reversed, we need to focus on low-risk primiparas as a means of reducing repeat cesarean sections. A broader discussion on the issue of unnecessary cesarean sections and the consequences of this practice, as well as a better definition of the correct indications for a cesarean delivery, may improve the current situation⁽³⁶⁾.

In conclusion, when correctly indicated, cesarean sections represent a life-saving intervention for the mother and her newborn infant; however, when there is no medical indication whatsoever elective cesarean sections involve a higher risk of health problems, both for the mother and for her newborn infant.

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