

CLINICAL PRESENTATION OF PATIENTS UNDERGOING MASS CLOSURE AND LAYERED CLOSURE FOR LAPAROTOMIES- AN INSTITUTION BASED STUDY

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Abstract

Background: Linen and Cotton were already being utilized, with Silk emerging as the preferred non-absorbable suture due to its exceptional handling characteristics. It gained popularity for its use in various surgical procedures, including Cardiovascular Surgery. The objective was to evaluate the clinical characteristics of Patients undergoing Mass Closure and Layered Closure Techniques in Laparotomies. **Materials and Methods:** History taking was conducted routinely for all cases admitted to the wards. Diagnostic tests such as Plain X-ray abdomen, Contrast X-rays like barium meal, Upper GI endoscopy, Abdominal ultrasound, and CT scan were performed when necessary. In emergency situations, only essential investigations were carried out to support the diagnosis. **Result:** The study involved midline incisions in 39 patients (65%), Right Para Median incisions in 18 patients (30%), and left Para median incisions in 3 patients (5%). In the mass closure group, the mean time taken for incision closure was 15.73 minutes with a standard deviation of 1.82. For the layered closure group, the mean time taken was 25.03 minutes with a standard deviation of 1.83. **Conclusion:** The age range of the patients varied from 15 to 65 years. Out of the 60 patients, 16 were below 30 years, 13 were between 30-39 years, 11 were between 40-49 years, and 20 were over 50 years old.

INTRODUCTION

The selection of suture materials in surgery has traditionally been based on personal experience rather than scientific evidence. Surgeons often adopt the preferences of their mentors when it comes to choosing suture materials, leading to a lack of scientific basis in their selection process.^[1,2]

The introduction of Polyester and Polyamide marked a significant advancement in suture materials, replacing the natural non-absorbable sutures that had certain limitations. Polyester was initially available in various forms such as braided, coated, and non-coated, and later as a Monofilament in finer sizes. The development of Monofilament Polypropylene further enhanced the range of suture materials available, offering a strong and versatile option that met the criteria of an ideal suture material. These synthetic materials have largely replaced traditional options like Silk, Cotton, and Linen in surgical procedures.^[3,4]

The advent of Synthetic absorbable sutures in the 1970s brought about a new era in surgical practice. The introduction of Polyglycolic acid as a suture

material was followed by the combination of Glycolide and Lactide to create Polyglactin 910, which was later coated for smoother performance. Subsequent research led to the development of PDS (Polydioxanone), VICRYL Rapide (Polyglactin 910), and MONOCRYL (Polyglactone 25). Further refinements resulted in the improved version of PDS known as PDS II.^[5,6]

MATERIALS AND METHODS

This prospective study was conducted at Nalanda Medical College and Hospital, Patna in the Department of General Surgery. The study received approval from the institutional research and ethical committee. Prior to the start of the study, all participating subjects provided informed and written consent.

The study took place from April 2022 to March 2024. As part of the standard procedure, a thorough history was taken from all patients admitted to the wards. This included information on diseases such as diabetes mellitus, hypertension, jaundice, tuberculosis, and other chest infections, as well as the

onset of these diseases. Additionally, the history included details on smoking habits and prolonged use of steroids.

A comprehensive clinical examination was conducted on all patients and the findings were recorded. Special attention was given to assessing anemia, nutritional status, jaundice, and respiratory tract infections. In addition to examining the specific systems involved, routine examinations of the cardiovascular system, respiratory system, and central nervous system were also performed.

As part of the standard procedure, the following investigations were conducted for all cases:

- Blood investigation: Hemoglobin percentage, total count, differential count, erythrocyte sedimentation rate, bleeding time, clotting time, blood grouping, and Rh typing.
- Fasting blood sugar and postprandial blood sugar tests for diabetic patients.
- Liver function tests to assess protein values and bilirubin levels. Blood urea and serum creatinine tests were also conducted.
- Urine tests: Albumin, sugar, and microscopy.

- Additional investigations included an electrocardiogram (ECG) and a chest X-ray in the posteroanterior (PA) view.

In cases of suspected hollow viscus perforation or intestinal obstruction, an erect posture plain X-ray of the abdomen was performed. Contrast X-rays, such as a barium meal, were utilized when deemed necessary. Upper GI endoscopy was employed for diagnosis in appropriate cases. Abdominal ultrasound and CT scan were conducted when required. However, in emergency situations, only the investigations essential for confirming the diagnosis were utilized.

RESULTS

The patients' ages varied from 15 to 65 years. Among the 60 patients, 16 belonged to the age group of under 30 years, 13 were between 30 and 39 years, 11 were between 40 and 49 years, and 20 were over 50 years old. The average age in group 1 was 39.6 years, while in group 2 it was 42.96 years.

Table 1: Types of closure technique used according to age.

| Socio-demographic variables | | Group-1 Mass Closure Technique N=30 | Group-2 Layered Closure Technique N=30 |
|-----------------------------|------------|-------------------------------------|--|
| Age (Mean &SD) | | 39.6 ± 14.7 | 42.96 ± 15.02 |
| Age Categories | < 30 yrs | 10 | 6 |
| | 30 – 39 | 4 | 9 |
| | 40 – 49 | 7 | 4 |
| | 50 & Above | 9 | 11 |

Table 2: Sex Distribution

| Sex | Group-1 Mass Closure Technique N=30 | Group-2 Layered Closure Technique N=30 | Percentage |
|--------|-------------------------------------|--|------------|
| Male | 17 | 25 | 70% |
| Female | 13 | 5 | 30% |

In group-1, emergency surgery was performed on 20 patients, while elective surgery was performed on 10 patients. In group-2, emergency surgery was performed on 21 patients, while elective surgery was performed on 9 patients. Overall, 68.33% of patients underwent emergency surgery, while 31.66% underwent elective surgery.

Table 3: Distribution of cases according to the nature of operation and closure technique

| | Group-1 Mass Closure Technique N=30 | Group-2 Layered Closure Technique N=30 | Percentage For 60 cases | Statistical Analysis |
|-----------|-------------------------------------|--|-------------------------|----------------------|
| Emergency | 20 | 21 | 68.33% | $\chi^2 = 0.07$, NS |
| Elective | 10 | 9 | 31.66% | |

In this study mid line incision was done in 39 patients, 65% of patients, Right para Median incision in 18 patients 30 %, left para median in 3 patients, 5%.

Table 4: Distribution of cases depending on the type of incision

| Type of incision | Group-1 mass closure technique N=30 | Group-2 layered closure technique N=30 | Percentage | Statistical analysis |
|-------------------|-------------------------------------|--|------------|----------------------|
| Mid Line | 20 | 19 | 65% | $\chi^2 = 0.58$, NS |
| Right Para Median | 8 | 10 | 30% | |
| Left Para median | 2 | 1 | 5% | |

In this mass closure group study, the average time required for incision closure was 15.73 minutes, with a standard deviation of 1.82. On the other hand, in the layered closure group, the mean time taken for closure was 25.03 minutes, with a standard deviation of 1.83. The obtained p-value of < 0.000 indicates statistical significance.

Table 5: Time taken for closure in mass and layered closure techniques

| Time Taken in Min | Group-1 Mass Closure Technique N=30 | Group-2 Layered Closure Technique N=30 | Statistical Analysis |
|-------------------|-------------------------------------|--|----------------------|
| Mean | 15.73 | 25.03 | t = 19.75, |
| Std Deviation | 1.82 | 1.83 | P<0.000 |

DISCUSSION

The presence of various techniques indicates that no single method is significantly superior to compel every surgeon to abandon their familiar approach. The fact that less effective techniques have not been discarded suggests that the end results are either very similar or only slightly less effective.^[7] For mass closure technique, Prolene No. 1 on a round body needle was used as the suture material. Suturing began at the top of the incision and proceeded downwards with continuous sutures. All layers of the abdominal wall, except for the skin and subcutaneous tissue, were included in a single layer. Large bites were taken approximately 1 cm from the wound edge, with a 1 cm distance between each suture. In the case of layered closure technique, for midline incisions, the abdominal wall was closed layer by layer, starting from the deep to superficial layers, ensuring anatomical approximation. The peritoneum was closed using continuous sutures of No. 2-0 Vicryl. The Linea Alba was closed separately using continuous sutures of No. 1 Prolene. In paramedian incisions, the peritoneum and posterior layer of the rectus sheath were closed using continuous locking sutures of Vicryl No. 2.0. The anterior layer of the rectus sheath was closed using continuous locking sutures of No. 1 Prolene.

The study identified wound infection and burst abdomen as the primary endpoints in both groups, along with the time required for closure. The age range of the patients was between 15 to 65 years. Among the 60 patients, 16 were below 30 years, 13 were between 30-39 years, 11 were between 40-49 years, and 20 were above 50 years. The mean age in group-1 was 39.6 years, while in group-2 it was 42.96 years. There were 42 male patients and 18 female patients, making up 70% of the study group. In group-1, 20 patients had emergency surgery, and 10 had elective surgery. In group-2, 21 patients underwent emergency surgery, and 9 had elective surgery. Overall, 68.33% underwent emergency surgery, while 31.66% underwent elective surgery. Smead is credited with performing the first near closure of the abdomen in 1900, known as the Smead Jones method in the United States.^[8] Dambrin reported a reduced incidence of wound evisceration with a mass layered technique in 1937.^[9]

In 1941, Jones and his colleagues reported that out of 81 operations using steel wire closure with interrupted mass 'far and near' sutures, only 1 case of burst abdomen occurred. This technique involved incorporating all layers of the abdominal wall except for the skin. A study conducted at Cleveland Clinic in 1951 by Hoerr et al found that there was little difference in terms of immediate postoperative

complications and postoperative pain between abdominal incisions closed with mass closure technique and those closed in layers. However, mass closures were simpler to perform and required only ¾ of the time compared to layered closure.^[10]

Spencer and Sharp utilized a single layer wire closure for abdominal incisions in a group of 293 patients. Their findings in 1963 concluded that single layer closure was a reliable and effective method, particularly for incisions where deficient wound healing was anticipated.

Experimental research conducted by Higgins et al (1969) demonstrated that abdominal incisions closed using the mass suture technique exhibited greater strength compared to those closed using the conventional layer method.^[11]

In a study carried out by Dudley in 1970, it was determined that mass closure provided increased resistance to disruption during the initial phase and did not pose a disadvantage when the healing process was nearing completion.^[12]

Kirk's comparative analysis in 1972 involved vertical laparotomy wound closure, with 540 cases utilizing chromic catgut through the conventional layer technique (method 1) and 327 cases closed in a single layer with monofilament nylon (method 2). The significant disparity in the rate of burst abdomen between method 1 (3.88%) and method 2 (.31%) was more than three times the standard error of the difference between the two rates.^[13]

A controlled clinical trial conducted by Goligher et al in 1975 explored three different methods of closing laparotomy wounds, ultimately concluding that "mass suture with wire was likely the most secure approach to abdominal wound closure."^[14]

In 1976, Nayman conducted a prospective study with 616 cases to assess the effectiveness of mass single layer closure for abdominal wounds. The study found that two patients experienced complete wound breakdown (.3%), while two patients had partial wound breakdown (.3%), resulting in a total incidence of (.6%).^[15]

In 1977, Irvin et al conducted a prospective clinical study involving 200 patients to compare layered closure and mass closure for abdominal wound healing. The study concluded that the incidence of incisional hernia and wound dehiscence were similar for both closure methods.^[16]

In 1979, Pollock et al conducted a prospective randomized trial with 305 patients and determined that laparotomy closure using a single continuous layer of sutures was satisfactory.^[17]

In 1980, Wallace et al concluded that mass closure of midline abdominal wounds using the Smead Jones technique was more effective than layered closure in preventing wound disruption.^[18] In 1983, Narsimharao et al recommended the routine use of single layer

abdominal wound closure technique, especially for high-risk patients and contaminated wounds.^[19]

Shepherd JH et al conducted a prospective study with 200 patients in 1983 and found that the continuous 1-layer abdominal closure method was effective, time-efficient, and had a low complication rate for high-risk patients for postoperative evisceration.^[20]

On the other hand, a randomized controlled clinical trial by Ausobsky et al in 1985 showed that layered closure of a paramedian incision had a lower incidence of incisional hernia compared to mass closure of a midline incision.^[21]

In 1986, S.B. Sharma et al conducted a comparative study on abdominal wound closure techniques. They compared single layer closure with the conventional layered closure technique. Their findings indicated that the single layer closure technique was superior due to its ease of use, time-saving benefits, and lower occurrence of postoperative complications.^[22]

Following a prospective study in 1987, Taube M et al concluded that the mass closure technique could significantly reduce the rate of wound complications in jaundiced patients.^[23] In 1988, Nasher studied 112 patients and reported that single layer closure of laparotomy wounds was more effective than the classical layered closure technique.^[24]

CONCLUSION

The age range of the patients included in the study varied from 15 to 65 years. Among the total of 60 patients, 16 belonged to the age group of less than 30 years, 13 were between 30 and 39 years old, 11 were between 40 and 49 years old, and 20 were above 50 years old. The average age in group 1 was 39.6 years, while in group 2 it was 42.96 years. Out of the total patients, 42 were male and 18 were female, which means that 70% of the study group consisted of male patients. In group 1, 20 patients underwent emergency surgery, whereas 10 patients underwent elective surgery.

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