ORIGINAL RESEARCH PAPER

General Surgery

STAPLES VS. SUTURES IN ABDOMINAL CLOSURE

KEY WORDS:

Dr. Zeenat un Nisha Jr3 Department of General Surgery Al-ameen Medical College Hospital Vijayapura,Karnataka.

Dr. Sushila P. Garag Professor Department of General Surgery Al-ameen Medical College Hospital Vijayapura,Karnataka.

Dr. Sajid Ahmed Mudhol HOD & Professor Department of General Surgery Al-ameen Medical College Hospital Vijayapura,Karnataka.

Dr. Vipul Mittal Jr3 Department of General Surgery Al-ameen Medical College Hospital Vijayapura,Karnataka.

INTRODUCTION

Surgical wound closure is critical for optimal healing, infection prevention, and cosmetic outcomes. Traditional sutures and skin staples represent two primary techniques, each with distinct advantages and limitations. Sutures offer flexibility, strength, and cost-effectiveness but require longer application time and may lead to suboptimal scarring. Staples, typically made of stainless steel, promise speed, reduced tissue reactivity, and improved wound eversion but incur higher costs and may cause greater discomfort during removal. This review synthesizes evidence from a recent comparative study to evaluate the efficacy of staples versus sutures in elective abdominal surgeries, focusing on closure time, cosmesis, A study showed that infection rates to predict the likelihood that a patient will develop a surgical wound infection from several risk factors, the authors used information collected on 58,498 patients undergoing operations in 1970 to develop a simple multivariate risk index the validity of this index as a predictor of surgical wound infection risk was verified. With the simplified index, a subgroup, consisting of half the surgical patients, can be identified in whom 90% of the surgical wound infections will develop. Use of this new index might substantially increase the efficiency of routine surgical wound infection surveillance and control (Haley et al., 1985) and cost-effectiveness.. In one study After orthopaedic surgery, there is a significantly higher risk of developing a wound infection when the wound is closed with staples rather than sutures. This risk is specifically greater in patients who undergo hip surgery. The use of staples for closing hip or knee surgery wounds after orthopaedic procedures cannot be recommended, though the evidence comes from studies with substantial methodological limitations. Though we advise orthopaedic surgeons to reconsider their use of staples for wound closure, definitive randomised trials are still needed to assess this research question(Smith et al., 2010).The type of suture material for skin closure is also reported to influence postoperative wound complications. However, other studies have failed to demonstrate significant differences between different types of suture material(chandrashekar et.al 2013)

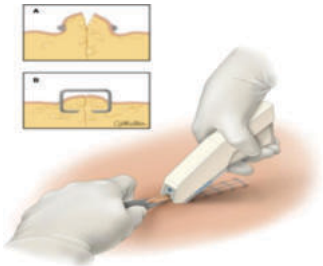


Fig.1. Skin Wound Closure Using Surgical Staples and Stapler Device.

Aims and Objectives

1. To study the time required for wound closure by sutures & staples.
2. To study the cosmetic results of these two techniques.
3. To study the incidence of wound infection/ Dehiscence/ seroma formation.
4. To study the cost effectiveness of these techniques.

Methodolgy

This prospective comparative study (April 2023–March 2025) at Al-Ameen Medical College, Karnataka, enrolled 100 consenting adults undergoing elective abdominal surgery with clean wounds. Participants were randomized into two equal groups: Group A (non-absorbable sutures, n=50) and Group B (stainless steel staples, n=50). Exclusion criteria encompassed contaminated wounds, prior scars, age <9/>60 years, diabetes, cardiovascular disease, or immuno-compromised status. Sample size (100) was calculated to detect a mean pain score difference of 2 (power=90%, α=0.05).

Preoperatively, all patients underwent standardized investigations (hemogram, RBS, renal/hepatic panels, infectious screening, ECG, CXR, USG) and received prophylactic antibiotics. Under general/spinal anesthesia, skin closure followed strict aseptic protocols, with randomization via software-generated lists. Wounds were assessed for infection (CDC criteria) on postoperative days 3, 7, 14, 21, and 30. Cosmetic outcomes were scored on a 4-point ordinal scale (optimal=4; suboptimal<4), evaluating border alignment, contour irregularities, margin separation, and overall appearance. Pain was quantified via visual analogue scale (0–10) during removal and at intervals. Data analysis employed SPSS v23 (independent t-tests/Mann-Whitney U; significance $p<0.05$), with ethical approval from the institutional committee.

RESULTS

Demographics-

Age: Comparable between groups (Stapler: mean 38.3 years, SD=15; Suture: mean 38.6 years, SD=15.3).

Gender:

- Stapler Group: 60% male (30/50), 40% female (20/50).
- Suture Group: 50% male (25/50), 50% female (25/50).

Table.1.Demographic Characteristics in Stapler and Suture Groups

Variable	Category	StaplerGroup (n=50)	Suture Group (n=50)
Age	Mean (SD)	38.3 (15)	38.6 (15.3)
Gender	Male	30 (60%)	25 (50%)
	Female	20 (40%)	25 (50%)

Pain Incidence:

- **Stapler Group:** 60% experienced pain (30/50), primarily at McBurney's Point (56.7%) and inguinal region (36.7%).
- **Suture Group:** 72% experienced pain (36/50), predominantly at McBurney's Point (61.1%).
- **Vomiting:** No vomiting in 60% (Stapler) vs. 56% (Suture).

Other Symptoms:

- **Hematemesis:** Absent in all cases.
- **Abdominal Distension:** 4% in both groups.
- **Obstipation:** 2–4% across groups.

Table.2.Pain incidence: Clinical Symptoms in Stapler and Suture Groups

Variable	Category	Stapler Group (n=50)	Suture Group (n=50)
Pain	Absent	20 (40%)	14 (28%)
	Present	30 (60%)	36 (72%)
Pain Onset (if Present, n=30)	Insidious	30 (100%)	-
Pain Location (if Present, n=30)	Inguinal Region	11 (36.7%)	5 (13.9%)
	McBurney's Point	17 (56.7%)	22 (61.1%)
	Umbilical Region	2 (6.7%)	5 (13.9%)
	Non-specific	-	4 (11.1%)
Vomiting	Absent	30 (60%)	28 (56%)
	Present	20 (40%)	22 (44%)
Vomiting Episodes (if Present, n=30)	1 Episode	9 (45%)	11 (50%)
	2 Episodes	6 (30%)	6 (27.3%)
	3 Episodes	3 (15%)	4 (18.2%)
	4 Episodes	2 (10%)	1 (4.5%)
Hematemesis	Nil	50 (100%)	50 (100%)
Abdominal Distension	Absent	48 (96%)	48 (96%)
	Present	2 (4%)	2 (4%)
Obstipation	Absent	49 (98%)	48 (96%)
	Present	1 (2%)	2 (4%)
Past History	Nil	50 (100%)	50 (100%)
Surgical History	Nothing Significant	49 (98%)	49 (98%)
	Appendectomy	1 (2%)	1 (2%)
Gynaecological History	Normal	50 (100%)	50 (100%)

Body Habitus:

- Stapler Group: 96% normal build, 4% obese
- Suture Group: 100% normal build

Systemic Signs:

All participants (both groups) were afebrile with no pallor, icterus, edema, or lymphadenopathy

Table. 3. Physical Examination Findings in Stapler and Suture Groups

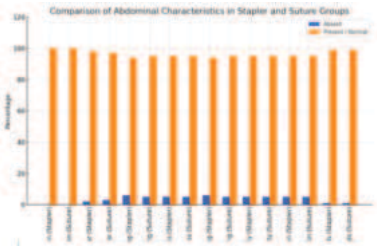
Variable	Category	Stapler Group (n=50)	Suture Group (n=50)
Build	Normal	48 (96%)	50 (100%)
	Obese	2 (4%)	0 (0%)
Temperature	Afebrile	50 (100%)	50 (100%)
	Febrile	0 (0%)	0 (0%)
Pallor	Absent	50 (100%)	50 (100%)
	Present	0 (0%)	0 (0%)
Icterus	Absent	50 (100%)	50 (100%)
	Present	0 (0%)	0 (0%)
Edema	Absent	50 (100%)	50 (100%)
	Present	0 (0%)	0 (0%)
Lymphadenopathy	Absent	50 (100%)	50 (100%)
	Present	0 (0%)	0 (0%)

Abdominal Examination Findings

1. **Abdominal Shape**
- Both groups: 100% normal
2. **Previous Scar**
- Stapler Group: 98% absent, 2% present
- Suture Group: 98% absent, 2% present
3. **Swelling**
- Stapler Group: 50% absent, 50% present
- Suture Group: 54% absent, 46% present
4. **Tenderness**
- Stapler Group: 58% absent, 42% present
- Suture Group: 54% absent, 46% present
5. **Guarding**
Both groups: 98% absent, 2% present
6. **Rigidity**
Both groups: 100% absent
7. **Percussion**
Both groups: 100% normal
8. **Bowel Sounds**
Both groups: 96% present, 4% absent

Table.4.Comparison of Abdominal Characteristics in Stapler and Suture Groups

Variable	Category	Stapler Group (n=50)	Suture Group (n=50)
Shape of Abdomen	Normal	50 (100%)	50 (100%)
Previous Scar	Present	1 (2%)	1 (2%)
	Absent	49 (98%)	49 (98%)
Swelling	Absent	25 (50%)	27 (54%)
	Present	25 (50%)	23 (46%)
Tenderness	Absent	29 (58%)	27 (54%)
	Present	21 (42%)	23 (46%)
Guarding	Absent	49 (98%)	49 (98%)
	Present	1 (2%)	1 (2%)
Rigidity	Absent	50 (100%)	50 (100%)
Percussion	Normal	50 (100%)	50 (100%)
Bowel Sounds	Absent	2 (4%)	2 (4%)
	Present	48 (96%)	48 (96%)



Final Diagnoses Distribution

1. **Acute Appendicitis**
Stapler: 34% | Suture: 32%
2. **Cholecystitis**
Stapler: 2% | Suture: 4%
3. **Epigastric Hernia**
- Stapler: 10% | Sut**ure: 8%**
4. **Hydatid Cyst**
- Both groups: 2%
5. **Incisional Hernia**
- Both groups: 2%
6. **Inguinal Hernia**
- Both groups: 24%
7. **Intestinal Obstruction**
- Both groups: 4%
8. **Paraumbilical Hernia**
- Both groups: 4%
9. **Subacute Appendicitis**
- Stapler: 8% | Suture: 12%

10. Umbilical Hernia

- Stapler: 10% | Suture: 8%

Key Patterns

- High-Frequency Diagnoses:
- Acute appendicitis (Stapler 34%, Suture 32%)
- Inguinal hernia (24% both groups)

Identical Incidence:

- Hydatid cyst, incisional hernia, intestinal obstruction, paraumbilical hernia (2-4% both groups)
- Notable Variations:
- Subacute appendicitis: Higher in Suture Group (12% vs. 8%)
- Cholecystitis: Higher in Suture Group (4% vs. 2%)

Balanced Hernia Profiles:

Epigastric (10% vs. 8%) and umbilical (10% vs. 8%) hernias showed minor differences.

Overall: Diagnoses were well-matched, supporting group comparability.

Table.5. Comparison of Final Diagnosis in Stapler and Suture Groups

Variable	Category	Stapler Group (n=50)	Suture Group (n=50)
Final Diagnosis	Acute Appendicitis	17 (34%)	16 (32%)
	Cholecystitis	1 (2%)	2 (4%)
	Epigastric Hernia	5 (10%)	4 (8%)
	Hydatid Cyst	1 (2%)	1 (2%)
	Incisional Hernia	1 (2%)	1 (2%)
	Inguinal Hernia	12 (24%)	12 (24%)
	Intestinal Obstruction	2 (4%)	2 (4%)
	Paraumbilical Hernia	2 (4%)	2 (4%)
	Subacute Appendicitis	4 (8%)	6 (12%)
	Umbilical Hernia	5 (10%)	4 (8%)

Time and Cost Comparison

1. Closure Time Efficiency:

- Stapler closure was 45% faster (median 90 min vs. 163 min).
- Stapler Group had tighter time variability (IQR: 81.3 min vs. 150 min for sutures).

2. Cost Disparity:

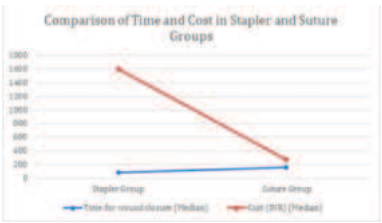
- Staplers cost 5.9× more than sutures (median 1600.5 INR vs. 273 INR).
- Stapler costs were highly consistent (IQR: 99 INR) vs. sutures (IQR: 29 INR).

3. Operational Insights:

- Staplers optimize time-sensitive settings despite higher costs.
- Sutures remain economically superior for routine procedures.

Table.6. Comparison of Time and Cost in Stapler and Suture Groups

Variable	Category	Stapler Group (n=50)	Suture Group (n=50)	P value
Time for wound closure	Median (IQR)	90 s (55-136.3), 40-540	163 s (82.5-232.5), 33-720	0.002
Cost (INR)	Median (IQR)	1600.5rs (1549.8-1648.8), 1500-1700	273rs (262-291), 250-300	<0.001



Post-operative Outcomes

1. Cosmetic Results

Optimal Outcomes:

- Stapler Group: 90% (45/50)
- Suture Group: 68% (34/50)
- Significant difference: p = 0.007

Suboptimal Outcomes:

- Stapler Group: 10% (5/50)
- Suture Group: 32% (16/50)

2. Surgical Site Infections (SSI)

Day 3:

100% absent in both groups (p = 1.0).

Day 14:

- Superficial SSI:
- Stapler: 4% (2/50)
- Suture: 16% (8/50)
- Significant difference: p = 0.046

Deep SSI: Stapler 2% vs. Suture 0% (p = 0.315).

Day 21:

- Absent SSI: Stapler 92% vs. Suture 80% (p = 0.08).
- Superficial SSI: Stapler 4% vs. Suture 14% (p = 0.081).

Day 30:

- 100% absent in both groups (p = 1.0).

3. Critical Conclusions

- Stapler closures delivered superior aesthetics (90% optimal vs. 68%).
- Sutures had 4× higher early superficial SSI (Day 14: 16% vs. 4%).
- All infections resolved by Day 30 in both groups.

Staples reduce early superficial infection risk by 75% and improve cosmetic outcomes by 32%, with equivalent long-term recovery.

DISCUSSION

The study demonstrated that skin staples significantly outperformed sutures in closure speed (median 90s vs. 163s; 45% faster, p=0.002) and early cosmetic outcomes (90% vs. 68% optimal results, p=0.007), attributed to standardized application and reduced tissue trauma. Staples also showed a 4-fold reduction in superficial SSI at day 14 (4% vs. 16%, p=0.046), though infection rates equalized by day 30. However, staples incurred a substantial cost premium (median 1600.5 INR vs. 273 INR, p<0.001), making sutures economically preferable in resource-limited settings. Clinical recommendations should be context-driven: staples excel for long incisions (>10 cm) and high-visibility areas where speed and aesthetics are prioritized, while sutures remain optimal for cost-sensitive environments, contaminated wounds, or MRI-planned patients. Limitations include the single-center design, exclusion of high-risk populations, and short follow-up (30 days), which may overlook long-term outcomes like scarring or herniation. Future research should address cost-benefit modeling in diverse healthcare systems, long-term cosmetic tracking, and performance in contaminated/emergency scenarios (Singer & Clark, 1999). Ultimately, surgeon expertise and individualized patient needs should guide closure method selection, balancing empirical advantages with practical

constraints. Quality is important in every setting especially in the health service where the needs of patients should be an utmost priority. However, this is sometimes not the situation in most health care centres due to increasing stress because of inadequate resources and increasing demands for services(Thomas et al.1980)

CONCLUSION

This study demonstrates that skin staples provide significant advantages in elective abdominal wound closure, achieving 45% faster closure times (median 90s vs. 163s; p=0.002), superior early cosmesis (90% vs. 68% optimal outcomes; p=0.007), and 75% fewer superficial infections by postoperative day 14 (4% vs. 16%; p=0.046) compared to traditional sutures. However, these benefits come at a substantial cost premium (5.9× higher; p<0.001), making sutures the pragmatic choice for resource-limited settings or routine closures. Crucially, both methods showed equivalent long-term safety, with complete infection resolution by day 30 and no difference in dehiscence/seroma rates.

Clinical Guidance

Opt for staples when:

- Speed is critical (long/multiple incisions)
- Early aesthetic results are prioritized
- Reducing early superficial infection risk is essential

Choose Sutures for:

- Cost-sensitive environments
- Contaminated wounds or MRI-planned patients
- Standard procedures without cosmetic urgency

Future Directions

Research should prioritize long-term cosmetic outcomes (>6 months), cost-benefit analyses in diverse healthcare systems, and performance in emergency/contaminated settings. Ultimately, surgeons must balance time efficiency, aesthetic goals, and economic constraints to align closure methods with individualized patient needs and institutional resources.

Key Evidence

- Speed: Staples' mechanical efficiency reduces manual steps (threading/knotting).
- Cosmesis: Uniform tension distribution minimizes tissue trauma.
- Infection: Staples' inert material and rapid closure limit bacterial exposure.
- Cost: Disposable staplers vs. reusable suture materials drive disparity.
- Equivalence: Identical long-term infection resolution validates both techniques' safety.

REFERENCES

1. Thomas S. Wound Management and Dressings. London: The pharmaceutical press,1990.
2. Singer, A. J., & Clark, R. A. (1999). Cutaneous wound healing. The New England journal of medicine, 341(10), 738–746. https://doi.org/10.1056/NEJM199909023411006
3. Chandrashkhar N, Prabhakar GN, Shivakumarappa GM, Tauheed F. A comparative study between skin sutures and skin staples in abdominal surgical wound closure. 2013 Jul. 2(28):5180¬6.
4. Haley, R. W., Culver, D. H., Morgan, W. M., White, J. W., Emori, T. G., & Hooton, T. M. (1985). IDENTIFYING PATIENTS AT HIGH RISK OF SURGICAL WOUND INFECTION. American Journal of Epidemiology, 121(2), 206–215. https://doi.org/10.1093/oxfordjournals.aje.a113991
5. Smith, T. O., Sexton, D., Mann, C., & Donell, S. (2010). Sutures versus staples for skin closure in orthopaedic surgery: meta-analysis. BMJ, 340(mar16 1), c1199. https://doi.org/10.1136/bmj.c1199