

# SINGLE LAYER CLOSURE VERSES CONVENTIONAL LAYERED CLOSURE OF LAPAROTOMY WOUND; A RANDOMISED CONTROLLED TRIAL IN RURAL MAHARASHTRA



## General Surgery

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## ABSTRACT

**Aim:** To compare the techniques of single layer closure and conventional layered closure of laparotomy wounds in a rural setup.

**Methadology:** 40 patients undergoing laparotomy were included in the study, randomly divided into 2 groups. In group-1 all the 20 patients single layer wound closure was done while in group-2 all 20 patients conventional layered closure was done. The operative time, healing time and postoperative complications were studied in each group and compared with each other.

**Results:** Comparing both the closures, single layer closure had reduced operative time than conventional layered closure, and hence, lessens anaesthetic hazards, reduces cost of anesthetic agents and saves the surgeons time. Post operative complications such as seroma, wound infection, wound gaping, burst abdomen and incisional hernia were significantly less with single layer closure as compared to conventional layered closure.

## INTRODUCTION:

Laparotomy is a major surgical procedure, whether elective or emergency always remains the bread and butter of a general surgeon.<sup>[1]</sup> The choice of surgical incision to open the abdominal cavity can be based on patient, surgeon, or health care system criteria. From a patient's point of view pain and restriction of ingestion are important. Surgeons' main interests, aside from the quick and optimal exposure of the operative field, are time to open and close the abdomen, and frequency of burst abdomen, wound infection, postoperative pulmonary complications, and incisional hernias. For health economy, parameters such as duration of operation, length of hospital stay, and full physical and mental activity are relevant.<sup>[2]</sup>

Commonly followed methods of abdominal closure are conventional layered closure and single layer closure. Smead and Jones in 1900 and 1941 respectively described a mass closure technique and after that it was named Smead- Jones technique. Dudley, in 1970 had shown that mass closure was superior to layered closure when using stainless steel wire.<sup>[2,5]</sup>

Factors such as improved pre and postoperative support of the patient, improved method of anaesthesia and the use of antibiotics should decrease the incidence of wound dehiscence and adhesion formation but still these wound complications are not uncommon.<sup>[3]</sup> The reported incidence of wound dehiscence after abdominal surgery is from 0.2 to 5.8% and is certainly more frequent after emergency surgical procedures. The incidence is definitely related to age and is reported in contrast 5.4% for those over 45 years. The mortality rate of wound disruption is 22-50%.<sup>[4]</sup>

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.

## MATERIALS & METHODS:

This study includes 40 patients admitted in Anand Hospital, Islampur, Maharashtra, during the period of June 2015 to Dec 2016 for abdominal surgical problems needing either elective or emergency surgery. The patients were chosen randomly, irrespective of gender,

age and nature of disease. Out of these 40 patients, 20 were randomized to have the abdominal wall closed by single layer closure technique and remaining 20 by conventional layered closure and were grouped as group 1 and group 2 respectively.

## Inclusion Criteria

- Patients aged 15-75 years.
- Patients posted for laparotomy, either elective or emergency.
- Patients who underwent surgery with midline and paramedian incisions.

## Exclusion Criteria

- Patients with co-morbid conditions like immunocompromised patients, patients on cancer chemotherapy, immunotherapy and on long term steroids.
- Patients who died within 7 days after surgery.
- Patients who underwent surgery by Grid-iron and Transverse abdominal incisions.
- Patients who underwent second laparotomy or relaparotomy.

## Methods

Relevant history of the patient including any comorbidities, personal and drug history were noted. Clinical examination was made and recorded with particular attention given to note the anemia, nutritional status, jaundice, respiratory tract infections. Routine investigations and investigations relevant and supporting

the particular diagnosis were employed. Patients were prepared pre-operatively. In emergency surgery, the general condition of the patient was improved by correcting dehydration, electrolyte imbalance and by giving antibiotics. Bowel wash was given for necessary cases. In the operation theatre, the part was painted and draped. General anaesthesia was used in all cases. Using suitable incision, the surgery planned was performed.

## CLOSURE OF ABDOMINAL INCISIONS

### In group 1:

#### 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 locking sutures using Prolene No. 1.

### Paramedian incision

The peritoneum, endoabdominal fascia, posterior layer of rectus sheath, the medial fibres of rectus abdominis muscle and anterior layer of rectus sheath were sutured as a single layer. The bites were taken about 1cm from the cut edges and about 1cm interval. Continuous locking sutures were put with Prolene No.1.

### In group 2

#### Mid line Incision

The peritoneum was closed with Vicryl No.2.0 by continuous locking sutures and the linea alba closed similarly with Prolene No.1.

### Paramedian Incision

The peritoneum and posterior layer of rectus sheath was closed with Vicryl No.2.0 by continuous locking sutures. The anterior layer of rectus sheath was closed with No.1 Prolene by continuous locking sutures. Skin was closed with nonabsorbable material like Nylon using interrupted mattress sutures or staplers in both groups of patients. Following surgeries, the wounds were cleaned with spirit and dressed. Time taken for closure of abdomen were recorded in all cases. Drains were used wherever necessary, through a separate stab incision.

### Postoperative

All patients received antibiotics suitable for the case in post operative period parenterally, usually for 2-3 days and orally for 5-7 days. Antibiotics were continued only whenever indicated after 10 days. Analgesics were given post operatively. Blood transfusions were given wherever indicated. The wound was examined on 3rd, 5th, 7th and 9<sup>th</sup> 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 days 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.

### Follow up

Regular monthly follow up were done for 3 months, and once in 3 months thereafter. During the follow up, the patients were examined for scar complications and incisional hernia.

### Results and Analyses:

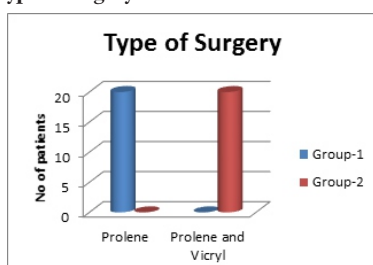
**Table No-1 Type of Surgery:**

No	Group-1 (Single layer closure)	Group-2 (Conventional layered closure)
Elective	6(30%)	7(35%)
Emergency	14(70%)	13(65%)
Total	20(100%)	20(100%)

In Group-1, 6 patients underwent an elective surgery while 14 underwent an emergency procedure.

In Group-2, 7 patients underwent elective surgery while 13 underwent an emergency procedure.

### Graph No-1 Type of surgery



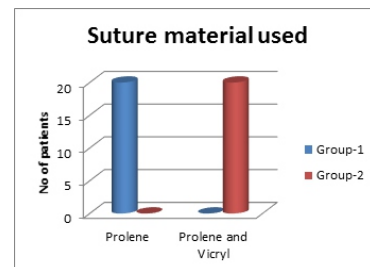
**Table No-2 Suture material used**

Material used	Group-1	Group-2
Prolene	20(100%)	0
Prolene and Vicryl	0	20(100%)

In Group-1 all the patients the wound closure was done with prolene No-1 in a single layer.

In group-2 all the patients, wound closure was done with the conventional layered technique with Prolene No-1 and Vicryl No 2-0.

**Graph No-2 Suture material used**



**Table No-3 Time taken for wound closure**

Time Taken (In Minutes)	Group-1	Group-2
<30	20 (100%)	6 (30%)
>30	0	14 (70%)

In Group-1- All the patients wound closure was completed in less than 30 minutes.

In Group-2- In 6 patients wound closure was done in less than 30 minutes, while 14 patients required more than 30 minutes for wound closure.

In our study, the mean time taken for closure of laparotomy wounds, by single layer closure technique was 19.5min and by conventional layered closure technique was 32.7min. There was a difference of about 13.2 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.

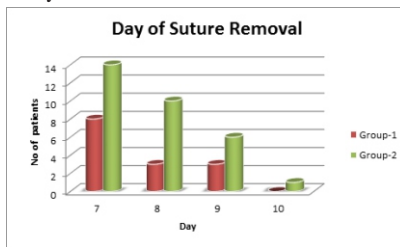
**Graph No-3 Time taken for wound closure.**



**Table No-4 Day of suture removal**

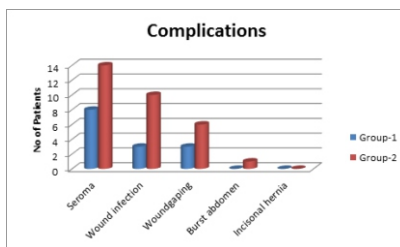
Day of suture removal	Group-1	Group-2
7	8 (40%)	2 (10%)
8	7 (35%)	9 (45%)
9	4 (20%)	5 (25%)
10	1 (5%)	4 (20%)

In our study, 26.7% of patients undergoing laparotomy had suture removal done on 7th on post operative day and 41.7% on 8th post operative day. The mean time taken was 7.9 days for single layer closure method and 8.4 days for conventional layered closure method. There was a significant difference ( $p=0.030$ ) in the time taken for suture removal between the single layer closure technique and the conventional layered technique.

**Graph no-4 Day of suture Removal****Table No-5 Complications**

Complication	Group-1	Group-2
Seroma	8 (40%)	14 (70%)
Wound infection	3 (15%)	10 (50%)
Wound Gaping	3 (15%)	6 (30%)
Burst abdomen	0	1 (5%)
Incisional hernia	0	0

In our study total 12 patients (60%) in group-1 had post operative complications while 17 patients (85%) in group-2 had post operative complications.

**Graph No-5 Complications**

## DISCUSSION:

The present study is aimed at comparing the techniques of laparotomy wound closure. The technique of laparotomy wound closure is one of the important factors in preventing post operative complications. Any error, such as a poorly placed incision, unsatisfactory method of closure or inappropriate selection of suture can lead to complications including hematoma, stitch abscess, infection, wound dehiscence or evisceration, incisional hernia or an unsightly scar. 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. In our study the mean age of patients taken up for study was 48.8 yrs in single layer closure group and 46 yrs in conventional layered closure group, did not show any significant difference between the two groups. Many larger earlier studies and Wieland *et al*<sup>7</sup> study, advocated the use of monofilament nonabsorbable suture material for closure of laparotomy wounds. Weiland *et al*<sup>8</sup>, 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. In our study, we used monofilament, non absorbable continuous interlocking sutures (Prolene No.1) for closure of laparotomy wounds, in single layer closure and Vicryl No.2.0 and Prolene No.1 for conventional layered closure. In our study mean time taken for closure of laparotomy wounds by single layer closure was 19.5 minutes and by conventional layered closure was 32.7 minutes. Single layer closure took about 13.2 minutes lesser than conventional layered closure. In Banerjee and Chatterjee<sup>7</sup> study, single layer closure took about 10 minutes lesser time than conventional layered closure. Our study was consistent with their study. Various studies have reported postoperative complication rates which are definitely less in single layer closure than in conventional layered closure. Considering that majority of our patients were from a rural setup most of them had poor nutritional status and were associated with one or more predisposing factors. The incidence of post operative seroma formation in our study was

40% in single layer closure group and 70% in conventional layered closure group, showing higher incidence in conventional layered closure group. Tearing through the weak infected tissues with intact suture is the main cause for wound dehiscence. The wound infection rate for Togart<sup>8</sup> was 17% and 29%, Shukla *et al*<sup>9</sup> was 0.5% and 16.9%, Singh *et al*<sup>10</sup> was 6.6% and 16.6% and for Chowdhury and Chowdhury<sup>11</sup> was 22.5% and 47.5% in single layer closure and conventional layered closure respectively. In our study, the incidence of wound infection was 15% in single layer closure and 50% in conventional layered closure, showing higher incidence in conventional layered closure. Incidence of wound gaping was 0.87% and 3.4% for Togart<sup>8</sup>, 2% and 13% for Shukla *et al*<sup>9</sup>, and 0% and 10% for Singh *et al*<sup>10</sup>, in single layer closure and conventional layered closure respectively. In our study, the incidence of wound gaping was 15% in single layer closure and 30% in conventional layered closure, again showing higher incidence in conventional layered closure group. Peritonitis requiring emergency surgery along with other associated factors like chest infection with cough, anaemia and hypertension were thought to be the causative factors for a higher incidence of wound gaping in our study. Irvin *et al*<sup>12</sup> found that wound infection was responsible for tenfold rise in the incidence of burst abdomen and incisional hernia. Incidence of burst abdomen was 0% and 3.9% for Jones<sup>1</sup>, 0.8% and 3.8% for Bucknall *et al*<sup>3</sup>, 4.7% and 12% for Sharma *et al*<sup>10</sup>, 3.6% and 7.27% for Banerjee and Chatterjee<sup>3</sup>, and 0% and 3.75% for Chowdhury and Chowdhury, in single layer closure and conventional layered closure respectively. In our study, incidence of burst abdomen was 0% in single layer closure and 5% in conventional layered closure, showing doubling of burst abdomen incidence in conventional layered closure group. Wound infection, wound gaping and burst abdomen increased patient's morbidity, hospital stay and cost.

## CONCLUSION:

Various methods of skin closure for laparotomy wounds have occupied the attention of surgeons over the years. Success of a surgery is complete when the wound heals with minimal complications and its cosmetic appearance is satisfactory. This is seen being possible with single layer closure technique of laparotomy wounds because of the shorter time required and other favourable factors for its healing. For a long time laparotomy wounds were closed in layers. When the mass closure technique of laparotomy wound was introduced, the myth of layered closure was broken. In our study, single layer closure of laparotomy wounds took less operative time than conventional layered closure thus reducing the risk of anaesthetic hazards and the intra operative time. In our study conducted in the rural setup, most of our patients were under nourished and had one or more associated factors which had an implication on the overall healing of the wound and hence a relative increase in the postoperative complications. The incidence of postoperative complications like seroma, wound infection, wound gaping, burst abdomen and incisional hernia were however less in single layer closure compared to conventional layered closure. Hence, we conclude that single layer closure is a better technique for closure of laparotomy wounds than conventional layered closure in terms of operative time and post operative complications. However, longer study period is required to know the exact incidence of incisional hernias in the comparison groups.

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