

Original Research Article

PROPORTION OF PATIENTS WHO DEVELOPED SIGNS OF POSTOPERATIVE WOUND INFECTION FOLLOWING PRIMARY WOUND CLOSURE BY SUBCUTICULAR COMPARED TO CONVENTIONAL INTERRUPTED SUTURING METHOD AFTER ELECTIVE SURGERY IN A TERTIARY CARE CENTRE IN SOUTH KERALA

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ABSTRACT

Background: Primary wound closure following surgery can be performed using various techniques, among which conventional interrupted suturing is widely practiced. Alternatively, the subcuticular continuous suturing method, which avoids piercing the skin surface, is proposed to offer better cosmetic outcomes and may reduce the risk of postoperative wound infections by preventing the translocation of superficial epidermal bacteria into deeper dermal layers. However, there remains uncertainty regarding its superiority, with limited consensus in the literature. This study aimed to compare the incidence of postoperative wound infection between subcuticular and interrupted suturing techniques following elective surgical procedures in a tertiary care center in South Kerala.

Materials and Methods: This observational cohort study included 182 patients undergoing elective surgical procedures in the Department of General Surgery at Dr. Somervell Memorial CSI Medical College, Karakonam, over a 19-month period. Participants were equally divided into two groups based on the method of skin closure interrupted or subcuticular suturing. Data were collected using a standardized proforma based on clinical symptoms and wound examination findings.

Results: The incidence of postoperative wound infection-related signs such as erythema, discharge, persistent wound pain, fever, wound odor, abnormal laboratory markers, or microbial isolation was comparable between the two groups with no significant difference. However, the occurrence of wound dehiscence involving deep tissue separation was significantly lower in the subcuticular group compared to the interrupted group (p < 0.05).

Conclusion: Subcuticular suturing may offer an advantage over interrupted suturing in reducing deep tissue separation associated with wound infections following elective surgery, despite similar overall infection rates. These findings suggest that subcuticular closure could be a preferred technique for elective surgical skin closure, warranting further large-scale studies for confirmation.

Keywords: Subcuticular suturing, interrupted suturing, primary wound closure, postoperative wound infection.

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INTRODUCTION

Wound closure is an essential component of surgical practice and plays a pivotal role in achieving hemostasis, preventing infection, and promoting optimal healing with favorable cosmetic results.^[1] Surgeons manage a broad range of wounds, from minor abrasions to extensive surgical incisions, and over time, techniques for wound closure have evolved significantly. Current methods include sutures, staples, and adhesives, with suturing remaining the most widely employed approach in primary wound closure. The main objectives of primary closure are to prevent infection, control bleeding, and ensure a cosmetically acceptable result.^[2]

The choice of suture material and closure technique is influenced by various factors such as wound type, depth, tension, and desired cosmetic outcomes. Simple interrupted sutures, which use separate stitches, are commonly preferred due to their ability to provide precise approximation of skin edges and underlying fascia, good tensile strength, and minimal compromise to cutaneous circulation.^[3] For deeper or more tension-prone wounds, mattress sutures placed either vertically or horizontally can offer additional support by distributing tension more evenly across wound margins.^[4,5] These sutures may be placed temporarily and removed once tissue tension is adequately reduced or left in place when necessary to minimize the risk of wound dehiscence.^[6,7]

An alternative approach to interrupted suturing is the subcuticular technique, performed either as simple or continuous intradermal sutures. In this method, the skin is not externally pierced, potentially resulting in improved cosmetic outcomes.^[8] Importantly, this technique may also prevent the implantation of epidermal bacteria into the dermis and subcutaneous layers, thereby reducing the risk of postoperative wound infections compared to conventional interrupted closure.^[9–11] Subcuticular sutures are typically placed just beneath the epidermis and are often absorbable, eliminating the need for removal.^[12] The increased availability of synthetic, absorbable suture materials has further contributed to the popularity of this technique. Nevertheless, there remains debate regarding the impact of subcuticular sutures on wound-related complications, and no definitive consensus exists on the ideal method for skin closure in elective surgery.^[13]

Wound healing is a complex and tightly regulated biological process that may be disrupted by both endogenous factors, such as patient comorbidities, and exogenous influences, primarily microbial colonization.^[14] The presence of microorganisms in surgical wounds is inevitable, and many may become pathogenic under conducive local conditions, particularly when host defenses are compromised.^[15,16] Factors such as wound moisture, tissue perfusion, and immune status can influence bacterial proliferation and infection risk.^[17] Surgical

site infections (SSIs) are among the most common postoperative complications, often resulting in prolonged hospitalization, increased healthcare costs, and unsatisfactory cosmetic outcomes.^[18]

MATERIALS AND METHODS

Study Design and Setting: This hospital-based prospective cohort study was conducted in the Department of General Surgery at Dr. SMCSI Medical College, Karakonam, a tertiary care center in South Kerala, India. The institution includes four surgical units performing both elective and emergency procedures, all of which share a common operation theatre and inpatient wards.

Study Period: The study was carried out over 19 months, from January 2023 to July 2024.

Study Population: Patients undergoing primary skin closure after elective surgical procedures were included. Based on the closure technique, participants were assigned to two groups:

Group A (Subcuticular group) received continuous subcuticular sutures, while Group B (Interrupted group) received conventional interrupted sutures.

Inclusion Criteria

Patients undergoing elective surgeries with primary skin closure and who provided written informed consent.

Exclusion Criteria

Patients were excluded if they declined consent, underwent emergency surgeries, or dropped out before completing follow-up.

Sampling Method and Sample Size

A non-probability consecutive sampling technique was adopted. Eligible patients were recruited until the required sample size was achieved.

Sample size was calculated using the formula:

 $n=(Z\alpha/2+Z1-\beta d)2\times 2\times P\times Qn$

 $\label{eq:left} $$ \left(\frac{Z_{alpha/2} + Z_{1-\beta}}{d}\right)^2 + Q = \frac{1-\beta^2}{2\times 2\times P\times Q} \\ \label{eq:left} $$ Qn=(dZ\alpha/2+Z1-\beta)^2\times 2\times P\times Q $$ Where: $$ does not set of the se$

- $Z\alpha/2=1.96Z_{\alpha/2}=1.96Z\alpha/2=1.96$,
- $Z1-\beta=0.84Z \{1-\beta=0.84Z\} = 0.84Z1-\beta=0.84$,
- P1=17.4%P_1 = 17.4\%P1=17.4%, P2=4.4%P_2 = 4.4\%P2=4.4%,
- $P=(P1+P2)/2=10.9P = (P_1 + P_2)/2 = 10.9P=(P1+P2)/2=10.9$,
- Q=100-P=89.1Q = 100 P = 89.1Q=100-P=89.1,
- d=P1-P2=13d = P 1 P 2 = 13d=P1-P2=13.
- The calculated sample size per group was 91 patients. **Operational Definitions:** Post-operative wound infection was defined by the presence of one or more of the following: erythema, serous or purulent discharge, wound dehiscence, positive wound culture, postoperative fever, leukocytosis (TLC
- >11,000/mm³), or CRP >10 mg/dL. Subcuticular Suturing refers to continuous suture

placement within the dermal layer.

Interrupted Suturing involves multiple individual full-thickness sutures with separate knots.

Data Collection Procedure: Patients were evaluated preoperatively and categorized into either group by the operating consultant. Standard preoperative protocols, including hair clipping and prophylactic antibiotics, were followed. Wounds were assessed for infection on postoperative day 3 after dressing removal.

Interviews were conducted in the local language, and findings were recorded by the principal investigator and verified by the study supervisor. Postoperative care included antibiotics and paracetamol.

Data Collection Tools: Data on sociodemographic and clinical variables were collected using a structured, pretested proforma.

Study Variables: Independent variables included age and gender. Dependent variables were clinical indicators of wound infection (e.g., local signs, lab markers, microbial culture). Covariates such as diabetes mellitus, immunosuppressive drug use, and viral seropositivity were also noted.

Statistical Analysis: Data entry was performed in Microsoft Excel and analyzed using SPSS (trial version). Categorical variables were reported as proportions; continuous variables were expressed as mean \pm standard deviation. The Chi-square test or independent t-test was used to assess significance, with a p-value < 0.05 considered statistically significant.

Ethical Considerations: The study received approval from the Institutional Scientific and Ethics Committees. Informed consent (English and Malayalam) was obtained from all participants. Data confidentiality was maintained through secure, password-protected systems for up to five years. There were no financial implications for participants, and surgical decisions remained uninfluenced by the study team.

Consent: All participants provided informed consent. Forms were available in both English and Malayalam to ensure clarity and comprehension.

RESULTS

The age distribution of patients in both the interrupted and subcuticular suture groups was comparable. The majority of patients in both groups belonged to the 50–59 years age group (31.8% in interrupted and 30.7% in subcuticular), followed by the 40–49 years group. The gender distribution was also similar between the groups, with a nearly equal proportion of males and females in each group (interrupted: 52.7% male, 47.3% female; subcuticular: 49.5% male, 50.5% female). This indicates that both groups were well-matched in terms of baseline demographic characteristics.

Table 1: Distribution of Study Subjects Based on Age and Gender.								
Category	Subcategory	Interrupted Suture	%	Subcuticular Suture	%			
		Group (n=91)		Group (n=91)				
Age (years)	10 to 19	4	4.40%	4	4.40%			
	20 to 29	9	9.90%	7	7.70%			
	30 to 39	14	15.40%	17	18.70%			
	40 to 49	20	22.00%	17	18.70%			
	50 to 59	29	31.80%	28	30.70%			
	60 to 69	6	6.60%	13	14.30%			
	70 to 79	9	9.90%	5	5.50%			
Gender	Male	48	52.70%	45	49.50%			
	Female	43	47.30%	46	50.50%			
Total Gender		91	100%	91	100%			

Table 2: Distribution of Study Subjects Based on Symptoms and Clinical Examination Findings.							
Parameter	Category	Interrupted Suture Group (n=91)	%	Subcuticular Suture Group (n=91)	%	p- value	Significance
Pain at wound	Yes	6	6.60%	2	2.20%	0.278	Not Significant
site	No	85	93.40%	89	97.80%		
Fever	Yes	5	5.50%	1	1.10%	0.211	Not Significant
	No	86	94.50%	90	98.90%		
Wound odour	Yes	0	0.00%	0	0.00%		Not Applicable
	No	91	100.00%	91	100.00%		
Erythema	Yes	8	8.80%	3	3.30%	0.12	Not Significant
around wound	No	83	91.20%	88	96.70%		
Discharge from wound	Serous discharge	3	3.30%	1	1.10%	0.303	Not Significant
	Pus discharge	5	5.50%	2	2.20%		
	No discharge	83	91.20%	88	96.70%		
Separation of	Yes	4	4.40%	0	0.00%	0.043	Significant
tissues	No	87	95.60%	91	100.00%		

The incidence of symptoms and clinical findings such as pain at the wound site, fever, erythema, and wound discharge were slightly higher in the interrupted suture group compared to the subcuticular group; however, the differences were not statistically significant for most parameters. Notably, separation of wound tissues was observed only in the interrupted suture group (4.4%) and was statistically significant

(p = 0.043), suggesting a higher risk of wound dehiscence with interrupted sutures. No wound odour

was reported in either group, indicating good overall infection control.

Parameter	Category	Interrupted	%	Subcuticular	%	p-	Significance
Turumeter	Caregory	Suture Group (n=91)	,.	Suture Group (n=91)		value	2-g
Pain at wound site	Yes	6	6.60%	2	2.20%	0.278	Not Significant
	No	85	93.40%	89	97.80%		
Fever	Yes	5	5.50%	1	1.10%	0.211	Not Significant
	No	86	94.50%	90	98.90%		
Wound odour	Yes	0	0.00%	0	0.00%		Not Applicable
	No	91	100.00%	91	100.00%		
Erythema around wound	Yes	8	8.80%	3	3.30%	0.12	Not Significant
	No	83	91.20%	88	96.70%		
Discharge from wound	Serous discharge	3	3.30%	1	1.10%	0.303	Not Significant
	Pus discharge	5	5.50%	2	2.20%		
	No discharge	83	91.20%	88	96.70%		
Separation of tissues	Yes	4	4.40%	0	0.00%	0.043	Significant
	No	87	95.60%	91	100.00%		
Elevated total leukocyte count	Yes	7	7.70%	2	2.20%	0.169	Not Significant
	No	84	92.30%	89	97.80%		
Increased CRP	Yes	5	5.50%	1	1.10%	0.211	Not Significant
	No	86	94.50%	90	98.90%		~

This table extends the analysis to include laboratory markers. Postoperative elevated total leukocyte count (7.7% vs 2.2%) and increased CRP (5.5% vs 1.1%) were observed more frequently in the interrupted suture group, though these differences were not statistically significant. These findings are consistent with a slightly higher but not statistically meaningful trend toward inflammation or infection in the interrupted suture group. The only statistically significant finding remains tissue separation, again seen only in the interrupted group.

Table 4: Distribution of Study Subjects Based on Symptoms, Clinical, Lab, and Additional Parameters							
Parameter	Category	Interrupted Suture Group (n=91)	%	Subcuticular Suture Group (n=91)	%	p- value	Significance
Pain at wound site	Yes	6	6.60%	2	2.20%	0.278	Not Significant
	No	85	93.40%	89	97.80%		
Fever	Yes	5	5.50%	1	1.10%	0.211	Not Significant
	No	86	94.50%	90	98.90%		
Wound odour	Yes	0	0.00%	0	0.00%		Not Applicable
	No	91	100.00%	91	100.00%		
Erythema around wound	Yes	8	8.80%	3	3.30%	0.12	Not Significant
	No	83	91.20%	88	96.70%		
Discharge from wound	Serous	3	3.30%	1	1.10%	0.303	Not Significant
	Pus	5	5.50%	2	2.20%		
	None	83	91.20%	88	96.70%		
Separation of tissues	Yes	4	4.40%	0	0.00%	0.043	Significant
	No	87	95.60%	91	100.00%		
Elevated WBC count	Yes	7	7.70%	2	2.20%	0.169	Not Significant
	No	84	92.30%	89	97.80%		
Increased CRP	Yes	5	5.50%	1	1.10%	0.211	Not Significant
	No	86	94.50%	90	98.90%		Ŭ
Organism isolated from wound	Yes	3	3.30%	1	1.10%	0.621	Not Significant
	No	88	96.70%	90	98.90%		
Pre-op viral markers positive	Yes	0	0.00%	0	0.00%		Not Applicable
	No	91	100.00%	91	100.00%		
Diabetes mellitus	Yes	35	38.50%	35	38.50%	1	Not Significant
	No	56	61.50%	56	61.50%		
On immunosuppressive drugs	Yes	0	0.00%	0	0.00%		Not Applicable
~	No	91	100.00%	91	100.00%		

The comprehensive analysis of symptoms, laboratory markers, microbiological findings, and comorbidities reveals several key observations. Microorganisms were isolated from wound discharge in 3.3% of patients in the interrupted suture group and in 1.1% of those in the subcuticular group; however, this difference was not statistically significant. All patients tested negative for pre-operative viral markers such as HIV, HBsAg, and HCV, ensuring uniform baseline health status regarding infectious risks. The prevalence of diabetes mellitus was identical in both groups (38.5%), indicating a balanced distribution of this significant comorbidity. Additionally, no patients in either group were on immunosuppressive therapy, thereby eliminating a potential confounding variable that could influence wound healing. Overall, the findings support the earlier observations that subcuticular suturing may offer slightly better wound-related outcomes particularly in terms of maintaining tissue integrity even though most of the measured parameters did not show statistically significant differences between the groups.

DISCUSSION

This study compared the proportion of patients who developed signs of postoperative wound infection following skin closure using either conventional interrupted sutures or continuous subcuticular sutures after elective surgical procedures. The findings suggest that although the subcuticular technique showed a numerically lower rate of wound-related complications, most differences between the two groups were not statistically significant.

A comparable retrospective study conducted at the Department of Orthopedic Surgery, Xiangya Hospital, Central South University, China, evaluated postoperative outcomes in 106 patients who underwent total knee arthroplasty between January 2017 and June 2019. The researchers concluded that continuous subcuticular skin closure was associated with better wound appearance, but neither closure technique demonstrated a definitive advantage in terms of efficacy or infection risk following surgery.^[19] In agreement with that study, our findings also showed that the rates of postoperative wound infection signs were similar between the two groups, regardless of age, gender, diabetic status, postoperative fever, persistent wound pain, wound odor, erythema, discharge, or microbial culture positivity.

No statistically significant differences were observed in postoperative pain between the groups (p = 0.278). Postoperative fever occurred in 5 patients (5.5%) in the interrupted suturing group and 1 patient (1.1%) in the subcuticular group (p = 0.211). Neither group reported wound odor as a complication. Erythema was observed in 8 patients (8.8%) in the interrupted group and 3 patients (3.3%) in the subcuticular group, with no significant difference (p = 0.120). Discharge from the wound, either serous or purulent, was seen in 8 patients (8.8%) in the interrupted group compared to 3 patients (3.3%) in the subcuticular group, a difference that was not statistically significant (p = 0.303). Similarly, elevated total leukocyte count was observed in 7 patients (7.7%) from the interrupted group and 2 patients (2.2%) from the subcuticular group (p = 0.169). Elevated C-reactive protein (CRP) levels were recorded in 5 patients (5.5%) in the interrupted group and in 1 patient (1.1%) in the subcuticular group (p = 0.211). Microbial growth from wound cultures was positive in 3 patients (3.3%) in the interrupted group and 1 patient (1.1%) in the subcuticular group, showing no statistically significant difference (p = 0.621).

Despite the trend toward fewer postoperative wound complications in the subcuticular group, these differences did not reach statistical significance. However, a noteworthy finding was the significantly lower incidence of deep tissue separation, a serious complication, in the subcuticular group compared to the interrupted group (p = 0.043). In the interrupted group, 4 patients (4.4%) experienced wound dehiscence involving deep tissue layers, whereas no such cases were reported in the subcuticular group. This difference may be attributed to the uniform distribution offered tension by continuous subcuticular suturing, which potentially reduces the risk of tissue separation.

These findings suggest that while subcuticular suturing may not significantly alter the overall incidence of postoperative wound infection, it may offer a protective advantage against deep tissue separation. Further randomized controlled trials with larger sample sizes are warranted to validate these observations and assess long-term outcomes, including scar formation and patient satisfaction. **Limitations**

This observational study used non-systematic sampling, limiting generalizability. The sample size addressed only the primary outcome, restricting analysis of effect modifiers. Lack of randomization, blinding, and control for variables like diabetic status further limits internal validity. Findings apply only to elective surgeries and may not extend to emergency procedures.

CONCLUSION

This hospital-based comparative study involving 182 patients found no significant difference in the overall incidence of postoperative wound infection between subcuticular and conventional interrupted suturing techniques following elective surgery. However, subcuticular suturing was associated with a significantly lower rate of deep tissue separation (p < 0.05), suggesting a potential advantage in minimizing wound-related complications. Larger, randomized controlled trials are warranted to validate these findings and support broader clinical adoption.

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