(e) ISSN Online: 2321-9599

(p) ISSN Print: 2348-6805

ORIGINAL ARTICLE

Clinical Profile of Patients Undergoing Mass Closure and Layered Closure Techniques in Laparotomies

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ABSTRACT:

Introduction: One acquires the skill of surgery from their superior and tends to employ the same suture materials as them. Therefore, the utilization of suture material has not consistently been based on scientific principles. Thus we conduct this study to assess the Clinical Profile of Patients Undergoing Mass Closure and Layered Closure Techniques in Laparotomies. **Materials and Methods:**The study design is a single-center prospective study.All the patients had standardized blood and urine tests. X-Ray, Ultra-Sound examinations, and other tests are conducted as necessary. The surgeries included both regular and urgent procedures. The study does not include incisions that are not made along the midline. The surgical technique is performed by all the surgeons in the surgery department. Abdominal wall closure is done with continuous non-absorbable No.1/0 Prolene® sutures. **Results:**In this study, a midline incision was performed on 48 patients, which accounted for 65% of the total. A right paramedian incision was done on 24 patients, representing 30% of the total, while a left paramedian incision was performed on 9 patients, accounting for 5%. The average time taken for the closure of the incision in the mass closure group was 16.71 minutes, with a standard deviation of 2.80. The average time taken in the multilayer closure group was 26.01 minutes, with a standard deviation of 2.81. The p value is less than 0.000, indicating statistical significance. **Conclusion:**The current research contributes to determining the most effective technique for closing wounds in the anterior abdominal wall. It clearly demonstrates that using a nonabsorbable, continuous suture for closing the abdominal wall with a single layer has the fewest issues and has been shown effective over a long period of time.

Keywords: Mass ClosureTechniques, Layered Closure Techniques, Laparotomies.

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This article may be cited as: Suri S. Clinical Profile of Patients Undergoing Mass Closure and Layered Closure Techniques in Laparotomies. J Adv Med Dent Scie Res 2016;4(3):203-207.

INTRODUCTION

An ancient Indian surgical treatise published by Susruta detailed various types of needles, including round-bodied, curved, and straight ones. Sutures were crafted with flax, hemp, bark fiber, or hair.

Egyptian Literature from around 1600 B.C. refers to the usage of linen strips covered in a sticky mixture of honey and flour to make the first skin closure strips.

Aurelius Cornelius Celsus, a Roman and a medical writer, authored a significant medical work around A.D. 30 called De Re Medicina. Celsus notes that sutures have been used since ancient times and should be flexible and not tightly twisted, in order to be more kind on the affected area. It is unclear if he was talking about linen or wool. He also mentioned tiny metal clips that resemble modern Michel Clips.[1]

Galen, in his treatise De MethodoMedendi, written in A.D. 150, mentions the use of catgut for the first time, although he also acknowledges that it was already known to the ancients. Catgut, which is formed from the twisted intestines of herbivorous animals, continues to be used today and is responsible for almost half of all sutures and ligatures utilized. Even though its primary feature is that it is taken in and broken down by enzymes in the body, this information was not uncovered until the 18th century. The people of ancient times used it because it was durable and readily accessible from any musician. The origin of the term 'catgut' is unclear and all we can tell for certain is that it has no connection to cats. One theory is that it is a form of corruption. Regarding "Kitgut," the kit is an early type of musical instrument that is akin to a violin.

Rhazes, the initial prominent Arabian figure, began his existence as a musician and a narrator. At a later stage in his life, he pursued a career in medicine. He utilized catgut to stitch the abdomen; a natural material for a lute player to select.[2]

Avicenna, known as the Prince of Physicians, contributed to suture development by his realization that traditional materials like linen and thread, when used in presence ofgross infection, tended to break down rapidly. In search ofmore suitable materials, he turned to pig's bristles and soinvented the first monofilament suture.

The strength of a stitched abdominal incision relies on the balance between the ability of the tissue to retain the sutures and the ability of the sutures to hold the tissue.[3]From the viewpoint of the surgeon, the optimal wound closure should be secure, efficient, offer adequate strength, and serve as a barrier against infections. The procedure should result in minimal wound opening, low risk of hernia development, and provide patient comfort and aesthetic appeal. There

are numerous clinical trials that have evaluated the closure of the abdomen using different methods, such as mass closure versus multilayer closure, absorbable versus non-absorbable suture materials, and continuous versus interrupted sutures.

In the meta-analysis comparing mass closure of the abdomen to layered closure, Weiland et al discovered that the layered abdominal closure technique resulted in a notable rise in the occurrence of incisional hernia. In this meta-analysis, nine studies are incorporated, comprising a total of 3,321 patients.[4]The meta-analysis conducted by Rucinski et al also affirmed the advantage of mass closure compared to layered closure.[5]A continuous mass closure is considered to be an effective approach for closing abdominal wall incisions after laparotomy. The choice of suture material has also been extensively studied and the findings have been published in several meta-analyses. Weiland and colleagues compared continuous sutures that can be absorbed by the body over time with sutures that cannot be absorbed. The occurrence of incisional hernia development is notably greater with absorbable continuous sutures.[4]The meta-analysis conducted by Hodgson et al also verified that the nonabsorbable, continuous suture has a much lower occurrence of problems such as an incisional hernia.

MATERIALS AND METHODS

A signed consent was acquired from all the patients. The ethics committee agreed to conduct the study. All the patients had standardized blood and urine tests. X-Ray, Ultra-Sound examinations, and other tests are conducted as necessary. The surgeries included both regular and urgent procedures. The study design is a single-center prospective study. The study does not include incisions that are not made along the midline. Patients with additional health conditions such as diabetes mellitus, weakened immune system, patients undergoing chemotherapy or radiotherapy, and patients taking long-term steroids were also not included. The surgical technique is performed by all the surgeons in the surgery department. Abdominal wall closure is done with continuous non-absorbable No.1/0 Prolene® sutures. The ratio between the length of the suture and the length of the wound was maintained at more than 4:1. The stitches provided are spaced one centimeter apart and the bite is taken one centimeter away from the midline. All stitches went through the entire thickness of the musculoaponeurotic layer and also included the peritoneum. The peritoneum is not closed individually. The stitch was fastened with sufficient force to bring the severed edges together. Once the fascia is closed, the skin is sewn using either silk thread or a stapler equipment. Throughout the procedure, a log was maintained documenting the duration of closure and the specific type of suture material utilized.

CLINICAL EXAMINATION

A comprehensive medical assessment of the patients was conducted and documented. Special care was paid to observe the presence of anemia, nutritional condition, jaundice, and respiratory tract infections. In addition to examining the system in question, regular examinations of the cardiovascular system, respiratory system, and central nervous system were conducted.

INVESTIGATIONS

Asaroutinethefollowinginvestigationsweredoneforallcases

- Blood:Hb%,TC,DC,ESR,BT,ClottingTime,Blood groupingandRhtyping.
- FBS,PPBS(fordiabetics)
- LFT forproteinvaluesand levelofbilirubin.
- Bloodurea,serumcreatinine
- Urine:foralbumin,sugar, microscopy
- ECGand chestX-rayPAview

SPECIAL INVESTIGATIONS

- Plain X-ray abdomen in erect posture was used in acuteabdominal cases suspectedof hollow viscus perforationorintestinal obstruction.
- ContrastX-rayslikebariummealwereusedwhenevernecessary.
- UpperGIendoscopywasusedinsuitablecasesfordiagnosis.
- AbdominalultrasoundandCTscanweredoneinnecessarycases.

Howeverinemergencycases,onlytheinvestigationsnecessaryforsupportingthediagnosis wereemployed.

RESULTS

The patients' ages varied from 15 to 65 years. Among the 80 patients, 22 were less than 30 years old, 17 were between 30 and 39 years old, 15 were between 40 and 49 years old, and 26 were more than 50 years. The average age in group 1 is 40.1 years, whereas in group 2 it is 43.91 years.

Table 1: Types of closure technique used according to age

Socio-demographic variables		Group-1 Mass Closure Technique N=40	Group-2 Layered Closure Technique N=40
Age(Mean&Sd)		40.1±15.3	43.91±16.03
Age Categories	<30 yrs	13	9
	30–39	6	11
	40–49	9	6

	50&Above	12	14

In this group of 80 individuals, 52 were male and 28 were female. That is to say, 0.65% of the study group consisted of male patients.

Table 2: Sex Distribution

Sex	Group-1MassClosure TechniqueN=40	Group-2LayeredClosure TechniqueN=40	Percentage
Male	22	30	65%
Female	23	15	35%

In group 1, 25 patients had emergency surgery, while 15 had elective surgery.
In group 2, 26 patients had emergency surgery whereas 14 had elective surgery.
In total, 63.7% of the patients had emergency surgery, while 36.2% had elective surgery.

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

	Group-1Mass ClosureTechnique N=40	Group-2Layered ClosureTechnique N=40	PercentageFor 80 cases	Statistical Analysis
Emergency	25	26	63.7%	$\chi 2$=0.07, NS
Elective	15	14	36.2%	

In this study, a midline incision was performed on 48 patients, which accounted for 65% of the total. A right paramedian incision was done on 24 patients, representing 30% of the total, while a left paramedian incision was performed on 9 patients, accounting for 5%.

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

Typeof incision	Group-1massclosure technique N=40	Group-2layeredclosure technique N=40	Percentage	Statistical analysis
Mid Line	24	24	60%	$\chi 2$=0.58, NS
Right Para Median	11	13	30%	
Left Para median	5	4	11.2%	

In this study, the average time taken for the closure of the incision in the mass closure group was 16.71 minutes, with a standard deviation of 2.80. The average time taken in the multilayer closure group was 26.01 minutes, with a standard deviation of 2.81. The p value is less than 0.000, indicating statistical significance.

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

Time Taken in Min	Group-1 Mass Closure Technique N=40	Group-2 Layered Closure Technique N=40	Statistical Analysis
Mean	16.71	26.01	t =20.71, P<0.000
StdDeviation	2.80	2.81	

DISCUSSION

The several ways of doing things show that no single method is significantly better to make every surgeon choose it and give up a more familiar method. The final outcomes must be rather comparable, or less effective methods would have been discarded long ago.[6]

In all instances of mass closure procedure, the suture material employed is Proline No. 1 on a round body needle. Sewing began at the top of the cut and continued downwards using uninterrupted stitches. All layers of the abdominal wall, excluding the skin and subcutaneous tissue, were encompassed in a single layer. Significant portions were removed approximately 1 cm away from the edge of the wound, with a gap of 1 cm between the stitches.

In all instances of layered closure approach, the abdominal wall was closed in a step-by-step manner using a midline incision. The closure involved bringing together the different layers of the abdominal wall, starting from the deepest layers and progressing towards the more superficial layers. The peritoneum was closed with continuous sutures made of No. 2-0 Vicryl. The Linea Alba was closed individually using No. 1 Proline with uninterrupted sutures. The peritoneum and posterior layer of the rectus sheath were closed with Vicryl No.2.0 with continuous locking sutures in paramedian incisions. The front layer of the rectus sheath was stitched closed using No.1 Prolene with continuous locking sutures.

The two groups experienced wound infection, burst abdomen (wound dehiscence), and differences in the time it took for closure.

The patients' ages varied from 15 to 65 years. Among

the 80 patients, 16 were less than 30 years old, 13 were between 30 and 39 years old, 11 were between 40 and 49 years old, and 20 were more than 50 years. The average age in group-1 is 39.6 years, whereas in group-2 it is 42.96 years. 42 individuals were identified as male, while 18 were identified as female. This means that 70% of the study group consisted of male patients. In group 1, 20 patients had emergency surgery, while 10 had elective surgery. In group 2, 21 patients had emergency surgery whereas 9 had elective surgery. In total, 68.33% of the individuals had emergency surgery, while 31.66% had elective surgery.

Smead is credited for performing in 1900 what is thought to be the first close closure of the abdomen, a technique often known in the United States as the Smead Jones method..[7]

Dambrin documented a reduction in the occurrence of wound evisceration using a mass layering approach in 1937.[8]

In 1941, Jones and his colleagues documented that out of 81 surgeries, there was only one case of a burst abdomen. This occurred after using steel wire closure with interrupted mass 'far and near' sutures that included all layers of the abdominal wall except for the skin.

A study conducted at Cleveland Clinic by Hoerr et al in 1951 found that there was minimal difference between the abdominal incision closed with mass closure technique and the one closed in layers in terms of immediate postoperative complications and postoperative pain. However, mass closures were easier to perform and took only 75% of the time compared to layered closure.[9]

Several published meta-analyses have indicated that the mass closure technique leads to a considerable reduction in hernia formation and dehiscence rate.[10]Closure techniques that are commonly used not only decrease the amount of time it takes to close an incision in the abdominal wall, but also lower the occurrence of wound separation and the development of hernias.[11]This could be because the strain is evenly spread along the whole length of the suture, which helps to minimize tissue strangulation.[12,13]In our series, there is no occurrence of burst abdomen. Wound gaping is observed in our collection and is ascribed to the infectious character of the original disease. Treatment involves managing infection control and caring for the wound.

A randomized controlled clinical trial done by Ausobsky et colleagues in 1985 found that using a layered closure technique for a paramedian incision resulted in a decreased occurrence of incisional hernia compared to using a mass closure technique for a midline incision..[14]

S.B. Sharma and colleagues conducted a comparative evaluation of two alternative methods for closing abdominal wounds. One was a closure with a single layer, whereas the other was a closure using the typical layered technique. In 1986, they determined that the single layer closure approach was better than the usual layered closure technique. This was because it was simple, saved time, and had less postoperative issues.[15]

Taube M et al, in a research conducted in 1987, found that the mass closure approach might significantly decrease the rate of wound infections in jaundiced patients.[16]

Nasher examined 112 patients and stated in 1988 that closing laparotomy wounds with a single layer was more efficient than the traditional multilayer closure.[17]

CONCLUSION

Surgeons face an ongoing problem in minimizing local wound complications and the development of incisional hernias. However, there is a significant amount of research regarding the most effective method for closing wounds. The current study reaches the following conclusions.

The single layer closure technique has a clear benefit over the layered closure technique in terms of the time it takes to close the incision, the occurrence of local wound problems, and the formation of incisional hernias.

A basic running suture, in comparison to interrupted sutures, is favored and has been backed by numerous prospective studies and 4 meta-analyses. Non-absorbable sutures outperform absorbable sutures. An optimal ratio of 4:1 between the length of the suture and the length of the incision has been shown to be validated by prospective experimental and clinical research. The current research contributes to determining the most effective technique for closing wounds in the anterior abdominal wall. It clearly demonstrates that using a nonabsorbable, continuous suture for closing the abdominal wall with a single layer has the fewest issues and has been shown effective over a long period of time.

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