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Original Research Article

Comparative Analysis of Suture Techniques in Emergency Laparotomy for Peritonitis: Continuous Versus Interrupted Suturing in Abdominal Wall Closure for Optimal Wound Healing

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Abstract: *Wound dehiscence and infection are major postoperative complications following emergency laparotomy, often necessitating secondary wound closure and leading to increased morbidity and higher recurrence rates. This study aimed to compare outcomes (in terms of wound dehiscence and wound infection) with continuous suture technique versus interrupted sutures technique in abdominal wall closure among patients undergoing emergency laparotomy due to peritonitis.* ***Methodology:*** *A total of 156 patients undergoing emergency laparotomy due to peritonitis were included in this study. After selection, these patients were randomly divided into two groups using the draws method. Patients in group A (n = 78) were managed by continuous suture technique (polypropylene #1 suture) whereas in group B, also having 78 patients, closure of rectus sheath was done by interrupted suture technique (1 centimetre apart and away from edges) by same surgeon having more than 10 years experience after post-graduation. Patients were called for follow-up every week for a maximum of 4 weeks to observe wound dehiscence and wound infection and findings were noted in the proforma. Data entry and analysis were done using SPSS–23.* ***Results:*** *Mean age of our study cases was 36.91 ± 9.00 years (range; 22 – 56 years) while 71.2 % (n = 111) were aged up to 40 years. Wound dehiscence was noted in 12.8% of all patients while it was 5.1%(n = 4) in group A compared with 20.5 % (n = 16) in group B. (P = 0.008). Wound infection was noted in 13.5% (n = 21), and in group A, infection was 3.8% (n = 3) compared with 23.1% (n = 18) in group B. (P = 0.001).* ***Conclusion:*** *Our study results indicate that continuous suturing of the rectus sheath in abdominal wall closure in an emergency laparotomy is safe, reliable, and effective as it is associated with significantly less wound dehiscence and infection burden.*

Keywords: Emergency laparotomy, continuous suture, Interrupted suture

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Introduction

Laparotomy stands as one of the most frequently conducted procedures globally, facilitating access to the internal organs of the abdominal cavity. Studies from developed nations highlight significant rates of emergency laparotomies, with figures such as 30,000 procedures in the UK and 70,000 in Sweden annually. (1, 2). Emergency laparotomy encompasses a spectrum of techniques employed to address various surgical pathologies. Patients typically present in acute or subacute states, with approximately 6% resulting from complications of elective surgeries. (3). Moreover, more than half of these patients are aged over 70 years, often with ASA grades equal to or exceeding 3, indicating potentially life-threatening illnesses requiring prompt interventions. Surgeons are often faced with limited time for investigations, pre-optimization, and initiating treatment for underlying comorbidities, highlighting the critical balance between optimization time and the risk of delaying surgery, particularly for time-sensitive conditions. Data from the National Emergency Laparotomy Audit (NELA) reveal varying surgical urgencies, with around 50% requiring intervention within 6 hours, 33% within 6-18 hours, and 17% after 18 hours. (4).

The optimal method for midline wound closure in emergency laparotomy remains a subject of controversy, given the significant incidence of abdominal wound dehiscence, particularly prevalent in Asian populations. (5). This complication contributes to elevated morbidity, mortality, healthcare costs, and prolonged hospitalizations upon readmission. Numerous studies have sought to compare the efficacy of different closure techniques and suture materials. (6). The choice of wound closure method in elective laparotomy is less critical in patients with adequate nutritional status. In developing countries like Pakistan, a majority of patients present with risk factors such as malnutrition, comorbidities, and prolonged intra-abdominal sepsis. This underscores the importance of implementing effective, safe, robust management strategies for these patients.

Wound dehiscence and infection are major postoperative complications following emergency laparotomy, often necessitating secondary wound closure and leading to increased morbidity and higher recurrence rates. The choice of surgical strategy for abdominal wall closure is crucial in preventing dehiscence and infection. Continuous and interrupted suture techniques are the two most commonly employed methods, yet consensus on the optimal approach remains elusive due to varied findings across studies. For instance, one study reported wound dehiscence rates of 20.5% with interrupted suturing compared to 4.5% with continuous suturing of the rectus sheath in abdominal wall closure during emergency laparotomy. (7).

This study aimed to compare outcomes (in terms of wound dehiscence and wound infection) with continuous suture technique versus interrupted sutures technique in abdominal wall closure among patients undergoing emergency laparotomy due to peritonitis.

Methodology

A Quasi-experimental study was conducted in the Department of Surgery, Nishtar Hospital Multan from May 2023 to May 2024. A total of 156 patients undergoing emergency laparotomy due to peritonitis were

included in this study after obtaining clearance from the Institutional Ethical Review Board (IERB) of Nishtar Medical University, Multan. The sample size was calculated using EpiInfo, the info software of CDC, by keeping the power of the test at 80 % and CI = 95 %. Patients were selected using a non-probability purposive sampling technique. Inclusion criteria were both male and female patients, aged 20 to 60 years, undergoing emergency laparotomy due to peritonitis with ASA grade I and II. Exclusion criteria were patients with a previous history of laparotomy, patients having bleeding disorders, and immunocompromised patients.

Strict compliance with inclusion and exclusion criteria was implemented to minimize the risk of biases. Patients were recruited after giving written consent and explaining the objectives and procedures of this study. Diagnosis of the acute abdomen associated with that peritonitis was established by the attending surgeon based on history, detailed clinical examination, and radiological findings of X-Ray, Ultrasonography, and CT scan. After selection, these patients were randomly divided into two groups using the draws method. Patients in group A (n = 78) were managed by continuous suture technique (with polypropylene #1 suture) whereas in group B, also having 78 patients, closure of rectus sheath (Also with polypropylene #1 suture) was done by interrupted suture technique (1 centimetre apart and away from edges) by same surgeon having more than 10 years experience after post-graduation. Patients were called for follow-up every week for a maximum of 4 weeks to observe wound dehiscence/Wound infection, and findings were noted in the proforma.

Data entry and analysis were done using SPSS–23 to calculate mean and standard deviation for age, duration of surgery, BMI, and hospital stay. Categorical variables like gender, obesity, wound dehiscence, wound infection and age groups were presented as frequencies and percentages. Confounders like gender, duration of surgery, hospital stay, obesity and age groups were addressed by stratification in terms of wound dehiscence and infection, applying chi-square test at the significance level 0.05 (95 % confidence interval).

Results

Our study included 156 patients undergoing emergency laparotomies due to peritonitis, 71.2 % (n = 111) male patients while 28.8% (n = 45) were female patients. In group A, 73.1 % were male patients compared with 69.2 % male patients in group B undergoing emergency laparotomy (P = 0.724). (Table I). The mean age of our study cases was 36.91 ± 9.00 years (range: 22 – 56 years) while 71.2 % (n = 111) were aged up to 40 years. Of these 156 study cases, 34.6 % (n = 54) belonged to rural areas and 65.4% (n = 102) belonged to urban areas. Poor socioeconomic status was noted at 28.2 % (n=44), while 71.8% (n = 112) were of middle income. The mean hospital stay in our study was 6.23 ± 1.12 days, 64.7% of patients (n = 101) had a hospital stay of up to 7 days, and the Mean duration of surgery in our study cases was 116.28 ± 23.49 minutes, and 64.7% had a duration of surgery up to 2 hours. Mean body mass index was 25.41 ± 2.19 kg/m2 and obesity was present in 12.8% (n = 20) of our study cases.

Wound dehiscence was noted in 12.8% of all patients while it was 5.1 %(n = 4) in group A compared with 20.5 % (n = 16) in group B. (P = 0.008) Wound infection was noted in a total of 13.5% (n = 21), in group A wound infection was 3.8% (n = 3) compared with 23.1% (n = 18) in group B (P = 0.001)

Wound dehiscence and wound infection were stratified according to gender, age, residential status, socioeconomic status, hospital stay, duration of surgery and obesity (Tables II and III).

Table 1: Patient's socio-demographics

Characteristics		Group A N (%)	Group B N (%)	P Value
Gender	Male	57 (73.1%)	55 (69.2%)	0.724
	Female	21 (26.9%)	24 (30.7%)	
Age	Up to 40	56 (71.8%)	55 (70.5%)	0.998
	More than 40	22 (28.2%)	23 (29.5)	
Residential Status	Rural	28 (51.8%)	26 (48.1%)	0.865
	Urban	50 (49%)	52 (51%)	
Socioeconomic status	Poor	23 (29.5%)	21 (26.9%)	0.859
	Middle income	55 (70.5%)	57 (73.1%)	
Duration of hospital stay	Up to 7 days	49 (62.8%)	52 (66.7%)	
	More than 7 days	29 (37.2%)	26 (33.3%)	0.738
Duration of Surgery	Up to 2 hours	51 (65.4%)	50 (64.1%)	
	More than 2 hours	27 (34.6%)	28 (35.9%)	0.998
Obesity	Yes	9 (11.5%)	11 (14.1%)	0.811
	No	69 (88.5%)	67 (85.9%)	
Wound Dehiscence	Yes	04 (5.1%)	16 (20.5 %)	
	No	74 (94.9%)	62 (79.5%)	0.008
Wound Infection	Yes	03 (3.8%)	18 (23.1%)	
	No	75 (96.2%)	60 (76.9%)	0.001

Table 2: Stratification of Wound Dehiscence

Characteristics		Group A No	Group B No	P Value
Gender	Male (6)	Yes 01	05	0.107
		No 56	49	
	Female (14)	Yes 03	11	
		No 18	13	0.028
Age	Up to 40 Years (02)	Yes 02	00	0.495
		No 54	55	
	More than Year 40 (18)	Yes 02	16	0.002
		No 20	07	
Residential Status	Rural (06)	Yes 01	05	0.095

		No 27	21	
	Urban (14)	Yes 03	11	0.042
		No 47	41	
Socioeconomic status	Poor (09)	Yes 01	08	0.008
		No 22	13	
	Middle income (11)	Yes 03	08	0.204
		No 52	49	
Duration of hospital stay	Up to 7 days (11)	Yes 03	08	0.202
		No 46	44	
	More than 7 days (09)	Yes 01	08	0.009
		No 28	18	
Duration of Surgery	Up to 2 hours (10)	Yes 02	08	0.051
		No 49	42	
	More than 2 hours (10)	Yes 02	08	0.078
		No 25	20	
Obesity	Present (20)	09	11	0.003
	Not present (136)	69	67	

Table 3: Stratification of Wound Infection

Characteristics		**Group A No**	**Group B No**	**P Value**
Gender	Male (6)	Yes 01	05	0.107
		No 56	49	
	Female (14)	Yes 03	11	
		No 18	13	0.028
Age	Up to 40 Years (02)	Yes 02	00	0.495
		No 54	55	
	More than Year 40 (18)	Yes 02	16	0.002
		No 20	07	
Residential Status	Rural (06)	Yes 01	05	0.095
		No 27	21	
	Urban (14)	Yes 03	11	0.042
		No 47	41	
Socioeconomic status	Poor (09)	Yes 01	08	0.008
		No 22	13	
	Middle income (11)	Yes 03	08	0.204
		No 52	49	
Duration of hospital stay	Up to 7 days (11)	Yes 03	08	0.202
		No 46	44	
	More than 7 days (09)	Yes 01	08	0.009
		No 28	18	
Duration of Surgery	Up to 2 hours (10)	Yes 02	08	0.051
		No 49	42	
	More than 2 hours (10)	Yes 02	08	0.078
		No 25	20	
Obesity	Present (20)	09	11	0.003
	Not present (136)	69	67	

Discussion

The optimal approach to abdominal wall closure remains a contentious topic among surgeons worldwide. Existing literature often overlooks cases of emergency laparotomies, thus neglecting the unique biological characteristics of such patients (8, 9). This study evaluated the efficacy of two distinct suturing techniques in emergency laparotomies for peritonitis.

Our sample consisted of 156 patients undergoing emergency laparotomies due to peritonitis, with 71.2% (n = 111) being male and 28.8% (n = 45) female. In group A, 73.1% were male compared to 69.2% of male patients in group B (P = 0.724). Previous studies have also noted a male predominance among patients undergoing emergency laparotomies, with similar male-to-female ratios (10, 11).

The mean age of our patients was 36.91 ± 9.00 years, with 71.2% (n = 111) aged up to 40. This aligns with findings reported previously (12). The majority of our cases were urban residents (65.4%), with 28.2% classified as having poor socioeconomic status and 71.8% as middle income, consistent with findings by Lima et al. (13).

The mean hospital stay in our study was 6.23 ± 1.12 days, with 64.7% (n = 101) staying up to 7 days. The mean duration of surgery was 116.28 ± 23.49 minutes, with 64.7% lasting up to 2 hours. These findings were

similar to those reported by Ullah et al. and Bhadauria et al(14, 15). Our participants' mean body mass index (BMI) was 25.41 ± 2.19 kg/m2, with obesity observed in 12.8% of cases. This is consistent with findings by Sachin et al. and Priyadarshi et al (16, 17).

Wound dehiscence occurred in 12.8% of all patients, with significantly lower rates in group A (5.1%) compared to group B (20.5%, P = 0.008). Similar rates were reported by Bansiwalet et al. and Kumar et al (18, 19). Wound infection rates were 13.5%, with significantly lower rates in group A (3.8%) compared to group B (23.1%, P = 0.001), consistent with findings in the literature (20, 21).

The majority of studies recommend continuous suture closure of the linea Alba over interrupted suturing due to its faster application and more even tension distribution. However, they caution against tight knotting in interrupted suturing, which could weaken wounds.

Conclusion

Our study findings strongly support the utilization of continuous suturing of the rectus sheath during emergency laparotomy for abdominal wall closure. This technique emerges as safe and reliable and remarkably effective, as evidenced by a significantly reduced incidence of wound dehiscence and wound infection.

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-NMMS-03-23)

Consent for publication
Approved

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Conflict of interest

The authors declared the absence of a conflict of interest.

Author Contribution

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AN (Associate Professor)
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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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