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Original Article

Comparison of Post-Operative Outcome of Standard Mass Closure Continuous Technique versus Hughes Repair in Patients Undergoing Exploratory Laparotomy – A Quasi-Experimental Study

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ABSTRACT

Objective: To compare post-operative outcome of mass closure technique versus Hughes repair in patients undergoing exploratory laparotomy.

Study Design: Quasi experimental study.

Place and Duration of Study: Department of Surgery, Combined Military Hospital, Multan Pakistan, from Dec 2022 to Jun 2024.

Methodology: One hundred and fifty patients of age >20 years undergoing elective or emergency laparotomy were distributed in two groups on basis of repair technique used for laparotomy closure. Patients who underwent Hughes repair were placed in Group-S (study group) and standard mass closure patients were placed in Group-C (Control group). Procedural outcome in term of post-operative incisional hernia at six month was assessed and analyzed in both groups.

Results: A Total 150 patients were included in final analysis with mean age of 47.23±9.86 years in Group-S (Hughes repair) and 47.82±9.44 years in Group-C (standard mass closure) (p=0.712). Post-operative complications were also noted and compared in both groups and Hughes repair group had lesser occurrence of post-op complications in comparison to standard mass closure group (p=0.142). At 6th month follow-up, incisional hernia was seen in 9(11.4%) and 17(23.9%) participants of Hughes repair and mass closure respectively (p=0.046). Odds ratio (OR) for the occurrence of incisional hernia at six months follow-up was <1 indicating less chances of incisional hernia (IHs) in Hughes repair as compared to standard mass closure method.

Conclusion: Hughes repair is associated with a lower rate of incisional hernia as compared to standard mass closure in both emergency and elective exploratory laparotomy.

Keywords: Exploratory Laparotomy, Hughes Repair, Incisional Hernia, Mass Closure.

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INTRODUCTION

Exploratory laparotomy (Ex Lap) is a procedure done for diagnostic as well as therapeutic purpose to obtain information which cannot be done via clinical examination and diagnostic modalities.[1] It is usually performed in patients with blunt abdominal trauma, for damage control and localization of internal bleeding secondary to trauma, acute and chronic unexplained abdominal pain, intestinal perforation or obstruction, resection or staging of malignancy and in some gynecological emergencies.[2] The vertical midline abdominal incision is preferred entry for exploratory laparotomy because it allows rapid entry into peritoneum and only terminal branches of abdominal wall vessels and nerves are located in this area, limiting bleeding and nerve injury risk.[3] Documented post-operative complications of laparotomy include surgical site infection (SSI 17-35%), sepsis (25-30%), peritonitis (12.8%), wound dehiscence, paralytic ileus, and incisional hernia (15-30%).[4] Incisional hernias (IHs) are common long term complication of midline abdominal incision with reported incidence of around 12.8% and up-to 35.6% at 2 year follow-up.[5] This long term complication significantly affects quality of life and contributes to morbidity and ultimately leads to re-exploration at already operated site adding load to disease burden.[6]

The standard technique of abdominal closure is "Mass closure continuous technique" which includes closing all layers of abdominal wall excluding skin using either non-absorbable or slow-reabsorbing sutures like polydioxanone suture (PDS).[7] The European Hernia Society Guidance (EHSG) 2015 recommended to use prophylactic mesh for elective midline laparotomy closure in high risk patients to minimize the long term risk of incisional hernia but incisional hernia risk still remains high.[8] Despite latest

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newer techniques, risk of incisional hernia in high risk patients (BMI ≥27 kg/m2) persists following midline incision of laparotomy including 53% incidence in suture repair and 25% in mesh repair.[9] Hence techniques and precautionary measures to prevent and reduce risk of incisional hernia has benefits in health care provision to patients.[10] The newer technique to close midline laparotomy wound is "Hughes Repair" which is also known as "far-near-near-far technique". This technique combines the standard mass closure using a single suture and includes a series of two horizontal and two vertical mattresses suture due to which stretch load and tension is distributed along the incision length as well as across it and therefore decreasing the risk of 'cut through' and formation of hernias.[10]

The purpose and rationale for conducting this study was to compare post-operative outcome of Hughes repair in comparison to standard mess closure technique in terms of complications and occurrence of incisional hernia at six month follow up.

METHODOLOGY

This Quasi-experimental study was done in the department of surgery, Combined Military Hospital (CMH), Multan Pakistan, from December 2022 to June 2024. Institutional Ethical Review Committee had granted the permission to conduct this study (ERC No. 04/2024 dated 19 Dec 2022). Using WHO sample size calculator, a total sample size of 154 patients was calculated with 77 patients in each group with 16% incidence of incisional hernia with Mass closure technique compared to a 4% incidence with Hughes technique[11] level of significance 5% and power of test at 80%.

A total of 188 patients requiring exploratory laparotomy (elective and emergency) presented to CMH Multan from Dec 2022 to Dec 2023 were screened and 179 patients fulfilling inclusion criteria were included after initial screening.

Inclusion Criteria: All patients aging 20 years or more of either gender, undergoing exploratory laparotomy (Ex Lap) elective or emergency with midline incision were included in this study.

Exclusion Criteria: Patients with history of previous laparotomy or abdominal hernia, not suitable for midline incision, use of mesh repair or undergoing musculofascial flap closure during surgery, BMI >30 or morbid obesity, uncontrolled diabetes, terminal illness, patients on steroids or immuno-compromised patients were all excluded from the study.

All participating surgeons including consultants and registrars were well trained and had more than 5 years of experience. Patients with indication of exploratory laparotomy elective as well as emergency were recruited for study and admitted in surgical ward with plan of laparotomy. Patients were planned for midline incision for laparotomy after initial clinical assessment and required investigations.

Abdominal wall closure techniques to be used were standard mass closure continuous technique and Hughes repair technique. Patients were recruited through random sampling and all recruited patients were segregated in two groups by lottery method. Patients planned to undergo Hughes repair were kept in Group-S (Study group) whereas patients planned for standard mass closure technique were in Group-C (Control/comparison group). Baseline investigations including CBC, coagulation profile, LFTs, RFTs, Hepatitis B & C serology, blood grouping and cross match were done in all patients before procedure. Pre-anesthesia assessment was sought in all patients.

In Mass closure technique, polypropylene suture (Prolene 1) was used starting from the upper and lower end of incision in continuous manner with 1-cm interval suture run having at least 1-cm bite of surrounding fascia in each prick and wound was closed in continuous fashion. In Group-S, Hughes repair was done using a mass closure with the addition of 'near and far' sutures again using a prolene 1 suture.[12] (Figure-1).

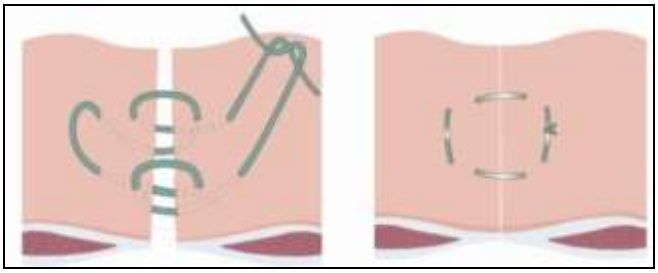

Figure-1: Hughes closure method of Midline Laparotomy Closure

A total of 188 patients were screened for study purpose, 179 patients who met inclusion criteria were included in this study. Out of 179 included patients, 11 needed mesh repair or musculofascial flap closure (assessed per-op at point of closure) and excluded from study. After surgical intervention, 87 patients

underwent Hughes repair, and 81 patients underwent standard mass closure continuous suture technique. Eighteen (19) patients lost to follow-up at one year, hence were not included in final analysis. A total 150 patients, 79 from study group and 71 from comparison group were included in final analysis. (Figure-2).

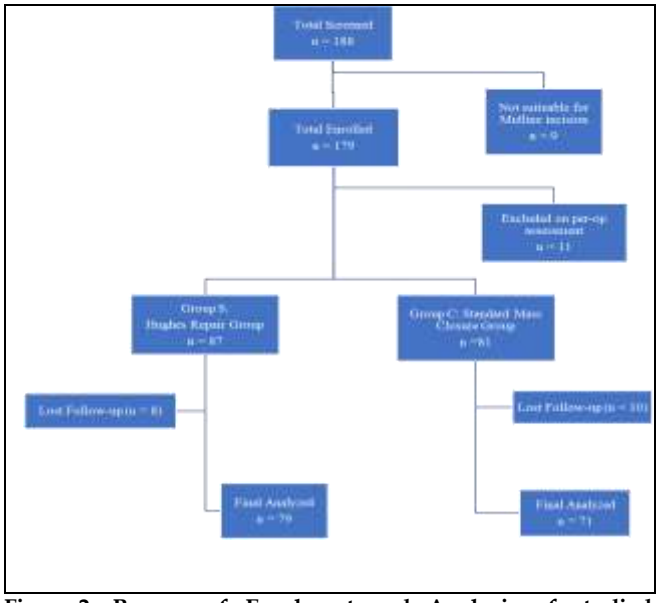

Figure-2: Process of Enrolment and Analysis of studied Participants

After surgical intervention, all patients were kept under observation in ITC or surgical wards, and wound assessment was done on daily basis during change of wound dressing. All patients were given intravenous antibiotics and IV fluids till start of per oral. Post-op complications including surgical site infections (SSIs), sepsis, peritonitis, wound dehiscence, paralytic ileus were observed, managed accordingly and noted for final analysis. Patients were discharged after 10-14 days of indoor observation when wound deemed clean, approximated and there were no signs of infection or post-op complications. Participants of both groups were advised for regular follow-up till 1 month and then called for follow-up at six months for assessment of occurrence of long term complication of incisional hernia (IH).

Variables including patient`s age, gender, causes of laparotomy, choice of procedure, postoperative complications, and incisional hernia occurrence were noted in all patients. Quantitative data was represented using mean with standard deviation and qualitative data was represented as frequency and percentage. Data were entered and analyzed using Statistical Package for Social Sciences version 23 (SPSS v23). Odds ratio (OR) analysis was done for the occurrence of incisional hernia between both groups. For analysis purpose, t-test was used and *p*-value of ≤0.05 was considered as statistically significant.

RESULTS

Total 150 patients were included in final analysis with 95(63.3%) males and 55(36.7%) females with mean age of 47.23±9.86 years in Group-S (Hughes repair) and 47.82±9.44 years in Group-C (standard mass closure) (*p*=0.712). There was no statistically significant difference observed in the cause and indications of laparotomy among both studied groups, most common indication being intestinal perforation 25(31.6%) and 26(36.6%) participants in Hughes repair group and standard mass closure group respectively (*p*=0.728). The urgency of Ex Lap as an elective or emergency procedure was noted and observed that in Group-S who underwent Hughes repair 55(69.6%) was done as emergency Ex Lap and 24(30.4%) as an elective procedure. While Ex Lap in 46(64.8%) of Group-C participants were done as emergency and 25(35.2%) done as an elective procedure (*p*=0.532). (Table-I).

Table-I: Comparison of Studied Parameters in Both Groups (n=150)

		Group-S (Hughes Repair Group) (n=79)	Group-C (Standard Mass Closure Group) (n=71)	*p*-value
Age (Mean years±SD)		47.23±9.86	47.82±9.44	0.712
Gender	Male	49(62.0%)	46(64.8%)	0.728
	Female	30(38.0%)	25(35.2%)	
Cause	Intestinal Perforation	25(31.6%)	26(36.6%)	0.788
	Abdominal Trauma	18(22.8%)	10(14.1%)	
	Intestinal Obstruction	12(15.2%)	10(14.1%)	
	Tumor Resection/ Grading	13(16.5%)	13(18.3%)	
	Chronic Abdominal Pain	11(13.9%)	12(16.9%)	
Laparotomy	Emergency	55(69.6%)	46(64.8%)	0.532
	Elective	24(30.4%)	25(35.2%)	
Complications	None	56(70.9%)	35(49.3%)	0.142
	SSI	7(8.9%)	14(19.7%)	
	Sepsis	5(6.3%)	9(12.7%)	
	Wound Dehiscence	3(3.8%)	7(9.9%)	
	Peritonitis	4(5.1%)	2(2.8%)	
	Miscellaneous	4(5.1%)	4(5.6%)	
Incisional Hernias (IHs)	At 6 months	9(11.4%)	17(23.9%)	0.046

Post-operative complications were also noted and compared in both groups and Hughes repair group had lesser occurrence of post-op complications in comparison to standard mass closure group (*p*=0.142). All patients were followed up at 6th month post-op for

occurrence of incisional hernias (IHs). It was noted that occurrence of IHs were less in Group-S participants who underwent Hughes repair as compared to Group-C who underwent standard mass closure. At 6th month follow-up, incisional hernia was seen in 9(11.4%) and 17(23.9%) participants of Hughes repair and mass closure respectively (p=0.046). (Table-I).

Odds ratio (OR) was calculated for the occurrence of incisional hernia at six months follow-up in both technique groups which was <1 indicating that there are less likely chances of incisional hernia (IHs) in patients in which Hughes repair was done as closure method in comparison to patients with standard mass closure technique (OR; 0.38). (Table-II).

Table-II: Odds Ratio with Comparison of Occurance of Incisional Hernia in Studied Groups (n=150)

		Closure Technique		Total
		Hughes Repair	Mass Closure Technique	
Incisional Hernia at six months	Yes	9(11.4%)	17(23.9%)	26(17.3%)
	No	70(88.6%)	54(76.1%)	124(82.7%)
Total		79	71	150

Odds of Incisional Hernia in Hughes Repair = (9/70) = 0.12
Odds of Incisional Hernia in Mass Closure Technique = (17/54) = 0.31
Odds Ratio (OR) = Odds in Hughes Repair / Odds in Mass Closure
OR = 0.12/0.31 = 0.38

DISCUSSION

The results of this study indicated that Hughes repair technique is slightly better technique as compared to standard mass closure in terms of post-op complication and incisional hernia. Exploratory Laparotomy (Ex Lap) is one of the most performed surgical interventions across surgical disciplines including Gynecological Surgeries. Surgical site infection (SSI) is the most common early complication with incidence rate of 15-25%[12,13] while incisional hernia remains the most common long-term complication of laparotomy with incidence rate of 15-22% as reported by Hope *et al.*[14] Hence systematic and safe closure of laparotomy wound with approximated abdominal layers is major key to minimize post-operative complications and morbidity.[15] The indication and cause of Ex Lap is also a decisive factor for decision making in regard to Ex Lap to be done either electively or as an emergency as the risk of postoperative complications are high in emergency surgeries. In a study conducted at Holy Family Hospital Rawalpindi by Syed *et al.*,[16] it was concluded that perforative peritonitis was the most common cause (32%) for emergency laparotomy in both trauma and non-trauma patients while similar results were also observed in our study where 34% of the laparotomies were due to gut perforations.

Studies from Egypt,[12,17] India,[18,19] and Pakistan[20,21] have reported that Hughes repair "far-near-far" technique of abdominal closure has better results in terms of postoperative wound complications and incisional hernia prevention. Mukesh *et al.*,[18] observed that Hughes repair had less chance of SSI, wound dehiscence, burst abdomen, and later less chance of incisional Hernia as compared to standard mass closure technique after laparotomy. In our study, 7(8.9%) of patients underwent Hughes repair had SSI as compared to 14(19.7%) patients who had standard mass closure, similar to above studies result. In a study by Soliman *et al.*,[17] it was observed that incidence of incisional hernia following midline laparotomy was 9.1% in Hughes repair as compared to 13.6% after standard mass closure of Ex Lap. In our study it was also observed that Hughes repair was associated with lower incidence of incisional hernia at 6 month follow-up as compared to patients in which abdominal closure was done using standard mass closure technique. In Hughes repair 9(11.4%) patients while in mass closure 17(23.9%) patients had incisional hernia at 6 months (p=0.046).

The results of a comparative study by Zaitoun *et al.*,[12] explained that far-near-near-far "Hughes Repair" technique in closure of midline Ex Lap wound was effective and preferred method as it has reduced risk of post-op wound dehiscence and incisional hernia. In Hughes Abdominal Repair Randomized Trail (HART), patients were followed-up at 1 year after surgery and it was noted that 14.8% patients in Hughes repair and 17.1% patients in standard mass closure had incisional hernia (Odds ratio OR: 0.84, CI 95%) (p=0.402).[22] In our study, odds ratio of <1 for the incidence of incisional hernia at six month follow-up indicates lower chances of incisional hernia in Hughes repair group (OR; 0.38). In the above randomized control study (HART) conducted at UK, it was concluded that there was little significant difference in the incidence of incisional Hernia at one year in patients undergoing both Hughes repair and standard mass closure (p=0.4), similar to our study results.

LIMITATION OF STUDY

The authors are well aware of limitation of the study most important being the single center study and limited sample size. Also, it was conducted as a quasi-controlled study with limited targeted population rather than

randomized controlled trial (RCT). The patient's profession, physical activity routine were not considered which could affect the outcome in terms of incisional hernia. Further studies including RCTs are needed nationwide on local population with large sample set and multiple centers with longer follow ups for more accurate results before implementing on wide scale.

CONCLUSION

Hughes repair "far-near-far technique" is relatively superior and preferable method for abdominal closure in both emergency and elective exploratory laparotomy as compared to standard mass closure. Hughes repair is linked with less risk of post-op complication of wound dehiscence and incisional hernia in later stage.

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Authors' Contribution

Following authors have made substantial contributions to the manuscript as under:

SAA & NR: Data acquisition, data analysis, critical review, approval of the final version to be published.

ASA & AW: Study design, data interpretation, drafting the manuscript, critical review, approval of the final version to be published.

SS & SK: Conception, data acquisition, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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