

Impact of Subcutaneous Tissue Closure Techniques During Primary Cesarean Section on Postoperative Wound Complications: A Narrative Review

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Abstract

Postoperative wound complications are one of the major issues after cesarean section, with reported rates ranging from 3% to 30%. The apparent advantage of closing the subcutaneous layer is the reduction of wound tension and the obliteration of dead space in which serous fluid and blood may collect, resulting in infection and wound disruption. Continuous and interrupted subcutaneous suturing are commonly used techniques. The continuous technique uses a single uninterrupted suture and distributes tension evenly across the wound, whereas the interrupted technique uses individually tied stitches and allows point-by-point adjustment of tension. Published studies have examined wound infection, seroma, hematoma, wound separation, postoperative pain, operative time, and cosmetic outcome, but the overall impact of each technique remains influenced by obesity, glycemic control, subcutaneous tissue thickness, suture material, surgical asepsis, and surgeon preference. This narrative review discusses the rationale for subcutaneous tissue closure, the technical characteristics of continuous and interrupted suturing, their potential effects on post-cesarean wound complications, and the clinical factors that should guide selection of the closure method.

Keywords: Cesarean section; subcutaneous tissue; continuous suturing; interrupted suturing; surgical-site infection; wound complications; obesity.

1. Introduction

Cesarean section is among the most widely practiced obstetric surgical procedures worldwide. Due to the high frequency of cesarean section and its potential short- and long-term consequences, it is essential to determine the surgical technique that achieves optimal wound healing and cosmetic results. However, there is no standard technique for cesarean section, and surgeons use different methods for each step of the procedure. Different endpoints have been studied when comparing wound closure techniques, including wound complication rates, short-term cosmetic outcome, and long-term cosmetic outcome (Helmy et al., 2022).

Postoperative wound complications are one of the major issues after cesarean section, with an incidence ranging from 3% to 30%. Obesity, prolonged operative time, diabetes, patient age, anemia, associated infection such as chorioamnionitis, delayed labor with repeated vaginal examinations, and reduced nutrition are recognized risk factors for wound infection (Childs et al., 2020).

The apparent advantage of closing the subcutaneous layer is the reduction of wound tension applied to the tissues and the obliteration of dead space in which serous fluid and blood may collect, resulting in infection and wound disruption. Theoretical drawbacks include prolonged operative time, reduced tissue mobility, and the presence of foreign material in the wound acting as a focus for infection (Alalfy et al., 2019).

2. Post-Cesarean Wound Complications

Postoperative complications include superficial infection, wound dehiscence, and the presence of a fluid reservoir such as seroma or hematoma at the wound site. These complications affect approximately 3% to 15%

of women after cesarean section and may result in prolonged hospitalization, antibiotic therapy, and increased postpartum care costs (Temming et al., 2017).

The risk factors for post-cesarean wound complications include young maternal age, smoking, obesity, arterial hypertension, diabetes, chorioamnionitis, increased intrapartum blood loss, prolonged rupture of membranes, emergency cesarean section, repeated surgical delivery, suboptimal antibiotic prophylaxis, improper preparation of the surgical field, extended duration of surgery, and the surgical technique used for incision and closure (Slabuszewska-Jozwiak et al., 2021).

Obesity is a major risk factor for post-cesarean wound complications. The etiology is probably related to poor vascularity of subcutaneous fat, serous fluid collection, and hematoma formation. Obese women are prone to wound complications even with prophylactic antibiotics, and the risk of wound disruption increases with greater subcutaneous tissue thickness (Ekanem et al., 2023).

3. Rationale for Subcutaneous Tissue Closure

Closure of the subcutaneous fat decreases tension on the skin layer. Suture closure also reduces the rate of postoperative hematoma and seroma development and may prevent retraction of the scar below the level of the surrounding skin by closing dead space and achieving optimal leveling of the opposing wound sides (Alalfy et al., 2019; Saxena et al., 2021).

Aesthetic results after closure of the subcutaneous layer are important. Tension acting on a scar is considered a factor that may initiate hypertrophic scarring. Closure of dead space and the subcutaneous tissue layer may reduce tension on the skin layer and may lead to a superior aesthetic result by reducing strain on skin sutures (Parikh et al., 2022).

On the other hand, suture closure of subcutaneous tissue produces an inflammatory reaction against the suture material and could therefore result in poorer cosmesis. Although evidence suggests that closure of subcutaneous fat at the time of cesarean section reduces the risk of wound disruption in women with subcutaneous tissue thicker than 2 cm, its effect on cosmetic outcome is not sufficiently studied (Saeed and Haggag, 2023).

4. Continuous Subcutaneous Suturing Technique

The continuous subcutaneous suturing technique is a widely used method for wound closure in obstetric and gynecologic surgery. It involves placing a single, uninterrupted suture along the length of the wound within the subcutaneous layer. By distributing tension evenly across the wound, this method may reduce dehiscence and improve cosmetic outcome (Maged et al., 2019; Maheshwari and Khan, 2024).

Absorbable sutures such as Monocryl, Vicryl, or polydioxanone are generally preferred because they eliminate the need for removal and provide adequate wound support during healing. Monofilament sutures may reduce tissue drag and infection risk compared with braided materials (Butt et al., 2021).

The needle is inserted at one end of the wound, usually 5–10 mm from the wound edge, and a horizontal back-and-forth motion is used through the deep dermal or subcutaneous layer while avoiding penetration of the epidermis. Each pass should be placed at a uniform depth and distance to maintain consistent tension. The final suture is usually anchored with a buried knot to prevent irritation or exposure at the skin surface (Chittoria and Reddy, 2024).

Studies have suggested that, compared with interrupted sutures or staples, continuous subcutaneous suturing may be associated with better cosmetic outcome, lower infection rates, and decreased postoperative pain. It also requires fewer knots and may shorten closure time. Nevertheless, patient comorbidities, surgical environment, suture material, and tension control can influence wound outcomes (Saxena et al., 2021; Niederstatter et al., 2021).

Continuous suturing is not free of complications. Excessive tightness may cause skin dimpling or impaired circulation, and some studies have reported seroma or minor wound separation, particularly in obese

patients or women with poor glycemic control. Correct placement, appropriate surgical asepsis, and careful tension control are therefore essential (Agodi, 2024; Shea and Soper, 2019).

5. Interrupted Subcutaneous Suturing Technique

The interrupted subcutaneous suturing technique involves placement of individual sutures beneath the skin surface, with each stitch tied and cut separately. This technique provides precise wound-edge approximation, individual tension adjustment, and the ability to manage or remove an isolated suture without compromising the entire closure (Chittoria and Reddy, 2024).

Absorbable sutures such as Vicryl or Monocryl are commonly used. The needle is inserted approximately 5–10 mm from the wound edge, and a deep pass through the subcutaneous tissue provides support without penetrating the epidermis. Each stitch is placed at regular intervals and tied individually, with the knot buried and the suture tails cut short (Stulberg and Usatine, 2024).

The interrupted method may minimize tissue ischemia by preventing excessive pressure at a single point and may reduce the likelihood of necrosis. If localized infection or wound complication occurs, only isolated suture points may be affected, which can make local management easier than with a continuous suture (Devick and Hendrickson, 2021).

The principal disadvantages are the time required for individual placement and knotting and the increased amount of suture material. Multiple entry points and knots may increase foreign-body reaction, wound infection, fluid accumulation, or visible track marks if the technique is not performed precisely (Luo et al., 2023; Mohsen, 2024).

6. Comparison of Continuous and Interrupted Closure

Both techniques aim to approximate the subcutaneous tissues, eliminate dead space, support the skin closure, and reduce postoperative wound complications. The available literature does not establish one technique as universally superior in every patient. The main practical differences are summarized in Table 1.

Table 1. Practical comparison of continuous and interrupted subcutaneous suturing techniques

Characteristic	Continuous suturing	Interrupted suturing
Suture configuration	Single uninterrupted suture	Individually tied stitches
Tension control	Even distribution along the wound	Point-by-point adjustment
Closure time	Generally shorter	Generally more time-consuming
Knots and foreign material	Fewer knots	Multiple knots and more suture material
Potential advantages	Uniform approximation, fewer knots, favorable cosmetic outcome in some studies	Precise adjustment, localized management when one stitch is affected
Potential concerns	Excessive tension, dimpling, seroma, or minor separation	Track marks, tissue reaction, infection, or fluid accumulation at multiple entry points

Source: Adapted from the review-of-literature chapter and the cited literature (Alalfy et al., 2019; Maged et al., 2019; Saxena et al., 2021; Luo et al., 2023; Maheshwari and Khan, 2024).

7. Clinical Considerations

The selection of a closure technique should be individualized. Important considerations include maternal body mass index, subcutaneous tissue thickness, diabetes and glycemic control, anemia, evidence of infection, duration of surgery, expected wound tension, and the quality of tissue perfusion. Obesity and poor glycemic

control are particularly important because they increase the risk of seroma, hematoma, infection, delayed healing, and wound separation (Ekanem et al., 2023).

Surgeon experience and the ability to maintain accurate tissue approximation without excessive tension are also essential. Regardless of the selected technique, careful hemostasis, irrigation when indicated, appropriate antimicrobial prophylaxis, sterile technique, and postoperative wound surveillance remain central measures for reducing surgical-site complications (Shea and Soper, 2019).

Current evidence supports closure of the subcutaneous layer when the tissue depth is greater than 2 cm, but the optimal method of closure remains uncertain. Further well-designed randomized studies are required to compare continuous and interrupted closure in obese and non-obese women using standardized definitions of infection, seroma, hematoma, wound separation, pain, patient satisfaction, and long-term cosmetic outcome.

8. Conclusion

Subcutaneous tissue closure during primary cesarean section is intended to reduce dead space, decrease tension on the skin closure, and limit postoperative seroma, hematoma, infection, and wound disruption. Continuous suturing provides uniform tension distribution and generally requires less time and fewer knots, whereas interrupted suturing provides individual tension control and facilitates localized management when a wound problem develops. Both methods have potential advantages and drawbacks. The choice between continuous and interrupted subcutaneous suturing should therefore be based on patient-specific risk factors, subcutaneous tissue thickness, surgeon experience, and the clinical circumstances rather than on a single universal technique.

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