Outcome of karydakis lateral flap versus open technique in the treatment of pilonidal sinus

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Introduction
Pilonidal sinus disease is a chronic, recurrent disorder of the sacrococcygeal region, which commonly occurs in young adults following puberty. The male population is affected more frequently compared with the female population. A large number of surgical techniques (with varying complexity) have been described in the literature for the treatment of this disease. Such diversity suggests that no single technique has emerged as the preferred method in preventing recurrence of this condition.

Objectives
The aim of this study was to compare karydakis lateral flap technique with open technique in the treatment of noncomplicated pilonidal sinus.

Patients and methods
A total of 70 patients with uncomplicated pilonidal sinus, attending Minoufiya University Hospital and other private hospitals, were included in this study. They were divided into two groups: the karydakis group and the open procedure group.

Results
A total of 57 male and 13 female patients were included in this study. The mean operative time in the karydakis and the open group was 45 ± 7.27 and 23.4 ± 4 min, respectively. There was a significantly lower rate of wound infection in the karydakis group. Two patients (5.7%) showed recurrence in the karydakis group, whereas eight patients (22.8%) had recurrence in the open group. There was no significant difference between the two groups as regards scar pain and numbness ($P > 0.05$), but there was a significantly lower recurrence rate in the karydakis group ($P = 0.022$). The healing time and duration of work-off was significantly shorter in the karydakis group ($P < 0.001$).

Conclusion
Karydakis technique showed shorter hospital stay, earlier healing, shorter duration of work-off, and lower rate of complications compared with the open technique.

Keywords:
karydakis, open technique, versus

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Introduction

Natal cleft pilonidal disease is prevalent worldwide, although it is probably more common in hot humid regions like the Middle East and Mediterranean basin. Patients may present after months and even years of repeated episodes of infection, resulting in deep branching tracks and multiple skin pits. Recurrence after surgery is common and is believed to be largely secondary to persistent natal cleft following surgery [1]. Pilonidal sinus disease is a chronic, recurrent disorder of the sacrococcygeal region, which commonly occurs in young adults following puberty [2–4]. The male population is affected more frequently compared with the female population, probably due to their hirsute nature and other causes that are not related to hair characteristics, such as sedentary occupation (44%), positive family history (38%), obesity (50%), and local irritation or trauma before onset of symptoms (34%) [5]. A large number of surgical techniques (with varying complexity) have been described in the literature for the treatment of this disease. Such diversity suggests that no single technique has emerged as the preferred method in preventing recurrence of this condition [6]. These include conservative nonexcisional care, phenol injection [7,8], pit excision and tract brushing (Millar–Lord procedure) [9,10], Bascom procedure [5,11], excision and leaving the wound to granulate [12,13], excision and marsupialization [13,14], excision and primary closure with midline or asymmetric incisions [12,15], or excision and closure using local flaps. The latter include karydakis procedure [16,17], rhomboid and Limberg flaps [18,19], Z-plasty [20,21], and V–Y flaps [22,23] or other reconstructions [24,25], and each method has

its own advantages. In this study, our objective was to compare karydakis lateral flap technique with open technique in the treatment of pilonidal sinus as regards operative time, complications, hospital stay, healing time, rate of recurrence, and work-off period.

Patients and methods

A total of 70 patients attending Minoufiya University Hospital and other private hospitals from January 2011 to December 2014 were included in this prospective randomized study. They were randomized into two groups: the open group and the closed group.

Open group

The open group included 35 patients who underwent sinus excision that was left open for daily dressing.

Closed (karydakis) group

The closed group included 35 patients who underwent sinus excision that was closed using karydakis lateral flap.

Inclusion criteria

Only patients with primary nonrecurrent and uncomplicated pilonidal sinus were included in the study. Patients were randomized using a sealed envelope containing the treatment option, which was chosen by the patients.

Preoperative care

A patient record form was prepared, and patients' age, sex, duration of symptoms, preoperative antibiotic use, previous treatments, length of hospital stay, return to work, and complications such as wound breakdown and infection and wound care time were recorded. All patients were subjected to full necessary laboratory tests before surgery. All patients were admitted to hospital the day before surgery and operated under general anesthesia. The natal cleft was shaved the day before the surgery. Patients were asked to use the numerical rating pain scale for pain and effect of analgesia after surgery. Patients also had the option to verbally rate their scale from 0 to 10 to be recorded.

Surgical techniques

Patients were made to lie in the prone position with the legs slightly abducted and the buttocks strapped apart with adhesive tapes on the table sides. Methylene blue mixed with 10% hydrogen peroxide was injected into the sinus orifice(s) just before the incision. All patients received a single intravenous dose of cefoperazone at the time of induction of anesthesia and at 12 h postoperatively for 48 h and then shifted to oral forms (amoxicillin and clavulanic acid 1 g every 12 h, plus metronidazole 500 mg three times per day for 7 days).

Open method

General anesthesia was induced with the patient in the prone position, then probing and injection of methylene blue mixed with 10% hydrogen peroxide is administered by means of a plastic canulla. Adding the hydrogen peroxide helps in dislodging thick pus flecks and opening up closed fistulous tracks. An elliptical incision parallel to the midline is made. The sinuses are excised with the surrounding skin and subcutaneous fat to the level of sacrococcygeal fascia and then proper hemostasis is induced with diathermy, and any side tracks are unroofed using a fistula probe. The resulting opened wound is packed with gauze and dressing (Fig. 1).

Karydakis lateral flap method

Probing of the sinus is carried out, followed by injection of methylene blue. An asymmetrical biconcave (elliptical) incision is made, with the patient in prone position (Fig. 2). An ellipse was made based on the side of any secondary opening or induration. If the sinus is entirely central, either side can be chosen. The incision is at least 5 cm long with gentle curvature. Each end of the incision is placed 2 cm to one side of the midline (Figs. 3 and 4). The medial edge of the incision is placed crossing the midline sufficiently to encompass the primary pit (Fig. 5). The lateral edge of the excised ellipse must be symmetrical with the medial edge even if this means excision of more skin and fat well beyond the sinus; thus, the final suture line is vertical, or its

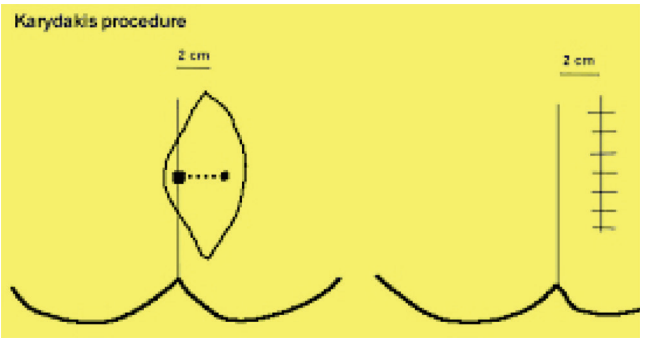
Figure 1

Open method (excision of boat-shaped wedge of tissue including the whole sinus).

Figure 2

Midline sinus.

Figure 3

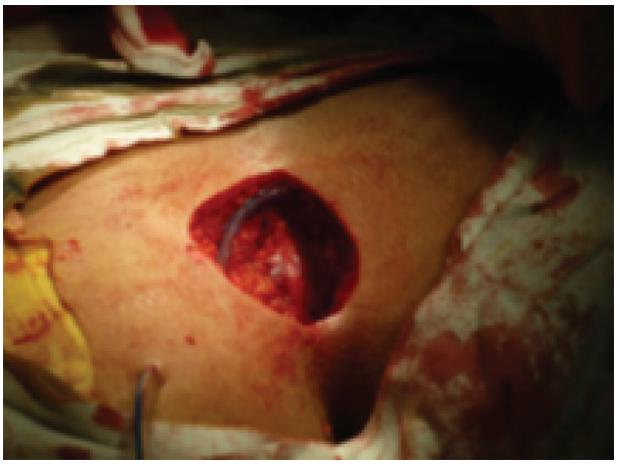


The karydakis technique (off-midline closure), (ends of the incision are placed 2 cm to one side of the midline).

Figure 4

Asymmetrical biconcave incision.

Figure 5



Defect with asymmetrical edges and drain away from the midline to avoid new track for hair.

central part may encroach towards the midline, which increases the risk of recurrence (Figs. 3 and 7).

Diathermy must not be used until the tissue has been removed, to avoid confusion of burn marks with that of methylene blue from divided sinus branches. The medial side of the wound is then undercut a distance of 2 cm and at the depth of 1 cm to produce a flap extending the full length of the wound. The flap should be of uniform thickness. A layer of interrupted absorbable sutures is placed; before any is tied, the needle is passed into the sacral fascia in the midline and then deeply into the fat at the base of the flap, taking a large bite that includes both surfaces of the undercut. As these series of sutures are tied, the assistant can both evert the edge with the fingers and use a thumb to push the base of the flap across to the midline to approximate the surface for knotting. A suction drain is placed across these knots and brought out well laterally before the second layer of sutures is placed to approximate the undersurface of the flap to the fat in the lateral edge of the wound (Fig. 6). During insertion of these sutures, the assistant can evert the edge and hold knots during tying as before. Interrupted 2/0 vicryl or prolene sutures (vertical mattress) are used for skin closure (Fig. 7).

Postoperative care

Patients were seen routinely on postoperative days 5, 10, and 14 for wound inspection and removal of sutures. The patients with delayed healing were continued to be seen until complete healing was achieved. Any wound complications were recorded. At 3 months after surgery, patients were invited to follow-up. Time to return to work and time until complete healing were recorded. Patients were advised to shave intergluteal cleft and adjacent buttocks, or use depilatory creams, and keep the operative area clean and dry at all times. Patients were informed to follow-up every 3 months for 36 months and/or at any time of suspected recurrence.

Figure 6

Suturing of the flap to the fat in the lateral edge of the wound.

Figure 7

Linear closure away from the midline and flattening of the natal cleft.

Results

Demography of the patients

A total of 70 patients were included in this study. Their ages ranged between 15 and 50 years, with a mean of 24.6 ± 7.1 years in the karydakis group and 27.43 ± 8.4 years in the open group. The karydakis group included 35 patients (30 male and five female). The open group included 35 patients (27 male and eight female). There was no significant difference between the two groups as regards age ($P > 0.05$), but was significant as regards male sex predominance ($P < 0.001$) (Table 1).

Table 1 Demography of the patients

Demography	Karydakis operation	Open procedure	Total number	*P*
Age				
Mean ± SD	24.6 ± 7.1	27.43 ± 8.4		0.7
Range	15–47	19–50		
Sex [*n* (%)]				
Male	30 (85.7)	27 (77.1)	57 (81.4)	
Female	5 (14.2)	8 (22.8)	13 (18.57)	

Clinical features in both groups

Clinical features varied from multiple sinuses, single sinus to sacrococcygeal swelling and sinus(es). However, there was no significant difference between the two groups as regards preoperative presentations.

Operative time

The mean operative time in the karydakis group was 45 ± 7.27 min, ranging from 35 to 55 min, compared with 23.4 ± 4.05 min, ranging from 20 to 30 min, in the open group. It was found that the operative time was significantly shorter in the open group than in the karydakis group ($P = 0.002$). These findings are shown in Table 2.

Table 2 Operative time in both groups

Operative time (min)	Karydakis operation	Open procedure	*P*
Mean	45 ± 7.27	23.4 ± 4.05	0.002
Range	33–55	17–30	<0.002

Assessment of pain using pain scale

There was a significant difference between the two groups as regards postoperative pain ($P = 0.013$) (Table 3).

Table 3 Postoperative pain in both groups

Severity of pain	Karydakis operation	Open procedure	*P*
Postoperative pain [*n* (%)]	10 (28.5)	19 (54.2)	0.013
Severity of pain [*n* (%)]			
Mild	7 (20)	7 (20)	0.013
Moderate	3 (8.5)	7 (20)	
Severe	0	5 (14.2)	

Postoperative complications in both groups

In the karydakis group, no patient had postoperative hemorrhage, and one patient had hematoma, one patient had wound dehiscence, and one patient had wound infection, compared with two patients with postoperative hemorrhage and 12 patients with wound infection in the open group. There was no significant difference between the two groups as regards postoperative hemorrhage, hematoma, and wound dehiscence ($P > 0.05$). However, there was a significantly lower rate of wound infection in the karydakis group ($P < 0.001$). These findings are shown in Table 4.

Hospital stay, time of healing (days), and duration of work-off in both groups

In the karydakis group, duration of hospital stay ranged from 18 h to 3 days compared with 2–6 days in the

Table 4 Postoperative complications in both groups

Postoperative complications	Karydakis operation [*n* (%)]	Open procedure [*n* (%)]	Total number (*n* = 30) [*n* (%)]	*P*
Overall postoperative complications	3 (8.5)	14 (40)	17 (24)	0.03 (S)
Postoperative hemorrhage	0	2 (5.7)	2 (28.5)	0.5
Hematoma	1 (2.8)	0 (13.3)	1 (14)	0.7
Wound dehiscence	1 (2.8)	0	1 (14)	
Wound infection	1 (2.8)	12 (34.2)	13 (13.5)	<0.001 (S)

open group. The healing time was 10–24 days compared with 31–62 days in the open group, and the duration of work-off ranged from 14 to 31 days in the karydakis group compared with 37–70 days in the open group. It was found that the hospital stay was significantly shorter in the karydakis group (P = 0.02). Moreover, the time of healing and the duration of work-off were significantly shorter in the karydakis group (P < 0.001) (Table 5).

Table 5 Hospital stay, time of healing (days), and work-off period in both groups

Convalescence	Karydakis operation	Open procedure	*P*
Hospital stay (days)			
Mean ± SD	1.3 ± 0.83	3.2 ± 1.4	0.02
Range	0.75–3	2–6	
Time of healing (days)			
Mean ± SD	16 ± 4.3	43.41 ± 8.2	<0.001
Range	10–24	31–62	
Work-off period			
Mean ± SD	22.4 ± 4.7	50.47 ± 8.1	<0.001
Range	14–31	39–70	

Long-term outcome in both groups

Patients in both groups were followed up for 24 months. In the karydakis group, two patients suffered from scar pain, compared with five patients in the open group. Two patients suffered from local numbness in the karydakis group, compared with one patient in the open group. Scar pain and numbness disappeared after 12 months postoperatively in both groups. Two patients showed recurrence in the karydakis group in the 14th and 16th month, whereas eight patients had recurrence in the open group – two of them had recurrence in the fourth month and the others had recurrence in the sixth, ninth, 12th, 15th, 17th, and 19th month postoperatively. There was no significant difference between the two groups as regards scar pain and numbness (P > 0.05), but there was a significantly lower recurrence rate in the karydakis group (P = 0.022) (Tables 6 and 7).

Table 6 Preoperative presentations

Clinical presentation	Karydakis operation [*n* (%)]	Open procedure [*n* (%)]	Total number [*n* (%)]	*P*
Multiple sinuses	10 (28.5)	14 (40)	24 (34.2)	0.73
Single sinus	18 (51.43)	12 (34.2)	30 (42.8)	
Sacrococcygeal swelling and sinus(es)	7 (20)	9 (25.7)	16 (22.8)	

Table 7 Long-term outcome in both groups

Late complications	Karydakis [*n* (%)]	Open procedure [*n* (%)]	Total [*n* (%)]	*P*
Scar pain	4 (11.4)	14 (40)	18 (25.7)	0.01
Numbness	5 (14.2)	2 (5.7)	7 (10)	0.08
Recurrence	2 (5.7)	8 (22.8)	10 (14.2)	0.022

Discussion

The ideal technique for the treatment of sacrococcygeal pilonidal sinus disease is a controversial issue [26]. The most common treatment approach is the excision of the cyst cavity. The traditional treatment modalities, either leaving the wound open to heal by secondary intention or primary closure, are the most commonly used techniques worldwide [27]. A clear benefit in terms of recurrence has, however, been seen when using off-midline closure compared with midline closure [28,29]. Simple excision with primary closure not only leads to faster convalescence but also results in a midline scar in a persistent deep natal cleft, potentially leading to high recurrence rates. Therefore, flattening the natal cleft is recommended, which decreases the generation of sweat and friction caused by buttock movement, skin maceration, and debris accumulation [30]. To avoid median recurrences and flattening of the natal cleft, numerous operative techniques have been developed, such as the karydakis technique, the Bascom procedure, rhomboid excision with Limberg flap closure, Z-plasty, or rotation flap [16,31–33]. Both open method and karydakis techniques have been suggested and favored by most surgeons for the management of pilonidal sinus among different operative procedures [5,34]. In our study, there was no significant difference between the two groups as regards age and sex; the mean operative time in the karydakis group was 45 ± 7.27 compared with 23.4 ± 4.05 min in the open group (P < 0.05%).

There was no significant difference between the two groups as regards postoperative bleeding and hematoma (P > 0.05), but there was a significantly lower rate of

wound infection in the karydakis group ($P < 0.001$, $P < 0.05$). In the karydakis group, four patients (11.4%) experienced temporary scar pain, compared with 14 patients (40%) in the open group. During the 36-month follow-up period, eight patients (22.8%) showed recurrence in the open method, whereas two patients (5.7%) had recurrence in the karydakis group ($P = 0.022$).

Al-Jaberi [35] reported a recurrence rate of 4%, minimal postoperative pain, and return to work after 3 weeks in the closed method.

Malik *et al*. [36] reported a higher complication rate in open method, for which the postoperative hemorrhage was 4% and postoperative infection was 16%, whereas in the karydakis group the overall complication rate was only 6%. In our study, no patient had postoperative hemorrhage in the karydakis group and one patient (2.8%) had hematoma, one patient (2.8%) had wound dehiscence, and one (2.8%) had wound infection; however, in the open group, two patients (5.7%) had hemorrhage. Malik *et al.* [36] recorded a mean hospital stay of 6.74 days in the open group and 3.23 days in the karydakis group, and the mean work-off period was 6.98 weeks in the open group and 2.68 weeks in the karydakis group. In our study, the mean hospital stay in the karydakis group was 1.3 ± 0.83 days compared with 3.2 ± 1.4 days in the open group; the mean healing time in the karydakis group was 16 ± 4.3 compared with 43.41 ± 8.2 days in the open group, and the mean work-off was 22.4 ± 4.7 days compared with 50.47+8.1 days in the open group. Similarly, Keshava [37] concluded that karydakis can be performed for managing primary and recurrent pilonidal sinus (PS) with low complications rate, short hospital stay, (2.5 days), and short time to return to normal activity (5 days). He also reported low recurrence rate (5%) and good long-term results. Marzouk *et al*. [38] reported significant disadvantages of the open method as regards postoperative infection rate, mobilization time, hospital stay, and work-off following a median follow-up period of 4.5 years. They reported a higher recurrence rate of 17.9% in the open group compared with 7.5% in the karydakis group ($P < 0.05$). Yildiz *et al.* [39] reported a morbidity rate of 10.5% and a recurrence rate of 2.3%. Karydakis technique requires early restriction of patient activities until wound healing is complete. In our study, the incidence rate of failed primary healing in the karydakis group was 2.8%, and healing failure in karydakis occurred because primary closure is rarely completely free of tension together with the potential infection related to its anatomical site. Despite the previous circumstances, the dehiscence incidence was low. Another advantage of karydakis technique is the possibility of flattening the natal cleft in contrast to open methods, in which there is a tendency for the healing wound edges to be drawn inward by fibrosis, recreating a deep natal cleft with a broad thin epidermal cover that is easily breakable. The main cause of recurrences in the open method is believed to be hair piercing the weak scar, rather than inadequate excision during the first operation. In our study it was noticed that recurrence not only had higher incidence in the open group but also appeared earlier than that in the karydakis group. In this comparative study, karydakis method has been reported to have lower infection and recurrence rate, shorter hospital stay, and better esthetic result. With this technique we can alter the depth of the natal cleft at the site of the sinus disease and make the suture line away from midline. It also showed better results compared with the open method, especially in postoperative pain, hospital stay ($P < 0.05$), and work-off ($P < 0.001$). The disease mostly affects patients during their second and third decades; the work-off period is of great importance to this active sector of the community. Prolonged work-off can affect their leaning process, or may cost their labor.

Conclusion

The karydakis technique showed a shorter hospital stay, earlier healing, shorter duration of work-off, and lower rate of complications compared with the open technique.

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Conflicts of interest

There are no conflicts of interest.

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