ORIGINAL ARTICLE

OUTCOME OF THE CHOICE OF WOUND CLOSURE TECHNIQUE IN EMERGENCY LAPAROTOMY

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Background: Abdominal surgeries are the most common surgeries performed around the world. Closure of abdominal wound is important and a number wound closing techniques are in practice. This study was conducted to determine the outcome of the choice of wound closure technique in emergency laparotomy. **Methods**: It was a retrospective study from March–September 2019, conducted at the Surgical A unit, Ayub Teaching Hospital, Abbottabad. Ninety-five patients aged 22–60 years, who underwent emergency laparotomies via midline and para-median incisions were included in the study. **Results**: There were 74 (77.89%) males and 21 (22.11%) females. Anatomical closure technique was used in 67 (70.53%) of study participants while mass closure technique was used in 28 (29.47%) of study participants. 50 (52.63%) patients had anaemia, 27 (28.42%) had hypo-proteinemia, and 14 (14.74%) developed peritonitis. Post-operative wound infection was noticed in 15 (15.79%) patients. Out of 95 patients, 19 (20%) developed burst abdomen. Overall, 5 (5.26%) patients died in the hospital. All cases of burst abdomen occurred within first two weeks of hospital stay (p= 0.004), had an association with peritonitis (p=0.0001) and post-operative wound infection (p= 0.005). Wound closure technique was not associated with development of post-operative complications including burst abdomen (p >0.05). **Conclusion**: Post-operative complications occur independently of wound-closure technique and surgeons should have a low threshold for prevention of post-operative complications where possible.

Keywords: Laparotomy; Median Incision; Para-median Incision; Peritonitis; Anatomical closure

Citation: Rafiq MK, Kamran H, Sultan B, Wadud F, Ayub M, Ali Saad *et al*. Outcome of the choice of wound closure technique in emergency laparotomy. J Ayub Med Coll Abbottabad 2022;34(1):164–8.

INTRODUCTION

Abdominal surgery is the commonest surgical procedure performed by general surgeons.[1] Closure of abdomen following a surgical procedure is an important step and depends on the type of incision, the repair technique and type of suture material in addition to other patient-related factors.[2,3] While technical factors such as suture material and technique are important for a successful closure of abdominal incision, there is no ideal method for closing the abdominal wound.[1,4,5] Two different methods of abdominal wall closure are employed depending on the surgeon's preference: anatomical closure or mass closure. In anatomical closure, the abdominal wound is closed in layers in an anatomical fashion and in mass closure technique, all layers of abdominal wall except the skin and underlying subcutaneous tissue, are sutured in a single layer.[6,7] Interrupted sutures are used to approximate the skin afterwards.[8] Although advances in medical field and the advent of antibiotics has reduced the incidence of surgery related complications significantly, complete or incomplete wound dehiscence or "burst abdomen" is still the commonest complication following abdominal surgery.[5] Other complications of abdominal surgery include haemorrhage, intestinal perforation, paralytic ileus, chest infections, peritoneal adhesions, intestinal obstruction, chronic wound discharge etc.[9–11]

Burst abdomen following abdominal surgery is observed in 0.2–9.8% of patients undergoing laparotomy and its incidence is more in emergency laparotomy (14.89%) compared to elective laparotomy (2.7%).[12–14] Some of other factors associated with burst abdomen include male gender, increased age, presence of anaemia, malnutrition, hypoproteinaemia, longitudinal incision, post-operative wound infection and peritonitis.[5,15–17] Mortality following burst abdomen ranges from 22–50%.[12] In view of these facts, we decided to observe the role played by the wound closure technique in causing burst abdomen after emergency laparotomy in our patients. We felt that the results of this study may help in reducing the incidence of burst abdomen after emergency laparotomy and help in reducing overall morbidity and mortality.

MATERIAL AND METHODS

This retrospective study reviewed the records of patients who underwent emergency laparotomy via midline and para-median incisions from March to September 2019 at the Surgical Unit A, Ayub Teaching Hospital, Abbottabad. The study cohort consisted of a total of 95 patients aged 22–60 years. Patients who underwent re-laparotomy and with co-morbid conditions such as diabetes mellitus, sero-positive, patients on chemotherapy and immunotherapy and, long-term steroid therapy were excluded from the study. Anaemia was defined as serum haemoglobin level <13 g/dl (for men) and <12 g/dl (for women). Hypoproteinaemia was defined as total serum proteins < 4 g/dl. Patients' records were reviewed and the data was

collected on a proforma. Data was entered into and analysed using SPSS 24. Continuous variables were described as mean and standard deviations while categorical variables were described as frequencies and percentages. The outcome variable, i.e., burst abdomen was stratified by age, sex, anaemia, hospital stay duration, hypoproteinaemia, wound closure technique, post-operative wound infection and peritonitis to see effect modification. Post-stratification chi-square test was applied and a $p \leq 0.05$ was taken as significant.

RESULTS

The Mean±SD age of study participants was 42.56±11.41 years with a range of 22–60 years. Similarly, the Mean±SD hospital stay duration of study participants was 11.89±4.5 days with a range of 4–21 days. There were 74 (77.89%) males and 21 (22.11%) females. Anatomical closure technique was used in 67 (70.53%) of study participants while mass closure technique was used in 28 (29.47%) of study participants. Among the study participants, 50 (52.63%) had anaemia, 27 (28.42%) had hypoproteinaemia, and 14 (14.74%) developed peritonitis during their stay in the hospital. Post-operative wound infection was noticed in 15 (15.79%). Out of 95 patients, 19 (20%) developed burst abdomen. Overall, 5 (5.26%) patients died in in the hospital.

All cases of burst abdomen occurred within first two weeks of hospital stay (p=0.004), had an association with peritonitis (p<0.0001) and post-operative wound infection (p=0.005). No statistically significant association was found between incidence of burst abdomen and age, sex, anaemia and hypoproteinaemia in the study participants (p>0.05) (Table-1). There was no statistically significant difference between the two wound closing techniques in terms of post-operative wound infection, peritonitis and wound dehiscence (burst abdomen) ($p > 0.05$) (Table-2).

Table-1: Cross tabulation of burst abdomen with different variables

Burst Abdomen	Wound Closure technique		Total	*p* value
	Anatomical	Mass closure		
Present	12	7	19	0.431
Absent	55	21	76	
Total	67	28	95	
Burst Abdomen	**Age (yrs)**		**Total**	***p* value**
	upto 40	more than 40		
Present	8	11	19	0.681
Absent	36	40	76	
Total	44	51	95	
Burst Abdomen	**Hospital Stay (days)**		**Total**	***p* value**
	Upto 2 weeks	More than 2 weeks		
Present	19	00	19	0.004
Absent	51	25	76	
Total	70	25	95	
Burst Abdomen	**Sex**		**Total**	***p* value**
	Male	Female		
Present	13	6	19	0.266
Absent	61	15	76	
Total	74	21	95	
Burst Abdomen	**Anaemia**		**Total**	***p* value**
	Present	Absent		
Present	10	9	19	1.00
Absent	40	36	76	
Total	50	45	95	
Burst Abdomen	**Hypoproteinaemia**		**Total**	***p* value**
	Present	Absent		
Present	8	11	19	0.139
Absent	19	57	76	
Total	27	68	95	
Burst Abdomen	**Peritonitis**		**Total**	
	Present	Absent		
Present	9	10	19	0.001
Absent	5	71	76	
Total	14	81	95	
Burst Abdomen	**Post-operative wound infection**		**Total**	***p* value**
	Present	Absent		
Present	7	12	19	0.005
Absent	8	68	76	
Total	15	80	95	

Table-2: cross tabulation of wound closure technique with different factors in study population

Wound Closure technique	Peritonitis		Total	*p* value
	Present	Absent		
Anatomical	9	58	67	0.58
mass closure	5	23	28	
Total	14	81	95	
Wound Closure technique	Post-operative wound infection		Total	*p* value
	Present	Absent		
Anatomical	13	54	67	0.13
mass closure	2	26	28	
Total	15	80	95	
Wound Closure technique	Hypoproteinaemia		Total	*p* value
	Present	Absent		
Anatomical	20	47	67	0.63
mass closure	7	21	28	
Total	27	68	95	
Wound Closure technique	Anaemia		Total	*p* value
	Present	Absent		
Anatomical	38	29	67	0.22
mass closure	12	16	28	
Total	50	45	95	
Wound Closure technique	Hospital Stay (days)		Total	*p* value
	Upto 2 weeks	More than 2 weeks		
Anatomical	49	18	67	0.851
mass closure	21	7	28	
Total	70	25	95	

DISCUSSION

The aim of the study was to evaluate the occurrence of burst abdomen in emergency laparotomy after closure of abdominal wound with anatomical and mass closure techniques. In this study the total number of patients were 95 out of them 74 (77.89%) were male and 21 (22.11%) were female. The increase number of males in our study is comparable with other studies.[18–20] The frequency of burst abdomen in this study was 19 (20%); incidence of burst abdomen following mass closure was 25% (7/28) while that following anatomical closure of abdomen was 17.91% (12/67), and the difference between the two groups was not statistically different (p>0.05). The incidence of burst abdomen is variable, for example, a study from Pakistan reported that the burst abdomen occurred in 14.89% of patients after emergency laparotomies.[14] The study included 130 patients who underwent emergency or elective laparotomies. 94 (72.31%) patients underwent emergency laparotomy while 36 (27.69%) had undergone elective laparotomy.[14] In a study by Deshmukh and colleague, the incidence of burst abdomen was 3.33%[19], and there was no difference between incidence of burst abdomen in wounds closed by either of the closure techniques. Lower incidence of burst abdomen have been reported in the literature as well.[21–24]

A study from India reported that burst abdomen was more common with anatomical layered closure of abdominal wound (2/40 in anatomical closure vs 0/40 in single-layer mass closure).[8] The same authors reported more wound infection in abdominal wounds closed via anatomical closure technique than in single layer/mass closure technique and recommended single-layer mass closure technique for closure of abdominal wounds. However, all these studies[8,21–24] included elective as well as emergency laparotomies in their study, while our study included only emergency laparotomies.

A study from Egypt reported that the incidence of burst abdomen in emergency laparotomies was 12.4%. The study identified a number of risk factors with statistically significant association with wound dehiscence such as: anaemia, hypoalbuminemia, wound infection, peritonitis, diabetes mellitus, previous laparotomy, chest diseases, creation of stoma and ascites (p<0.05). Single-layer or mass closure technique was used to close the abdominal wound in this study.[25] We found only post-operative wound infection and peritonitis to be significantly associated with wound dehiscence in our study.

A study from India reported that burst abdomen following laparotomy occurred in 24.2% of patients.[26] Patients had undergone elective as well as emergency laparotomies in this study. Majority of these patients were male, and more than 70% of wound dehiscence was associated with emergency laparotomy. Anaemia, hypoproteinaemia, post-operative wound infection and concomitant chest infection were identified as being significantly associated with the occurrence of wound dehiscence.[26]

The incidence of post-operative wound infection in this study was 15.79% which is quite high as compared to literature. Post-operative abdominal wound infection rates around 7% have been reported.[27] Similarly, a study by Waqar and colleagues from Pakistan reported burst abdomen in 7 (5.9%) out of 117 patients in their study. The incidence of burst abdomen in emergency laparotomy was 4.2% compared to 1.7% in elective laparotomies.[28] The authors identified peritonitis, wound infection and failure to close the abdominal wall properly as important determinants of burst abdomen. Our results also point to the role played by peritonitis and post-operative wound infection in development of wound dehiscence.[28] Another study from Pakistan reported that the incidence of burst abdomen in their study was 7.8%.[18] The authors identified increased age, emergency laparotomy and wound infection as important precipitants of burst abdomen. On the other hand, we did not find any association of age with burst abdomen in our study. We did not compare incidence of burst abdomen in elective and emergency laparotomies. It is difficult to identify the reason for such a high incidence of burst abdomen based on retrospective analysis of data. However, it should alert the surgeons towards remedy of the situation.

While we did not find any statistically significant difference between the two wound closing techniques in terms of post-operative wound infection, peritonitis or burst abdomen, it has been observed that anatomical closure is associated more with development of post-operative wound infection. For example, in 60 patients randomized to have their wound closed via anatomical or mass closure techniques, the incidence of wound infection in anatomical closure technique was 36.66%. Whereas the incidence of post-operative wound infection in mass closure technique was 13.33% ($p<0.05$).[29] However, another study from India reported that there was no statistically significant difference between anatomical closure (37.5%) and mass closure groups (20%) in terms of post-operative wound infection.[30] Similarly, a study from India reported that the mean time to close wound in mass closure technique was significantly less than the time required for anatomical closure of abdominal wound ($p<0.05$).[20] Since ours was a retrospective study, we couldn't compare the two techniques in terms of time taken to close the laparotomy wound.

To sum up, there is no consensus on the ideal wound closure technique for laparotomy and surgeons have their own preferences. However, the presence of post-op wound infection or peritonitis affects the outcome of wound healing adversely and these are significantly associated with burst abdomen. Improved surgical, perioperative and post-operative care can help reducing the incidence of wound infection in patients undergoing emergency laparotomy. It is recommended that a prospective study with a large sample size be conducted to appreciate the possible role of wound closure technique as an etiological factor of burst abdomen following emergency laparotomy.

AUTHORS' CONTRIBUTION

MKR: Literature search, conceptualization. BS: Data collction data analysis. FW: Data collection. MA, SA, AA: Data analysis, data interpretation.

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Submitted: October 16, 2020	*Revised: March 12, 2021*	*Accepted: March 14, 2021*

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