

Management of 634 Consecutive Patients with Chronic Pilonidal Sinus: A Nine-Year Experience of a Single Institute

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ABSTRACT

Objectives: Different surgical techniques, with variable morbidity and recurrence rates, have been advocated for the management of chronic pilonidal sinus (PNS). This study was conducted to report the outcome of surgical treatment of 634 cases of chronic PNS at a single institute between January 2001 and January 2010. **Methods:** Karydakis flap was performed in 244 patients (38.5%, Group 1). Excision and midline closure was performed in 371 patients (58.5%, Group 2), while the open method was used in 19 (3.0%). Data regarding patient and sinus characteristics, operative details, postoperative course, complications and recurrence were recorded. Mean follow-up was 73.5 months. **Results:** 571 patients were male (90.1%) and 63 were female (9.9%). Their ages ranged between 16 - 44 years (mean 25.7 years). The mean body mass index was 31.2 (range 23.6 - 41.9), and 71.5% (453/634) were hirsute. Chronic PNS was the first presentation (primary) in 504 patients (79.5%) and recurrent in 130 (20.5%). Overall complication rate was 16.1% (102/634) and overall recurrence rate was 8.4% (53/634). Comparing both groups showed that they were similar regarding demographic characteristics, clinical presentation, hospital stay, healing time and time off work. Operative time was insignificantly longer with Karydakis technique (mean 43.2 versus 39.1 minutes, respectively). Complications were significantly more in patients with midline closure (21%, 78/371) as compared with Karydakis procedure (9%, 22/244) ($P = 0.0001$). Likewise, there was a significantly ($P = 0.0001$) higher rate of recurrence with midline closure (12.1%, 45/371) as opposed to Karydakis technique (2.5%, 6/244). **Conclusions:** 1) PNS affects mainly young male adults who are usually, obese and hirsute, 2) Karydakis technique for the management of chronic PNS, whether primary or recurrent, is a non-lengthy, efficient procedure that has less overall complications and a lower recurrence rate than conventional excision and midline closure.

Keywords: Pilonidal Sinus; Chronic; Karydakis; Midline Closure; Recurrence

1. Introduction

Chronic pilonidal sinus (PNS) is a common disabling disorder that affects mainly young adults [1]. It has a high incidence in some countries, particularly in the Middle East and Gulf region owing to differing hair characteristics and growth patterns [2-4]. Today's most widely accepted explanation for the pathogenesis of PNS was suggested by Karydakis [3] who attributed the occurrence of PNS to three main factors: the invader (loose hair), the force (causing insertion) and the skin vulnerability (depth of the natal cleft).

Despite the variety of surgical techniques proposed for

the management of chronic PNS, the best method is still controversial. Surgery should not only eradicate the existing sinus and the crevice in which hair tends to accumulate, but also aim to establish complete and rapid primary healing and to prevent recurrence [5,6]. The ideal operation should also be simple, require short hospitalization, cause minimal morbidity, and allow rapid return to work and normal activities [7].

The present study was conducted to explore the clinical features of adult patients (>16 years) with chronic PNS admitted to Ahmadi Hospital, Kuwait (secondary care hospital) over a period of 9 years, and to report the outcome of surgical treatment of their disease.

2. Patients and Methods

2.1. Study Population

Between January 2001 and January 2010, 801 patients with PNS were treated at Ahmadi Hospital. Patients who were under the age of 16 years (n = 7) and those who presented with acute pilonidal abscess (n = 160) were excluded from the study. The remaining 634 adult patients presented with chronic (>3 months) PNS and represent the population of this study. Body mass index (BMI) was used as an objective indicator of obesity, according to the WHO anthropometric criteria for health [8], as follows: a BMI of 25 - 29.9 is overweight (grade 1), 30 - 39.9 is obesity (grade 2) and ≥ 40 is morbid obesity (grade 3). Patient disposition is shown in **Figure 1**.

2.2. Data Collection

Data regarding patient demographics, BMI, history, clinical presentation, sinus characteristics, previous management, operative details, post-operative course (duration

of hospital stay, time from the day of surgery to resumption of work or daily activities, complications and recurrence of disease), and duration of follow-up, were retrospectively collected using hospital computer records, as well as theatre and first author's log books.

2.3. Surgical Procedures and Post-Operative Regimen

Karydakis technique (eccentric flap) [3,9] was performed in 244 patients (Group 1), while sinus excision, through a midline elliptical incision, was performed in 390 patients, with direct primary closure (closed technique) in 371 (Group 2), and healing by secondary intention (open technique) in only 19. All procedures were performed under general anesthesia (patient preference/cultural factor) with the patient in the prone position and the buttocks strapped apart. One dose of intravenous second generation cephalosporin was given to all patients with induction of anesthesia. Apart from patients treated with the open technique, suction drains were routinely used

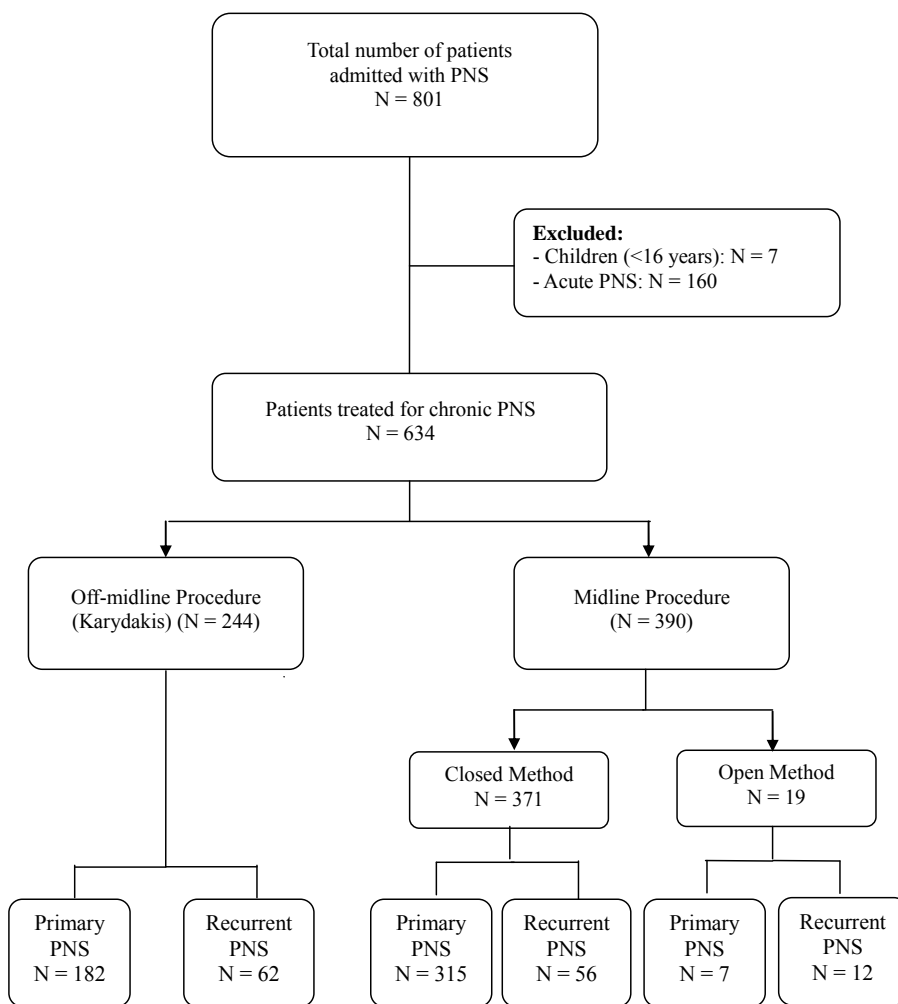


Figure 1. Patient flow diagram.

through separate stab incisions.

Post-operatively, patients were nursed supine and kept in bed for 1 - 2 days to help hemostasis by direct pressure. Antibiotics were not prescribed routinely. Patients were usually discharged from the hospital on the 2nd or 3rd day post-operatively (after drain removal), with emphasized instructions regarding personal regional hygiene and hair depilation. Sutures were removed after 10 - 12 days. Follow-up visits were scheduled at regular two- to four-week intervals for the first 8 weeks, and at 3-month intervals thereafter for 12 months for monitoring of post-operative complications and recurrence. Patients were then reviewed yearly or earlier in case of recurrence of symptoms. Mean follow-up after surgical treatment was 73.5 months (range 12 - 120 months).

2.4. Statistical Analysis

Statistical analysis was performed using the SPSS/PC version 13 computer software (Prentice-Hall; Chicago, IL). Patients who underwent midline excision and left open (n = 19) were not included in the comparisons due to their relatively small number. Accordingly, comparisons were made between Group 1 patients who underwent Karydakakis technique (n = 244) and those of Group 2 who underwent excision and midline closure (n = 371). The students t test was used to compare the mean values between the two groups. The Chi square test with Yate's correction was used for comparison between categorical qualitative values, and the Fisher's exact test was used to compare recurrences. The 5% level was set as the level

of significance.

3. Results

There were 571 men (90.1%) & 63 women (9.9%). Their ages ranged between 16 - 44 years with a mean of 25.7 years. The mean BMI of the study population was 31.2 (range 23.6 - 41.9), and 72.9% (462/634) of patients were hirsute in nature. Chronic PNS was the first presentation (primary) in 504 patients (79.5%) and recurrent in 130 (20.5%). The overall complication rate was 16.1% (102/634) and overall recurrence rate was 8.4% (53/634).

Of the 634 patients, 19 underwent excision and open technique, and were not included in comparisons due to their relatively small number (n = 19). Of the remaining 615 patients, 244 underwent Karydakakis technique (Group 1) and 371 underwent midline closure (Group 2). Half of the patients (50%, 307/615) were obese [8], and approximately three quarters (73.6%, 453/615) had overabundance of hair (hirsute nature) [10]. History of smoking was documented in 50.2% of patients (309/615) and positive family history of PNS for first-degree relatives in only 16% (98/615). As seen in **Table 1**, no significant differences between the two groups were observed in any of the aforementioned patient characteristics in addition to age and gender. Likewise, **Table 2** shows that both groups had similar clinical presentation and sinus characteristics with no statistically significant differences between them (P > 0.05). Primary PNS, as opposed to recurrent PNS, was the main clinical presentation in the two groups (74.6% versus 85.0%). Chronic

Table 1. Patient demographics and characteristics.

Characteristic Features	Group 1 (n = 244) Karydakakis Technique	Group 2 (n = 371) Midline Closure	P Value
Age(Years)			
Mean	26.5	24.3	0.736
Range	16-42	16-39	
Gender			
Male	205 (84.0%)	321 (86.5%)	0.4549
Female	39 (16.0%)	50 (13.5)	
Obesity ⁽⁸⁾	110 (45.1%)	197 (53.1%)	0.0625
Overweight (BMI 25 - 29.9)	63	106	
Obesity (BMI 30-39.9)	41	84	
Morbid obesity (BMI ≥ 40)	6	7	
Hirsute Nature ⁽¹⁰⁾	171 (70.1%)	282 (76.0%)	0.1371
History of Smoking	121 (49.6%)	188 (50.7%)	0.8567
Positive family history of PNS	43 (17.6%)	55 (14.8%)	0.4151

BMI = body Mass Index, PNS = Pilonidal sinus.

Table 2. Clinical presentation and sinus characteristics.

Characteristic Features	Group 1 (n = 244) Karydakakis Technique	Group 2 (n = 371) Midline Closure	P Value
Clinical Presentation			
Primary PNS	182 (74.6%)	315 (85.0.6%)	0.0021
Recurrent PNS	62 (25.4%)	56 (15.0%)	
Chief Symptom			
Discharge	152 (62.3%)	234 (63.1%)	0.9125
Pain	73 (29.9%)	121 (32.6%)	0.5383
Local induration	12 (4.9%)	13 (3.5%)	0.5092
Bleeding	7 (2.9%)	3 (0.8%)	0.0988
Duration of Symptoms (Y)			
0.5 - 1	52 (21.3%)	101 (27.2%)	0.1178
1 - 2	144 (59.1%)	197 (53.1%)	0.1734
2 - 3	34 (13.9%)	41 (11.1%)	0.3457
>3	14 (5.7%)	32 (8.6%)	0.2400
Location of sinuses (pits)			
Midline	125 (51.2%)	204 (55.0%)	0.4409
Off-midline	76 (31.1%)	108 (29.1%)	0.6529
Both	43 (17.7%)	59 (15.9%)	0.6525
Number of sinus openings			
1	49 (20.1%)	52 (14.0%)	0.0608
2	73 (29.9%)	133 (35.8%)	0.1506
3	88 (36.1%)	119 (32.1%)	0.2924
4	26 (10.7%)	53 (14.3%)	0.2329
5 or more	8 (3.2%)	14 (3.8%)	0.9192

discharge was the main symptom in both groups (62.3% versus 63.1%) lasting mostly for 1 - 2 years. Multiple sinuses were encountered in the majority of patients (80% versus 86%, respectively), most commonly seen in the midline (51.2% versus 55.0%, respectively) (**Figures 2(a)** and **(b)**).

Table 3 shows that operative time was insignificantly longer with the Karydakakis technique than with midline closure (mean 43.2 versus 39.1 minutes, respectively). Likewise, the two groups did not differ significantly from each other regarding the duration of hospital stay, time needed for complete wound healing, or required to resume work or normal physical activity. Overall complication rate was significantly lower in patients with Karydakakis procedure (9%, 22/244) than those with midline closure (21%, 78/371) ($X^2 = 14.718$, $P = 0.0001$). Wound infection and/or dehiscence (**Figure 3**) was seen in 13 patients (5.3%) in Group 1 as opposed to 47 (12.7%) in

Group 2 ($X^2 = 8.194$, $P = 0.0042$). Recurrence (**Figure 4**) was observed in 6 patients (2.5%) with Karydakakis technique and in 45 (12.1%) with midline closure ($P < 0.0001$).

Table 4 summarizes the characteristics related to first surgery in patients who presented with recurrent PNS (n = 130). The mean age at first surgery was 22 ± 2.5 years. Regarding the type of surgery, most patients underwent excision and midline closure (75.4%) and 17.7% of patients underwent excision and open technique. Only 9 patients (6.9%) had 2 previous procedures. Wound complications after the primary surgery were recorded in approximately one third of the patients (36.2%), and most recurrences (105/130, 80.8%) were seen within the first 3 years post-operatively.

Figure 5 shows that the complication rate was significantly higher with midline closure as compared to Karydakakis technique for patients with *primary* PNS (18.4%



Figure 2. (a) (b). Two different male patients with primary chronic PNS presenting with multiple midline sinuses. Note the presence of hair.

Table 3. Operative time and postoperative course.

Characteristic Features	Group 1 (n = 244) Karydakis Technique	Group 2 (n = 371) Midline Closure	P Value
Operative Time (Hours)			
Mean \pm SD	43.2 \pm 8.9	39.1 \pm 6.8	0.746
Range	40 - 55	30 - 45	
Hospital Stay (Days)			
Mean \pm SD	2.7 \pm 0.7	2.2 \pm 0.5	0.393
Range	2 - 5	2 - 4	
Wound Healing (Days)			
Primary (X = 9 - 11)	234 (95.9%)	330 (88.9%)	0.251
Secondary (X = 18 - 21)	10 (4.1%)	41 (11.1%)	
Time off work (Weeks)	3 - 4	3 - 4	0.831
Complications	22 (9.0%)	78 (21.0%)	0.0001*
Seroma	9 (3.7%)	27 (7.3%)	
Wound infection	7 (2.9%)	24 (6.5%)	
Partial wound dehiscence	3 (1.2%)	12 (3.2%)	
Infection + dehiscence	3 (1.2%)	11 (2.9%)	
Bleeding	0	4 (1/1%)	
Recurrence	6 (2.5%)	45 (12.1%)	0.0001*

*Statistically significant difference ($P < 0.05$).

(58/315) versus 8.2% (15/182), respectively) ($X^2 = 8.729$, $P = 0.0031$) and also for those with *recurrent* PNS (35.7% (20/56) versus 11.3% (7/62), respectively) ($X^2 = 8.611$, $P = 0.0033$). Similarly, as shown in **Figure 6**, the recurrence rate was significantly higher with midline

closure than Karydakis technique for both *primary* PNS (11.4% (36/315) versus 2.2% (4/182), respectively, $P = 0.0001$) and *recurrent* PNS (16.1% (9/56) versus 3.2% (2/62), respectively, $P = 0.0243$). However, within the Karydakis Group, results were similar for both primary

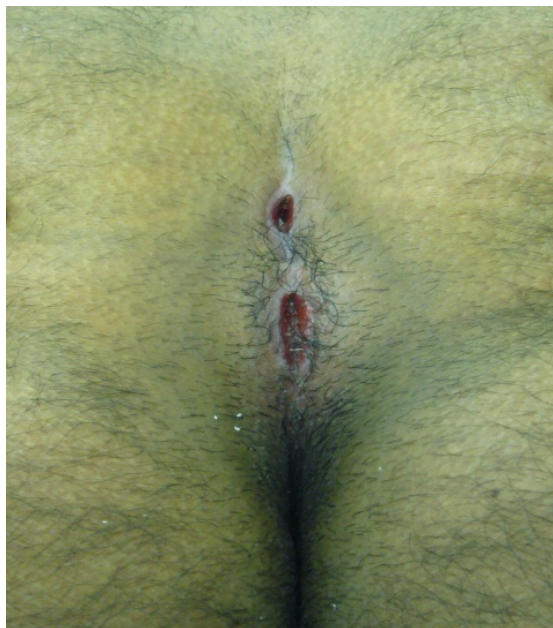


Figure 3. A 24-year-old gentleman with partial wound dehiscence after sinus excision and midline closure. Note hirsute nature of the patient.



Figure 4. Recurrent chronic PNS (white arrow) in a 36-year-old female patient. Note the scar of previous surgery (midline closure)(red arrow).

and recurrent PNS in terms of complication rate (8.2% versus 11.3%, respectively) and recurrence rate (2.25 versus 3.2%, respectively). On the other hand, though patients with primary and recurrent PNS who underwent midline closure had similar recurrence rate (11.4% versus 16.1% respectively), yet those with recurrent disease had a significantly ($X^2 = 7.562, P = 0.0060$) higher complication rate (35.7% (20/56) versus 18.4% (58/315).

Table 4. Characteristics related to first surgery in patients who presented with recurrent PNS.

Characteristic Features	Recurrent PNS (n = 130)
Age at first surgery (Years, X ± SD)	22 ± 2.5
Type of previous surgery	
Midline (Closed Method)	98 (75.4%)
Midline (Open Method)	23 (17.7%)
Two procedures	9 (6.9%)
Wound complications after first surgery	47 (36.2%)
Timing of recurrence after first surgery	
6 m - 1 y	57 (43.8%)
1 y - 3 y	48 (36.9%)
3 y - 5 y	19 (14.7%)
>5 y	6 (4.6%)

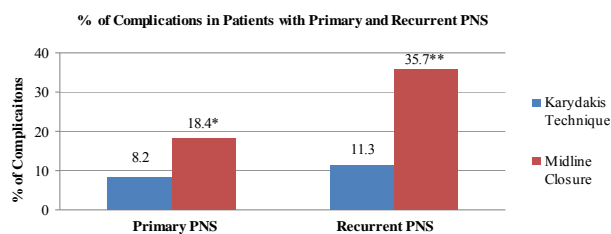


Figure 5. Bar chart showing the complication rate among patients with primary and recurrent PNS undergoing Karydakis technique versus excision and midline closure. Note significant differences between both groups ($X^2 = 8.729, P = 0.0031, X^2 = 8.611, P = 0.0033$).

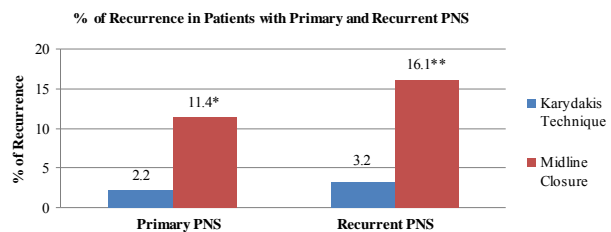


Figure 6. Bar chart showing the recurrence rate among patients with primary and recurrent PNS undergoing Karydakis technique versus excision and midline closure. Note significant differences between both groups ($P = 0.0001, P = 0.0243$).

4. Discussion

Initially thought to be congenital in origin, it is now appreciated that hair insertion not only causes PNS, but also prevents spontaneous recovery, delays healing, and is the main cause of recurrence [3]. The natural depth of the natal cleft is very vulnerable to hair insertion because of a number of congenital or acquired characteristics that

vary widely from one person to another according to age, gender, race, body constitution and the type of operation performed previously [3]. The most obvious contributing factors to the high incidence of PNS observed herein were the hirsute body habitus of the population (mostly young men), poor personal hygiene, family history, and obesity which results in a tendency to increased depth of the natal cleft, increased friction, and a tendency to softness and maceration in depth. Obesity has been reported in the literature not only to predispose to the development of PNS [11], but also to be associated with prolonged surgery [12], longer hospital stay [12], higher postoperative complication [12], and recurrence rates [13].

Surgery for chronic PNS should not only eradicate the existing sinus and the crevice in which hair tends to accumulate, but also aim to eliminate factors that predispose to formation of other sinuses [3,12]. Day surgery with simple lay-open, curettage, brushing, or phenol injection may eliminate the hairs and cure the sinus but the midline wound may take several weeks to heal, and there is a significant recurrence rate because of the open portal for hair insertion [7]. Thus, the advantage of simple day surgery may be outweighed by the longer time to return to work and the greater likelihood of a further operation with longer hospitalization for recurrence.

For sinus excision through a midline approach, the wound can be primarily closed, marsupialized, or left open to heal by secondary intention [14]. Excision with an open wound involves prolonged hospitalization or clinic attendance for many painful dressings and takes months to heal. Both this method and excision with marsupialization leave a portal in the midline for further hair entry and have a significant recurrence rate [15-19]. Several studies have demonstrated superiority of excision with primary closure over excision with an open wound, by providing less bleeding, lower infection, reduced wound pain, fewer postoperative visits, shorter time off work, and faster healing time [16,18,20-22], albeit with a higher recurrence rate [23-25], reaching up to 50% [1,4,12,26,27]. Still however, midline excision and primary closure remains the most commonly adopted technique worldwide [28]. In the present study, recurrence rate with the closed method was 12.1% (45/371). After surgical excision, the base of the unhealed surgical wound is believed to become filled with granulation tissue, hair, and skin debris, which is a nidus for the ongoing foreign body reaction that takes place to create the chronic disease. The known predisposing intergluteal anatomy that draws hair into the PNS cavity or surgical wound, is also thought to precipitate the extensive chronic and recurrent disease.

A successful procedure for treating and preventing recurrence of PNS would therefore be one that results in

removal (excision or displacement) of the vulnerable raphe, and avoidance of any wound scar in the depth of the intergluteal fold. It should also be as simple as possible to shorten the duration of in-hospital stay and minimize time off work. This is achieved by the asymmetric eccentric Karydakias flap, which reduces the depth of the natal cleft and ensures that all parts of the wound and all suture holes are away from the midline. In his own review of more than 6000 cases, Karydakias [3] demonstrated fast healing with a wound complication rate of 8% and recurrence rate of 2%. In this study, 95.9% of patients who underwent Karydakias operation had primary wound healing within 9 - 11 days and a hospital stay of about 3 days. Recurrence was observed in only 2.5% of patients, which is significantly lower than that observed with midline closure (12.1%). Likewise, Can *et al.* [6] who operated on 200 patients with PNS reported a 4.6% recurrence rate with Karydakias flap and 18.4% with midline closure. Akinci *et al.* [29] reported an even lower recurrence rate (0.9%) after Karydakias procedure in a large series of 112 patients. Patel and colleagues [30] using Karydakias' method, avoided recurrence and unhealed midline wound, albeit with an inpatient stay of 5 days. Anyanwi *et al.* [31] treated also 28 patients by this procedure and reported no recurrences after a median follow-up of 3 years. Applying the same technique, both Kitchen [32] and Al-Jaberi [33] reported a recurrence rate of 4%. Moreover, Sakr *et al.* [12] reported a recurrence rate of 3.13% with the Karydakias flap used exclusively for obese patients and a hospital stay for a mean of 3.2 days.

In the present study, more postoperative complications were encountered in patients with midline closure mainly wound infection with or without wound dehiscence. Similar results of low complication rate with Karydakias method, though with a shorter period off-work (2 weeks) than that observed herein (3 - 4 weeks), were reported by other authors [30,31,33,34]. However, it is worth mentioning that neither of these two procedures offers any advantage over the other in terms of operative time, duration of hospital stay, time needed for wound healing, or to return to normal physical activity.

Numerous plastic flap-based procedures aimed at stopping hair insertion by flattening the natal cleft, including rotation flap, rhomboid flap, and Z-plasty were reported to provide a low recurrence rate [11]. Although beyond the scope of this study, it is noteworthy that Karydakias flap is simpler and does not require time-consuming, sophisticated surgery, extensive mobilization, or real transposition. Moreover, a trap for loose hair is created, especially at the lower part of the natal cleft, if these methods leave the lower part of the wound in the midline, together with an un-excised part of the vulnerable raphe [3].

Some of the variables associated with recurrence of

PNS are believed to be related to the “patient” such as obesity, hirsute nature, smoking, positive family history, and age at first surgery. Other factors are related to the “primary procedure”, such as type of surgery, post-operative wound complications (mainly infection) and the timing of recurrence postoperatively [35]. All such variables were similar between the two groups under comparison, and so were the “sinus characteristics” that included the chief symptom, duration of symptoms, as well as location and number of sinuses. In 2010, Nursal *et al.* [36] reported that younger age, recurrent cases, sinus discharge on physical examination, and post-operative infection were independent predictors of recurrence. In addition, Cubukcu *et al.* [13] reported that obese patients have a higher risk of PNS recurrence; however, Doll *et al.* [37] did not find obesity to have any negative influence on recurrence rate, and emphasized that long-term recurrence rate was significantly elevated when family history was positive and when surgery was needed at a younger age. In this study, 43.81% of the patients admitted with recurrent PNS developed their recurrence within the first year post-operatively, and 80.7% by 3 years. Only 4.6% of recurrences occurred after 5 years. Similar to our findings, Doll *et al.* [38], who followed-up their patients for up to 20 years, reported that 71% of recurrences occur in the first 4 years post-operatively and recommended a follow-up of at least five years.

Relatively few data exist that focus on an optimal surgical approach that should be followed in cases of recurrent PNS [39]. In a previous communication, we reported that Karydakakis technique was superior to midline closure for the management of chronic PNS by yielding significantly lower recurrence and post-operative complication rates [4]. In this study, we compared also the results of Karydakakis technique versus midline closure in patients with “primary” and “recurrent” PNS separately, and demonstrated that complication and recurrence rates were significantly less with the Karydakakis flap in both subgroups. Over a 5-year period, Sondenaar *et al.* [35], treated 44 patients with recurrent PNS using excision and primary midline closure. They reported a high re-recurrence rate of 59.1% (26/44) during the first year post-operatively and attributed this high incidence, at least in part, to the high rate of post-operative infection. Post-operative complications are encountered more when midline closure is used to treat patients with recurrent PNS as compared to those with primary disease. Tension on the suture line and risk of accumulating hair in the midline clefts are considered the main problems associated with direct midline closure [40].

On the other hand, Karydakakis technique has been shown to have a low recurrence rate ranging between 0% and 4.6% [4,12,27,29,41,42]. These reports however, do not reflect the results obtained exclusively for manage-

ment of recurrent disease. Sakr *et al.* [4] for example, recorded recurrence in 2 out of 79 (2.5%) patients with chronic PNS treated with Karydakakis flap (mean follow-up 30.4 months); however, only 16.5% of the patients (13/79) were treated for recurrent PNS. The low re-recurrence rate (3.2%) associated with Karydakakis technique reported herein confirms the advantage of Karydakakis flap over midline closure in managing recurrent cases, since it flattens the natal cleft, removes the vulnerable raphe, and avoids any wound scar in the depth of the inter-gluteal fold. Karydakakis technique provides equal benefits of low complication and recurrence rates when used to treat both primary and recurrent PNS. Fashioning the flap with an appropriate thickness, tension-free flap fixation, and the prevention of collection by meticulous hemostasis and short-time suction drainage appear to be the keys to avoiding complications and recurrence after Karydakakis procedure [27].

Based on the data presented, it may be concluded that 1) PNS affects mainly young, male, adults, who are usually, obese and hirsute, 2) the majority of patients with recurrent disease present within 3 years of the first surgery, 3) contrary to Karydakakis technique, midline closure yields more post-operative complications when used to treat recurrent PNS as compared to primary PNS, and 4) Karydakakis technique for the management of chronic PNS is a non-lengthy, efficient procedure that has less overall post-operative complications and a lower recurrence rate than conventional excision and midline closure, irrespective of the location of the sinuses, and whether PNS is primary or recurrent. Identifying independent variables responsible for post-operative morbidity and recurrence merit further investigation.

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