A COMPARATIVE STUDY OF SINGLE LAYER CLOSURE AND CONVENTIONAL LAYERED CLOSURE OF LAPAROTOMY WOUNDS

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ABSTRACT: OBJECTIVE: To compare the techniques of single layer closure and conventional layered closure of laparotomy wounds on the basis of operative time and post-operative complications. **METHODS**: Prospective randomized study of 100 patients who underwent laparotomy in a tertiary care hospital in Karnataka, for abdominal surgical problems needing either emergency or elective surgery. Out of these 100 patients, 50 patients underwent laparotomy wound closure by single layer closure technique and the rest 50 patients by conventional layered closure technique. Time taken for closure of laparotomy wound was noted and patients were followed up post-operatively for any wound complications like seroma, wound infection, wound gaping, burst abdomen and incisional hernia. **RESULTS**: The mean time taken for closure of laparotomy wounds by single layer closure technique was 19 minutes and by conventional layered closure technique was 27 minutes. There was a difference of 8 minutes which was statistically significant (p=0.001). In the postoperative period, in patients who underwent single layer closure, totally 9 patients (18%) had post operative complications. In that 3 patients (6%) had seroma, 3 patients (6%) had wound infection, 2 patients (4%) had wound gaping, 1 patient (2%) had burst abdomen and none had incisional hernia. In patients who underwent conventional layered closure, totally 15 patients (30%) had post operative complications. In that 5 patients (10%) had seroma, 4 patients (8%) had wound infection, 3 patients (6%) had wound gaping, 2 patients (4%) had burst abdomen and 1 patient (2%) had incisional hernia. **CONCLUSION**: Laparotomy wound closure with single layer closure technique is better than the conventional layered closure technique in terms of decreased operative time and also decreased postoperative complications.

KEY WORDS: Laparotomy wound; Single layer closure; Conventional layered closure; Seroma; Wound infection; Wound gaping; Burst abdomen; Incisional hernia.

INTRODUCTION: Many of the operations performed by the general surgeons take place within the abdomen and consequently incision and suturing of the abdominal layers are the commonest exercises in operative surgery. Abdominal closure is very important as regards to incision, technique of repair and use of newer suture material, and has created a great interest to surgeons.

Recent data suggests that technical factors are crucial and can be manipulated by the surgeon. Different suture techniques are used for closure of laparotomy wounds and each has its strong proponents. But the ideal method of abdominal wound closure is modified frequently. Commonly followed methods of abdominal closure are conventional layered closure and single layer closure.

Though, approach was the main aim of the surgeon in the beginning, the complications of surgery became common with increase in number of surgeries performed. This has led to changes in

the closure of laparotomy incisions. In the beginning much stress was on the type of suture material used for closure. This led to advent of both synthetic and natural, absorbable and nonabsorbable suture materials. Use of various combinations of suture materials for closure of laparotomy incisions, did not bring down the rate of complications of laparotomy to an appreciable level. This led to changes in technique of closure of laparotomy incisions. The conventional closure of layer by layer was given up and all the layers were closed en mass. Harold Ellis[1] in his text on closure of laparotomy incisions says "My preferred technique of closure of laparotomy incisions is, by mass closure, using nylon". Until recently, layered closure of abdominal wall was considered better, with great emphasis particularly on closure of peritoneal layer. It is now fully realized, both from clinical and laboratory animal studies that healing of an incision takes place by formation of a dense fibrous scar that unites the opposing faces of the laparotomy wound en mass. The purpose of sutures is to co-apt the wound edges, and to act as a splint, while this dense fibrous scar deposits and matures.

The sutures can potentially cut through the tissues when wound is closed using small bites, and not enough length of suture is left in wound, for later wound expansions. A wound may lengthen by 30% if distension occurs. An adequate reserve of suture length in the wound is necessary to allow this lengthening to occur and to ensure a minimal resulting rise in tension between the sutures and the tissues. Wound disruption is associated with the use of SL: WL ratio (Suture length: Wound length) of 2:1 or less – the lower the ratio, the greater is the risk of a burst wound. Wound disruption because of cutting out of sutures can be prevented by the use of nonabsorbable continuous sutures at 1cm intervals and a SL: WL ratio of 4:1 or more (Jenkins rule).[2]

The ideal method of wound closure should be:

-Technically simple;

-Free from complications of burst abdomen, incisional hernia and persistent sinuses;

-Comfortable to the patient;

-Leave a reasonably aesthetic scar.

Conventionally the abdominal incisions are closed layer by layer, meticulously. The peritoneum with transversalis fascia is closed as a layer. However laboratory and clinical observations have shown that closure of peritoneal layer makes no difference in abdominal wound healing. Hence, it can be omitted without any adverse effect on wound healing. The raw peritoneal defects heal rapidly. In Gilbert[3] and Ellis[1] study of peritoneal closure in the lateral paramedian incisions, wound disruption rates did not alter in both groups in whom peritoneum was closed with number one chromic catgut and in those in whom peritoneum was not closed. However layer by layer closure of abdominal incision has a strong aesthetic appeal. Hence, if technically easy to accommodate, the peritoneum may be closed with synthetic absorbable material. In the words of Lord Moynihan "every unnecessary stitch is a bad surgery" and avoidance of unnecessary step of peritoneal closure leads to a saving in time and cost.

Since 1973, different workers have carried out comparative studies of these two methods with encouraging results and single layer closure was found to have definite advantages over conventional closure as regards to operating time, cost, feasibility, ease and postoperative morbidity.

The present study was taken up to evaluate the advantages of single layer closure in comparison with the conventional layered closure on the basis of operative time, healing time and postoperative morbidity such as wound infection, burst abdomen and incisional hernia.

AIM OF THE STUDY: To compare the operative time and healing time for single layer closure and conventional layered closure of laparotomy wounds.

To compare the post-operative complications after performing single layer closure and conventional layered closure of laparotomy wounds, like seroma, wound infection, wound gaping, burst abdomen and incisional hernia.

MATERIALS AND METHODS: This study includes 100 patients who were admitted in the Department of Surgery in a tertiary care hospital in Karnataka for abdominal surgical problems needing either elective or emergency surgery.

Out of these 100 patients, 50 were randomized to have the abdominal wall closed by single layer closure technique and remaining 50 by conventional layered closure and they were grouped as Group 1 and Group 2 respectively. The patients were chosen randomly, irrespective of their age, sex and nature of disease to these two groups.

Inclusion criteria:

-Patients aged 15-75 years.

-Patients posted for laparotomy, either elective or emergency.

-Patients who underwent surgery with midline, paramedian and subcostal incisions.

Exclusion criteria:

-Patients with co-morbid conditions like diabetes mellitus, immunocompromised patients, patients on cancer chemotherapy, immunotherapy and on long term steroids.

-Patients who died within 10 days after surgery.

-Patients who underwent surgery by Grid-iron and transverse abdominal incisions.

-Patients who underwent second laparotomy or relaparotomy.

Closure of Abdominal Incisions:

In Group 1 (Single layer closure)

a. Midline incision: Closure was performed by suturing the cut edges of the peritoneum and linea alba together. Bites were taken about 1 cm from the cut edges and interval of about 1cm with continuous sutures using Prolene No. 1.

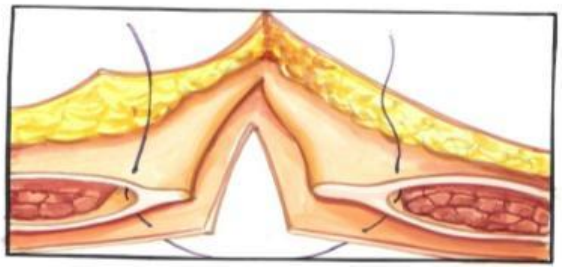


Figure 1: Mass closure of the midline incision

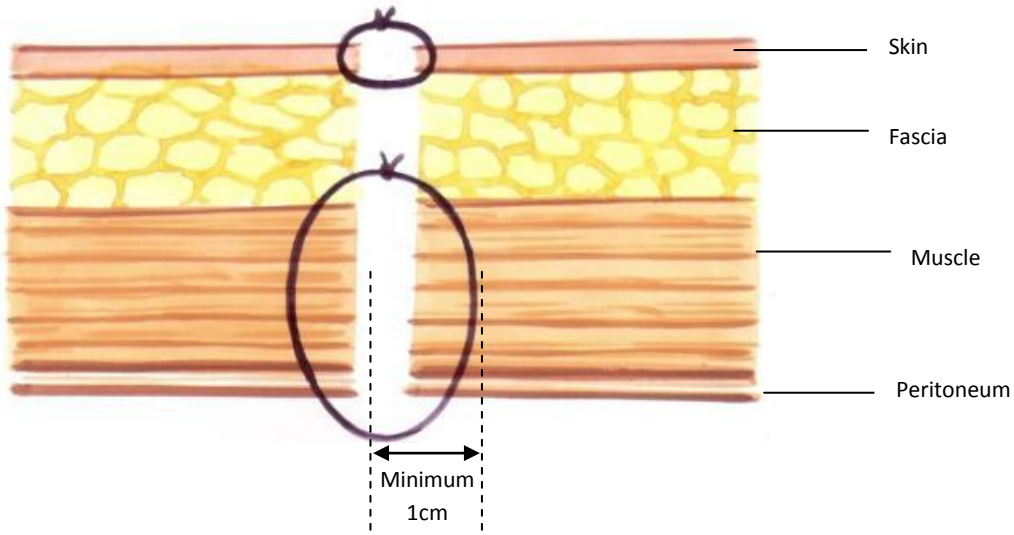


Figure 2: Principle to be followed in single layer closure technique

b. Paramedian incision: The peritoneum, endoabdominal fascia, posterior layer of rectus sheath, the medial fibers of rectus abdominis muscle and anterior layer of rectus sheath were sutured as a single layer. The bites were taken about 1 cm from the cut edges and about 1cm interval. Continuous sutures were employed using Prolene No. 1.

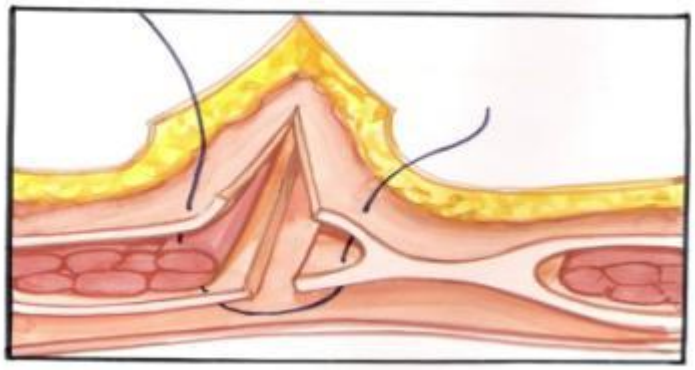


Figure 3: Mass closure of a paramedian incision

c. Kocher's incision: The peritoneum and cut edges of anterolateral abdominal wall muscles on the lateral aspect and the peritoneum and rectus abdominis along with its sheath on the medial aspect were sutured as a single layer. The bites were taken about 1cm from cut edges and about 1cm interval. Continues sutures were employed using Prolene No.1.

In Group 2 (Conventional layered closure)

a. Mid line incision: The peritoneum was closed with Vicryl or Chromic catgut by continuous sutures and the linea alba was closed similarly with Prolene No.1.
b. Paramedian incision: The peritoneum and posterior layer of rectus sheath were closed with Vicryl or Chromic catgut by continuous sutures. The anterior layer of rectus sheath was closed with No.1 Prolene by continuous sutures.

Skin was closed with nonabsorbable material like Ethilon using interrupted mattress sutures in both groups of patients.

Drains were used wherever necessary, through a separate stab incision.

Time taken for closure of abdomen was recorded in all cases.

Post operative: All the patients received antibiotics suitable for the case parenterally, usually for 2-3 days and orally for 5-7 days. Antibiotics were continued only whenever indicated after 10 days.

The wound was examined on 3rd, 5th, 7th and 9th or 10th day and the condition of the wound noted. Drains wherever employed were removed on 2nd or 3rd day unless required.

The sutures were removed between 7th to 10th day in both the groups.

During the post operative period, the patients were examined for abdominal distension, vomiting, hiccup and chest infection. Seroma and wound infection was also noted. Regular examination of the wounds for signs of wound gaping and burst abdomen was done.

In this study: Seroma was considered when there was collection of only serous fluid in the subcutaneous tissue of the laparotomy wound without any evidence of infection.

Wound infection was considered when there was infection in the skin and subcutaneous tissue of the laparotomy wound discharging pus.

Wound gaping was considered when wound infection reached muscle and there was separation of the skin and wound edges.

Burst abdomen was considered when there was separation of all layers including peritoneum with or without protrusion of viscera out of the laparotomy wound.

Incisional hernia was considered to be present when a protruding swelling was noticed and a fascial defect was palpable in the wound during postoperative follow up of the patient, in supine position, lifting either legs, head raising test or expansile impulse on coughing.

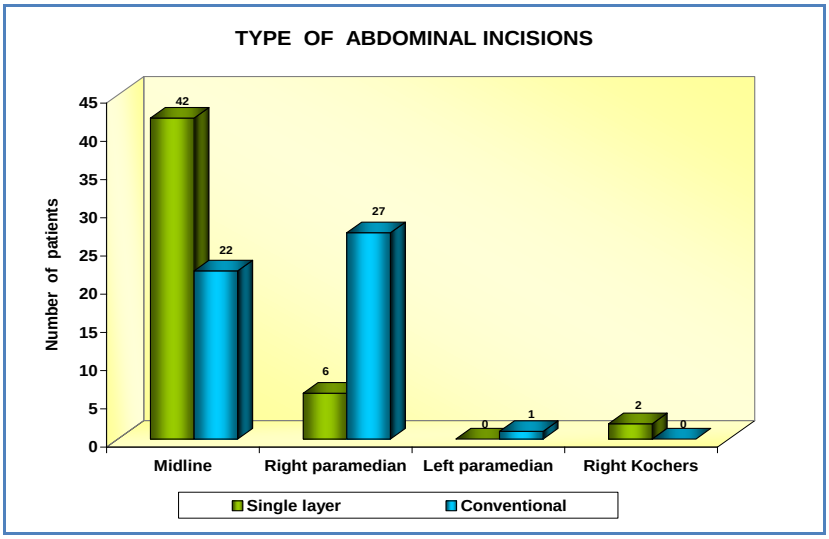
Follow up: Regular monthly follow up was done for first 3 months, once in 3 months for one year and then half-yearly. During the follow up, the patients were examined for scar complications and incisional hernia.

The data was analyzed for comparison between single layer closure and conventional layered closure of laparotomy wounds by using incidence rate and unpaired student T test for continuous numerical values, and chi square test for categorical value.

Results and Analysis: In this study, age of the patients ranged from 15 to 71 years in group 1 and 23 to 73 years in group 2, with mean age of 49.9 years in group 1 and 47.6 in group 2.
Male: Female ratio in this study undergoing laparotomy was 3: 1.

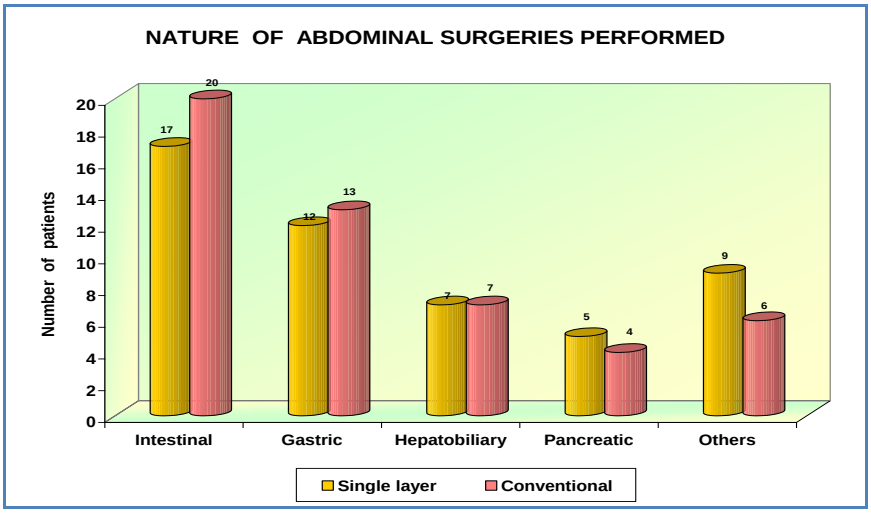
Type of surgery	Type of closure		Total
	Single layer	Conventional	
Elective	30	27	57
Emergency	20	23	43
Total	50	50	100

Table – 1: Type of surgery in patients undergoing laparotomy



Graph – 1: Type of abdominal incision used in patients undergoing laparotomy

In this study, 64% of patients had midline abdominal incision and 33% had right paramedian incision.



Graph – 2: Nature of abdominal surgeries performed in patients undergoing laparotomy

Other surgeries included splenectomies, nephrectomies, drainage of intraabdominal abscesses and 1 case of common iliac artery aneurysm rupture and hemoperitoneum for which ligation and bypass surgery was done.

Time taken (min)	Type of closure		Total
	Single layer	Conventional layered	
10 – 15	7	0	7
15 – 20	26	1	27
20 – 25	16	10	26
25 – 30	1	26	27
30 – 35	0	11	11
35 – 40	0	2	2
Total	50	50	100

Table – 2: Time taken for closure of laparotomy wounds

In this study, the mean time taken for closure of laparotomy wounds, by single layer closure technique was 19.6min and by conventional layered closure technique was 27.9min. There was a difference of about 8 minutes in the mean time between the two techniques used which was statistically significant (p=0.001), indicating that the time needed for single layer closure technique was significantly less than that needed for conventional layered technique.

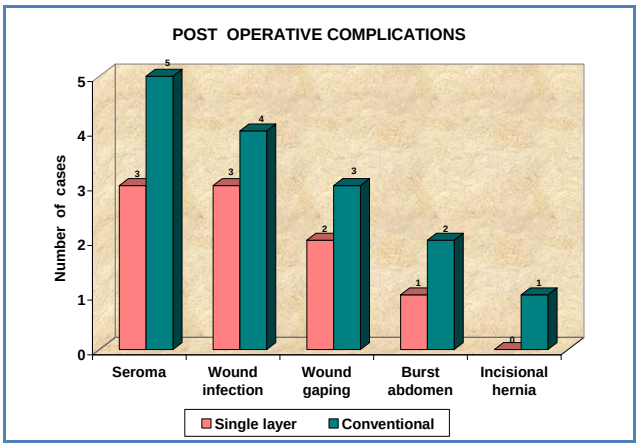
Time taken for suture removal	Type of closure		Total
	Single layer	Conventional	
7 days	27	26	53
8 days	12	13	25
9 days	8	7	15
10 days	3	4	7
Total	50	50	100

Table – 3: Time taken for suture removal after laparotomy

In this study, 53% of patients undergoing laparotomy had suture removal done on 7th post operative day and 25% on 8th post operative day. The mean time taken was 7.74 days for single layer closure method and 7.75 days for conventional layered closure method.

Factors	Type of closure		Total
	Single layer	Conventional	
Anemia	12	11	23
Hypertension	2	3	5
Uremia	2	1	3
Hyper bilirubinemia	4	3	7
Chest infection and cough	3	3	6
Hypoproteinemia	0	1	1

Table – 4: Factors Affecting Wound Healing in the Study Group



Graph – 3: Post Operative Complications in the Study Group

POST OPERATIVE COMPLICATION IN THE STUDY GROUP: In this study, in single layer closure group, totally 9 patients (18%) and in conventional layered closure group, 15 patients (30%) had post operative complication like seroma, wound infection, wound gaping, burst abdomen and incisional hernia.

Seroma: In group 1, all the 3 patients who had seroma were anemic.
In group 2, out of 5 patients who had seroma, only one had anemia, and 4 out of 5 patients underwent emergency surgery.
Wound infection: In group I, all the 3 patients who had wound infection underwent emergency surgery. In that one patient was anemic and one patient had uremia.

In group 2, out of 4 patients who had wound infection one underwent emergency surgery and 2 patients had anemia.
Wound gaping: In group 1, both the patients who had wound gaping underwent emergency surgery and both had chest infection with cough. One patient was anemic and the other was hypertensive.

In group 2, out of 3 patients who developed wound gaping, 2 patients underwent emergency surgery. One patient was anemic and one patient was hypertensive in this group.
Burst abdomen: In group 1, burst abdomen occurred in one patient on 6th post operative day. These patients had ileal perforation and peritonitis with chest infection and cough and were also anemic. This patient underwent emergency surgery.

In group 2 burst abdomen occurred in 2 patients, both operated on an emergency basis. First patient had colonic perforation and peritonitis secondary to carcinoma sigmoid colon and was anemic. Burst abdomen occurred in 7th post operative day. The second patient had gastric ulcer perforation and peritonitis. He also had chest infection with cough and hypoproteinemia. In this patient burst abdomen occurred on 8th postoperative day.
Incisional hernia: None of the patient in group 1 had incisional hernia.

In group 2, one patient had incisional hernia 4 months after the surgery. This patient underwent emergency surgery for intestinal obstruction with gangrenous jejunal segment. He also had uremia and chest infection and had developed wound infection and gaping in the immediate postoperative period.

Study	Wound Infection		Wound Gaping		Burst Abdomen		Incisional hernia	
	SLC	CLC	SLC	CLC	SLC	CLC	SLC	CLC
Jones et al 1941	-	-	-	-	0%	3.9%	-	-
Togart 1967	17%	29%	0.87%	3.4%	-	-	-	-
Shukla et al 1981	0.5%	16.9%	2%	13%	-	-	0%	3%
Singh et al 1981.	6.6%	16.6%	0%	10%	-	-	0%	6.6%
Bucknall TE et al 1982	-	-	-	-	0.8%	3.8%	-	-
Sharma et al 1986	-	-	-	-	4.7%	12.3%	-	-
Banerjee & Chatterjee1989	-	-	-	-	3.6%	7.27%	-	-
Choudhary & Choudhary 1994	22.5%	47.5%	-	-	0%	3.75%	-	-
Present study	6%	8%	4%	6%	2%	4%	0%	2%

Table – 5: Comparison of post operative complications in earlier studies with the present study.

Follow up (in months)	Type of closure		Total
	Single layer	Conventional layered	
≤1	10	6	16
1-3	24	17	41
4 – 6	7	13	20
7 – 9	5	7	12
10 – 12	4	6	10
>12	0	1	1

Table – 6: Post operative follow up of the patients in the study group

In this study, the mean postoperative follow up of patients in the single layer closure group was 3.74 months and in the conventional layered closure group was 5 months.

DISCUSSION: The present study was aimed at comparing the techniques of laparotomy wound closure. The technique of laparotomy wound closure is one of the important factor in preventing post operative complications like wound infection, burst abdomen and incisional hernia. Prevention of herniation of abdominal contents through the incisional wound, resulting in burst abdomen or herniation through a weak scar resulting in incisional hernia are the main aims of a surgeon closing laparotomy wounds.

Literature review shows almost since the beginning of abdominal surgery the masters of technique have preached the importance of meticulous layer by layer closure of abdominal wall and indeed this certainly has strong aesthetic appeal. It is interesting that Smead, a resident to Finney in Baltimore, first used the "far-near" stitch in 1900, a technique often referred to in the United States as the "Smead-Jones Technique". In 1941, Jones[4] and associates reported a burst abdomen rate of 11% when incisions were sutured with two layers of catgut, and 7% when sutured with catgut for peritoneum and interrupted steel wire for the anterior rectus sheath. However only one burst abdomen occurred in 81 operations after steel wire closure with interrupted mass far-near sutures incorporating all layers, apart from skin. Dudley[5] in 1970 observed that ischemic necrosis in relation to a suture is the outcome of revascularizing of the bite and continued pressure exerted by any distractive force at the suture-tissue interface. In mass closure, a deep bite of tissue provides more

cushioning effect and therefore less strangulation of tissue. Kirk[6] in 1972 had no wound disruption in 186 laparotomies closed with continuous all coat nylon. He also noted that the technique of mass closure with nylon significantly reduced the rate of wound dehiscence. In paramedian laparotomies, Goligher[7] in 1975 reported one burst abdomen and no incisional hernias among 108 cases, using all coats interrupted steel wire sutures. Martyak and Curtis[8] in 1976 closed 280 midline wounds with all coats continuous nylon, again without a single wound dehiscence and a similar finding was reported by Leaper[9] in 1977 in 120 laparotomies subjected to mass closure using steel wire. Most remarkable achievement of only one wound dehiscence in a series of 1505 closures using all coats nylon was reported by Jenkins[2] in 1976. The introduction of this technique produced quite dramatic improvements in the results of Bucknall TE, Cox PJ and Ellis H.[10] In their study from 1975 to 1977, 341 layered closures were performed with 13 burst abdomens (3.8%) and from 1977 to 1980 the mass closure technique was used in 788 patients with 6 burst abdomens (0.8%). Ellis1[9] in 1977, Gilbert[3] in 1987 and TB Hugh[11] in 1990 reported no significant statistical difference in laparotomy closures with peritoneum closed or open. Gilbert et al concluded that the lateral paramedian incision, successfully abolishes the occurrence of burst abdomen and, incisional hernia was rare. Hugh TB et al concluded that single layer closure of abdominal wall was quicker, less costly and safer than layered closure. Poole GV et al[12] in 1984 found that simple interrupted suture technique was unaffected by suture tension, but was generally inferior to the running stitch in terms of wound bursting strength. They recommended that closing midline abdominal fascial wounds with a running suture may be a superior method of closure in clean, incised wounds. Trimbos JB et al[13] in 1992 found that continuous closure of laparotomy wound was faster. They concluded that a running polyglyconate suture was better choice for closure of abdominal wall following midline laparotomy. Weiland DE, Bay RC and Del Sordi S[14] from their meta-analysis study in 1998 suggested that continuous closure with non-absorbable suture should be used to close most abdominal wounds; but however, if infection or distention is anticipated, interrupted absorbable sutures are preferred. According to them mass closure was superior to layered closure.

Many larger earlier studies and Weiland et al[14] study, advocated the use of monofilament nonabsorbable suture material for closure of laparotomy wounds. Weiland et al, from their meta analysis study suggested that continuous closure with non-absorbable suture should be used to close most abdominal wounds; but however, if infection or distension is anticipated, interrupted absorbable sutures are preferred. Rucinski et al,[15] in their meta analysis of optimal technique for closure of abdominal midline fascia compared absorbable and nonabsorbable sutures. They found no statistically significant difference between nonabsorbable and monofilament absorbable sutures with regard to postoperative wound infection, dehiscence and incisional hernia. There was, however, a higher incidence of wound infection and incisional hernia formation when braided absorbable suture material was used. There was a higher incidence of incision area pain and suture sinus formation when nonabsorbable suture material was used. They advocated a continuous mass closure with absorbable monofilament suture material for laparotomy wounds. But results of larger studies showing the advantages of absorbable sutures over non absorbable sutures are still awaited. In the present study, we used monofilament, non absorbable continuous sutures (Prolene No.1) for closure of laparotomy wounds.

In the present study, the mean time taken for closure of laparotomy wounds by single layer closure was 19.6 minutes and by conventional layered closure was 27.9 minutes. Single layer

closure took about 8 minutes lesser time than conventional layered closure. In Banerjee and Chatterjee[16] study, single layer closure took about 10 minutes lesser time than conventional layered closure. Reduction in operative time prevents anesthetic hazards, reduces the cost of anesthetic agent and saves the time of the surgeon.

Different studies have reported postoperative complication rates which are definitely less in single layer closure than in conventional layered closure. Irvin et al[17] found that wound infection was responsible for tenfold rise in the incidence of burst abdomen and incisional hernia. Tearing through the weak infected tissues with intact suture is the main cause for wound dehiscence.

Anemia was considered as a predisposing factor contributing for the formation of seroma in the present study. However further studies are required in this regard. Detection of seroma and its management in the postoperative period is important. If ignored may lead to formation of wound infection and its sequelae.

The incidence of postoperative seroma formation in the present study was 6% in single layer closure group and 10% in conventional layered closure group, showing higher incidence in conventional layered closure group.

The wound infection rate for Togart[18] was 17% and 29%, Shukla et al[19] was 0.5% and 16.9%, Singh et al[20] was 6.6% and 16.6% and for Chowdhury and Chowdhury[21] was 22.5% and 47.5% in single layer closure and conventional layered closure respectively. In the present study, the incidence of wound infection was 6% in single layer closure and 8% in conventional layered closure, showing only slightly higher incidence in conventional layered closure. Use of newer antibiotics and better suture materials has probably decreased the rate of wound infection.

Incidence of wound gaping was 0.87% and 3.4% for Togart,[18] 2% and 13% for Shukla et al[19] and 0% and 10% for Singh et al,[20] in single layer closure and conventional layered closure respectively. In the present study, the incidence of wound gaping was 4% in single layer closure and 6% in conventional layered closure, again showing only slightly higher incidence in conventional layered closure group. Peritonitis requiring emergency surgery along with other associated factors like chest infection with cough, anemia and hypertension were thought to be the causative factors for a slightly higher incidence of wound gaping in this study.

Incidence of burst abdomen was 0% and 3.9% for Jones[4], 0.8% and 3.8% for Bucknall et al,[10] 4.7% and 12% for Sharma et al,[22] 3.6% and 7.27% for Banerjee and Chatterjee[16] and 0% and 3.75% for Chowdhury and Chowdhury,[21] in single layer closure and conventional layered closure respectively. In the present study, incidence of burst abdomen was 2% in single layer closure and 4% in conventional layered closure, showing doubling of burst abdomen incidence in conventional layered closure group. Peritonitis requiring emergency surgery leading to wound infection and gaping, along with associated factors like chest infection with cough, anemia and hypoproteinemia were the contributing factors for the occurrence of burst abdomen in the present study. Wound infection, wound gaping and burst abdomen increased patient's morbidity, hospital stay and cost.

Incisional hernia is common after wound infection. 88% of patients requiring repair of incisional hernia had wound infection in the study of Fischer and Turner.[23] Grace and Cox[24] found that burst abdomen was an important predisposing factor for the occurrence of incisional hernia. No incisional hernias occurred in the single layer closure study group of Shukla et al[19] and Singh et al.[20] However in conventional layered closure group Shukla et al[19] had 3% and Singh et al[20] had 6.6% of

incisional hernias. In the present study no incisional hernia occurred in single layer closure group and in conventional layered closure group the incidence of incisional hernia was 2%. The patient who developed incisional hernia in the present study, had intestinal obstruction with gangrenous jejunal segment and uremia requiring emerging surgery and had wound infection and gaping along with chest infection and cough in the postoperative period which contributed for the occurrence of incisional hernia. Overall incidence of incisional hernias in the best centres has been at least 10% according to the literature.[25] Still longer period of follow up is necessary for the present study to know the exact incidence of incisional hernias in the comparison groups.

Summary of the present study: -Single layer closure had reduced operative time than conventional layered closure, and hence, prevents anesthetic hazards, reduces cost of anesthetic agents and saves time of the surgeon.

-Incidence of postoperative complications like seroma, wound infection, wound gaping, burst abdomen and incisional hernia are comparatively less in single layer closure technique.

-Detection of seroma and its management in postoperative period prevents the occurrence of wound infection.

-Use of newer antibiotics and better suture materials has reduced the rate of wound infection.

-Peritonitis, emergency surgery, anemia, hypertension, hypoproteinemia, uremia, hyperbilirubinemia and chest infection with cough, are contributing factors for development of wound gaping and burst abdomen.

-Longer period of follow up is required to know the exact incidence of incisional hernia.

CONCLUSION: In this study, single layer closure of laparotomy wounds took less operative time than conventional layered closure. Also the incidence of postoperative complications like seroma, wound infection, wound gaping, burst abdomen and incisional hernia were less in single layer closure. Hence, single layer closure technique is better than conventional layered closure of laparotomy wounds in terms of operative time and post operative complications. However, longer study period is required to know the exact incidence of incisional hernia.

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PHOTOGRAPHS:

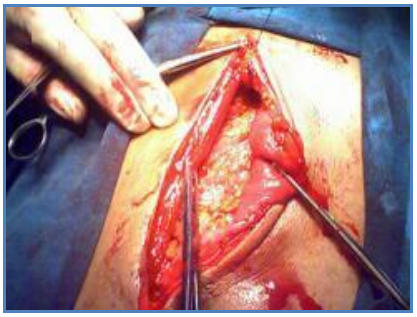

Figure – 4 Operative Photograph of single layer closure technique: starting

Figure – 5 Operative Photograph of single Layer closure technique in progress

Figure – 6 Operative Photograph of single layer closure technique: completion

Figure – 7 Operative Photograph of Conventional Layered closure: Peritoneal closure.

Figure – 8 Operative Photograph of conventional layered closure: Anterior rectus sheath closure.

Figure – 9 Clinical Photograph of wound gaping in a post operative patient.

Figure – 10 Clinical Photograph of incisional hernia in a paramedian laparotomy scar.

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