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Report and Literature Review on Type III Cesarean Scar Pregnancy Tissue Resection and Scar Defect Repair Surgery

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Abstract: To investigate the clinical efficacy of tissue resection and scar defect repair surgery in patients with Type III cesarean scar pregnancy (CSP), this study aims to provide scientific evidence for diagnosis and treatment of such patients by analyzing the applicability and safety of the surgical procedure in conjunction with a literature review. A retrospective analysis was conducted on several cases of Type III CSP patients, evaluating preoperative condition, surgical procedure, postoperative recovery, and follow-up outcomes. Additionally, a literature review was performed to summarize the advancements in CSP diagnosis and treatment, including the selection of treatment approaches and surgical repair techniques, both domestically and internationally. Patients with Type III CSP who underwent scar pregnancy tissue resection and scar defect repair surgery experienced minimal intraoperative bleeding and smooth postoperative recovery, with no significant complications observed. The literature review indicates that this surgical procedure is highly safe and effective in improving patient prognosis and reducing the risk of severe complications, such as uterine rupture. Early surgical intervention for Type III CSP is recommended, with the combination of scar pregnancy tissue resection and scar defect repair surgery effectively reducing surgical risks and improving patient outcomes. This study provides valuable reference for the clinical treatment of Type III CSP and offers suggestions for future research directions based on the literature review.

1. Introduction

Cesarean scar pregnancy (CSP), a unique form of ectopic pregnancy, has seen a gradual increase in incidence globally, especially in countries and regions with higher cesarean section rates. CSP refers to the implantation of the embryo into the scar tissue formed by a previous cesarean section. Based on the severity of the condition, CSP is classified into different types. Among them, Type III cesarean scar pregnancy is the most severe. In this form, the gestational tissue invades not only the uterine scar muscle layer but may also penetrate the full thickness of the uterine wall, extending to the pelvic cavity and adjacent organs such as the bladder and intestines. This type of pregnancy is

highly invasive and destructive, posing a significant risk of severe complications, including massive hemorrhage, uterine rupture, and bladder injury, which can be life-threatening if not promptly treated.

Although advances in imaging techniques, such as ultrasound and magnetic resonance imaging (MRI), have greatly improved early diagnosis of CSP, the clinical treatment of Type III CSP remains challenging. Traditional treatments include conservative drug therapy, interventional surgery, and hysterectomy. However, due to the complexity and high risks associated with Type III CSP, a single treatment approach often fails to achieve optimal results. In recent years, with the continuous development of minimally invasive surgical techniques, scar pregnancy tissue resection combined with scar defect repair has gradually become an effective treatment for Type III CSP. This surgical approach not only completely removes invasive gestational tissue but also repairs the scar defect while preserving uterine function, reducing intraoperative bleeding and postoperative complications. As a result, it has gained increasing attention and application among clinicians.

However, there is currently no standardized protocol for the choice of surgical method or detailed procedural guidelines for Type III CSP, particularly concerning long-term outcomes, such as uterine function recovery and the risks associated with future pregnancies. Furthermore, there is considerable debate in the literature regarding the comparison of different surgical strategies and the optimal timing for surgery. Therefore, this study provides a detailed account of the treatment practices for several cases of Type III cesarean scar pregnancy and conducts a comprehensive review of relevant literature both domestically and internationally. The goal is to assess the clinical efficacy, safety, and indications for scar pregnancy tissue resection and scar defect repair, providing valuable reference for clinical practice.

In addition to summarizing the pathogenesis, diagnostic criteria, and treatment methods for Type III CSP, this paper offers a detailed technical analysis of the procedures for scar pregnancy tissue resection and scar repair. It also explores potential risks during surgery and corresponding countermeasures. Moreover, through a review of the literature, this study outlines the latest research developments in this field, evaluates the advantages and disadvantages of various treatment options, and provides suggestions for future research and clinical practice.

2. Literature Review

Cesarean scar pregnancy (CSP), as a special type of ectopic pregnancy, has been discussed in both domestic and international literature regarding its pathogenesis, diagnostic methods, and treatment strategies. With the rise in cesarean section rates, the incidence of CSP has also been increasing, particularly among patients with a history of multiple cesarean deliveries. Studies suggest that CSP may be closely related to factors such as poor uterine scar healing, reduced local blood supply, and weakened uterine tissue at the scar site [1]. Due to its high risk, early identification and timely treatment are crucial to patient prognosis.

2.1 Classification and Diagnosis of Cesarean Scar Pregnancy

CSP can be classified into Type I, Type II, and Type III based on the depth of invasion of the gestational tissue into the scar [2]. Among these, Type III is the most severe, with the gestational tissue deeply invading the uterine scar and potentially penetrating the entire uterine wall and affecting surrounding organs. Ultrasound examination is the primary tool for diagnosing CSP, allowing early detection of the relationship between the gestational sac and the scar site [3]. Additionally, magnetic resonance imaging (MRI) provides valuable supplemental information in complex cases, offering clearer visualization of the depth of invasion and the relationship with surrounding tissues [4].

2.2 Development of Treatment Strategies

Several strategies for the treatment of CSP have been reported in the literature, including conservative drug therapy, surgical treatment, and interventional therapy. Early treatments often relied on conservative drug therapy, such as methotrexate (MTX) injections, to control the growth of gestational tissue. However, this approach has limited efficacy in Type III CSP and carries a high risk of complications [5]. With advances in imaging and minimally invasive surgical techniques, an increasing number of studies advocate early surgical intervention for Type III CSP. Laparoscopic or open surgery to directly remove the scar pregnancy tissue and repair the scar defect not only reduces the risk of severe complications, such as uterine rupture, but also preserves the patient's fertility to a certain extent [6]. In recent years, interventional therapies have also gained traction in CSP treatment, particularly with the use of uterine artery embolization (UAE) to reduce intraoperative bleeding [7]. Research has shown that combining UAE with surgery significantly improves bleeding control during the treatment of Type III CSP, especially in cases involving extensive invasive gestational tissue, effectively reducing both intraoperative and postoperative hemorrhage [8].

2.3 Application of Scar Defect Repair Surgery

Scar defect repair surgery is playing an increasingly important role in the surgical treatment of CSP, particularly in Type III CSP. Repairing the scar not only restores the structural integrity of the uterus but also helps prevent future occurrences of scar pregnancy or uterine rupture during subsequent pregnancies [9]. Many experts in the literature recommend using tissue adhesives or suturing techniques to repair the scar defect after removing the scar pregnancy tissue, which enhances the tensile strength of the uterine scar and reduces the risk of complications in future pregnancies [10].

2.4 Postoperative Prognosis Studies

Studies on the postoperative prognosis of Type III CSP are relatively limited, but existing literature suggests that postoperative pregnancy success rates are closely related to the quality of scar repair, patient recovery, and follow-up management [11]. Some studies indicate that reasonable family planning following surgery, including avoiding premature pregnancy, can significantly reduce the risk of recurrence [12]. Additionally, regular ultrasound follow-ups help monitor the recovery of the scar site, allowing for the timely detection and management of potential issues [13].

2.5 Future Research Directions

Currently, surgical treatment of Type III cesarean scar pregnancy still faces numerous challenges. Future research should focus on optimizing surgical techniques, reducing postoperative complications, and improving fertility preservation rates. Large-sample, multicenter clinical trials may be needed to comprehensively assess the long-term efficacy and safety of different surgical strategies. Furthermore, exploring molecular mechanisms involved in uterine healing post-surgery and advances in scar tissue regeneration techniques could offer new insights into improving patient outcomes [14].

In conclusion, the existing literature indicates that while various treatment methods are available for Type III cesarean scar pregnancy, scar pregnancy tissue resection combined with scar defect repair surgery is gradually becoming a safe and effective treatment option. However, further clinical studies are necessary to optimize treatment protocols.

3. Classification of Cesarean Scar Pregnancy (CSP)

Cesarean scar pregnancy (CSP) is classified into three types based on the extent of embryo implantation into the uterine scar and its depth of invasion into surrounding tissues. Each type presents different clinical characteristics and management challenges, with classification primarily based on ultrasound and magnetic resonance imaging (MRI) findings.

3.1 Type I (Superficial CSP)

Type I CSP (as shown in Fig. 1) represents the mildest form of the condition. The gestational sac implants into the superficial part of the uterine scar, located only within the endometrial layer and part of the myometrium of the scar, and typically does not penetrate through the full thickness of the scar. This type is associated with relatively low bleeding and localized disease, making surgical intervention easier. Conservative treatment with medication or simple surgical procedures, such as curettage, generally yields good results, with better preservation of reproductive function postoperatively [15].

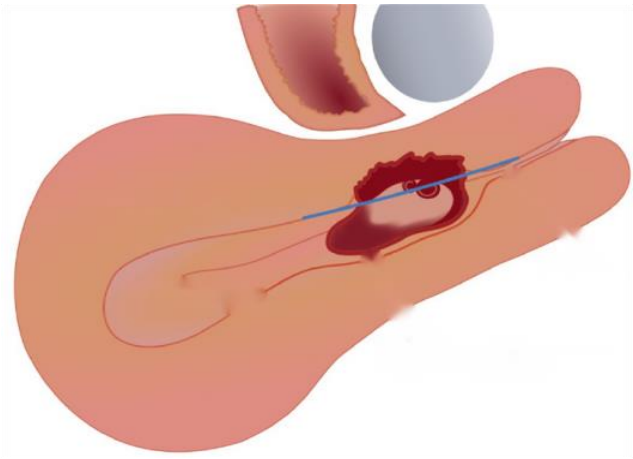

Figure 1: Type I (Superficial CSP)

3.2 Type II (Invasive CSP)

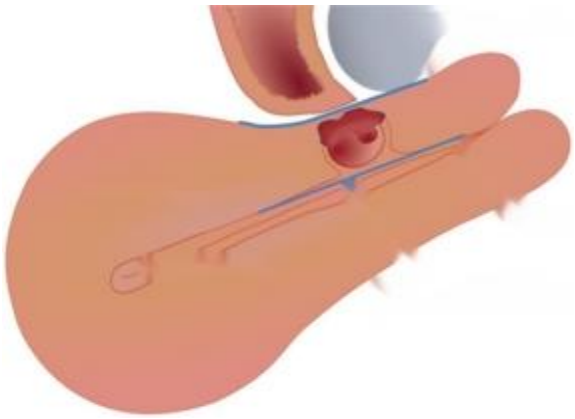

Figure 2: Type II (Invasive CSP)

Type II CSP (as shown in Fig. 2) is a moderate form where the gestational sac has invaded deeper into the myometrium of the uterine scar. This type often features increased local blood flow, with rich blood supply to the gestational tissue, leading to a higher risk of bleeding. Ultrasound usually shows

the gestational sac closely adherent to the myometrial layer of the scar, possibly accompanied by localized thinning or defects in the myometrium. For Type II CSP, medication alone is usually ineffective, necessitating interventional treatment such as uterine artery embolization (UAE) combined with surgical intervention [16]. During surgery, careful attention is required to control bleeding and potentially repair the scar defect.

3.3 Type III (Perforative CSP)

Type III CSP (as shown in Fig. 3) is the most severe form, where the gestational sac not only deeply invades the myometrium of the uterine scar but may also penetrate through the full thickness of the uterine wall, extending into surrounding tissues such as the bladder or pelvic cavity. Patients with this type are at extremely high risk for severe complications, including uterine rupture and massive bleeding, which can be life-threatening. The treatment for Type III CSP is highly complex; conservative medication is nearly ineffective, and early surgical intervention is necessary. Conventional surgery involves excising the scar pregnancy tissue and repairing the uterine scar defect [17]. Due to the high risk, preoperative measures such as UAE are often employed to control intraoperative bleeding, and careful dissection of the gestational tissue with efforts to preserve reproductive function is essential [18].

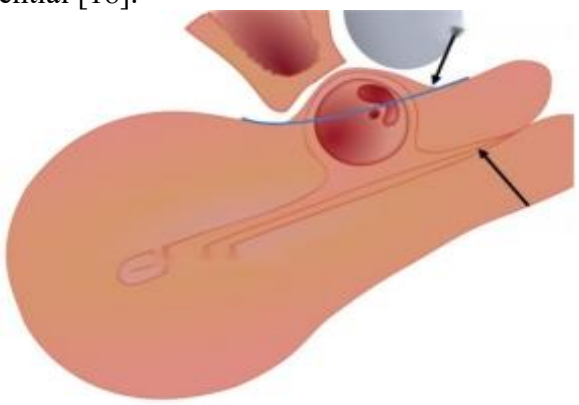

Figure 3: Type III (Perforative CSP)

3.4 Importance of Classification

The classification of CSP is crucial for clinical diagnosis and selection of treatment strategies. Imaging techniques such as ultrasound or MRI help determine the depth of invasion of the gestational sac, which aids in assessing surgical risks and choosing the most appropriate treatment approach. Type I CSP is often managed with medication or curettage, while Types II and III require more interventional and surgical measures. Type III CSP, in particular, demands not only the removal of diseased tissue but also repair of the scar defect to minimize postoperative risks of uterine rupture and subsequent pregnancy complications.

4. Case Report

4.1 Two Cases of Cesarean Scar Pregnancy (Type III)

Case 1: A 31-year-old woman of childbearing age, G3P2, with a history of two cesarean deliveries in 2014 and 2016, was admitted to the hospital due to "6 weeks and 5 days of amenorrhea, accompanied by mild vaginal bleeding for 6 days." The serum HCG level was 1505 mIU/ml. Transvaginal ultrasound revealed a gestational sac at the site of the uterine scar, measuring 68 × 45 ×

74 mm, with an indistinct boundary between the sac and the anterior uterine wall. The myometrium appeared to be thinned to approximately 1.4 cm, and part of the sac seemed to reach the serosal layer. Color Doppler Flow Imaging (CDFI) detected abundant blood flow signals around and within the mixed echogenic area (as shown in Fig. 4). Pelvic MRI revealed a mass occupying the anterior uterine wall, protruding into the uterine cavity, with the disappearance of the junctional zone in the anterior uterine wall and near-total replacement of the myometrium by the mass. The serosal layer remained intact, and no abnormal signal was observed in the bladder wall or within the bladder (as shown in Fig. 5).

Figure 4: Ultrasound image

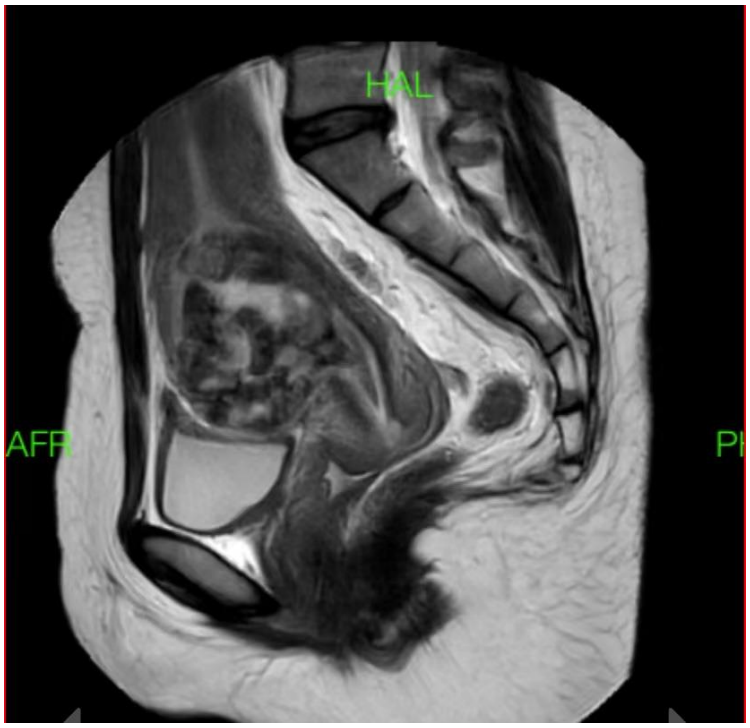

Figure 5: Pelvic MRI image

Case 2: A 39-year-old woman of childbearing age, G3P1, with a history of one cesarean delivery

in 2016, was admitted due to "7 weeks of amenorrhea, accompanied by mild vaginal bleeding for 3 days." The serum HCG level was 105,188 mIU/ml. Transvaginal ultrasound revealed a gestational sac at the site of the uterine scar, measuring 45 × 12 × 13 mm, with a surrounding ring-like hyperechoic area. The sac was seen bulging outward in the direction of the bladder, with the myometrium between the gestational sac and the bladder notably thinned to approximately 1.3 cm (as shown in Fig. 6).

Figure 6: Ultrasound image

4.2 Treatment Plan

The general treatment principles for Cesarean Scar Pregnancy (CSP) typically involve preoperative preparation, such as methotrexate treatment and/or uterine artery embolization (UAE) to terminate the embryo and reduce bleeding. Subsequently, laparoscopic or open surgery is performed to remove the lesion. However, studies have shown that UAE may have potential impacts on female fertility, possibly leading to ovarian function decline, intrauterine adhesions, fetal growth restriction, preterm birth, and other complications, thereby affecting fertility. Both of these patients expressed a strong desire for future fertility. After a thorough evaluation, our team opted for a laparoscopic resection of the scar pregnancy tissue, preceded by temporary uterine artery occlusion.

During the surgery, as shown in Fig. 7, we dissected the bilateral uterine arteries and temporarily clamped them to block blood flow, bypass the ureter. Using an ultrasonic scalpel, we completely excised the pregnancy tissue and trimmed the original cesarean scar. After forming a fresh wound, we closed the uterine incision in two layers using 2-0 absorbable sutures. Blood flow to the uterine arteries was then restored, and we observed good uterine perfusion with no bleeding in the surgical area. Intraoperative blood loss in both cases was less than 50 ml. The patient's physical recovery was good after surgery, and they were discharged smoothly on the third day. Two to three weeks after surgery, the serum HCG level returned to normal, and a follow-up ultrasound showed no masses requiring surgical treatment at the site of the uterine scar (as shown in Fig. 8). Menstruation resumed one month after surgery.

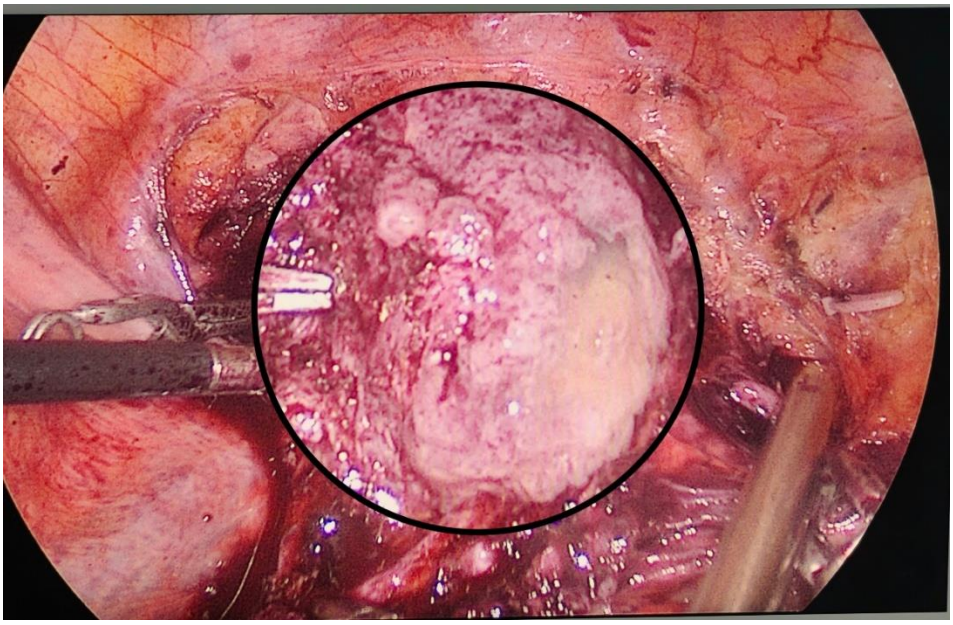

Figure 7: Schematic diagram of the lesion.

Figure 8: Ultrasound image (After surgery)

4.3 Follow-up

Post-treatment, it is essential to monitor the patient's blood β-hCG levels until normalization and conduct follow-up ultrasounds. Attention must be paid to vaginal bleeding and menstrual recovery, particularly sfor patients who did not undergo scar defect repair, as there remains a risk of retained chorionic tissue or local mass formation. Postoperative monitoring should be intensified, and patients should be informed of the potential risk of significant bleeding, with the possibility of additional conservative or surgical treatment if necessary.

For patients not planning to conceive within 2 years post-surgery, long-acting reversible contraception is recommended, such as intrauterine devices (IUDs) or subdermal implants. For those with plans for future pregnancies, it is advised to wait at least one year before attempting conception if scar defect repair was performed, and at least six months if no repair was done. Regardless of scar

defect repair status, subsequent pregnancies still carry risks of CSP, placenta accreta, and uterine rupture. Early ultrasound examination to confirm embryo implantation location and close monitoring throughout pregnancy are advised.

5. Conclusion

Cesarean Scar Pregnancy (CSP), particularly Type III, poses significant clinical challenges due to its complexity and high risk. Early diagnosis through ultrasound and MRI is crucial for effective intervention. A comprehensive treatment approach, including scar tissue removal, scar repair, and uterine artery embolization, significantly improves outcomes by managing bleeding and enhancing recovery. Postoperative monitoring and fertility planning are essential to prevent complications and guide future pregnancies. Continued research is needed to refine surgical techniques, develop better treatments, and improve patient outcomes.

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