IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 19, Issue 9 Ser.6 (September. 2020), PP 49-58
www.iosrjournals.org

A Comparative Study of Single Layer Closure vs Conventional Layer Closure of Laparotomy Wounds

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ABSTRACT
BACKGROUND: *In this study we compare single layer closure and conventional layer closure in laprotomy wounds and the post operative complications and outcomes associated with this study.*
METHODS: *In this prospective study of 100 patients who admitted in Department of General Surgery between July 2018 to March 2020 were assigned such that 50 will be randomized to have the abdominal wall closed by single layer closure technique and remaining 50 by conventional layered closure and they will be grouped as group 1 and group 2 respectively.*
RESULTS: *In this comparative study of 100 patients group 1 patients have less complicates than group 2 , such as seroma is seen in 22 patients in group 1 where as 35 patients in group 2, wound infection is seen in 10 patients in group 1 where as 26 in group 2, wound gaping is seen in 10 patients in group 1 where as 16 in group 2, burst abdomenis seen in only one in group 1 where as 02 in group 2, incisional hernia is seen in only one patient in group 2.*
CONCLUSION: *Our study shows single layer closure is always superior to conventional layer closure in laprotomy wound as of the findings and follow up of us.*
KEYWORDS: *single layer closure , conventional layer closure ,laprotomy wound ,complications .*

Date of Submission: 05-09-2020 Date of Acceptance: 20-09-2020

I. Introduction

Exploration and re-exploration (Laparotomy) is one of the most common surgeries performed in an emergency as well as elective setting. Incision and suturing of the abdominal layers are the commonest exercises in operative surgery. While performing laparatomies, surgeons should keep in mind that the incision chosen should have good accessibility, extensibility, security and a resultant acceptable scar.

Abdominal closure is very important and incision, technique of repair and use of newer suture material has created great interest to surgeons. Different suture techniques are used for closure of laparotomy wounds and each has its strong proponents. Ideal method of abdominal wound closure is modified frequently. Commonly followed methods of abdominal closure are conventional layered closure and single layer closure.

Factors other than mechanical ones are also known to predispose to poor wound healing. Thus, obesity renal failure, jaundice and sepsis should alert the surgeon to use meticulous technique.

The standard practice of closure of laparatomy wounds was or, is a multilayer closure with chromic catgut and a recent technique of figure of eight technique with mass closure with steel wire (Jones et al.) stitches and more recent mass closure with monofilament prolene.

Over the years the method of mono layer closure using non absorbable sutures has been gaining popularity. Minimum discomfort, good patient compliance, the low rate of complications and reliability of this method of closure confirm the merits of monolayer closure technique of laparotomy incisions.

II. Aims And Objectives

My objective is to study 100 cases of laparotomy, dividing them into two groups of 50 each. Patients of one group will undergo closure of the laparotomy wound by conventional method and the other group will undergo closure in a single layer. The objectives being to:

1. Compare the operative time and healing time for single layer closure and conventional layered closure of laparotomy wounds.
2. Compare the post-operative complications of laparotomy wounds like seroma, wound infection, wound gaping, burst abdomen and incisional hernia in the two groups.

3. Incisions taken.

III. MATERIALS AND METHODS

SOURCE OF DATA:

100 patients admitted in the Department of General Surgery, Mediciti Institute of Medical Sciences, Hyderabad, will be included in the study. The patients are chosen randomly, irrespective of gender, age and nature of disease.

Out of these 100 patients, 50 will be randomized to have the abdominal wall closed by single layer closure technique and remaining 50 by conventional layered closure and they will be grouped as group 1 and group 2 respectively.

METHOD OF DATA COLLECTION:

History regarding the particularillness will be noted followed by clinical examination and the routine investigations like blood and urine. Other necessary investigations will be sent for. Special investigations relevant to the disease will be done.

Patients under Group 1 will undergo mass closure of abdomen as follows:

i. MIDLINE INCISION: Closed by suturing the peritoneum and linea alba together using prolene.
ii. PARAMEDIAN INCISION: The peritoneum, posterior layer of rectus sheath, the medial fibres of rectus abdominis muscle and anterior layer of rectus sheath is sutured as a single layer.

Patients under Group 2 will undergo conventional layered closure of abdomen as follows:

i. MIDLINE INCISION: The peritoneum is closed with absorbable sutures. The linea alba with prolene or PDS.
ii. PARAMEDIAN INCISION: The peritoneum and posterior layer of rectus sheath is closed with absorbable sutures. The anterior layer of rectus sheath is closed with prolene or PDS.

FOLLOW UP OF PATIENTS:

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

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 diabetes mellitus, immuno-compromised 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.

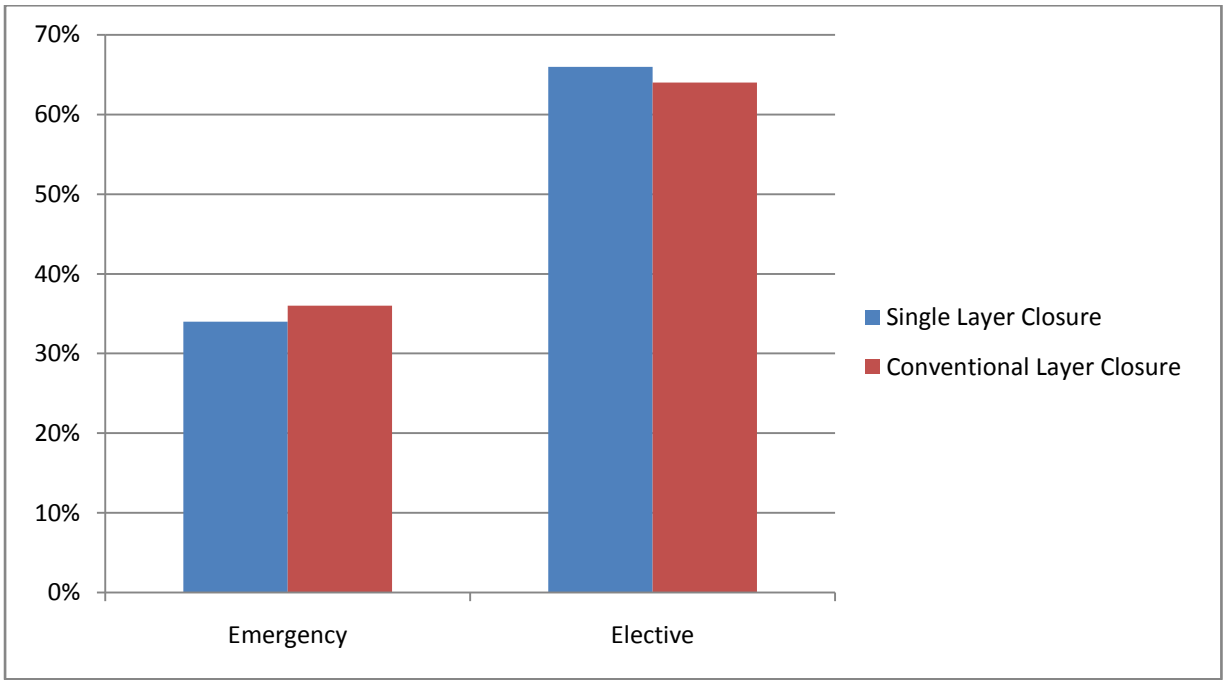
Patients who underwent second laparotomy or re-laparotomy.

STUDY DESIGN: A COMPARATIVE TWO GROUP STUDY

Table 1:Mode of Delivery

Mode of delivery	Single layer closure No	Single layer closure %	Conventional layer closure No	Conventional layer closure %
Emergency	17	34	18	36
Elective	33	66	32	64
Total	50	100	50	100

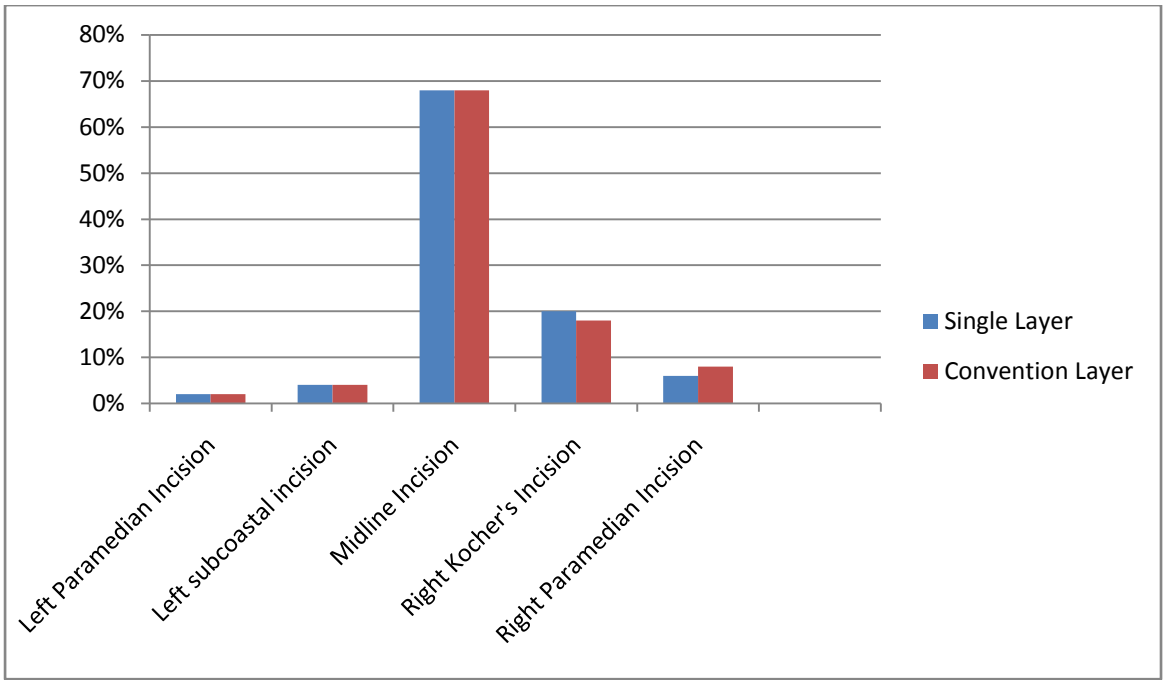
P value = 0.767



In our study, 17 cases underwent emergency surgery and 33 cases underwent elective surgery in group 1(single layer closure). In group 2 (conventional layer closure), 18 cases underwent emergency and 32 cases underwent elective surgery.

Table 2: Type of Incision

Incision	Single layer No	Single layer %	Conventional layer No	Conventional layer %
Left paramedian incision	1	2	1	2
Left subcoastal incision	2	4	2	4
Midline incision	34	68	34	68
Right kocher's incision	10	20	9	18
Right paramedian incisioin	3	6	4	8
Total	50	100	50	100



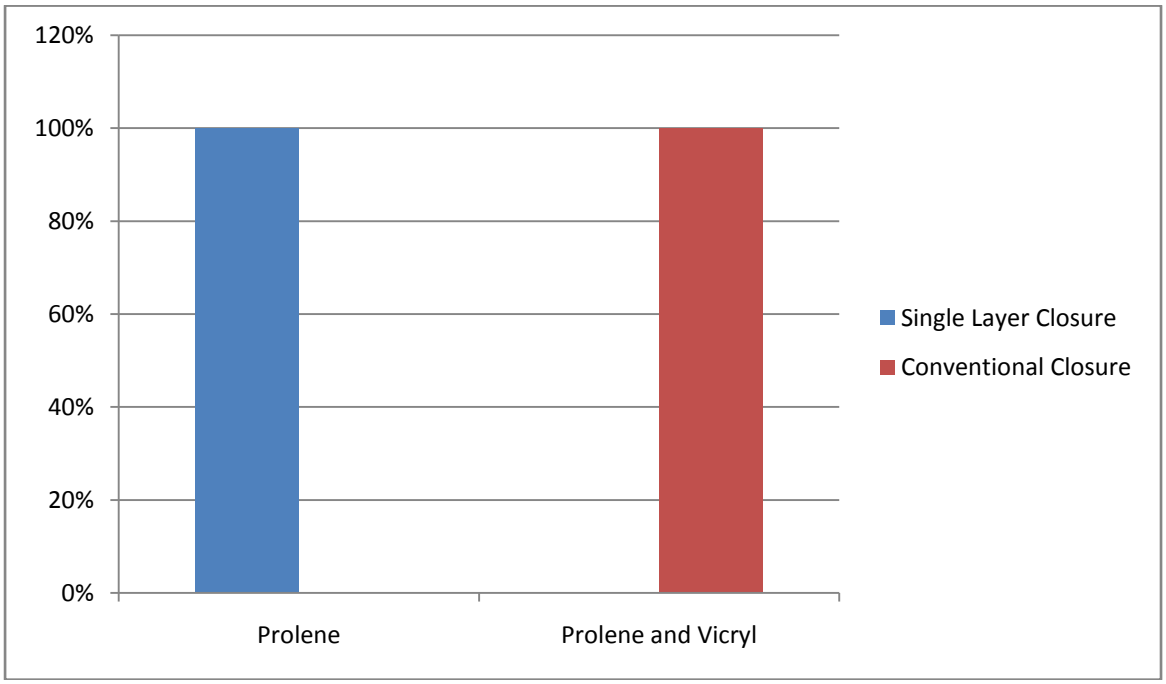
In our study, 68% of the patients in the single layer group had undergone midline incision,followed by 20% of the patients underwent right kocher's incision, followed by 6%of the patients underwent right para median incision, 4% of the patients had undergone right kocher's incision and 2% of the patients were given a left subcoastal incision of the 50 total patients in the group.

Similarly, 68% in the group of conventional layer closure were taken up for midline incision, with 18% of them taken up with right subcoastal incision, 8% of them were taken up with right kocher's incision, 4% underwent right kocher's incision and 2% of them were taken up with left subcoastal incision.

Table 3: Material used

Materials used	Single layer closure no	Single layer closure %	Conventional closure no	Conventional closure %
Prolene	50	100	0	0
Prolene and vicryl	0	0	50	100
Total	50	100	50	100

P=<0.001

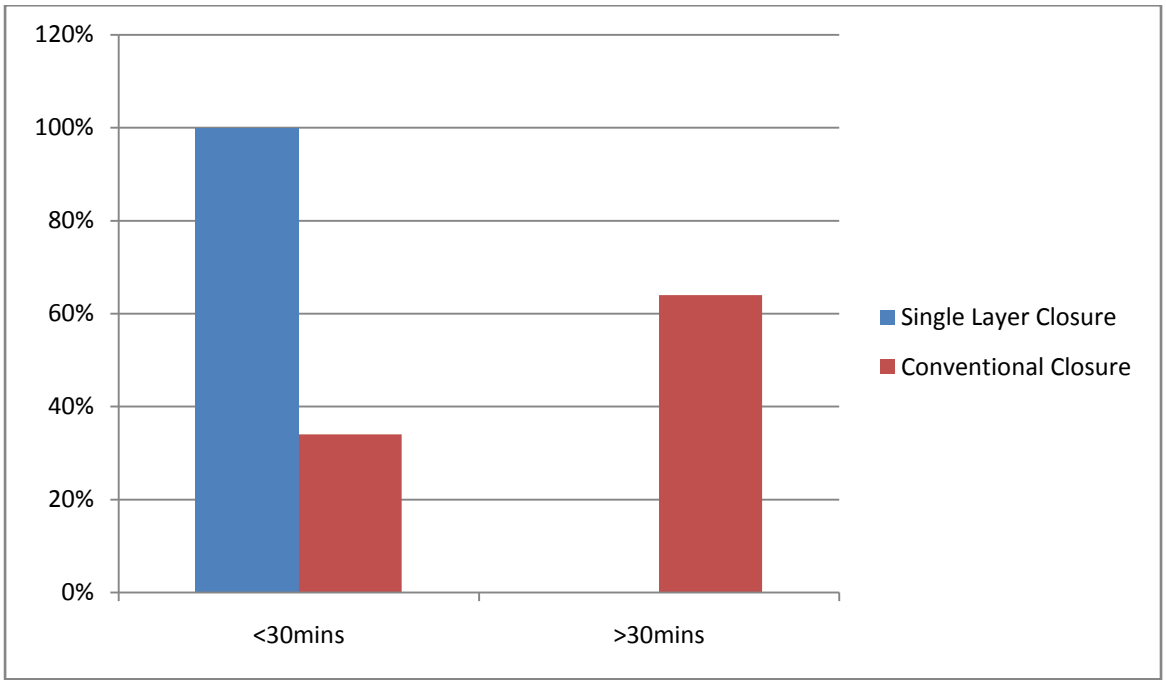


In our study, single layer closure was done with prolene no.1,conventional closure was doneby vicryl no.1 and prolene no.1.

Table 4: Time taken for closure

Time taken for closure	Single layer closure no	Single layer closure %	Conventional closure no	Conventional closure %
<30 mins	50	100	17	34
>30 mins	0	0	33	64
Total	50	100	50	100

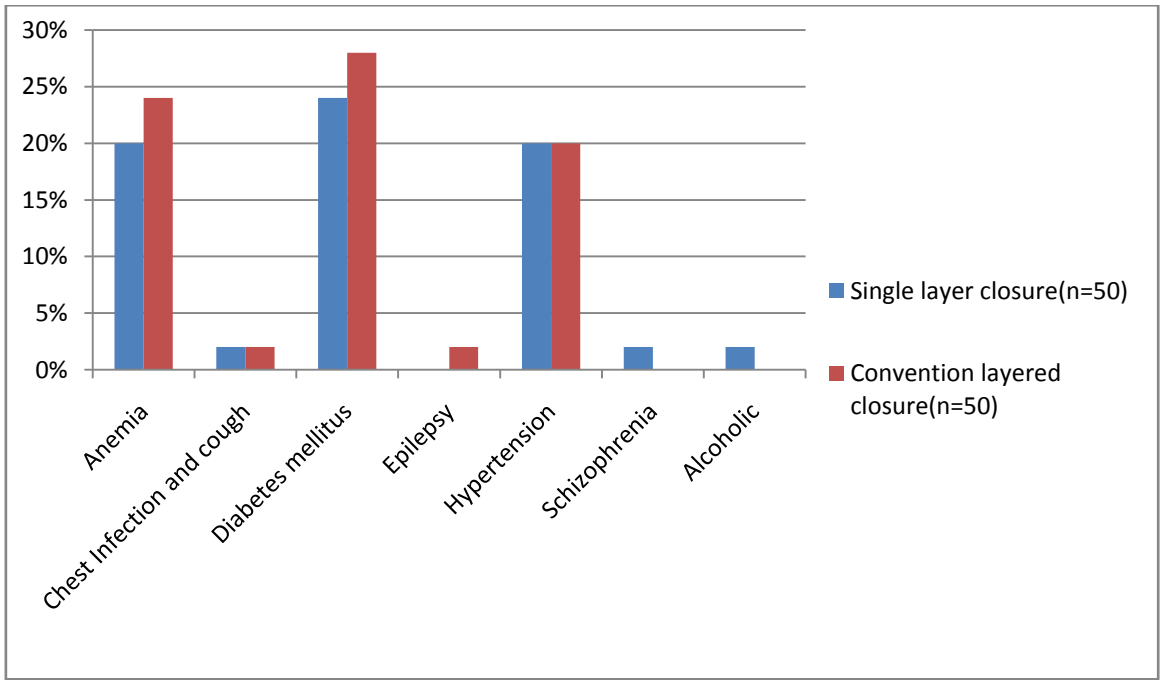
P=0.001



In our study, mean time taken for laparotomy wounds, by single layer closure is 20 mins, while mean time taken for conventional closure was 32 mins. There is a difference of 12 mins between the two techniques with a P value of 0.001% which is statistically significant, which means single layer closure takes less time in closing the laparotomy wound subjecting the patient to less time in anaesthesia.

Table 5: Associated factors

Associated factors	**Single layer closure (n=50)**		**Conventional layered closure (n=50)**	
	No	**%**	**No**	**%**
1.Anemia	10	20	12	24
2.Chest infection and cough	1	2	1	2
3.Diabetes mellitus	12	24	14	28
4.Epilepsy	0	0	1	2
5.Hypertension	10	20	10	20
6.Schizophrenia	1	2	0	0
7.Alcoholic	1	2	0	0

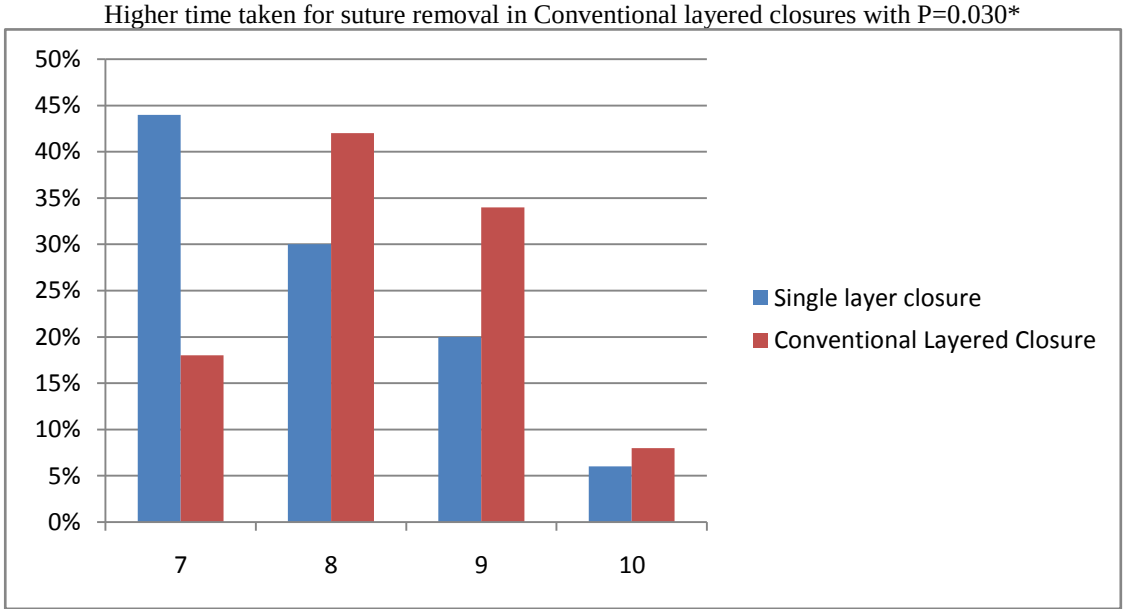


In the study, 35 patients in group 1 and 38 patients in group 2 had associated risk factors. They had single or multiple risk factors. 20 % had anemia, 24 % were diabetic, 20 % had hypertension, 1 had chest infection with cough, 1 patient had schizophrenia and 1 was an alcoholic in group 1. 24 % were anemic, 28 % were diabetic, 20 % were hypertensive, 1 had chest infection with cough and 1 had epilepsy in group 2

Table 6: Day of suture removal

Day of suture removal	Single layer closure		Conventional layered closure	
	No	%	No	%
7	22	44	8	18
8	15	30	21	42
9	10	20	17	34
10	3	6	4	8
Total	50	100.0	50	100.0

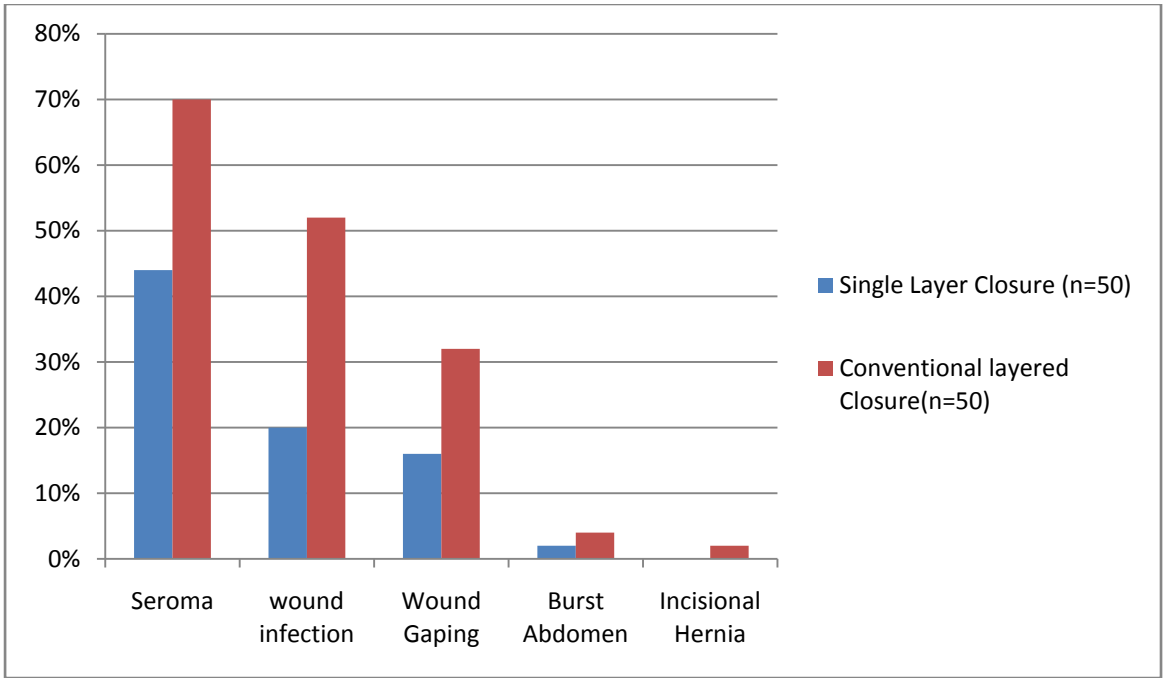
Higher time taken for suture removal in Conventional layered closures with P=0.030*



In the study, 44% of patients undergoing laparotomy had suture removal done on 7th post operative day and 30% 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.

Table 7: Complications

Complications	Single layer closure (n=50)		Conventional layered closure (n=50)		P value
	No	%	No	%	
1.Seroma	22	44	35	70	0.037*
2. Wound Infection	10	20	26	52	0.007**
3. Wound Gaping	8	16	16	32	0.243
4. Burst Abdomen	1	2	2	4	1.000
5. Incisional Hernia	0	0	1	2	1.000



POST OPERATIVE COMPLICATION IN THE STUDY GROUP:

In the study, 30 patients (60%) in single layer closure group and 45 patients (90%) in conventional layered closure group, had post-operative complications like seroma, wound infection, wound gaping, burst abdomen and incisional hernia. Most of them had more than one complication.

Seroma

In group 1, 22 patients had seroma, out of which 15 had only seroma and 7 had other complications. 7 of them were associated with single or multiple risk factors. In group 2, out of 35 patients who had seroma, 22 of them had more than one complication. 12 had anaemia, and 18 of them underwent emergency surgery.

Wound Infection

In group 1, 10 patients had wound infection out of which 4 of them were associated with more than one complication and 5 of them underwent emergency surgery. In that 3 patients were anaemic and 2 were diabetic. In group 2, out of 26 patients who had wound infection, 21 had more than one complication, 14 underwent emergency surgery and 8 patients had anaemia.

Wound Gaping

In group 1, 10 patients had wound gaping, out of which 6 of them had more than one complication, 5 of them underwent emergency surgery. 3 of them were diabetic, 1 was an alcoholic, and 1 had chest infection with cough. One patient was anaemic and two others were hypertensive. In group 2, out of 16 patients who developed wound gaping, out of which 12 of the m had more than one complication, 15 patients underwent emergency surgery. 5 patients were anaemic out of which one had an additional factor of diabetes, 4 were diabetic and a hypertensive and one patient had chest infection with cough and hypertension.

Burst Abdomen

In group 1, burst abdomen occurred in one patient on 6th post operative day. This patient was a schizophrenic and had a liver contusion and mesenteric tear with peritonitis. This patient underwent emergency surgery. In group 2 burst abdomen occurred in 2 patients, both operated on an emergency basis. First patient had blunt trauma abdomen with bowel injury and peritonitis. Burst abdomen occurred on 7th post operative day. The second patient had liver trauma with multiple lacerations and contusions. He was hypertensive. In this patient burst abdomen occurred on 8th postoperative day.

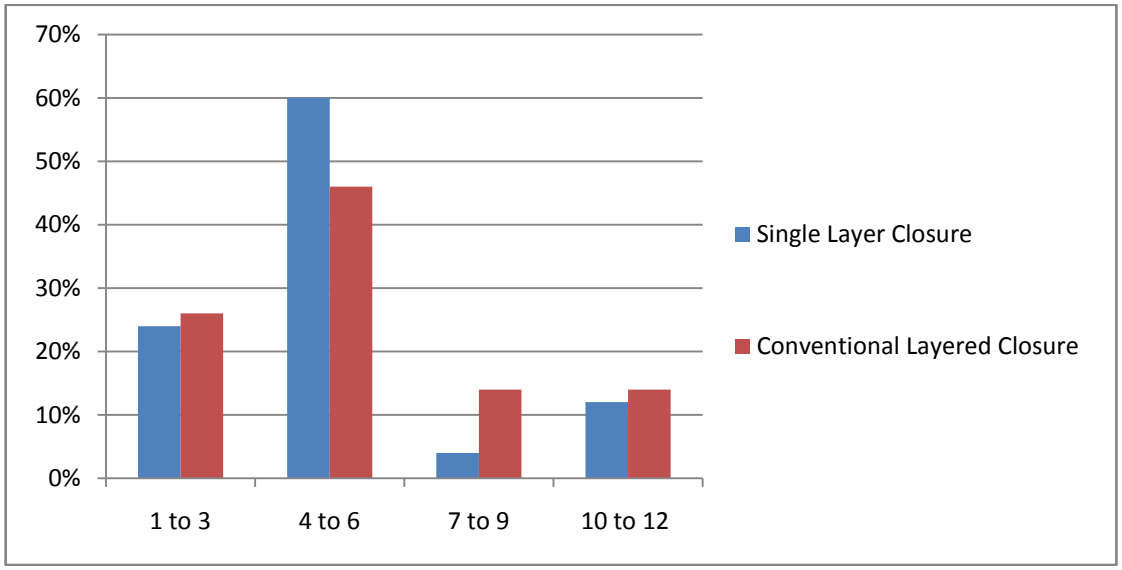
Incisional Hernia

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 ileal perforation and peritonitis. He had developed seroma and wound gaping in the immediate postoperative period.

Table 8: Follow up in months

Follow-up in months	Single layer closure		Conventional layered closure	
	No	%	No	%
1 – 3	12	24	13	26
4 – 6	30	60	23	46
7 – 9	2	4	7	14
10 – 12	6	12	7	14
Total	50	100	50	100
Mean ± SD	5.3 ± 2.57		5.7 ± 2.65	

P=0.491



In our study, the mean postoperative follow up of patients in the single layer closure groupwas 5.3 months and in the conventional layered closure group was 5.7 months.

IV. DISCUSSION

The present study is aimed at comparing the techniques of laparotomy wound closure which in a very common practice in the surgical practice. The study had two groups of 50 each of the total hundred cases we intended to study about the closure of laparotomy wounds.

The technique of laparotomy wound closure is one of most the important factors in preventing post operative complications of surgical wound and the most important factor in the long-term behavior of the wound inflicted on the patient by the surgeon. Any error, error of judgement, such as a poorly placed incision on the abdomen, unsatisfactory method of closure of the incised laparotomy wound or inappropriate selection of the suture material can lead to complications of the surgical wound including hematoma, stitch abscess, infection, wound dehiscence or evisceration, incisional hernia or an unsightly scar.

It has been mentioned that the whole surgical wound was closed with No1 Prolene while group 2 closed in multiple layers one with absorbable suture material and non absorbable suture material. absorbable being vicryl and non-absorbable being prolene.

Time consumed in single layer closure was much lesser than time consumed in conventional layer closure there by proving that single layer closure is a superior technique in decreasing the time to which a patient is subjected to both surgical and anaesthetic stress and thereby decreasing morbidity of the patient and also mortality. Meticulously closed single layer closure is a superior surgical closure compared to conventional closure. Time factor is one of the good indicators to use single layer closure over conventional layer closure.

Multiple factors play an important role in the long-term outcome of any surgical wound and particularly more abdominal wounds because of the deleterious outcomes that could be a sequalae to the factors influencing the outcome of abdominal surgical wounds. Each factor has its own effect on the next factor.

Seroma is a simple surgical complication to occur, but it has a big affect on the outcome on a long-term basis as it would increase the chances of wound infection if not identified at the earliest not properly taken care off. In the present study. seroma was found to be particularly high in both the groups and most of the surgical wounds that had wound infection. Seroma is a simple surgical factor, if taken care of decreases other complications of surgical wound. And the present study clearly shows that single layer closure has less chances of developing seroma compared to the conventional layer closure. This is another reason to adopt single layer closure.

Wound infection as a complication is another factor in determining the long-term outcome of the surgical wounds of the abdomen. Care must be taken to prevent wound infection to decrease both morbidity and mortality of the patientin the present study wound infection was high in both groups particularly more in the conventional layer group. In comparison to the standard studies, wound infection was relatively high in the present study but was similarto other studies in establishing that single layer closure is superior to conventional layer closure. Henceforth, we can clearly say that wound infection rates are lower in single layer closure.

Wound dehiscence is another factor that determines the long term outcome of the abdominal surgical wound in the present study to it is clearly established that wound dehiscence which is sequel to seroma and wound infection are much lesser in the single layer group to the conventional layer group.Care must be taken to not allow wound dehiscence in the patients. In the present study,similar to most of the studies clearly establishes that single layer closure is superior in preventing wound dehiscence and our study had lesser number of wound dehiscence that other studies.

Burst abdomen and incisional hernia are other serious complications of abdominal surgical wounds. Our study had relatively very low cases of burst abdomen and incisional hernias, allinall only four of them and conventional layer closure had more cases□3 of them and only one case of burst abdomen had occurred in the single layer closure. Care must be taken to prevent both these complications of abdominal surgical wounds because in both these cases patient has to be subjected to both anaesthetic and surgical stress and these both factors play a major role in deciding, how effective closure a surgeon has done. Meticulous closure can prevent these complications.

In the present study, it is established that single layer closure is superior to conventional layer closure even though our study is a short period study.Hence, the actual outcome of surgical wound could not really be established because incisional hernias occur after a period of 5 to 10 years and not within the first year as once thought to be. Hence, the present study has that short coming.

Though single layer abdominal closure is a popular technique in abdominal closure, there are still many surgeons who close the abdomen in conventional closure and find it good enough for long term outcome.It's difficult to say but meticulous closure of abdomen will prevent long term complications surgical abdominal wounds.

V. 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 group.

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