

On the history of Caesarean Section

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The caesarean section is one of the most commonly performed surgical operations in the 21st century. Throughout the history of the abdominal delivery method, its various components (indications, surgical techniques, tools and materials, anesthesia, and perioperative support) have undergone significant changes. The positive results of caesarean sections have influenced obstetrical indicators as a whole.

However, a steady tendency towards increasing the frequency of its use indicates an unjustified expansion of the indications for this type of operation, which allows us to view the current situation as a worldwide problem. This is due to the negative effect of unnecessary surgical delivery on the health of mother and child. Changes in the indications for the operation and the techniques for using it have made it possible, on the one hand, to significantly reduce reproductive losses, and on the other hand, to perform the operation without due cause. The immediate and long-term negative consequences for both mothers and children born by caesarean section are presented. To address them, the European Board and College of Obstetrics and Gynaecology suggests developing a strategy for optimizing caesarean delivery based on M. Robson's ten-stage classification, accumulating and comparing the findings and studying those countries where low maternal and neonatal mortality rates are combined with low caesarean delivery rates.

Keywords: *history of medicine, history of obstetrics, abdominal delivery, surgical technique, immediate and long-term results of caesarean section*

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The cesarean section (CS) has become one of the most frequently performed abdominal surgeries. It is one of the oldest obstetrical operations.¹ The first reliable information on the retrieval of a child via an incision in the abdomen dates back to the 7th century BC (during Numa Pompilius' reign, 715–673 BC) [1]. At that time, there was a law according to which it was forbidden to bury a deceased pregnant woman

or a woman who had died in childbirth before a CS was performed in order to save any still living child. In the second millennium AD, such legislation existed in Christian countries in order not to deprive a fetus of the sacrament of baptism if it could be extracted while still alive. [1] In Art. 1742 t. 8 of the Code of Laws of the Russian Empire from 1858 we find: "If a pregnant woman dies suddenly in the second half of her pregnancy, in this case, for the salvation of the fetus and its baptism, a Cesar section must be performed with all the precautions that are observed for the living" (cited in [1, p. 340]).

The term "Cesar" or "Caesar" is derived from the name of Julius Caesar, who was born through

¹ For example, in the mythology of Ancient Egypt, India, China and Greece there are references to the birth of children in an unnatural way.

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a cut in the abdomen while his mother remained alive, as was recounted by Pliny the Elder (23–79). In 1581, the French citizen Rousset and in 1598 Jacques Guillemeau used the term “cesarean section” in their books on midwifery.

In sources on the history of medicine, there is no consensus on the priorities for CS. In the “Fundamentals of the History of Medicine” by H. Haeser, published in 1890, the first CS case involves a woman sentenced to death in 1350. However, most obstetricians recognize Dr. Jeremias Trautmann as the first in this field. In 1610, he performed a CS on a cooper’s wife, who had suffered a penetrating stomach injury at the end of her pregnancy. The fetus was removed alive, but the mother died on the 24th day after the operation. As the autopsy showed, the cause of death probably was not associated with the damage to the uterus. Such an outcome was unexpected, because until the middle of the 19th century, the death rate of parturient women after CS was 100 percent. Despite such results, there were supporters of its use in cases where delivery was impossible via the natural birth canal. Among them was Jean Le Baudelocque, who, despite the unsuccessful outcomes, continued to develop this operation, understanding its future prospects [1].

In Russia, the first CS was performed in 1756 by Iohann Friedrich Erasmus in Pernov with a favourable outcome, the second was in 1796 by K.B. Sommers in Riga, and the third was by V.M. Richter in 1842 in Moscow. Unfortunately, the circumstances under which these operations were performed are unknown. In America, the very first publication on a successful CS operation refers to 1827 when it was carried out by Dr. John Lambert Richmond in Newton, Ohio. The diagnostic reason for the operation was eclampsia during childbirth. The patient survived and recovered [2].

The increase in the number of operations on pregnant and parturient women began in the mid-19th century, thanks to the introduction of aseptic and antiseptic principles and the emergence of ethereal anesthesia. According to Professor A.Ya. Krassovsky, founder of the St. Petersburg Scientific School of Obstetricians and Gynecologists, from 1756 to 1881, 12 operations were performed (according to other sources – 21) in Russia, only four women recovered [3], and by the end of the 1920s, i.e., in 40 years’ time,

their number had already exceeded 1 percent of all births. Thanks to the improvement of anesthesia and the advent of the antibiotics era, the frequency of abdominal deliveries increased slowly but steadily, and by the end of the 1980s the national average reached 3–3.5 percent [4].

As the use of obstetric surgery increased, surgical techniques, surgical instruments and suture materials were improved. It is understood that the first operations were performed on deceased women, who had been in labour, to save the still-living babies. The operations consisted of simply cutting the anterior abdominal wall and the body of the uterus as quickly as possible. The uterus incision was not sewn closed even in those who survived the operation, which explained the mothers’ certain mortality due to sepsis and bleeding. A huge achievement in the history of CS was the understanding that the uterus needed suturing, which was first performed by P. Kehrer in 1881. In 1882, M. Zanger substantiated the classical CS technique in theory.

After the development of a method for the sewing of the incision in the uterus and the first steps in surgical asepsis and antiseptics, the mortality rate decreased to a quarter of its previous level [5]. In addition, in the 20th century the operating procedure changed. At first, the incision was made longitudinally approximately in the middle of the body of the uterus (a so-called corporal CS was performed). Then B. Kronig in 1912 and B. Sellheim in 1928 began to “enter” the uterus through a longitudinal incision in the lower segment, motivated by the decreased blood loss, since the lower segment in labour is much thinner than elsewhere in the abdomen and has less vascularization [6].

Later, in different countries, J.B. De Lee (USA), H. Doerfler (Germany) and L.A. Gusakov (USSR) proposed to dissect the wall of the uterus in the lower segment not longitudinally, but with a transverse incision, which is still widely used today. This variant of opening the uterine cavity was carried out in different ways. In Russia, the Gusakov method is widely used, providing for a small incision in the lower segment of the uterus, followed by its spreading with the fingers to the sides, not reaching the uterine sidewall by about a centimeter on each side. According to its creator, this provides for reduced blood loss from dissected tissue. However, there are many

supporters of not spreading, but the dissection of the womb using scissors to make a semilunar incision in the transverse direction, as according to H. Doerfler. This technique makes it easier to extract the head due to a larger surgical wound to the uterus, and also provides for better healing of the incision, since the incised wound heals better than a torn wound [4]. This is important in connection with the possibility and the desire of many women to plan future pregnancies, despite the presence of a scar on the uterus after the previous CS.

In the 1990s, a variant of laparotomy as according to Joel-Cohen was proposed, consisting of using the fingers to bluntly spread the skin, aponeuroses, muscles and peritoneum in the transverse direction after a small incision of the superficial layers of the anterior abdominal wall. This method speeds up the time taken from beginning the operation to the extraction of the baby and helps to reduce blood loss.

The method for sewing the uterine wall after extraction of the baby and after birth has also changed. The first version of the suture was three-staged: first, a submucosal-muscular suture was applied, then a muscle-muscular suture and, finally, a serous-muscular suture. All ligatures were placed separately, parallel to each other. The presence of nodes in the thickness of the myometrium often led to inadequate sutures and the dissection of the wound on the uterus, which caused the onset of peritonitis. In connection with this, Professor V.I. Yeltsov-Strelkov proposed to apply first-row sutures (submucosal-muscular) with the immersion of the nodes in the uterine cavity, and the second row of muscular-serous sutures with the nodes arranged on the uterus surface [7]. However, this method did not last long due to the frequent infection of the internal series of sutures and the large amount of purulent discharge indicative of endometritis.

Analysis of the causes of postoperative peritonitis has shown that a necessary condition for the prevention of this formidable complication is leak-free sutures, and instead of the separate nodal sutures, preference is given to the continuous Reverdin suture. The frequency of obstetric peritonitis with this variant of uterus suturing decreased, but not significantly. Morphological studies of sutures with different options for suturing the incision on the uterus

showed that the prevention of tissue healing and the formation of a full-fledged scar prevents the deterioration of the vascularization of the wound edges and, as a consequence, their necrosis when tightening the loops by the Reverdin method. Currently, the most common are single-row continuous, double-row continuous or double-row interrupted sutures, which do not cause such violations [8]. For better healing of the wound and prevention of intermuscular hematomas, argon-plasma coagulation of the edges of the wound before stitching is successfully used [9]. Other surgical innovations are also used, such as the use of staplers.

In the first decade of the 21st century, CS using the M. Stark modification was very popular worldwide. Its distinguishing features are a Joel-Cohen variant laparotomy and sutures of the walls of the uterus, aponeurosis and skin following removal of the baby and the placenta. Such an approach shortens the duration of the operation to 15–20 minutes. However, this technique is justly criticized by Russian specialists due to significant technical difficulties arising from repeated laparotomy due to the adhesive process in the abdominal cavity.

Suture material also changed over time: from silver wire threads, silk and catgut from reindeer tendons to synthetic absorbable threads such as Vicryl and Polysorb. As it turned out, the material from which surgical threads are made has a significant effect on the healing nature of the surgical wound due to the peculiarities of bioavailability with living tissues, as well as the risk of maintaining infections of the wound [10].

A similar situation is observed with anesthesia. Etheral and Fluothane anaesthesia have ceased to be used as they have many side effects, especially associated with hypotonia of the uterus. In addition, neuroleptanalgesia, requiring the use of muscle relaxants, which have a negative effect on the respiratory function of the newborn, has been minimized. Peridural anesthesia, recently considered the “gold standard” in CS anesthesia, is gradually being replaced by spinal anesthesia, which saves time and financial costs. Regional methods of anesthesia are superior to those previously used due to the absence of negative effects on the baby prior to it being removed from the uterine cavity and the minimization complications for the mother [8].

As has been shown, for many centuries there have been changes in CS techniques and perioperative support, which have contributed to a steady increase in the frequency of abdominal delivery. An “explosion” in obstetrician operations has occurred in the last 25–30 years, during which the frequency of CS in all developed countries has increased from 3 percent to 30 percent [11]. A similar process, only a decade later, has been observed in Russia [5]. Despite the WHO’s (World Health Organisation) request to the obstetric community to restrict abdominal delivery (a higher frequency of which no longer affects maternal and perinatal mortality) to 15 percent, the frequency of CS increases annually by 1 percent on average. In countries such as Italy, Portugal, Brazil and Argentina, this indicator is approaching the 50 percent mark among the population [12].

One of the main reasons for the continued increase in the frequency of CS worldwide is a complex development path for medical indications, which has begun to expand as the operation itself and its perioperative maintenance have been refined. Back in the 1870s only absolute indications were allowed, when the birth of a living or dead child through the natural birth canal was not possible. In 20 years’ time, a group of so-called relative indications began to arise when the vaginal delivery represented a high risk to the life of the mother or child, and also the implication of certain life-threatening conditions. These include, for example, eclampsia, bleeding due to detachment or presentation of the placenta, prolapse of the umbilical cord loops, extensor insertions of the baby’s head, and heart disease with severe heart failure. In Russia, a pioneer in the introduction of relative indications for CS in the early 20th century was an honorary professor of the Imperial Military Medical Academy, A.I. Lebedev, who managed to reduce maternal mortality after surgery to 17 percent. Fifty years later, the relative indications became so extensive that in preoperative conclusions they began to be referred to as “a set of relative indications”. In isolation, they have a moderate risk, but if a single patient has several of them, then the probability of adverse outcomes of a vaginal birth significantly increases. Examples include such combinations as a large baby and

pelvic presentation, preeclampsia and adverse outcomes of previous births and so on.

In the 21st century, in the West and then in Russia, elective CS began to be performed, i.e., conducting operations without medical indications, at the request of a woman. A particular group for such CS operations is women who become pregnant via the use of assisted reproductive technologies.

Improvements in training materials and the techniques for performing CS contributed to a reduction in maternal and perinatal mortality caused by obstetric complications and concomitant diseases. However, in the 1990s, the optimal CS frequency was achieved, the exceeding of which did not affect the quality of obstetric care. Moreover, due to the obstetricians’ excessive surgical activity, negative aspects have emerged with both medical and social manifestations. For the mother, the degree of risk increases with each subsequent operation (bleeding, rupture of the uterus, placenta previa, placenta aneurysm, adhesions, endometriosis of the anterior abdominal wall, varicose veins of the pelvis, thromboembolism and embolism with amniotic fluid, etc.), and for the baby early and long-term complications are associated with a violation of the function of the first inspiration, the central nervous system, the restructuring of the circulatory system and, in general, with psycho-emotional damage caused by an unexpected and rapid extraction from the womb [13, 14]. For the doctor, the enthusiasm for CS leads to a decrease in professionalism (a loss of the skills needed for conducting vaginal births). N.N. Fenomenov has already noted out that this operation has started to be conducted “with an easy heart and sometimes without sufficient grounds” [1]. Professor K.K. Skrobansky at the 6th All-Union Congress of Obstetricians and Gynecologists in Moscow in 1924 warned: “The use of surgical delivery is tempting for young doctors in that it greatly simplifies the entire activity: there is no need to understand the biomechanism of labor and all its diverse deviations, a thorough evaluation of each case and the analysis of necessary conditions and indications for various operations” [5, p. 98]. These thoughts can be addressed to modern obstetricians and gynecologists. It should be taken into account that the significant reduction

in perinatal mortality that has been achieved has not been accompanied by a significant decrease in morbidity among newborns. Moreover, the modern principles of obstetrics do not take into account the provisions of perinatal psychology, presupposing the existence of a fetus' mental life and the spiritual connection between mother and child at all stages of the gestational process, especially in childbirth [14, 15]. Thus, despite favourable immediate results, both individual (the birth of a live child) and socially significant (reduction of perinatal mortality), the long-term consequences make it necessary to reconsider the existing attitude to this method of childbirth and seriously consider the question of the famous French obstetrician and humanist Michel Odent: Cesarean section: a safe solution or a threat to the future? [16].

In April 2017, the European Association of Obstetricians and Gynaecology (EBCOG) published an appeal in which it expressed its view on the issue of CS in Europe [17]. It said that CS is an indispensable operation for saving lives, but

it has become an alternative to natural childbirth. The operation is not devoid of complications and negative consequences for subsequent pregnancy and childbirth. The damaging effect of operative births on the baby immediately after birth and for his or her health in the future has been proven. In addition, the financial costs of this operation significantly exceed the costs of vaginal delivery. EBCOG announced the need to develop a strategy to optimize the frequency of CS use in Europe, based on a universal system for the collection and comparison of indicators in each country. Such a system could help identify the short-term and long-term consequences of CS. The main similar system could be the 10-group classification of M. Robson [18, 19], which provides for the division of all women in labor into categories with similar initial data. This makes it possible to more accurately see the causes of unsatisfactory results. Under modern conditions, it is necessary to learn and adopt experience from countries with a low level of maternal and neonatal mortality and low incidence of CS.

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