

Primary Closure vs Limberg Flap for Pilonidal Sinus-Meta-Analysis and Systematic Review

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Abstract: **Background:** Pilonidal sinus is characterized by chronic inflammation and recurrent infections in the sacrococcygeal region. Pilonidal sinus primarily affects young males and has an incidence rate of 26 per 100,000 people, according to reports. Obesity, poor personal hygiene, and unhealthy habits like prolonged sitting are its risk factors. It has a significant risk of recurrence and a lot of consequences like persistent non healing wounds, infection and possibly sinus tract squamous cell carcinoma [1]. **Methods:** Systemic review and meta-analysis were performed according to PRISMA guidelines. Forest plots were generated and treatment effects calculated from each study. **Results:** Limberg Flap is associated with lesser infection than primary closure with the pooled risk ratio of 0.3. Limberg Flap is reported as the lesser occurrence for wound dehiscence than primary closure with the pooled risk ratio of 0.1. Limberg Flap is associated with fewer days of hospital stay in all of the seven studies with pooled MD of 7 days. Return to normal activities was significantly shorter for Limberg Flap compared with primary closure with the pooled MD of 21 days. **Conclusion:** The study concluded Limberg Flap is better than primary closure.

Keywords: pilonidal sinus, young males, Limberg Flap, risk factors, treatment outcomes

1. Introduction

Sacrococcygeal pilonidal sinus is an acquired disease most commonly affecting young adults. Pilonidal sinus is characterized by weak hair buildup within and often comprises one or more apertures connected by a fibrous track that is coated with granulation tissue. It can be acquired and brought on by deep natal clefts, excessive hairiness, inadequate hygiene, or local trauma. This benign condition is more likely to affect males who are young, overweight, hirsute [2].

Patients may experience severe bleeding, drainage and pain. Recurrence and chronicity are frequent. The intensity of the disease process varies; it might cause fistulation distant from the midline and several tracts in addition to small, asymptomatic pits. The illness has a high rate of patient discomfort and surgical morbidity. Karydakos proposed that hair, force and vulnerability such as obesity and family history interact to cause disease. According to certain studies, a congenital pilonidal dimple may be the cause of pilonidal sinus. Perspiration, maceration, bacterial contamination and hair penetration all thrive in a deep birth cleft. Therefore, these contributing elements need to be removed in order to cure and prevent [2].

While there are a number of well-defined conservative and surgical techniques for treating Pilonidal sinus, the recurrence rate is still quite high. A good recovery may result from the excision of the pilonidal sinus or sinuses completely and from suitable restoration.

The surgical treatment is the cornerstone for this disease and various procedures like excision and packing and leaving it for secondary granulation and healing, excision and primary closure, marsupialization and flap techniques have been suggested for the treatment [3].

Excision along with either primary closure or secondary healing of the wound has been the standard definitive care for decades; the original inspiration for these techniques came primarily from military hospital experience with Jeep riders' sickness. There is still no agreement on the best surgical strategy for treating Pilonidal Sinus, despite the literature reporting a plethora of procedures ranging from intricate advanced off-midline flap mobilisations to abscess drainage [4].

The most crucial element in wound healing is midline modification and the placement of the incision scar within the cleft; however, a recent Cochrane research suggested that off-midline closure approaches brought to be the go-to treatment for Pilonidal Sinus disease because it excises the underlying disease, provides healthy tissue coverage of the cavity without tension, and is linked to low recurrence (by flattening and lateralizing the gluteal cleft, respectively) and complication rates. The Limberg Flap technique has become more and more popular among these flap techniques, winning the trust of many surgeons.

Surgery is still the cornerstone of care and is designed to be a straightforward operation with low rates of recurrence, minimal post-operative pain, minimal wound care, quick wound healing, shorter hospital stays, and an early return to normal activities [5].

Although many surgical approaches have been established, no single strategy has been identified as the best course of treatment. These techniques range from wide local excision to intricate rotating flap surgeries. Research on the results of pilonidal sinus surgery revealed a 38.4% wound infection incidence following an open technique, whereas another study found a 7% wound complication rate following a Limberg Flap procedure^[4].

2. Methods

This protocol is developed according to the Preferred Reporting Items for Systematic Reviews and Meta-analysis (PRISMA) guidelines. Forest plots were generated and treatment effects calculated from each study. Heterogeneity was calculated using Cochran q statistics and quantified with I_2 . The patient, intervention, comparator and outcome (PICO) method is used for assessing and selecting appropriate studies.

Search Strategy

The following English databases were searched systematically: PubMed, Embase, Web of Science and Cochrane Library for clinical trials published from 2015, to 2024 using the following terms: (“pilonidal” OR “pilonidal disease” OR “pilonidal sinus” OR “pilonidal cyst” OR “sacroccygeal disease” OR “Surgical Wound Infection” OR “Postoperative Complications”) AND “randomized clinical trial” AND “Length of hospital stay”. We also personally checked reference lists of earlier systematic reviews and meta-analyses of pilonidal sinus research to prevent the possible omission of papers. All of the titles and abstracts were screened out independently by the two authors.

Study Selection

Studies that met the following requirements were accepted for inclusion:

- 1) Peer-reviewed case-control studies, cohort studies, or randomized controlled trials (RCTs) published in the English language.
- 2) Compared between primary closure with Limberg Flap versus open procedure in treatment of pilonidal sinus.
- 3) Reported the outcomes of interest.

Studies were excluded if they are unpublished data such as conference abstracts and preprints and with data reported in a univariate rather than multivariate analysis.

Data Extraction and Quality Assessment

Two reviewers worked independently on this process, following the rules of the Cochrane Collaboration for Systematic Reviews and utilizing a common collecting form. The senior researchers were consulted in all conflicts. First author, publication year, area, median age, number of participants, treatments, length of follow-up, results, male proportion, gender ratio (male/female) and main or recurrent pilonidal sinus disease were among the details retrieved from each study. In accordance with the Cochrane Collaboration for Systematic Reviews criteria, all of the missing data were computed. Each study's methodological quality was assessed using the following criteria: creation of random sequences, concealment of allocation sequences, blinding of personnel and participants, blinding of outcome assessments,

incomplete outcome data, selective reporting and other biases.

Statistical Analysis

The distribution of putative impact modifiers (geographical factor, publication year, sample size, average follow-up time, mean age, and % male) among studies was compared in order to assess the transitivity assumption first. Additionally, these modifiers were chosen for additional meta-regression analysis. Second, the direct comparisons were examined using pair-wise meta-analysis. The I_2 statistic was used by the authors to assess study heterogeneity. For comparisons with negligible heterogeneity ($I_2 < 50\%$), a fixed-effect model was used. With the exception of comparisons involving just two studies, the random-effect model and influence diagnosis were used to determine the source of heterogeneity.

After determining which one contributed the most significantly to heterogeneity, the authors eliminated it and computed the adjusted results. The study investigated publication bias using contour-enhanced funnel plots. The outcomes were then presented with matching 95% confidence intervals (CIs) as the mean difference (MD) for continuous outcomes and risk ratio (RR) for dichotomous outcomes^[1].

Risk of Bias

The Cochrane risk of bias tool was utilized by two impartial reviewers to assess studies for possible bias. The seven areas that make up this instrument are: incomplete result data, biased reporting, participant and staff blinding, allocation sequence concealment, random sequence creation and other biases.

Outcome

This study compares the frequency of post-operative wound infection between an open surgery and primary closure with a Limberg Flap for the treatment of pilonidal sinus. Studying post-operative problems including infection and wound dehiscence is the main goal. Studying the length of hospital stay and the time required to resume regular activities or employment is the secondary outcome.

3. Results

114 RCTs from PubMed, Embase and Medline were identified. Out of 134 studies, 64 duplications were found. 38 studies were excluded in the further screening process which leaves us with 12 studies to proceed further.

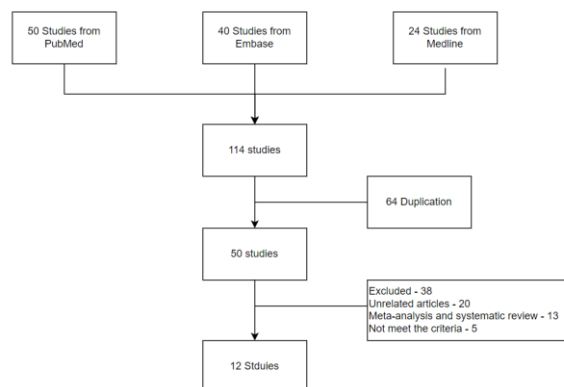


Figure 1: Studies selection flow

The characteristics of the eligible studies are presented in table 1. Sample size of most of the studies ranges from 60 – 120 and mean age ranges between 30 and 35.

Table 1: General characteristics of eligible studies

Source	Sample Size	Mean Age	Country
Parwez Sajad Khan (2019) ^[6]	120	34	India
Devaprashanth M (2021) ^[1]	60	32	India
Muhammad Sohail Jabbar (2018) ^[7]	60	33	India
Nida Khan (2021) ^[8]	30	32	India
Ahmet Serdar Karaca (2015) ^[9]	120	34	UK
Mümin Demir (2022) ^[10]	94	31	US
A. Tavassoli (2016) ^[11]	100	32	US
WalidGalalElshazly (2015) ^[5]	120	30	UK
MArnous (2018) ^[12]	60	31	UK
Sawsan Soliman Mohamed (2020) ^[13]	60	35	Africa
Aamna Nazir (2022) ^[14]	60	30	Africa
Omar Abdelraheem (2017) ^[4]	60	32	Africa

Infection

In most of the studies, Limberg Flap is associated with lesser infection rate than primary closure with the pooled risk ratio of 0.7 where the risk ratio for primary closure is 1.2.

Wound Dehiscence

Wound dehiscence has reported only in 8 studies out of 12 studies. Limberg Flap had lesser wound dehiscence than primary closure with the pooled risk ratio of 0.6.

Duration of Hospital Stay

Only 7 studies have reported the duration of hospital stay. Limberg Flap is associated with lesser days of hospital stay in all the seven studies with pooled MD of 7 days.

Duration of Return to Routine Work

Only 5 studies have reported the duration of return to routine work. Return to normal activities was significantly shorter for Limberg Flap compared with primary closure with the pooled MD of 21 days.

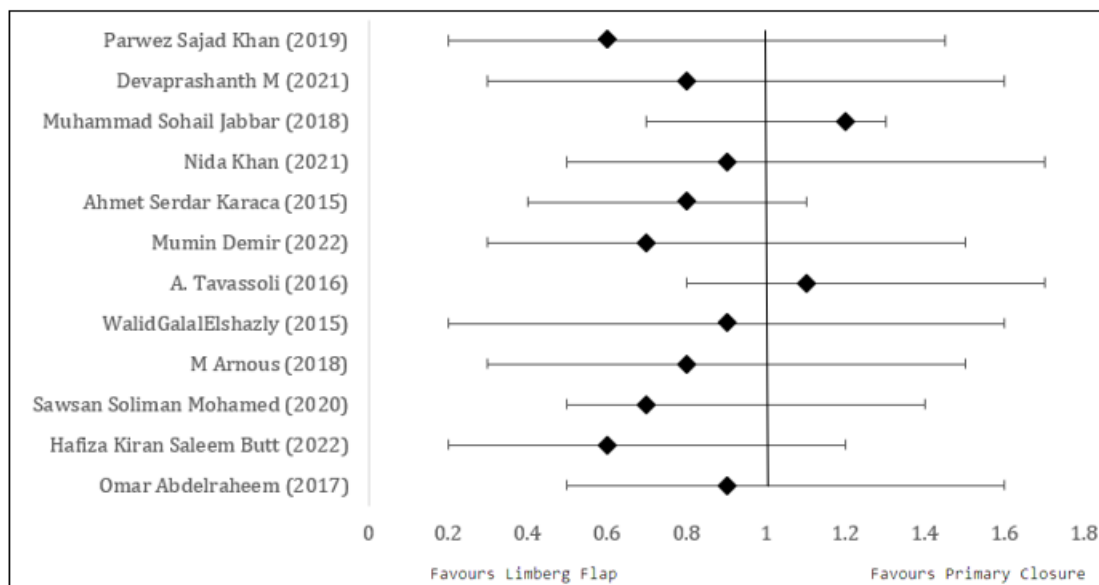


Figure 1: Forest plot of meta-analysis for infection between Limberg Flap and Primary Closure

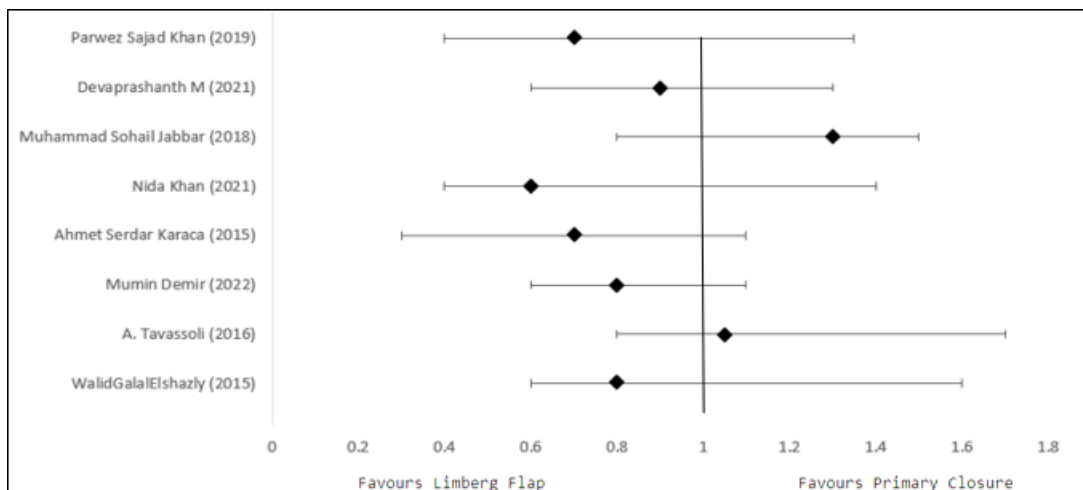


Figure 2: Forest plot of meta-analysis for wound dehiscence between Limberg Flap and Primary Closure

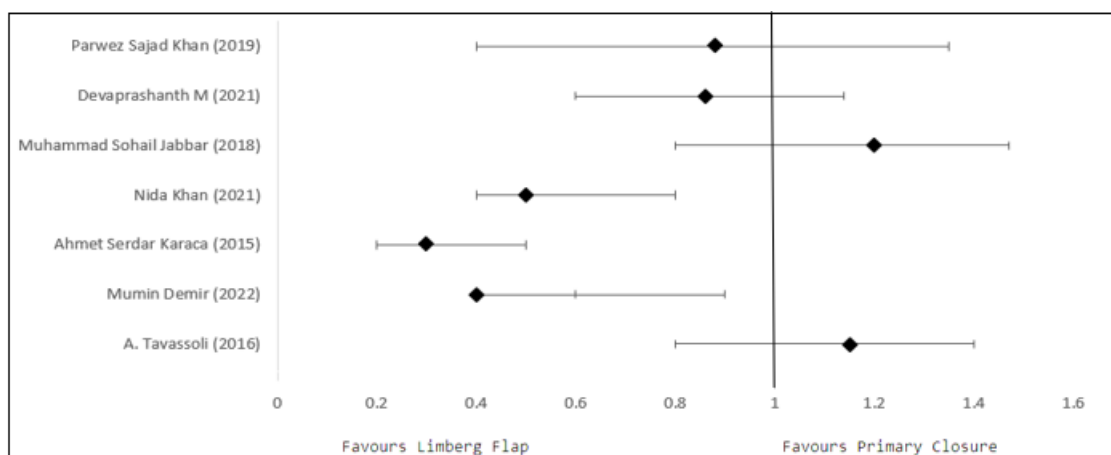


Figure 3: Forest plot of meta-analysis for duration of hospital stay between Limberg Flap and Primary Closure

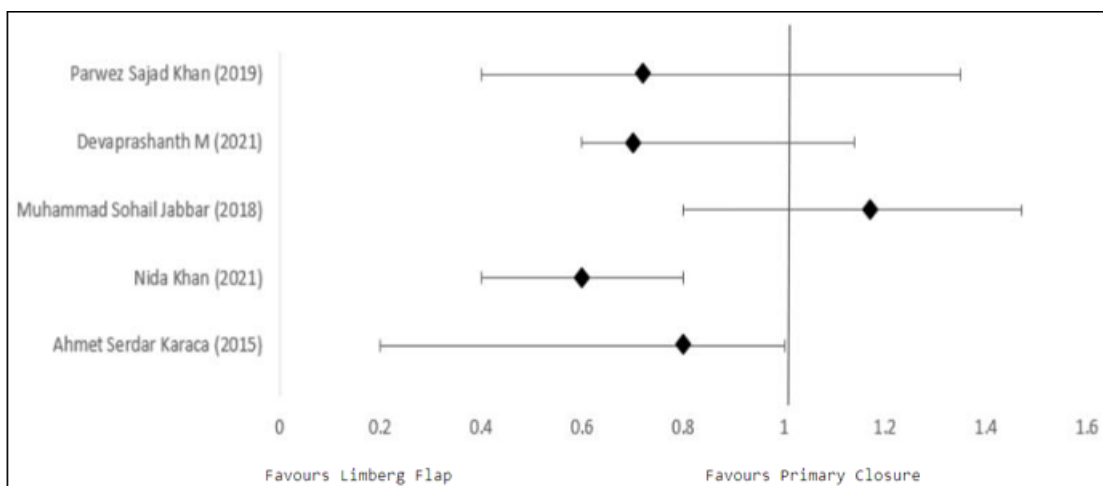


Figure 4: Forest plot of meta-analysis for duration for return to routine work

4. Discussion

A widespread, debilitating illness that often affects young people in the workforce and in school, sacrococcygeal pilonidal disease causes significant morbidity and lost workdays. A range of clinical manifestations, from painless draining lesions to asymptomatic pits, are indicative of the pilonidal sinus [12].

Many evidence support that pilonidal sinus is an acquired disease, but the exact mechanisms of development are speculative. The age of incidence of pilonidal sinus are highly variable. Although it is stated that 82% occur between the ages of 20 and 29.

It is stated that the combination of buttock friction and shearing forces in that area allows hair to shed or broken hairs may collect there and get lodged in the skin by the suction created by the movement, which later gets infected and leads to sinus formation. From this primary sinus, secondary tracks

may spread laterally, which emerge at the skin as granulation tissue lined discharging openings.

Pilonidal sinus can be successfully treated surgically by removing the sinus and surrounding hair nests completely. As a result, a wide range of surgical methods, from straightforward curettes to complex flap procedures, have been documented. Various surgical procedures for pilonidal sinus includes z plasty, Limberg Flap, karydakis procedure and Boscom procedure, but this study compares between primary closure versus Limberg flap, as Limberg Flap is the most commonly used procedure.

The best way to end the condition would be to remove the natal cleft, which would remove the anatomical risk of the sinus recurring. After broad excisions, skin flaps have been used to cover the sacral defects. The rhomboid flap technique creates a flap to obliterate the deep birth cleft and aid in primary closure. The rhomboid flap operation was originally recommended as a first line of treatment for chronic sacrococcygeal pilonidal sinuses, but it was also approved for complex and recurrent instances^[14].

Limberg flap is superior to primary closure, according to the data, in terms of infection and other problems. According to the relevant studies, Limberg Flap wound dehiscence and infection rates are lower than those of primary closure. In addition, Limberg Flap has shorter hospital stays and a quicker timetable for returning to regular job than primary closure.

However, a smaller number of trials found no discernible difference in the surgical outcome between the use of drains and those that did not^[8].

Additionally, our patients' early postoperative surgical results demonstrated that, when compared to the other group, the flap group series had a lower reported incidence of wound infection, wound dehiscence, and subcutaneous hematoma formation. Similar stated outcomes were observed by numerous another recent research^[4].

After rhomboid flap surgery, vacuum drains were employed in many trials to eliminate dead space and avoid problems like hemorrhage, seroma and recurrence. However, a smaller number of trials found no discernible difference in the surgical outcome between the use of drains and those that did not.

Following surgical care of pilonidal sinus illness, partial resection, high flap tension, persistent inflammation, trauma and the makeup of the skin and body hairs are the main causes of recurrence. The deep intergluteal sulcus and midline incision may be the main causes of the unsatisfactory outcomes^[4].

The apices of the symmetrical rhomboid Limberg flap are located on the midline. The procedure involves excising the afflicted area in a rhomboid form all the way down to the sacral fascia and creating a fasciocutaneous flap that may be transferred to cover the defect tension-free. The rhombus flap was created by Leningrad University professor Limberg. He gave an example of a parallelogram with two 120-degree

angles and two 60-degree angles. The parallelogram's sides are all the same size. The flap's base is next to the flaw, and it is closed straight. The development of new vascular channels between the flap and the recipient wound bed, as well as the blood supply at the flap's base, are essential for flap survival. Neovascularization usually happens three to seven days following flap transfer; in the interim, the flap is supplied by the imbibition of nutrients from the wound bed and perfusion pressure from the flap's base. To maximize scar hiding and decrease tension during closure, properly assessing the relaxed skin tension line and maintaining an adequate flap laxity are crucial. Studies have shown that for recurrent occurrences and significant involvement, rhomboid excision with Limberg flap is preferred^[8].



5. Conclusion

Sacrococcygeal pilonidal sinus is a condition which is associated with higher recurrence rates despite effective surgical treatments and associated with chronic bothersome discomfort even after discharge from the hospital. Following Limberg's reconstruction these bothersome discomfort and patients agonys had been reduced.

Limberg Flap is better than primary closure in terms of postoperative complication, duration of hospital stays, recurrence and duration of return to routine works.

Conflict of Interest

None

Source of Funding

None

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