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ORIGINAL ARTICLE

Comparative Study Between Karydakis Flap and Rhomboidal Flap in Treatment of Sacrococcygeal Pilonidal Sinus

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Abstract

Background: **Pilonidal sinus disease (PSD) is an acquired disease that usually impacts young people and causes a lot of pain and discomfort after surgery.**

Aim: **This research aimed to compare the karydakis operation and the rhomboidal flap for the treatment of pilonidal sinus in terms of postoperative pain, length of hospital stay, recovery time, complications, and recurrence rate.**

Patients and methods: **This research was performed at the Al-Azhar University Hospitals' General Surgery Department between March 2021 and February 2022. There were 34 people who had been diagnosed with sacrococcygeal pilonidal sinus. The patients were divided equally into two groups:**

Group A: karydakis technique was used for excision and closure.

Group B: Rhomboid flap was used for excision and closure.

Results: **Highly statistically significant (*P*-value >0.05) decreased postoperative VAS in group A (5.5 ± 1.1) when compared with postoperative VAS of group B (8.6 ± 0.9), statistical insignificant difference (*P*-value >0.05) between both the studied groups (group A and group B) as regard postoperative complications (complete healing, wound breakdown and recurrence).**

Conclusion: **The Karydakis procedure is better in terms of time to remove stitches, time to resume work, shorter operation length, and less discomfort in the therapy of nonrecurrent pilonidal sinus. The rhomboidal flap differs in that it may be used on patients with significant pilonidal sinus disease and lateral extension.**

Keywords: Karydakis flap, Rhomboidal flap, Sacrococcygeal pilonidal sinus

1. Introduction

Pilonidal sinus disease (PSD) is an acquired disease that usually impacts young people and causes them to have a lot of pain and discomfort after surgery.

Two of the most significant risk factors for the development of pilonidal sinus are the existence of a deep natal cleft and the presence of hair within the cleft. An environment that is conducive to perspiration, maceration, bacterial contamination, and hair penetration is a deep natal cleft. Therefore, these contributing elements need to be removed for both therapy and prevention.[1]

The condition is claimed to have a population-wide incidence of 26/100 000, with a peak occurrence between the ages of 15 and 24, and in 12–38% of cases, it is linked to a well-known hereditary propensity. Pilonidal sinus affects both sexes equally, however males outnumber women two to one in instances.[2]

PSD can manifest as a painful sinus tract with persistent drainage or as an abrupt abscess. The sacro-coccygeal region around the natal cleft is where it is most frequently observed. With a male to female ratio between 3:1 and 4:1, the incidence is around 25/100 000.[3]

Hodges' idea is currently referred to as the acquired theory, which states that hair causes the

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creation of sinuses by inducing a foreign body reaction in the tissue around it. Pilonidal cysts can appear everywhere on the body, but the sacrococcygeal and upper gluteal cleft are where they most frequently extend cephalad.[4]

Diagnosis may be made by looking for cutaneous pits in the middle of the gluteal cleft. Symptoms of an acute pilonidal cyst are similar to those of other types of superficial abscesses, including pain, discomfort, and swelling.[5] Inflammation and scarring contribute to the severity of chronic pilonidal illness, which is connected to the subcutaneous cavity through the sinuses and regularly drains under pressure.[6]

Contrarily, it is believed that the pilonidal infection originates from keratin-filled hair follicles in the natal cleft that become inflamed and also develop pilonidal abscesses, according to the acquired theory.[7]

The disease's acuteness or recurrence determines the available therapy options. Until now, conservative treatment methods including laser and light therapy and several surgical alternatives have been used.[8]

They can be as minimally invasive as pit excision and marsupialization up to different flap techniques used in plastic surgery. They can also include incisions and excision techniques with primary or secondary wound closure. The best surgical procedure for treating pilonidal sinuses is still up for dispute due to the wide range of clinical symptoms and physical manifestations.[8]

This research aimed to compare the karydakis operation and the rhomboidal flap for the treatment of pilonidal sinus in terms of postoperative pain, length of hospital stay, recovery time, complications, and recurrence rate.

2. Patients and methods

From March 2021 to February 2022, this research was carried out at the Al-Azhar University Hospitals, General Surgery Department. 34 individuals with sacrococcygeal pilonidal sinus with symptoms of pain, discharge, or discomfort at the natal cleft were included in the study.

2.1. Inclusion criteria

Patients with nonrecurrent Pilonidal sinus between the ages of 18 and 50.

2.2. Exclusion criteria

Age of less than 18 or greater than 50, acute pilonidal abscess, diabetes mellitus, HIV-positive individuals, cancer patients receiving chemotherapy, immunosuppressant treatment patients, endo anal form of pilonidal sinus, and recurring instances of pilonidal sinus.

2.3. Follow-up strategy

Patients were seen at the outpatient clinic for 3, 6, and 12 weeks after surgery. Then every month for six months for assessment of wound healing and the recurrence.

2.3.1. All of the patients underwent to

A. PreOperative:

2.4. History taking

2.4.1. Personal history

Name, sex, residence, age …. etc.

2.4.2. Complaint

Bleeding, pain, discharge, fibrous band.

2.4.3. Present history

In-depth recounting of how the symptoms first appeared, how long they lasted, and how they progressed.

2.4.4. Past history

Repeated natal cleft infection, previous medications, operations, and chronic diseases (as diabetes mellitus, hypertension … etc.), and history of incision drainage of pilonidal abscess.

2.5. Clinical examination

2.5.1. General examination

As vital signs.

2.5.2. Local examination

Local examination with special attention to hair distribution, site and number of external openings of the sinus (primary and secondary) and distance from the anus.

2.6. Laboratory investigations

2.6.1. Routine

Complete blood count (C.B.C), ALT, AST, Urea, Creatinine, blood sugar, virology and P.T.

2.6.2. Radiological investigations

Preoperative sinogram and MRI if needed.

2.6.3. Preoperative preparation

Cleaning the site of operation. With the onset of anesthesia, a single dosage of a broad-spectrum antibiotic may be administered.

2.6.4. Anesthesia

Spinal or general anesthesia.

2.6.5. Operative

The patients were divided equally into two groups based on the method utilized to treat the pilonidal sinus.

Each group consisted of 17 patients:

Group A: were treated by excision and closure by karydakis technique.

Group B: were treated by excision and closure by transposition rhomboid flap technique.

2.6.6. Position of the patient

The patient is positioned in the Jack-Knife position (Fig. 1).

2.6.7. Sterilization

Operative field in all patients was sterilized by povidone-iodine. A set of fistula probes were used to estimate the level and direction of sinuses. Methylene blue injection for sinus track.

2.7. Preoperative marking and photographing

2.7.1. In karydakis technique

Marking was done by: A vertical eccentric elliptical line around the openings of pilonidal sinus with its upper and lower apices 1.5 cm lateral to midline (Fig. 2).

2.7.2. In Rhomboid flap transposition

The natal cleft was delineated by drawing a rhomboid with its upper and lower apices 1.5 cm laterally from the midline to encompass the apertures of the pilonidal sinus. In order to demarcate the asymmetrical lower apex of the rhomboid, a line is drawn across the gluteal region (Fig. 3).

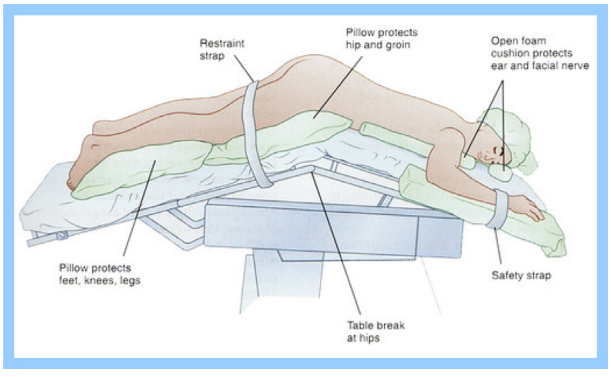

Fig. 1. Jack-Knife position.

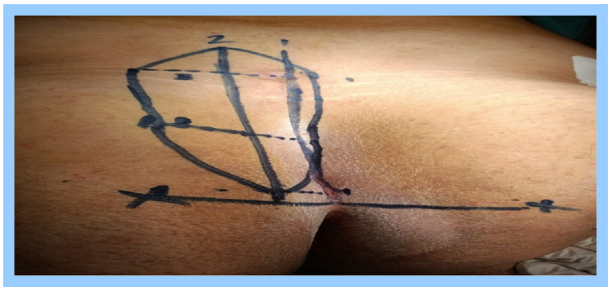

Fig. 2. Marking of Karydakis flap.

Fig. 3. Marking of rhomboidal flap transposition.

2.8. Operative techniques

Group A: Karydakis published the biggest series of cases in the literature (6,545) and advocated for a method that avoids recurrence as well as healing the presenting disease (Fig. 4).

The infected material was excised along with a border of healthy tissue surrounding the sinus and cyst (Fig. 5).

Effective hemostasis was achieved, and a vacuum drain was inserted. Specifically, one must pay great attention to the lower apex of the incision line if the flap is to be lateralized more than 1.5 cm from the midline, and then one must advance the flap across

Fig. 4. A vertical eccentric elliptical incision (Karydakis incision).

Fig. 5. Removal of sinus tracts through eccentric elliptical incision.

the midline and suture its edge to the lateral wound edge (Fig. 6).

Group B: One of the plastic surgical techniques for treating pilonidal sinus, rhomboid transposition flaps are utilized to conceal the scar produced by radical excision of the sinus. The natal cleft is smoothed out after surgery, and the wound heals quickly and with a minimal scar, making it visually acceptable. Before its use to the pilonidal sinus, the rhomboid transposition flap has only been mentioned as a means of concealing skin defects on other parts of the body (Figs. 7 and 8).

Incorporating the gluteal fascia, a fasciocutaneous rhomboid transposition flap was performed on the side of the body opposite the asymmetric lower center of the defect (Fig. 9).

A good hemostasis was done and vacuum drain was placed. The subcutaneous fascio-adipose tissue was approximated with interrupted 2-0 vicryl sutures. Defects in the donor area were generally repaired with interrupted 2-0 polypropylene sutures to sew the skin (Fig. 10).

2.9. Postoperative data

The patient was nursed on his or her side, or prone, for the first 24 h. After which, the mobilization was restricted for at least 48 h in to avoid hematoma formation. Analgesia was given as required. Antibiotics in the form of broad-spectrum were given for about 1 week parentally.

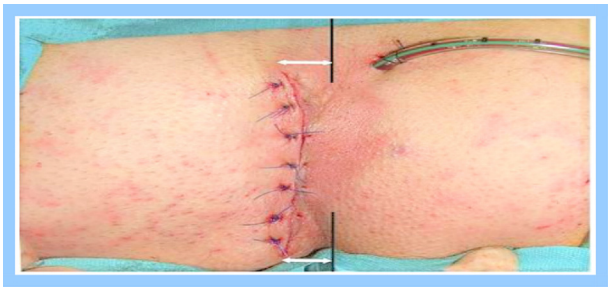

Fig. 6. Wound closure in Karydakis flap.

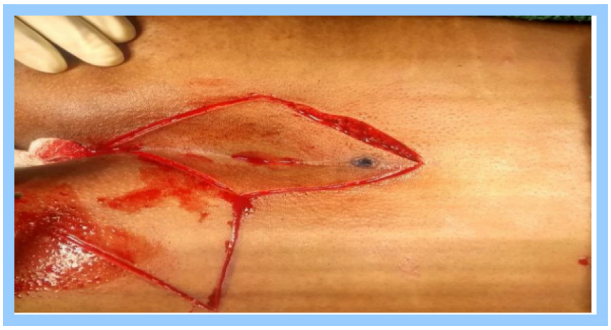

Fig. 7. Rhomboid shaped incision with the lower apex 1.5 cm lateral to the midline.

Data recorded: Personal data: age, sex, obesity, and hair distribution. Clinical presentation: Asymptomatic (multiple openings in sacrococcygeal area). Symptomatic (pain-discharge-bleeding-abscess). Preoperative imaging (Sinogram) if needed. Duration of surgery (In minutes) and usage of drain. First time to mobilize after surgery. The time spent in hospital before discharge. The time of removal of suction drain and stitches. The time to complete healing. Postoperative complications up to 6 months. The wound infection rate and wound breakdown. The recurrence rate was recorded.

2.10. Follow-up (6 months)

Patients were reviewed in the outpatient surgical clinic at 3, 6 and 12 weeks then every month for 6 months for assessment of: Wound healing and the recurrence.

2.11. Statistical analysis

Version 24 of the Statistical Program for Social Science (SPSS) was used to analyses the data. Both qualitative and quantitative data were expressed using frequency and % for quantitative data. The mean (average) is the middle value in a set of

Fig. 8. Excision of sinus.

Fig. 9. Fasciocutanous rhomboid transposition flap.

Table 1. Comparison between the two studied groups as regard general characteristics.

	Group A ($N = 17$)	Group B ($N = 17$)	Stat. test	*P*-value
Age (years)				
Mean ± SD	30.8 ± 9.2	32.1 ± 9.7	T = 0.4	0.691 NS
Sex				
Male	14 (82.4%)	13 (76.5%)	$X^2 = 0.11$	0.735 NS
Female	3 (17.6%)	4 (23.5%)		
BMI				
Normal	6 (35.3%)	9 (52.9%)	$X^2 = 1.29$	0.524 NS
Obese	8 (47.1%)	5 (29.4%)		
Overweight	3 (17.6%)	3 (17.6%)		

Fig. 10. Wound closure in rhomboid flap transposition.

discrete numbers; it is the sum of values divided by the total number of values. Standard deviation is a statistical measure of the dispersion of a data collection (SD). As a high SD indicates that the values span a wide range, a low SD indicates that the data cluster around the mean.

3. Results

The hospitals of Al-Azhar University, General Surgery Department, played host to this study on 34 patients with sacrococcygeal pilonidal sinus. Patients were randomized into two groups as follows:

Group A: Underwent Karydakis technique (17 patients).

Group B: Underwent rhomboidal flap (17 patients) (Table 1).

Statistically insignificant differences were found in the data shown in table. (*P*-value >0.05) between the two studied groups (group A and group B) as regard age, gender and BMI (Fig. 11).

This table shows statistically insignificant difference (*P*-value >0.05) between both studied groups as regard discharge, pain and pain with discharge (Table 2).

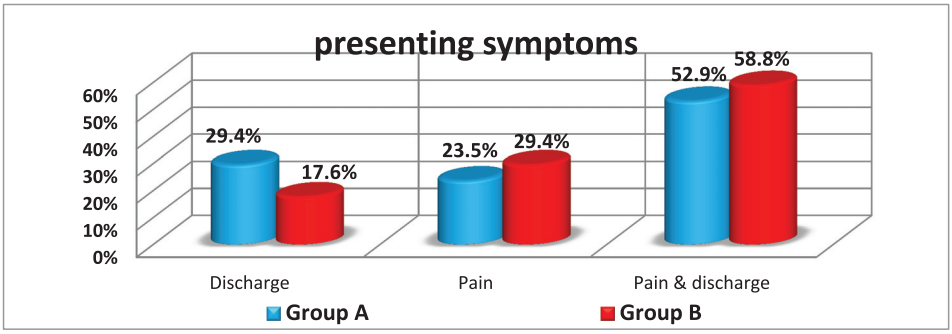

Fig. 11. Comparison between both studied groups as regard presenting symptoms.

Table 2. Comparison between the two studied groups as regard Sinogram.

	Group A (N = 17)	Group B (N = 17)	X^2	P-value
Sinogram	17 (100%)	17 (100%)	–	–
Sinogram type				
Branching	3 (17.6%)	4 (23.5%)	0.17	0.671 NS
Non-branching	14 (82.4%)	13 (76.5%)		

Table 3. Comparison between studied groups as regard operative time.

	Group A (N = 17)	Group B (N = 17)	Stat. test	P-value
Operative time (min) Mean ± SD	40.3 ± 8.4	68.3 ± 6.6	T = 10.8	<0.001 HS

There was no statistically significant difference (*P*-value >0.05) between studied groups as regard sinogram type (branching and nonbranching) (Table 3).

There is highly statistically significant (*P*-value >0.05) decreased operative time in group A (40.3 ± 8.4 min) when compared with operative time of group B (68.3 ± 6.6 min) (Table 4).

There is highly statistical significant (*P*-value >0.05) decreased postoperative VAS in group A (5.5 ± 1.1) when compared with postoperative VAS of group B (8.6 ± 0.9) (Table 5).

There is insignificant difference (*P* value > 0.05) between the two groups regarding postoperative mobilization (Table 6).

This table shows highly statistical significant (*P*-value >0.05) decreased postoperative hospital stay in group A (1.3 ± 0.2 days) when compared with postoperative hospital stay of group B (3.4 ± 0.4 days) (Fig. 12).

This table shows highly statistical significant (*P*-value >0.05) decreased post-operative wound healing in group A (11.3 ± 1.3 days) when compared with postoperative wound healing of group B (18.4 ± 2.1 days) (Fig. 13).

This table shows highly statistical significant (*P*-value >0.05) decreased postoperative time to stitches removal in group A (17.8 ± 2.3 days) when compared with postoperative time to stitches removal of group B (26.4 ± 2.5 days) (Fig. 14).

Table 4. Comparison between the two studied groups as regard post-operative VAS.

	Group A (N = 17)	Group B (N = 17)	Stat. test	P-value
Postoperative VAS Mean ± SD	5.5 ± 1.1	8.6 ± 0.9	T = 8.9	<0.001 HS

Table 5. Comparison between studied groups as regard post-operative start of mobilization.

	Group A (N = 17)	Group B (N = 17)	Stat. test	P-value
Time to mobilization (days) Mean ± SD	2.3 ± 0.5	2.1 ± 0.4	T = 1.28	0.207 NS

This table shows highly statistical significant (*P*-value >0.05) decreased postoperative work return in group A (18.2 ± 2.5 days) when compared with postoperative work return of group B (28.4 ± 2.1 days) (Table 7).

4. Discussion

A comparison of two surgical approaches to treat PSD was done in this thesis. 34 individuals with sacrococcygeal pilonidal sinus were included in the research. Two groups of patients were randomly assigned. While 17 patients in group, B got rhomboidal flap surgery, the 17 patients in group An underwent the Karydakis procedure.

Young adult males with black, dense, and strong hair who are between the ages of 15 and 30 are the most frequently affected with phillidal sinus Abu Galala and colleagues.[9]

In our study, the average age of patients receiving the Karydakis procedure was 30, whereas the average age of patients receiving the rhomboidal flap was 32. Male patients made up 80% of those who had the Karydakis procedure and 75% of those who underwent rhomboidal flap surgery.

These results corroborated those of Sözen and colleagues[10] who reported that the mean age of patients treated with the Karydakis procedure was 28.3 years and that the mean age of patients treated with the rhomboidal flap was 29.2 years.

Younger ages were recorded for both the Karydakis method and the rhomboidal flap in the study by Bessa, Samer S.[11] In both procedures, a median age of 23 years was recorded. Our findings were consistent with a male predominance. 90% of patients who received the Karydakis procedure and 97% of patients who got rhomboidal flap were reported to be men.

In patients who underwent the Karydakis procedure, 20% of patients complained of pain, 30% of

Table 6. Comparison between the two studied groups as regard post-operative hospital stay.

	Group A (N = 17)	Group B (N = 17)	Stat. test	P-value
PO hospital stay (days) Mean ± SD	1.3 ± 0.2	3.4 ± 0.4	T = 19.3	<0.001 HS

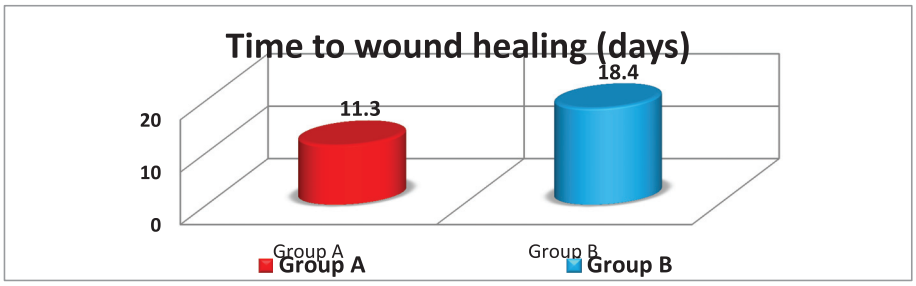

Fig. 12. Comparison between the two studied groups as regard post-operative wound healing.

patients complained of discharge, and 50% of patients complained of both complaints.

According to a research by Kohla and colleagues,[12] 20% of patients who underwent the Karydakis procedure complained of discomfort, 26.6% complained of discharge, and 40% complained of both pain and discharge. Similar percentages of those using the Karydakis method complained of discomfort, according to Ates and colleagues[13]; however, greater percentages of people complained of discharge (81.0%).

According to our study, the rhomboidal flap technique's mean operating time (66 min) was substantially longer than the Karydakis approach (38 min). This result was in line with research by Bessa[11] who found that the rhomboidal flap technique required more time during surgery than the Karydakis approach.

According to our study, individuals who received the rhomboidal flap method had a median VAS that was substantially greater than those who got the Karydakis procedure (VAS was 8). (VAS was 6). This was in line with the results of a research by Ates and colleagues,[13] which showed that patients who received the rhomboidal flap method experienced greater VAS than those who underwent the Karydakis procedure. While Erosy and colleagues[14] showed no change in VAS between the two approaches while Karaca and colleagues[15] indicated that pain was greater in the Karydakis technique.

According to our study, there was no discernible difference in time to mobilization between patients who received the rhomboidal flap procedure and those who underwent the Karydakis technique (2 days in both techniques). This was in line with research by Sözen and colleagues[10] and Kohla and colleagues[12] that likewise found no statistically significant difference between the two approaches.

According to our study, patients who received the rhomboidal flap procedure had a substantially longer average hospital stay (3 days) than those who underwent the Karydakis approach (1 day). This was in line with the findings of the study by Ates and colleagues,[13] which showed that patients who underwent the rhomboidal flap procedure spent longer in the hospital.

There was no statistically significant difference between the two procedures in terms of post-operative hospital stays, according to studies by Sözen and colleagues[10] and Kohla and colleagues[12] and Karaca and colleagues.[15]

In this study, we found that, compared with the Karydakis approach, the mean time to wound healing was considerably longer in patients who received rhomboidal flap surgery (19 days) (12 days). In terms of the amount of time needed for wound healing, Kohla and colleagues[12] and Karaca and colleagues[15] found no significant differences between the two groups.

Our study found that individuals who received the rhomboidal flap technique had a considerably longer mean time to stitch removal (28 days) than those who underwent the Karydakis procedure (18 days). This was in line with a research by Kohla and

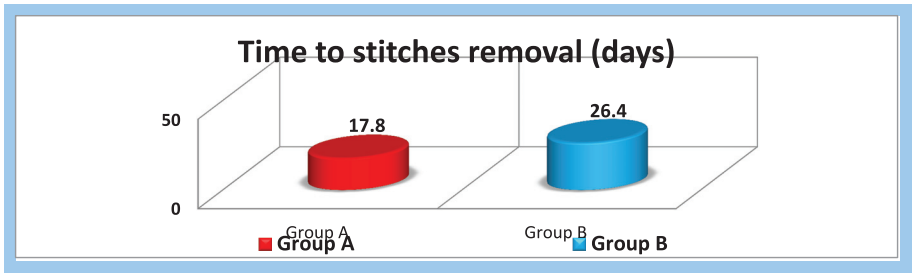

Fig. 13. Comparison between the two studied groups as regard postoperative time to removal of stitches.

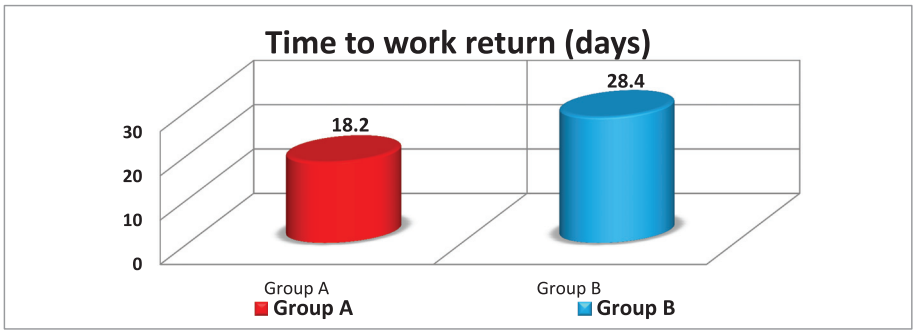

Fig. 14. Comparison between the two studied groups as regard postoperative time to return to work.

colleagues,[12] which found that patients who received the rhomboidal flap method took longer to have their sutures removed than those who underwent the Karydakis procedure.

In this study, we found that patients who received rhomboidal flap method had considerably longer mean times to return to work (29 days) than those who got Karydakis procedure (19 days). This was in line with a research by Kohla and colleagues,[12] which showed that patients who received the rhomboidal flap procedure took longer to return to work than those who got the Karydakis technique.

According to a study by Sözen and colleagues,[10] patients who had the Karydakis procedure took longer to return to work than patients who got the rhomboidal flap technique. Studies conducted by Ates and colleagues[13] and Erosy and colleagues[14] revealed no statistically significant difference between the two approaches in terms of time to resume employment.

With regard to the incidence of various problems, we found statistically insignificant differences between the both groups in our study. This agreed with research from Sözen and colleagues[10] and Kohla and colleagues[12]

According to a research by Ates and colleagues,[13] individuals who received the rhomboidal flap procedure experienced significantly more problems than those who underwent the Karydakis approach.

A further research by Erosy and colleagues[14] found that individuals who had the Karydakis procedure experienced more problems than those who received rhomboidal flap surgery.

Table 7. Comparison of Postoperative Complications Across both Groups.

	Group A ($N = 17$)	Group B ($N = 17$)	X^2	*P*-value
Complete healing	14 (82.4%)	12 (70.6%)	0.65	0.418 NS
Wound breakdown	3 (17.6%)	5 (29.4%)	0.65	0.418
Recurrence	1 (5.9%)	1 (5.9%)	0	1.0 NS

The data in this table do not indicate any statistically significant differences between the two groups as regard postoperative complications.

4.1. Conclusion

The Karydakis procedure is better to the rhomboid flap in terms of time to remove stitches, time to resume work, shorter operation length, and less discomfort in the therapy of nonrecurrent pilonidal sinus. The rhomboidal flap differs from the Karydakis flap in that it may be used on patients with significant PSD and lateral extension.

Conflict of interest

Payment/services info: All authors have declared that no financial support was received from any organization for the submitted work. Financial relationships: All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work. Other relationships: All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

References

1. Mahdy T. Surgical treatment of the pilonidal disease: primary closure or flap reconstruction after excision. *Dis Colon Rectum*. 2008;51:1816–1822.
2. Steinemann DC. Therapie des Pilonidalsinus – ist mehr wirklich mehr? *Ther Umsch*. 2013;70:393–398.
3. Kalaiselvan R, Sonia B, William A, Aloka L, Rajasundaram R. Minimally invasive techniques in the management of pilonidal disease. *Int J Colorectal Dis*. 2019;34:1–8.
4. Eryilmaz R, Okan I, Ozkan OV. Interdigital pilonidal sinus: a case report and literature review. *Dermatol Surg*. 2012;38:1400–1403.
5. Khanna A, Rombeau JL. Pilonidal disease. *Clin Colon Rectal Surg*. 2011;24:46–53.
6. de Parades V, Bouchard D, Janier M. Pilonidal sinus disease. *J Vis Surg*. 2013;150:237–247.
7. Aydede H, Erhan Y, Sakarya A, Kumkumoglu Y. Comparison of three methods in surgical treatment of pilonidal disease. *ANZ J Surg*. 2011;71:362–364.

8. Käser SA, Zengaffinen R, Uhlmann M, Glaser C, Maurer CA. Primary wound closure with a Limberg flap vs. secondary wound healing after excision of a pilonidal sinus: a multicentre randomised controlled study. *Int J Colorectal Dis*. 2015; 30:97–103.
9. Abu Galala KH, Salam IMA, Abu Samaan KR. Treatment of pilonidal sinus by primary closure with a transposed rhomboid flap compared with deep suturing: a prospective randomized clinical trial. *Eur J Surg*. 2009;165:468–472.
10. Sözen S, Mehmet A, İlhan B, Ali CY. Comparison of drainage, delayed pits excision, and closure with excision and secondary healing in pilonidal sinus abscess cases. *Int Surg*. 2016;101: 227–232.
11. Bessa SS. Comparison of short-term results between the modified Karydakis flap and the modified Limberg flap in the management of pilonidal sinus disease: a randomized controlled study. *Dis Colon Rectum*. 2013;56:491–498.
12. Kohla SM, Alsesy AA, Abd El-Aziz TF, Mohammed MA, Zaid MA. Comparative study between the Karydakis technique and the Limberg flap in pilonidal sinus. *Menoufia Med J*. 2016;29:539.
13. Ates M, Dirican A, Sarac M, Aslan A, Colak C. Short and long-term results of the Karydakis flap versus the Limberg flap for treating pilonidal sinus disease: a prospective randomized study. *Am J Surg*. 2011;202:568–573.
14. Erosy E, Devay AO, Aktimur R, Doganay B, Ozdogan M, Gundogdu RH. Comparison of the short-term results after Limberg and Karydakis procedures for pilonidal disease: randomized prospective analysis of 100 patients. *Colorectal Dis*. 2009;11(7):705–710.
15. Karaca T, Yoldaş Ö, Bilgin BÇ, Özer S, Yoldaş S, Karaca NG. Comparison of short-term results of modified Karydakis flap and modified Limberg flap for pilonidal sinus surgery. *Int J Surg*. 2012;10:601–606.