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Unilateral Asymmetrical Z-Plasty Including Presacral Fascia for Reconstruction of Sacrococcygeal Pilonidal Defect: Clinical Evaluation

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Abstract

Background: Pilonidal disease frequently occurs in adults and is characterized by a significant rate of recurrence, leading to discomfort for the affected cases.

Aim of the Work: The aim of this work is to evaluate the results of ellipse excision of sacrococcygeal pilonidal sinus and reconstruction of the defect with a unilateral unequal Z-plasty at the upper third part defect.

Patients and Methods: The study involved 50 patients who were diagnosed with sacrococcygeal pilonidal sinus. They underwent an ellipse excision of the sacrococcygeal pilonidal sinus, followed by the reconstruction of the excised area using a unilateral unequal Z-plasty at the upper third of the defect. A follow-up period of 6 months was observed. Data on surgical outcomes, any complications, rate of recurrence, and patient's satisfaction levels were recorded and analyzed.

Results: The study included 50 participants, comprising 45 men and 5 women, with a median age of 23.7 years (ranging from 18 to 37 years). Healing of the wound occurred within the first two weeks for both primary and subsequent occurrences, with an average healing time of 14 days (ranging from 10 to 30 days). Two patients (4%) experienced postoperative infections, which were treated with wound dressing, appropriate antibiotics, and extended drainage. The length of hospital stay varied from 1 to 2 days, and the average duration before patients could return to work was 12 days (ranging from 10 to 17 days). After an average follow-up period of 6 months, recurrences were observed in three cases (6%).

Conclusion: Unilateral unequal Z-plasty provides a simple healthy and well vascularized flap that fits and fills the defect following pilonidal sinus excision.

Key Words: *Pilonidal sinus – Ellipse excision – Z-plasty.*

Ethical Committee: The study was done following the approval from the Benha Faculty of Medicine Research Ethics Committee and after obtaining fully informed written consent from all patients regarding the surgical procedures and follow-up. Patient identification and location information were kept strictly confidential.

Disclosure: No conflict of interest.

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Introduction

Pilonidal disease is commonly treated via a surgical procedure and is predominately seen in young men compared to women, and some estimated it is about 8.8% in the army recruited youth **[1]**. Pilonidal sinus affects youth from ages 16–25 years (peak incidence) **[1]**. Pilonidal sinus (PNS) develops due to penetration of shed hair via the skin, causing an infection at its site that may be acute or chronic, and is widely affected by the occupational and habitual environment of those with the condition **[2]**.

Based on Karydakis, the pathogenesis of PNS is dependent on three factors; loose hair invaders, the force at which the hair is inserted, and the skins vulnerability at the site of insertion and depth of the natal cleft. Predisposing factors which affect these three components include moisture level, obesity, prolonged sitting, and a hairy back. Another important factor is the suctioning effect caused by the buttocks, which allows for the entry of hair, detritus, and anaerobic germs into the subcutaneous fatty tissue layer **[4]**.

For the treatment of PNS, several methods have been tested, including phenol injection **[5]**, cryotherapy **[6]**, excision and wound packing **[7]**, excision and marsupialization **[5]**, excision and primary closure **[8]**, and excision with defect reconstruction using a flap **[8]**. However, the method of wound closure after excision is the source of debate in the surgical treatment of PNS **[9]**.

Components which should be considered in the management of this procedure include the simplicity of the surgical intervention and selecting the easiest method that is inexpensive, has lower hospital stay duration, minimal pain, minimal wound care, and fastest recovery that allows the patient to continue with daily tasks normally **[10,11]**.

The main objective behind most of the flap techniques such as PNS excision and defect reconstruction is that they produce a lateralization and flattening of the natal cleft, which if done successfully, will decrease the overall postoperative complications and recurrence **[12,13,14]**.

In cases that require excision, managing of the deformity located on the tense sacral area is of vital importance as it is associated with post-operative recurrence and morbidity **[7,15]**. The downside of using a primary closure approach is that it is associated with the longer hospitalization and increased rates of post-op infection **[5,16]**, while the drawbacks of using the marsupialization and open packing methods include wound tenderness, the need for continuous dressing changes, and longer hospital stay (shorter than that of the primary closure technique) **[17]**.

To prevent such drawbacks, various flap reconstructions were documented, including the Karydakis flap **[18,19]**, the V-Y advancement flap **[20]**, the gluteus maximus musculocutaneous flap **[17]**, Z-plasty **[21,22]**, W-plasty **[23]**, the rhomboid transposition flap **[24,25,26]** and modified Limberg flap **[27]**.

This study is intended to document our findings after performing ellipse excision of a sacrococcygeal pilonidal sinus and performing a unilateral unequal Z plasty including presacral fascia in the upper third of the defect for reconstruction.

Patients and Methods

The study included fifty patients who were diagnosed with sacrococcygeal pilonidal sinus and admitted to Benha University Hospital from September 2022 to March 2024. This was done following the approval from the Benha Faculty of Medicine Research Ethics Committee and after obtaining fully informed written consent from all patients regarding the surgical procedures and follow-up. Patient identification and location information were kept strictly confidential.

The data recorded included demographics (gender and age), clinical presentations, characteristics of the pits (including number and location), treatments administered, outcomes after surgery, complications, and the duration of hospital stay. The mean age of the patients at the time of presentation was 23.7 years, ranging from 18 to 37 years. The cohort consisted of 45 male and 5 female patients. Only three cases presented with an additional lateral sinus opening due to a branching tract, while all exhibited midline pits.

The outcome measures in this study were the postoperative complications including wound infection, wound dehiscence, recurrence of the disease, postoperative pain, and patient satisfaction.

Inclusion criteria: All patients with benign non-complicated sacrococcygeal pilonidal sinus.

Exclusion criteria: Included patients with complicated sacrococcygeal Pilonidal disease such as a pilonidal abscess that required drainage or deroofing procedures during the time of hospital admission.

All patients underwent complete preoperative evaluation that included history taking, examination, and preoperative investigations.

Technique:

All patients were given spinal anesthesia and sedation and placed in prone position at the start of the operation. After strapping apart via plaster, the buttocks were sterilized and draped. About 20–30 cm mixture solution (15ml lidocaine 2% + 35ml saline 0.9% + 0.25mg adrenaline to get an adrenaline concentration of 1:200 000) was used for local infiltration around the PNS tract. A singular dose of intravenous 3rd generation cephalosporin was given pre-operatively. The hair around the natal cleft was shaved, and using a blue dye injection at the opening, the sinus cavity and sidetracks were stained for a better visualization.

Conservative elliptical excision of the sinus including all its branches was performed. As regards to reconstruction of the defect, wound irrigation using normal saline was carried out, hemostasis was ensured, and the traction plaster was released, where we then undermined the two edges of the defect deep to the level of presacral fascia creating two fascio-adipo-cutaneous flaps.

Subsequently, we made unilateral asymmetrical Z-plasty in the upper end of the wound by dividing the defect into three thirds. In the upper third, a line was drawn from the base laterally and equal to it, and from the apex a line drawn laterally and to a distance half the base and from the lateral end of the upper line two lines drawn to the ends of the lower line creating two asymmetric triangles to be replaced by each other as in Fig. (1). Transferring of the large lateral triangle in place of the small medial triangle, allowed for a tension free closure that filled the defective gap thereby flattening and obliterating the natal cleft and preventing the entrapment of shed hair (one of the potential pathogenic mechanisms).

In this case, the most acute angled flap was placed in the greater arc, while the donor triangle was filled using the flap with the greater angle. The goal of this technique was to develop a thick flap that could cover the entire wound cavity. The fascia was sutured using absorbable interrupted sutures (00 vicryl), followed by deep dermal and skin closure over the subcutaneous suction drain.

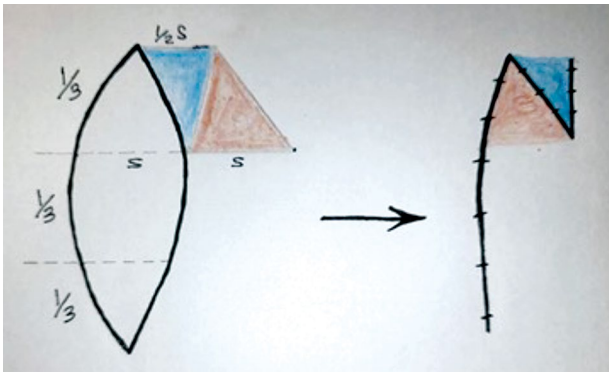


Fig. (1): (Diagram showing division of the defect into 3 thirds. From the upper third base, line is drawn laterally and equal to it "S=S" and from the apex, line is drawn laterally and measures half of the base "½ S" and from the lateral end of the upper line two lines are drawn to both ends of the lower line creating two asymmetric triangles to replace each other as in the second diagram).

On the second post-op day, all patients were discharged and advised to maintain the cleanliness of the sacrococcygeal area and keep it shaved to avoid post-op complications. Oral antibiotic coverage was recommended after discharge. On post-op day 14, sutures were removed. In the outpatient clinic, drainage was taken out when the total daily drainage was less than 20ml.

Outcomes of this study included wound complications, duration of hospital stay, recurrence rate, patient complaints (ex. dissatisfaction and numbness), and the time it took to return to normal daily activities (ex. work).

Postoperative care and follow-up were initiated four hours after surgery. Patients were permitted to walk eight hours after the procedure, though they were advised to avoid stretching the sacral area until they no longer experienced pain or tension.

Follow-up evaluations were scheduled for one and two weeks after surgery, and then at one, three- and six-months post-surgery. Discharge instructions emphasized the importance of avoiding prolonged periods of sitting and refraining from bicycling for up to six weeks. Patients were encouraged to maintain local cleanliness and regularly remove hair through shaving, clipping, or the use of depilatory creams or laser treatment. Follow-up assessments focused on the detection of wound seroma, infection, or disruption, as well as evaluating pain, mobility, time taken off from work, recurrence of the condition, and patient satisfaction.

Statistical analysis:

To determine the sample size, the G*power 3.1 programme (Universities, Dusseldorf, Germany) was used. Through data distribution analysis, the normality of the measured results was investigated. Chi-square test was used to the gender nominal data. The assessed factors were subjected to a two-way mixed ANOVA. The ANOVA test was used to the participant demographic data. Whereas nominal data were shown as number and %. Numerical data were presented as mean and SD. A significant threshold of $p<0.05$ was established. The statistical analysis was conducted using SPSS Statistics version 20.

Results

Fifty patients presented with sacrococcygeal pilonidal sinus, forty-five men and five women were admitted to Benha University Hospital in the period from September 2022 to March 2024. PNS was managed via an ellipse excision of the sacrococcygeal PNS plus a unilateral unequal Z-plasty for defect reconstruction.

The mean age of patients was 23.7 years (range 18–37 years) (Table 1).

Table (1): Demographic data.

Total number	50 patients
Gender	- 45 males (90%) - 5 females (10%)
Age	Mean age 23.7 years Range (18-37)

Clinical presentation of our patients included 23 patients (46%) with natal cleft pain, 22 patients (44%) complained of discharge from sinus opening either single or multiple openings, and only 5 patients (10%) gave a history of previous pilonidal abscess which was drained (Table 2). Eight patients (six males, two females) were obese (BMI >30).

Table (2): Clinical presentation of patients.

Presentation	Number	Percentage
Pain	23	46
Discharge from one opening	15	30
Discharge from multiple openings	7	14
History of PN abscess drainage	5	10
Recurrent cases	10	20

Early parameters for assessing wound morbidity include maceration (characterized by soft, white, and moist skin), infection (evidenced by cellulitis or purulent discharge from the wound edge or drain), gaping (complete separation of all wound layers), seroma, edema, as well as the timing for drain removal, the ability to sit on a toilet, and to walk without pain. Late parameters focus on the appearance of scars, patient satisfaction, and the recurrence of the condition (Table 3).

The average duration of the surgery was 38 minutes, with a range of 25 to 47 minutes. Hospital stays varied from one to two days, and the healing period spanned from 14 to 20 days. Seroma formation was observed in three cases (6%), which were treated through aspiration. Wound infections occurred in two patients (4%) and were managed with regular dressing changes. Fifteen patients (30%) experienced flap edema, which diminished over time. In three patients (6%), wound infection and disruption were noted. Two of these cases involved partial disruption and were addressed by controlling the infection and re-suturing the wound. The third case was left to heal by secondary intention due to complete disruption, resulting in full recurrence (Table 3).

Wound healing was successfully achieved within the first two weeks for both initial and subsequent incidents, with the average healing time being 14 days (ranging from 10 to 30 days). The average time until patients could resume daily activities was 8 days (ranging from 7 to 17 days), with a follow-up period of 6 months As regards to late postoperative complications five patients developed hypertrophic scars managed with a corticosteroid injection and silicone sheets (Table 3). No adverse effect on the process of defecation were reported.

Table (3): Operative data and Post-operative complications.

Parameter	Number & Percentage
Operative time (mint)	38 min (range 25–47 min)
Length of hospital stay (day)	1 to 2 days
Time of return to work	12 (10-17)
Time to walk free	7 (5-10)
Time to sit free on toilet	5 (3-7)
Complete wound healing	14–20 days
Postoperative complications:	
Infection	2 (4%)
Seroma	3 (6%)
Flaps edema	5 (10)
Partial wound dehiscence	2 (4%)
Complete wound dehiscence	1 (2%)
Hypertrophic scars	5 (10)
Recurrence rate	3 (6%)

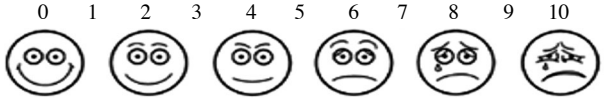
As regards to patient satisfaction, 35 (70%) rated their degree of satisfaction as excellent, 9 (18%) rated it as good, 4 (8%) rated it as fair, and 2 (4%) rated their degree of satisfaction as poor (Table 4).

Table (4): Aesthetic outcomes in the studied patients.

Aesthetic outcome	Number	Percentage
Excellent	35	70
Good	9	18
Fair	4	8
Poor	2	4

Visual analog scale (VAS) was used to analyse severity of pain 24 hours postoperatively (Table 5).

Table (5): Visual analogue pain scale.



No pain | Mild, annoying pain | Nagging, uncomfortable, troublesome pain | Distressing, miserable pain | Intense, dreadful, horrible pain | Worst possible, unbearable, excrutiating pain

Visual analogue pain scale (VAS)	Number and percentage of patients
1	10 (20%)
2	30 (60%)
3	8 (16%)
4	2 (4%)

As regards to drain removal, most patients (37 cases) had their drains removed after 5 days, 10 of the cases had it removed after 7 days, and only 3 of the cases had the drain removed after 10 days (Table 6).

Table (6): Time of drain removal.

Time of drain removal in days	Number and percentage of cases
5 days	37 (74%)
7 days	10 (20%)
10 days	3 (6%)

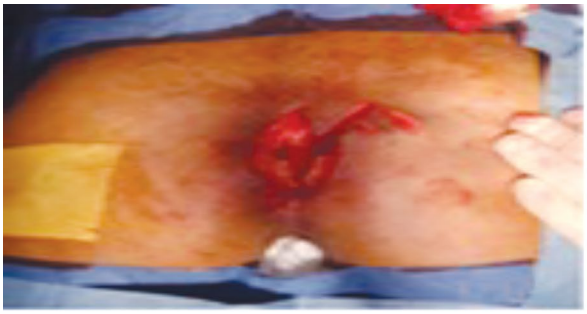
Fig. (2): Case (1):

1- Opening of pilonidal sinus on the skin.

2- Marking of the 2 triangles.

3- After elliptical excision.

4- Flaps dissection including Presacral fascia.



1- Design of the flaps.

2- After flaps replacement.

3- After fascial suturing.

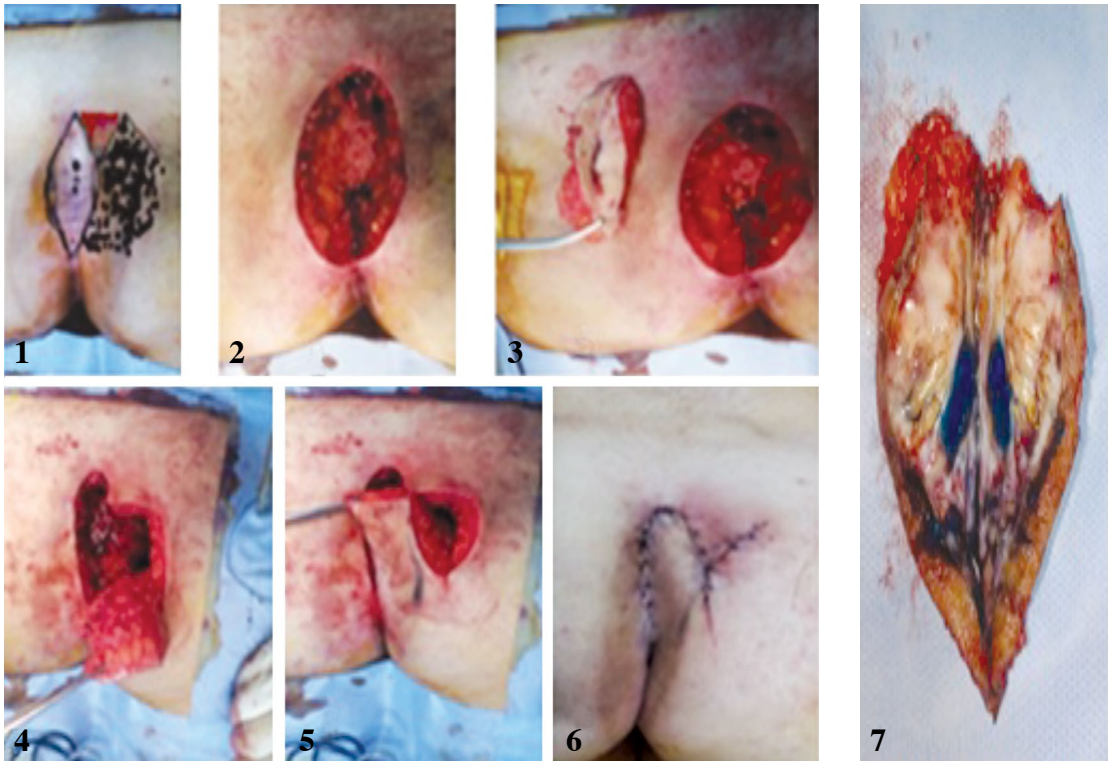
4- After skin closure.


One week post-operative.


After stitches removal.


4 weeks post-operative.

Fig. (3): Case (2):



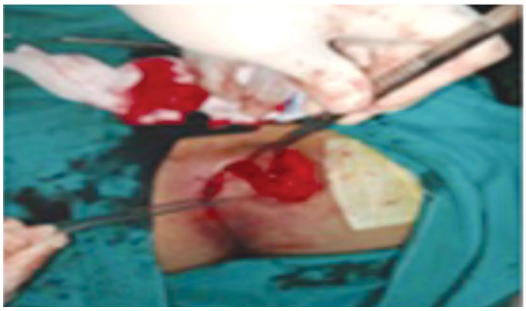
1- Multiple openings sinus and marking of the 2 triangles.
2- Elliptical excision.
3- The defect and the specimen.
4- Dissection of the flaps.
5- Triangles transfer.
6- Post operative view.
7- The specimen after excision showing complete excision of all blue dye.

Fig. (4): Case (3):

1- Macerated pilonidal area.

2- Marking of the ellipse and 2 asymmetric triangles.

3- Dissection of the 2 triangles.



4- Transfer of the 2 triangles.

5- Intra operative view with sc. drain.

Fig. (5): Case (4):

1- Sacrococcygeal pilonidal sinus.

2- Marking 2 asymmetric triangles.

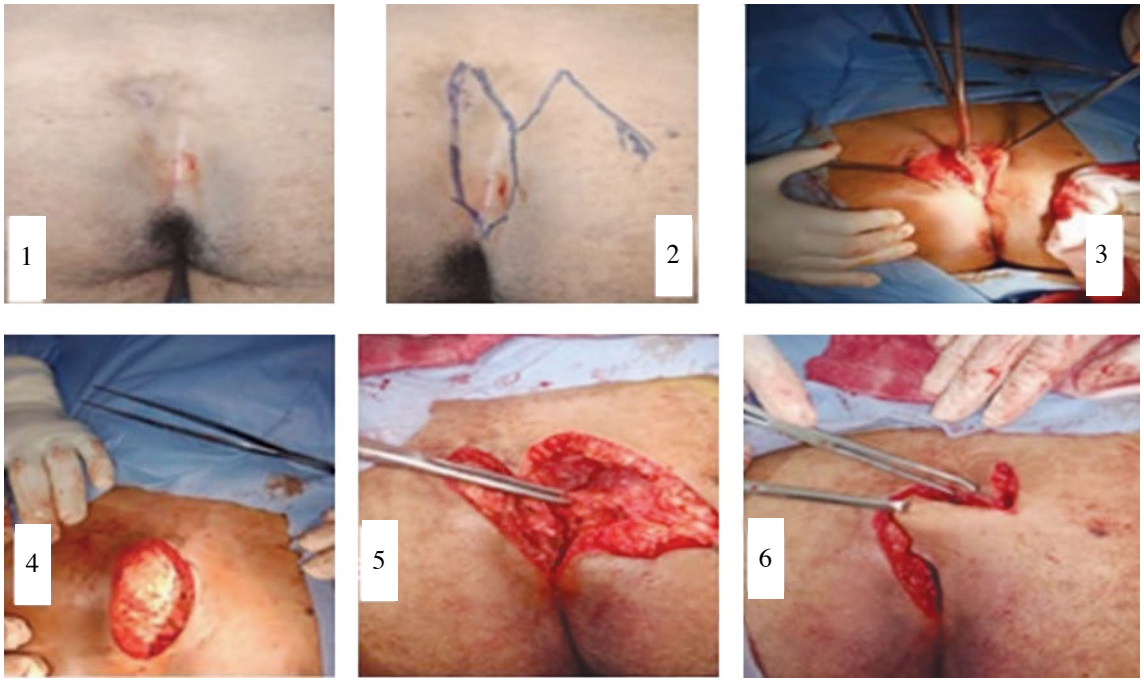
3- Elliptical excision of the sinus and dissection of the flaps deep to the fascia.

4- Triangles transfer.

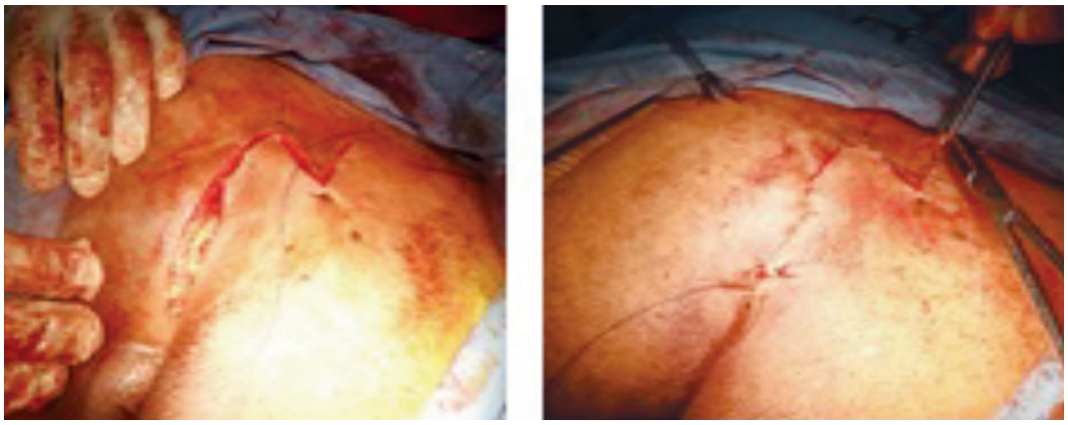
5- Intraoperative view.

6- Post operative view.

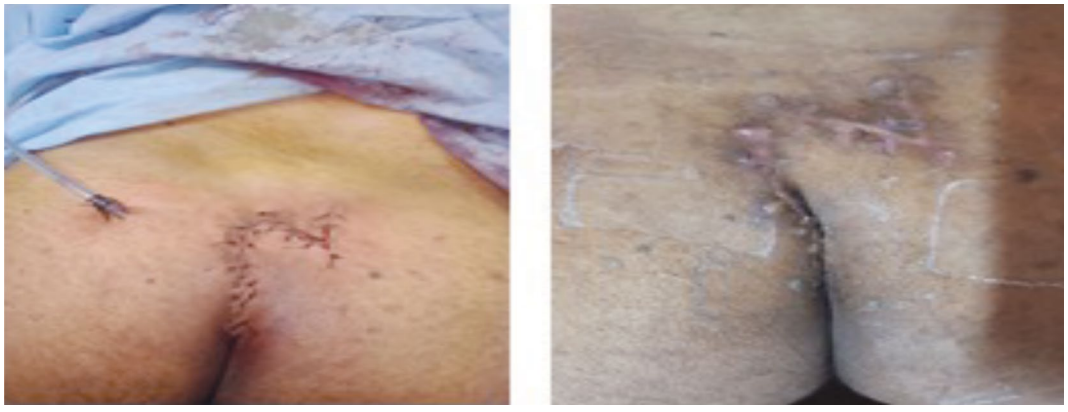
Fig. (6): Case (5):



1- Pilonidal sinus opening.
2- Marking of the ellipse and the 2 asymmetric triangles.
3- Elliptical excision of the sinus.
4- Defect after elliptical excision.
5- Subfascial dissection.
6- Transfer of the 2 triangles.



Intra operative.



Early and late post-operative.

Discussion

In any surgical procedure, optimal outcomes are characterized by a brief hospital stay, quick wound healing, minimal time away from work, reduced complication rates, lower levels of pain, and high patient satisfaction. Pilonidal illness is a prevalent health concern with a high rate of morbidity and discomfort for patients. The disease's natural history is so variable that a small percentage of patients may have no symptoms at all, and the problem is limited to a few small pits in their backs, whereas a larger percentage of patients may have a more dramatic history with chronic inflammatory process, acute exacerbation, and abscess formation.

According to Karydakis' theory, sacrococcygeal pilonidal disease (SPD) occurs only when three primary factors are present: First is loose hair acting as an invader, second is a force that drives the hair to penetrate the skin, and third is the vulnerability of the skin beneath, often linked to the depth of the intergluteal sulcus **[1,28]**. Several researchers have proposed that the primary reasons for the recurrence of SPD after complete excision are connected to these theories **[7]**. Our goal was to address and mitigate these underlying causes.

Although a variety of surgical and non-surgical therapeutic options for SPD have been documented, no single treatment has been recommended by all surgeons, and no treatment is without risk of complication, particularly disease recurrence. While most conservative therapy options aid in the removal of numerous SPD predisposing variables, surgery, in all its modalities, aims to address the primary cause of SPD, which is the existence of a deep intergluteal sulcus **[1,29,30]**. This allowed for the development of novel plastic reconstructive treatments, such as Z-plasty, W-plasty, and V-Y plasty. The short hospital stays, low recurrence rates (reported to be under 5% among all flap procedures), and high patient satisfaction score are the key benefits of post excision flap closure **[24,31]**.

Karydakis tried an asymmetric excision and closure, intending to make the incisional line to be lateralized away from the midline. This type of surgery results in a flattened gluteal cleft that prevents hair from penetrating this area, as well as acceptable cosmetic results. If a postoperative infection occurs, the defect will be smaller than with the Limberg flap **[19,32]**.

Originally designated for difficult or recurring pilonidal illness, the Limberg procedure is now commonly employed as a plastic approach for SPD. This technique uses rhomboid flap to achieve primary closure and obliteration of the deep natal cleft. Although the Limberg procedure has several benefits, such as minimal recurrence and complication rates, it tends to lack visual appeal, particularly among female patients due to multiple scars **[33,34,35]**.

The use of surgical drainage continues to be debated, with many surgeons supporting its application to decrease the occurrence of postoperative complications such as fluid accumulation and wound dehiscence. However, its impact on the rate of recurrence remains uncertain **[36,37]**. While Akinici et al., reported a very low recurrence rate of 0.9% **[38]** with the routine application of a suction drain and subcuticular skin closure, Gurer et al., **[32]** in their prospective randomized trial, observed that routine cavity drainage following Karydakis surgery did not influence the recurrence rate of the disease. In our study, drains were utilized for all patients, with removal times as follows: The majority of patients (37 cases) had their drains removed after 5 days, 10 cases had theirs removed after 7 days, and in only 3 cases were the drains removed after 10 days.

The duration of hospitalization following a Karydakis procedure is generally shorter. For instance, Morden et al., **[39]** reported an average hospital stay of 4.68 days post-Karydakis surgery, whereas patients undergoing the Limberg flap method tend to experience longer hospital stays, with Daphan et al., **[40]** recording an average stay of 5.9 days. In our research, the average duration of hospitalization was between 1 and 2 days. Akinici et al., **[38]** noted that the typical period before returning to normal activities after pilonidal surgery using the Karydakis flap repair ranged from 12.4 to 20 days. Conversely, Daphan et al., **[40]** found the recovery time to be between 8 and 9.4 days following a modified Limberg flap procedure. In our study, the average time required for patients to resume normal activities was 12 days, with a range of 10 to 17 days.

Can et al., in their comparison of the Karydakis and Limberg procedures, discovered that 78.3% of patients who underwent the Karydakis technique expressed their satisfaction as "excellent," while 5% were dissatisfied with the outcome. In contrast, only 40% of those who underwent the Limberg procedure rated their satisfaction as "excellent," and 6.44% reported dissatisfaction, largely attributing it to the procedure's lesser cosmetic appeal **[29]**.

In our study, patient satisfaction was distributed as follows: 35 patients (70%) described their satisfaction level as excellent, 9 patients (18%) as good, 4 patients (8%) as fair, and only 2 patients (4%) as poor. High satisfaction levels were linked to factors such as quick healing, prompt return to work, early ability to sit and use the toilet without restrictions, and minimal scarring compared to other flap techniques.

As regards to defecation, there was no adverse effects on the process of defecation as the dissection process was confined to the upper third of the defect away from the lower end near the anus. But in the study comparing Karydakis and Limberg procedures, there was significant difficulty in defecation in the Karydakis group in comparison to Limberg group (p=0.002). This observation has no definitive explanation but may be related to the geometrical reasons associated with flap design and tension **[30]**.

Closing the defect primarily after an elliptical excision, followed by layer-by-layer closure of the surrounding areas, is considered the simplest way to minimize complications associated with reconstructive surgery after excision. While primary closure is commonly employed for small defects, recent research has shown its effectiveness even in larger excisions, such as those with a 50% risk of wound dehiscence **[40]**. A meta-analysis by Petersen et al., indicated that asymmetric-oblique or flap closure techniques offer more advantages than straightforward midline closure **[41]**.

However, surgeons may encounter dilemmas when closing larger excisions using this approach, as closing the defect under tension might lead to ischemia at the wound edges, increasing the risk of infection. Alternative approaches include excision with partial closure (marsupialization) or leaving the wound open to pack. Marsupialization results in a smaller wound compared to the open method, which relies on wound granulation for healing **[42]**.

Marsupialization typically has a lower recurrence rate (1.2-8%) and limits the development of wound infection via covering of the subcutaneous tissue, thereby shortening the duration of the time needed for the wound to completely heal (3-5 weeks) **[43,44]**. Lower rates of recurrence have also been documented in other excision-reconstructive procedures like W (0%–16.7%) and V-Y (0%–9.5%) flaps as well as Z-plasty (1.6%–10%) **[23,45]**.

Flap surgeries provide the flexibility for extensive tissue removal. The Limberg flap technique stands out for effectively flattening the natal cleft and exhibiting lower recurrence rates **[24]**. Despite the general concern that scars from the Limberg flap might affect the patient's quality of life or satisfaction, our findings revealed that scarring was minimal and limited to the upper third of the defect and the midline.

Conclusion: Our research focused mainly on assessment of short-term outcomes of using this flap for reconstruction of the defect, but for long term outcomes for recurrence should be focused in another research which is already under processing.

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