

Continuing Medical Education

# The Management of Pilonidal Sinus

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## Summary

**Background:** Pilonidal disease is an acute or chronic infection in the subcutaneous fatty tissue, mainly in the natal cleft. Its incidence in Germany in 2012 was 48 cases per 100 000 persons per year.

**Methods:** This review is based on pertinent publications retrieved by a selective literature search.

**Results:** The numerous minimally invasive techniques that are available for the treatment of pilonidal disease have the advantages of being relatively atraumatic and of enabling the patient to continue working almost without interruption. They are suitable for small lesions that have not been previously surgically treated. These techniques are associated with a higher recurrence rate than excisional methods (level of evidence [LoE]: Ib). It is not yet clear whether minimally invasive techniques employing laser or endoscopic technology can reduce the recurrence rate. In systematic meta-analyses, the duration of wound healing was shorter after off-midline techniques (the Karydakis procedure, the Limberg procedure, and others) than after excision with open wound treatment; the off-midline techniques should, therefore, be preferred for patients who have undergone previous surgery and for those with large lesions (LoE: Ia). Excision with midline suturing should not be performed (LoE: Ia). Postoperative permanent shaving cannot be recommended either (LoE: IV).

**Conclusion:** Further randomized trials are needed to clarify the role of newer techniques in the treatment of pilonidal disease.

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**P**ilonidal disease is an acute or chronic infection in the subcutaneous fatty tissue, mainly in the natal (intergluteal) cleft. The term “pilonidal” means “nest of hair”. Its incidence in Germany in 2012 was 48 cases per 100 000 persons per year (1). Although it is usually easily treated and carries a favorable prognosis, recurrences and wound complications do occur in a minority of cases. Much has been written about pilonidal disease internationally, but there are still widely divergent conceptions of its optimal treatment. In this review, we present the current state of the debate on the treatment of this condition on the basis of the German S3 guideline of 2014 (1).

### Learning objectives

After reading this review, the reader should

- be acquainted with the current state of knowledge of the pathogenesis of pilonidal disease,

- understand the main advantages and disadvantages of each surgical technique used to treat it,
- and know the recommendations for the management of acute pilonidal abscess.

### Method

The content of this review is based on publications retrieved by a systematic search in the PubMed database including articles published before 28 May 2017, employing the terms “sinus” and “pilonidal\*<sup>†</sup>”. Publications before 1990 were considered if they were still relevant to the topic. Further publications were identified from the reference lists of numerous reviews. The American and Italian guidelines (2, 3) were considered as well, as were review articles and current analyses from the Cochrane database (4, 5).

### Definition

Pilonidal disease is an acute or chronic infection in the subcutaneous fatty tissue, mainly in the natal (intergluteal) cleft. Much has been written about pilonidal disease internationally, but there are still widely divergent conceptions of its optimal treatment.

### Postoperative recurrences and wound complications

Wound complications are not rare, particularly when the wound has been closed primarily. There is no generally accepted definition of a recurrence after surgery for a pilonidal sinus.

## Pathogenesis

Pilonidal disease is now considered an acquired condition of the hair follicles. In the dermatological literature, it is counted as one of four conditions constituting the so-called follicular occlusion tetrad (6). The central pathological event in these conditions is thought to be follicular hyperkeratosis (7), leading to obstruction of the infundibulum of a hair follicle. The follicle becomes dilated and ruptures, leading to secondary infection and the formation of fistulae and abscesses. This theory has not, however, been confirmed by any new research in the last 30 years. On the contrary, Karydakis already hypothesized in the 1970s (8) that fistulae arise only when free hairs perforate the vulnerable, but still intact skin. The hairs that are found in the subcutaneous sinus cavity seem to be broken (8) or cut head and neck hairs, i.e., hairs that have been separated from their follicles (9). It is unclear how they reach the subcutaneous space. Karydakis (8) suspected that they become implanted in the natal cleft and then bore deeper and deeper into the subcutaneous tissue, in the manner of a screw. The keratin flakes of these hairs function as barbs that permit movement in one direction only. This theory clearly diverges from the theory of hyperkeratosis and follicular occlusion. Bascom (7) hypothesized that hyperkeratosis, obstruction, and follicular rupture are the primary events and that the hairs only secondarily come to lie in the preformed openings. Brearley (10) showed experimentally that movement of the gluteal musculature leads to negative pressure in the pilonidal sinus, drawing the free hairs inward. Nonetheless, the fact that pilonidal disease can arise in the interdigital space of hairdressers seems rather to confirm the theory of Karydakis.

A fistulous opening in the natal cleft is called a pit. A cavity (sinus) in the subcutaneous tissue is found in all cases. In the 1930s, the sinus was thought to be an epithelialized cyst, and the notion therefore arose that the condition is congenital (11). Later, however, Patey (12) and others (7) showed that the subcutaneous cavity is actually lined by granulation tissue.

## Clinical features and diagnostic evaluation

The symptoms depend on the mode of presentation. The asymptomatic form is characterized by one or more non-inflamed pits in the natal cleft and is only discovered as an incidental finding. Pilonidal abscess presents with swelling and pain in the natal cleft, usually in a paramedian location. In the chronic phase, there is a continuous or intermittent serous or purulent discharge, either from the pits (rare) or from the lateral secondary openings

(Figures 1 and 2). Recurrent abscesses can occur, but remissions lasting many years are quite frequent. The diagnosis can be established clinically as the appearance of pits in the natal cleft is highly typical. The pits are easy to overlook at the time of abscess formation because of the swelling, but they are generally readily visible two to three weeks after the abscess is opened or perforated. Ultrasonography, endoscopy, computed tomography (CT), and magnetic resonance imaging (MRI) are generally not indicated unless there is a difficulty in differentiating the finding from Crohn's disease, cystic formations, or neoplasia. Hidradenitis suppurativa is a further element in the differential diagnosis.

## The definition of recurrence

The recurrence rate is the most important variable for the comparative assessment of different modes of treatment, but there is no generally accepted definition of what constitutes a recurrence. In most publications on pilonidal disease, recurrence is not defined at all. In one publication, it is stated that "the term 'recurrence' was used when symptoms of the disease recurred some time after complete wound healing" (13). In some patients, however, surgical treatment is followed by a chronic, non-healing wound (Figure 3), and there are no clear data on how often this happens. Such wounds are often operated on a second time. From the academic perspective, absence of wound healing is not correctly designated as a recurrence; nonetheless, from the patient's point of view, the only relevant fact is that repeat surgery became necessary. Therefore the term "treatment failure" (i.e. newly arising fistulae, chronic wound after excision and any kind of repeat surgery), would be preferable over the term "recurrence", as is still used in the literature.

## Acute abscess formation

Simple incision should be performed instead of complete excision, even though the latter is still traditionally used in many centers (level of evidence [LoE]: IV) (14). Incision can generally be performed under local anesthesia on an outpatient basis (Figure 2). An incision outside the natal cleft is recommended (e1) in order to avoid the formation of poorly healing median wounds (LoE: V). A few weeks after incision of the abscess, the pits become visible and definitive treatment can be provided. Permanent healing after abscess incision alone is possible, but rare (15). Some authors prefer to aspirate pus and give antibiotics, rather than incising the abscess (16). Antibiotics can bring about the resolution of small abscesses but cannot be generally recommended.

## Pathogenesis

There are conflicting pathogenetic hypotheses, in which fistula formation is attributed either to hyperkeratosis followed by the dilatation and rupture of a hair follicle, or else to perforation of the skin by hairs that have been shed or cut.

## Clinical features

A pilonidal abscess is characterized by painful swelling, usually in a paramedian location adjacent to the natal cleft. In the chronic stage, there is an intermittent serous or purulent discharge.

**Figure 1:** Chronic pilonidal disease. The openings in the natal cleft, so-called pits, correspond to the destroyed hair follicles. The fistulous openings outside the natal cleft (arrow) have no conventional definition; in this article, they are called secondary lesions.



### Minimally invasive techniques

#### Pit-picking and similar techniques

A minimally invasive treatment was described initially in 1965 by Lord and Millar (17) and in a similar technique in 1980 by Bascom (7). The motivation for minimally invasive procedures came from the increasing awareness that the pits play a key role in the pathogenesis of pilonidal disease, along with general dissatisfaction with the results of the traditional excisional methods.

In pit-picking, as it is called, the midline pits are excised under local anesthesia with a 1 mm skin margin. An incision of 1–2 cm over the secondary lesions (fistulous openings, scars, indurations, subcutaneous cavities lateral to the natal cleft) is made, and the subcutaneous cavity is cleaned.

There is no generally accepted term for this method; terms for it have included follicle removal (7), minimal surgery (18), Bascom surgery (19), pit pick (20), ambulatory surgery of pilonidal disease (e2), and pit-picking (21). Technical details vary across published accounts, but the basic principles remain the same.

This method is suitable for smaller lesions that have not previously been operated upon (LoE: IV–V). Recur-

rence rates of 10–20% have been described, with highly variable definitions of recurrence (7, 18–20). In one of our own publications, a healing rate of 79% was achieved three years after either one or two pit-picking procedures (21). The main advantage of minimally invasive techniques is that they involve minimal trauma; the patients can return to work in one or two days, and no specific follow-up care is required. In case of treatment failure, all existing methods can still be applied. It is stated in the German-language and Italian guidelines that small primary lesions are an indication for pit-picking surgery (1, 3). In the American guideline, however, this technique is not mentioned (2).

#### Sinusectomy

Sinusectomy is another minimally invasive surgical technique, described by Soll et al. (22), in which the fistula is selectively excised along the track from the pit to the secondary opening, without excision of the surrounding soft tissue. The wounds are left open. A recurrence rate of 7% is reported (LoE: IV) (22). Unfortunately, there have not been any further scientific publications on this technique. It can be performed in combination with pit-picking.

#### Newer minimally invasive techniques

The last ten years have seen markedly increased interest in the use of a laser for the treatment of pilonidal disease. Most authors (23, e3) combine the principles of the minimally invasive techniques mentioned above with laser ablation of the subcutaneous tracks. The healing rate after one or more sessions is described to be in the range of 80–90% (23). Because adequate evidence is not yet available to demonstrate any advantage of laser surgery (which is more expensive) over the conventional minimally invasive techniques, it is not recommended in the German-language guideline (LoE: IV–V) (1). The same applies to video-assisted endoscopic ablation procedures (EPSiT) (24).

#### Phenol instillation

Phenol solution can be instilled into the fistulae in order to induce an inflammation and scarring. This is done under local anesthesia. The patient needs to take only one or two days off from work, and the cure rate is 70–95% at 14–56 months (25, e4). Phenol injection is recommended for selected cases in the current American and Italian guidelines (2, 3). Phenol treatment is not approved in Germany because of its presumed toxicity.

#### Diagnosis

Fistulous openings in the natal cleft, called pits, are a typical and obligatory finding but may be difficult to identify during the stage of abscess formation. They are usually easily recognized a few weeks after abscess incision.

#### The treatment of acute pilonidal abscess

Simple incision, rather than complete excision, is recommended. A paramedian incision should be made next to the natal cleft to avoid the creation of a poorly healing midline. Antibiotic treatment is not recommended.

TABLE

**Main findings of the most recent meta-analysis of prospective, randomized, controlled trials (RCTs), by Enriquez-Navascues et al. (5)**

	Results	RR [95% CI]
<b>Number of RCTs included</b>	<b>25</b>	
<b>Sinusectomy or simple incision versus complete excision and open wound treatment</b>		
Number of RCTs	4	
Time to heal	n.s.	n.a.
Recurrence rate	n.s.	RR = 0.63 [ 0.17; 2.38]
Time to return to work	longer after complete excision	n.a.
Postoperative pain	higher scores after complete excision	n.a.
<b>Median suture versus off-midline technique</b>		
Number of RCTs	10	
Recurrence rate	increased after median suture	RR = 2.32 [0.98; 5.45]
Wound infection	increased after median suture	RR = 2.75 [1.83; 4.13]
Wound dehiscence	increased after median suture	RR = 1.63 [1.13; 2.36]
Time to return to work	n.a.	
Postoperative pain	higher scores after median suture	n.a.
<b>Advancing versus rotation flaps*<sup>1</sup></b>		
Number of RCTs	5	
Recurrence rate	n.s.	RR = 1.12 [0.47; 2.63]
Wound infection	n.s.	RR = 1.38 [0.61; 3.10]
Wound dehiscence	n.s.	RR = 1.56 [0.68; 3.57]
Time to return to work	longer after rotation flap	n.a.
Cosmetic outcome	worse after Limberg flap	
<b>Sinusectomy or unroofing versus primary closure*<sup>2</sup></b>		
Number of RCTs	6	
Time to heal	n.a.	
Recurrence rate	increased after primary wound closure	RR = 0.27 [0.11; 0.63]
Wound complications	n.s.	RR = 0.33 [0.85; 1.35]
Time to return to work	n.a.	

\*<sup>1</sup> This comparison is mainly between the Karydakis procedure and cleft lift on the one hand versus the Limberg procedure on the other.

\*<sup>2</sup> Both median suture (four trials) and off-midline techniques (two trials)

n.a., data not available; n.s., no statistically significant difference; RR, relative risk; 95% CI, 95% confidence interval.

**Minimally invasive treatments for pilonidal disease**

These include pit-picking, sinusectomy, laser ablation, phenol instillation, and other techniques. Phenol instillation is not approved in Germany because of its presumed toxicity.

**Pit-picking**

The pits that are visible in the midline are excised under local anesthesia with a 1 mm skin margin, 1–2 cm of skin is opened over the secondary lesions, and the subcutaneous cavity is debrided.

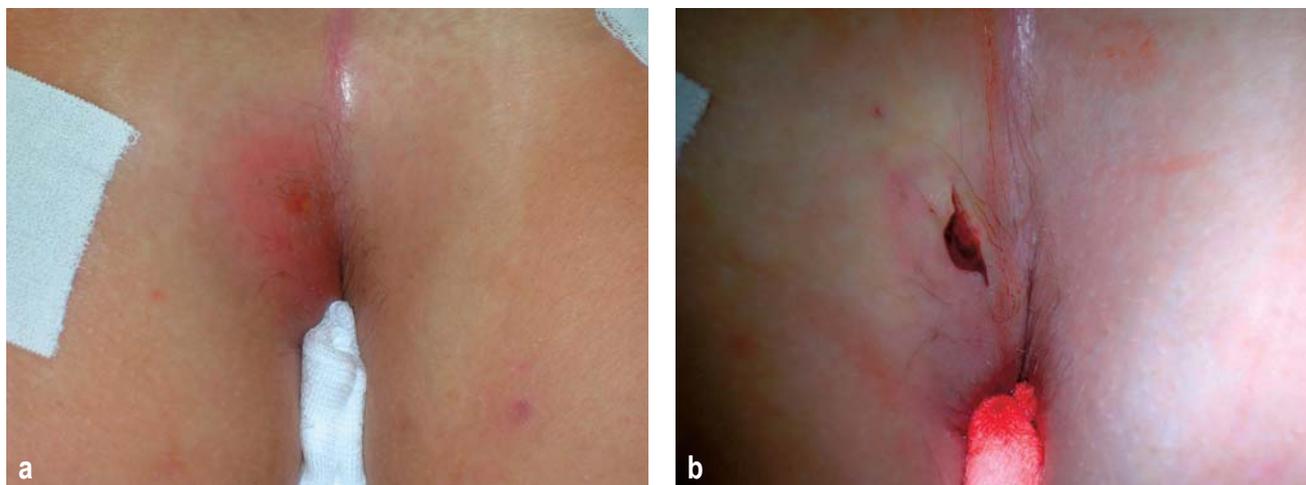


Figure 2: a) A pilonidal abscess; b) the same pilonidal abscess after incision under local anesthesia. Incision can almost always be performed under local anesthesia.

### Excisional techniques

“Midline excisional techniques” (excision and either open treatment or midline closure) are procedures after which the postoperative wound is located in the midline. In contrast, after off-midline techniques, the postoperative wound lies completely laterally to the midline. The off-midline techniques almost always involve the creation of a subcutaneous flap and are therefore commonly referred to as “plastic” in Germany (1). In this review, because of length constraints, we will only discuss the three most common off-midline techniques: the Karydakís procedure, the cleft lift, and the Limberg flap.

### Excision and open treatment

Excision and open treatment is still designated as the standard technique in the current German-language guideline. Nonetheless, in the English version of the same guideline, the reviewers declined to allow the use of the term “standard” to describe it, as it was felt that this would conflict too much with the current state of the evidence (26).

Most surgeons use the same operative technique: after methylene blue is given into the tracks, blue tissue is excised completely. The reported recurrence rates vary widely, from 0% to 57% (1, 27). Patients with prior surgery seem to have the highest rates of (second) recurrence (28). The greatest suffering for patients after complete excision is caused by the prolonged wound healing, which can take from 1.5 to 3 months (e5). Patients need to take an average of one

month off from work (e6). Healing is not complete in some cases, leading to a chronic wound (Figure 3); the incidence of this problem is, unfortunately, unknown. Non-healing wounds in the natal cleft are the most common reason for reoperation after excision and open treatment.

### Excision and midline suture

Wound closure in the midline is intended to shorten the mean duration of wound healing, yet the incidence of wound dehiscence is high, with reported rates varying from 14% to 74% (29). In most studies, the recurrence rate after this procedure is higher than after open treatment or after off-midline procedures (Table) (29). This method is no longer recommended in any of the three current guidelines.

### The Karydakís procedure

In 1973, Karydakís reported in *The Lancet* (30) on a new treatment for pilonidal disease involving an asymmetrical, elliptical incision. A subcutaneous flap is mobilized from across the midline and used to close the wound primarily, lateral to the natal cleft (Figure 4). Postoperative wound-healing infections were described in 8.5% of patients and recurrences in only 9 of the 754 patients who were followed up. In 1996, Kitchen (31) reported a 4% recurrence rate and a 9% wound dehiscence rate in 141 patients who had undergone the procedure; 23% of these patients had undergone surgery before. Kitchen’s publication includes a very

### Video-assisted techniques and laser application

Adequate evidence is lacking for the benefit of these two newer technologies, either of which can be used in combination with pit-picking. Laser ablation is expensive and is not recommended in the German-language guideline.

### Complete excision

Aside from the minimally invasive treatment options, there is also the option of complete excision. Excisional techniques are classified into two types—midline and off-midline—depending on the site of the postoperative wound.

thorough description of the operative technique that is a great help to surgeons who want to learn how to perform it. The patients' hospital stay is less than four days in the majority of cases and the time off from is two to three weeks work (e7).

### Cleft lift

The cleft lift method is a modification of the Karydakis procedure (32), described by Bascom (7). The thickness of the excised tissue and of the mobilized flap is only 2–3 mm and the incision line is also somewhat different. In 2007, Bascom reported on the results of 69 cleft lifts, all of them on patients who had undergone numerous prior surgical procedures for pilonidal disease. All patients were healed after 30 months of follow-up, although six of them required at least one further surgery to achieve this (7).

Further publications have documented the low recurrence rate after this procedure (0% to 9%) and the patients' need to take only two to three weeks off from work. However, the rate of wound-healing problems is relatively high, at 18–40% (e8, e9, 32).

### The Limberg flap

The Limberg flap is the most common off-midline procedure used to treat pilonidal disease. After a rhomboid excision of diseased tissue, a rhomboid subcutaneous flap is mobilized and transposed to cover the defect.

The Limberg flap, too, involves the flattening of the natal cleft and the lateralization of the wound, however the lower part of the wound crosses the natal cleft. This is the usual site of the wound breakdown and recurrences in some cases (33). Thus, many authors have modified the technique (33) so that the lower end of the flap lies completely outside the natal cleft, as does the resulting scar (Figure 5).

Recurrence rates from 0% to 8% have been reported; they decreased by 4–6% after the modified Limberg procedure (33). Reported wound dehiscence rates vary from 0% to 45% (33, e10) and they also decreased after the modified procedure (33).

### A comparison of excisional procedures

A randomized trial (34) comparing a minimally invasive procedure (pit-picking) with an off-midline technique (cleft lift) showed that the former is associated with a significantly higher recurrence rate (LoE: Ib). It should be noted, however, that the intention for the use of minimally invasive methods is to give the patient the best possible quality of life instead of the lowest recurrence rate.

### Median excision

In median excision techniques, the tissue excision is followed either by open wound treatment or by primary suturing in the midline. The latter method is associated with high recurrence rates and is, therefore, no longer recommended in the current guidelines that are considered in this review.



**Figure 3:** Chronic wound in the natal cleft two years after excision and open treatment. This condition causes considerable suffering but is not reflected in recurrence statistics, because it is not classified as a recurrence. This should be called a treatment failure.

The various excisional techniques have been compared in multiple meta-analyses and review articles. In 2002, Petersen et al. (35) presented a review of more than 10 000 patients who had undergone primary wound closure. The rates of recurrence and wound infection were 10% and 12%, respectively, after midline suture; 2% and 3%, respectively, after Karydakis flap or cleft lift; and 2% and 3%, respectively, after various flap procedures (mainly the Limberg flap). Overall, the off-midline techniques yielded better results than midline suture (LoE: IIIa).

Two Cochrane reviews published in 2008 and 2011 (4, 29) included the results of 18 and 26 randomized trials, respectively. Excisional techniques were divided into three main categories: open treatment, off-midline techniques, and midline closure. With respect to recurrence rates, the off-midline techniques (1.4%) and open treatment (4.5%) were found to be superior to midline closure (11%) (29). Primarily closed wounds were found to heal significantly more rapidly than those treated by secondary intention, although wound infections were less frequent after off-midline procedures than after midline closure.

Time off from work was longer after open treatment than after primary closure. The study revealed no

### Off-midline excision

The three most common off-midline procedures are the Karydakis flap, the cleft lift, and the Limberg flap. In these techniques, the primarily closed wound is off the midline.

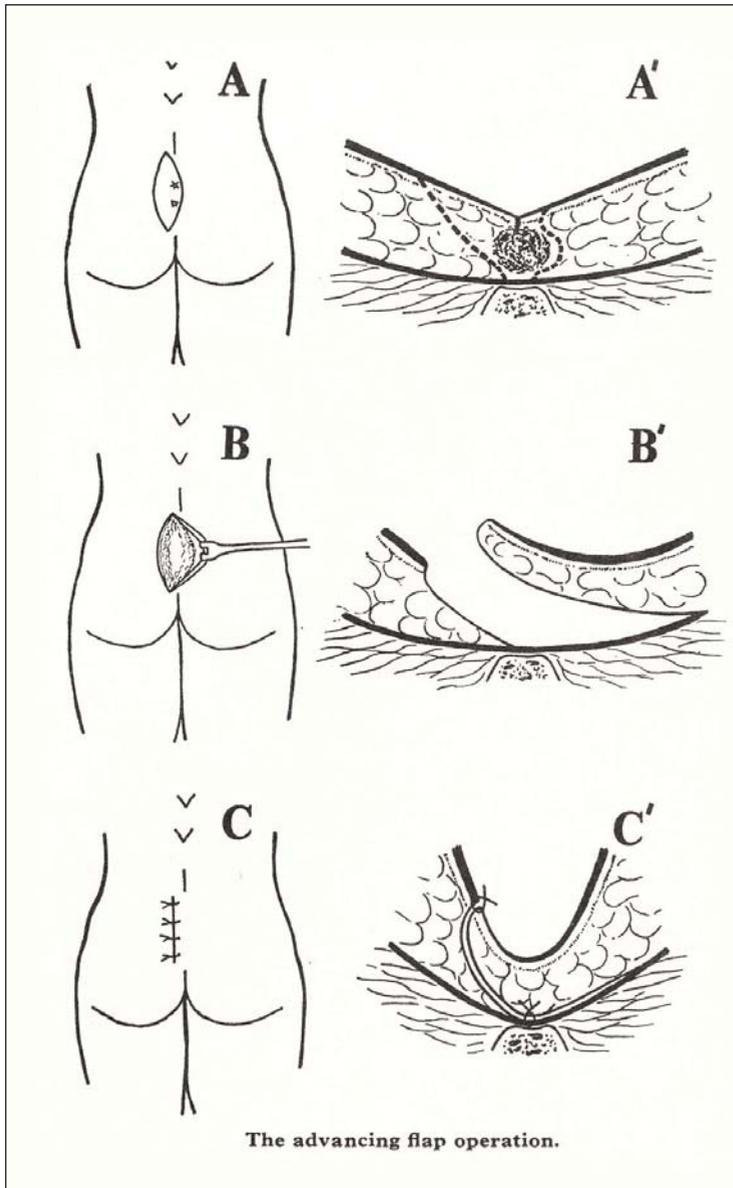


Figure 4: The Karydakis flap as originally described in The Lancet in 1973 (reproduced with kind permission from Elsevier).

**Comparison of surgical methods**

Minimally invasive and excisional techniques are hard to compare, as they have been evaluated by different criteria. Low recurrence rates after excision have been found for procedures with open treatment and off-midline procedures. Comparative studies of the off-midline techniques are still lacking.

statistically significant difference in recurrence rates between open treatment and the off-midline techniques (LoE: 1a). It was only after these two Cochrane analyses had been published that two prospective, randomized trials (36, 37) demonstrated, for the first time, a lower recurrence rate after off-midline surgery than after open treatment (LoE: 1b). A more recent meta-analysis of randomized trials (5) led likewise to the conclusion that the off-midline techniques and various “limited” (i.e., minimally invasive) procedures are preferable to the traditional excisional techniques (Table).

At present, the available evidence does not show the superiority of any off-midline method over the others (1), although the Karydakis flap yields better cosmetic results than the Limberg flap (38).

**Postoperative hair removal**

For decades, shaving the gluteal hair for the rest of the patient’s life was a standard postoperative recommendation for patients with pilonidal disease. Then, however, a large-scale retrospective cohort study from Germany surprisingly revealed that regular shaving after midline excisional surgery actually increases the rate of postoperative recurrences (39). In a review, postoperative laser depilation was found to confer an improved long-term prognosis (40), but some of the individual studies included in this review actually implied a higher recurrence rate after depilation (e11).

**Discussion**

Despite the very large number of scientific articles about pilonidal disease, there is still no consensus on its optimal treatment. The current German S3 guideline does not resolve these discrepancies. Among other things, comparative studies of the various minimally invasive procedures are lacking. Moreover, no generally applicable selection criteria for or against minimally invasive methods have yet been determined. Current debate about the treatment of pilonidal disease centers on four developments:

- Most surgeons still perform excision with open healing. This method is both technically simple and easy to learn.
- Nonetheless, the current evidence supports the use of off-midline techniques (5) because of lower recurrence rates and avoidance of all the disadvantages of open treatment.
- The minimally invasive techniques are becoming increasingly popular as outpatient procedures. These procedures are technically simple, patient

**Postoperative hair removal**

A large-scale retrospective cohort study showed that regular shaving after midline excisional surgery, as was once recommended, actually increases the rate of postoperative recurrences. The evidence on the utility of laser depilation is not yet conclusive.

satisfaction is high, and the billing potential is favorable.

- The popularity of newer techniques—laser surgery and endoscopic fistula surgery—is likewise rapidly increasing.

Minimally invasive techniques are appealing in their technical simplicity, ease of postoperative care, and relatively atraumatic nature. They are also economically highly advantageous, because they keep patients away from work for a minimal time. On the other hand, treatment failure, i.e., the need for repeat surgery, is relatively common, at about 20–25 % three years after surgery (21); and an even further increase in failure rate can be expected on longer follow-up (14). In any case, the advantages of minimally invasive techniques regarding patients' quality of life are clear. All surgical candidates must be extensively informed about the advantages and disadvantages of these procedures so that they can competently decide for themselves.

Excision and open treatment is likely to remain the most popular method among surgeons for many years to come. This is certainly less problematic for small lesions, since smaller wounds can heal very well in four to six weeks. This method, therefore, should not be rejected out of hand. It should not, however, be used for patients with pilonidal abscesses because very large wound defects may result due to the acute swelling. This method is also problematic in patients with a pilonidal sinus larger than 4–5 cm and in those who have undergone a prior midline excision. Large wounds in the midline can take a very long time to heal. Repeated excision and open treatment has a failure rate of more than 50% (28).

On the basis of the scientific evidence alone, the off-midline techniques should be preferred to all others (1–5). In patients with small lesions, however, a marked discrepancy is felt between the extent of the disease and that of the surgery. If wound complications ensue, this discrepancy seems even greater. Moreover, poorly performed off-midline operations can result in quite dramatic wound dehiscences. Therefore these procedures should be performed only by surgeons well-trained in those techniques, and preferentially in patients who have undergone surgery for pilonidal disease before or who present with large lesions.

The advantages of the newer technologies—laser surgery and endoscopy—over conventional minimally invasive methods remain to be demonstrated. Nonetheless, one should not rush to explain away the currently reported positive results as being merely the reflection of a conflict of interest. Rather, there is an urgent need for industry-independent prospective randomized trials that



**Figure 5:** Diagram of the incision in a modified Limberg flap. The lower pole of the rhomboid excision lies lateral to the natal cleft, so that the resulting wound will also lie lateral to the midline.

will compare the safety and efficacy of the minimally invasive techniques with and without the application of these new technologies.

**Conflict of interest statement**

The authors state that they have no conflict of interest.

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**Heterogeneous treatment methods**

Despite the existence of an S3 guideline, there are still no generally accepted treatment algorithms. Excision with open treatment is currently the most common form of treatment, but the use of minimally invasive techniques, endoscopy, and laser surgery is increasing.

**Off-midline techniques**

The evidence supports the use of off-midline techniques, since they result in the lowest recurrence rates. These techniques should be carried out by well-trained surgeons, and preferentially in patients who have already undergone surgery for pilonidal disease and in those with large lesions.

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► **Supplementary material**

For eReferences please refer to:  
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Only one answer is possible per question. Please select the answer that is most appropriate.

### Question 1

**What is the most common site of a pilonidal sinus?**

- a) interdigital
- b) perianal
- c) intergluteal
- d) palpebral
- e) pudendal

### Question 2

**What is the main feature of a pilonidal sinus?**

- a) erosions along the natal cleft
- b) small openings in the natal cleft
- c) putrid discharge from the umbilicus
- d) flaking lesions in the natal cleft
- e) perianal ulcers

### Question 3

**A patient presents with a painful acute pilonidal abscess.**

**What is the treatment of choice?**

- a) endoscopic ablation
- b) complete excision
- c) ichthyl-based ointment
- d) simple incision
- e) laser ablation

### Question 4

**How is pilonidal disease generally diagnosed?**

- a) by biopsy
- b) by magnetic resonance imaging
- c) by endoscopy
- d) by inspection
- e) by ultrasonography

### Question 5

**Which of the following is an element of the differential diagnosis of pilonidal disease?**

- a) acne vulgaris
- b) hidradenitis suppurativa
- c) lichen ruber
- d) malignant melanoma
- e) pemphigus vulgaris

### Question 6

**Which of the following is a minimally invasive treatment for pilonidal disease?**

- a) excision and primary midline suture
- b) the Karydakis procedure
- c) pit-picking
- d) sphincteroplasty
- e) V-Y-plasty

### Question 7

**Which of the following is an off-midline treatment of pilonidal disease?**

- a) permanent laser depilation
- b) endoscopic ablation
- c) excision and open wound treatment
- d) laser ablation
- e) the Karydakis procedure

### Question 8

**What surgical treatment is associated with the longest time to heal?**

- a) the Karydakis procedure
- b) the cleft lift procedure of Bascom
- c) the Limberg procedure
- d) complete excision and open wound treatment
- e) permanent laser depilation

### Question 9

**Which of the following surgical techniques is considered obsolete in multiple guidelines?**

- a) excision by the cleft lift method
- b) excision by the Limberg procedure
- c) excision and open wound treatment
- d) excision and primary midline suture
- e) pit-picking

### Question 10

**What was the incidence of pilonidal disease in Germany in 2012?**

- a) 18/100 000\*year
- b) 28/100 000\*year
- c) 38/100 000\*year
- d) 48/100 000\*year
- e) 58/100 000\*year

► Participation is possible only via the internet:  
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## Supplementary material to:

# The Management of Pilonidal Sinus

by Igors Iesalnieks and Andreas Ommer

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