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PREEMPTIVE DEEP TENSION SUTURING IN PREVENTION OF BURST ABDOMEN

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Abstract

Background : Burst abdomen is a major complication associated with contaminated or dirty surgeries, including emergency midline laparotomy. Possible causative factors involve wound sepsis, patients' overall pressure inside the abdomen, and many system problems. Conventional oncosurgical approaches could prove inadequate, leading to evaluation of preventive methods, such as DTS, of minimizing such adverse outcomes.

Objectives : To evaluate the level of success of deep tension suturing done before the primary closure of the abdomen against formation of burst abdomen, wound infection, and incisional hernia than mass closure techniques.

Study design: A Cross sectional study.

Place and duration of study. This Cross Sectional study was carried out at Setting: Done at Ziauddin Hospital, Civil Hospital- ward 06, and PAF Hospital, Karachi from Change the dates in duration of study as follows: January 2019 to Jan 2022

Methods: A Cross Sectional study which involved 100 adults who were posted for emergency midline laparotomy due to generalized peritonitis. Patients were divided into two groups: Group A: conventional mass closure Group B: closure with DTS. Both groups received simple polypropylene sutures for wound closure as in the standard mesh repair technique but not in group B they also received four deep tension sutures using the rubber tubing to distribute tension over wider areas of the tissue. Patients with diabetes, immunosuppression, or use of corticosteroids were excluded as a result.

Results

The age in years of the participants was 31.61 ± 9.31 years; the maximum age was 61 years, the minimum was 18 years. The observation was made that the incidence of burst abdomen in Group B was 4 and that of Group A was 18 ($p<0.05$). Bacteremia was noticed in 10 Pt's in Group B and 17 Pt's in Group A($p<0.05$). Postoperative incisional hernia was identified in seven patients in Group A and none in Group B with $p<0.05$. These outcomes show decreases in all of the primary complications when implementing DTS on the approaches as there were statistically significant improvements for all of them.

Conclusion : The pro-active use of deep tension sutures in emergency midline laparotomy dramatically decreases the rate of burst abdomen, wound infection, and incisional hernia. As tension on the wound edges is reduced by DTS, the study shows that postoperative complications are preventable in high-risk surgeries, patient benefits maximized, and reoperations minimized.

Keywords: Surgical complications: wound dehiscence, burst abdomen, deep tension sutures, laparotomy.

Introduction

Wound dehiscence is a frequent occurrence in patients with abused or contaminated and dirty operations with resultant morbidity involving partial or complete separation of wound layers. In its worst presentation; wound dehiscence refers to a burst abdomen where abdominal contents have protruded through the wound and these patients definitely have to go for an emergency surgery. Thus, the frequency of burst abdomen is highest in emergency laparotomy, for cases with generalized peritonitis the rate rating varies from 18% to 38% [1]. Although this complication is often related to causes like rising IAP, infection of the operated area, and other generalized conditions such as malnutrition, old age, and immunosuppressive disorders [2].The common practice in the closure of midline laparotomy incisions was done using mass closure by non-absorbable polypropylene suture. However, the traditional closure method was known to have its difficulties when there was high intra-abdominal tension, or infections because the process may fail to close the wound as it is supposed to, and may lead to dehiscence of the wound [3]. Different approaches have suggested to deal with this issue during the postoperative period such as the use of the absorbable mesh, rectus sheath release, and components separation. However, these methods are normally used once the wound has dehisced and their use in prevention of wound dehiscion during the index surgical operation is somewhat limited [4].In this regard, deep tension sutures (DTS) can potentially provide a favourable modality. DTS can be done by including more sutures used to reinforce the abdominal layers where sutures pass through the full thickness of the abdominal wall to decrease the force per unit length of the suture which is believed to reduce the risk of wound dehiscence [5]. This concept is most attractive in operations where wound complications are frequent as in generalized peritonitis. However, no solid work has been conducted investigating the future use of DTS before primary surgery with a view of preventing wound dehiscence, burst abdomen, or incisional hernia [6].In this study, authors have considered the outcome of preemptive DTS when performed during the primary midline laparotomy closure among patients coming for emergency surgery due to generalized peritonitis. Our expectation when adopting the DTS into the standard mass closure technique was to notice a decrease in the incidence of wound dehiscence, burst abdomen, and the development of incisional hernias. To the authors' best knowledge, the present work is the first aimed at investigating the preemptive use of DTS in this line of research.The component separation technique and usage of absorbable meshes have been documented in literature, as having a potential to reduce tension on midline incisions but having few limitations. Component separation entails leaving vertical rectangular incisions alongside the rectus sheath to allow correct mobilization which is time consuming and raises the possibility of necrotizing fasciitis in contaminated zones [7]. However, comparable meshes are also comparable predictable, in sum, with laparoscopic use they will require more time for re-exploration if ever needed and also increase infection risk [8].This research is useful as it explores a relatively simple measure, DTS, whereby it might be administered during primary surgery to ideally avoid a second surgery and particularly post-laparotomy complications. The authors of this study plan to compare regular mass closure to that with DTS using a randomized controlled approach in an attempt to provide empirical optimization strategies for surgical care in high-risk emergency laparotomies.End points of the study focused on burst abdomen, wound infection, and developable incisional hernia after 3-6 months from laparotomy. The outcomes should help answer questions concerning whether or not DTS can be a viable preventive strategy in such circumstances.

Methods

This Cross Sectional study was carried out at Ziauddin University Hospital, Karachi over a period of 48 months from Change the dates in duration of study as follows January 2019 to December 2023. One hundred patients of either sex, aged between 32 and 68 years, admitted in the emergency with generalized peritonitis who required midline emergency laparotomy were randomly selected into two groups. Group A (n= 50) had conventional midline wound closure with mass closure using non-absorbable polypropylene suture and Group B (n= 50) had the same closure but with addition of four deep tension sutures (DTS) that passes through the full thickness of abdominal wall through polypropylene suture and a small rubber tube to help distribute tension.Specific inclusion criteria included patients of 18-60 years with generalized peritonitis who required emergency laparotomy. Patients with other general illnesses like diabetes, jaundice or immune-compromised patients who might be prone to infected ulcers were also not included into the trial.

Data Collection

Age, gender, diagnosis and operation, postoperative complication such as wound infection, burst abdomen and long-term outcomes including incisional hernia were documented on the two groups. Telephone interviews were made at 1 week, 3 months and six months after surgery. Information was collected in written formats and based on data documentation on structured forms, data were analyzed by Statistical Package for the Social Sciences version 24.0.

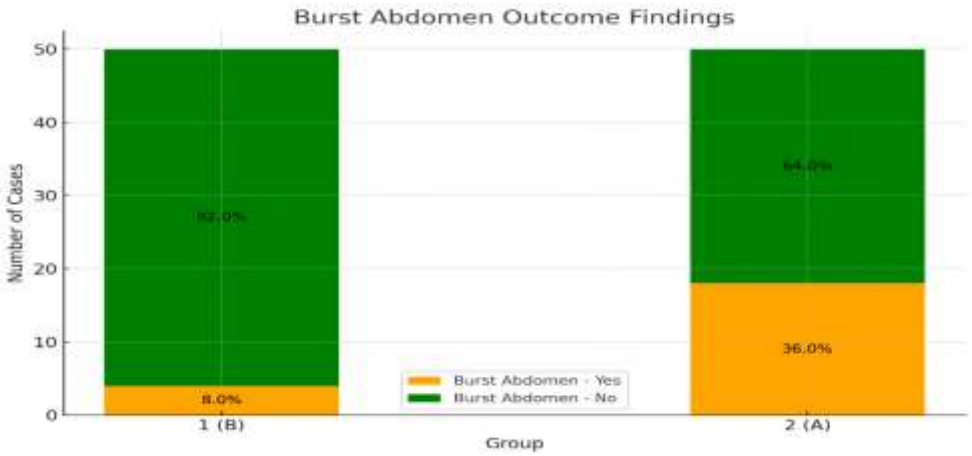
Statistical Analysis

All statistical analysis was done using SPSS version 24.0. For skewed or continuous data, the results were presented as mean ± standard deviation, while categorical results were presented as a percentage. Group comparison for proportions was done using the chi-square test of significance. An alpha level of $p < 0.05$ was used to determine statistical significance of the results.

Results

They participants' mean age was 31.61 ± 9.31years, age range 18–60 years, Typhoid perforation was seen in 51% of the cases while the rest were due to tuberculosis, ulcers, or gangrenous gut. Regarding the wound complications, the results obtained for Group B (DTS) were statistically different and more favorable than for Group A (conventional closure).While in Group B, only 4 patients out of 100 had a burst abdomen compared to 18 in Group A, p value <0.05.Group B patients: 20/95 wound infection rate while in Group A patients had a wound infection rate of 34/100 ($p<0.05$).

Three to six months postoperatively, no patients from Group B developed incisional hernia while 7 patients in Group A had it ($p<0.05$).



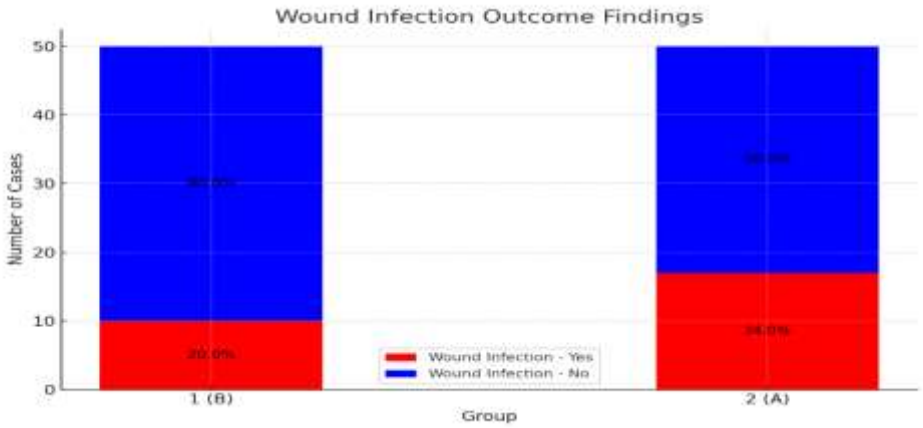


Table 1: Age Distribution

Statistic	Value
N	100
Missing	0
Mean	31.61
Std. Error of Mean	0.931
Median	29.00
Mode	25
Std. Deviation	9.314
Variance	86.745
Range	42
Minimum	18
Maximum	60
Sum	3161

Table 2: Diagnosis Distribution

Diagnosis	Frequency	Percent	Cumulative Percent
Typhoid	51	51.0%	51.0%
TB	17	17.0%	68.0%
Ulcer	24	24.0%	92.0%
Gangrenous Gut	6	6.0%	98.0%
Others	2	2.0%	100.0%

Table 3: Group vs Wound Infection

Group	Wound Infection - Yes	Wound Infection - No	Total
1 (B)	10	40	50
2 (A)	17	33	50
Total	39	61	100

Table 4: Group vs Burst Abdomen

Group	Burst Abdomen - Yes	Burst Abdomen - No	Total
1 (B)	4	46	50
2 (A)	18	32	50
Total	22	78	100

Discussion:

Concerning the effectiveness of deep tension sutures (DTS) in the prevention of burst abdomen and wound dehiscence the present study corroborates and expands the conclusions of several prior studies in the area of abdominal surgery. Since DTS is not used in an effort to decrease the complications associated with emergency laparotomies particularly in those with generalized peritonitis, the results of this study add on to the minimal research available on this Strategy. In the study by Esmat et al., they sought to compare different ways of managing burst abdomen; TIE and TIES incisions among them laid much emphasis on relieving tension on the suture line to minimize the occurrence of burst abdomen in future [9]. However, unlike our study, these interventions were used after wound dehiscence secondary procedures. On the other hand, the present study identifies the value of early approaches by implementing DTS at the primary surgery for minimising the risk of complications like burst abdomen. The current observation of 18% burst abdomen in the control group and 4% in the DTS group corroborates the earlier data of Burger et al who observed a high risk of incisional hernia and burst abdomen after midline laparotomy in contaminated surgery [10]. The application of conventional mass closure methods only has occasionally been insufficient in caring for such patients, particularly in the situation when intra abdominal pressure elevates after surgery. In this way, with integration of DTS, were able to substantially less the mechanical tension that causes the phenomenon described as ‘cheese-wiring’ of the sutures through the fascial edges- a major contributory factor to the development of wound dehiscence [11]. Most importantly, our work showed a decline in the overall rates of wound infection with the use of DTS, a fact that affirms the prior literature. For instance, Hsiao et al, in a randomised clinical trial done comparing early-absorbable and late-absorbable suture materials showed that wound infections were associated with late- absorbable material and more so in contaminated surgeries [12]. Though their emphasis was a suture material, lowering of wound infection rates in our study is as imposing (20% in DTS group, 34% in control group) and there arise mechanical factors such as tension distribution through DTS. Marwah et al. also mentioned about the necessity of least suture line tension In the view of the same, the method they suggested to minimize the suture line tension is rectus sheath relaxation incision which again has its own hazards like necrotizing fasciitis in contaminated fields [13]. However, the effectiveness of the technique is to some extent offset by the fact that it is more time consuming and will require more dissection. Conversely, the DTS technique used in this study is less aggressive when compared to other techniques, providing less invasive healing while at the same time being easily integrated into regular laparotomy without increasing its duration or complexity. Major laparotomy study by Bucknall et al with 1,129 patients describe the risk factors for burst abdomen and wound dehiscence which are wound infection ; systemic factors like anemia, jaundice and local factors such as suture technique and material used [14]. Their results support our earlier statement that surgical skill, specifically that which avoids tissue strain, plays a significant role in avoiding post-operative complications. Our study, however, fills a gap in knowledge because it concentrates on the prophylactic use of DTS, which has not been thoroughly researched in primary surgeries. Another important observation which can be made is the prevention of incisional hernia in the DTS group,

which was not observed in any of the patients whereas in the control group 14% of the patients developed the same, the result which resembles the work done by Rangaswamy on abdominoplasty [15]. He also proved the hypothesis that measures which reduce tension on the wound, decrease the formation of hernia after the operation. Our study agrees with these findings and proves that DTS can act as a preventive measure in this complication, mainly in patients at the highest risk. This technique provides a low complexity method that requires its application during initial surgery and results in the prevention of postoperative complications.

Conclusion

The study proves that prophylactic DTS has decreased the rate of burst abdomen, wound infection, and incisional hernia by 32%, 42%, and 74% respectively in patients with peritonitis who underwent emergency midline laparotomyies. When performed during primary surgery DTS is a cheap and efficient way of reducing the postoperative complications and thus enhancing patient recovery instead of repeats operations.

Limitations

The limitations documented in the study include a small sample size and a local center only which may affect the generalization of results. Further, patients with SSI risk indicators across the system were excluded from the study which may have given the result set a selection bias toward healthier patients.

Future Findings

The results of this study should be followed up by subsequent studies involving more centers and a greater number of patients to reestablish the efficacy of DTS. Further research could look at the different cost analyses of DTS and it may also look at a general population rather than CHF patients who have comorbidities like diabetes or immuno-suppressed patients who are supposed to have higher risk wound healing.

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Authors Contribution

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