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Original Research Article

Comparison of Surgical Site Infection in Absorbable and Non-Absorbable Sutures Among Patients Undergoing Abdominal Wound Closure After Laparotomy: A Randomized Controlled Trial

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Abstract: *Surgical site infection remains a common postoperative complication following laparotomy and is influenced by several operative factors, including the type of suture material used for abdominal wound closure.* ***Objective:*** *To compare the frequency of surgical site infection in absorbable and non-absorbable sutures in patients undergoing abdominal wound closure after laparotomy.* ***Methodology:*** *This study included 144 patients undergoing abdominal wound closure after laparotomy and were allocated into two equal groups using blocked randomisation. Group A underwent wound closure with an absorbable polydioxanone suture, while Group B received closure with a non-absorbable polypropylene suture. Surgical site infection (SSI) was assessed in both groups at 21 days post-procedure. Data was analyzed using SPSS 27.* ***Results:*** *The mean age of patients in Group A was 43.76 ± 15.44 years, while in Group B it was 46.53 ± 14.43 years. In both groups, males had a majority. A statistically significant difference in SSI incidence was observed. In the absorbable suture group, 16 patients (22.2%) developed an SSI. In the non-absorbable suture group, 30 patients (41.7%) developed an SSI (p=0.01).* ***Conclusion:*** *The frequency of surgical site infection was significantly higher in non-absorbable sutures in patients undergoing abdominal wound closure after laparotomy as compared to absorbable sutures.*

Keywords: Surgical site infection, Absorbable suture, Non-absorbable suture, Abdominal closure, Laparotomy, Randomised controlled trial.

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Introduction

Laparotomies are highly versatile surgical procedures that are extensively used in many different medical specialties such as cancer, gynecology, urology, and general surgery. A study included patients treated with laparotomy involved 60.2% males and 39.8% females. Reported perforated peptic ulcer was 37.7%, ruptured appendix 25.0%, typhoid perforation 18.6%. However, overall morbidity and mortality rates were 33.8% and 28.5%, respectively (1-3).

Contingent on the exact surgical goal and organs being operated on, the laparotomy incision size varies (3). The surgeon plans the size and site of the incision to ensure adequate access to the target area while minimizing damage to nearby tissues. When noninvasive diagnostics cannot reliably identify symptoms, a laparotomy may be essential to visually inspect the abdominal organs and detect any irregularities (4,5). This is particularly common in acute abdomen, where identifying the underlying cause of the symptoms may require prompt surgical intervention (6).

The materials for absorbable sutures degrade and are ultimately absorbed by the body. Since these sutures break down naturally within tissues, there is no need to remove them. Based on the substance, the rate of absorption varies; some absorbable sutures take weeks to absorb, while others take months (7). Materials such as polyglycolic acid, polylactic acid, and caprolactone are frequently used in absorbable sutures (8). Conversely, nonabsorbable sutures are made of materials the body cannot degrade, and they remain in place unless removed. When tensile strength is needed or when absorbable sutures would not provide sufficient support, non-absorbable sutures are utilized. Surgical site infection (SSI) arises after laparotomy. At the same time, there have been developments in surgical procedures, antibiotic prophylaxis, and infection control measures; yet SSI continues to be a problematic complication usually associated with abdominal surgery. During laparotomy, the skin's integrity is compromised, exposing underlying tissues to the external environment, thereby increasing the likelihood of SSI (9-12).

Absorbable sutures may not provide long-term support for closure of the skin layer, and Non-absorbable sutures are favored in situations where the suture material needs to remain in place for a prolonged period to support tissues. Due to the scarcity of literature on these suturing techniques for local wound closure following laparotomy, this study aims to compare the frequency of surgical site infection associated with absorbable and non-absorbable sutures in patients undergoing abdominal wound closure after laparotomy. The findings will be crucial for enabling surgeons to make informed decisions that promote optimal wound healing and recovery following laparotomy procedures.

Methodology

This study was conducted as a randomized controlled trial in the Department of Surgery at Saidu Group of Teaching Hospital, Swat, from 03-November-2024 to 03-April-2025. An ethical approval was obtained from the hospital's IRB. The WHO sample size calculator was used to determine the sample size by keeping the following assumptions: the frequency of surgical site infection (23.2%) (12) in absorbable sutures, and the frequency of surgical site infection in non-absorbable sutures (45.5%) (12) among patients who underwent abdominal wound closure after laparotomy. Keeping 95% confidence level and 80% power. The calculated sample size is 144 (72 in each group). A consecutive nonprobability sampling technique was used.

Selected patients were 18 to 65 years old of either gender, undergoing abdominal wound closure after laparotomy. Laparotomy was defined as a surgical approach that involves making a large incision in the wall of the abdomen to attain access to the abdominal cavity. This incision allows for visual inspection and operation of the organs within the abdomen, including the liver, stomach, intestines, spleen, and pancreas, due to abdominal trauma and acute abdomen/infections. Patients who were pregnant, had a history of previous abdominal surgery, or had a bleeding disorder were excluded.

After obtaining informed written consent from the patients, their demographic details, such as age, gender, BMI, educational status, occupation status, socioeconomic status, and residence, were recorded. All patients undergoing abdominal wound closure after laparotomy under general anesthesia were divided into two groups (A & B) by using a blocked randomization technique. Patients in Group A were treated with absorbable suture (Polydiaxanone); all abdominal wall layers were included in a single layer. Outside, a bite was taken 2 cm from the cut edge of the linea alba. The needle emerged via the other side diagonally, 2 cm from the edge and 4 cm above or below the first bite. This strand was crossed near the free end of the suture and sustained diagonally outside-in at 90 degrees to the initial diagonal. A bite was taken from the inside out, and the end was secured with a free end of suture to resemble the linea alba. Patients in Group B were treated with Non-absorbable suture (Polypropylene) for the closure of all layers of the abdominal wall in a single layer. Externally, a bite was made 2 cm away from the incised border of the linea alba. The needle was inserted diagonally on the opposite side, 2 cm away from the edge, and either 4 cm above or below the first puncture. The strand was intersected near the loose end of the suture and secured diagonally from the outside to the inside at a 90-degree angle to the original diagonal. A portion was removed from the interior, starting from the center and moving outward, and the remaining part was fastened using a loose end of suture to imitate the linea alba. Surgical site infections were observed after 21 days in both groups. SSI was determined among patients presenting with all of the following complaints: fever> 39 oC, swelling, tenderness, and pain (VAS>4) at the surgical site. Diagnosis was established by clinical evaluation 21 days after the procedure, which revealed pleural drainage from the wound site. This whole assessment was performed under the supervision of a surgeon with at least 5 years of post-fellowship experience. A pre-designed, structured pro forma was used to record each patient's details.

IBM SPSS v.27 was used to analyze the data. Frequencies and percentages were determined for categorical data such as gender, surgical site infection, education status, occupation status, socioeconomic status, and residence. Mean ± SD were calculated for numerical data on age and BMI. Surgical site infection was compared between groups using the Chi-square test; p-values < 0.05 were considered significant. Effect modifiers such as age, gender, BMI, educational status, occupational status, socioeconomic status, and residence were controlled for through stratification. A post-stratification Chi-square test was applied, with p-values < 0.05 considered significant. The results of this study were presented in tables.

Results

The study enrolled 144 patients who were undergoing abdominal wound closure following laparotomy. Patients were evenly divided between Group A, which received absorbable sutures, and Group B, which received non-absorbable sutures.

The mean age of patients in Group A was 43.76 ± 15.44 years. In Group B, the mean age was 46.53 ± 14.43 years. The Body Mass Index was 24.26 ± 1.94 kg/m² in Group A and 24.74 ± 2.17 kg/m² in Group B.

Table 1 presents the detailed demographic profile of patients in both groups. The gender distribution showed a male predominance in both groups, with 43 males (59.7%) in Group A and 40 males (55.6%) in Group B. Employment status showed that 32 patients (44.4%) in the absorbable group and 31 (43.1%) in the non-absorbable group were employed. Literacy rates were 35 patients (48.6%) in Group A and 38 (52.8%) in Group B.

The primary outcome of the present study was surgical site infection, which showed a notable difference between the two groups. In Group A, sixteen patients (22.2%) developed an SSI, and in Group B, 30 patients (41.7%) developed an SSI. This difference in SSI was found to be statistically significant (P = 0.01) (Table 2). Table 3 presents the demographic stratification of SSI in both groups.

Table 1 Demographics

Demographic		Group A (Absorbable Sutures)		Group B (Non-Absorbable Sutures)	
		n	%	n	%
Age distribution (Years)	27 to 45	23	31.9%	15	20.8%
	46 to 60	19	26.4%	24	33.3%
	61 to 75	30	41.7%	33	45.8%
Gender	Male	43	59.7%	40	55.6%
	Female	29	40.3%	32	44.4%
Occupation status	Employed	32	44.4%	31	43.1%
	Unemployed	40	55.6%	41	56.9%
Education status	Literate	35	48.6%	38	52.8%
	Illiterate	37	51.4%	34	47.2%
Area of residence	Urban	34	47.2%	35	48.6%
	Rural	38	52.8%	37	51.4%
Socioeconomic status	Lower class	29	40.3%	30	41.7%
	Middle class	38	52.8%	35	48.6%
	Upper class	5	6.9%	7	9.7%

Table 2 Comparison of surgical site infection between the two groups

SSI	Group A (Absorbable Sutures)		Group B (Non-Absorbable Sutures)		P value
	Count	Column N %	Count	Column N %	
Yes	16	22.2%	30	41.7%	0.01
No	56	77.8%	42	58.3%	

Table 3: Stratification of SSI in both groups with respect to demographics

Variables				Group A (Absorbable Sutures)		Group B (Non-Absorbable Sutures)		
				n	%	n	%	
Gender	Male	SSI	Yes	11	25.6%	15	37.5%	0.24
			No	32	74.4%	25	62.5%	

	Female	SSI	Yes	5	17.2%	15	46.9%	0.01
			No	24	82.8%	17	53.1%	
Occupation status	Employed	SSI	Yes	8	25.0%	14	45.2%	0.09
			No	24	75.0%	17	54.8%	
	Unemployed	SSI	Yes	8	20.0%	16	39.0%	0.06
			No	32	80.0%	25	61.0%	
Education status	Literate	SSI	Yes	7	20.0%	12	31.6%	0.26
			No	28	80.0%	26	68.4%	
	Illiterate	SSI	Yes	9	24.3%	18	52.9%	0.01
			No	28	75.7%	16	47.1%	
Area of residence	Urban	SSI	Yes	6	17.6%	11	31.4%	0.18
			No	28	82.4%	24	68.6%	
	Rural	SSI	Yes	10	26.3%	19	51.4%	0.02
			No	28	73.7%	18	48.6%	
Socioeconomic status	Lower class	SSI	Yes	7	24.1%	17	56.7%	0.01
			No	22	75.9%	13	43.3%	
	Middle class	SSI	Yes	9	23.7%	11	31.4%	0.45
			No	29	76.3%	24	68.6%	
	Upper class	SSI	Yes	0	0.0%	2	28.6%	0.19
			No	5	100.0%	5	71.4%	
Age distribution (Years)	27 to 45	SSI	Yes	6	26.1%	3	20.0%	0.66
			No	17	73.9%	12	80.0%	
	46 to 60	SSI	Yes	2	10.5%	12	50.0%	0.006
			No	17	89.5%	12	50.0%	
	61 to 75	SSI	Yes	8	26.7%	15	45.5%	0.12
			No	22	73.3%	18	54.5%	
BMI (Kg/m2)	18 to 24.9	SSI	Yes	9	19.1%	18	45.0%	0.009
			No	38	80.9%	22	55.0%	
	> 24.9	SSI	Yes	7	28.0%	12	37.5%	0.45
			No	18	72.0%	20	62.5%	

Discussion

The selection of optimal suture material for abdominal wound closure remains a subject of debate among surgeons. A meta-analysis evaluated delayed-absorbable polydioxanone (PDS) against non-absorbable polypropylene (Prolene) and nylon across eight randomised trials encompassing. The findings indicated no statistically significant differences in postoperative outcomes, including incisional hernia, wound dehiscence, and surgical site infection (SSI), suggesting that both suture classes were suitable for laparotomy closure. (13) In contrast, Ahmed et al. reported a significantly higher incidence of wound dehiscence with absorbable Vicryl (21.5%) compared to non-absorbable Prolene (6.2%) in their randomised controlled trial. (14) Conversely, Shah et al. observed a significantly lower SSI rate with delayed-absorbable PDS (13%) versus polypropylene (25%). (15) This discrepancy underscores the influence of study design, patient demographics, and surgical context on reported outcomes.

The type of surgical procedure, whether elective or emergency, appears to be a significant modifier of outcomes. Tolat et al. investigated the use of barbed PDS sutures exclusively in emergency laparotomies and reported an overall SSI rate of 40%, which is substantially higher than rates typically reported in elective settings. (16) This suggests that patient factors and the inherent contamination of emergency procedures may surpass any potential differential effect of suture material. The study's high SSI incidence, coupled with a burst abdomen rate of 5.7% occurring only in dirty wounds, strengthens the superiority of wound classification over suture choice in predicting major complications. This aligns with the broader surgical principle that technique and patient-related variables are often more consequential than the specific implantable material used for approximation.

The present study contributes to this debate by evaluating SSI rates in a cohort of 144 patients undergoing laparotomy stratified by suture type. The demographic profile of the cohort, with a mean age in the mid-40s and a slight male predominance, is consistent with the typical patient populations undergoing general abdominal surgery. The distribution of socioeconomic status, educational status, and occupation provides a contextual background often absent in similar studies, situating the findings within a specific healthcare environment. The baseline characteristics, including age, BMI, gender, occupation, education, residence, and socioeconomic status, were well-balanced between the absorbable and non-absorbable suture groups. This balance strengthens the internal validity of the comparison by reducing the possibility that confounding variables account for the observed differences in the primary outcome.

The central finding of this study was a statistically significant difference in the incidence of surgical site infection between the two groups. The SSI rate was 22.2% in patients whose wounds were closed with absorbable sutures, compared with 41.7% in those receiving non-absorbable sutures ($p=0.01$). This result aligns with the findings of Shah et al., who also reported a lower SSI rate with absorbable PDS. (15) Similarly, another study showed that using riclosan-coated sutures in abdominal surgeries can reduce the incidence of SSI.(17)

The results of the present study suggest that the use of absorbable sutures for abdominal wall closure could be a simple modifiable factor to reduce the morbidity and cost associated with SSI. Several limitations must be acknowledged when interpreting these findings.

The study was conducted at a single centre, which may have limited the generalisability of the results to other settings with different surgical protocols, antibiotic policies, or patient populations. A larger multicentre trial would provide more robust and widely applicable evidence.

Conclusion

In conclusion, the present study demonstrated that the frequency of surgical site infection was significantly higher with non-absorbable sutures than with absorbable sutures in patients undergoing abdominal wound closure after laparotomy. These findings suggest that the choice of

suture material may influence postoperative infectious complications and warrant consideration in surgical practice.

Declarations

Data Availability statement
All data generated or analysed during the study are included in the manuscript.
Ethics approval and consent to participate
Approved by the department concerned. (IRBEC-24)
Consent for publication
Approved
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Conflict of interest

The authors declared no conflicts of interest.

Author Contribution

AS (TMO/PGR)
Data Collection, Manuscript drafting, Study Design,
FA (Professor)
Review of Literature, Critical Guidance.

All authors reviewed the results and approved the final version of the manuscript. They are also accountable for the integrity of the study.

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