Original Article

Outcomes of Karydakis Flap Procedure for Primary Pilonidal Sinus Disease at a Teaching Hospital in Pakistan: A Prospective Study of a Single-Arm Surgical Intervention

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Abstract

Background: Pilonidal sinus disease (PSD) of natal cleft is a long-term illness characterized by a blind epithelial tract containing hair, commonly affecting young males with excessive body hair. Various surgical techniques have been developed to treat PSD, yet no universally accepted standard exists.

Objective: To evaluate the clinical outcomes of the Karydakis flap procedure in patients who were diagnosed with primary natal cleft pilonidal sinus disease.

Methodology: This research was carried out at a teaching hospital in Lahore, Pakistan in which 100 patients suffering from primary sacrococcygeal pilonidal sinus disease underwent Karydakis flap procedure. Patient data, including procedure duration, hospital stay, postoperative pain levels, wound infection rates, seroma formation, flap necrosis, and recurrence, were systematically recorded and analysed using SPSS version 21.0.

Results: The results demonstrated favourable outcomes, with an 86% primary healing rate. The average procedure time was 47.50 ± 5.14 minutes, and the average length for hospitalization was 1.87 ± 0.80 days. Postoperative pain was measured by using the Visual Analog Scale (VAS), which had a mean score of 3.45. Surgical site infections were observed in 8% of cases, while 6% experienced seroma formation. No case of flap necrosis was reported, and disease recurrence occurred in only 2% of patients within six months.

Conclusion: Karydakis flap procedure is a reliable and effective surgical approach for treating primary pilonidal sinus disease of the natal cleft. Its design supports faster recovery, minimal postoperative issues, and reduced recurrence, making it a preferred option in clinical practice.

Keywords: Pilonidal Sinus , Karydakis , Surgical Flaps, Complications, Recurrence

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Introduction

Pilonidal sinus disease of the natal cleft is a closed epithelial passage that typically harbours hair and is often present a few inches above the external anal opening, in the natal cleft skin.[1,2] Its highest prevalence is usually found among the young males who have excessive body hair, though it can affect individuals across a wider age range.[1] The condition may present as

an abscess or a draining sinus, often discharging pus or blood.[1,2] Pilonidal sinus disease is more commonly found in men as compared to the women.[3] Karydakis identified three primary factors contributing to its development: an excessive amount of loose hair at the nape of neck and the back, extreme pressure that forces these hair into the skin, and increased susceptibility to infection due to a deep natal cleft.[4] The depth of the natal cleft makes an ideal environment for hair penetration, leading to bacterial contamination.[4] Other significant risk factors include chronic itching, a sedentary lifestyle, genetic predisposition, inadequate hygiene, and excessive body hair. Loose hair can become embedded within the skin of the natal cleft, rolling up to form a nest-like structure that eventually triggers pain and infection.[1,2,5]

The treatment approach for primary natal cleft pilonidal sinus disease varies widely, it could range from wide excision with secondary intention healing to excision followed by some form of flap reconstruction. However, a universally accepted standard surgical method is yet to be established. Most surgical procedures are associated with common complications, including wound infections, seroma formation, and a high recurrence rate. Flap reconstruction techniques aim to address the root cause of pilonidal sinus disease by flattening the intergluteal region.[6,7]

The Karydakis procedure is a reconstructive technique that relies on the superior gluteal and sacral perforators for reinnervation.[5] Research indicates that this flap rotation technique yields better outcomes compared to alternatives like the Limberg and Bascom procedures. It has been linked to a shorter hospital stay, faster recovery, reduced pain levels, higher patient satisfaction, and a significantly lower incidence of wound infections, seroma formation, and recurrence.[8]

The varying perspectives in the medical literature have led to an ongoing debate about the effectiveness of various flap reconstruction methods to treat the sacrococcygeal pilonidal sinus disease. This research aimed to evaluate the results of the Karydakis flap procedure at a teaching hospital in Pakistan. The results of this study will provide important insights to help surgeons to select the optimal surgical technique for treating patients suffering from primary sacrococcygeal pilonidal sinus disease. This study specifically examined variables including the duration of hospitalization, postoperative pain intensity, initial healing success, incidence of surgical wound infections, flap necrosis, development of seroma, and rate of the relapse.

Methodology

This was a prospective study of a single-arm surgical intervention spanning a duration of three years (from January 2022 till December 2024) at Ghurki Trust Teaching Hospital, Lahore, Pakistan.

Ethical Approval: The study was approved by the Ethical Review Board of Lahore Medical and Dental College, Lahore Pakistan via reference number LMDC/13110-12 Dated: 20/12/2021. Informed written consent was obtained and confidentiality was maintained. The first patient was admitted on January 10, 2022, while the last patient was admitted on December 20, 2023. On December 20, 2024, the last follow-up visit for the last participant was conducted. A total of 100 consecutive patients visiting the outpatient department were included in this research through non-probability convenient sampling. Sample size was calculated to detect clinically significant difference of 5 % with 95% confidence and 80% power (https://doi.org/10.1002-/wjs.12492).[9] Each eligible patient was thoroughly counselled about the research, and only those who provided informed consent proceeded with the Karydakis procedure.

Inclusion criteria:

Individuals with the age ranging from 18 years to 60 years and were suffering from primary sacrococcygeal pilonidal sinus disease, no indications for infection or abscess formation were included in this research.

Exclusion criteria:

Individuals with recurrent pilonidal sinus disease, uncontrolled diabetes, non-managed hypertension, renal failure, or immunosuppressive conditions were not the part of this research. Patients deemed unfit for general anesthesia due to pre-existing health

conditions, as indicated by the anaesthesia team, were also not the part of this research.

Statistical Analysis:

Patient data was systematically documented using a structured proforma. A single surgical resident gathered comprehensive medical histories from all participants, while a single consultant surgeon conducted their clinical examinations. Necessary laboratory tests, as required by the anesthesia team for administering general anesthesia, were completed for each patient. All patients gave their informed consent before the surgery.

A single consultant surgeon performed all the surgeries. The surgeon who performed the surgeries was specifically trained in performing this technique. To ensure consistency and minimize bias, the same surgeon was responsible for both pre-operative assessments and post-operative evaluations. Before surgery, hair in the sacrococcygeal area were trimmed on the operating table. All patients received intravenous antibiotics, including 1.2 grams of Amoxicillin with Clavulanic acid and 400 mg of Metronidazole, at the time of induction of anesthesia. The procedures were conducted under general anesthesia, with patients positioned in the prone, jack-knife position. The flap was delineated using a sterile skin marker, after which an elliptical excision was made symmetrically which was positioned at 2 cm to the side of the midline of natal cleft (Figure. I). The excision was made on the side on which most of the tissues were effected or on the secondary sinus openings of the natal cleft skin (Figure. I). All diseased tissue associated with pilonidal sinus disease, along with a portion of healthy normal tissue, was excised to move the final wound closing to the lateral side (away from the midline). A skin flap measuring 2-cm width and 1-cm in thickness was moved from the opposite side of the body to cover the surgically removed area and reconstruct the natal cleft, ensuring the midline was covered with normal healthy skin (Figure. II). To facilitate drainage, the placement of suction drain was carried out in the subcutaneously for all the cases. Intravenous antibiotics were administered for 48 hours postoperatively, followed by a five-day course of oral antibiotics.

Figure-I: *(Pre-operative)*

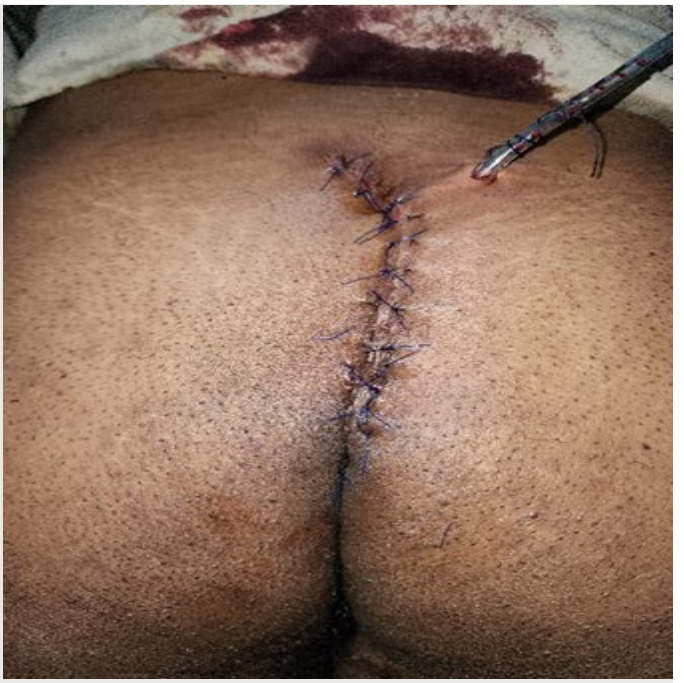

Figure-II: *(Post-operative)*

The duration of surgery was measured in minutes for each patient and the duration for hospitalization was documented hourly. The data of all patients was systematically recorded using a proforma, including all necessary details such as duration of the surgery (in minutes), time for hospitalization (in days), postoperative pain assessment using the Visual Analog Scale (VAS) at 24 hours, as well as

occurrences of flap necrosis, surgical site infections, and seroma development. Patients attended follow-up appointments in the outpatient department on the 7th and 14th postoperative days. Wound infections were evaluated by evaluating clinical signs including redness, erythema, and purulent discharge from the surgical site. Six months after surgery, a third follow-up evaluation was conducted to detect recurrence, which was identified by the recurrently occurring sinus in the natal cleft and by the signs of purulent or discharge of blood during examination. The final follow-up took place at the one-year mark, evaluating recurrence based on the same criteria used at the six-month review. Patients who failed to attend their scheduled follow-ups were contacted and reminded to visit the clinic to document any complications or recurrences.

The version 21.0 of SPSS software was used to carry out the statistical analysis. Numerical variables such as patient age, disease duration, surgical time, and hospital stay length were expressed as mean ± standard deviation (SD). Meanwhile, demographic variables, which included gender, seroma development and the incidences of wound infection were represented as frequencies and percentages.

Table I: *Demographic information of the study participants*

Number of patients	n = 100
Males Frequency (%)	67 (67)
Females Frequency (%)	33(33)
Age of the participants (years) Mean ± SD	26.6 ± 8.6
Duration of the disease (months) Mean ± SD	3.7 ± 1.7

n= Number of Participants, Mean ± SD: Mean ± Standard Deviation

Results

100 patients in total were treated with the Karydakis flap procedure in this research. The demographic information is given in Table I. Patient's ages were ranging from 18 years to 60 years. The duration of the disease was ranging from 1 month to 6 months, with a mean duration of 3.7 ± 1.7 months. The outcome variables of this research are shown in Table. II. The average time of operation was 47.50 ± 5.14 minutes, and the average time of hospitalization was 1.87 ± 0.80 days. Postoperative pain was assessed by administering the VAS after 24 hours of surgery, and the mean score was recorded to be 3.45.

Table II: *Outcomes of the study*

Number of patients	n = 100
Operating time (minutes)	47.50 ± 5.14
Hospital stay (days)	1.87 ± 0.80
Postoperative pain (VAS at 24h)	3.45
Complete primary healing	86 (86%)
Surgical site infection	8 (8%)
Seroma formation	6 (6%)
Flap necrosis	0 (0%)
Recurrence within one year	2 (2%)

n= Number of Participants, VAS = Visual analogue scale

Among all cases, 86% (86 patients) achieved complete primary healing without any complications. Surgical site infections were observed in 8% (8 patients), while 6% (6 patients) experienced seroma formation. There were no instances of flap necrosis. Additionally, 2% (2 patients) with initially successful healing presented with disease recurrence within six months. Every patient was followed up for a total duration of one year after the procedure.

Discussion

Pilonidal sinus disease of the natal cleft is known for its high recurrence rate, leading to prolonged healing and increased treatment costs for patients.[10] Surgeons continue to debate about the most effective treatment approach, as no single surgical procedure has been universally accepted as the gold standard. Various techniques are used, yet all carry a significant risk of complications and recurrence. An ideal surgical procedure should minimize complications, be cost-effective, reduce hospital stays, and lower recurrence rates.[11] Research suggests that reducing recurrence risk requires flattening the natal cleft and ensuring that wound closure is positioned away from the midline. Midline surgical closures are more prone to wound dehiscence, infection, and recurrence.[12,13]

The Karydakis technique offers a reconstructive solution that flattens the natal cleft and ensures lateralised wound closure, promoting faster healing. This procedure involves a large transposition flap with a well-vascularized pedicle, making it a versatile and effective option.[14] Its advantages include ease of design and execution, with the flap size adaptable to the number and location of sinus pits, allowing for tension-free closure and a cosmetically acceptable scar.[15] This method is particularly beneficial for patients with complex pilonidal sinuses featuring multiple pits or those with a history of unsuccessful surgical treatments. To prevent seroma formation and subsequent wound infection, post-operative drain placement is crucial.[5] Additionally, a gradual return to daily activities, routine hair removal from the affected area, and proper wound hygiene play key roles in minimising recurrence.

The outcomes of this study support and align with existing literature, demonstrating a low rate of surgical site infections, minimal recurrence, and no cases of flap necrosis. In this study, only 8% of patients developed infection of the surgical site, which was successfully managed with oral antibiotics. Additionally, 6% of patients experienced seroma formation, which resolved with stitch removal at the affected site, eliminating the need for further surgical intervention. These results compare favourably to those reported in other studies.

The hospital stay duration, averaging 1.87 ± 0.80 days, was recorded to be lesser than those reported in the previously existing literature. This is a notable advantage, as it helps lower hospitalization costs for patients. The postoperative pain level, assessed using the VAS scale 24 hours after surgery, averaged 3.45, categorizing it as moderate and aligning with findings from earlier research. Notably, no cases of flap necrosis were observed, which compares favourably to other studies.[1,3,5,11,13,16] Recurrence was recorded in only two patients (2%) within a time duration of six months following surgery. The rate of relapse reported here, remains within an acceptable range and is consistent with results from other studies. A contributing factor to recurrence in these cases was poor adherence to postoperative guidelines, particularly the failure to maintain regular hair removal from the nape of the neck. The accumulation of hair in the natal cleft led to reinfection and the formation of a new sinus. Thus, 86% of patients experienced complete primary healing, demonstrating the effectiveness of this procedure in managing primary pilonidal sinus disease of the natal cleft.

Conclusion

The Karydakis flap proved to be an effective and reliable surgical technique for primary pilonidal sinus disease, with 86% of patients achieving complete primary healing without complications. Its design supports faster recovery, minimal postoperative issues, and reduced recurrence, making it a preferred option in clinical practice.

Strengths and Limitations: The follow up time period of one year was a major strength in this study as it allowed for a thorough assessment of complications and recurrence rates. However, a limitation of the study was the lack of comparison between the Limberg flap reconstruction procedure and other flap rotation techniques.

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Authors Contribution: All authors are responsible for integrity of the study and had substantial contributions according to ICMJE as follows:

WMC: Literature search, conceptualization of project and writing and revision of manuscript

WA & HA: Data collection and literature search and writing

HA: Data collection and literature search and writing

FT: Literature search, Data collection and writing, revision

RA: Data collection, Statistical analysis revision

SZ: Literature search, analysis and revision of manuscript.