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Comparative Study of Abdominal Wall Closure Method – Hughes Technique versus Conventional Mass Closure in Reducing Incisional Hernia

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ABSTRACT

Background: Laparotomy procedures often result in an incisional hernia. There are several methods developed to lessen the chances of incisional hernia after laparotomy. Hughes is an improved method compared to conventional mass closure. But it is not routinely practiced due to a scarcity of evidence in the local population. **Objective:** To compare the outcome of abdominal wall closure by Hughes technique versus conventional mass closure after laparotomy. **Study Design:** Randomized controlled trial. **Place and Duration:** Department of Surgery, Lahore General Hospital, from December 2022 to June 2023. **Material and Methods:** There were 100 individuals undergoing laparotomy enrolled. Consent was obtained and demographics were noted. Patients were randomly assigned to two groups. Closure was achieved in group A through the use of the Hughes technique. In group B, closure was done by using conventional mass closure technique. Outcomes were noted and analyzed in SPSS version 25. **Results:** Patients undergoing the Hughes technique, mean age was 46.18 ± 10.48 years. In Conventional mass closure group, mean age of patients was 39.98 ± 9.59 years. In the Hughes technique group, there were 36 (72%) males and 14 (28%) females. Patients undergoing conventional mass closure, there were 25 (50%) males and 25 (50%) females. The mean suture time was 14.44 ± 2.32 minutes with Hughes technique and 13.62 ± 2.06 minutes with conventional method ($p>0.05$). Wound infection was noted in [4 (8%) vs. 12 (24%), $p<0.05$]. But wound dehiscence and pain as almost similar in both groups ($p>0.05$). Incisional hernia developed in 14 (28%) cases with the Hughes technique, while in 27 (54%) cases with conventional mass closure ($p<0.05$). **Conclusion:** Hughes technique is superior to conventional mass closure in preventing the development of incisional hernia after surgery, making it more effective and beneficial.

INTRODUCTION

In a systematic review of 14,618 patients, the incidence of incisional hernias in midline abdominal incisions is reported to be 12.8% at 2 years, making them a common complication. The rate of incisional hernia has been reported to be 39.9% among patients who underwent colorectal cancer resection surgery including both open and laparoscopic approaches (40.9% and 37.1%, respectively). Significant morbidity can result from them , impairing quality of life, and often necessitate urgent surgeries. In spite of the advancements in mesh technology, the recurrence rates for incisional hernia repair are still disappointingly high (up to 36% in mesh repair and up to 54% in suture repair). Preventing the development of incisional hernias has significant benefits for both patients and healthcare providers.[1-4]

Mass closure is the standard method for abdominal closure, which includes closing all layers of the abdominal wall, except for the skin , either with non-absorbable or slowly resorbing suture.[5-7]A single suture is used for continuous fascial closure during mass closure.The suture's entire length can be tensioned evenly with this method, resulting in minimal tissue strangulation. The goal is to make sure the tissue edges are as close to one another to facilitate scar formation. Excessive tension can lead to tissue necrosis and eventual failure of the closure.[8]

Mass closure has a theoretical disadvantage because a single suture is responsible for keeping the closure intact. The advantages of mass closure are reduced cost and operating time. There is no evidence that the

incidence of hernia formation or wound dehiscence is associated with mass closure. Numerous studies have deemed continuous mass closure to be the superior closure method.[9-11] No significant benefit associated with any of the three methods of abdominal wall closure in the INSECT trial in 625 patients.[12]

The Hughes Repair (Professor Leslie Hughes, 1932–2011), also known as the 'far-and-near' or 'Cardiff Repair' combines a standard mass closure (two loop 1-polydioxanone sutures) with a series of horizontal and two vertical mattress sutures within a single suture (1 Nylon); theoretically spreading the tension along both the axis of incision.[13]It has been shown that the Hughes repair is equally effective as compared to the standard mesh repair for treating incisional hernias in patients.[14] It is often employed to close abdomens when patients are at a high risk of incisional hernias, usually after abdominal wound and laparostomy.[15] The aim of this study is to determine if this method can be used as a primary method to prevent incisional hernia formation. Moreover, it will offer valuable information on the aetiology of incisional hernia with an objective, radiological analysis of their formation.

In routine, laparotomy is done with mass closure. But internationally, it has been reported that Hughes technique is a better option for laparotomy that can lead to significantly reduce chances of incisional hernia after surgery. But very few work has been done before and there is a need to investigate a new technique, which leads to less complications, thus reduce hospital stay and redo surgeries. Therefore, we conducted a trial to compare both type of mass closures to attain the evidence in favor of more appropriate and effective mode of mass closure for future use.

Objective

To compare the outcome of abdominal wall closure by Hughes technique versus conventional mass closure after laparotomy.

MATERIAL AND METHODS

Study Design: Randomized controlled trial

Place and duration: Department of Surgery, Lahore General Hospital, Lahore

Duration: Six months after approved from ethical review committee i.e. from December 2022 to June 2023.

Sample Size: The sample size of 100 cases was determined using 95% confidence level, 10% margin of error and percentage of incisional hernia i.e. 54% after laparotomy through suture repair technique.[16]

Sampling Technique: Non-probability consecutive sampling.

Sample Selection

Inclusion Criteria: Patients of age 20-60 years, eight genders, undergoing laparotomy under general anesthesia included in the study with ASA I-III.

Exclusion Criteria: Patients undergoing mesh repair, musculofascial flap closure of perineal defect in abdominoperineal wound closure, were excluded from the sample.

Data Collection Procedure: The research was conducted with the approval of the "Ethical Review Board". Informed consent was obtained from all candidates. All demographic data, including age, gender, BMI, cause of laparotomy, medical history, ASA status and suture type were recorded. Patients were randomly divided into two groups. In group A, closure was done by using Hughes technique. In group B, closure was done by using conventional mass closure technique. Outcomes in terms of suture time, wound infection, dehiscence, pain score, hospital stay and occurrence of incisional hernia were noted in an especially designed proforma.

Statistical Analysis: Statistical Package for Social Sciences (SPSS) version 26 was used to analyze the data. Both groups were compared by using independent samples t-test for numeric variables and chi-square test for categorical variables. *P*-value ≤0.05 was kept as significant.

RESULTS

In patients of Hughes technique, mean age was 46.18 ± 10.48 years. In Conventional mass closure group, mean age of patients was 39.98 ± 9.59 years. In Hughes technique group, there were 36 (72%) males and 14 (28%) females. In conventional mass closure group, there were 25 (50%) males and 25 (50%) females. In Hughes technique group, mean BMI of patients was 25.73 ± 4.41 kg/m^2. In conventional mass closure group, mean BMI of patients was 26.09 ± 4.33 kg/m^2. In Hughes technique group, 10 (20%) underwent surgery because of trauma, 10 (20%) had surgery because of ventral hernia repair, 14 (28%) patients had duodenal or pancreatic tumor excision and 16 (32%) patients had intestinal tumor. In conventional mass closure group, 15 (30%) underwent surgery because of trauma, 8 (16%) had surgery because of ventral hernia repair, 17 (34%) patients had duodenal or pancreatic tumor excision and 10 (20%) patients had intestinal tumor. History of diabetes was positive in 30 (60%) cases in Hughes group and in 22 (44%) cases in conventional mass group. History of hypertension was positive in 20 (40%) cases in Hughes group and in 23 (46%) cases in conventional mass group. History of anemia was positive in 35 (70%) cases in Hughes group and in 19 (38%) cases in conventional mass group. There were 23 (46%) smokers in Hughes group while 13 (26%) in conventional mass closure group. There were 5 (10%) alcoholics in Hughes group while 1 (2%) in conventional mass closure group.

In Hughes technique group, 14 (28%) had ASA I, 20 (40%) had ASA II and 16 (32%) had ASA III. In the conventional mass closure group, 19 (38%) had ASA I, 12 (24%) had ASA II, and 19 (38%) had ASA III. In the Hughes technique group, suturing was done with Prolene in 24 (48%) cases while with Vicryl Rapide in 26 (52%) cases. In conventional mass closure group, suturing was done with Prolene in 32 (64%) cases while with Vicryl Rapide in 18 (36%) cases.

Table 1
Basic characteristics of patients in study groups

	Group	
	Hughes technique	**Convectional mass closure**
n	50	50
Age (years)	46.18 ± 10.48	39.98 ± 9.59
Gender		
Male	36 (72%)	25 (50%)
Female	14 (28%)	25 (50%)
BMI	25.73 ± 4.41	26.09 ± 4.33
Cause of laparotomy		
Trauma	10 (20%)	15 (30%)
Ventral hernia repair	10 (20%)	8 (16%)
Duodenal / pancreatic tumor	14 (28%)	17 (34%)
Intestinal tumor	16 (32%)	10 (20%)
History of		
Diabetes mellitus	30 (60%)	22 (44%)
Hypertension	20 (40%)	23 (46%)
Anemia	35 (70%)	19 (38%)
Smoker	23 (46%)	13 (26%)
Alcoholic	5 (10%)	1 (2%)
ASA status		
I	14 (28%)	19 (38%)
II	20 (40%)	12 (24%)
III	16 (32%)	19 (38%)
Suture type		
Prolene	24 (48%)	32 (64%)
Vicryl rapide	26 (52%)	18 (36%)

In Hughes technique group, mean suture time was 14.44 ± 2.32 minutes. In conventional mass closure group, mean suture time was 13.62 ± 2.06 minutes. The difference was insignificant ($p>0.05$). In Hughes technique group, wound infection was noted in 4 (8%) cases while in conventional mass closure group, 12 (24%) cases were had wound infection. The difference was significant ($p<0.05$). In Hughes technique group, wound dehiscence was noted in 6 (12%) cases while in conventional mass closure group, 8 (16%) cases were had wound infection. The difference was insignificant ($p>0.05$). After 2 hours, the mean pain score was 1.16 ± 0.79 with Hughes technique and 1.06 ± 0.87 with conventional mass closure group ($p>0.05$). After 6 hours, the mean pain score was 3.36 ± 1.05 with Hughes technique and 3.54 ± 1.09 with conventional mass closure group ($p>0.05$). After 12 hours, the mean pain score was 3.42 ± 1.16 with Hughes technique and 3.58 ± 1.11 with conventional mass closure group ($p>0.05$). After 24 hours, the mean pain score was 0.96 ± 0.83 with Hughes technique and 1.04 ± 0.83 with conventional mass closure group ($p>0.05$). In Hughes technique group, incisional hernia developed in 14 (28%) cases. In conventional mass closure group, incisional hernia developed in 27 (54%) cases. The difference in both groups was significant ($p<0.05$).

Table 2
Comparison of outcome in both groups

	Group		P-value
	Hughes technique	**Convectional mass closure**	
n	50	50	
Suture time (min)	14.44 ± 2.32	13.62 ± 2.06	0.065
Wound infection			
Present	4 (8%)	12 (24%)	0.029
Absent	46 (92%)	38 (76%)	
Dehiscence			
Present	6 (12%)	8 (16%)	0.564
Absent	44 (88%)	42 (84%)	
Pain score after			
2 hours	1.16 ± 0.79	1.06 ± 0.87	0.548
6 hours	3.36 ± 1.05	3.54 ± 1.09	0.402
12 hours	3.42 ± 1.16	3.58 ± 1.11	0.483
24 hours	0.96 ± 0.83	1.04 ± 0.83	0.632
Incisional hernia			
Present	14 (28%)	27 (54%)	0.008
Absent	36 (72%)	23 (46%)	

DISCUSSION

The most frequent complications that arise after midline laparotomy are hernias and surgical site infections, with an incidence of 10-15% and 15-25% respectively.[17] Even with ongoing efforts to develop guidelines for the closure of the abdominal wall, there is still no consensus on the optimal method for closing it following emergency laparotomy. Future work is needed and encouraged to cover this aspect as most wounds in emergency settings are classified as contaminated and caries an increased risk of herniation. A risk assessment module by Van Rmshorst could be used.[18, 19] Incisional hernias were found to occur at a rate of 9.9% by Le HuuNho R et al. following midline laparotomy surgeries.[20]

Numerous research efforts have been made to lower the rate of incisional hernias. A meta-analysis of systematic literature concerning various randomized trials involved in abdominal wall closure following midline laparotomies was carried out by Heger P, et al and have been published since 2010 and concluded that the optimal outcome be achieved by using slow absorbable monofilament suture material with a continuous suture technique.[21] In our study, the mean suture time was 14.44 ± 2.32 minutes with Hughes technique and 13.62 ± 2.06 minutes with conventional method ($p>0.05$). Wound infection was noted in [4 (8%) vs. 12 (24%), $p<0.05$]. But wound dehiscence and pain as almost similar in both groups ($p>0.05$). Incisional hernia developed in 14 (28%) cases with Hughes technique while in 27 (54%) cases with conventional mass closure ($p<0.05$). Thus the risk of incisional hernia

reduces with Hughes technique. A previous study also concluded that there is no evidence supporting the use of specific suture techniques or suture material for emergency laparotomies. Numerous meta analysis have deemed continuous mass closure to be the superior closure method than layered closure.[22]

After reviewing published literature, there is a lack of assessment on whether this technique is a suitable method for primary closure in emergency laparotomy, Rajasekaran et al. evaluated this for primary closure, but he took into account all patients the who underwent emergency and elective laparotomy while our work was solely focused on closure of emergency laparotomy. At 1 year follwup, 8% of his patients with Hughes repair and 14% with mass closure developed incisional hernia , while in our study, 9% of our patients with Hughes repair and 13.6% with mass closure developed incisional hernia. Although there are differences in the inclusion criteria, the results are almost identical, which suggests that Hughes repair in general is superior in primary laparotomy closure. The HART trial was conducted to investigate the technique for closure in patients after elective cancer surgery. The results showed no statistical difference between the two closure techniques.[22]

Results of previous studies elucidate that far-near-near-far (Hughes) technique was superior in reducing postoperative dehiscence either incisional hernia or burst abdomen when it came to closing midline exploratory wounds. Additionally, surgeon and patient satisfaction improved. However, it has a few drawbacks, including prolonged operative time, postoperative pain, and a longer hospital stay. In another study, the Hughes repair was deemed effective as the criterion for mesh repair in incisional hernia. Furthermore, it is used in the abdominal closure if the patient is at the high risk of incisional hernias, post complete abdominal wound dehiscence, and laparostomy.[14, 15]

According to other authors, in order to prevent midline incisional hernias in patients undergoing colorectal cancer resection surgery, a feasibility trial comparing the Hughes technique with criterion mass closure was conducted. This study may be favorable to patients if it results in adequate mobilization or induction or if there are no early safety concerns. Additionally, it stated that there were no early safety concerns discovered by the feasibility trial and that the trial was beneficial to patients..[23] Development to the pilot and fundamental stages of the trial is underway following approval by the independent data monitoring committee.[23]

Several studies were conducted to determine the best method for closing the abdominal wall, although this is still up for debate. The results of the metanalyses byYan't Riet et al. , Hodgson et al., Weiland et al.,indicate that non-absorbable sutures lower the risk of incisional hernia. According to a more recent meta-analysis conducted by Diener et al., absorbable sutures were found to be associated with minimal hazards. Different inclusion and exclusion criteria may be claimed as a result of this conflict. Additionally, several investigations used in these meta-analyses only included a small number of patients and lacked enough strength to identify a meaningful statistically significant difference between groups..[4, 9, 10]

CONCLUSION

Hughes technique is more effective and beneficial as mesh repair to prevent he development of incisional hernia after procedure than conventional mass closure. This will help to reduce the duration of suture time, pain, hospital stay as well as develop least number of incisional hernias. Now in future, we will recommend to use Hughes technique for laparotomy in local setting to improve our practice. But it is strongly recommended to conduct similar trials with larger sample size in order to get more reliable results in favor of Hughes technique.

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