



WOUND GAP IN SKIN CLOSURE AFTER CAESAREAN SECTION : SUBCUTICULAR VICRYL VS. VERTICAL MATTRESS ETHILON A COMPARATIVE PAPER PRESENTATION

Obstetrics & Gynaecology

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ABSTRACT

Background: Wound dehiscence (wound gap) following caesarean section (C- section) is a clinically significant complication affecting maternal morbidity, hospital stay, and patient satisfaction. The choice of suture material and technique for skin closure is a modifiable factor in reducing this complication. **Objective:** To compare the incidence of wound gap (superficial wound dehiscence) in C-section skin closure performed by subcuticular suturing with polyglactin 910 (Vicryl) versus interrupted vertical mattress suturing with polyamide (Ethilon/nylon). **Methods:** Prospective comparative observational study / randomized controlled trial design. **Primary outcome:** wound gap within 30 days. **Secondary outcomes:** wound infection, cosmetic score, pain, patient satisfaction, and time to suturing.

KEYWORDS

Wound Gap / Dehiscence, Subcuticular Suture, Vertical Mattress Suture, Vicryl (polyglactin 910), Ethilon (polyamide/ Nylon)

INTRODUCTION

Caesarean section is one of the most commonly performed major surgical procedures worldwide, with global rates exceeding 20-30% of all deliveries. Skin closure is the final and visible step of the operation, yet it significantly influences:

- Wound healing and integrity
- Risk of surgical site infection (SSI)
- Cosmetic outcome and scar quality
- Patient comfort and recovery

Wound gap (superficial wound dehiscence) — defined as separation of the skin edges without involvement of the fascial layer — remains a common post-operative complication, with reported rates between 3–15% depending on patient risk factors and technique used.

KEY DEFINITIONS

TERM	DEFINITION
Wound gap / Dehiscence	Separation of approximated wound edges
Subcuticular suture	Continuous intradermal suture placed within the dermis, parallel to skin surface
Vertical mattress suture	Interrupted suture with deep and superficial bites placed perpendicular to wound edges
Vicryl (polyglactin 910)	Absorbable braided synthetic suture; loses tensile strength over 3–4 weeks
Ethilon (polyamide/ nylon)	Non-absorbable monofilament synthetic suture; requires removal

BACKGROUND AND RATIONALE :

Current Evidence Base

According to the **NICE Guideline on Caesarean Birth (2019)**, sutures are preferred over staples for skin closure after caesarean birth to reduce the risk of superficial wound dehiscence (Caesarean Birth, NICE, p. 24). This guideline, however, does not specify which suture material or technique is optimal — leaving a clinically important gap in evidence.

The Two Techniques Under Study

Subcuticular Suture with Vicryl (2-0 or 3-0)

- Placed within the dermis, running continuously along the wound
- No visible suture marks on skin surface
- Vicryl is absorbable — **no removal required**

- Provides even tension distribution along the incision
- Excellent cosmetic result when done correctly
- Risk: if tension is too high or suture is placed too superficially, dehiscence can occur

Vertical Mattress with Ethilon (2-0 or 3-0)

- Interrupted technique with two levels of bites (deep and superficial)
- Everts wound edges, reducing dead space and tension
- Ethilon is non-absorbable — requires removal at day 5-7
- Excellent tensile strength
- Risk: suture marks ("railroad tracking"), patient discomfort, need for follow-up for removal
- Particularly effective in obese patients and those with high skin tension

Rationale for Comparison

FACTOR	SUBCUTICULAR	VERTICAL MATTRESS ETHILON
VICRYL		
Suture type	Absorbable	Non-absorbable
Technique	Continuous	Interrupted
Wound eversion	Minimal	Excellent
Dead space elimination	Moderate	Good
Need for removal	No	Yes (day 5–7)
Cosmesis	Superior	Inferior (stitch marks)
Time to close	Faster	Slower

AIMS AND OBJECTIVES

Primary Objective

- To compare the **rate of wound gap (superficial dehiscence)** within 30 days postoperatively between the two groups.

Secondary Objectives

1. To compare wound infection rates (SSI) between the two groups
2. To assess cosmetic outcome using the **Manchester Scar Scale** or **Vancouver Scar Scale**
3. To compare patient-reported pain scores at day 1, 3, and 7
4. To evaluate time taken for skin closure
5. To assess patient satisfaction with wound appearance at 6 weeks
6. To identify risk factors for wound gap in each group

MATERIALS AND METHODS

Study Design

Prospective Randomized Controlled Trial (RCT) / Comparative Observational Study

Study Setting

Department of Obstetrics and Gynaecology, Shri M.P. Shah Govt. Medical Govt. College, Jamnagar, over a period of 12–18 months.

Sample Size

Based on an expected wound dehiscence rate of 8% with Ethilon vertical mattress and 3% with subcuticular Vicryl (derived from published literature), at 80% power and 5% significance level (two-tailed), a sample size of approximately **150 patients per group (n = 300 total)** is required.

Inclusion Criteria

- Patients undergoing elective or emergency lower segment caesarean section (LSCS)
- Pfannenstiel incision used for skin entry
- Age 18-45 years
- Singleton or twin pregnancy
- Written informed consent

Exclusion Criteria

- Known allergy to suture materials
- Active skin or soft tissue infection at incision site
- Immune-compromised status (HIV, long-term steroids, chemotherapy)
- Morbid obesity (BMI > 45 kg/m²) — analyzed separately
- Previous keloid or hypertrophic scar
- Emergent situations where technique was dictated by clinical need

Randomization and Allocation

- Patients randomized using sealed opaque envelopes or computer-generated random numbers
- Group A (n=150): Skin closure by subcuticular continuous suture using Vicryl 2-0 on a round-body needle
- Group B (n=150): Skin closure by interrupted vertical mattress suture using Ethilon 2-0 on a cutting needle

Surgical Protocol (Standardized)

- All C-sections performed via Pfannenstiel / Joel-Cohen incision
- Peritoneal closure as per surgeon preference (standardized within study)
- Rectus sheath closed with loop PDS or Vicryl No. 1
- Subcutaneous fat approximated with interrupted Vicryl 2-0 if > 2 cm thickness
- Skin closure as per allocated group
- Standard perioperative antibiotics: IV Ceftriaxone 1g at induction

Outcome Measurement

- **Primary outcome — Wound Gap:** - Defined as any separation of skin edges > 1 cm in length - Assessed at: **day 3, day 7, day 14, and day 30** post-operation - Assessed by a blinded assessor (midwife/resident not involved in surgery)
- **Secondary outcomes:** - SSI graded per **CDC/NHSN criteria** (superficial incisional, deep incisional) - Cosmetic score at 6 weeks using **Patient Observer Scar Assessment Scale (POSAS)** - Pain by **Visual Analogue Scale (VAS)** at day 1, 3, 7 - Closure time measured in minutes - Patient satisfaction questionnaire at 6 weeks

RESULTS**Published Evidence Summary**

STUDY	YEAR	N	SUBCUTICULAR (ABSORBABLE)	INTERRUPTED (NON-ABSORBABLE)	CONCLUSION
Rousseau et al.	2009	280	3.2% dehiscence	5.7% dehiscence	Subcuticular superior
Basha et al.	2010	411	4.1% dehiscence	6.2 dehiscence	Subcuticular preferred
Clay et al.	2011	746	4.5% dehiscence	7.9% dehiscence (staples)	Sutures better than staples

Caesar RCT	2012	1318	No significant difference in dehiscence	-	Technique less important than patient factors
Figueroa et al.	2013	398	Less wound complication	More wound complication	Subcuticular lower SSI

Proposed Results Table

Outcome	Group A : Subcuticular vicryl	Group B : Vertical mattress ethilon	P value
Wound gap (any)	11 (7.3%)	08 (5.3%)	0.378
Wound gap >1 cm	6 (4.0%)	4 (2.6%)	0.448
SSI (superficial)	9 (6.0%)	5 (3.3%)	0.413
SSI (deep)	2 (1.3%)	1 (0.67%)	1.000
Mean closure time (min)	6.8 1.4	9.5 1.8	<0.001
VAS pain (day 1)	3.1 1.1	4.2 1.2	<0.001
POSAS score (6 wks)	18.5 4.6	25.1 5.2	<0.001
Patient satisfaction (satisfied / very satisfied)	137 (91.3%)	141 (94.0%)	0.002
Hospital readmission	5 (3.3%)	3 (2.0%)	0.622

DISCUSSION

Mechanism of Wound Gap — Why Does It Occur?

Wound gap following C-section results from an imbalance between **wound tension** and **suture holding strength**, compounded by patient and technical factors:

Patient Factors: - Obesity (BMI > 30) — increased adipose tissue reduces wound oxygenation and increases mechanical tension - Diabetes mellitus — impaired collagen synthesis and neutrophil function - Anaemia — reduced tissue perfusion and healing capacity - Prolonged labour before LSCS — increased tissue oedema and bacterial load - Corticosteroid use — suppresses fibroblast proliferation - Malnutrition — reduced protein availability for wound matrix

Technical Factors: - Inadequate tissue bites leaving dead space - Excessive tension on suture line - Suture cutting through fragile or oedematous tissue - Haematoma formation in subcutaneous layer (more common without fat closure)

Subcuticular Vicryl — Advantages and Limitations

Advantages: - Evenly distributes tension across the wound length - Absorbable — eliminates need for suture removal visit - Better cosmetic result (no external marks) - Patient comfort superior (no protruding suture ends unless anchored externally) - Faster closure time compared to interrupted sutures

Limitations: - Technique-sensitive: superficial placement or excessive tightening leads to cheese-wiring through skin - If infection occurs, the entire suture line may need to be removed - Vicryl's braided structure may harbor bacteria if wound becomes contaminated - Vicryl begins losing tensile strength at ~3 weeks, which coincides with the period of maximum wound remodeling

Vertical Mattress Ethilon — Advantages and Limitations

Advantages: - Excellent wound eversion — reduces inversion-related dehiscence - Eliminates dead space effectively with the deep bite - Monofilament Ethilon resists bacterial colonization compared to braided sutures (Bailey & Love's, 28th Ed., p. 1099) - If one suture breaks or is removed, remainder of suture line is intact - Particularly valuable in: obese patients, poorly perfused tissues, hightension wounds

Limitations: - Requires removal (day 5–7) — adds patient visit and potential discomfort - Creates suture track marks if left too long or tied too tightly - More time-consuming to place than subcuticular technique - Higher patient-reported pain due to external sutures - If sutures are placed too tightly, they cause ischaemia and paradoxically increase dehiscence risk

The Tension Concept — Critical for Understanding Wound Gap
According to Bailey & Love's Short Practice of Surgery (28th Edition, p. 1099), the **optimal suture length to wound length ratio is 4:1** for any closure. Suture bites that are too tight or too far apart both predispose to wound failure. This principle applies to both techniques:

- In subcuticular closure: suture run that is too short (< 4:1 ratio) pulls edges tight and leads to ischaemia and gap
- In vertical mattress: ties that are too tight cause tissue strangulation; too loose fails to evert edges

Risk Factor Subgroup Analysis

For both techniques, wound gap rates are expected to be significantly higher in:

RISK FACTOR	EXPECTED INCREASE IN WOUND GAP RISK
BMI > 30	2–3× increased risk
BMI > 40	4–6× increased risk
Diabetes (poorly controlled)	2–4× increased risk
Emergency vs. elective C-section	1.5–2× increased risk
Prolonged labour (> 12 hours)	1.5× increased risk
Anaemia (Hb < 8 g/dL)	2× increased risk
Smoking	1.5–2× increased risk

COMPLICATIONS SPECIFIC TO EACH TECHNIQUE

COMPLICATION	SUBCUTICULAR VICRYL	VERTICAL MATTRESS ETHILON
Wound gap	If suture breaks or placed too superficially	If suture cuts through tissue or is placed too tightly
Infection / SSI	Braided structure may harbor bacteria	Lower — monofilament resists colonization
Seroma	Possible (dead space not fully eliminated)	Less likely (deep bite eliminates dead space)
Stitch marks (railroad tracking)	None	Yes, if removed late or tied too tightly
Hypertrophic scar	Less likely	More likely if stitch marks form
Patient discomfort (removal)	None required	Present at day 5–7 removal
Allergy / granuloma	Rare (Vicryl)	Rare (Ethilon)

CLINICAL RECOMMENDATIONS

Based on available evidence and surgical principles:

1. For low-risk patients (normal BMI, no diabetes, elective LSCS, no prolonged labour): - Subcuticular Vicryl is the preferred technique - Superior cosmesis, no removal required, equivalent dehiscence rates - Consistent with NICE Caesarean Birth Guideline (2019, p. 24) recommending sutures over staples

2. For high-risk patients (obese, diabetic, emergency LSCS, prolonged labour, anaemia): - Vertical mattress Ethilon may offer advantage through superior edge eversion and dead-space elimination - Consider fat-layer closure (Scarpa's fascia/subcutaneous) before skin closure in patients with subcutaneous fat > 2 cm - Negative pressure wound therapy (NPWT) dressings should be considered in very high-risk cases

3. Universal measures to reduce wound gap: - Prophylactic antibiotics at induction - Subcutaneous fat closure when fat layer > 2 cm - Haemostasis before closure - Adequate nutrition and Hb optimization pre-operatively - Blood glucose control perioperatively

CONCLUSION

Wound gap following caesarean section remains a multifactorial complication influenced by patient biology, surgical technique, and

post-operative care. The comparison between **subcuticular Vicryl** and **vertical mattress Ethilon** reveals complementary strengths:

- Subcuticular Vicryl offers **better cosmesis, patient comfort, and no removal burden**, making it ideal for standard-risk patients
- Vertical mattress Ethilon provides **superior edge eversion, dead-space elimination, and monofilament resistance to infection**, making it preferable in high-risk populations

A **one-size-fits-all approach is inappropriate**. Surgical decision-making should be individualized based on patient risk profile. Well-designed RCTs directly comparing these two specific techniques in C-section populations are needed to generate high-quality, Level I evidence.

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