ORIGINAL ARTICLE

Comparison of Skin Staples versus Skin Sutures After Inguinal Hernioplasty in Terms of Surgical Site Infection

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ABSTRACT

Background: Surgical site infection is a major concern following inguinal hernia repair, potentially leading to extended hospital stays, increased morbidity, patient discomfort, and higher healthcare costs. This study aimed to conduct a comparative analysis between skin staples and skin sutures in inguinal hernioplasty, explicitly focusing on their impact on surgical site infection rates.

Methods: From September 2022 to June 2023, a randomized control trial study was carried out at the Surgery Department, Kulsoom Bai Valika Hospital Karachi. A total of 100 patients who underwent Lichtenstein tension-free mesh hernioplasty were allocated into two groups: the stapler group (n=50) and the polypropylene suture group (n=50). The patients were monitored for 3 to 6 hours post-surgery and safely discharged on the first postoperative day. Follow-up was scheduled 7 days after surgery to assess wound complications, specifically surgical site infections. Comparison between both groups was done using the Chi-square/Fisher exact test for surgical site infection and independent samples t-test for pain score. The level of significance was set at 5%.

Results: The incidence of postoperative pain was slightly lower in the stapler group compared to the suture group (10% vs. 16%), this difference was not statistically significant (p=0.544). Moreover, the surgical site infection rate was significantly lower in the stapler group (3%) than in the suture group (12%) with p=0.012.

Conclusion: When securing the mesh in inguinal hernia cases, the utilization of skin staples was considered a safe approach and was associated with lower surgical site infection as compared to skin sutures.

Keywords: Hernia, Surgical wound infection, Surgical mesh, Postoperative complications

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INTRODUCTION

Hernia repair is a prevalent surgical procedure performed worldwide, with a staggering number of over 20 million individuals undergoing the treatment annually[1,2]. Among the different types of hernias, inguinal hernia is the most frequent one, accounting for 73% of all hernia cases, with a lifetime risk of 3% in females and 27% in males[1,3]. However, the procedure has challenges, literature reveals that surgical site infection (0.48%), bleeding (0.86%), and other complications (0.41%) are significantly associated with inguinal hernia repair[1, 3]. Surgical site infection is a major concern following inguinal hernia repair, potentially leading to extended hospital stays, increased morbidity, patient discomfort, and higher healthcare costs[4,5]. Identifying and minimizing risk factors of surgical site infection is crucial for achieving successful outcomes[4, 5].

Numerous techniques have been explored for wound closure aimed at decreasing the rate of surgical site infections. Among the various methods, two primary approaches have gained popularity i.e., skin staples and skin sutures[6-9]. Polypropylene sutures, known for their monofilament structure and biologically inert properties, are the established method for securing the mesh along the posterior inguinal canal wall. Their use is associated with a lower likelihood of infections[8, 9]. However, there has been a recent adoption of skin staples made from stainless steel, which offer the advantage of easier placement and result in a remarkable 80% reduction in wound closure time when compared to polypropylene sutures[6, 7, 10].

Research by Khulique et al. also found lower surgical site infection in mesh securing with skin staples as compared to conventional pro-lene 2/0 sutures (3.1% vs 12.3%, p=0.048). However, there was an insignificant difference in the incidence of seroma formation (p=0.403) and urinary retention between both groups (p=0.380) [11]. Similarly, Munghate et al. reported 24% of wound infections in the suture group and 4% in the stapler group (p=0.001)[6].

In Pakistan, the prevalence of inguinal hernias is considerable, impacting both males and females.[11] Given the healthcare landscape of the country, it becomes imperative to find effective strategies for mitigating the occurrence of surgical site infections following inguinal hernioplasty. Therefore, this study aimed to conduct a comparative analysis between skin staples and skin sutures in inguinal hernioplasty, specifically focusing on their impact on surgical site infection rates. The findings from this research are expected to play a pivotal role in optimizing surgical outcomes and enhancing post-operative recovery for patients in Pakistan.

METHODS

From September 2022 to June 2023, a randomized control trial study was carried out at the Department of Surgery, Kulsoom Bai Valika Hospital in Karachi, Pakistan. Sample size calculation was performed on the Open Epi sample size calculator. The total sample size was 96 i.e. 48 patients in each group were estimated using statistics of wound infection as 24% in the suture group[6] and 4% in the stapler group, power of test as 80% and 95% confidence level[6]. However, we have included 50 patients in each group. Patients of age more than 18 years of either gender having inguinal hernias, who underwent elective hernioplasty under general or spinal anesthesia were included in the study. Patients with congenital, irreducible, and sliding or massive scrotal hernias, strangulated and obstructed hernias, and patients with hypertension, diabetes, or coagulation disorders were not included in the study.

Ethical approval of the study was obtained from the ethical review committee. Written informed consent was obtained from all the eligible patients and information regarding age, gender, and BMI was collected. A total of 100 patients who underwent Lichtenstein tension-free mesh hernioplasty were divided into two groups: the polypropylene suture group (n=50) and the stapler group (n=50). The polypropylene suture group consisted of 50 patients, where a 7.5×15 cm mesh was secured using interrupted 2/0 Prolene sutures. In contrast, the stapler group also comprised 50 patients, with skin closure performed using a stainless-steel stapler used for securing the mesh. Subsequently, the wound was cleansed with pyodine, and an aseptic dressing was applied in both groups. Patients in both groups received Injections of Augmentin 1.2 gm during anesthesia induction and tablet Brufen as needed. Patients in both groups were monitored for three to six hours period until they had emptied their bladders, and they were safely discharged on the first postoperative day. Dressing guidelines and methods remained the same in both groups i.e., Mepore dressing opened after 72 hours of surgery and onwards changed 24 hourly.

A follow-up review was scheduled in the outpatient department 7 days after surgery for clip/stitch removal and to gather information regarding wound complications. Complications were categorized as surgical site infections (presence of pus discharge, inflammation, or fever > 100 °F) and post-operative pain (pain score>4 assessed using a visual analog scale). To ensure adequate follow-up, contact numbers of the patients were obtained. Bias and confounding factors were effectively managed by strictly adhering to the exclusion criteria.

The collected data was managed and analyzed using SPSS version 23. Mean and SD were reported for numeric data like age, BMI, and pain score. Frequency and percentage were reported for

gender and surgical site infection. Comparison between both groups was done using the Chi-square/Fisher exact test for surgical site infection and independent samples t-test for pain score. The level of significance was set at 5%.

RESULTS

A total of 100 patients were included who underwent Lichtenstein tension-free mesh hernioplasty. The mean age of the patients was 43.24±6.58 years and the mean BMI of the patients was 37.15±7.24 kg/m^2. Of 100 patients, 71% were males and 29% were females. In both groups, most of the patients were males. (Table 1)

Table 1: Baseline characteristics of study samples.

Variables	Groups		Overall (n=100)
	Stapler (n=50)	Suture (n=50)	
Age (years)	43.70±6.05	42.78±7.10	43.24±6.58
BMI (kg/m^2)	37.48±8.23	36.82±6.17	37.15±7.24
Gender			
Male	33 (66%)	38 (76)	71 (71%)
Female	17 (34%)	12 (24%)	29 (29%)

Of 100 patients, 13 (13%) patients had post-operative pain. Figure 1 shows post-operative pain (VAS>4) was lower in the stapler group as compared to the suture group (10% vs 16%) after a follow-up of 7 days. However, this difference was statistically insignificant with p=0.544.

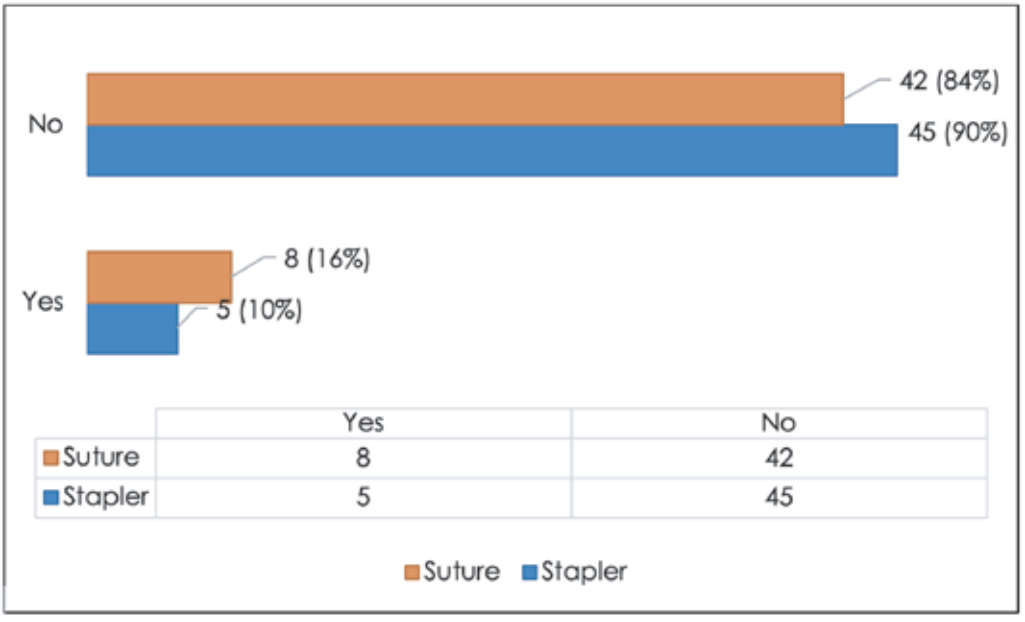

Figure 1: The distribution of post-operative pain (VAS>4) among both groups.

Of 100 patients, 15 (15%) patients developed surgical site infection. Figure 2 shows surgical site infection rate was lower in the stapler group as compared to the suture group (3% vs 12%) after a follow-up of 7 days. Moreover, this difference was statistically significant with p-value=0.012.

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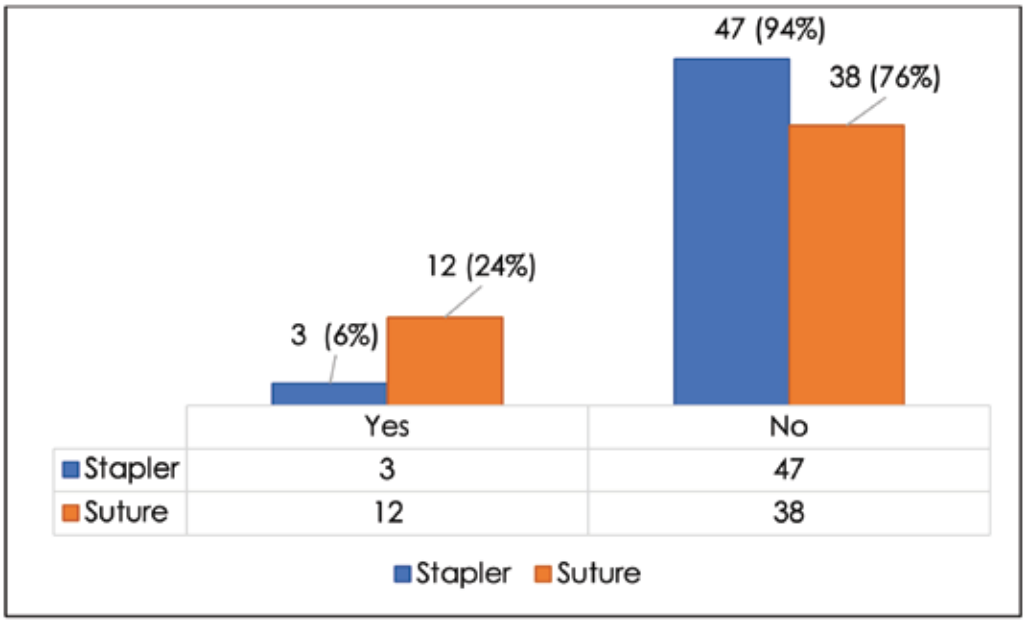

Figure 2: The distribution of surgical site infection (presence of pus discharge, inflammation, or fever > 100 °F) among both groups.

The age is not statistically significant in predicting surgical site infection. The odds ratio is 1.043, suggesting a very slight increase in the odds of surgical site infection for a one-unit increase in age (p=0.345). Gender is also not statistically associated with surgical site infection (p=0.537). However, the odds ratio is 1.494, indicating that, on average, females have 1.494 times higher odds of surgical site infection as compared to males. Furthermore, the odds of surgical site infection are 5.374 higher in the suture group as compared to the stapler group (p=0.015). (Table 2)

Table 2: Multivariate logistic regression analysis for surgical site infection.

Variables	p-value	OR	95% C.I. for OR	
			Lower	Upper
Age	0.345	1.043	0.956	1.137
Gender (Female)	0.537	1.494	0.417	5.349
BMI	0.781	0.987	0.902	1.080
Group (Suture)	0.015	5.374	1.382	20.902

DISCUSSION

The management of inguinal hernia has undergone continuous evolution for more than 150 years[6, 12]. Numerous modifications have been implemented in this approach, demonstrating varying levels of effectiveness[6-9, 11, 13]. Among these advancements, Lichtenstein introduced the tension-free inguinal hernioplasty, which has proven to be a highly effective and safe technique with a lower recurrence rate[9, 14, 15]. Initially, the mesh fixation on the posterior inguinal canal wall was performed using polypropylene 2/0 suture. However, this method significantly impacted patients' quality of life and recovery[16]. In recent decades, a new approach has emerged, utilizing staples instead of polypropylene sutures for mesh fixation. This innovative method has been associated with reduced operative time and complications such as wound infection[6, 7, 11, 17]. Consequently, the current study aims to compare the use of skin staplers and sutures for securing the mesh, with a specific focus on evaluating the occurrence of surgical site infections.

We found the mean age of patients in the stapler group was 43.70±6.05 years, while in the suture group, it was 42.78±7.10 years. Similarly, Wani et al., reported mean ages of 46.75 ± 12.02 years in the suture group and 46 ± 12.10 years in the stapler group in their study at Srinagar[18]. Likewise, Khan et al. conducted a similar study in Pakistan and found a similar pattern of age distribution, with a mean age of 48.9±14.3 years in the suture group and 46.4±14.1 years in the stapler group[19]. These consistent findings regarding the mean age of patients in both the stapler and suture groups across

different studies may be attributed to the common occurrence of inguinal hernia in various age groups and the standardized selection criteria employed by researchers.

In our study, most of the participants with inguinal hernia were males and had a mean BMI of 37.15±7.24 kg/m^2. Ali et al. in their research also found that most of the patients were males, and had a mean BMI of 35.7 kg/m^2 [15]. Wani et al. also observed a higher proportion of males than females.[18] The predominance of male patients with higher mean BMI in all studies, may suggest possible gender and BMI-related factors contributing to inguinal hernia occurrence[20-22].

In the current study, we found a similar proportion of post-operative pain in both groups (p=0.544). The same findings were reported by previous studies, where they also observed the same proportion of pain in both groups[6, 23]. Furthermore, Garg and colleagues reported that the duration of pain was comparable in both groups, spanning 2 days[24]. In contrast, Khan and colleagues discovered a notable reduction in pain within the stapler group in contrast to the suture group, with a significant p-value of 0.026[19]. The lack of significant difference in postoperative pain observed in our study and the cited studies may be attributed to advancements in surgical techniques and anesthesia management, standardized post-operative pain management protocols, and balanced representation of patient characteristics between the stapler and suture groups.

The present study revealed a notable decline in the occurrence of surgical site infections within the stapler group in contrast to the suture group (3% vs. 12%, p=0.012). Even after adjustment in the multivariate logistic regression model, the odds of surgical site infection remain significantly higher in the suture group as compared to the stapler group. Likewise, Khulique et al. discovered a decreased frequency of surgical site infections when employing skin staples for mesh fixation compared to the traditional prolene 2/0 sutures (3.1% vs. 12.3%, p=0.048) [11]. Similarly, Munghate et al. reported a higher incidence of wound infection in the suture group (24%) compared to the stapler group (4%, p=0.001) [6]. Attaullah et al. found only two cases of surgical site infection in the staple group and 12 cases in the polypropylene suture group in a similar study[25]. However, Wani et al. found no significant difference in wound infection rates between the suture group and stapler group, and Garg et al. reported no cases of wound infection in either group during the post-operative period[18, 24]. The observed significant differences in surgical site infection rates between the stapler and suture groups in various studies can be attributed to the different methods of mesh fixation, which might affect wound healing and infection risk. Additionally, variations in patient populations, surgical techniques, and post-operative care protocols may also contribute to the differences in infection rates observed among the studies.

The study has a few limitations. One limitation of the study is that it was conducted at a single center, which may limit the generalizability of the findings to other healthcare settings or populations. Additionally, the follow-up period for assessing complications was relatively short (7 days), which might not capture delayed-onset complications. A longer follow-up duration could have provided a more comprehensive understanding of the outcomes. Lastly, the study did not account for potential confounding variables such as patients' comorbidities or smoking status, which might influence surgical site infection rates. For future studies, we recommend conducting multicenter randomized controlled trials with longer follow-up periods and incorporating comprehensive data on potential confounding factors (e.g., comorbidities, smoking status) to further validate the benefits of using skin staples over skin sutures for mesh fixation in inguinal hernioplasty and to explore potential predictors of surgical site infection.

CONCLUSION

The use of skin staples for mesh fixation in inguinal hernia repair emerges as a promising approach, demonstrating both safety and a notably lower incidence of surgical site infections when contrasted with the traditional use of skin sutures. This finding underscores the potential benefits of incorporating skin staples into hernioplasty procedures, not only for enhancing patient outcomes but also for optimizing healthcare resource utilization. Further research and clinical studies are warranted to validate these findings and solidify the case for this innovative technique as a standard practice in hernia surgery.

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None

CONFLICT OF INTEREST

There is no conflict of interest.

ETHICAL APPROVAL

Ethical approval of the study was obtained from the ethical review committee of the institute (SGR-2020-187-11675).

PATIENT CONSENT

Written informed consent was obtained from all the eligible patients.

AUTHORS CONTRIBUTIONS

MA, MG W: Conceptualization, Methodology design, Manuscript writing and editing, Literature review, Manuscript review. KA: Data analysis and interpretation, Manuscript review, and final approval. SMA, RW: Data collection and validation, manu-

script drafting and revision, data entry and management, drafting specific sections of the manuscript, project supervision.

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