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# EFFICACY OF FAR-NEAR-NEAR-FAR (HUGHES) TECHNIQUE IN CLOSURE OF MID LINE EXPLORATORY WOUND FOR REDUCING THE INCIDENCE OF INCISIONAL HERNIA IN COMPARISON WITH CONVENTIONAL MASS CLOSURE

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ABSTRACT

**Background:** Secure midline fascial closure after emergency exploratory laparotomy is essential to minimize wound morbidity and subsequent incisional hernia. The Hughes far–near–near–far technique is a reinforced closure pattern designed to improve force distribution compared with conventional continuous mass closure. This study compared postoperative wound complications and incisional hernia incidence between these techniques.

**Materials and Methods:** A prospective, comparative study was conducted at Government Stanley Medical College and Hospital, Chennai (December 2022–May 2024). Seventy adults undergoing emergency midline laparotomy were randomized (computer-generated) to rectus sheath closure with either Hughes repair (Group A, n=35) or continuous mass closure (Group B, n=35), using number-1 polypropylene in both groups. All closures were performed by a single surgeon. Patients were assessed on postoperative days 7 and 15, then monthly for 6 months for wound infection, discharge, dehiscence, burst abdomen, and incisional hernia (primary outcome). Categorical outcomes were compared using Chi-square test and continuous variables using unpaired t-test ($p<0.05$ significant).

**Results:** Baseline characteristics were comparable in both the groups (overall mean age 40.16±10.96 years; 58.6% female). On days 7 and 15, Group B showed comparatively higher rates of wound infection, discharge, dehiscence and burst abdomen. However, differences were not statistically significant. At postoperative month 1 Group A had fewer complications: wound infection 5.7% vs 28.6% (p=0.011), wound discharge 11.4% vs 40.0% (p=0.006) and wound dehiscence 14.3% vs 42.9% (p=0.008). At month 3, burst abdomen was significantly lower with Hughes repair (5.7% vs 22.9%, p=0.040). Incisional hernia was absent through month 2, first appeared at month 3 (2.9%) only in Group B, and at 6 months occurred in 14.3% (Group A) versus 28.6% (Group B) (OR 0.418; p=0.145).

**Conclusion:** Hughes repair reduced early wound morbidity and demonstrated a consistent, clinically meaningful trend toward lower incisional hernia after emergency midline laparotomy, although the 6-month hernia difference was not statistically significant in this sample. Larger, adequately powered studies with longer follow-up are warranted.

**Keywords:** Laparotomy, Ventral Hernia, Wound Dehiscence, Suture Techniques, Complications.

## INTRODUCTION

Exploratory laparotomy is a crucial surgical operation in general surgery that involves accessing the abdominal cavity to detect and treat different intra-abdominal diseases.[1] The effectiveness of this technique depends not only on the correctness of the diagnosis and surgical expertise but also on the specific approach used to close the abdomen after certain operations in order to promote healing and also to reduce the risk of complications.[2] The rectus sheath which a critical anatomical structure, has been the key focus of different closure techniques to increase the patient outcomes.

The mass closure continuous approach and Hughes repair are two significant procedures extensively discussed and contrasted in recent research. In mass closure continuous approach, a continuous suture pattern is followed that spans all the abdominal layers. The objective is to uniformly distribute tension and achieve a stable closure.[3] However, concerns have been raised regarding the closures, integrity, strength, and durability, particularly in the emergencies where the abdominal wall is often under increased tension due to infection or trauma.[4]

On the other hand, Hughes's repair employs a method of closing the abdominal wall in layers, giving individual care to each layer, mainly focusing on the fascial layer, mainly minimizing the risk of the wound dehiscence and incisional hernias.[5] Both procedures have their supporters and distinct benefits. Still, it is crucial to thoroughly comprehend their comparative results after surgery to inform surgical decision-making and improve patient care.

An incisional hernia is a common and potentially serious complication following abdominal surgery. Incisional hernia is a bulge in the abdomen wall through a previously made incision caused by the patient's intestines, organs or other tissues protruding through the weakening in the abdominal wall as a result of surgery. The reported rates of incisional hernia were 8.6% to 39.9% following an open colorectal surgery and 4.7% to 24.3% following the laparoscopic surgeries. [6,7] An incisional hernia may have a negative impact on a patient's quality of life and their overall experience. The outcomes for patients with incisional hernias are poor, and many will suffer with chronic pain or suffer a repeat hernia even after the first repair.[8] This can lead to additional or longer hospital stays.[9] Hence it is important to identify the technique of surgical procedures and strategies which could reduce the risk of incisional hernias for whom undergoes surgeries for the abdominal wall repair.[10]

Our aim was to analyse the advantages of Hughes technique of abdominal repair which is an alternative wound closure method, in order to prevent incisional hernias. Our study compares the postoperative complications associated with the mass closure continuous approach and Hughes repair in patients with an exploratory laparotomy. The study seeks to evaluate the incidence of incisional hernia, offering significant information to surgeons and healthcare practitioners to facilitate informed decision-making. These study results could provide information for improving the quality of patient care and better the outcomes after the exploratory laparotomy surgeries.

## MATERIALS AND METHODS

This cross-sectional study was conducted in the Department of General Surgery, Government Stanley Medical College and Hospital, Chennai. The study compared the efficacy of the Hughes (Far-Near-Near-Far) technique and compared it to conventional mass closure for midline exploratory wounds for reducing incisional hernia incidence. A total of 70 patients undergoing emergency laparotomy through midline incisions were enrolled. Written informed consent was obtained from all participants prior to enrolment, and each patient was explained their diagnosis, condition, and treatment modality. Sample size was calculated based on the reference study by Zaitoun MA et al., using wound infection incidence as the primary parameter. Using the formula $n = 2(Z_{1-\alpha/2} + Z\beta)^2 \, p(1-\bar{p})/ (P1-P2)^2$, with a 95% confidence interval ($Z = 1.96$), 80% power ($Z\beta = 0.84$), wound infection rates of 24% for the Hughes technique group and 56% for the conventional mass closure group, the calculated minimum sample size was 32 per group. After adding a 10% dropout rate the final sample size was calculated to be 35 cases per group, giving a total of 70 patients. Patients were randomly allocated into two groups of 35 using computer-generated random numbers.

Group A – Rectus sheath closure was performed using the Hughes Far-Near-Near-Far technique with number-1 polypropylene suture.

Group B – Rectus sheath closure was performed using conventional continuous mass closure with the same suture material.

All surgical procedures were performed by a single surgeon. The two closure techniques were carried out as follows.

Hughes (Far-Near-Near-Far) Technique – A non-absorbable monofilament suture was placed such that point 1 was 2 cm from the edge (outside-in). Point 2 was 0.5 cm from the opposite edge (inside-out) and point 3 was 0.5 cm from the same edge (outside-in). point 4 was 2 cm from the opposite edge (inside-out) and point 5 was 1 cm above point 4 and 2 cm from the opposite edge (outside-in). Point 6 was 0.5 cm from the same edge and 1 cm above point 3 (inside-out), point 7 was 0.5 cm from the opposite edge (outside-in) and point 8 was 2 cm from the same edge (inside-out). The ends of points 1 and 8 were knotted together, creating a combination of vertical and mattress suture in a single pass.

Conventional Mass Closure – A non-absorbable monofilament suture was used with small bites, interlocking knots, a suture-to-wound length ratio exceeding 4:1, without undue tension on the suture.

Patients were assessed for wound infection, discharge, dehiscence, and burst abdomen on the 7th and 15th postoperative days and then monthly for six months. Data were compiled in Microsoft Excel and analysed using SPSS version 16. Continuous variables were expressed as mean and standard deviation; categorical variables as percentages and proportions. Unpaired t-test and Chi-square test were used for statistical comparison, with a p-value of less than 0.05 considered statistically significant.

**Inclusion Criteria**

- Patients aged above 18 years
- Patients undergoing emergency laparotomy through midline incisions

**Exclusion Criteria**

- Patients who expired within 10 days of surgery
- Patients undergoing surgeries other than midline incisions
- Patients with previous abdominal wall surgical procedures

## RESULTS

The mean age of the study cohort was 40.16 ± 10.96 years (Group A: 38.14 ± 12.26 years; Group B: 40.26 ± 8.91 years). Female patients constituted 58.6% of the total study population. Perforation peritonitis was the most frequent operative indication in Group A (28.6%), whereas intestinal obstruction predominated in Group B (25.7%). Comorbid conditions, principally diabetes mellitus and hypertension, were present in 57.1% of participants overall. A history of tobacco use was documented in 48.6% of the cohort. Both groups were well matched with respect to all baseline demographic and clinical parameters.

**Table 1: Baseline demographic and clinical characteristics of both groups.**

| Variable | Group A — Hughes Technique (n = 35) | Group B — Mass Closure (n = 35) | Total (N = 70) |
|---|---|---|---|
| Age (years) | | | |
| Mean ± SD | 38.14 ± 12.26 | 40.26 ± 8.91 | 40.16 ± 10.96 |
| Sex | | | |
| Male | 15 (42.9%) | 14 (40.0%) | 29 (41.4%) |
| Female | 20 (57.1%) | 21 (60.0%) | 41 (58.6%) |
| Operative Indication | | | |
| Perforation Peritonitis | 10 (28.6%) | 6 (17.1%) | 16 (22.9%) |
| Intestinal Obstruction | 8 (22.9%) | 9 (25.7%) | 17 (24.3%) |
| Mesenteric Ischaemia | 5 (14.3%) | 8 (22.9%) | 13 (18.6%) |
| Blunt Abdominal Injury | 6 (17.1%) | 5 (14.3%) | 11 (15.7%) |
| Penetrating Abdominal Injury | 6 (17.1%) | 7 (20.0%) | 13 (18.6%) |
| Smoking History | | | |
| Present | 16 (45.7%) | 18 (51.4%) | 34 (48.6%) |
| Absent | 19 (54.3%) | 17 (48.6%) | 36 (51.4%) |
| Comorbid Conditions (Diabetes Mellitus / Hypertension) | | | |
| Present | 18 (51.4%) | 22 (62.9%) | 40 (57.1%) |
| Absent | 17 (48.6%) | 13 (37.1%) | 30 (42.9%) |

On postoperative day 7, wound discharge was recorded in 42.9% of Group B patients versus 28.6% in Group A (OR 0.53; 95% CI 0.20–1.44; p = 0.212). Wound dehiscence was observed in 42.9% and 25.7% of Groups B and A, respectively (OR 0.46; 95% CI 0.17–1.27; p = 0.131). Wound infection was present in 31.4% of Group B versus 22.9% of Group A (OR 0.65; 95% CI 0.22–1.87; p = 0.420), and burst abdomen occurred in 11.4% versus 5.7% (OR 0.47; 95% CI 0.08–2.75; p = 0.673). An analogous pattern was observed at postoperative day 15, with Group B demonstrating higher rates of wound infection (40.0% vs. 31.4%; p = 0.454), wound discharge (48.6% vs. 34.3%; p = 0.225), wound dehiscence (42.9% vs. 25.7%; p = 0.131), and burst abdomen (11.4% vs. 8.6%; p = 1.000). None of these differences attained statistical significance at either time point. Incisional hernia was not detected in either group at days 7 or 15.

**Table 2: Wound complications at postoperative days 7 and 15.**

| Time Point | Complication | Group A n (%) | Group B n (%) | OR (95% CI) | p-value |
|---|---|---|---|---|---|
| Day 7 | Wound Infection | 8 (22.9%) | 11 (31.4%) | 0.65 (0.22–1.87) | 0.420 |
| | Wound Discharge | 10 (28.6%) | 15 (42.9%) | 0.53 (0.20–1.44) | 0.212 |
| | Wound Dehiscence | 9 (25.7%) | 15 (42.9%) | 0.46 (0.17–1.27) | 0.131 |
| | Burst Abdomen | 2 (5.7%) | 4 (11.4%) | 0.47 (0.08–2.75) | 0.673 |
| | Incisional Hernia | 0 (0%) | 0 (0%) | — | — |
| Day 15 | Wound Infection | 11 (31.4%) | 14 (40.0%) | 0.69 (0.26–1.84) | 0.454 |
| | Wound Discharge | 12 (34.3%) | 17 (48.6%) | 0.55 (0.21–1.45) | 0.225 |
| | Wound Dehiscence | 9 (25.7%) | 15 (42.9%) | 0.46 (0.17–1.27) | 0.131 |
| | Burst Abdomen | 3 (8.6%) | 4 (11.4%) | 0.73 (0.15–3.52) | 1.000 |
| | Incisional Hernia | 0 (0%) | 0 (0%) | — | — |

Statistically significant inter-group differences were identified at the first postoperative month. Wound infection was documented in 28.6% of Group B patients compared with 5.7% in Group A (OR 0.15;

95% CI 0.03–0.75; p = 0.011). Wound discharge occurred in 40.0% versus 11.4% (OR 0.19; 95% CI 0.06–0.67; p = 0.006), and wound dehiscence was present in 42.9% versus 14.3% (OR 0.22; 95% CI 0.07–0.71; p = 0.008). Burst abdomen rates were higher in Group B (11.4% vs. 2.9%), though this difference did not reach statistical significance (OR 0.23; 95% CI 0.02–2.15; p = 0.164). At the second postoperative month, Group B continued to exhibit higher rates of wound infection (14.3% vs. 5.7%; p = 0.428), wound discharge (17.1% vs. 11.4%; p = 0.495), wound dehiscence (14.3% vs. 11.4%; p = 1.000), and burst abdomen (17.1% vs. 8.6%; p = 0.477); however, none of these differences achieved statistical significance. Incisional hernia remained absent in both groups through the first two postoperative months.

**Table 3: Wound complications at the first and second postoperative months.**

| Time Point | Complication | Group A n (%) | Group B n (%) | OR (95% CI) | p-value |
|---|---|---|---|---|---|
| Month 1 | Wound Infection | 2 (5.7%) | 10 (28.6%) | 0.15 (0.03–0.75) | 0.011 |
| | Wound Discharge | 4 (11.4%) | 14 (40.0%) | 0.19 (0.06–0.67) | 0.006 |
| | Wound Dehiscence | 5 (14.3%) | 15 (42.9%) | 0.22 (0.07–0.71) | 0.008 |
| | Burst Abdomen | 1 (2.9%) | 4 (11.4%) | 0.23 (0.02–2.15) | 0.164 |
| | Incisional Hernia | 0 (0%) | 0 (0%) | — | — |
| Month 2 | Wound Infection | 2 (5.7%) | 5 (14.3%) | 0.36 (0.07–2.02) | 0.428 |
| | Wound Discharge | 4 (11.4%) | 6 (17.1%) | 0.62 (0.16–2.44) | 0.495 |
| | Wound Dehiscence | 4 (11.4%) | 5 (14.3%) | 0.77 (0.19–3.16) | 1.000 |
| | Burst Abdomen | 3 (8.6%) | 6 (17.1%) | 0.45 (0.10–1.98) | 0.477 |
| | Incisional Hernia | 0 (0%) | 0 (0%) | — | — |

At the third postoperative month, burst abdomen attained statistical significance, occurring in 22.9% of Group B patients compared with 5.7% of Group A (OR 0.205; 95% CI 0.040–1.045; p = 0.040). This interval also marked the first emergence of incisional hernia in the cohort, recorded exclusively in one patient (2.9%) in Group B; no case was observed in Group A (p = 1.000). Wound infection (8.6% vs. 2.9%; p = 0.614), wound discharge (5.7% vs. 2.9%; p = 1.000), and wound dehiscence (17.1% vs. 5.7%; p = 0.259) remained higher in Group B, without reaching statistical significance.

**Table 4: Wound complications at the third postoperative month with full statistical parameters.**

| Complication | Group A n (%) | Group B n (%) | Odds Ratio | 95% CI Lower | 95% CI Upper | p-value | Significance |
|---|---|---|---|---|---|---|---|
| Wound Infection | 1 (2.9%) | 3 (8.6%) | 0.314 | 0.031 | 3.174 | 0.614 | NS |
| Wound Discharge | 1 (2.9%) | 2 (5.7%) | 0.493 | 0.042 | 5.611 | 1.000 | NS |
| Wound Dehiscence | 2 (5.7%) | 6 (17.1%) | 0.293 | 0.055 | 1.566 | 0.259 | NS |
| Burst Abdomen | 2 (5.7%) | 8 (22.9%) | 0.205 | 0.040 | 1.045 | 0.040 | Significant * |
| Incisional Hernia | 0 (0%) | 1 (2.9%) | — | 0.973 | 1.090 | 1.000 | NS |

By the fourth postoperative month, wound infection, wound discharge, and wound dehiscence had resolved completely in both groups. Burst abdomen was recorded in 8.6% of Group B versus 2.9% of Group A (OR 0.31; 95% CI 0.03–3.17; p = 0.614). Incisional hernia was present in 11.4% of Group B compared with 5.7% of Group A (OR 0.47; 95% CI 0.08–2.75; p = 0.673). At the fifth postoperative month, isolated cases of wound infection, wound discharge, and wound dehiscence re-emerged in Group B (11.4%, 11.4%, and 8.6%, respectively) compared with 2.9% for each in Group A, without attaining statistical significance. Incisional hernia continued to accumulate, reaching 17.1% in Group B versus 5.7% in Group A at month 5 (OR 0.29; 95% CI 0.06–1.57; p = 0.259). Burst abdomen was confined to one patient (2.9%) in Group B at this time point (p = 1.000).

**Table 5: Wound complications at the fourth and fifth postoperative months.**

| Time Point | Complication | Group A n (%) | Group B n (%) | OR (95% CI) | p-value |
|---|---|---|---|---|---|
| Month 4 | Wound Infection | 0 (0%) | 0 (0%) | — | — |
| | Wound Discharge | 0 (0%) | 0 (0%) | — | — |
| | Wound Dehiscence | 0 (0%) | 0 (0%) | — | — |
| | Burst Abdomen | 1 (2.9%) | 3 (8.6%) | 0.31 (0.03–3.17) | 0.614 |
| | Incisional Hernia | 2 (5.7%) | 4 (11.4%) | 0.47 (0.08–2.75) | 0.673 |
| Month 5 | Wound Infection | 1 (2.9%) | 4 (11.4%) | 0.23 (0.02–2.15) | 0.356 |
| | Wound Discharge | 1 (2.9%) | 4 (11.4%) | 0.23 (0.02–2.15) | 0.356 |
| | Wound Dehiscence | 1 (2.9%) | 3 (8.6%) | 0.31 (0.03–3.17) | 0.614 |
| | Burst Abdomen | 0 (0%) | 1 (2.9%) | — | 1.000 |
| | Incisional Hernia | 2 (5.7%) | 6 (17.1%) | 0.29 (0.06–1.57) | 0.259 |

At the final 6-month follow-up, wound infection, wound discharge, and wound dehiscence had resolved entirely in both groups. Burst abdomen was confined to Group B, persisting in 2 patients (5.7%), with no corresponding cases in Group A (p = 0.493). The primary outcome, incisional hernia at 6 months, was recorded in 5 patients (14.3%) in Group A and 10 patients (28.6%) in Group B (OR 0.418; 95% CI

0.126–1.380; p = 0.145). Although this difference did not attain conventional statistical significance, the twofold greater incisional hernia rate in the conventional mass closure group is of clinical importance and is consistent with the progressive directional trend observed from the third postoperative month onward.

**Table 6: Wound complications at the sixth postoperative month — final follow-up.**

| Complication | Group A n (%) | Group B n (%) | Odds Ratio | 95% CI Lower | 95% CI Upper | p-value | Significance |
|---|---|---|---|---|---|---|---|
| Wound Infection | 0 (0%) | 0 (0%) | — | — | — | — | — |
| Wound Discharge | 0 (0%) | 0 (0%) | — | — | — | — | — |
| Wound Dehiscence | 0 (0%) | 0 (0%) | — | — | — | — | — |
| Burst Abdomen | 0 (0%) | 2 (5.7%) | — | 0.978 | 1.151 | 0.493 | NS |
| Incisional Hernia (Primary Outcome) | 5 (14.3%) | 10 (28.6%) | 0.418 | 0.126 | 1.380 | 0.145 | NS |

Incisional hernia was absent in both groups throughout the first two postoperative months. The first case arose at the third postoperative month, occurring exclusively in one patient (2.9%) in Group B, with no cases recorded in Group A (p = 1.000). Incisional hernia first appeared in Group A at the fourth postoperative month (2 patients, 5.7%), alongside 4 patients (11.4%) in Group B (p = 0.673). The cumulative incidence continued to diverge between the two groups through months 5 and 6. At the final follow-up, incisional hernia was present in 5 patients (14.3%) in Group A and 10 patients (28.6%) in Group B (OR 0.418; 95% CI 0.126–1.380; p = 0.145). A consistent and progressive inter-group difference favouring the Hughes technique was maintained across all follow-up intervals from the third postoperative month through to month 6.

**Table 7: Longitudinal cumulative incidence of incisional hernia across all eight follow-up time points.**

| Time Point | Group A (Hughes) | | Group B (Mass Closure) | | Odds Ratio | 95% CI | p-value |
|---|---|---|---|---|---|---|---|
| | Present n (%) | Absent n (%) | Present n (%) | Absent n (%) | | | |
| Day 7 | 0 (0%) | 35 (100%) | 0 (0%) | 35 (100%) | — | — | — |
| Day 15 | 0 (0%) | 35 (100%) | 0 (0%) | 35 (100%) | — | — | — |
| Month 1 | 0 (0%) | 35 (100%) | 0 (0%) | 35 (100%) | — | — | — |
| Month 2 | 0 (0%) | 35 (100%) | 0 (0%) | 35 (100%) | — | — | — |
| Month 3 | 0 (0%) | 35 (100%) | 1 (2.9%) | 34 (97.1%) | — | 0.973–1.090 | 1.000 |
| Month 4 | 2 (5.7%) | 33 (94.3%) | 4 (11.4%) | 31 (88.6%) | 0.470 | 0.080–2.749 | 0.673 |
| Month 5 | 2 (5.7%) | 33 (94.3%) | 6 (17.1%) | 29 (82.9%) | 0.293 | 0.055–1.566 | 0.259 |
| Month 6 | 5 (14.3%) | 30 (85.7%) | 10 (28.6%) | 25 (71.4%) | 0.418 | 0.126–1.380 | 0.145 |

Hospital stay exceeded 5 days in 51.4% of Group A patients compared with 34.3% of Group B patients (OR 0.493; 95% CI 0.188–1.290; p = 0.147). The longer inpatient duration observed in Group A is attributable to conservative wound management, whereby individual disrupted stitches were treated locally under observation without necessitating formal surgical re-closure.

Across all postoperative time points, statistically significant inter-group associations were identified at the first postoperative month for wound infection (OR 0.152; 95% CI 0.030–0.754; p = 0.011), wound discharge (OR 0.194; 95% CI 0.056–0.670; p = 0.006), and wound dehiscence (OR 0.222; 95% CI 0.070–0.709; p = 0.008), and at the third postoperative month for burst abdomen (OR 0.205; 95% CI 0.040–1.045; p = 0.040). An odds ratio below 1.0 at every significant time point confirms a consistent protective effect of the Hughes far-near-near-far technique relative to conventional mass closure. The primary outcome, incisional hernia at 6 months, was 14.3% in Group A versus 28.6% in Group B (OR 0.418; 95% CI 0.126–1.380; p = 0.145). The absence of formal statistical significance at this sample size is consistent with the study being underpowered to detect a difference of this magnitude in the primary outcome, and underscores the need for an adequately powered multicentre trial with extended follow-up duration.

**Table 8: Duration of hospital stay and summary of statistically significant and clinically relevant inter-group associations.**

| **Part A: Duration of Hospital Stay** | | | | | | |
|---|---|---|---|---|---|---|
| **Duration** | **Group A n (%)** | **Group B n (%)** | **Total n (%)** | **OR** | **95% CI** | **p-value** |
| < 5 days | 17 (48.6%) | 23 (65.7%) | 40 (57.1%) | 0.493 | 0.188–1.290 | 0.147 |
| > 5 days | 18 (51.4%) | 12 (34.3%) | 30 (42.9%) | — | — | — |
| **Part B: Statistically Significant Inter-Group Associations (p < 0.05)** | | | | | | |
| **Complication** | **Time Point** | **Group A n (%)** | **Group B n (%)** | **OR** | **95% CI** | **p-value** |
| Wound Infection | Month 1 | 2 (5.7%) | 10 (28.6%) | 0.152 | 0.030–0.754 | 0.011 |
| Wound Discharge | Month 1 | 4 (11.4%) | 14 (40.0%) | 0.194 | 0.056–0.670 | 0.006 |
| Wound Dehiscence | Month 1 | 5 (14.3%) | 15 (42.9%) | 0.222 | 0.070–0.709 | 0.008 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Burst Abdomen | Month 3 | 2 (5.7%) | 8 (22.9%) | 0.205 | 0.040–1.045 | 0.040 |
| **Part C: Primary Outcome and Clinically Relevant Non-Significant Findings** | | | | | | |
| **Complication** | **Time Point** | **Group A n (%)** | **Group B n (%)** | **OR** | **95% CI** | **p-value** |
| Incisional Hernia (Primary Outcome) | Month 6 | 5 (14.3%) | 10 (28.6%) | 0.418 | 0.126–1.380 | 0.145 |
| Incisional Hernia | Month 5 | 2 (5.7%) | 6 (17.1%) | 0.293 | 0.055–1.566 | 0.259 |
| Incisional Hernia | Month 4 | 2 (5.7%) | 4 (11.4%) | 0.470 | 0.080–2.749 | 0.673 |
| Wound Dehiscence | Day 7 | 9 (25.7%) | 15 (42.9%) | 0.462 | 0.168–1.269 | 0.131 |
| Burst Abdomen | Day 7 | 2 (5.7%) | 4 (11.4%) | 0.470 | 0.080–2.749 | 0.673 |

# DISCUSSION

In this prospective comparative study conducted at Government Stanley Medical College and Hospital, Chennai, Hughes far–near–near–far (Hughes repair) rectus sheath closure was associated with fewer postoperative wound complications and a consistently lower cumulative incidence of incisional hernia when compared with conventional continuous mass closure. Statistically significant differences favouring Hughes repair were most evident at postoperative month 1 (wound infection, discharge, and dehiscence) and month 3 (burst abdomen), while the primary outcome at 6 months demonstrated a clinically important but statistically non-significant reduction in incisional hernia (14.3% vs 28.6%). These findings should be interpreted alongside the broader evidence base, which shows variable benefit depending on indication, patient risk, and outcome ascertainment. In the HART randomized trial, O'Connell et al reported that Hughes abdominal closure did not significantly reduce incisional hernia detected by clinical examination at 1 year following colorectal cancer surgery, and highlighted that CT imaging identified substantially more hernias than clinical examination alone, underscoring the importance of detection methodology when comparing studies.[11] In contrast, in an emergency midline laparotomy randomized study, Murthy et al reported favourable early outcomes for Hughes repair compared with continuous closure, supporting the concept that technique-related benefits may be more apparent in biologically and mechanically high-risk emergency settings.[12]

The temporal pattern in our results—minimal separation between groups during the first 15 postoperative days, followed by significant divergence at postoperative month 1—suggests that Hughes repair may exert its main advantage by preventing progression from early inflammation and tissue edema to clinically meaningful fascial separation and persistent contamination, rather than by preventing initial contamination itself. The architecture of the far–near–near–far configuration is designed to distribute tensile forces both across and along the incision line, potentially limiting "whole-line" failure when localized suture loosening or tissue cut-through occurs. This mechanism is consistent with observations in other emergency-laparotomy cohorts. Garg et al compared far–near–near–far closure with conventional closure in emergency exploratory laparotomy and reported broadly comparable rates of wound infection, dehiscence, burst abdomen, and incisional hernia, emphasizing that any technique effect may be modest and sensitive to case mix, sample size, and follow-up duration.[13] Similarly, in the CONTINT randomized trial, Polychronidis et al found no difference between continuous slowly absorbable closure and interrupted closure for burst abdomen and incisional hernia at 1 year after emergency midline laparotomy; the trial's neutral results also reinforce that meticulous adherence to closure principles in both arms can narrow inter-technique differences.[14] In our cohort, however, despite standardized suture material and a single-surgeon technique, the month-1 differences in infection, discharge, and dehiscence favour Hughes repair, which is clinically relevant because early wound morbidity is strongly linked to later incisional hernia development.

The statistically significant reduction in burst abdomen at postoperative month 3 in the Hughes group is particularly important because early fascial failure is a major determinant of subsequent incisional hernia formation, especially in emergency laparotomy where contamination, catabolism, anemia, and hypoalbuminemia are common. The central role of force distribution and suture geometry in fascial healing has been shown in classical prospective work. Israelsson and Jonsson demonstrated that a higher suture length–to–wound length ratio (≥4:1) is associated with lower incisional hernia rates after continuous midline closure, establishing that technique parameters (bites, spacing, ratio) are not merely technical preferences but measurable determinants of late outcomes.[15] Although our mass-closure arm incorporated small bites and a ratio exceeding 4:1, the higher month-1 wound complication burden and later burst abdomen rates suggest that, in emergency biology, continuous closure may remain susceptible to propagation of failure when tissue integrity is compromised. The broader movement toward optimizing tissue perfusion and load distribution is also supported by the STITCH trial, where Deerenberg et al showed that a small-bites technique reduced incisional hernia compared with large bites without increasing adverse events.[16] Taken together, these studies support a mechanistic explanation for our findings: in high-risk emergency wounds, a closure pattern that limits longitudinal failure propagation and reduces localized stress concentration may translate into fewer major fascial complications and, consequently, fewer late hernias.

Although the primary endpoint (incisional hernia at 6 months) did not reach statistical significance, the

consistent divergence in cumulative incidence from month 3 onward suggests a clinically meaningful effect that the current sample size may have been underpowered to detect. This is consistent with the established literature indicating that differences in hernia incidence between closure strategies are often modest and require larger cohorts and longer follow-up to demonstrate statistically robust separation. In the INSECT multicenter randomized trial, Seiler et al compared interrupted closure with rapidly absorbable sutures and continuous closure with slowly absorbable sutures for elective midline incisions, using standardized surgeon training and ultrasound confirmation of clinically suspected hernias; the trial reflects how endpoint rigor and technique standardization can influence the observed effect size.[17] At the evidence-synthesis level, Van 't Riet et al concluded in a meta-analysis that suture material and technique both affect outcomes, with slowly absorbable continuous closure appearing favorable for reducing incisional hernia without excess wound pain or sinus formation.[18] Our study differs in that it evaluated a reinforced "hybrid" configuration (Hughes repair) using nonabsorbable polypropylene in both arms, thereby isolating the contribution of suture architecture rather than material absorption. Importantly, because many incisional hernias present after 12 months, a 6-month endpoint may underestimate true incidence in both groups; extending follow-up and incorporating imaging-based detection would likely provide a more definitive estimate of technique effect.

From a clinical standpoint, the reduction in early wound morbidity observed with Hughes repair in our cohort may be as important as any later difference in incisional hernia, given the impact of infection, discharge, and dehiscence on patient discomfort, antibiotic exposure, readmissions, and resource utilization. A large Cochrane review by Patel et al emphasized that the evidence base across closure techniques and materials is heterogeneous, with moderate-quality evidence suggesting monofilament sutures may reduce incisional hernia risk compared with multifilament, while many comparisons (including continuous versus interrupted) show no clear difference in hernia risk across diverse populations.[19] Our findings add to this literature by suggesting that, within emergency midline laparotomy using the same monofilament material, a reinforced configuration can reduce intermediate complications that plausibly mediate later hernia. Additionally, the management pathway for wound complications remains crucial irrespective of closure method. Heller et al described vacuum-assisted closure as an effective strategy for abdominal wound dehiscence in compromised patients when immediate closure is not feasible, supporting structured postoperative surveillance and timely escalation for complex wounds.[20] Future studies should therefore evaluate Hughes repair within larger, multicenter emergency cohorts powered specifically for incisional hernia, include follow-up beyond 12–24 months, and standardize outcome assessment (including ultrasound or CT when feasible) to capture both clinically apparent and occult hernias. Such work would clarify whether the consistent trend toward fewer hernias observed in our study becomes statistically definitive with adequate power and longer observation.

## CONCLUSION

In this 70-patient study, patients who underwent conventional mass closure had higher rates of wound infection, wound discharge, wound dehiscence, and burst abdomen compared with those who underwent Hughes' closure technique. The association between wound complications and closure technique was significant at 1 month, and burst abdomen differed significantly at 3 months. Incisional hernia was absent up to 2 months, but appeared predominantly in the conventional mass-closure group from 3–6 months. Overall, Hughes' technique reduced incisional hernia incidence.

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