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Clinical effectiveness of different cesarean section techniques in cases of morbid obesity

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The World Obesity Federation (WOF) projects that by 2030, one billion people worldwide will be living with obesity. The WOF specifically highlights morbid obesity (MO), defined as a body mass index (BMI) of greater 40 kg/m². Pregnant women with MO are known to be at significantly increased risk of prenatal, perinatal, and postpartum complications. In particular, MO is strongly associated with cardiometabolic disorders. It has been established that the cesarean section (CS) rate among pregnant women with BMI ≥ 50 kg/m² approaches 50%.
The objective: **to evaluate the clinical effectiveness of two different CS techniques in pregnant women with MO by conducting a comparative analysis of intraoperative and postoperative complications.**
Materials and methods**. A retrospective cohort study was conducted during 2022–2025 at the clinical bases of the Department of Obstetrics and Gynecology No. 1, Shupyk National Healthcare University of Ukraine. The study included 55 women aged 29–41 years with singleton pregnancies and diagnosed MO. Cases of CS performed using two different surgical techniques were analyzed. The participants were stratified into two groups: I group (n = 21) included pregnant women with MO who underwent supraumbilical laparotomy and fundal transverse CS; II group (n = 34) involved women with MO who underwent standard CS (via suprapubic Joel-Cohen laparotomy and lower uterine segment transverse incision). Patient history, comorbidities, pregnancy complications, indications for CS, and intra- and postoperative outcomes were analyzed. Statistical processing was carried out using MedCalc and Microsoft Excel 365. Student's t-test was applied, and results were considered significant at p < 0.05.**
Results**. Both groups primarily included older primiparous women, with a mean age of 32.0 ± 2.1 years, BMI > 40 kg/m², and significant panniculus (p > 0.05). The groups were representative in extragenital pathology, predominantly cardiovascular diseases (chronic arterial hypertension – CAH) and endocrine pathology (gestational diabetes mellitus – GDM). The main indications for CS were severe combined preeclampsia on the background of CAH, diabetic fetopathy due to GDM, and fetal distress during pregnancy or labor. Compared to I group, in women in II group had significantly higher intraoperative blood loss, longer fetal extraction time and CS duration; in the postoperative period – pain intensity, hospital stay, and the incidence of complications involving the surgical wound and uterus (p < 0.05).**
Conclusions**. Our retrospective cohort study confirmed the obvious advantages of supraumbilical laparotomy with fundal transverse CS in pregnant women with MO: optimal access to the uterine fundus and body, ease of fetal extraction, reduced blood loss, shorter CS duration, decreased postoperative pain, and lower risk of purulent-inflammatory postpartum complications. These factors contributed to faster recovery and shorter hospital stay.**
Keywords: *morbid obesity, cesarean section, supraumbilical laparotomy, fundal cesarean section, preeclampsia, postpartum hemorrhage.*

Клінічна ефективність різних методик проведення кесаревого розтину за морбідного ожиріння

О. В. Голяновський, О. В. Морозова, Р. М. Ворона, К. С. Островець

Світова федерація ожиріння (СФО) прогнозує, що до 2030 року один мільярд людей у світі матиме ожиріння. Особливу увагу СФО приділяє морбідному ожирінню (МО), яке діагностують в осіб з індексом маси тіла (ІМТ), що перевищує 40 кг/м². Встановлено, що у вагітних із МО значно частіше виникають пренатальні, перинатальні та післяпологові ускладнення. Зокрема, МО тісно пов'язане з кардіометаболічними порушеннями. Встановлено, що рівень кесаревих розтинів (КР) у вагітних з ІМТ ≥ 50 кг/м² наближається до 50%.
Мета дослідження: оцінка клінічної ефективності двох різних методик проведення КР у вагітних із МО шляхом порівняльного аналізу інтра- та післяопераційних ускладнень.
Матеріали та методи. На клінічних базах кафедри акушерства і гінекології № 1 Національного університету охорони здоров'я України імені П. Л. Шупика упродовж 2022–2025 рр. проведено ретроспективне когортне дослідження серед 55 жінок з одноплідною вагітністю та МО віком 29–41 років, з аналізом випадків КР за двома різними методиками. Вагітні були стратифіковані на 2 групи: І група (n = 21) – вагітні з МО, яким проведено супраумбілікальну лапаротомію та донний КР із поперечним розрізом; ІІ група (n = 34) – вагітні з МО, яким КР виконано за стандартною методикою (надлобкова лапаротомія за Joel-Cohen і КР у нижньо-матковому сегменті). Проведено аналіз анамнестичних даних, соматичної патології, ускладнень перебігу вагітності, показань до КР, інтра- та післяопераційних ускладнень. Статистичну обробку даних здійснювали за допомогою MedCalc та Microsoft Excel 365 з використанням критерію Стьюдента, результати вважали статистично значущими при p < 0,05.
Результати. В обох групах переважали вагітні віком у середньому 32,0 ± 2,1 року, які народжували вперше та мали ІМТ ≥ 40 кг/м² і виражений панікулюс (p > 0,05). Групи були репрезентативними за екстрагенітальною патологією з переважанням серцево-судинної (хронічна артеріальна гіпертензія – ХАГ) і ендокринної патології (гестаційний цукровий діабет – ГЦД). Показаннями до КР у групах були: тяжка поєднана прееклампсія на тлі ХАГ, діабетична фетопатія на тлі ГЦД, дистрес плода під час вагітності та пологів. У вагітних ІІ групи, порівняно з І групою, достовірно вищим був об'єм

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інтраопераційної крововтрати, тривалішим часом вилучення плода і проведення КР, а в післяопераційний період – вираженість больового синдрому, збільшена тривалість перебування в стаціонарі, що було пов'язано зі зростанням частоти ускладнень із боку післяопераційної рани та матки ($p < 0,05$).

Висновки. Дані проведеного ретроспективного клінічного дослідження достовірно свідчать про переваги супраумбілікальної лапаротомії та донного КР у вагітних із МО: забезпечується оптимальний доступ до дна і тіла матки, зручність вилучення плода, зменшення об'єму інтраопераційної крововтрати й тривалості КР, зменшення вираженості післяопераційного болю та ймовірності розвитку гнійно-запальних післяпологових ускладнень. Це сприяє швидшому відновленню після операції та скороченню тривалості госпіталізації породіль.

Ключові слова: *морбідне ожиріння, кесарів розтин, супраумбілікальна лапаротомія, донний кесарів розтин, прееклампсія, післяпологова кровотеча.*

The World Health Organization (WHO) and the World Obesity Federation (WOF) define obesity as a complex chronic disease characterized by excessive accumulation of adipose tissue that can negatively impact human health [1, 2].

Obesity impairs the function of various organs and systems, contributing to the development of cardiovascular and endocrine disorders, reduced resistance to infections, and increased risk of pregnancy complications, adverse labor and postpartum outcomes in women, as well as perinatal morbidity and mortality in newborns. These complications are particularly pronounced in pregnant women with morbid obesity (MO), defined as a body mass index (BMI) over 40 kg/m^2 [3–5].

Moreover, women with MO often experience menstrual dysfunction, which may indicate a strong link between obesity and hormonal imbalances in the female reproductive system, including infertility and miscarriage [6].

According to WHO, as of 2022, approximately 16% of adults aged 18 and older worldwide suffer from obesity. From 1990 to 2022, the global prevalence of obesity more than doubled [1]. The prevalence of obesity continues to rise, reaching pandemic proportions-WOF predicts that by 2030, one billion people worldwide will live with obesity [2].

These negative trends also affect a significant portion of the female population. An estimated 39 million pregnancies annually are complicated by maternal obesity, and in some countries, the prevalence of overweight and obesity during pregnancy exceeds 60% (e.g., South Africa – 64%, Mexico – 65%, United States of America – 55–63%) [7, 8]. In England, the prevalence of overweight and obesity is 35% among women aged 16–24, increasing to 61% among those aged 35–44, highlighting the high potential risk among women of reproductive age [8]. The highest rates of antenatal obesity are observed in areas with high levels of deprivation, among older mothers, and within ethnic minorities.

It is well established that obesity rates have risen sharply over the past three decades, with pregnancy increasingly complicated by extreme or pathological obesity. In the United Kingdom, approximately 1 in 1,000 births involve women with a BMI > 50 kg/m^2, while in Australia, the prevalence of MO is 2.1 per 1,000 births [7]. Obesity, once thought to be a problem of high-income countries, is now rapidly increasing in low- and middle-income countries [8].

Although overweight and obesity significantly increase the risk of adverse pregnancy outcomes, it is important to recognize that most women with a BMI > 25 kg/m^2 will have an uncomplicated pregnancy [8]. Therefore, MO, defined by WOF as BMI > 40 kg/m^2, deserves specific attention, as it is associated with a substantially higher risk of antenatal, perinatal, and postpartum complications [9].

The most common antenatal complications include anemia, gestational hypertension, non-alcoholic fatty liver disease, gestational diabetes mellitus (GDM), metabolic syndrome (MS), preeclampsia, sleep apnea, preterm labor, and emergency cesarean section (CS) [10–12]. Additionally, pregnancy with obesity carries an increased risk of stillbirth [12].

Preeclampsia is a major cause of preterm delivery, as the primary treatment for this condition is CS. A systematic review of 13 cohort studies involving nearly 1.4 million women showed that the risk of preeclampsia doubles with every 5–7 kg/m^2 increase in BMI above the ideal [10].

Women with obesity are at increased risk of developing MS. Various authors report that the prevalence of MS continues to rise and currently ranges from 5% to 20% [11]. Increased insulin resistance during pregnancy may unmask subclinical cardiometabolic dysfunction, which manifests as preeclampsia, GDM, or obstructive sleep apnea. These complications are associated with adverse pregnancy outcomes. Compared to women without obstructive sleep apnea, those women with this condition have higher rates of preeclampsia, eclampsia, cardiomyopathy, pulmonary embolism, and in-hospital mortality.

All pregnant patients should be screened for GDM based on medical history, clinical risk factors, or laboratory screening results for blood glucose levels. Routine screening typically occurs between 24–28 weeks of gestation. Early pregnancy screening for glucose intolerance (GDM or overt diabetes) should be based on risk factors. If early screening is negative, repeat screening is generally performed at 24–28 weeks [11, 13].

The association between obesity and increased risk of CS is well documented, with CS rates approaching 50% among women with BMI ≥ 50 kg/m^2 [9]. Studies suggest that women with MO are more likely than obese women to have preeclampsia and fetal macrosomia [12, 14]. Prepregnancy obesity or excessive weight gain during pregnancy are major contributors to macrosomia (i.e., a fetus large for gestational age-birth weight > 4 kg and length > 54 cm). Many studies have shown a linear correlation between maternal pre-pregnancy BMI and newborn weight. Obese mothers have a higher rate of macrosomia, independent of GDM prevalence. Macrosomia is associated with shoulder dystocia and a greater predisposition to obesity later in life. Prospective cohort studies indicate that normalizing maternal weight reduces the risk of delivering a large infant [10]. Research also suggests that the distribution pattern of body fat negatively affects cervical ripening, the timely onset of labor, and its progression [15].

Maternal obesity increases the risk of prolonged labor and failed induction. With increasing maternal BMI, the

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likelihood of CS increases proportionally. Reports indicate emergency CS rates in women with MO range from 42–50%, compared to approximately 9% in control groups [14, 16]. Maternal obesity is also associated with longer surgical time.

Obese women undergoing repeat cesarean delivery have nearly double the overall maternal morbidity and a five-fold risk of neonatal trauma [16]. Post-CS, obese women experience more postoperative complications than their non-obese counterparts, including postpartum hemorrhage (PPH) (34.9% in MO patients vs 9.3% in non-obese), peritonitis, endometritis (32.6% vs 4.9%, respectively), wound infections, and venous thromboembolism [12].

PPH is a critical obstetric complication occurring in 1–10% of all deliveries. PPH is defined as blood loss > 500 mL during vaginal delivery and > 1000 mL during CS, occurring within the first 24 hours postpartum [17–19]. Obesity is one of the key risk factors for PPH. L. Thies-Lagergren et al. reviewed data on over 400,000 pregnancies from the Swedish Birth Register, demonstrating that women with a BMI > 25 kg/m^2 had a higher risk of blood loss > 1000 mL within two hours after birth [20].

Overall, CS in pregnant women with MO requires meticulous planning, specialized approaches, and close medical supervision to ensure the highest safety standards for both mother and child.

The objective: to evaluate the clinical effectiveness of two different CS techniques in pregnant women with MO through comparative analysis of pregnancy course, intraoperative, and postoperative complications.

MATERIALS AND METHODS

A retrospective cohort study was conducted at the clinical sites of the Department of Obstetrics and Gynecology No. 1 of the Shupyk National Healthcare University of Ukraine during 2022–2025. The study included 55 women aged 29–41 years with singleton pregnancies complicated by MO who underwent CS using two different techniques.

Participants were stratified into two groups:

– *Group I (n = 21)* – pregnant women with MO who underwent *supraumbilical laparotomy with fundal transverse CS;*
– *Group II (n = 34)* – pregnant women with MO who underwent standard CS technique (*suprapubic Joel-Cohen laparotomy and lower uterine segment incision*).

The analysis included anamnesis, somatic comorbidities, fetal ultrasound findings, pregnancy complications, CS indications, and intra- and postoperative complications based on electronic medical records from affiliated obstetric institutions. All pregnant women with chronic arterial hypertension (CAH) and GDM were evaluated and treated in accordance with the Ukrainian Ministry of Health guidelines [13, 21].

Inclusion criteria:

– gestational age 33–40 weeks;
– singleton pregnancy;
– no detected fetal malformations;
– voluntary written informed consent.

Exclusion criteria:

– multiple pregnancy;
– severe somatic or psychiatric maternal diseases;
– patient refusal to participate.

The study complied with the Declaration of Helsinki (1964, revised in 2013) and was approved by the Local Bioethics Committee of the Shupyk National Healthcare University of Ukraine (Protocol No. 8, dated 07.11.2022).

The supraumbilical laparotomy and fundal cesarean technique was previously described in our earlier publication [5] and is illustrated in Fig. 1–3.

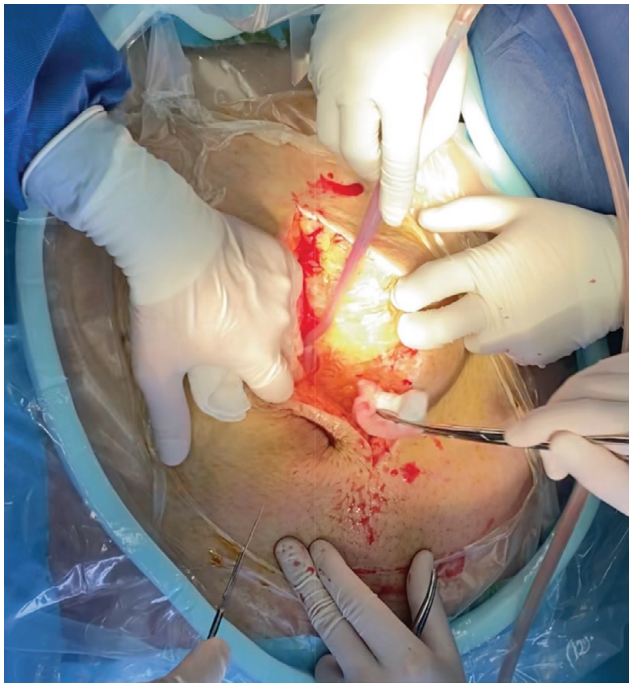

Fig. 1. Supraumbilical longitudinal incision of the anterior abdominal wall during fundal CS in a pregnant woman with MO

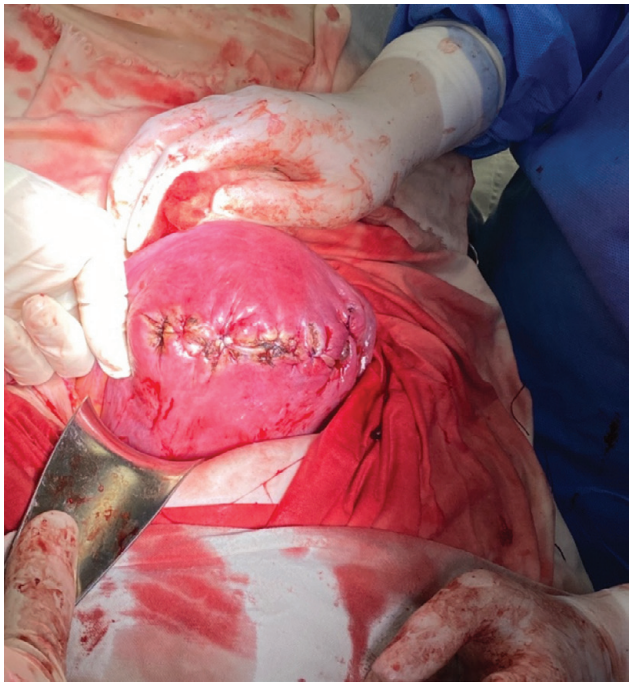

Fig. 2. Fundal CS (uterus sutured with a two-layer Vicryl stitch)

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Fig. 3. Laparorrhaphy with cosmetic skin closure and subcutaneous fat drainage (pronounced panniculus)

The volume of intraoperative blood loss was measured using the gravimetric method. Blood loss was considered pathological if it exceeded 1.0% of the patient's body weight, which required initiation of infusion-transfusion therapy in accordance with the guidelines of the Ministry of Health of Ukraine [22].

To prevent intraoperative bleeding and coagulopathy during CS, both groups of pregnant women received antifibrinolytic therapy (tranexamic acid 1.0 g intravenously, administered slowly) and modern uterotonic agents (carbetocin 100 μg intravenously, administered slowly) after fetal delivery [23, 24]. In the postoperative period, to prevent atonic hemorrhage in the context of increased intraoperative blood loss, the *RELUS technique* (Remodulation of the Lower Uterine Segment) was applied [25].

In cases of massive hemorrhage, along with the use of modern bleeding control methods, the Damage Control Resuscitation concept was followed. This included early initiation of transfusion therapy, restricted use of crystalloid infusions, permissive hypotension, application of massive transfusion protocols, and targeted correction of coagulopathy [18, 26, 27].

Antibiotic prophylaxis was administered 30 minutes prior to surgery using first-generation cephalosporins (cefazolin 1.0 g intravenously) in both groups, following standard practice. Thromboembolic event (TEE) prophylaxis in the postoperative period followed general recommendations and included the administration of low-molecular-weight heparins. Dosage was based on the woman's body weight, and duration was determined by the TEE risk category. Preventive measures were implemented in accordance with Order No. 8 of the Ministry of Health of Ukraine, dated January 5, 2022 [23].

Statistical analysis was conducted using MedCalc and Microsoft Excel 365 software. Normality of distribution was assessed with the Shapiro–Wilk test. For normally distributed variables, the independent samples t-test (Student's t-test) was used; for non-normal distributions, the Mann–Whitney U test was applied. The chi-square (χ^2) test or Fisher's exact test was used for categorical variables. A p-value of < 0.05 was considered statistically significant.

RESULTS AND DISCUSSION

Data on the average age of pregnant women, somatic and obstetric complications in both study groups are presented in Table 1. In both groups, the majority were advanced maternal age primiparas. The mean age of women in Group I was 31.3 ± 2.1 years, and in Group II – 32.1 ± 1.3 years ($p = 0.09$). All women had a BMI > 40 kg/m^2 and a pronounced panniculus (Fig. 3).

The groups were also comparable in terms of extragenital comorbidities, with a high frequency of cardiovascular (CAH) and endocrine (GDM) disorders. These often necessitated preterm delivery and were associated with fetal distress ($p > 0.05$).

Indications for CS in both groups included severe combined preeclampsia in the setting of CAH, diabetic fetopathy associated with GDM, and fetal distress during pregnancy and labor.

Intraoperative and postoperative parameters and complications in the study groups are presented in Table 2. According to Table 2, the time to fetal extraction, duration of CS, and length of hospital stay were significantly lower in Group I ($p < 0.05$), which we attribute to the advantages of the supraumbilical approach and the fundal transverse CS technique.

Table 1

Mean age, somatic and obstetric complications during pregnancy in the study groups

Indicators	Group I (n = 21)	Group II (n = 34)	p-value
Mean maternal age (years)	31.3 ± 2.1	32.1 ± 1.3	0.09
CAH (n, %)	17 (81.0)	25 (73.5)	0.53
GDM (n, %)	7 (33.3)	12 (35.3)	0.88
Severe preeclampsia on the background of CAH (n, %)	9 (42.9)	14 (41.2)	0.91
Preterm delivery (33–37 weeks) (n, %)	12 (57.1)	17 (50.0)	0.59
Fetal distress (n, %)	11 (52.4)	15 (44.1)	0.58

Notes: CAH – chronic arterial hypertension; GDM – gestational diabetes mellitus.

Table 2

Intra- and postoperative indicators and complications in study groups

Indicators	Group I (n = 21)	Group II (n = 34)	p-value
Fetal extraction time (min)	4.3 ± 1.1	7.5 ± 1.2	0.04
Duration of CS (min)	41.3 ± 4.2	54.5 ± 3.1	0.01
Duration of hospital stay after CS (days)	6.0 ± 1.1	10.0 ± 2.2	0.01
Average blood loss (mL)	790.0 ± 50.0	1050.0 ± 70.0	0.003
Atonic bleeding (n, %)	3 (14.3)	7 (20.6)	0.51
Endometritis (n, %)	1 (4.7)	4 (11.7)	0.63
Complications of the surgical wound (n, %)	1 (4.7)	9 (26.5)	0.04

Note: CS – cesarean section.

As for the number of atonic hemorrhages and cases of endometritis in the study groups, these rates were higher in Group II, although not statistically significant ($p > 0.05$). One case of massive atonic intraoperative hemorrhage occurred during delivery in a patient from Group II, with a total blood loss of 1700.0 mL in the context of severe combined preeclampsia. Despite uterine vessel ligation and a full range of hemostatic measures, the situation required a hysterectomy without adnexa.

Compared to Group I, pregnant women in Group II had a significantly higher volume of intraoperative blood loss. In the postoperative period, there was a higher incidence of complications related to purulent-inflammatory processes at the surgical site (seromas, wound dehiscence, and wound infections). These were associated with the surgical incision being located beneath the panniculus, a zone with poor oxygen access and increased perspiration, which created conditions conducive to infection by anaerobic microorganisms in the subcutaneous fat ($p < 0.05$). Additionally, the presence of a suprapubic incision under the panniculus in Group II patients caused considerable discomfort, which was associated with a longer and more intense pain syndrome.

CS in pregnant women with obesity, particularly MO, is associated with an increased rate of surgical challenges: longer operation duration, greater blood loss, and a higher likelihood of requiring general anesthesia. In the postoperative period, this group is more prone to purulent-inflammatory complications (such as endometritis, peritonitis, wound infections), PPH, and TEE [28–30].

Standard CS is typically performed via a Joel-Cohen or Pfannenstiel incision, both of which are low transverse suprapubic approaches. These incisions are preferred for their aesthetic appearance, mild postoperative pain, rapid healing, and minimal blood loss [23]. However, according to our findings, when applied to women with MO, these approaches present significant challenges. The difficulty of retracting the thick subcutaneous adipose tissue results in a limited surgical field and challenges in fetal extraction.

A major drawback of these incisions in patients with MO is their location beneath the panniculus, which places the postoperative wound in a moist, hypoxic environment that promotes infection, anaerobic bacterial growth, and impaired wound healing. Some authors suggest that a supraumbilical midline incision is an optimal alternative for laparotomy in women with MO, as it avoids placing the surgical wound beneath the "apron" of the panniculus [29, 31].

This approach improves access to the uterine fundus and body, allowing for a fundal CS. In MO, the panniculus is large, making anatomical landmarks difficult to identify. Therefore, preoperative assessment is conducted in both standing and supine positions, without repositioning the panniculus, to determine the appropriate incision level based on the projection of the upper edge of the pubic symphysis. The adipose layer is thinnest above the umbilicus, facilitating access to the uterus, simplifying fetal extraction, and reducing perinatal complications [31, 32].

When using an upper midline or supraumbilical incision, access to the lower uterine segment is reduced, increasing the likelihood of performing a corporal or fundal CS. This can help reduce blood loss, as the uterine fundus has a thinner muscle layer than the body and the incision is made parallel to the arcuate arteries. Supraumbilical laparotomy and fundal CS also lead to strong uterine contractions after placental separation, helping to control hemorrhage without the need for additional compression sutures [5, 29].

Based on our retrospective cohort study, we identified several clear advantages of the supraumbilical laparotomy and fundal CS in women with MO: optimal access to the uterine fundus and body, ease of fetal extraction, reduced blood loss and postoperative pain, faster postoperative recovery, early return of bowel function, earlier patient mobilization, and shorter hospital stay. Our findings are consistent with the limited data available in the current scientific literature [5, 29, 30].

Key conditions for an uncomplicated postoperative course include the use of double-layer uterine suturing with long-lasting absorbable synthetic material, mandatory drainage of the abdominal cavity and subcutaneous tissue, and prevention of infectious and thromboembolic complications. Long-term management includes contraception for at least 24 months following CS and ultrasound assessment of uterine scar formation at 12 months postoperatively [23, 29].

Further multicenter randomized studies are needed to determine the most effective approach to pregnancy management and CS technique in cases of MO.

CONCLUSIONS

In women with MO, transverse suprapubic incisions for CS pose significant challenges due to the difficulty of retracting edematous subcutaneous fat in the lower

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abdomen (panniculus), which reduces the surgical field, complicates fetal extraction, increases CS duration, and raises the risks of intraoperative bleeding and postpartum purulent-inflammatory complications.

According to our study, the supraumbilical laparotomy and fundal CS offer clear, statistically significant advantages in patients with MO: optimal access to the uterine fundus and body, ease of fetal extraction, reduced intraoperative blood loss and postoperative pain, lower incidence of postpartum infectious complications, faster wound healing, and shorter hospital stays.

The use of modern pharmacological support (carbetocin, tranexamic acid), advanced surgical tools (radiofrequency scalpel, argon plasma coagulation of the tissues), drainage of the abdominal cavity and subcutaneous fat, and administration of low-molecular-weight heparins all contribute to reducing the risks of intra- and postoperative complications in this high-risk pregnant women.

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