Original Research Article

Evaluation of abdominal wall closure technique in emergency laparotomies at a tertiary care hospital

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ABSTRACT

Background: Abdominal wound closure technique should be efficient to perform, provide strength and be a barrier to infection. The method of closure of the abdominal wall is a critical aspect of an effective incision closure, in addition to the choice of suture material. Abdominal wound dehiscence is a common complication of emergency laparotomy. This study was done to know whether our method of abdominal closure was helpful in reducing incidence of burst abdomen.

Methods: This retrospective study was carried out in the department of general surgery in a tertiary medical centre in Mumbai. 126 Patients undergoing emergency laparotomies for extensive generalised peritonitis through a vertical midline incision were included in this study; the indications for laparotomy were inflammatory, traumatic and neoplastic.

Results: Out of 126 patients undergoing closure of laparotomy wound by our method, wound infection was noted in 12 (9.52%) cases and 3 (2.38%) patients developed wound dehiscence (burst abdomen).

Conclusions: This retrospective study demonstrates that our method of abdominal closure was helpful in reducing the incidence of burst abdomen post-operatively. This is of extreme clinical importance in reducing morbidity, mortality and healthcare cost related to abdominal wound dehiscence in a patient undergoing emergency laparotomy.

Keywords: Burst abdomen, Abdominal wound dehiscence, Emergency laparotomy, Closure technique

INTRODUCTION

Exploratory laparotomy whether elective or emergency has always remained one of the common operations across the surgical disciplines. The closure of such a laparotomy wound is key to reduce the post-operative morbidity like wound pain, wound infections and incisional hernias.¹ Wound dehiscence carries with it a substantial morbidity and mortality. Mortality associated with burst abdomen has been estimated at 16%.² The mean time for wound dehiscence is 8-10 days after operation.^{2,3} Abdominal wound dehiscence is a common complication of emergency laparotomies in Indian setup.

Wound dehiscence is related to technique of closure of abdomen. Many patients in India have poor nutritional status and the presentation of patients with peritonitis is often delayed. This makes the problem of wound dehiscence more common in Indian setup.⁴ Post-operative complete wound dehiscence is a very serious complication associated with high morbidity and mortality.⁵ The optimal strategy of abdominal wall closure after midline laparotomy has remained an issue of ongoing debate. To date, various randomised clinical trials and meta-analysis have been published with heterogeneous results. While the choice may not be so important in elective patients who are nutritionally

adequate, do not have any risk factors for dehiscence and are well prepared for surgery, however it may prove crucial in emergency patients who often have multiple risk factors for developing dehiscence.⁶ The aim of this study was to determine the local wound complication in terms of wound dehiscence using modified midline abdominal wound closure technique in emergency laparotomies for extensive generalised peritonitis.

METHODS

This a retrospective non-randomised study of 126 cases which were treated as surgical emergencies during the period from April 2015 to May 2016 at KEM hospital, Mumbai, Maharashtra.

Inclusion criteria

All patients who had undergone midline laparotomy for emergency indications which included patients with extensive generalised peritonitis.

Exclusion criteria

- Cases with minimal peritoneal contamination (less than 50 ml)
- Patients who had undergone previous laparotomy for any condition.
- Patients younger than 18 years of age.
- Patients who required re-exploration in post-operative course.

All patients were initially seen in the casualty and later referred to emergency surgical room (ESR) for further evaluation. A detailed history and clinical examination was done by senior surgical resident and consultant. The data was noted on a proforma. Baseline investigations like complete blood count, serum creatinine, BUN, serum electrolytes, chest X-ray, electrocardiograph and random blood sugar were noted in all the cases. Abdominal X-rays, ultrasonography and CT scans of abdomen and pelvis were also done in a few cases. All the patients had an acute presentation and required immediate intervention. Initially resuscitation was carried out with intravenous fluids (Ringer's lactate) along with Foley's catheterisation and nasogastric tube insertion. All the patients were assessed by one anaesthetist, written and informed consent was taken after counselling regarding the condition of the patient and the possible outcomes.

Under general anaesthesia operative field was prepared with povidone iodine scrub (10%) and all the patients were opened through vertical midline incision. The surgical procedure was conducted according to the need of underlying disease. After dealing with primary pathology thorough peritoneal lavage was given with normal saline. Two 32 F UMA-ADK tube drains were placed in the peritoneal cavity and were brought out through separate stab incisions. The drains were kept in Rutherford-Morrison's pouch and pelvis from right and

left sides respectively. A modified repair of the midline abdominal wound was performed in all the cases.

Technique

After completion of intraperitoneal procedure, a space was created between anterior rectus sheath and subcutaneous fat on either side so as to facilitate direct visualisation of anterior rectus sheath during the closure of abdominal wound (Figure 1). The space was created laterally for a distance of 2.5 cm from the cut edge of linea Alba. The care was taken not to damage the perforating vessels (Figure 2), care was also taken not to cut umbilical tube (Figure 3).

Figure 1: Space creation between anterior rectus sheath and fat.

Figure 2: Perforating vessels are preserved.

The parietal peritoneum, posterior rectus sheath, and the anterior rectus sheath all were approximated by a single layer of continuous sutures of No. '1' monofilament polyamide loop (NW 3348, Ethicon), mounted on a 48mm half circle, heavy, round bodied needle starting from either ends of the abdominal wound with the help of 2 no.1 monofilament polyamide loop (Figure 5). Each suture was placed 1.5 to 2 cm away from the cut edge of linea Alba on either side, each bite being at an interval of

about 1 cm from the other. The monofilament polyamide loop was locked after the first stitch (Figure 4).

Figure 3: Space created all around except for the region of umbilical tube.

Figure 4: Locking of the first stitch.

Figure 5: Continuous sutures taken from either end.

The edges of linea alba were gently approximated without strangulation with an attempt to keep suture wound length ratio of 4:1. Both the sutures were tied in the midline just above the umbilicus (Figure 6) to

overcome the difficulty encountered in inserting the last suture at the end of the wound.

Figure 6: Both sutures tied in midline above umbilicus.

Figure 7: Placement of sub-cutaneous suction drain.

After approximation of linea Alba, a Romson's 100% silicone- Jackson Pratt type close wound drainage system was placed in the sub-cutaneous space between anterior rectus sheath and sub-cutaneous fat which was created at the beginning of abdominal wall closure (Figure 7). This drain was brought out through separate stab incision away from main wound on skin. The sub-cutaneous tissue was closed with 2-0 polyglycolic acid violet (Vicryl). Skin was closed with either skin staplers or 2-0 monofilament polyamide suture (Ethilon).

All the patients were given pre-operatively antibiotics half an hour prior to surgery based on weight and the creatinine clearance of the patients. The antibiotic course was extended (cephalosporin and metronidazole) after the surgery. The midline laparotomy wound was managed by dressing only in cases of wound soakage otherwise wound check was done only after 72 hrs.

Each patient was followed up for 4 weeks after surgery to determine the risk of dehiscence.

Measurement of variables

The main outcome variable was the presence of an abdominal wound dehiscence or burst. This was recorded as a binary variable-present/absent. A burst was considered present when intestine, omentum or other viscera were seen in the abdominal wound. Its presence was ascertained by a consultant surgeon.

The following predictor variables were recorded

- Intraperitoneal sepsis- coded as a binary variable-present/absent
- Coughing- present/absent
- Diabetes- present/absent. Its presence was defined as fasting blood sugar >140 mg/dl or random blood sugar >200 mg/dl.
- Abdominal distension- coded as binary variable-present/absent
- Intra-abdominal malignancy – binary variable-present/absent. If present the histological type of tumour was recorded.
- Anaemia- coded as a binary variable-present/absent. Its presence was defined as Hb<10 gm%.
- Hypoxia-coded as binary variable-present/absent. Its presence was defined as PaO₂ less than 60 mmHg as recorded by an arterial blood gas analysis or saturation less than 90% on pulse-oximeter immediately pre-operatively on room air.
- Malnutrition-coded as binary variable-present/absent. Its presence was defined as weight <70% of expected weight, loss of muscle mass (mid-arm circumference less than 22 cm) or serum albumin <3 gm. %.
- Uraemia-coded as binary variable-present/absent. Its presence was defined as blood urea greater than 50 mg/dl.
- Jaundice-coded as binary variable-present/absent. Its presence was defined as serum bilirubin levels greater than 2 mg%.

Statistical analysis

Data was entered in SPSS version 24.0 and statistical analysis was done. Mean was calculated for descriptive variables like age, sex while frequency was determined for different diagnoses of cases undergoing emergency laparotomies along with wound dehiscence.

RESULTS

A total of 126 patients were included in this retrospective observational study carried out during a period of 14 months from April 2015 to May 2016.

Table 1: Age.

Age in years	Number of patients	Percentage
18-30	16	12.70 %
31-45	56	44.44 %
46-60	33	26.20 %
61-75	17	13.49 %
75-86	4	3.17 %
Total	126	100 %

The age of patients at presentation ranged from 18-86 yrs. With a median age of 45.55 yrs. Majority of the study participants were in the age group of 31-45 years, constituting 44.44 %. Next commonest age group was between 46-60 years at 26.20% (Table 1).

Table 2: Distribution according to sex.

Sex	Patients	Percentage
Male	79	62.70 %
Female	47	37.30 %
Total	126	100 %

In our study group number of male patients were more as compared to females (Table 2).

Table 3: Indications for exploratory laparotomy.

Cause	Patients	Percentage
Gastric/duodenal perforations	39	30.95%
Ileal perforations(Enteric)	11	8.73%
Gall bladder perforations	2	1.59%
Acute perforated appendicitis.	14	11.11%
Tuberculous peritonitis (stricture perforations)	19	15.08%
Stab injuries with intestinal perforations	9	7.14%
Gunshot injuries with intestinal perforations	2	1.59%
Blunt abdominal trauma with intestinal perforations	5	3.97%
Malignant perforations	4	3.17%
Pathological colonic perforations	3	2.38%
Mesenteric vascular occlusion leading to intestinal perforations	18	14.29%

The exploratory laparotomies were performed for a variety of conditions including inflammatory, traumatic, neoplastic, vascular pathologies etc. (Table 3). The main complication encountered in these patients was found to be local wound sepsis. It was seen in 12 cases (9.52%). Out of these, 3 (2.38%) patients developed wound dehiscence (Table 4).

Table 4: Local (wound) complications.

Complications	Patients	Percentage
Wound sepsis	12	9.52%
Burst abdomen	3	2.38%

DISCUSSION

A variety of abdominal wound closure techniques have evolved over many years, however, wound dehiscence remains a serious complication. The optimal technique and suture material for abdominal wall closure have long been a matter of debate.⁷ The ideal suture method should aim at preventing wound dehiscence without increasing wound infection, wound pain or formation of stitch sinus and keloid.^{7,8} Despite advances in surgical techniques and materials, abdominal fascia closure has remained a procedure that often reflects a surgeon's personal preference with reliance on tradition and anecdotal experience.⁹⁻¹¹ However, generally the selection of a particular suture material is governed by availability, cost and knowledge of suture material. There are many studies in literature comparing various methods of wound closure, with conflicting results. Three meta-analyses of these studies have been performed, which have been successful in resolving many of the issues. However, there is still no consensus over continuous versus interrupted methods of wound closure, with one meta-analyses favouring the interrupted method, another favouring the continuous method and the third not finding any significant difference between the two.^{12,3} According to some authors the ideal suture material should have no impact on the incidence of infection, should avoid patient discomfort and should not induce sinus formation in the surgical wound.^{3,11}

The burst abdomen is associated with risk of morbidity of upto 40% and mortality upto 18% in elderly or malnourished patients in whom a burst represents a final additional insult to their already stressed physiology. Indian authors have reported burst abdomen to occur in 10-30% of emergency cases.^{4,13,14} Protein calorie malnutrition is widely prevalent in the Indian population. The problem gets compounded with the onset of consuming diseases like tuberculosis, typhoid and cancer. Many patients undergoing emergency laparotomy suffer from one or more of these co-morbid conditions, detrimental to healing. Rural hospitals and nursing homes often keep patients with perforation peritonitis on conservative management (antibiotics and even steroids). At laparotomy we observe profound necrosis of the aponeurotic layers of the abdomen in these cases. Such necrosed linea Alba do not hold sutures well which cut out with a bout of coughing or sneezing. The low dehiscence in elective laparotomy group can be explained by the facts that patients do not have any intraperitoneal sepsis, have less abdominal distension, their malnutrition and anaemia are corrected prior to surgery and they are operated in a more controlled setting where errors of technique are minimal.

Penninckx et al documented a 2.58% wound dehiscence in 4538 patients treated with gastrointestinal operations.⁵ They also noted that complicated neoplasms and complicated inflammatory diseases had an extremely of wound dehiscence; 15.07% and 22.73% respectively, with routine continuous suture closure technique. The frequency of wound dehiscence after emergency laparotomy was 6.7% as compared to 1.5% in elective cases. Rahman recorded abdominal wound dehiscence in 7 (23.23%) cases, among the 33 patients of spontaneous ileal perforations with acute peritonitis and an incidence of wound infection in 30.3%.¹⁵ This study had 126 patients and all were emergency laparotomies and there were 3 cases of wound dehiscence with our abdominal wound closure technique.

Apart from the surgical technique, better preparation of the operative field and scrupulous sterility throughout the procedure can decrease the incidence of post-operative wound infection and subsequent dehiscence and incisional hernia formation. However, patient variables like age, obesity, co-morbid conditions like diabetes mellitus, hypoproteinemia, immunocompromised states and personal cleanliness can also affect the outcome as well. Theoretically two factor may be concerned in the causation of burst abdomen, either intra-abdominal pressure is too great or the wound is too weak. However the intra-abdominal pressure is frequently not within surgeons control but wound must be made sufficiently strong to withstand the pressure. During the post-operative period a wound must depend for its strength on following things-

- Cohesion of healing tissue
- The bandage and dressing
- Suture

CONCLUSION

Wound infections after abdominal surgery are still frequent nosocomial infections.

Our modified technique used in managing the patients with generalised peritonitis and perforated malignancies (complicated/high risk laparotomies) is associated with a low incidence of serious complications like wound sepsis and wound dehiscence.

- Acute wound dehiscence can be reduced in emergency laparotomy using our method of abdominal wound closure.
- Use of suction drain in sub-cutaneous space reduces incidence of local wound sepsis.
- Intraperitoneal sepsis is important factor in predicting burst.

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