



International Journal of Health Sciences (Egypt)

Journal homepage: <https://ijhegy.journals.ekb.eg/>

Original article

The outcomes of keystone perforator island flap versus lay open in re-recurrent pilonidal sinus disease (two times of recurrence or more): one year experience study

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ARTICLE INFO

Article history:

Received 24 February 2025

Received in revised form 3 March 2025

Accepted 3 March 2025

Keywords:

Recurrent
pilonidal sinus
keystone
lay open

ABSTRACT

Background: Pilonidal sinus is a common surgical problem. It has a tendency for recurrence. Recurrent disease is difficult to manage. re-recurrent disease is more difficult to manage, because it is hard to choose the right operation and to provide sufficient tissue to close the defect. This study aims to assess and evaluate the outcomes of keystone perforator island flap and lay open techniques in treatment of pilonidal sinus disease which is recurrent for the second time or more. **Methods:** This is a single-center comparative clinical study performed at Zagazig University Hospitals from December 2023 to December 2024. The study included 27 patients. **Results:** 27 patients with re-recurrent pilonidal sinus were classified randomly into two groups. Group 1 underwent treatment with keystone island perforator flap and group 2 underwent closure by lay open technique. There was no statistical significant difference between the 2 groups in age, sex, type of 1st and 2nd operation, mean time for 1st and 2nd recurrence. Operation time, bleeding, pain score and wound dehiscence were more in group 1, while healing time and recurrence rate were more in group 2. **Conclusion:** Both keystone island perforator flap and lay open techniques can be used in treatment of re-recurrent pilonidal sinus disease. Keystone island flap is better regarding the healing time and recurrence rate.

Introduction

Pilonidal derives its name from Latin- pilus meaning "hair," and nidus meaning "nest." The name "pilonidal disease" has been attributed to R.M. Hodges in 1880. Early after its diagnosis, many clinicians interpreted the condition as congenital in origin, being derived from remains of the medullary tube, dermoid traction, inclusion dermoid, or preen glands [1]. Currently, pilonidal disease is considered

an acquired condition. Patey et al. suggested the theory of pilonidal illness being an acquired disease., arguing that pilonidal disease develops from the suction of hair from surrounding soft tissue and skin, ultimately leading to a foreign body reaction and foreign body granuloma[2].

The pathophysiology is mostly unknown; the cause is considered to be trapped hair follicles.

Microscopically, hair within pilonidal cysts comes from the overlying, surrounding skin; nevertheless, follicles are never detected within the cyst wall, but rather free of granulation and scar tissue [3]. Pilonidal disease is diagnosed clinically and does not require any more labs, tests, or imaging. However, imaging may be useful in circumstances where the diagnosis is unclear.

Treatment can be one of two major categories: nonoperative and operative, with many cases combining the two. Pilonidal illness is primarily regarded as a surgical disease, particularly in cases of acute secondary infection and abscess. Infection or abscess necessitates incision and drainage. When there is an acute infection or abscess, definitive therapy is usually deferred until the infection has been treated. There are numerous surgical treatments for treating pilonidal cysts and sinuses. The surgical treatment must be tailored to the patient. Lifestyle adjustments and modifiable risk factors should be addressed and included in the treatment strategy [4].

There are various surgical methods for treating pilonidal illness, including "pit picking," curettage, aspiration, deroofting, and surgical excision. Defects can be repaired via flaps or grafts, or they can be let to heal on their own. Negative pressure wound therapy is another treatment option for surgically treated pilonidal illness [5]. Despite high rates of recurrence, many studies in the literature discussed the management of primary and recurrent disease, but to our knowledge no previous study dealt with the re-recurrent disease. This study aims to discover a standard treatment for recurrent pilonidal sinus disease.

Methods

This is a single institution comparative randomized clinical study which was performed in general surgery department in Zagazig University, Egypt. It included 27 with recurrent pilonidal sinus for the second time or more. Patients were divided randomly in two groups. Group I (12 patients) received surgery with keystone perforator island flap, group II (15 patients) had a lay open technique method.

Randomization was done by lottery method. Patients were blind to the type of surgery.

The study protocol was approved by the Institutional Research Board (IRB) at Zagazig University with registration ID #101080-5-9-2023 in adherence to the Helsinki Declaration of 1975, as

revised in 2000 and registered in clinical trials by ID number NCT06741449.

This study followed the CONSORT guidelines.

Pre-operatively: patients were diagnosed clinically as re-recurrent pilonidal sinus for the second time or more. Patients of both sexes above 18 years old with median or paramedian recurrent openings were included. Patients with primary or recurrent disease, patients younger than 18 years old, those with autoimmune disease or who were immune-compromised were excluded.

Patient admitted and fasted for 6 hours. Preoperative ceftriaxone vial was administrated. Intra-operatively; injection of methylene blue dye in the opening to exclude hidden openings and tracks, the patient either had a lay open technique by elliptical excision of the disease and the defect is left to heal by granulation tissue (Group II) (**Fig. 1**), or semilunar excision and closure by a fascio-cutaneous advancement flap (keystone perforator island flap) . The flap consists of two V-Y advancement flaps in opposing directions. The movement of these advancement flaps provides extra tissue to the defect to facilitate the closure. S.C suction was placed (group I) (**Fig.2**).

Post-operatively, patients received analgesia and antibiotics. Patients were discharged after 24 hours; the 1st dressing was done, and to ensure the flap vascularity, they were followed in outpatient. Patients had a daily dressing in group II and a day-after-day dressing in group I. Operative time, bleeding, time for healing, ambulation, cosmeses, wound dehiscence and pain score were compared between the two groups.

A visual analogue scale was used to assess the pain; a maximum score of 10 refers to very painful, and a minimum score of 0 indicates painless. The customer satisfaction score scale was used to evaluate the patient satisfaction about the surgery; score 10 is very satisfied, and score 0 is unsatisfied. Stony Brook's scar evaluation scale was used for doctor evaluation of the final scar with a score out of 5. Sensory affection was evaluated using a subjective question of the patient to score his sensation in this area by a score out of 10 (0-2 means lost, 3-6 diminished, 7-10 preserved).

Statistical design

Data were statistically analyzed using mean \pm SD, Chi square, t test and Bonferroni Post-hoc-Tests RM Factor.

Results

Table 1 demonstrated no difference between the two groups in age, sex, hairy person or history of hair removal.

Table 2 showed no statistical difference between groups in the type of the first or the second operation, time interval for recurrence and number of openings. Operation time and intra-operative

bleeding were highly significant higher in group I with a P value <0.0001. Pain score and wound dehiscence were also higher in group I. Despite that, it showed faster healing and less recurrence than group II. No differences between both groups in wound infection, ambulation time, customer satisfaction score, cosmeses and sensory affection were found (**Fig. 3**).

Table 1: Patient characteristics and history

	keystone	Lay open	test	P value
age	23.67± 3.82	26.40± 3.72	1.87	@0.07
sex	Male 7 (58.3) Female 5	Male 8 (53.3%) Female 7		
Hairy person	Yes 9 (75%) No 3	Yes 11 (73.3%) No 4		
Laser hair removal	Yes 1 No 11	Yes 1 No 14		

@ t test

Table 2: Surgical parameters evaluation between the 2 groups

	keystone	Lay open	test	P value
1 st operation				
Karydakis	0	2		
Open	7	5		
Rhomboid	5	8		
2 nd operation				
Karydakis	0	0		
Open	11	13		
rhomboid	1	2		
Mean Time for 1 st recurrence	5.5 ± 1.446	4.8 ± 1.5213	@1.2141	0.2360
mean time for 2 nd recurrence	8.4167 ± 3.1754	7.0667± 3.1952	@1.0939	0.2844
Number of openings				
1	3	3		
2	8	10		
3	1	2		
Operation time (min)	128.3333 ± 24.8022	53.3333± 12.6303	@10.2062	<0.0001**
Bleeding (ml)	146.6667± 52.6279	70.6667± 26.0403	@4.9082	<0.0001**
Pain score	6.6667± 1.0731	5.6667± 1.1127	@2.3570	0.0266*
Wound dehiesence			#14.211	0.0002*
Yes	8	0		
no	4	15		

Wound infection				
Yes	4	1	#3.142	0.0763
No	8	14		
Cosmosis	2.33 ±1.23	2.47 ±0.99	@0.3122	0.75
Customer satisfaction score	3.0833 ±0.9003	2.9333 ± 0.7988	@0.4584	0.6507
Healing time	55.4167± 7.5252	56.4667 ± 7.5201	@2.1877	0.0383*
Sensation Diminished	8	9	\$11	0.173
Lost	2	4		
preserved	3	3		
Recurrence			#4.909	0.0267*
Yes	0	3		
no	12	12		
AMBULATION h	8.6667± 0.7785	8.4± 0.9103	@0.8056	0.4281

#chi square @ t test \$ Bonferroni Post-hoc-Tests RM Factor * significant **highly significant

Figure 1. Male patient with recurrent pilonidal sinus after lay open and rhomboid falp underwent lay open technique

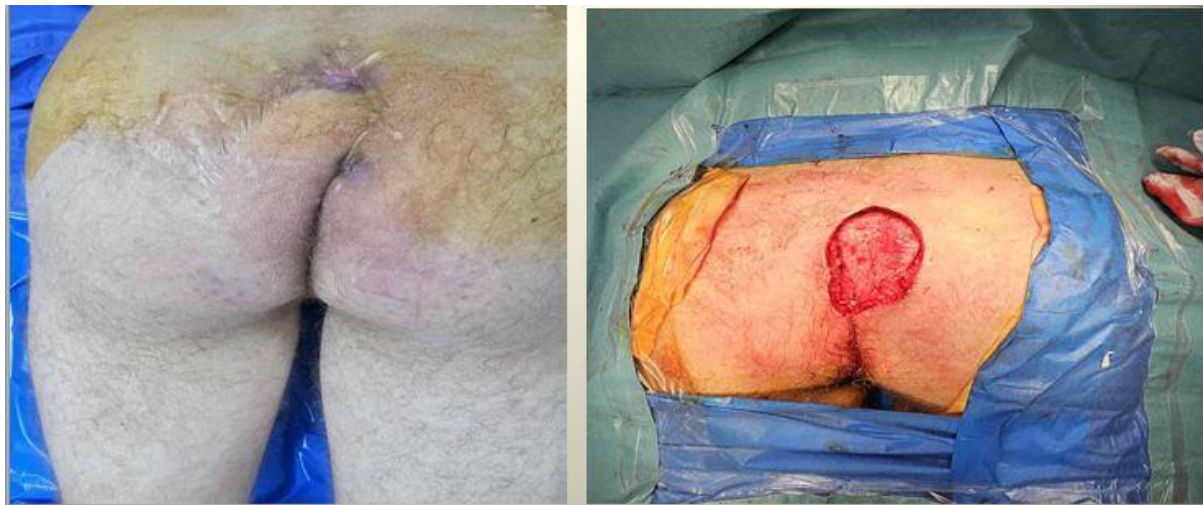
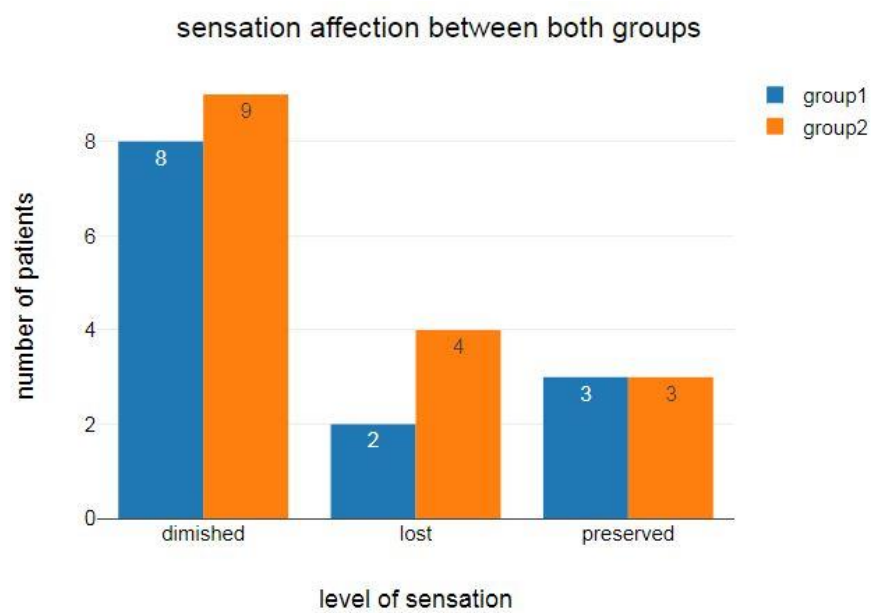


Figure 2. Female patient underwent keystone perforator island flap after lay open and rhomboid flap, A,B,C,D are the steps.



Figure 3. Sensory level affection between both groups.



Discussion

Although there are numerous therapies for pilonidal illness, recurrence cannot be totally prevented. However no process can get rid of it entirely. Two frequent surgical techniques are direct suture and lying open. They are simple to execute, don't require specialized surgical training, and permit total excision of the sinus. In recent decades, flap repair has become more common following pilonidal sinus excision. This enables the suture to be positioned outside the disease's focal point, the median line. In cases of multi-recurrent and multi-fistular diseases, this is especially helpful. However, it necessitates skill in reconstructive and plastic surgery techniques [6].

Although gluteal region is a redundant fatty area and because pilonidal disease has tendency for recurrence, repeated excision in this area may lead to tissue deficiency to recover the area in each time of recurrence. It also lead to a longer healing time, bad cosmeses and a bad psychic impact on the patient.

A few studies discussed the management or recurrent pilonidal disease. Nearly no previous study discussed the management of re-recurrent disease. Lay open technique may be preferred by many surgeons. This study was conducted to compare between excision of the recurrent disease and either to cover the defect by a keystone perforator island flap or leave it open to heal by secondary intention.

There may be both an acute and a chronic phase to recurrent disease. Similar to treating its original active counterpart, the objectives of treating acute, recurrent pilonidal illness are to reduce pain and drainage symptoms and promote wound healing. The patient should incur as little "cost" as possible in terms of money, time away from work, and leisure activities in order to accomplish these goals. The therapies used can be the same since the objectives are fundamentally the same [8].

In this study, there was no significant statistical difference between the two groups regarding the age, sex, if the patient is hairy or had previous laser hair removal or not. As in Yoldas et al study [7], recurrent pilonidal disease was more common in males. It was notices that recurrent cases almost had no laser hair removal after the previous surgeries. This means laser hair removal may act as a protective factor against recurrence. In 75% and 73% of cases respectively in group I and group II, buried hair theory was the aetiology.

Although there was no statistical significant difference between the two groups in the

type of first and second operation. Lay open technique was more among the recurrent surgeries followed by rhomboid flap. The least was Karydakis. This was against Gençosmanoğlu and Inceoglu study, which stated that lay open has the least recurrence. This can be due to high preference for lay open technique by surgeons [9].

Covering the defect after excision for the 3rd time or more is challenging. Vascularity may be affected, no sufficient available tissue to cover, and lastly scars and cosmeses. So, lay open technique may be preferred.

In order to repair the damaged area, the perforator flap operation mobilizes skin and/or subcutaneous fat from a local or distant section of the body. Perforator arteries that pass through muscle or intermuscular septa provide the flap's arterial feed from a deep vascular system.

Perforator flaps' primary benefits include preserving the underlying muscle, reducing donor site morbidity, shortening recovery times, and improving cosmetic outcomes by using "like with like." With shorter operating times, less postoperative pain, a shorter hospital stay, and better results for large defects, the keystone perforator is a single flap based on multiple perforators. It is also the best option for patients with numerous comorbidities [10].

Keystone perforator flap is very popular in covering extremities and facial defects, but not in covering defects in natal cleft.

In this study, operative time and intraoperative bleeding were significantly higher in keystone flap group (128 ± 24 versus 53 ± 12 minutes and 146 ± 52 versus 70 ± 26). This is logic as group I needed more steps with more time and more blood loss. Although time for keystone flap was shorter in Roatis et al study [11], this can be attributed to re-recurrent disease with required more time for excluding residual sinuses and providing a good flap design and a sufficient tissue.

Pain was evaluated in both groups using the visual analogue scale. Pain score was higher in group I. this is due to multiple incisions in this group. Ambulation was early in both groups without statistical difference.

Wound dehiscence was an expected complication in group I especially if there is no redundant tissue and excess previous scarring. No statistical significant difference was found between the two groups regarding wound infection as group I was closely drained using suction and group II was open drained.

Healing duration was significantly shorter in group I and this period can be shorter if no dehiscence or infection occurred (55 ± 7 Vs 56 ± 7). Also recurrence rate was lesser in group I.

Sensation in the scar was evaluated by a subjective question to the patient with a score out of 10, but there was no difference between the two groups. Cosmesis of the scar was evaluated by surgeon using Stony Brook's scar evaluation scale and patient satisfaction about the whole outcome of the operation was evaluated using customer satisfaction score, but there was no statistical difference between the two groups.

Conclusion

Keystone perforator island flap is better than lay open technique in healing time and prevention of recurrence in the re-recurrent pilonidal sinus, but with longer operative time and intra-operative bleeding.

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