



A Comparative Analysis of Wound Closure Techniques in Uncomplicated Open Inguinal Hernia Surgery: Sutures vs. Skin Staplers

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Article History	Abstract
Received: 06 June 2023 Revised: 05 Sept 2023 Accepted: 12 Oct 2023	Objective: This study compared the results of wound closure with skin staplers and traditional sutures in uncomplicated open inguinal hernia surgery. Methods: An 18-month prospective cohort study was carried out in a tertiary care facility. Patients (n = 100) who met the eligibility requirements were randomly assigned to one of two groups: suture (n = 50) or skin stapler (n = 50). We evaluated wound infection rates, wound healing times, postoperative pain levels, and aesthetic results. Chi-squared tests, t-tests, and Mann-Whitney U tests were used in the statistical analysis. Results: Skin staplers demonstrated lower wound infection rates (2% vs. 10%) and faster wound healing (10.5 ± 1.8 days vs. 14.2 ± 2.1 days) compared to sutures. Postoperative pain scores were consistently lower in the skin stapler group at 24 hours (2.4 ± 0.8 vs. 3.7 ± 1.2), 1 week (1.4 ± 0.6 vs. 2.1 ± 0.9), and 4 weeks (0.6 ± 0.3 vs. 0.9 ± 0.4) post-surgery. Skin staplers with a higher percentage of "excellent" results (54% vs. 14%) had better cosmetic results. Conclusion: In uncomplicated open inguinal hernia surgery, skin staplers are superior to conventional sutures in terms of lower wound infection rates, quicker wound healing, decreased postoperative pain, and enhanced cosmetic results. Surgeons' ought to think about how skin staplers could improve patient satisfaction and outcomes. Inguinal hernia surgery wound closure techniques may be improved with further study and practical practice.
CC License CC-BY-NC-SA 4.0	Keywords: inguinal hernia, wound closure, sutures, skin staplers, surgical outcomes

1. Introduction

One of the most popular surgical procedures performed worldwide, inguinal hernia repair involves millions of patients each year [1]. If neglected, the disease, which is defined by the belly contents protruding through the inguinal canal, can lead to discomfort, pain, and problems. The gold standard for treating inguinal hernias is surgery, and other methods have been created over time to deal with this common medical condition.

Inguinal hernia surgery involves a critical choice of wound closure method since it directly affects patient outcomes, postoperative healing, and overall surgical success. Sutures have traditionally been used to close wounds during open inguinal hernia surgery. Surgery has long used sutures to close wounds and provide tissue apposition, hemostasis, and other benefits. Sutures have been a mainstay of surgical treatment for a very long time because of these benefits.

Since many years ago, incisions have been held in place and wound healing has been accelerated by the use of sutures, both absorbable and non-absorbable. They are the preferred method for wound closure in open hernia surgery due to their adaptability to different wound forms and versatility. Sutures have been used for a very long time, giving surgeons a wealth of knowledge and assurance in their use. Sutures do have some inherent restrictions and difficulties, despite their long history and established function.

The risk for tissue trauma during suture insertion and removal is one of the main issues. Suture needle threading through sensitive tissues has the potential to create microtrauma, which can result in postoperative pain and sluggish wound healing [2]. Additionally, rigorous expertise and a lot of time are needed when using sutures to ensure a secure wound closure. Due to the prolonged contact to the surgical environment, this extended operative duration can raise the risk of surgical site infection (SSI) [3].

Sutures may also not always produce the best cosmetic effects, particularly in regions like the inguinal region where appearance is very important. Suture use can lead to keloid or hypertrophic scarring, suture track markings, and uneven incision margins [4]. The perception of one's body and patient happiness can both be impacted by these cosmetic issues.

Skin staplers have become more common as an alternate method of wound closure in recent years, which has been observed by the surgical community. Skin staplers, which were initially created for use in skin closure, have become more common in a number of surgical disciplines, including orthopedics and general surgery [5]. Skin staplers are appealing because they have the ability to overcome some of the drawbacks of sutures.

Skin staplers have a number of benefits over conventional sutures. They primarily offer a quick and effective method of wound closure. The mechanical action of stapling makes it possible to quickly approximate the borders of wounds, shortening the duration of the procedure [6]. Lower SSI rates and less exposure to potential toxins may result from this accelerated closure.

Skin staplers also lessen the chance of tissue damage during closure, which is another important advantage. Staplers just apply pressure to the tissue, reducing the possibility of microtrauma, in contrast to sutures, which involve the insertion of a needle through tissues [7]. This lessening of tissue damage can hasten wound healing and lessen pain following surgery.

Additionally, skin staplers might provide better cosmetic results, especially in cosmetically delicate locations like the inguinal area. The danger of track marks or suture-related scarring is decreased by the consistent insertion of staples along the borders of the incision [8-10]. Following surgery, this can increase patient happiness and self-esteem.

Despite these potential benefits, the use of skin staplers in inguinal hernia surgery has not been well investigated, and further study is still required to assess their effectiveness and safety in this particular situation. In order to compare the results of wound closure in straightforward open inguinal hernia surgery utilizing conventional sutures and skin staplers, this study was carried out. In order to improve wound closure procedures for patients following inguinal hernia repair, the research evaluated wound infection rates, wound healing times, postoperative pain, and cosmetic outcomes.

2. Materials And Methods

Study design: An 18-month prospective cohort research was conducted in a tertiary care center according to the study's design. In this study, two distinct repair methods—conventional sutures and skin staplers—were used to treat patients who had simple open inguinal hernias. The goal of the study was to give a thorough evaluation of a number of different factors, such as wound infection rates, wound healing times, postoperative pain, and cosmetic results.

Selection of Patients: Following compliance with the following inclusion criteria, a total of 100 patients were enrolled in the study:

1. Adult patients
2. Clinical assessment and imaging corroborate the simple inguinal hernia diagnosis.
3. No past history of hernia surgery.
4. There are no substantial comorbidities that might affect how a surgery goes or how well a wound heals.
5. All subjects gave their free and informed permission.

Patients who failed to meet these requirements or who had difficult hernias, immunosuppression, or other factors that would impair wound healing were not allowed to participate in the trial.

Interventions: Suture (n = 50) or skin stapler (n = 50) groups were randomly allocated to patients (n = 100) who met the qualifying criterion. Computer-generated randomization was used to distribute the patients evenly between the two groups during the allocation process.

- Suture Group: Wound closure in this group was accomplished with standard sutures of size [n=50]. Experienced surgeons used a uniform suturing method.
- Skin Stapler Group: Wound closure in this group was accomplished with skin staplers of size [n=50]. The staples were put uniformly and consistently along the borders of the wounds.

Data Gathering: During the course of the study, the following information was gathered for each participant:

1. Wound Infection Rates: Wound infection was measured by keeping an eye out for any erythema, induration, or purulent discharge surrounding the incision site. At each subsequent visit, the infection status was noted as "infected" or "not infected."
2. Duration of Complete Wound Healing: The duration of complete wound healing, which was measured in days and defined as the absence of wound dehiscence and the presence of epithelialization, was noted. Until the wound had fully healed, patients were observed at follow-up appointments.
3. Postoperative Pain: At predetermined intervals (e.g., 24 hours, 1 week, and 4 weeks after surgery), postoperative pain was evaluated using a standardized pain measure (e.g., Visual Analog measure, Numeric Rating Scale). Numbers were recorded indicating the severity of the pain.
4. Cosmetic Results: At follow-up appointments, the surgical scar's appearance was examined to determine the cosmetic results. Results were rated as "excellent," "good," "fair," or "poor" depending on whether hypertrophic scarring, wound dehiscence, or other cosmetic issues were present.

Statistical Analysis: SPSS ver 25 was used to analyze the data. For categorical variables (like wound infection rates) or continuous variables (like wound healing time), statistical tests included chi-squared tests, t-tests, and Mann-Whitney U tests. For non-normally distributed data (like pain scores), these tests included Mann-Whitney U tests. Statistical significance was defined as a p-value <0.05.

3. Results and Discussion

Baseline Characteristics (Table 1): The study included a total of 100 patients, evenly distributed between the suture group and the skin stapler group. Baseline characteristics such as age, gender, BMI, and hernia type were similar between the two groups, ensuring a balanced patient population for comparison.

Wound Infection Rates and Wound Healing Time (Table 2): Wound infection rates were significantly lower in the skin stapler group (2%) compared to the suture group (10%) ($p < 0.05$). This finding suggests that skin staplers are associated with a reduced risk of wound infections. Additionally, wound healing time was significantly shorter in the skin stapler group (10.5 ± 1.8 days) compared to the suture group (14.2 ± 2.1 days) ($p < 0.05$). These results indicate that skin staplers promote faster wound healing.

Postoperative Pain Scores and Cosmetic Outcomes (Table 3): Postoperative pain scores, assessed using the Visual Analog Scale (VAS), showed a consistent trend of lower pain scores in the skin stapler group at 24 hours, 1 week, and 4 weeks post-surgery. These differences were statistically significant ($p < 0.05$) at all time points, indicating that patients in the skin stapler group experienced less postoperative pain compared to those in the suture group.

Cosmetic outcomes were also evaluated, and a significantly higher percentage of patients in the skin stapler group reported "excellent" cosmetic outcomes (54%) compared to the suture group (14%) ($p < 0.05$). This suggests that skin staplers may contribute to better cosmetic results with a lower incidence of hypertrophic scarring and wound dehiscence.

Table 1: Baseline Characteristics of Study Participants

Characteristic	Suture Group (n = 50)	Skin Stapler Group (n = 50)
Age (years)	Mean ± SD: 49.2 ± 6.3	Mean ± SD: 50.1 ± 5.7
Gender (Male/Female)	38/12	39/11
BMI (kg/m ²)	Mean ± SD: 25.6 ± 2.8	Mean ± SD: 26.0 ± 3.1
Hernia Type	Right/Left/Bilateral	23/24/3

Table 2: Wound Infection Rates and Wound Healing Time

Outcome Measure	Suture Group	Skin Stapler Group
Wound Infection Rates (%)	10	2
Wound Healing Time (days)	14.2 ± 2.1	10.5 ± 1.8

Table 3: Postoperative Pain Scores and Cosmetic Outcomes

Outcome Measure	Suture Group (n = 50)	Skin Stapler Group (n = 50)
24 Hours Post-op (VAS)	Mean ± SD: 3.7 ± 1.2	Mean ± SD: 2.4 ± 0.8
1 Week Post-op (VAS)	Mean ± SD: 2.1 ± 0.9	Mean ± SD: 1.4 ± 0.6
4 Weeks Post-op (VAS)	Mean ± SD: 0.9 ± 0.4	Mean ± SD: 0.6 ± 0.3
Cosmetic Outcomes		
Excellent	7 (14%)	27 (54%)
Good	32 (64%)	20 (40%)
Fair	9 (18%)	2 (4%)
Poor	2 (4%)	1 (2%)

The results of this study offer important new information on the selection of wound closure methods in straightforward open inguinal hernia surgery. Multiple outcome indicators showed substantial differences between skin staplers and conventional sutures, leading to a full discussion of their clinical implications and the possible advantages of skin staplers in this surgical setting.

Wound Healing Time and Wound Infection Rates: One of the study's most important findings was the skin stapler group's significantly lower wound infection rate of 2% compared to the suture group's 10%. The potential benefit of utilizing skin staplers in inguinal hernia surgery to lower the incidence of surgical site infections is highlighted by this noteworthy difference. This result could be influenced by a number of things.

Skin staplers provide a quick and effective way to close wounds while minimizing tissue handling and, as a result, lowering the risk of infection [11]. Skin staplers mechanically add staples to the edges of the wound as opposed to sutures, which entail passing a needle through tissues. As a result, there is less chance of bringing bacteria into the surgery site, especially in the inguinal area, which is vulnerable to contamination [12]. Additionally, maintaining secure wound closure is made easier by the equal distribution of staples around the wound's margins, which lowers the danger of infection.

In line with earlier research that found faster wound healing using staplers [13], the skin stapler group's wound healing time was shorter (10.5 ± 1.8 days) than that of the suture group's (14.2 ± 2.1 days). Patients may benefit from faster healing times since they can resume their regular activities more quickly and perhaps spend less money on healthcare as a result of shorter healing times. The clinical relevance of skin staplers in accelerating postoperative wound healing is highlighted by this study.

Postoperative Pain Scores and Cosmetic Outcomes: Another interesting discovery was that the skin stapler group consistently had reduced postoperative pain levels at 24 hours, 1 week, and 4 weeks after surgery. At each time point, the variation in pain scores was statistically significant. Reduced postoperative pain is crucial for improving recovery as well as patient comfort and satisfaction.

Skin staplers' ability to relieve postoperative pain probably depends on a number of different factors. As previously indicated, the lessened tissue stress brought on by skin staplers may help to lessen

discomfort [14]. Sutures call for the insertion of a needle through tissues, which may cause tissue damage and microtrauma that cause pain and discomfort [5,11,12]. On the other hand, skin staplers apply staples devoid of the necessity for needle penetration, reducing tissue trauma and related pain.

The skin stapler group also had better cosmetic results, with a much higher proportion of patients describing their appearance as "excellent". According to the theory that uniform staple placement leads to even wound apposition and lowers the likelihood of hypertrophic scarring and wound dehiscence [6], this is in line with that theory. Patient satisfaction and perceptions of one's body may benefit from the superior cosmetic outcomes seen in the skin stapler group; these are important considerations in surgical decision-making.

Clinical outcomes: The results of this study have a number of practical ramifications for doctors performing straightforward open inguinal hernia surgery on patients. First and foremost, skin staplers seem to give a distinct advantage in terms of postoperative outcomes due to their much lower wound infection rates and quicker wound healing. Skin staplers are a surgical tool that surgeons should think about using, especially when there is a risk of infection.

Another strong argument in favor of using skin staplers in inguinal hernia surgery is the decreased postoperative pain they have been shown to cause. A key component of surgical treatment is pain management, and reducing patient suffering can raise general patient satisfaction and enhance the patient experience. Skin staplers may make the healing process after surgery more comfortable and less painful.

Additionally, skin staplers' enhanced cosmetic results are pertinent in situations when aesthetics are particularly important, such as in cosmetic surgery or when patients have high expectations for the appearance of scars. Patients and surgeons may both value the enhanced cosmetic outcomes produced by skin staplers.

Limitations: Despite the interesting results, this study has some flaws. The study was limited to a single center, so it's possible that the findings don't apply to all clinical contexts. Longer-term results were not evaluated, and the follow-up time frame was only 4 weeks. Multicentre studies with extended follow-up could be part of future research to assess the durability of wound closure procedures and to further validate the findings.

4. Conclusion

The findings of this study suggest that skin staplers have a number of advantages over traditional sutures in straightforward open inguinal hernia repair. These benefits include noticeably lower wound infection rates, quicker healing times, decreased postoperative pain, and better cosmetic results. Surgeons should think about the advantages of using skin staplers in their practice, especially where infection risk, patient comfort, and aesthetic considerations are crucial. The best techniques for wound closure in inguinal hernia surgery may be improved with further study and clinical practice.

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