Evaluation of Continuous Versus Interrupted Abdominal Fascial Closure in Patients with Peritonitis

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Abstract

Background: The objective of this study is to compare the continuous versus interrupted method of abdominal wall closure using non-absorbable suture in patients of acute peritonitis.

Methods: The study was conducted in the Department of Surgery, govt. medical college, Kota & attached hospital. The study duration was 18 months from JULY 2018 to DECEMBER 2019. The study included 60 patients, who were divided randomly into Two groups.

Group A- 30 patients who underwent continuous closure of abdominal wall using non-absorbable monofilament (polypropylene) suture.

Group B -30 patients who underwent interrupted suturing of abdominal wall using non-absorbable monofilament (polypropylene) suture.

Results: No statistical difference in either technique was observed in terms of wound infection. Interrupted-x closure was statistically significant in wound dehiscence, incisional hernia formation, burst abdomen and total duration of hospital stay. Continuous suturing was found to be easier, faster, economical and associated with less suture sinus formation.Interrupted-x closure thus becomes the method of closure for abdominal fascia closure for acute peritonitis in emergency settings as it is associated with less post op complications.

Conclusion: Interrupted –x closure thus becomes the preferred material and method of closure for abdominal fascia closure for acute peritonitis in emergency setting although it is more time consuming & suture consuming(less economically) but post op complications are lesser.

Keyword: Interrupted –x closure, Infection, Continuous closure.

Introduction

Peritonitis is defined as inflammation of the peritoneal cavity, caused by a number of etiologic agents including bacteria, fungi, viruses, chemical irritants, and foreign bodies. The sequence of both local and systemic events that occurs following the peritoneal insult represents a relatively constant response to a

variety of injurious agents. However, the clinical aspects, specifically, the management of peritonitis is influenced significantly by the aetiology of the infective process.[1]

Abdominal wound dehiscence (burst abdomen, fascial dehiscence) is a severe postoperative complication, with mortality rates reported as high as 45%. Incidence as described in literature ranges from 0.4%to3.5%.[6]

Closure of skin has always been debated in dirty or clean contaminated wounds but it has been proven beyond doubt that leaving skin open in presence of contamination reduces the chances of wound sepsis as primary closure of skin in such circumstances creates an infected closed space and invariably leads to abscess formation and attendant sequelae[7]. Therefore, it is logical to exclude this factor when comparing the two method of closure.

There have been very few studies comparing the continuous method of closure with interrupted using non-absorbable suture in patients with peritonitis.

The objective of this study is to compare the continuous versus interrupted method of abdominal wall closure using non-absorbable suture in patients of acute peritonitis.

Materials And Methods

The study was conducted in the Department of Surgery, govt. medical college, kota & attached hospital. The study duration was 18 months from JULY 2018 to DECEMBER 2019. The study included 60 patients, who were divided randomly into Two groups:

Group A: 30 patients who underwent continuous closure of abdominal wall using non-absorbable monofilament (polypropylene) suture.

Group B: 30 patients who underwent interrupted suturing of abdominal wall using non-absorbable monofilament (polypropylene) suture.

Inclusion criteria: Patients having bowel perforation peritonitis

Exclusion criteria

- Cases of primary peritonitis
- Severe co-morbid conditions: severe renal and liver disease, severe anaemia (Hb<8mg/dI), uncontrolled diabetes, malignancy, patient on anticancer chemotherapy or steroids, previous laparotomy or those with incisional hernia or burst abdomen at present time
- Age <18 and >70 years

Procedure

Patients were first seen in the surgery emergency ward wherein detailed history was taken from the patient if possible or the relative accompanying the patient. Patients then subjected to preliminary and essential general physical and detailed systemic examination. Patients then investigated accordingly for confirmation of the diagnosis (X-ray or non-contrast computer tomogram with or without ultrasonogram with all routine blood investigations). Patients were then shifted to operation theatre. All patients had been given pre-operative dose of antibiotics which was continued in the post-operative period also. Exploratory laparotomy carried out through a midline vertical incision.

The required closure was performed accordingly. The time taken for closure was noted. The total length of the suture material used were noted along with the suture pieces which got wasted while tying knots or while dividing suture. The net length of the suture material was calculated subsequently by subtracting the length of the wasted pieces from the total length used.

Suture length:Wound length ratio was subsequently computed.

Detailed methodology

This study has been reported in line with Consolidated Standards of Reporting Trials (CONSORT) guidelines. Decision for emergency laparotomy made based on thorough history, clinical examination, emergency laboratory investigations such as hemogram, blood dextrose, blood urea, serum creatinine, liver function tests. Emergency radiological investigations such as ultrasound abdomen, chest skiagram postero anterior view, abdomen skiagram erect and supine views, computed tomography (wherever indicated). Informed consent was taken before enrollment into study. All patients were given prophylactic antibiotics with injection ceftriaxone 1 gram and injection metronidazole 500 mg intravenously during anesthetic induction. However post-operative antibiotics were decided according to pathology found. Patients who had procedures lasting more than 4 hours were given second dose of antibiotics. Skin disinfection was done with Povidone iodine and spirit. Emergency laparotomy was made with midline incision. Intra operative findings were recorded. After necessary procedures were carried out for the pathology identified. Thorough peritoneal lavage was given and abdominal drains placed. Rectus sheath was closed with following techniques.

Methods of Closure

The randomization of the patients was done with computer generated random tables which were informed intraoperatively by a nursing attendant. Written & informed consent was taken from all the patients. Patients were subsequently divided into the following two groups for closure

Group A was conventional continuous closure of rectus sheath as follows: Each bite taken 1cm from the cut edge of linea alba. Successive bites taken 2 cm from each other.

The edges of linea alba gently approximated without strangulation with an attempt to keep suture to wound length ratio of ≥4:1.

Group B underwent interrupted-X technique closure of rectus sheath as follows:

A bite taken at (a)—a point 1 cm from cut edge. The needle emerge at (b) another point 1 cm from cut edge, 4 cm cranial or caudal to (a). Two ends of suture strand crossed. Needle enters at (c) and come out at (d). Point (c) 2 cm away from (a) and 1 cm from cut edge. Point (d) 2 cm away from (b) and 1 cm from cut edge. Two ends of suture tied in front of linea alba. Small free end of suture pulled inside with an artery forceps or right angle forceps. Small free end of suture tied with long strand of suture. Knot buried behind linea alba to prevent sinus formation. After initial few cases, burying of knots behind linea alba appeared to impinge of bowel loops. So the knot burying step was modified to bury it on the wound edges on its superior surface. Two interrupted X-sutures applied 2 cm apart.

Patient were assessed during postoperative period till discharge, and subsequent follow up at 2 weeks and 1month of procedure for wound dehiscence, sinus formation, and surgical site infection. It was defined as an infection that occurs within 30 days after the operation and involves the skin and subcutaneous tissue of the incision (superficial incisional) and/or the deep soft tissue (for example, fascia, muscle) of the incision (deep incisional) and/or any part of the anatomy (for example, organs and spaces) other than the incision that was opened

or manipulated during an operation (organ/space). Length of wound (sterile ruler was used), time taken for closure, length of suture material, duration of hospital stay, wound complications were recorded. Factors influencing wound healing such as anemia, hypoproteinemia, immuno-compromised states, diabetes mellitus, hypertension, liver disorders, renal disorders were recorded.

Results

Table 1: Socio-demographic profile

	Group A	Group B	p-Value
Age(Mean±SD)	44.43±15.18	42.53±14.98	0.796
Male : Female	24:6	22:8	0.760

Patients included in our study were ranged b/w 18 to 70 years. In group A(continuous) mean age of presentation was 44.53 & in group B (interrupted-x) mean age was 42.53 years. Distribution of age among both group was statistically non significant.

Table 2: Suture Length (IN CM.)

	Group A		Group B	
	Mean	SD	Mean	SD
Suture Length	85.03	06.48	121.03	14.26
Median	82		124	
P value	p<0.001			

Suture length was noted in cm. which was used to close rectus sheath after excluding wastage of suture

In group A-> mean suture length was 85.03 cm. with s.d. of 06.48 & median value was 82 cm

In group B->mean suture length was 121.03 cm. with s.d of 14.26 & median value was 124cm

P value was <0.001 so it suggest its significance that group B (interrupted-X)closure takes more time than group a (continuous closer)

Table 3: Sheath closure time

	Group A		Group B	
	Mean	SD	Mean	SD
Sheath closure time	10.55	2.41	19.54	3.59
Median	9.47		19.55	
P value	P<0.001			

In continuous group-> mean sheath closure time was 10:55 min+_2.41 with median time of 9:47 min

In interrupted group->mean sheath closure time was 19.54 min +_3.59 with median time of 19:55min

P value was <0.001 which states significance of this study regarding time factor thus undoubtedly interrupted techniques takes more time (almost double) than continuous closure tecniques

Table 4: SL: WL Ratio (Suture Length: Wound Length)

	Group A		Group B	
	Mean	SD	Mean	SD
WL Ratio	4.63	0.85	6.54	0.77
Median	4.38		6.68	
P value	P<0.001 (S)			

Suture length & wound length measured & compared sl:wl ratio compared in both groups.

In continuous groups-> mean value of sl:wl ratio was 4.63 with s.d. of 0.85

In interrupted groups->mean value of sl:wl ratio was 6.54 with s.d. of 6.68

P value was<0.001 which denoted statistically significance of comparison

Table 5: Wound Infection

	Group A		Group B	
	No.	%	No.	%
Yes	14	46.67	8	26.67
No	16	53.33	22	73.33
Total	30	100.00	30	100.00
P value	0.180 (NS)			

Wound infection is most common side effect in midline emergency laparotomy . so in our study total 22 patients out of 60 developed wound infection

In continuous method(group A)->14 out of 30 patients developed wound infection which was 46.67%

In interrupted-X method(group B)-> 8 out of 30 patients developed wound infection which was 26.67%

P value is 0.180 so association of wound infection to closer method cannot be decided & it was non significant

Table 6: Wound dehiscence (s)

	Group A		Group B	
	No.	%	No.	%
Yes	9	30.00	2	6.67
No	21	70.00	28	93.33
Total	30	100	30	100.00
P value	0.045 (S)			

Wound dehiscence studied in both groups & after comparison of both groups we found that it is more common in continuous group & it is statistically significant as p-value is 0.045

In continuous group->9 out of 30 patients developed wound dehiscence which was 30% of total

In interrupted group->2 out of 30 patients developed wound dehiscence which was 6.67% of total patients.

Table 7: Hospital Stay (in days)

	Group A		Group B	
	Mean	SD	Mean	SD
Hospital Stay	11.03	4.56	8.43	1.45
Median	9		8	
P value	0.004 (S)			

For continuous group-> patients mean hospital stay was 11.03 days with s.d.of 4.56 days while for interrupted group-> patients mean hospital stay was 8.43 days with s.d. of 1.45 days

P value of this comparison was <0.004 so period of hospital stay in interrupted-X closure group was significantly lesser than continuous group.

Table 8: Satisfactory Index

	Group A		Group B	
	No.	%	No.	%
Not Satisfied	12	40.00	3	10.00
Satisfied	11	36.67	10	33.33
Very Satisfied	7	23.33	17	56.67
Total	30	100.00	30	100.00
P value	0.008 (S)			

Patients were ask about their satisfaction in term of local discomfort, local wound pain, any starching n feeling of any foreign body or sutures post operative period and divided in to 3 category->Very satisfied, satisfied n not satisfied

In continuous group-> 40% of total patients were not satisfied

In interrupted group ->10% of total patients were not satisfied

P value was 0.008 which denotes significance if interpretation of results in study.

Table 9: Burst abdomen (s)

	Group A		Group B	
	No.	%	No.	%
Yes	6	20.00	0	0.00
No	24	80.00	30	100.00
Total	30	100.00	30	100.00
P value	0.031 (S)			

In continuous group-> 6 out of 30 patients developed burst abdomen. In interrupted group ->none patient developed burst abdomen.P value is 0..31 which is statistical significant.

Table 10: Incisional hernia(s)

	Group A		Group B	
	No.	%	No.	%
Yes	6	20.00	0	0.00
No	24	80.00	30	100.00
Total	30	100.00	30	100.00
P value	0.031 (S)			

In continuous group->6 out of 30 patients (20%)developed incisional hernia in follow up period.

In interrupted group-> no patient developed incisional hernia in follow up till 12 weeks.

P value is 0.031 which is statistical significant

Table 11: Suture Sinus

	Group A		Group B	
	No.	%	No.	%
Yes	2	6.67	9	30.00
No	28	93.33	21	70.00
Total	30	100.00	30	100.00
P value	0.045 (S)			

In continuous group-> 2 out of 30 patients(6.67%) developed suture sinus in follow up period

In interrupted group->9 out of 30 patients(30%) developed suture sinus in follow up period.

So chances incidence of suture sinus are more interrupted-X closure technique as p value in this test was significant(p=0.045)

Discussion

The best method of abdominal closure is one that maintains tensile strength throughout the healing process with good tissue approximation, does not promote wound infection or inflammation, is well tolerated by patients and is technically simple and expedient. The specific technique used in closure of the abdominal fascia for the individual is frequently based on nonscientific factors. Because of difficulties arising from differently tailored study designs, the surgical literature has not clearly demonstrated an optimal technique to close abdominal fascia, especially in emergency settings.

In our study Mean suture length used in closing rectus sheath in group A was 85.03±06.48 cms, and that in group B was 121.03±14.26 cms. Mean suture length used in continuous suturing was less compared to x - interrupted suturing, the difference being statistically significant (p<0.05). Since difference in suture length can be present depending upon the length of the incision, it was standardized in each group and each group was comparable with regards to incision length. SL:WL was, therefore, considered a more standard parameter to evaluate and compare the amount of suture material used in either technique. Mean SL:WL for continuous and x-interrupted groups as computed was 4.63 and 6.54, the difference being statistically significant as P value is <0.001

Jenkins (1976)[3] was the first one to define an ideal ratio of 4:1 for closure of laparotomy wounds based on clinical trials and mathematical model. This fact has been since then validated by many studies and meta-analysis.

IN our study Mean time taken for closure of rectus sheath in group A was 10.55+-2.41 and that for group B was 19.54±3.59. Mean time taken for closure in continuous technique was less as compared to x - interrupted group, the difference being statistically highly significant (p<0.001).

The difference in time can be attributed to running closure in continuous suturing without having to tie multiple knots. This was similar to the study by Shashikala et al,[4] mean time taken for closure of rectus sheath in group A (continuous) was 13.9±2.9, and that for group B (interrupted) was 28.9±3.4.6 Mean time

taken for closure in continuous technique was less as compared to interrupted-x group, the difference being statistically highly significant . Karwasara R K et al[5] was found that the mean length of incision in both the groups were comparable i.e. 20.64 in group I and 20.56 in group II. The mean time taken for closure of rectus sheath in Group I was 39.56 mins and 19.8 mins in Group II. The difference was found to be extremely statistically significant.

In our study wound infection in continuous group was 46.67% as 14 patients developed infection out of 30 patients while in interrupted group infection rate was 26.67%. The total wound infection rate was 36.67%.

Wound infection rate has been found to be present in 3-10% patients undergoing clean elective surgeries. Cruse and Foord[6] found in a retrospective survey a wound infection rate of (4%) among 2,093 dirty wounds but they did not specify how skin closure was performed.

Wound dehiscence studied in both groups & after comparison of both groups we found that it is more common in continuous group & it is statistically significant as p-value is 0.045 . In continuous group 9 out of 30 patients developed wound dehiscence which was 30% of total & In interrupted group 2 patients out of 30 patients developed wound dehiscence which was 6.67% of total patients.

Richards PC, Balch CM, Aldrete JS (1983)[7] found in mid-line incisions, the dehiscence rate was 2.0% for the continuous group versus 0.9% for the interrupted group.

In the literature, documented the day of wound dehiscence ranges from

Patients were asked about their satisfaction at the time of discharge in terms of local wound pain or discomfort. Significant difference was present in satisfaction of patients in continuous group than in interrupted group (p<0.001).

In continuous group-> 40% of total patients were not satisfied

In interrupted group ->10% of total patients were not satisfied

No data could be found in surgical literature to the best of my knowledge which showed less wound pain with continuous suturing than interrupted. In our study patients in continuous group experienced less wound pain and were more satisfied than interrupted suturing

For continuous group patients mean hospital stay was 11.03 days with s.d.of 4.56 days while for interrupted group-> patients mean hospital stay was 8.43 days with s.d. of 1.45 days

P value of this comparison was <0.004 so period of hospital stay in interrupted-X closure group was significantly lesser than continuous group.

Similar result observed by Richards who noted hospital stay of 12.9 in interrupted group and 19.5 in continuous group.[7]

Karwasara R K et al[4] was found that mean duration of hospital stay in continuous Group was 12.84 days and 12.2 days in interrupted Group

In our study hospital stay are less in both groups because of better care in our hospital.

Theoretically two factor may be concerned in the causation of burst abdomen, either the 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 this pressure. During the postoperative period a wound must depend for its strength on following things

1- Cohesion of the healing tissue
2- The bandage and dressing

3- Suture

Immediately after operation wound must depends on entirely on suture and dressing. In a continuous suturing cutting out of even a single bite of tissue lead to opening of entire wound.

Burst abdomen noted in the groups-A was 20% patients. Indian authors have reported burst abdomen to occur in 10-30% of emergency cases.[8] High percentage of wound dehiscence could be attributed to higher wound infection rate and malnourishment. Opposite to our results, all the five recent meta-analysis trials have shown that there is no significant difference in terms of wound dehiscence while comparing the technique of closure. In Indian set-up, burst abdomen occurred in 1/46(2.17%) in interrupted group and 8/54(14.8%) in continuous group in a study by Srivastav et al on 100 patients undergoing emergency laparotomy, the difference being statistically significant.[89] Patients were followed up for evidence of burst abdomen till 6 weeks. Richards et al also concluded that statistically significant difference in incidence of burst abdomen is present in infected wounds than in noninfected wounds.[7]

The cumulative incidence of incisional hernia in our study was 10%. There was statistically significant difference in the occurrence of incisional hernia when comparing continuous (20%) with zero incidence in interrupted(0%) (p value = 0.031)

Van et al (2002)[9] found that closure by continuous suture was followed by significantly more incisional hernias than closure by interrupted suture (P < 0.009).

Most of the studies have reported an incidence of 2-16% of incisional hernia irrespective of the technique and suture material used.

In most of the studies no significant difference in incisional hernia incidence was found between continuous and interrupted sutures. Richards et a1[7] reported an overall incisional hernia incidence of 1.3% independent of method of closure.

Conclusion

Interrupted –x closure thus becomes the preferred material and method of closure for abdominal fascia closure for acute peritonitis in emergency setting although it is more time consuming & suture consuming(less economically) but post op complications are lesser.

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