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Short-term results of Karydakis flap for pilonidal sinus disease

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Abstract Background Because of the higher quality of life that the Karydakis flap provides compared to excision-only treatment, it became a recommended closure technique for pilonidal sinus disease. This study aimed to evaluate whether Karydakis flap technique can be performed in potentially infected tissue if the surrounding cellulitis allows wound closure. **Methods** 188 patients with pilonidal sinus who underwent excision only ($n=91$, 48%) or the Karydakis-flap technique ($n=97$, 52%) were evaluated. The results were reviewed according to the degree of wound contamination, and the effects of closure technique were studied in terms of early wound complications and the duration of hospital stay. **Results** In the excision-only group, one patient developed a hematoma (1%) and one patient had cellulitis of the surrounding tissue (1%), which resulted in a 2% complication rate this group. In the Karydakis flap group, wound abscesses were observed in 12 patients (12%).

Additionally, four patients (4%) had hematomas, two patients had seromas (2%) and three had other complications. For the Karydakis group, the overall complication rate was 21%, significantly higher than that for the excision-only group ($p<0.01$). In the Karydakis group, no association was found between complications and the degree of contamination ($p=0.36$). **Conclusions** These data provide evidence that the Karydakis flap technique might be performed even in potentially infected tissue. Although a considerable number of wound-related complications was observed in the Karydakis flap group, the majority of patients had primary healing. Thus, from our viewpoint, the Karydakis flap seems to be a potential alternative to simple excision in infected pilonidal sinus disease.

Key words Pilonidal sinus • Surgery • Flap technique • Karydakis • Complication • Infection

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Introduction

Excision is the basic treatment modality for pilonidal sinus disease, especially in acute infected conditions. However, open treatment is associated with a prolonged healing process which might need up to months of treatment [1, 2].

With the intention to reduce the recurrence rate by flattening the anal cleft, a large variety of closure techniques for chronic pilonidal disease has been described within the past decades [1, 3]. The techniques are mainly recommended for chronic disease. Thus, the question arises whether to provide the benefit of wound closure for patients presenting with potentially infected pilonidal sinus [4]. In order to evaluate the impact of surgical technique in potentially infected tissue, we reviewed our data with special respect to wound contamination in a group of patients with pilonidal sinus disease treated by excision only or excision with Karydakis flap closure.

Patients and methods

Between January 2003 and December 2005, 188 patients with pilonidal sinus disease were treated surgically at the Department of General and Abdominal Surgery at the Dresden-Friedrichstadt Hospital, exclusively. One out of a group of six staff surgeons performed the procedure. All patients were included consecutively in a prospective observation study.

Wound contamination

The degree of contamination was categorized according to the Cruse and Foord classification [5] modified for pilonidal sinus disease (Table 1).

Surgical procedure

The operation was standardized during the years of the study. Whether to perform a flap technique was based on the surgeon's judgment. The main criteria for the decision to perform Karydakis flap were whether the inflammatory response of surrounding tissue allowed the flap technique. In cases in which the cellulitis of the surrounding tissue was too severe, the pilonidal sinus was excised without attempting to close the wound. All patients with grade 4 contamination were operated under emergency situations. For the surgical procedure itself, a standardized consent was obtained from the patient. However, no approval by an ethics committee was recommended.

Surgery was regularly performed under general anesthesia; patients were placed in jack-knife position followed by shaving and preparation of the skin by administration of isopropanol and povidone iodine solution. Single-shot antibiotic was given regularly for the closure procedure using ampicillin and sulbactam (3.0 g iv; Unacid, Pfizer, Karlsruhe, Germany). Neither bacterial swab sampling was routinely done nor were antibiotics routinely continued.

Using an ellipsoid incision, the pilonidal sinus was excised to the level of the sacral fascia. Care was taken that the fistula system was removed en bloc without perforation of potential abscesses. Methylene blue or other agents to visualize the border of the cysts were not used routinely.

The Karydakis flap technique was performed to lateralize the natal cleft. An asymmetric ellipsoid excision was made lateral to the natal cleft. After excising the pilonidal sinus down to the

level of the sacral fascia, the flap was mobilized on the level of the gluteal fascia. After mobilising the flap, a Redon-drainage was inserted and a double layer Vicryl 3–0 suture of the subcutaneous tissue closed the defect. Skin closure was made by single knots of 4–0 polypropylene in Donati technique [6, 7]. The drainage was removed routinely on the second postoperative day. As recommended by Karydakis, patients were asked to rest in bed for two days; regular diet was provided, and patients left the hospital whenever they felt comfortable [8].

Statistical methods

Statistical analysis was carried out using the Statistical Package for Social Science (SPSS) version 10.0.7 (SPSS, Chicago, USA). Pearson's chi-square test was used to compare frequencies between groups. Comparison of means was performed using the *t* test. Variables with a *p* value less than 0.05 were considered to be significantly different between groups.

Results

A Karydakis flap was carried out in 97 (52%) of 188 patients with pilonidal sinus disease (Table 2). In this group, a wide range of grades of contamination was observed. The remaining 91 patients with pilonidal sinus disease (48%) underwent excision treatment only. In this group, nearly all patients (89 of 91) had grade 4 contamination; these patients were treated in emergency situation.

Complications

The mean follow-up for all patients was 30 days (SD=10 days). A total of 23 patients (12%) had wound-related complications in the early postoperative period. No general complications were observed. The majority of these cases were septic complications necessitating reopening of the wound. In the excision-only group, one of 91 patients developed a hemorrhage and a hematoma and one patient

Table 1 Modified Cruse and Foord categorization of wound contamination in pilonidal sinus disease

Degree of contamination	Description
1	Clean wound without any evidence of infection; pilonidal sinus disease with pits without discharge at the time of operation
2	Clean but potentially contaminated wound, e.g. a pilonidal sinus with clear discharge from pits
3	Pilonidal sinus with pus discharge from the pits, but no severe inflammatory reaction or only minor cellulitis
4	Severely infected pilonidal sinus with pus from the pits or serious inflammatory reaction such as severe cellulitis or an abscess

Table 2 Characteristics of 188 patients with pilonidal sinus disease, by treatment group. Values are mean (SD) unless otherwise indicated

Variable	Karydakis flap group (n=97)	Excision-only group (n=91)
Age, years	27.3 (8.8)	27.7 (9.4)
Males, n (%)	71 (73)	63 (69)
Body mass index, Kg/m ²	25.6 (3.9)	27.3 (4.0)
Contamination, no. of patients		
Grade 1	6	1
Grade 2	40	0
Grade 3	23	1
Grade 4	28	89
Previous operations, no. of patients		
0	74	68
1	15	14
2	7	4
>2	1	1
Operation time, min	40 (16)	15 (9)
Hospital stay, days	5 (1)	4 (1)

Table 3 Characteristics of the subgroup of 117 patients with pilonidal sinus disease and severe contaminated tissue (grade 4 infection), by treatment group. Values are mean (SD) unless otherwise indicated

Variable	Karydakis flap subgroup (n=28)	Excision-only subgroup (n=89)	p
Age, years	27.3 (9.2)	31.1 (18.1)	0.15
Males, n (%)	20 (71.4)	61 (68.5)	0.08
Body mass index, Kg/m ²	26.2 (3.7)	27.3 (4.1)	0.69
Previous operations, no. of patients			
0	22	68	0.94
1	5	14	
2	1	4	
>2	0	1	
Operation time, min	43 (18)	15 (9)	<0.01
Hospital stay, days	5 (1)	4 (2)	0.08

had cellulitis of the surrounding tissue, which was treated conservatively by oral antibiotics for five days (ampicillin and sulbactam; Unacid PD Oral, Pfizer). In the Karydakis group, 21 of 97 patients (21%) had complications, including 12 patients with wound abscess. The mean time to revision was 9 days (SD=7 days). The infection was managed routinely without general anesthesia by removing the stitches, opening and cleaning the wound cavity. Only in one of these cases a Penrose drain was inserted. An additional four patients developed a hematoma (4%) with the need for wound revision in two of these cases after a mean of 6 days (SD=6 days). Two patients (2%) had seroma formation, treated with fluid aspiration. A further two patients (2%) had cellulitis of the surrounding tissue without the need for intervention, and one patient (1%) had wound failure without evidence of infection. In this case, the stitches were removed 8 days after surgery. The chi-square test revealed a significantly higher frequency of complications in the Karydakis flap group ($p<0.01$).

The evaluation of septic complications with respect to the contamination classification showed, in the Karydakis flap group, one abscess in 6 patients with contamination grade 1 (17%), two infections in 40 patients with grade 2 (5%), four abscesses in 23 patients with grade 3 (17%) and 5 infections in 28 patients with grade 4 (18%). This resulted in an insignificant difference in the frequency of septic complications according to the degree of contamination in the chi-square test ($p=0.36$). There was also no significant difference in the frequency of septic complications when patients with grades 1–3 contamination were compared to those with grade 4 contamination (15 complications among 68 patients vs. 7 complications in 28 patients; $p=0.26$).

To better understand the higher rate of complications in the Karydakis flap group, we performed a subgroup analysis of only those patients with grade 4 contamination (Table 3). The 28 Karydakis flap patients and 89 excision-only patients were similar in terms of age, gender, body mass index and

number of previous operations. Thus, no demographic characteristic could easily explain the worse outcome among patients treated with the Karydakis flap.

Discussion

Pilonidal sinus is a common disease and its high incidence among young males is well described [9, 10]. Besides the simple unroofing or lay open technique, in chronic pilonidal sinus disease without signs of acute infection a primary closure is the favored surgical option. Simple excision and open wound healing cause more patient discomfort, lengthen hospitalization and require more time off work [11]. Probably the most often used procedure is primary wound closure by wound suture in the midline of the nates. This procedure is associated with a relatively high complication rate [1], such as failure of primary wound healing and late pilonidal recurrence. Thus, a large variety of flap techniques to cover the wound cavity have been introduced [3].

The guiding idea of other full-thickness flap techniques is to flatten the natal cleft, which should 'solve every pilonidal problem' [12]. We choose the Karydakis flap technique, which is characterized by asymmetric excision of the pilonidal sinus and lateralization of the natal cleft. From our understanding, the Karydakis technique has several advantages over other flap techniques. First, this technique provides all theoretical advantages of flap techniques such as flattening of the anal cleft and potentially better oxygenation of the wound outside the midline. Second, this technique is relatively simple to learn. This point is important because the vast majority of these procedures is performed at night and every surgeon in a large department must be familiar with this technique to ensure consistent quality. The third advantage is that if wound-reopening becomes necessary because of infection, the defect is not as large as it would be for reopening, for instance, a Limberg flap.

In the Karydakis flap group, the infection rate was 12%. Although this is nearly 10-times that in the excision group, this result is similar to published data from larger series on wound infection after asymmetric procedures [8, 13–17]. Nevertheless, this substantial complication rate in the Karydakis flap group needs to be improved. One option to improve the results is to better select the patients who undergo a flap technique. In this context, it is worthwhile evaluating the degree of contamination prior to surgery, e.g. by bacterial swab sampling and bacterial culture. However, the evaluation of swab samples is time consuming and for decision making in acute surgery a clinical classification needs to be established. Thus, the classification of the degree of contamination was performed in this study according to a modified Cruse and Foord scale [5].

Introduced in the early 1970s, this clinical classification proved to be a simple but effective tool to differentiate surgical wounds according to grades of potential bacterial contamination. Obviously the clinical contamination grade is not an absolute classification system; the differentiation between grades 2 and 3 is somehow weak. Nevertheless, the Cruse and Foord classification has been shown to be a reliable instrument for wound classification in ten thousand patients [18].

Since the majority of complications were related to infection, this aspect has to be elucidated. Local antibiotics seem not to be helpful to improve the rate of primary closure. For example, Brieler [19] observed a group of patients with primary closure combined with local antibiotics and concluded that the application of antibiotic carriers does not raise the rate of primary wound healing. A variety of antibiotic agents and different schedules has been proposed for pilonidal sinus surgery. Lundhus et al. [20] found no difference between one and four days of metronidazole and ampicillin application. In contrast, Chaudhuri and co-workers [21] demonstrated a potential benefit of a 5-day multidrug antibiotic regimen compared to single-dose metronidazole. To keep a routine antibiotics regimen, we gave a single shot of ampicillin and sulbactam to all patients undergoing a flap technique independent of the degree of contamination. Following recommendations of the German Arbeitskreis Krankenhaus- und Praxishygiene der AWMF (www.awmf.de) for wound contamination of grades 2 and 3, routine single-shot application of ampicillin in combination with sulbactam was given. In addition, we provided antibiotics for closing procedures even in grade 4 contamination, based on the idea that these patients would substantially benefit from a single-shot dose of a beta-lactamase-inhibiting aminopenicillin [22]. Probably it would be useful to continue antibiotics in this special group, as suggested by others [21, 23]. The combination of ampicillin and sulbactam covers the majority of bacteria growing in the pilonidal sinus cavity, such as gram-positive aerobes and gram-negatives like *E. coli*. Furthermore, ampicillin and sulbactam are useful for most observed anaerobics in pilonidal sinus, such as *Bacteroides fragilis* and peptostreptococcus [24].

Since the Cruse and Foord classification failed to predict septic complications, other variables could be worthwhile to take into consideration. Fuzun et al. [25] proposed that the treatment of chronic pilonidal sinus should be based on patients' preference and characteristics, especially employment status, because a successful primary closure significantly reduces time of illness and time off work.

Pilonidal sinus disease might always be considered as an infected situation [24]. Thus, the question arises whether it is justified to perform a closing procedure. Our data provide evidence that, despite an infected sinus, the majority of patients benefited from surgery by facing

wound healing within two weeks of surgery. Therefore, from our understanding it is correct to offer this option even to patients with infections. Nevertheless, it has to be emphasized that excision only is the basic treatment option for infected sinuses and, if a closing procedure is suggested, patients need to be well informed about the potential threat of septic complications.

The hospital stay recorded in this study is relatively long compared to international standards and obviously excision only could also be performed on a day care basis [26]. However, in recent years the German health care system did not provide clinics for day care surgery in general hospitals and since payment was based on the number of days, patients stayed as inpatients. Moreover several authors provided evidence that, compared with other surgical procedures, flap techniques are associated with earlier discharge from hospital and increased patient comfort [27, 28]. In addition, Sondenaar et al. [29] showed in an economic analysis that excision with primary closure of chronic pilonidal sinus causes less morbidity and is more cost effective than excision with open packing.

In conclusion, keeping the major limit of the non-randomized study in mind (i.e. that a bias is possible since the surgeons might have chosen to perform excision in the clinically worse cases), the data presented here provide evidence that the Karydakis flap technique might be performed even in potentially infected tissue. Although, a considerable amount of wound-related complications was observed in the Karydakis group, the majority of patients had primary healing. Since it is known that primary closure is more cost efficient and the quality of life is improved after closure technique, this opportunity should be offered to all patients that are suitable for closing procedures. Thus, from our viewpoint, Karydakis flap seems to be a potential alternative to simple excision in infected pilonidal sinus disease if the cellulitis of the surrounding tissue allows the closing procedure. In this context, it would be worthwhile to compare Karydakis flap to other flap techniques in an appropriate trial.

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