fortune Journals

Research Article

FORTUNE JOURNAL OF HEALTH SCIENCES

ISSN: 2644-2906



Comparison of Wound Infection in Patients Undergoing Primary Closure and Open Technique in The Treatment of Pilonidal Sinus

Muhammad Arshad[1], Unsia Fatima[1], Wagma Hidayat[1], Aqib Ali Khan[1], Gohar ali[*,2], Muhammad Sanaan Fida[1], Salahuddin Khan[1]

Abstract

Objective: To compare 30-day wound infection and postoperative recovery following primary closure versus the open technique for pilonidal sinus.

Study design: This single-center randomized controlled trial

Place and Duration of study: This study was conducted in General surgical unit of Hayatabad Medical Complex, Peshawar, KPK, Pakistan.

Methods: the study encompassed 76 patients allocated equally to primary closure or the open technique (38 per group). The primary outcome was wound infection within 30 days. Secondary outcomes were operative duration, time to complete wound healing, and postoperative hospital stay. All patients were included in the intention-to-treat analysis. Categorical and continuous outcomes were compared using chi-square and independent-samples t tests, respectively.

Results: Wound infection occurred in 5 patients (13.2%) after primary closure and 13 (34.2%) after the open technique (p=0.031), corresponding to a risk ratio of 0.38 (95% CI 0.15–0.97) and an absolute risk reduction of 21.1 percentage points. Mean healing time was shorter with primary closure (19.95±4.05 versus 44.42±10.01 days; p<0.001). Operative duration was longer (43.26±6.10 versus 36.13±5.88 minutes; p<0.001). Hospital stay did not differ significantly (2.13±0.58 versus 2.39±0.72 days; p=0.082).

Conclusion: Primary closure resulted in fewer 30-day wound infections and faster complete wound healing than the open technique, with a modest increase in operative duration. Long-term recurrence was not evaluated and requires further follow-up.

Keywords: Pilonidal Sinus; Surgical Wound Infection; Wound Healing; Suture Techniques; Treatment Outcome.

Introduction

Pilonidal sinus (PS) is a frequent condition of natal cleft in the sacrococcygeal area that is characterized by weak hair buildup within. It typically consists of one or more apertures connected by a fibrous track lined by granulation tissue. [1] the current consensus holds that this condition is developed over time and is brought on by factors such as improper hygiene, high hairiness, localized trauma, or the presence of a deep natal cleft. [2,3] This benign condition has a predisposition for developing in people who are male, young, overweight, and hirsute or who have a positive family history. Other risk factors include having a positive family history. [4] Surgery is still the most common form of treatment but not ideal, despite the fact that many other treatment options have been documented.[3,4] The goal of surgery is to perform a technique that is as straightforward as possible, with minimal post-operative

Affiliation:
[1]Trainee Medical Officer, General Surgery Hayatabad Medical Complex Peshawar KPK Pakistan

[2]Specialist registrar, General Surgery Hayatabad Medical Complex Peshawar KPK Pakistan

***Corresponding author:**
Gohar ali, Specialist registrar, General Surgery Hayatabad Medical Complex Peshawar KPK Pakistan.

Citation: Muhammad Arshad, Unsia Fatima, Wagma Hidayat, Aqib Ali Khan, Gohar ali, Muhammad Sanaan Fida, Salahuddin Khan. Comparison of Wound Infection in Patients Undergoing Primary Closure and Open Technique in The Treatment of Pilonidal Sinus. Fortune Journal of Health Sciences. 9 (2026): 600-606.

Received: October 20, 2026
Accepted: October 27, 2026
Published: November 16, 2026

Arshad M, et al., Fortune J Health Sci 2026
DOI:10.26502/fjhs.453

pain, minimal wound care, rapid wound healing, shorter hospital stays, early returns to regular activities, and a low recurrence rate. [5,6] Although many different surgical methods, ranging from wide local excision to sophisticated rotating flaps surgeries, have been devised, there is no one way that is considered to be the best treatment for the condition. [4,7]

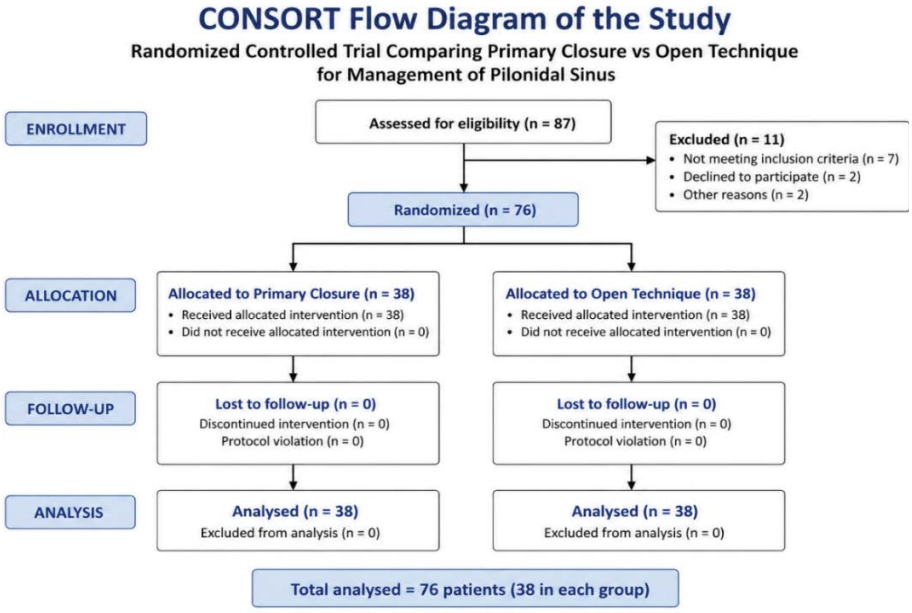
A simple incision and drainage, lying open, marsupialization, excision and primary closure, or rhomboid excision and the Limberg flap technique are some of the surgical therapeutic options that are available.[8,9] Due to the presence of the birth cleft and the structure of the natal cleft itself, simple excisional methods are associated with a high morbidity and recurrence rate. [1,10] However, the most usual procedures are the Limberg flap transposition, the Karydakis flap transposition, primary closure, and permitting healing with secondary intention following the total excision of the cyst. [1,8] A study reported the wound infection in primary closure technique **(7.69%)**, and in open technique **(35.71%)** undergone for the treatment of pilonidal sinus. [11] In light of the variability in surgical management practices for pilonidal sinus and the potential impact of wound infections on patient outcomes and healthcare costs, conducting a rigorous comparative study to evaluate wound infection rates in patients undergoing primary closure and open techniques is both scientifically and clinically warranted. As there is no such study conducted on this in our local level that is why, the goal of this study is to compare the wound infection in patients undergoing primary closure and open technique in the treatment of pilonidal sinus. The results of this study will be helpful for health care professional in contributing to valuable insights to the field, guide treatment decisions, enhance patient care, and potentially lead to improvements in the overall management of pilonidal sinus. The main objective of the study is to compare the frequency of wound infection in patients undergoing primary closure and open technique in the treatment of pilonidal sinus.

Materials and Methods

A parallel-arms randomized control trial was conducted at General Surgery department, Rehman Medical Institute, Peshawar from January 2025 to august 2026.

Sample Size

The sample size was calculated for both the groups comparing the proportion of wound infections. The calculation of sample size is performed by using WHO sample size calculator taking the frequency of wound infection in primary closure technique **(7.69%)** [11] in patients undergone for the management of pilonidal sinus. Taking the frequency of wound infection in open technique **(35.71%)** [11] in patients undergone for the management of pilonidal sinus. Power 80%, Confidence level 95%, substituting into the formula yielded total calculated sample size is 68 (34 in each group) were used. We include 76 (38 in each group) to reduce confounding in the study shown in CONSORT figure. Randomization and blinding: Randomization was conducted using computer generated sequence with R. patients were allocated in 1:1 into either groups and concealment was ensured by independent researcher who was not involved in patients care or data collection. All the eligible patients were deemed to have a randomization code after they were decided to be enrolled in study. The treating physicians and researchers assessing the outcomes were aware of the group allocation; however, patients remained blinded to the treatment they received.



Citation: Muhammad Arshad, Unsia Fatima, Wagma Hidayat, Aqib Ali Khan, Gohar ali, Muhammad Sanaan Fida, Salahuddin Khan. Comparison of Wound Infection in Patients Undergoing Primary Closure and Open Technique in The Treatment of Pilonidal Sinus. Fortune Journal of Health Sciences. 9 (2026): 600-606.

Sampling Technique: Consecutive Non-Probability Sampling.

Inclusion Criteria:

- Male &Female
- Age between (18-75) Years
- Patients with pilonidal sinus as defined in the operational definition.

Exclusion Criteria:

- Patients with debilitating disease
- Patients with immunocompromised state like malignancy, and tuberculosis.

Data Collection Procedure

Following receipt of approval from the ethical review board of the hospital and the research department of CPSP Karachi, the study was carried out. The study was conducted according to the principles of Declaration of Helsinki which was registered with ClinicalTrial.gov (NCT07798752). Participants: Patients who satisfied the requirements for participation in the study were enrolled in it. Every patient received a simplified explanation of the study's objectives, as well as its potential advantages and drawbacks. Every patient was asked to sign a written consent form after they have been fully informed. Demographic information like age, gender, BMI, education status, profession, socio economic status, residence area, comorbid such as diabetes, and hypertension were recorded. Medical history was obtained and physical examination was performed. All patients with pilonidal sinus were divided equally into two groups with the help of blocked randomization method. Patients in Group A received primary closure technique, and patients in Group B received open technique.

Interventions:

Patient in **group A** undergone the Primary Closure: This method entails cutting out the sinus and the surrounding tissue down to the sacral fascia from a small piece of skin (1-1.5cm). Secondary tracts were meticulously searched for and, if present, the wound was subcutaneously removed with a one-centimeter healthy margin. A careful hemostasis was achieved. The sacral fascia was incised, and the neighboring skin flaps was pulled together. A 1/0 circle needle made of polypropylene (prolene) was used to suture the wound closed. About 2 centimeters in from the skin's edge and 2.5 centimeters apart, stitches were passed. At the point where the fat and fascia on the sacrum and coccyx meet, the stitches emerged from the wound. Then, grab a sliver of fascia roughly in the middle and gone through the other side wall, going from the fat to the skin. In this case, a suction drain (Radivac system) was installed. Vertical mattress sutures of Prolene 2/0 were used to join the skin's borders and the subcutaneous fat beneath them. The anchored dressing was then covered with more gauze and cotton wool and held in place with numerous strips of elastic strapping running transverse to the wound.

Patients in **Group B** received open technique: The sinus at natal cleft was excised with some healthy tissue down to sacral fascia. Pyodine-soaked gauze was used to pack the cavity and ensure hemostasis. After 48 hours, the pack was taken off and the patients were sent to the outpatient clinic for weekly checkups until the wound was completely healed. The wound infection in both groups was assessed after the 7 days of the procedure in both groups. Under the supervision of a consultant this entire evaluation was performed, and the obtained data from each patient was recorded on a designated proforma.

Pilonidal sinus was defined in patients presenting with pain (VAS≥5), and redness of the skin. Diagnosis was made on the basis of clinical evaluation as sinus having one or two openings in natal cleft at sacro-coccygeal area. **Wound infection** was defined in terms of all of the following clinical manifestations: Swelling, Redness, and pus/serous discharge at the wound site after the 7 days of the procedure until 30 days.

Data Analysis Procedure

The data analysis was performed by using SPSS 23 program. Mean ± SD or median IQR was described for numerical data such as age, height, weight, BMI, and duration of hospital stay. Frequencies and percentages were used to describe for gender, wound infection, diabetes, hypertension, education status, profession, socio economic status, and residence area. Wound infection was compared in both groups by using chi square test keeping p-value ≤ 0.05 considered as significant. Wound healing and infections were graded as per Southampton scoring system. Effect modifiers such as age, gender, BMI, diabetes, hypertension, education status, profession, socio economic status, and residence area was controlled through stratification. duration of hospital stay, surgery time, healing time, were documented comparing between the groups. Post stratification chi-square test was perfumed by keeping the p-value ≤ 0.05 as significant. Results of this study were illustrated in the form of tables/graphs.

Results

In this randomized trial, 76 participants (38 each group) were included after randomization; 38 underwent primary closure (PC) of wound and 38 underwent without closure of wound (Open Technique - OT). Table I, demonstrated demographic, clinical and perioperative features of participants which was comparable between the groups. The over all mean age was 33.37 ± 8.08 years; 58 (76.3%) participants were male and 18 (23.7%) were female. All

Arshad M, et al., Fortune J Health Sci 2026
DOI:10.26502/fjhs.453

the baseline features, demonstrated in table I, including age, gender, BMI, Education status of patients, occupation, socioeconomic status, residence, diabetes mellitus as comorbidity, hypertension, preoperative pain score NRS, and number of Sinus openings were comparable between the PC group and OT groups, with all have observed no statistically significant differences.

The primary outcomes of 30-days wound infections occurred in overall 18 (23.6%); PC group 5 (13.2%), 13 (34.2%) in OT group (Pearson χ^2=4.66, p=0.031) as shown in the figure 1 and table I. Southampton Grade II or higher was recorded in all clinically infected patients manifesting with swelling of wound, redness and pus or serous discharge from wound. More severe Southampton grades III-IV occurred in 3 (7.9%) after primary closure vs 10(26.3%) after open wound technique (p = 0.033). However, the full five-level Southampton distribution did not differ significantly between groups (permutation χ^2 p=0.088; Figure 3) as shown in Figure 2. Figure 3 and table II shows medians and IQR of the secondry outcomes; perioperative and recovery outcomes of the study, demonstrated distribution by both the groups. The mean operative duration was significantly longer (p < 0.001, CI: 4.39-9.86) in the PC group compared to OT group (43.26 ± 6.10 vs. 36.13 ± 5.88 minutes; mean difference 7.13). The post-operative Hospital stay was slightly shorter in PC group (2.13 ± 0.58 vs. 2.39 ± 0.72 days; mean difference -0.26, 95% CI: –0.56 to 0.034; p = 0.082) compared to OT group but did not reach statistical significance. Notably,

Table I: Baseline demographics

Variable	Category	Overall	Primary closure (n=38)	Open technique (n=38)	p-value
Age, years		33.37 ± 8.08	33.97 ± 7.00	32.76 ± 9.08	0.517
Sex	Male	58 (76.3%)	29 (76.3%)	29 (76.3%)	1
	Female	18 (23.7%)	9 (23.7%)	9 (23.7%)	
BMI, kg/m²		26.72 ± 2.99	26.91 ± 2.85	26.53 ± 3.15	0.59
Education	No Formal/primary	15 (19.7%)	4 (10.5%)	11 (28.9%)	0.197
	Secondry	23 (30.3%)	12 (31.6%)	11 (28.9%)	
	Graduate	19 (25.0%)	12 (31.6%)	7 (18.4%)	
	Postgraduate	19 (25.0%)	10 (26.3%)	9 (23.7%)	
Occupation	Student	28 (36.8%)	13 (34.2%)	15 (39.5%)	0.201
	Manual/Field Worker	15 (19.7%)	9 (23.7%)	6 (15.8%)	
	Office Worker	19 (25.0%)	12 (31.6%)	7 (18.4%)	
	Other/unemployed	14 (18.4%)	4 (10.5%)	10 (26.3%)	
Socioeconomic status	Low	23 (30.3%)	14 (36.8%)	9 (23.7%)	0.292
	Middle	46 (60.5%)	22 (57.9%)	24 (63.2%)	
	High	7 (9.2%)	2 (5.3%)	5 (13.2%)	
Residence	Urban	46 (60.5%)	23 (60.5%)	23 (60.5%)	1
	Rural	30 (39.5%)	15 (39.5%)	15 (39.5%)	
Diabetes mellitus	No	63 (82.9%)	31 (81.6%)	32 (84.2%)	0.761
	Yes	13 (17.1%)	7 (18.4%)	6 (15.8%)	
Hypertension	No	71 (93.4%)	35 (92.1%)	36 (94.7%)	1
	Yes	5 (6.6%)	3 (7.9%)	2 (5.3%)	
Preoperative pain score		7.29 ± 0.92	7.18 ± 0.93	7.39 ± 0.92	0.322
Number of sinus openings	1	56 (73.7%)	28 (73.7%)	28 (73.7%)	1
	2	20 (26.3%)	10 (26.3%)	10 (26.3%)	
Composite wound infections	No	58 (76.31%)	33 (86.8%)	25 (65.7%)	0.031
	Yes (when swelling, redness, and discharge are all present)	18 (23.6%)	5 (13.2%)	13 (34.2%)	

Citation: Muhammad Arshad, Unsia Fatima, Wagma Hidayat, Aqib Ali Khan, Gohar ali, Muhammad Sanaan Fida, Salahuddin Khan. Comparison of Wound Infection in Patients Undergoing Primary Closure and Open Technique in The Treatment of Pilonidal Sinus. Fortune Journal of Health Sciences. 9 (2026): 600-606.

Arshad M, et al., Fortune J Health Sci 2026
DOI:10.26502/fjhs.453

the complete wound-healing time was markedly reduced in the primary closure group (19.95 ± 4.05 vs. 44.42 ± 10.01 days; mean difference –24.47, 95% CI: –27.99 to –20.95; p < 0.001). Thus, these results show that primary closure was associated with 61.5% reduction in infection risk (RR 0.38, 95% CI: 0.15-0.97) and absolute risk reduction of 21.1% points (95% CI: 2.5-39.6) with corresponding odd ratios was 0.29 (95% CI: 0.09-0.92). One wound infection for every five patients managed with primary closure instead of open technique, would be prevented provided the observed effect is reproducible. Primary closure reduced 30 days wound infections significantly and shortened the complete wound healing by 24.5 days.

Table II: Peri-operative and Recovery Outcomes

Outcomes Variables	Primary closure (n=38)	Open technique (n=38)	Mean difference	95% CI	p-value
Operation duration, min	43.26 ± 6.10	36.13 ± 5.88	7.13	4.39-9.86	<0.001
Postoperative hospital stays, days	2.13 ± 0.58	2.39 ± 0.72	-0.26	-0.594	0.082
Complete wound-healing time, days	19.95 ± 4.05	44.42 ± 10.01	-24.47	-27.99 to -20.95	<0.001

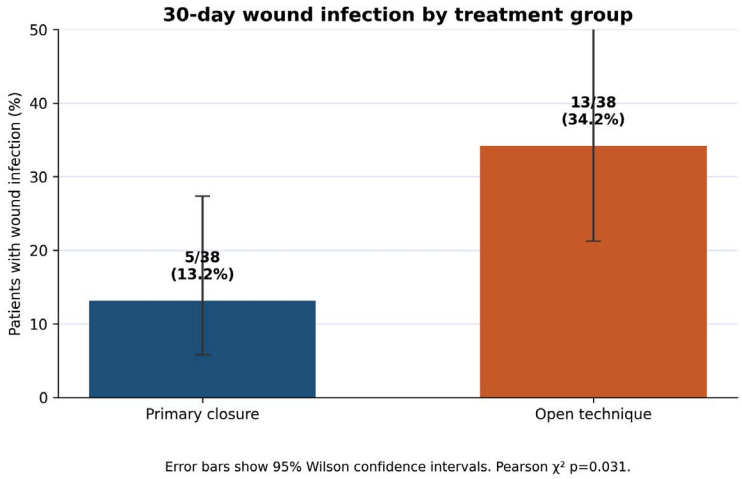


Figure 1: Thirty-day wound infection according to treatment group. Bars show observed percentages and error bars show 95% Wilson confidence intervals. Infection occurred in 5/38 (13.2%) patients after primary closure and 13/38 (34.2%) after the open technique (Pearson χ^2 p=0.031).

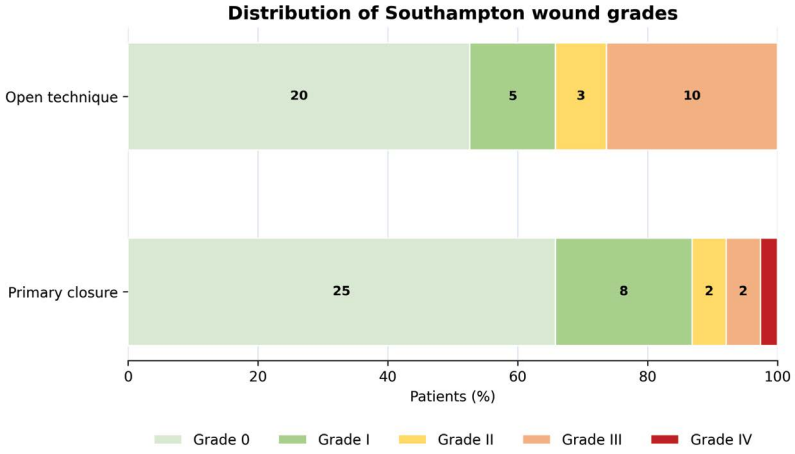


Figure 2: Southampton wound-grade distribution by treatment group. Numbers within segments are patient counts. The overall five-level distribution was compared using a permutation chi-square test (p=0.088). Grade III–IV findings occurred in 3/38 (7.9%) and 10/38 (26.3%) patients, respectively (p=0.033).

Citation: Muhammad Arshad, Unsia Fatima, Wagma Hidayat, Aqib Ali Khan, Gohar ali, Muhammad Sanaan Fida, Salahuddin Khan. Comparison of Wound Infection in Patients Undergoing Primary Closure and Open Technique in The Treatment of Pilonidal Sinus. Fortune Journal of Health Sciences. 9 (2026): 600-606.

Arshad M, et al., Fortune J Health Sci 2026
DOI:10.26502/fjhs.453

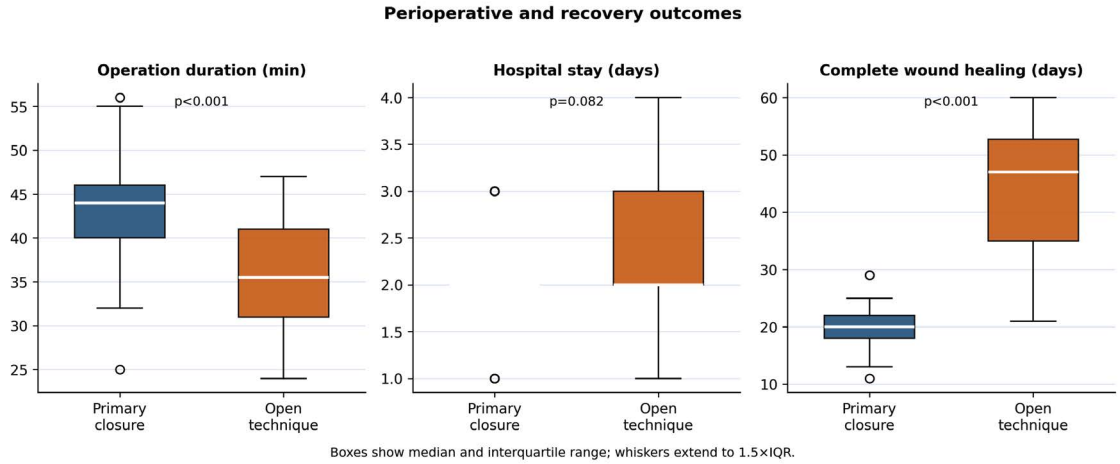


Figure 3: Distribution of operation duration, postoperative hospital stays, and time to complete wound healing by treatment group. Boxes show medians and interquartile ranges; whiskers extend to 1.5 times the interquartile range. Group comparisons used independent-samples t tests or Welch's t test, as appropriate.

The main enigma that still exist in the modern world that whether to use open method or closed method to treat pilonidal sinus disease and to heal the sinus as early as possible while avoiding the risk of recurrence or infections. [1,2,4] In this study the outcomes of both primary closure group and open technique were evaluated for 76 participants who underwent pilonidal sinus excision surgery. In this study we observed some advantages of the Open method of surgery to have lower surgical time but increased rate of wound infections and delay wound healing time. Similarly, Southampton score was higher in open technique. These findings are similar in literature reported by Ekici et al. and Jabbar et al. [3,9] However, wound infections rate was reported less by Shah et al. in open method compare to primary closure, which is inconsistent with our findings. [11] Primary closure was observed to have lower rate of infection in our study may be due to strict adherence to guidelines of operative and postoperative care of the wound. This requires further trials studies to evaluate the wound infections in both the groups. These findings are similarly reported by Wajid et al. that primary closure had observed to have lower wound infections compare to secondry closure. [12] In-contrast, Shah et al. and Gojayev et al. reported higher infections rate in primary closure of pilonidal sinus wound. [11,13] Thus, these differences in closure methods, wound care protocols, case mix and statistical power may explain this discordant finding in literature. Contemporary evidences suggest that question is not simply "closed vs open" wound technique but recent studies by Wiinblad et al. and Shah et al. reported longer healing time with secondry than primary closure. [11,14] While, the current findings for short-term infection and healing should be interpreted within a broader hierarchy of surgical options. These findings are similar to our study; reported by Jazi et al. and Vejdan et al. that primary closure has fast wound healing compare to secondry intentions.[16,17] The Southampton results support the direction of the primary analysis. All protocol-defined infections were Grade II or higher, and Grade III–IV complications were less frequent following primary closure in this study. [15]

This study randomized allocation, equal group sizes, complete follow-up and prespecified definitions of infections, use of Southampton score strengthen it. However, several limitations require emphasis like small sample size and single center study prevents the data generalizability. treating surgeons and outcome assessors were not blinded, creating a risk of performance and detection bias for clinically judged wound signs. Additionally, the 30-day follow-up was insufficient to evaluate recurrence, delayed wound healing, return to work or quality of life. Thus, we recommend appropriately selected patients with pilonidal sinus, primary closure may provide a useful short-term advantage by reducing wound infections and burden of an open wound. This conclusion should not be extended to long-term superiority unless; emphasizing future multicenter trials for variant flap techniques, standardize postoperative wound care and patient-reported outcomes over at least 12 months including recurrence of disease.

Conclusion

Primary closure was associated with lower 30-day wound-infection rate and markedly faster complete wound healing than the open technique, although it required a slightly longer operative time. Longer follow-up is needed before recommending either approach for overall patient benefits.

Data Availability Statement

The data collected and analyzed in the present study are not publicly available as they contain information at the level of the participants and are subject to institutional confidentiality requirements. The data will be made available from the corresponding author upon reasonable request with appropriate ethical and institutional approvals.

Citation: Muhammad Arshad, Unsia Fatima, Wagma Hidayat, Aqib Ali Khan, Gohar ali, Muhammad Sanaan Fida, Salahuddin Khan. Comparison of Wound Infection in Patients Undergoing Primary Closure and Open Technique in The Treatment of Pilonidal Sinus. Fortune Journal of Health Sciences. 9 (2026): 600-606.

Generative AI Disclosure

I, the corresponding author, on behalf of all the authors, declare that no generative artificial intelligence (AI) tools were used in the preparation of this manuscript in any of the following ways: conception, drafting, writing, editing, data analysis, statistical analysis, interpretation of results, preparation of tables or figures, or in any other way. All content has been prepared by the authors and is accurate, complete and original.

Conflict of Interest

The authors declare that they have no financial or non-financial conflicts of interest or relationships that could have influenced the conduct, analysis, interpretation, or reporting of this study within the 36 months prior to submission.

Ethical Committee approval

The enrolled participants were started following institutional ethical committee approval (for studies involving human subjects or animals) with launched IREB # RMI/RMI-REC/Approval/189.

Clinical Trial registration: The study was conducted according to the principles of Declaration of Helsinki which was registered with ClinicalTrial.gov (NCT07798752).

Authors contribution statement

All authors meet the authorship criteria established by the International Committee of Medical Journal Editors (ICMJE) and have made substantial contributions to the work. All authors have reviewed and approved the final manuscript and agree to be accountable for all aspects of the work.

References

1. Iesalnieks I, Ommer A. The Management of Pilonidal Sinus. Dtsch Arztebl Int 116 (2019): 12–21.
2. Kober MM, Alapati U, Khachemoune A. Treatment options for pilonidal sinus. Cutis 102 (2018): E23–9.
3. Jabbar MS, Bhutta MM, Puri N. Comparison between primary closure with Limberg Flap versus open procedure in treatment of pilonidal sinus, in terms of frequency of post-operative wound infection. Pak J Med Sci 34 (2018): 49–53.
4. Maione F, D'Amore A, Milone M, et al. Endoscopic approach to complex or recurrent pilonidal sinus: A retrospective analysis. Int Wound J 20 (2023): 1212–8.
5. Meinero P, La Torre M, Lisi G, et al. Endoscopic pilonidal sinus treatment (EPSiT) in recurrent pilonidal disease: a prospective international multicenter study. Int J Colorectal Dis 34 (2019): 741–6.
6. Harries RL, Alqallaf A, Torkington J, et al. Management of sacrococcygeal pilonidal sinus disease. Int Wound J 16 (2019): 370–8.
7. Segre D, Pozzo M, Perinotti R, et al. Italian Society of Colorectal Surgery. The treatment of pilonidal disease: guidelines of the Italian Society of Colorectal Surgery (SICCR). Tech Coloproctol 19 (2015): 607–13.
8. Sahsamanis G, Samaras S, Mitsopoulos G, et al. Semi-closed surgical technique for treatment of pilonidal sinus disease. Ann Med Surg (Lond) 15 (2017): 47–51.
9. Ekici U, Kanlıöz M, Ferhatoğlu MF, et al. A comparative analysis of four different surgical methods for treatment of sacrococcygeal pilonidal sinus. Asian J Surg 42 (2019): 907–13.
10. Oetzmann von Sochaczewski C, Hackmann T, Heitmann H, et al. Pilonidal Sinus Recurrence Rates in Young Adults—Similar to Children or Adults? Surgeries 6 (2025): 60.
11. Shah SMI, Bakhsh I, Khan RMA, et al. PILONIDAL SINUS: A COMPARATIVE STUDY OF OPEN VERSUS CLOSED METHODS OF SURGICAL APPROACH. J Popl Ther Clin Pharmacol 32 (2025): 544–9.
12. WAJID, Khan H, Jabeen S, et al. COMPARISON PRIMARY CLOSURE AND OPEN TECHNIQUE IN THE TREATMENT OF PILONIDAL SINUS SURGERY IN MTI-LADY READING HOSPITAL PESHAWAR. Pakistan Journal of Intensive Care Medicine 4 (2024): 38–38.
13. Gojayev A, Erkent M, Aydin HO, et al. Comparative Outcomes of Surgical Techniques for Pilonidal Sinus: A Turkish Retrospective Study. Med Sci Monit 31 (2025).
14. Wiinblad IMM, Ulrichsen J, Brandstrup B. Outcome After Surgical Treatment for Chronic Pilonidal Sinus Disease: A Systematic Review of Common Surgical Techniques. Dis Colon Rectum 68 (2025): 515–29.
15. Ali G, Ali J, Ullah F, et al. Frequency of Port Site Infection in Laparoscopic Cholecystectomy, Evaluation by Southampton Score: A Prospective Study. J Med Res Surg 6 (2025): 9–14.
16. Jazi K, Larijani A, Rahimi M, et al. Future of pilonidal cyst surgery: a comparative review of traditional and laser techniques. BMC Surgery 25 (2025): 486.
17. Vejdan SA, Danesh HA, Amirian F, et al. Evaluation of the efficacy of the Z-plasty surgical technique vs. secondary wound healing mechanism in the treatment of the pilonidal sinus: a clinical trial. Ann Med Surg (Lond) 86 (2024): 2715–22.