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### RESEARCH ARTICLE

#### “COMPARATIVE STUDY BETWEEN MASS CLOSURE VERSUS CONVENTIONAL LAYERED CLOSURE OF ABDOMINAL WOUNDS WITH MIDLINE AND PARAMEDIAN INCISIONS”

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#### Abstract

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#### Introduction:-

In abdominal surgery, wisely chosen incision, correct method of making and closing such wounds are factors of great importance. The ideal method of abdominal wound closure should be technically so simple that the results are as good in the hands of trainee as in those of master surgeons. It should be free from complications of burstabdomen, incisional hernia, and persistent sinuses. It should be comfortable to the patients and should leave a reasonably aesthetic scar.

Until recently layered closure of the abdomen wounds were considered ideal with great emphasis placed on peritoneal layered. It is now fully realized; both from clinical observation and animal studies, that healing of incisions takes place by a dense fibrous scar that unites the opposing faces of laparotomy wound en masse.<sup>1</sup>

Therefore, this study is intended to show that continuous en masse closures of laparotomy wounds is preferred to conventional layered closure.

This study is a prospective comparative study between mass closure versus conventional layered closure of abdominal wounds with midline and paramedian incisions. The data collection for our study included patients from Mahatma Gandhi Mission Hospital and Medical College attending the outpatient and emergency services and subsequent admission as in-patient during the period, June 2010 to June 2012.

The study group included patients who were randomly selected irrespective of their age, sex and nature of disease. Out of 109 patients, 53 patients were randomized to have their ventral abdominal incisions closed in single layered mass closure and 56 patients in conventional layered closure. These patients are grouped as Group 1 and Group 2 respectively.

In Group 1 (53 out of 109 patients) ventral abdominal incisions were closed in single layered mass closure using, polypropylene no. 1 by continuous interlocking.

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In Group 2 (56 out of 109 patients) ventral abdominal incisions were closed in conventional layers using No. 1-0 chromic catgut for peritoneum and polypropylene No. 1 for linea alba or the layers of rectus sheath by continuous interlocking skin was closed with non absorbable material like No. 1.0 cotton thread or mersilk using interrupted mattress suture in both groups. Six Patients in the former and twelve patients in the latter had wound infection. Four cases of burst abdomen occurred in layered closure and one in mass closure. Two cases of incisional hernia occurred in layered and one in mass closure. Thus, minimal complication and good patient compliance seem to justify the use of mass closure in place of layered closure in all types of abdominal operations.

### **Aim And Objectives Of The Study**

The study aims to show that mass closure of laparotomy wounds:

1. Is easier, faster and cost effective.
2. Has a lesser rate of complications like burst abdomen, incisional hernia and sinus formation.
3. Has better patient compliance.
4. Leaves a reasonably aesthetic scar.<sup>1</sup>

### **Methodology:-**

In case of median incisions peritoneum was closed with chromic catgut No. 1 by continuous interlocking and linea alba was closed with polypropylene No. 1 by continuous interlocking sutures.

In case of paramedian incisions peritoneum and posterior layer of rectus sheath was closed with chromic catgut No. 1 and anterior layer of rectus sheath was closed with polypropylene No. 1 by continuous interlocking sutures.

Skin was closed with non-absorbable material like No. 1-0 cotton thread or mersilk, using interrupted mattress sutures.

### **Methods:-**

#### **History and clinical examination:**

Detailed history taking was followed in all cases admitted in our wards.

Particulars regarding the diseases like hypertension, diabetes, jaundice, tuberculosis and other chest infections were made note of.

Thorough clinical examination of the patients was made and recorded, particular attention was given to note the anemia, nutritional status, jaundice, and respiratory tract infection.

#### **Investigations:**

A thorough preoperative search was made to exclude anaemia, jaundice, uremia, diabetes mellitus, malnutrition or obesity.

The following investigations were done as a routine:

1. Blood: Hb%, TC, DC, ESR, BT, CT, blood grouping and Rh typing.
2. Blood: Random blood sugar, FBS and PPBS.
3. Blood: Urea and serum creatinine.
4. Blood: For HbsAg, HIV.
5. Urine: For albumin, sugar and microscopy.
6. Stool: It was tested for ova, cyst and occult blood wherever necessary.
7. X-ray chest PA view was done routinely in all cases preoperatively.
8. Height and weight of the patient: To calculate the BMI =  $\text{Weight}/(\text{Height})^2$ .

Special investigations like:

1. Erect x-ray abdomen was used in all acute abdominal conditions.
2. Contrast x-rays like barium meal follow through were used wherever necessary.
3. In patients with jaundice and hepatobiliary disorders, LFT was done.
4. Abdominal ultrasound scanning was used wherever necessary.
5. Endoscopy of upper gastrointestinal tract was used in suitable cases for diagnosis.

However, in emergency cases only the investigations necessary for diagnosis were employed. Complete workup was done in all cases that underwent elective surgery.

The positive criteria for the different factors are:

Anaemia: < 10 gm%

Jaundice: Bilirubin > 2 mg/dl

Diabetes: FBS > 120 mg/dl

Uremia: S.Urea > 40 mg/dl, Serum creatinine: > 1.4 mg/dl

Wound infection: Presence of pus

Obesity: BMI > 30

Malnutrition: BMI < 20

Postoperative: Cough, expectorations and fever

### **Preoperative preparation of the patient**

In patients who underwent emergency surgery, the general condition of the patients was improved to optimum level. In patients who underwent elective surgery, the general condition was improved by correcting dehydration, anemia and electrolyte imbalance. Diabetes and hypertension were brought under control. In patients with jaundice, glycogen storage was improved, hydration was corrected, renal and hepatic functions were tested and corrected to optimum levels. Suitable antibiotics were administered preoperatively to treat infections.

### **Operative techniques**

In the operation theatre, the part was prepared and draped. General anaesthesia was used in most of the cases. Drains were used wherever necessary, through a separate stab incision, away from the main incision.

The following points were paid special emphasis on:

The type of Incision: Midline and paramedian.

The type of closure: Mass closure and two-layered closure.

### **Technique of closure**

#### **Group I**

##### **A. Midline incisions**

Closure performed by suturing the out edges of the peritoneum, linea alba together as a single layer. Bites were taken about 1.5 cm from the cut edges and about 1.5 cm from the previous bite. Continuous locking sutures using polypropylene No. 1.

##### **B. Paramedian incisions**

The peritoneum, posterior layer of rectus sheath, the rectus abdominis muscle and anterior layer of rectus sheath were sutured as a single layer. The bites were taken about 1.5 cm from the cut edges and about 1.5 cm from the previous bite. Continuous interlocking sutures employed using polypropylene No. 1.

#### **Group II**

##### **A. Midline incisions**

The peritoneum was closed with chromic catgut No. 1 by continuous interlocking. The linea alba was closed with polypropylene No. 1 by continuous interlocking sutures.

##### **B. Paramedian incision**

The peritoneum and the posterior layer of rectus sheath were closed with chromic catgut No. 1 by continuous interlocking. The anterior layer of rectus sheath was closed using polypropylene No. 1 by continuous interlocking sutures.

The subcutaneous fatty layer if thick was closed using No. 2-0 chromic catgut with interrupted sutures. Skin was closed using mattress sutures with mersilk No. 1-0 or cotton thread No. 1-0 in both study groups.

The wounds were cleaned with spirit and dressed. No local antibiotics dressings were employed. Time taken for closure of abdomen was recorded in all cases.

**Postoperative period**

The patient was observed postoperatively till all the abdominal sutures were removed and the patient discharged from hospital.

The postoperative complications like, vomiting, chest infection, abdominal distension, suture sinus formation, wound infections or wound dehiscence were noted. All the patients received antibiotics suitable for the case parenterally usually for 6-7 days till the drains were removed and orally for about 5-6 days. Antibiotics were continued for more than 12-14 days only whenever indicated. As a routine NSAIDs, B-complex and

Vitamin C were given postoperatively as a schedule. Blood transfusion were used whenever indicated.

The wound was examined on 5m, 7., 9m or 11i day and the wound status noted. Drains whenever employed were removed after the patient tolerated oral feeds and passed stools regularly, usually 5 to 6th postoperative days.

Culture and sensitivity testing sent for infected cases. Alternate sutures were usually removed on 11 to 12th postoperative days and remaining sutures were removed on 13 to 14th postoperative days.

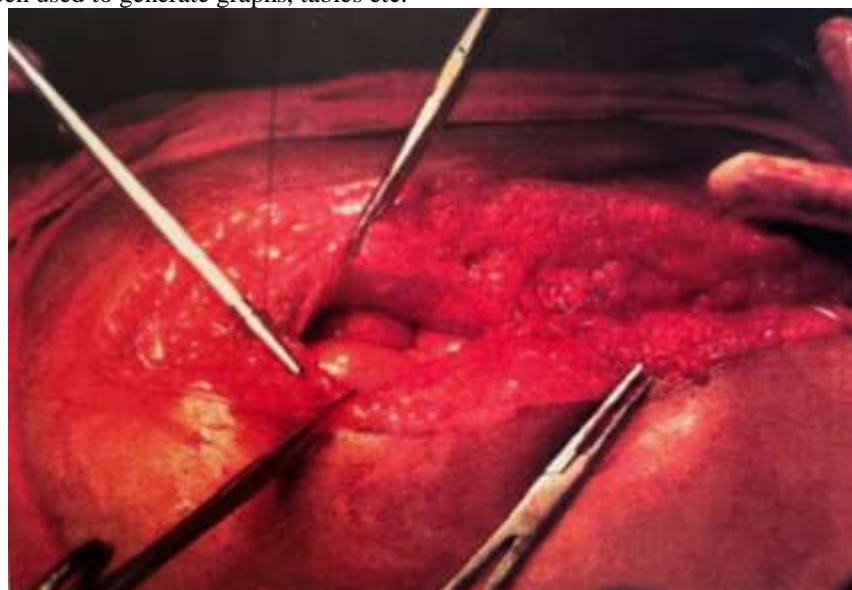
After the patients were discharged from the hospital, regular monthly follow-ups was done for first three months, once in three months for next one year. During the follow-up, patients were examined in the first visit specially for wound infection or wound dehiscence and during subsequent visits attention was paid to wound pain, suture sinus formation, scar complication, incisional hernia. However, it was imperative that cases, which were done towards the end of this study, obviously had a shorter follow up.

**Statistical Methods:-**

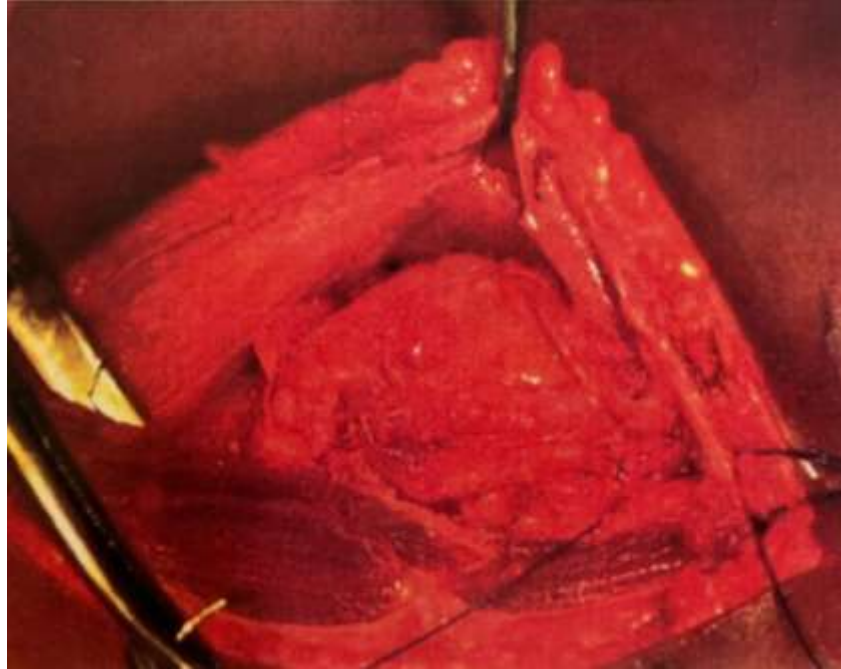
Chi-square and Fisher exact test have been used to test the significance of proportions of parameters of interest between single layered and conventional layered.

**Statistical software**

The statistical software namely SPSS 11.0 and Systat 8.0 were used for the analysis of the data and Microsoft word and Excel have been used to generate graphs, tables etc.



Single layered closure of mid line incision.



Single layered closure of paramedian incision



Conventional layered closure of paramedian incision.



Conventional layered closure of mid line incision.

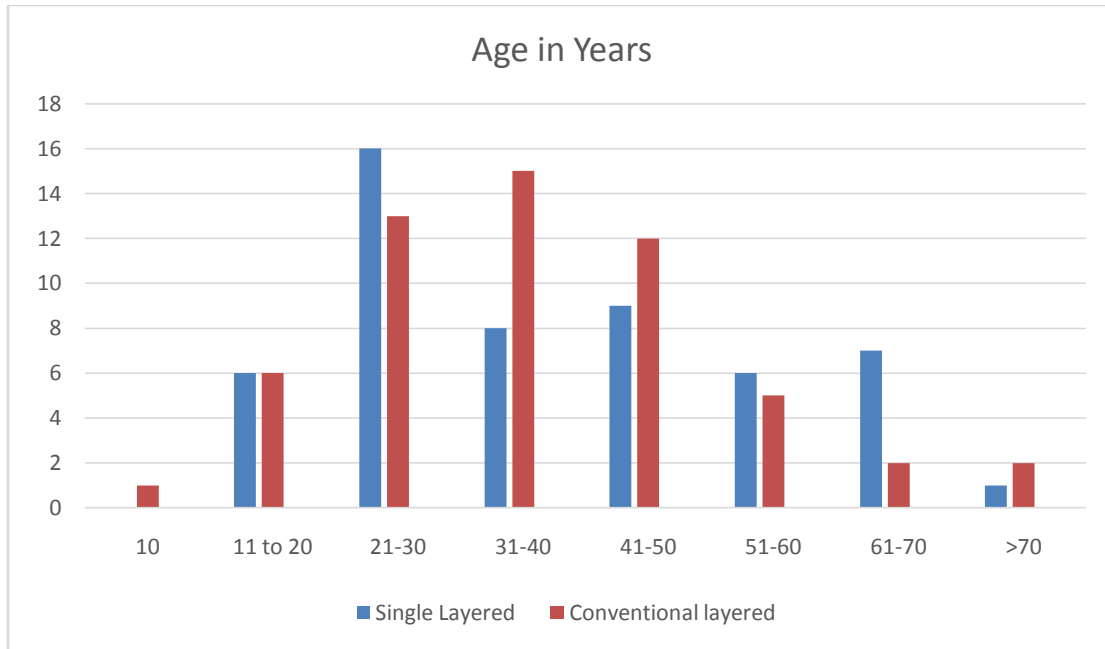
## Results:-

### Study Design

A comparative study consisting 109 cases divided in to two groups (Single layered- 53 cases and Conventional layered - 56 cases) is undertaken to compare the type of closures, complications etc

**Table 1:-** Age Distribution.

Age in Years	Single layered		Conventional Layered		Total	
	Number	%	Number	%	Number	%
10	-	-	1	1.8	1	0.9
11-20	6	11.3	6	10.7	12	11.1
21-30	16	30.2	13	23.2	29	26.6
31-40	8	15.1	15	26.8	23	21.1
41-50	9	16.9	12	21.4	21	19.3
51-60	6	11.3	5	8.9	11	10.1
61-70	7	13.2	2	3.6	9	8.3
>70	1	1.9	2	3.6	3	2.8
Total	53	100.0	56	100.0	109	00.0
Mean SD	39.51 ± 16.80		38.04 ± 15.04		38.75 ± 15.87	
Inference	Age between two groups is statistically similar with p= 0.630.					

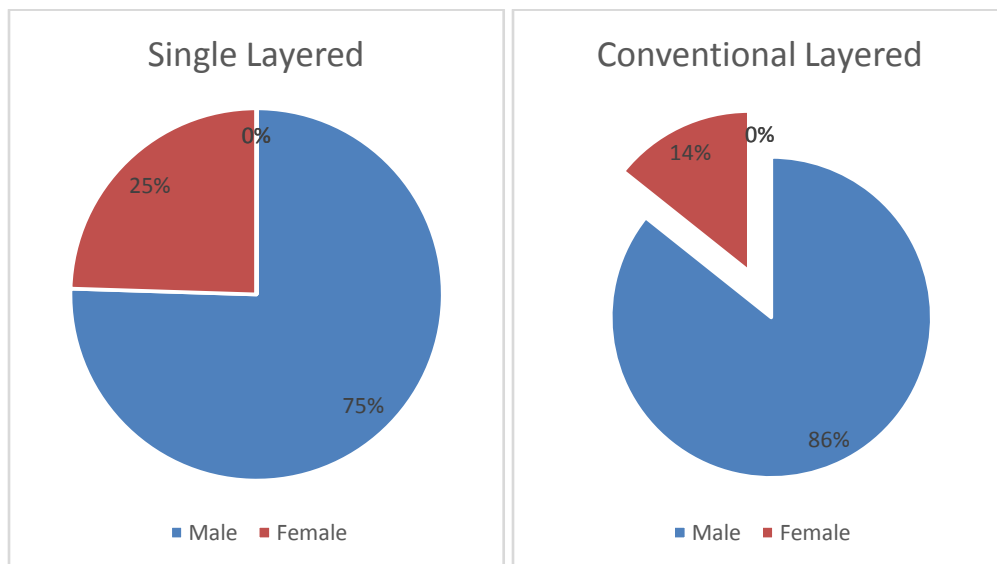


Graph 1:- Age Distribution.

The distribution of age of patients in our study group varied from 11 years to 75 years. In single-layered closure (Group I) with the mean age of 39.5 ± 11.68 years. In conventional layered closure (group II) age varied from 8 years to 82 years with the mean age of 38.040 ± 15.87 years.

Table 2:- Sex Distribution.

Sex	Single layered		Conventional Layered		Total	
	Number	%	Number	%	Number	%
Male	40	75.5	48	85.7	88	80.7
Female	13	24.5	8	14.3	21	19.3
Total	53	100.0	56	100.0	100	100.0
Inference	Sex distribution between two groups are statistically similar with p=0.175					



Graph 2:- Sex Distribution.

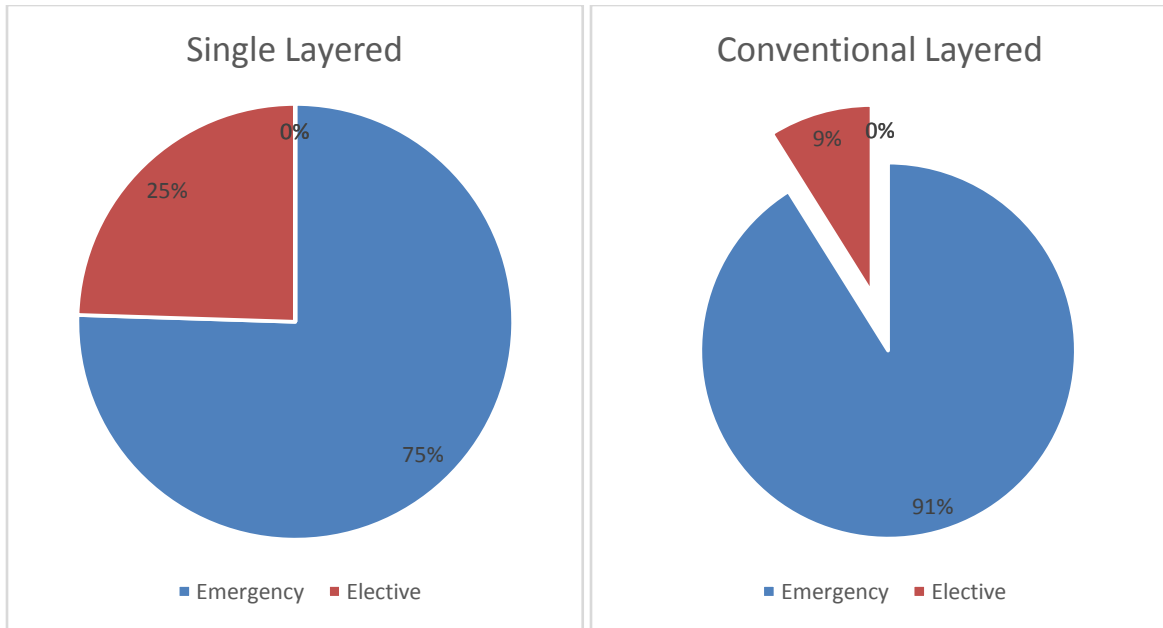
There were 40 males and 13 Females in single layered closure (Group I) as compared to 48 Males and 8 Females in Conventional Layered (Group II)

**Table 3:-** Primary etiology.

Primary Etiology	Type of Closure			
	Single Layered		Conventional layered	
	Number	%	Number	%
A. Perforation				
1. Gastric perforation	1	1.8	2	3.6
2. Duodenal Perforation	12	22.6	14	25.0
3. Jejunal Perforation	2	3.8	3	5.4
4. Ileal perforation	5	9.4	11	19.6
5. Appendicular Perforation	2	3.8	4	7.1
B. Malignancy				
1. Colorectal carcinoma	5	9.4	2	3.6
C. Hepatobiliary				
1. Ruptured Liver abscess	1	1.9	3	5.4
2. Stab Liver Laceration	1	1.9	-	-
3. Pseudopancreatic Cyst	3	5.7	-	-
4. Acute haemorrhagic pancreatitis	1	1.9	-	-
D. Splenic abscess	1	1.9	-	-
E. Pyloric Stenosis with GOO	3	5.7	5	8.9
F. Small bowel obstruction	5	9.4	8	14.3
G. Small Bowel Gangrene	4	7.5	-	-
H. Obstructed Inguinal Hernia	1	1.9	2	3.6
I. Strangulated Inguinal hernia	1	1.9	1	1.8
J. Acute intussusception	4	7.5	-	-
K. Appendicular Abscess	1	1.9	1	1.8
L. Large bowel gangrene	-	-	-	-

**Table 4:-** Type of Surgery.

Emergency/ Elective	Single layered		Conventional Layered		Total	
	Number	%	Number	%	Number	%
Emergency	40	75.5	51	91.1	91	83.5
Elective	13	24.5	5	8.9	18	16.5
Total	53	100.0	56	100.0	109	100.0
Inference	Number of elective cases are significantly more in single layered when compared to conventional layered with $p=0.028$					



Graph 3:- Type of Surgery.

It is Broadly divided into

1. Elective Surgery
2. Emergency Surgery

**In single layered closure**

There were 53 patients in this Group I who underwent either elective or emergency surgery. Among 13 patients who underwent elective surgery, 2 patients developed wound infection. There was no incidence of wound dehiscence and incisional hernia. Among 40 patients who underwent emergency surgery, 4 patients developed wound infection, 1 patient developed wound dehiscence and 1 patient developed incisional hernia.

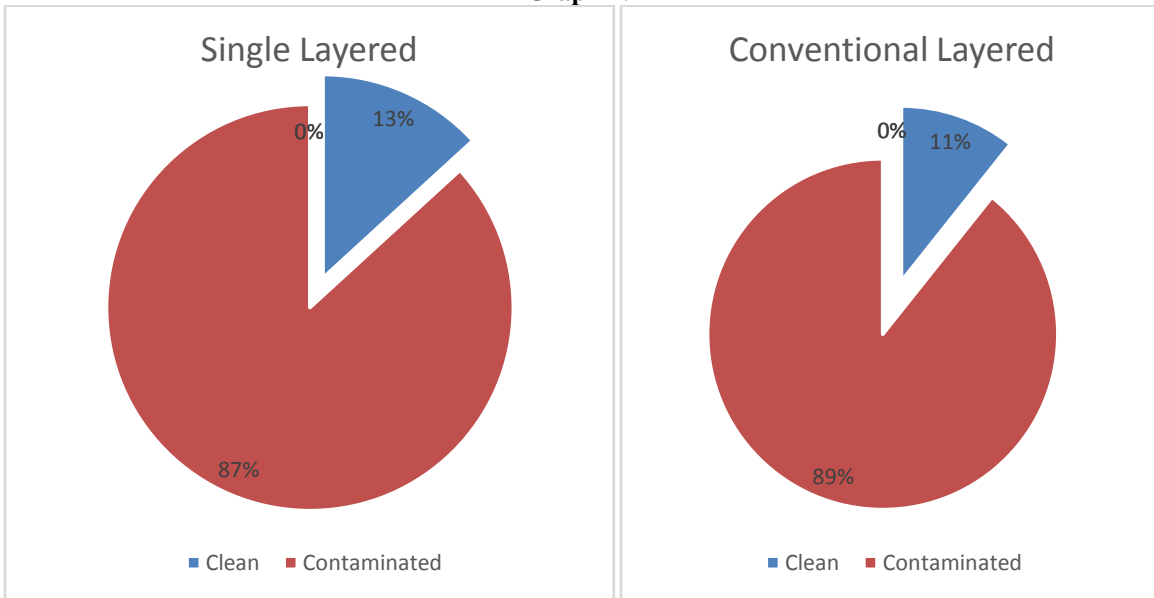
**In conventional layered closure**

There were 56 patients in this Group II, who underwent either elective or emergency surgery. Among 5 patients who underwent elective surgery. There was no incidence of wound infection, wound dehiscence and incisional hernia 12 months after surgery. Among 51 patients who underwent emergency surgery, 12 patients developed wound infection, 4 developed wound dehiscence and 2 patients developed incisional hernia 12 months after surgery.

Table 5:- Type of Wound.

Type of Wound	Single layered		Conventional Layered		Total	
	Number	%	Number	%	Number	%
Clean	7	13.2	6	10.7	13	11.9
Contaminated	46	86.8	50	89.3	96	88.1
Total	53	100.0	56	100.0	109	100.0
Inference	Frequency distribution of type of wound is equally distributed between the two groups with p=0.688					

Graph 4:-



**Type of Wound**

Classified as

1. Clean Wounds
2. Contaminated Wounds

There were 53 patients in this Group (Group I) who had either clean or contaminated wounds.

**Clean wounds**

7 patients with clean wounds were operated. No patient had wound infection, wound dehiscence and had incisional hernia.

**Contaminated wounds**

Among 46 patients who had contaminated wounds and were operated, 6 patients had wound infection, 1 had wound dehiscence and 1 patients had incisional hernia.

**In conventional layered closure**

There were 56 patients in this group (Group II) who had either clean or contaminated wounds.

**Clean wounds**

Among 6 patients with clean wounds who were operated. No one had wound infection, wound dehiscence and incisional hernia.

**Contaminated wounds**

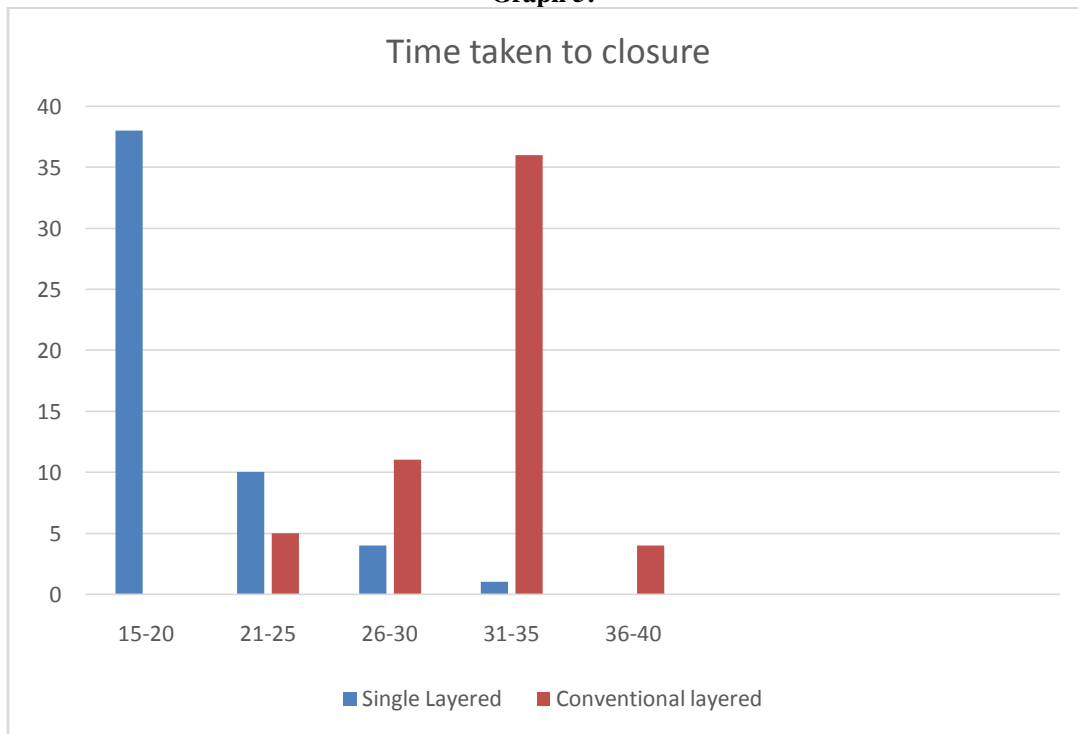
Among 50 patients who had contaminated wounds operated 12 patients had wound infection, 4 had wound dehiscence, 2 developed incisional hernia.

**Table 6:-** Time taken for closure.

Time in Minutes	Single layered		Conventional Layered		Total	
	Number	%	Number	%	Number	%
15-20	38	71.1	-	-	38	34.9
21-25	10	18.9	5	8.9	15	13.8
26-30	4	7.5	11	20.8	15	13.8
31-35	1	1.9	36	67.9	37	33.9
36-40	-	-	4	7.5	4	3.7

Total	53	100.0	56	100.0	109	100.0
Inference	Significant proportion of cases in single layered have taken less time to closure (p<0.001)					

Graph 5:-



Particular attention was paid to the duration of time consumed for abdominal wall closure. The mean time consumed was

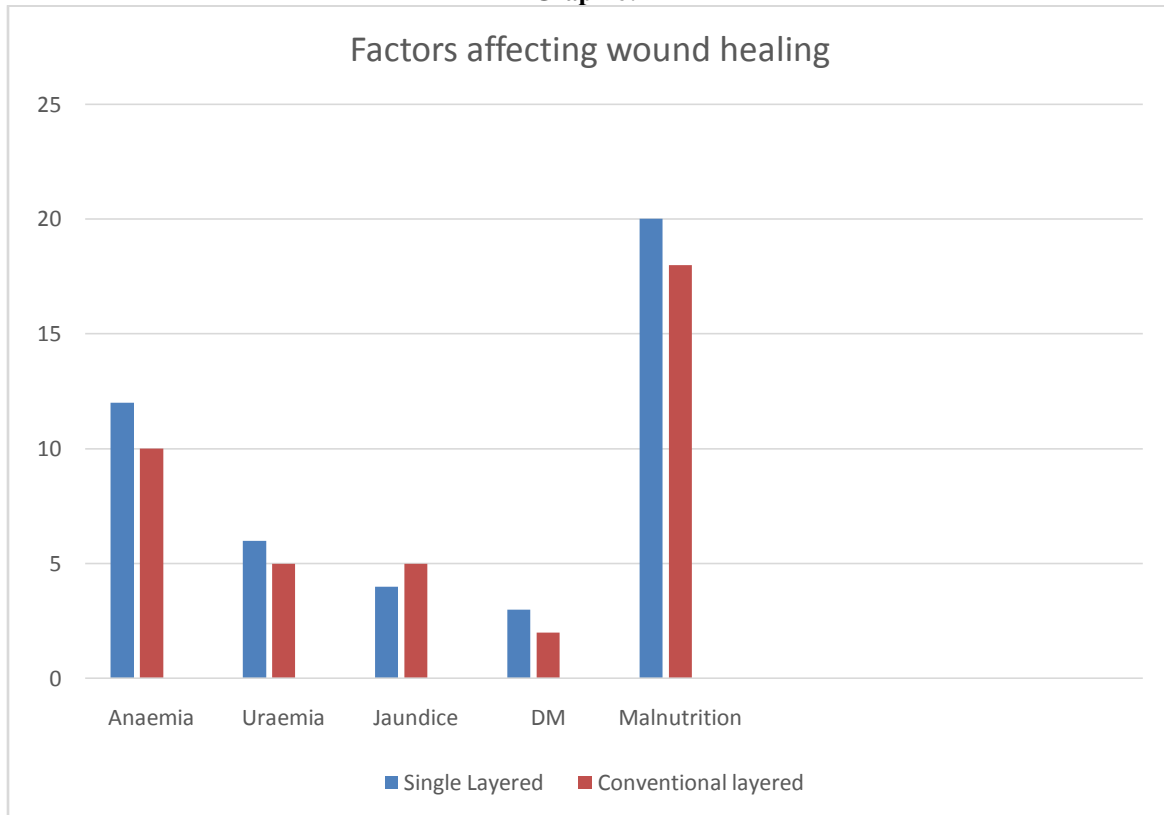
1. In single layered closure (Group I) 20.18 min
2. In conventional layered closure (Group II) 33.42 min

Thus, the time consumed in single layered closure (Group I) was about 13 minutes lesser than in Conventional layered closure (Group II).

Table 7:-Factors affecting wound healing.

Factors affecting wound Healing	Single layered		Conventional Layered		Total	
	Number	%	Number	%	Number	%
Anaemia	38	71.1	-	-	38	34.9
Uremia	10	18.9	5	8.9	15	13.8
Jaundice	4	7.5	11	20.8	15	13.8
DM	1	1.9	36	67.9	37	33.9
Malnutrition	-	-	4	7.5	4	3.7
Inference	Factors affecting the wound healing are equally distributed in both the groups (p>0.05)					

Graph 6:-



Incidence of various factors affecting wound healing are as follows:  
Anaemia, uremia, jaundice, diabetes, malnutrition, pulmonary disease.

Positive criteria for different factors

1. Anaemia :< 10 gm%
2. Uremia: Serum Urea > 40mg/dl, Serum creatinine > 1.5 mg/dl
3. Jaundice: Bilirubin > 2 mg/dl
4. Diabetes: FBS > 120 mg/dl, PPBS> 160 mg/dl
5. Obesity: BMI > 30
6. Malnutrition: BMI < 20.
7. Pulmonary disease: cough, expectoration and fever.

### Wound infection

Wound infection is defined as emergence of pus from wound, irrespective of subsequent culture.

### Classified as:

1. Superficial infection - When skin and sub cutaneous tissue involved
2. Deep infection - when infection was reaching upto the muscles.

All patients with purulent or seropurulent discharge were subjected to culture and sensitivity.

### In single layered closure (Group I)

Among 53 patients undergoing single layered closure with whom 40 patients who had undergone emergency surgery 4 developed wound infection. In 13 patients who had undergone elective surgery, 2 developed wound infection during postoperative period.

### In conventional layered closure (Group II)

Among 56 patients undergoing conventional layered closure, with whom

51 patients who had undergone emergency surgery 12 developed wound infection, in 5 patients who had undergone elective surgery no one developed wound infection during postoperative period.

**Wound dehiscence**

It is defined for our stud purpose as "wound separation of all layers including peritoneum with or without protrusion of viscera out of the wound.

**In single layered group (Group I)**

Out of 53 patients who underwent surgery, which were, followed 1 patient developed wound dehiscence. An incidence of 1.88%.

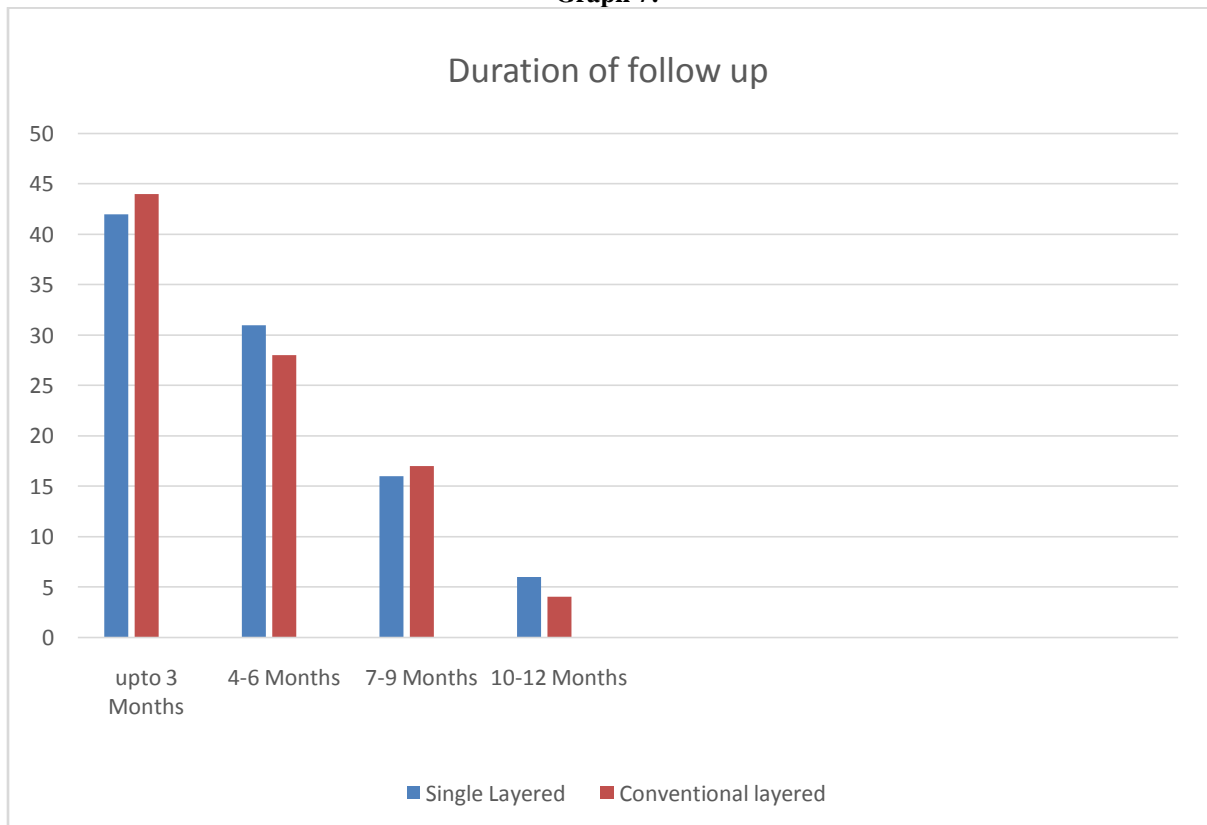
**In conventional layered group (Group II)**

Out of 56 patients who underwent surgery which were followed, 4 patients developed wound dehiscence. An incidence of 7.14%.

**Table 8:-** Duration of follow up.

Duration of follow up	Single layered		Conventional Layered		Total	
	Number	%	Number	%	Number	%
Upto 3 Months	42	79.2	44	78.6	86	78.9
4-6 Months	31	58.5	28	50	59	54.1
7-9 Months	16	30.2	17	30.4	30.4	30.3
10-12 Months	6	11.3	4	7.1	7.1	9.2
Inference	Duration of follow up is statistically similar between the two groups (p>0.05)					

**Graph 7:-**

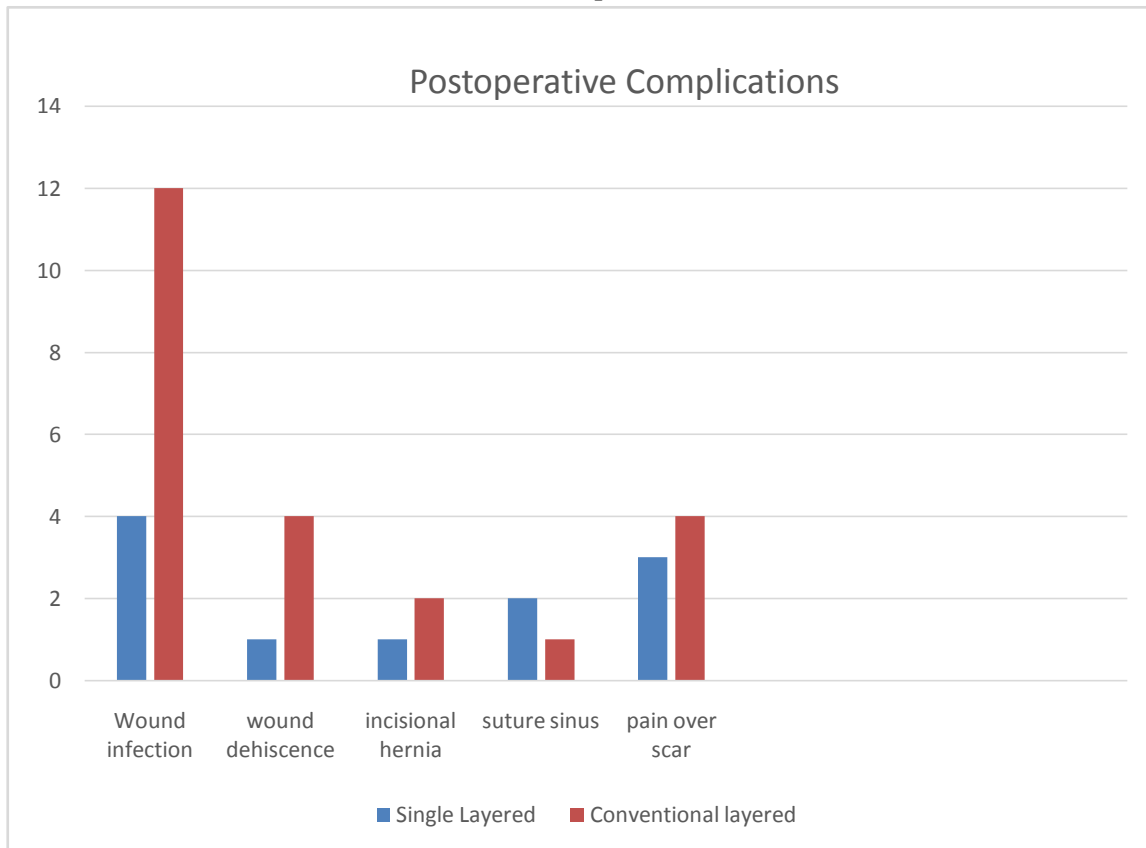


After the patients were discharged from hospital, regular monthly follow-ups was done for first three months, once in three months for next one year. During the follow up, patients were examined in the first visit specially for wound infection or wound dehiscence and during subsequent visits attention was paid to wound pain, suture sinusformation, incisional hernia and scar complications.

**Table 9:-** Post operative Complications.

Factors affecting wound Healing	Single layered			Conventional Layered		
	Number	%	Total	Number	%	Total
Wound infection	4	2	6(11.3%)	12	-	12 (21.4%)
Wound dehiscence	1	-	1 (1.9%)	4	-	4 (7.1%)
Incisional hernia	1	-	1 (1.9%)	2	-	2 (3.6%)
Suture sinus	2	-	2 (3.8%)	1	1	2 (3.6%)
Pain over the scar	3	2	5 (9.4%)	4	3	7 (12.5%)
Inference	Wound infection and dehiscence are more in conventional layered group with p= 0.200 and p= 0.363					

**Graph 8:-**



Postoperative complications	Single layered				Conventional Layered			
	Upto 3Months	4-6 Months	7-9 Months	10-12 Months	Upto 3 Months	4-6 Months	7-9 Months	10-12 Months
Wound infection	5	1	-	-	10	2	-	-
Wound dehiscence	1	-	-	-	3	1	-	-
Incisional hernia	-	-	1	-	-	-	1	1
Suture sinus	1	1	-	-	1	1	-	-
Pain over the scar	-	2	3	-	-	4	3	-

### Suture sinus formation

It was diagnosed to exist when a micro abscess or chronic granulation infection had resulted in a fistulous tract.

In single layered closure (Group I) - Suture sinus formation was observed in 2 patients, out of 53 patients undergoing single layered closure.

In conventional layered group (Group II) - Suture sinus formation was observed in 2 patients. Out of 56 patients undergoing conventional layered group, which was due to chronic catgut suture material reaction and which healed after removing it.

### Incisional hernia

Is defined as a protruding swelling palpable in the wound during the examination of the patient in supine position, due to failure of fascial layer closure of abdominal wall postoperative.

In single layered closure, out of 53 patients undergoing surgery 1 had incisional hernia.

In conventional layered closure, out of 56 patients undergoing surgery 2 patients had incisional hernia 12 months after surgery.

### Scar complication

These were in form of:

1. Pain over the scar
2. Hypertrophy of the scar

In single layered closure out of 53 patients, 5 patients developed pain over the scar and no incidence of hypertrophy of the scar.

In conventional layered closure, out of 56 patients, 7 patients developed pain over the scar and none had incidence of hypertrophy of the scar.

**Table 11:-** Types of closure.

Type of closure	Single layered		Conventional Layered		Total	
	Number	%	Number	%	Number	%
Median	48	90.6	7	12.5	55	50.5
Paramedian	5	9.4	49	87.5	54	49.5
Total	53	100.0	56	100.0	109	100.0
Inference	Midline closures are significantly more in single layered and paramedian closures are significantly more in conventional layered with $p < 0.001$					

Graph 9:-

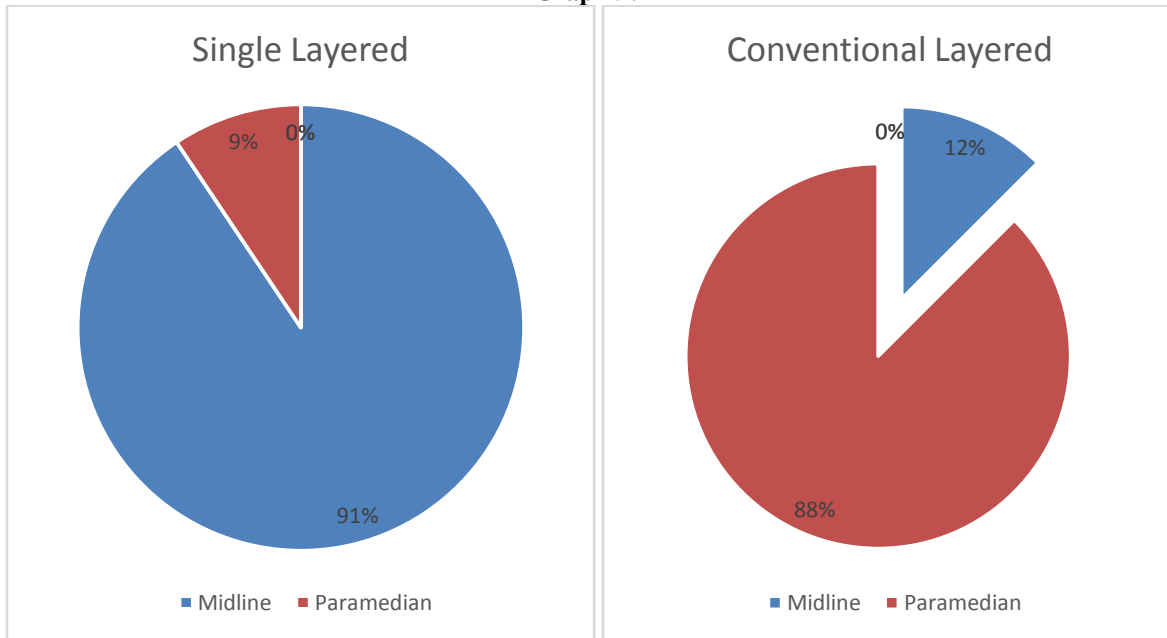


Table 12:- Mean pattern of Hospital stay in days.

Hospital Stays in Days	Single Layered	Conventional Layered	Overall
Range	2-39	1-49	1-49
Mean ± SD	16.34 ± 6.96	18.18± 8.62	17.28± 7.87
Significance	Duration of hospital stay after surgery is higher for the group with conventional layered with p= 0.225		

**Discussion:-**

Any contribution to the study and knowledge of wound closure is important to surgical speciality and this is a valuable contribution. Closure of abdominal incision has been greatly simplified by realization that all incisions heal by forming a block of fibrous tissue.<sup>35</sup>

The strength of abdominal wall depends on linea alba and anterior rectus sheath.

The technique of laparotomy wound closure is an important factor in preventing the postoperative wound complications like wound infection, wound dehiscence, suture sinus formation, incisional hernia and scar complications.

However, there are many systemic and local factors responsible for delay in wound healing.

**Systemic factors include –**

obesity, jaundice, diabetes, emaciation, deficiency of protein, iron and vitamin, old age, Cachexia, toxemia, uremia, alcoholism, malignancy, treatment with steroids and immuno suppressants and other disease status.

**Local factors include –**

infection, haematoma formation, foreign body reaction and the lack of rest. Mechanical factors such as postoperative vomiting, hiccough, explosive coughing and chest infection, gross gaseous distension, ascites, straining during micturition and constipation.<sup>36</sup>

The time taken for closure in single layered closure (Group I) was 20.18 mins as compared to conventional layered closure (Group II) was 33.42 mins. Thus the time consumed for single layered closure was about 13 mins lesser than conventional layered closure. Thus it is proved in our study that the time consumed for closure is reduced by single layered closure as compared to conventional layered closure.

The current study has shown that the mass closure technique for abdominal wounds results in lower incidence of wound infection, burst abdomen and incisional hernia than in layered technique.

**Wound infection**

The part played by wound sepsis is important, as this is the major avoidable cause of wound failure. Inadequate treatment or immuno-compromised state may lead to serious systemic complications like septicemia, shock and multi organ failure.

The incidence of wound infection is reduced by taking larger bites of tissues and exerting less pressure taken in single layered closure there by maintaining adequate blood supply, rather than exerting more pressure and taking lesser tissues in the conventional layered closure, thus leading to ischaemia and necrosis which predisposes to infection.

The incidence of wound infection among various study groups also confirm this observation.

In the comparative studies conducted Jones (1941), reported an infection rate of 0.85% with single layered closure as compared to 22.8% with conventional layered closure.

Tagart (1967) had 18% wound infection with single layered closure as compared to 29% with conventional layered closure.

Goligher (1976) had 10.18% wound infection with single layered closure as compared to 9.34% with conventional layered closure.

Leaper (1977) had 23.33% wound infection with single layered closure as compared to 19.82% with conventional layered closure.

A Singh (1981) had 6.6% wound infection with single layered closure as compared to 16.6% with conventional layered closure.

Shukla (1984) had 10% wound infection - with single layered closure as compared to 17% with conventional layered closure.

Chowdhury (1994) had 22.5% wound infection with single layered closure as compared to 47.5% with conventional layered closure.

In our study, the incidence of wound infection with single layered closure was 11.32% as compared to conventional layered closure with 21.42%, which is comparable with most of the above-mentioned studies.

Different authors used different suture materials for mass closure technique and have reported wound infection rates, which are definitely less than those, observed in conventional layered closure. In the present study we have used polypropylene No. 1 only for single layered closure and for conventional layered closure we have used polypropylene no 1 for linea alba or rectus sheath and chromic catgut no 1 for peritoneum or posterior rectus sheath. The cause of sutured material for infection cannot be compared with other studies.

**Wound dehiscence**

Wound dehiscence is a grave complication with poor prognosis. Faulty suture technique is entirely responsible for early dehiscence but only partly responsible for late incisional hernia, the other culprit being deep wound sepsis often associated with intraperitoneal drainage. Wound dehiscence rates are higher with conventional layered closure than single layered closure. The suture holding capacity of the anterior rectus sheath alone was 2.25kg compared with 3.93 kgs after, full thickness musculoaponeurosis. The structures found to have the greatest suture holding capacity was the linea alba 7.93kgs as compared with 4.12kg for full thickness without linea alba (Leaper).

A comparison of wound dehiscence between midline and paramedian incisions in our study, there were 53 patients whose ventral abdominal incisions were closed with single layered closure technique. Among them 48 patients

belonging to midline incisions, 1 patient developed wound dehiscence. Among 5 patients belonging to para median incisions, no one developed wound dehiscence. Since the wounds closed by mass closure technique in para median incisions is less as compared to midline incisions, the results could not be analyzed properly and comparable figures with the standard could not be assessed.

Incidence of wound dehiscence in various study groups also confirms this observation. Jones (1941) had no incidence of wound dehiscence with single layered closure as compared to 3.93 with conventional layered closure.

Mc Callum (1964) had an incidence of 1.43% with single layered closure as compared to 2.28% with conventional layered closure.

Tagart had an incidence of 0.87% with single layered closure as compared to 3.4% with conventional layered closure

Higgins (1969) has an incidence of 0.7% with single layered closure as compared to 3.7% with conventional layered closure.

Golligher (1976) has reported an incidence of 0.92% with single layered closure as compared to 10.2% with conventional layered closure.

Leaper (1977) had an incidence of 0.41% with single layered closure compared to 0.9% with conventional layered closure. Singh A. (1981) had no cases of wound dehiscence with single layered closure as compared to 10% wound dehiscence with conventional layered closure.

Shukla (1981) had an incidence of 2% with single layered closure as compared to 1.5% wound dehiscence with conventional layered closure.

Bucknell (1982) had an incidence of 0.8% with single layered closure as compared to 3.8% wound dehiscence with conventional layered closure.

Chowdhury (1994) had no wound dehiscence cases with single layered closure as compared to 3.75% wound dehiscence with conventional layered closure.

In our study, we had 1.88% wound dehiscence with single layered closure (Group 1) as compared to 7.14% wound dehiscence with conventional layered closure (Group II).

This study has found that single layered closure reduced the incidence of dehiscence as compared to conventional layered closure.

In our study, the incidence of wound dehiscence is higher in both the study groups as compared to the studies by various authors. This is because in our study, we had a large number of patients who were elderly, had intraabdominal sepsis and presented late.

Most of these patients were anemic, uremic, malnourished and most of them were operated on emergency basis and also had higher incidence of post operative wound infections. These predisposing factors were responsible for delayed wound healing and subsequent dehiscence as compared to the western countries where the incidence is less.

### **Incisional hernia**

It develops from the scar of a surgical incision, when a patient is examined by making him lie flat on the bed and is asked to lift his legs or to cough, any bulges in the scar is considered as Incisional hernia. Incisional hernias are mainly due to faulty incision and faulty technique of closure, other important determinants are sex (males more predisposed) and age (elderly more predisposed) of the patients, chest infection and wound infection. As age advances, breakdown of collagen fibres takes place weakening the old-healed scars, predisposing for hernia, thus indicating the need to use non-absorbable suture material to support it, using chromic catgut in conventional layered closure proved to be a draw back in causing incisional hernia and thus proving the advantages of using

polypropylene in preventing incisional hernia by holding more tissue with little tension for a long period of time after the wound heals.

Various study groups confirm that incidence of incisional hernia is reduced by single layered closure with polypropylene as compared to conventional layered closure with chromic catgut and polypropylene.

Gollicher (1976) had no incidence of incisional hernia with single layered closure as compared to 3.73% with conventional layered closure.

Leaper (1977) had 2.48% incisional hernia with single layered closure as compared to 4.2% in conventional layered closure.

Singh A (1981) had no cases of incisional hernia with single layered closure as compared to 6.6% with conventional layered closure.

Shukla (1981) had no cases of incisional hernia with single layered closure as compared to 3% with conventional layered closure.

In our study, the incidence of incisional hernia was 1.89% with single layered (group I) as compared to 3.757% with conventional layered closure (Group II).

### **Suture Sinus Formation**

It is defined as a chronic granulating infection or micro abscess that results in a persistent fistulous tract. The incidence of suture sinus formation is predisposed by the use of multi filament suture material. Due to lodgment of infective foci in the crevices of suture material. The incidence of suture sinus formation is various study groups are as

#### **follows:**

In a Comparative study conducted by Goligher (1976) had 0.92% suture sinus formation with single layered closure as compared 6.54% with conventional layered closure.

Bucknall (4932) had 2.60%, suture sinus formation with single layered closure as compared to 2.6% with conventional layered closure.

Chowdhry (1994) had 2.5% suture sinus formation with single layered closure as compared to 25% with conventional layered closure.

The incidence of suture sinus formation is lesser in singled layered closure as compared to conventional layered closure by various authors.

In our study the incidence of suture sinus formation in single layered closure was 3.8% as compared to 3.6% in conventional layered closure. In our study we have used only mono filament sutures in both the study groups so the incidence of suture sinus formation is similar and inconclusive.

### **Conclusion:-**

Finally, the observations tabulated from our comparative study proved to be similar to other studies conducted by various authors thus proving that single layered technique had the following advantages in:

1. Reduces the time consumed for closure. Closure is even more secure in cachectic patients and this allows early mobilization.
2. Reduces the incidence of wound infection, thus decreasing the hospital stay and morbidity.
3. Reduces the incidence of wound dehiscence.
4. Reduces the incidence of incisional hernia.
5. Reduces the incidence of suture sinus formation and scar complications by using monofilament suture material.

Thus, this method holds the promise for a safe technique of closure with minimal complication.

**Summary**

Large clinical experience and experimental findings seems to prove the superiority of single layered closure over conventional layered closure of abdominal incisions. Ideally, the technique of closure should be so simple that results should be good in the hands of trainee as in those of the master surgeon it should be free from the complications of wound infection, wound dehiscence, incisional hernia and persistent sinuses, it should be comfortable to the patient and should leave a reasonably aesthetic scar.

In conventional layered closure of abdominal wounds, the time consumed is relatively more, the tissue reaction is more, more pressure is exerted to hold the facial planes leading to avascularity and pressure necrosis which further leads to wound infection and wound dehiscence and therefore produces - weak scar, which results in increased incidence of incisional hernia.

**Advantages of single layered closure**

Less time is consumed for closure of abdominal wounds.

Prevents strangulation of tissues and maintains adequate blood supply by taking larger bites and less force to hold the tissues. This results in a healthy and strong scar, decreased incidence of wound dehiscence and incisional hernia.

The use of non-absorbable monofilament polypropylene, which has less tissue reaction and does not harbour organisms on its surface and thus decreases the incidence of postoperative wound infection.

Hence, it can be concluded that less time consumption, minimum complications, reduced hospital stay and leaving a reasonably aesthetic scar. Justify the use of single layered closure technique in place of conventional layered closures technique in ventral abdominal incisions.

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