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Comparative evaluation of the advantages of single-layer closure to en-masse closure in the surgeries of the abdomen

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Abstract---Background: Closure of the abdomen is a vital step in abdominal surgeries, with advent of newer techniques for suturing and suture material, repair technique, and incision, which has evoked great interest among surgeons. Aim: To comparatively evaluate the advantages of single-layer closure to en-masse closure in the surgeries of the abdomen. Subjects and Methods: 64 subjects randomly divided into two groups of 32 subjects each where Group I was closed with single-layer closure, and, Group II with layered closure. The subjects were assessed postoperatively on days 1, 3, 7, and 10, and were compared for burst abdomen, infection, and operative time. The follow-up was done every month for first 3 months and then after 6 months. Results: Wound infection incidence was higher in Group II (layer closure) compared to Group I (mass closure). In the Group I, elective surgery group, wound infection was seen in 1 subject with an abdomen burst. In emergency surgery group, wound infection was seen in no subject with abdomen burst and subjects without abdomen burst. In Group II (layered closure), in elective surgery group, wound infection was seen in 5 study subjects. In emergency group subjects, in subjects with abdomen burst, wound infection was seen in 4 study subjects, whereas, in subjects without abdomen burst, wound infection was seen in 5 study subjects. Conclusion: Mass closure is a significantly better approach compared to the layered closure technique in abdominal surgeries with less incidence of wound infection.

Keywords---abdominal suturing, layered closure, mass closure, mid-line incision, paramedian incision.

Introduction

The majority of general surgical procedures carried out are done in the abdominal region making the incision and suturing common practices in the field of surgery. Closure of the abdomen is a vital step, with the advent of newer techniques for suturing and suture material, repair technique, and incision, which has evoked great interest among surgeons. Literature in the recent past showed that technical factors in abdominal closure are vital and can be changed. Various techniques are utilized for abdominal closure with each having unique advantages. However, frequent modifications are done in the ideal abdominal closure methods. Commonly and conventionally used methods are single-layer closure and layered closure for the abdomen region. Change in closure methods has recently been focused more on due to increased complications which can further be attributed to the increased number of abdominal surgeries.¹

Initially, the focus was done on the suture material type used for abdominal closure which led to the introduction of non-absorbable and absorbable, and, natural and synthetic types of suture materials. However, the rate of laparotomy complications did not reduce much even with the different combinations use of suture materials for abdomen closure. This, in turn, led to alterations in laparotomy closure incision techniques. The conventional closure technique utilizing layer by layer closure was used no further and en-mass closure was followed. Until recently, closure of the abdominal wall in layers was considered the better technique of abdominal closure.²

In the conventional method, closure of the abdominal incision was done in layer-by-layer method meticulously, and the peritoneum along with the transversalis fascia was also closed as a layer. However, clinical and laboratory studies have shown that peritoneal layer closure has shown no difference in the healing of the abdominal wound. Hence, the closure of the peritoneum along with the transversalis fascia can be avoided during the abdominal closure without causing any ill effect on the wound healing. On the other hand, the raw peritoneum heals better.³

Previous studies done in literature have shown by various authors that on comparison of the two methods, significantly better results were shown with the single-layer closure over conventional method concerning postoperative morbidity, ease, feasibility, cost, and operating time. However, few studies have shown that there are increased reports of incisional hernia and burst abdomen with the layered closure technique, whereas, few other studies have failed to establish any such complications difference. No study in the literature has depicted the layered closure technique as advantageous over the mass closure.⁴ Hence, the present study was conducted to evaluate the advantages of mass closure in a single layer compared to the layered closure based on postoperative morbidity including incisional hernia, burst abdomen, wound infection, healing time, and operative time.

Materials and Methods

The present clinical study was conducted to evaluate the advantages of mass closure in a single layer compared to the layered closure based on postoperative morbidity including incisional hernia, burst abdomen, wound infection, healing time, and operative time. The study was carried out at Department of Surgery, Sri Krishna Medical College and hospital, Muzaffarpur, Bihar, after obtaining clearance from the concerned Ethical committee. After explaining the detailed study design, informed consent was taken from all the study subjects. The study included 64 subjects randomly divided into two groups of 32 subjects each where Group I was closed with single-layer closure, whereas, Group II subjects were managed with the layered closure. The subjects of two groups were assessed postoperatively on days 1, 3, 7, and 10 respectively, and were compared for burst abdomen, infection, and operative time. The follow-up was done every month for the first 3 months and then after 6 months.

After the final inclusion of the study subjects, detailed history was taken followed by the clinical examination with special emphasis on respiratory tract infections, jaundice, nutritional status, and anaemia. Routine examination of other systems was also done. For emergency surgeries, the general condition of the subject was improved by the administration of antibiotics, control of hypertension, correcting electrolyte imbalance, and dehydration. Gastric wall tone was improved by normal saline employment in the stomach for all the subjects. Bowel wash was given wherever needed. The pre-anaesthetic check-up was done followed by part preparation. Suitable anaesthesia was given depending on the surgery to be performed (general/epidural/spinal).

For Group I, suturing was done on the cut edges of linea alba and peritoneum together with continuous locking, whereas, for paramedian incision, an anterior layer of the rectus sheath, rectus abdominis muscle medial fibres, posterior layer of the rectus sheath, endo-abdominal fascia, and peritoneum was closed as a single layer. In Group II, linea alba and a midline incision were closed by continuous locking, and the paramedian incision skin was closed with non-resorbable sutures, the anterior layer of the rectus sheath, posterior layer of the rectus sheath, and was closed with continuous locking suture. After surgery, wounds were cleaned and time for closure was noted.

Postoperatively, antibiotics were given to all the subjects for 5 days along with analgesics. The wound assessment was done on the 3rd, 5th, 7th, and 10th day postoperative, and the suture removal was done on the 8th day postoperative. In postoperative time, subjects were examined for chest infections, hiccup, vomiting, and abdominal distension along with wound infection and seroma. A regular examination was done to see a burst abdomen and wound gaping. Wound infection was assessed as swelling, redness, need opening, and serous fluid exudation. Partial burst abdomen was assessed in all three-layers disruption except skin or peritoneum, whereas, complete abdomen burst was for all abdominal walls including peritoneum. The subjects of two groups were assessed postoperatively on days 1, 3, 7, and 10 respectively, and were compared for burst abdomen, infection, and operative time. The follow-up was done every month for the first 3 months and then after 6 months. During this time, incisional hernia

and scar complications were also assessed.

Results

The present clinical study was conducted to evaluate the advantages of mass closure in a single layer compared to the layered closure based on postoperative morbidity including incisional hernia, burst abdomen, wound infection, healing time, and operative time. The study included 64 subjects randomly divided into two groups of 32 subjects each where Group I was closed with single-layer closure, whereas, Group II subjects were managed with the layered closure. On assessing the complications in the study subjects, it was seen that burst abdomen was seen in 6.25% (n=2) subjects of mass closure and 25% (n=8) subjects with the layered closure, which was significantly higher for Group II compared to Group I with $p<0.05$. Wound infection was seen in 15.62% (n=5) subjects of group I (mass closure), whereas, it was seen in 37.5% (n=12) subjects from group II which was also significantly higher with $p<0.05$ (Table 1). For the assessment of variables in the Group I (mass closure) subjects, it was seen that elective surgeries were done in 11 subjects and emergency surgeries in 21 study subjects. In the elective surgery group, wound infection was seen in 1 subject with an abdomen burst and was seemingly in 1 subject and not seen in 9 subjects without an abdomen burst. In the emergency surgery group, wound infection was seen in no subject with abdomen burst and subjects without abdomen burst, wound infection was seen in 2 study subjects and not seen in 19 study subjects as depicted in Table 2.

Concerning the evaluation of the study variables in the subjects of Group II (layered closure), it was seen that elective surgery was done in 10 study subjects, whereas, emergency surgeries were done in 22 study subjects. In subjects where elective surgery was done, wound infection was seen in 5 study subjects and not seen in 1 study subject. In the subjects where abdominal burst was not seen wound infection was seen in no study subjects and was not seen in 5 study subjects. In emergency group subjects, in subjects with abdomen burst, wound infection was seen in 4 study subjects, whereas, in subjects without abdomen burst, wound infection was seen in 5 study subjects and not seen in 15 study subjects (Table 3).

Discussion

The present clinical study was conducted to evaluate the advantages of mass closure in a single layer compared to the layered closure based on postoperative morbidity including incisional hernia, burst abdomen, wound infection, healing time, and operative time. The study included 64 subjects randomly divided into two groups of 32 subjects each where Group I was closed with single-layer closure, whereas, Group II subjects were managed with the layered closure. On assessing the complications in the study subjects, it was seen that burst abdomen was seen in 6.25% (n=2) subjects of mass closure and 25% (n=8) subjects with the layered closure, which was significantly higher for Group II compared to Group I with $p<0.05$. Wound infection was seen in 15.62% (n=5) subjects of group I (mass closure), whereas, it was seen in 37.5% (n=12) subjects from group II which was also significantly higher with $p<0.05$. These results were

consistent with the studies of Ceydeli A et al⁵ in 2005 and Domball FT et al⁶ in 2005 where authors reported wound infection and abdominal burst as complications of the abdominal surgeries in their studies.

Concerning the assessment of variables in the Group I (mass closure) subjects, it was seen that elective surgeries were done in 11 subjects and emergency surgeries in 21 study subjects. In the elective surgery group, wound infection was seen in 1 subject with an abdomen burst and was seemingly in 1 subject and not seen in 9 subjects without an abdomen burst. In the emergency surgery group, wound infection was seen in no subject with abdomen burst and subjects without abdomen burst, wound infection was seen in 2 study subjects and not seen in 19 study subjects. These results were in agreement with the studies of Sreeharsha MV⁷ in 2013 and Chalya PL et al⁸ in 2015 where authors reported similar wound infection and abdominal burst in the mass closure of abdominal surgeries.

For the evaluation of the study variables in the subjects of Group II (layered closure), it was seen that elective surgery was done in 10 study subjects, whereas, emergency surgeries were done in 22 study subjects. In subjects where elective surgery was done, wound infection was seen in 5 study subjects and not seen in 1 study subject. In the subjects where abdominal burst was not seen wound infection was seen in no study subjects and was not seen in 5 study subjects. In emergency group subjects, in subjects with abdomen burst, wound infection was seen in 4 study subjects, whereas, in subjects without abdomen burst, wound infection was seen in 5 study subjects and not seen in 15 study subjects. These findings were comparable to the studies of Gurusamy KS et al⁹ in 2013 and Armananzas L et al¹⁰ in 2014 where authors suggested comparable results in the subjects where layered closure was done.

Conclusion

Within its limitations, the present study concludes that mass closure is a significantly better approach compared to the layered closure technique in abdominal surgeries with less incidence of wound infection. The present study had a few limitations including a small sample size, shorter monitoring period, and geographical area biases. Hence, more longitudinal studies with a larger sample size and longer monitoring period will help reach a definitive conclusion.

Type of study: original research paper

Conflicts of interest: Nil

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Tables

S. No	Complication	Group I (mass closure) % (n=32)	Group II (layered closure) % (n=32)	p-value
1.	Burst abdomen			
a)	Seen	6.25 (2)	25 (8)	<0.05
b)	Not seen	93.75 (30)	75 (24)	
2.	Wound infection			
a)	Seen	15.62 (5)	37.5 (12)	<0.05
b)	Not seen	84.37 (27)	62.5 (20)	

Table 1: complications based on the type of closure in the study subjects

S. No	Variable	Elective (n=11)		Emergency (n=21)	
		Burst abdomen		Burst abdomen	
		Yes	No	Yes	No
1.	Wound infection				
a)	Seen	1	1	0	2
b)	Not seen	0	9	0	19

Table 2: Assessing the variables for mass closure in the study subjects

S. No	Variable	Elective (n=10)		Emergency (n=22)	
		Burst abdomen		Burst abdomen	
		Yes	No	Yes	No
2.	Wound infection				
c)	Seen	5	0	4	5
d)	Not seen	1	5	0	15

Table 3: Assessing the variables for layered closure in the study subjects