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## Sacrococcygeal pilonidal sinus: historical review, pathological insight and surgical options

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**Abstract** Sacrococcygeal pilonidal disease is a common and well recognized entity. For many years the cause of sacrococcygeal pilonidal sinus has been matter of debate. When the treatment is considered, there was a frequent lack of success of the surgical methods of excision regarding morbidity, healing, recurrence and cure. All these factors rendered the acquired thesis of pilonidal sinus disease to be more accepted. In dealing with the pathogenesis of pilonidal sinus disease, Karydakos attributed the hair insertion process to three main factors: the invader, i.e. the loose hair; the force, which causes the insertion; and the

vulnerability of the skin to the insertion of hair at the depth of the natal cleft. The sinus is initiated from a small mid-line opening lined by stratified squamous epithelium. Additional sinuses are frequent and have lateral openings. Malignant transformation is rare but cases of squamous cell carcinoma and verrucous carcinoma have been reported. Pilonidal sinus disease consists in a symptoms complex with presentations ranging from asymptomatic pits to painful draining lesions that are predominantly located in the sacrococcygeal region. Asymptomatic pits do not require treatment. Options for treatment of acute abscess include aspiration, drainage without curettage, and drainage with curettage. The choice of a particular surgical approach depends on the surgeon's familiarity with the procedure and perceived result in terms of low recurrence of sinus and a quick healing of resulting cavity or surgical wound. Conservative nonoperative management, closed methods, laying of track, wide excision and open drainage, wide excision and primary closure, and limited excision are the methods currently used. From the profusion of studies, it is apparent that various methods are being tried and no one method is universally acceptable. Recurrence rates vary with the technique, operator and length of follow-up. Primary closure with a lateral approach appears to give the best results.

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### Introduction

Sacrococcygeal pilonidal disease is a common and well recognized entity. In 1833 Herbert Mayo described a hair-containing sinus [1] but not until 1880 did Hodge suggest the term "pilonidal" [2] (Latin: *pilus* = hair and *nidus* = nest), to indicate a disease consisting of hair-containing sinus in the sacrococcygeal area.

In England alone, in the year 2000–2001, a total of 11 534 admissions was recorded for pilonidal disease by the Department of Health (England), Hospital Episode Statistics 2000/01 (ungrossed data) [3]. There was a male preponderance of 71.85% with a mean age of 30 years; 46.11% of the cases were treated in an emergency setting. The mean length of hospital stay was 4.3 days with a median of 1.5 days reflecting the difference in stay in emergency versus elective situation. 98.9% of the patients were in the age group of 15–60 years and this being a productive age group and combined with the hospital stay accounts for considerable loss to society in man-hours. In terms of effect on hospital throughput this has accounted for 17 084 bed days. This loss of productive man-hours and effect on hospital resources has led to a renewed interest in understanding the mechanics and exploring an ideal method of treatment for this disease.

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### Aetiology and pathogenesis

For many years the cause of sacrococcygeal pilonidal sinus (PNS) has been a matter of debate. In the nineteenth century, basing their theories on the study of the human embryo, many authors proposed a congenital origin of the lesion [4–6]. These theories suggested that this entity might be caused by:

1. Persistence of a caudal remnant of the neural canal that remained adherent to the cutaneous surface, forming small cysts which later rupture, causing blind-ended sinuses [7–10].
2. Dermal inclusions caused by cystic changes of sequestered epithelial rests [11–13].
3. Dermoid tractions created during involution of human tail bud - a lack of development of the caudal appendix attracts the skin into a subcutaneous area resulting in an epithelium-lined tract [14–19].
4. Preen gland-like structures (considered to be a phylogenetic representation of the preen gland or “scent” gland found in the sacrococcygeal region of some species of birds [6]) which empty through a duct in the skin of the posterior region [20–23] were thought to be special down growths of epithelium originating from the skin.

The opponents of the congenital origin of this condition state the following:

1. The presence of developmental abnormalities similar to those in sacrococcygeal region in the cervical and dorsal areas of the vertebral column unaccompanied by pilonidal sinus [6].
2. The presence of the entity in males more than females while in congenital aspects an equal ratio is expected [6].
3. Its appearance in the adolescence period of life is not in accordance with a developmental defect.
4. The linkage between pilonidal disease and occupation e.g. among Jeep-driver soldiers (hence labelled “Jeep-driver’s bottom” [24]), and on barbers’ hands [25].

5. The description of similar lesions in other sites of the body.
6. The lack of hair follicles and other skin appendages in the wall of the sinuses despite the presence of hair shafts, freely and deeply embedded in granulation tissue or scar and the lack of lining epithelium in most cases were important histological factors that added criticism to the congenital theories.

When the treatment is considered, there was a frequent lack of success of the surgical methods of excision regarding morbidity, healing, recurrence, and cure. All these factors rendered the acquired thesis of pilonidal sinus disease to be more accepted.

Bascom examined midline pits in the natal cleft microscopically and concluded that they are enlarged and distorted hair follicles [26]. The cause of formation of these distorted hair follicles is unclear [27]. Gravity and motion of the gluteal folds have been suggested as a cause of creation of a vacuum that pulls on the follicles [28]. Local inflammation by bacteria, debris and oedema, which occludes the mouth of the follicle, leads to further expansion of the follicle which then ruptures resulting in a foreign body reaction and microabscesses which then develop into acute and chronic pilonidal abscesses along with laterally displaced and epithelialised tracts. Once the microabscess becomes a burrowing infection, the disease is defined as a pilonidal sinus [29].

Although only 50%–75% of cysts or sinuses contain hair shafts [6, 25] during exploration, hair has three important distinct roles. First, *de novo* [2] hair in the distended hair follicle can remain unshed and enhance microabscess formation. Second, free hairs from other parts of the body can invade the follicles’ open mouth and creating foreign body reaction. Third, skin hair in close vicinity to pilonidal wound irritates it mechanically, affecting healing [5].

In dealing with the pathogenesis of pilonidal sinus disease, Karydakis attributed the hair insertion process to three main factors [30]:

1. The invader, which is the loose hair,
2. The force, which causes the insertion, and
3. The vulnerability of the skin to the insertion of hair at the depth of the natal cleft.

He also identified secondary factors and expressed these in an equation [30, 31]. Some of these factors had been postulated earlier [32], but Karydakis showed their relevance in formulating a successful surgical approach [31]. These two theories by Karydakis [30] and Bascom [26] offer the best explanations of pathogenesis of pilonidal sinus disease.

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### Pathology

The sinus is initiated from a small midline opening lined by stratified squamous epithelium. Additional sinuses are frequent and have lateral openings. Cyst cavities are lined by

chronic granulation tissue and may contain hairshafts, epithelial debris, and young granulation tissue. The sinus is lined by granulation tissue, infiltrated by neutrophils, lymphocytes, plasma cells, and sometimes haemosiderin-laden macrophages. Foreign body giant cells in association with dead hairs are a frequent finding. Hair shafts are seen in 50%–75% of pilonidal sinuses lying free in the cavity or embedded in granulation tissue or deeply in a scar tissue. Occasionally, there is no visible opening or only a depression. Cutaneous appendages (hair follicles, sweat or sebaceous glands, and muscoli arrectores pilorum) are not found in the wall of sinuses [6, 28, 33, 34]. Malignant transformation is rare but cases of squamous cell carcinoma and verrucous carcinoma have been reported [5, 35].

### Pathological differential diagnosis

This condition should be differentiated from some other inflammatory lesions, which may have some similar histological features such as tracts (which could be epithelialised or even contain hair), granulation tissue, foreign-body giant cells and granuloma. These lesions are:

1. Anal fistula which presents as a perianal extension from an internal opening within the anal canal and is associated with an absence of a midline opening in the postanal region. It is important to note that 7% of the PNS run caudally and can present as perianal fistula [36, 37].
2. Hidradenitis suppurativa. These lesions may contain hair shafts.
3. Pyoderma gangrenosum sometimes contain hair shafts.
4. Congenital abnormalities like (i) sacrococcygeal sinus (vestigial remnant of the medullary canal), (ii) presacral sinus or dimple (traction dermoid), (iii) inclusion dermoid, and (iv) treaties.

### Clinical features

Pilonidal sinus disease consists of a symptom complex with presentations ranging from asymptomatic pits to painful draining lesions that are predominantly located in the sacrococcygeal region. It has also been reported to occur in interdigital spaces in barbers [25], sheep shearers [38] and dog groomers [39]. Rare occurrences such as in finger tip pulp [40] and penis [41] have been recorded. Pilonidal sinus can be observed in both sexes – Routine physical examination of Minnesota college students [42] showed 365 out of 31 497 males (1.1%) and 24 of 21 367 females (0.11%) had pilonidal sinus, but symptomatic ones appear to predominate in men and in the second and third decades of life. However, in children the female to male ratio is 4:1 [43]. Patients with pilonidal disease frequently present with asymptomatic pits

or holes in the natal cleft. In a study of 1000 Turkish soldiers, 88 were found to have pilonidal sinuses; 48 were symptomatic and 40 were asymptomatic [44]. Another common presentation is of a chronic or recurrent sinus. Sondanaa et al. [43] noted discharge in 66%, swelling in 50% and pain in 35% of chronic pilonidal disease presentations. Half of all patients present with an abscess [45] and can present with progressive discomfort or pain after physical activity or a period of prolonged sitting, such as during a long drive or with obvious acute purulent drainage, pain, and swelling. Spontaneous drainage often occurs, to be followed by generally painless chronic waxing and waning drainage from the secondary sinuses. Anaerobic organisms (bacteroides and anaerobic cocci) have been cultured only from 77% of abscesses, aerobic organisms only from 4%, and a combination of both from 17% [43]. The majority of secondary sinuses track cephalad, but some (about 7%) may track toward the anus and present as perianal sepsis. A rare complication of carcinomatous change (squamous cell and spinocellular) has been reported [46]. de Bree et al. [47] from the Netherlands Cancer Institute found 59 cases reported in world literature; these carry a higher recurrence rate and poorer prognosis than a regular non-melanoma skin cancer.

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### Management options

Asymptomatic pits do not require treatment. For acute abscesses, various options are available:

- *Aspiration* followed by treatment with antibiotics and later curative intent surgery.
- *Drainage without curettage*: simple drainage of abscess.
- *Drainage and curettage*: surgical drainage of abscess and curettage of cavity to remove hair and granulation tissue.

Of these choices, the drainage of abscess with curettage of cavity has the advantages of quick relief of symptoms and early return to work in all cases [48]. Complete healing occurs in 60% of patients. Recurrence occurs in 25% of those with initial healing and the overall cure rate at 18 months is 75% [49]. Bascom advocated placing a lateral incision 2.5 cm from the midline and cutting a 1.0-cm button of skin to prevent premature resealing [50]. Furthermore, in 7 days he continues with definitive excision of the midline pits which become visible at this time [50].

For chronic and recurrent sinuses, various techniques have been reported. Allen-Mersh did an extensive review in 1990 of over 90 papers dealing with the treatment of pilonidal sinus [51]. He concluded that “virtually without exception these studies are flawed because of one or more defects in study design...” [51]. The choice of a particular surgical approach is dependent on the surgeon’s familiarity with the procedure and perceived results in terms of low recurrence of sinus and of quick healing of resulting cavity or surgical wound.

### Conservative nonoperative management

Meticulous hair control by shaving the natal cleft regularly, removal of hair and scraping of granulation tissue has been practiced. However it needs significant time and a long period to achieve results. The incidence of cases needing excisional procedures is, however, low [52]. Laser depilation of the natal cleft (14 cases over a 5-year period) as an alternative method of hair removal has been reported [53].

### Closed methods

Lord and Millar in 1965 described excision of midline epithelial follicles under local anaesthesia and passing a small brush in the track to remove hairs within the granulation-lined track [54]. At about the same time 50% phenol was used after curettage to destroy the epithelial component of the track [55]. Schneider et al. [56] in 1994 reported that phenol injection gave similar results to surgery with patients staying in hospital for 1–2 days and returning to work within 2 weeks; 60% of sinuses showed complete healing with an average healing time of 6.2 weeks.

### Laying open of track

This is associated with a low recurrence rate but slow healing. In a group of 146 patients with pilonidal sinus, Isbister and Prasad felt the procedure could be done safely on an outpatient basis [57].

### Wide excision and primary drainage

Healing by secondary intention takes longer to achieve but has lower recurrence [58]. The median duration of work incapacity was 4 weeks, longer for the employed and manual workers than for the self employed [59]. The delay in healing appeared to be due to infection, particularly by anaerobic bacteria [60].

### Wide excision and primary closure

In a retrospective review of 129 patients with chronic pilonidal disease treated over a 5-year period, complete healing was fastest in the primary closure group, despite a 14% postoperative wound infection rate, in comparison to open excision without closure [61]. In a randomised controlled trial of 120 patients from Norway, with a median follow-up

of 4.2 years, recurrence was noted in 5% of patients with primary suture and in 10% of patients with excision and healing by secondary intention [62]. Primary closure can be performed vertically, horizontally or obliquely. Incisions have been devised symmetrically and asymmetrically and closed with or without suction drains; skin closure can be interrupted or subcuticular [63]. Various kinds of flaps have been used: 1- or 2-stage skin flaps (Toulouse experience) [64], fasciocutaneous flaps like the V-Y flap (for recurrent and complicated pilonidal sinus disease) [65] and rhomboid excision and Limberg flap [66]. In a randomised controlled trial of 46 patients, the Limberg flap gave superior results to deep tension suturing [67]. Musculocutaneous flaps have also been used [68].

Following Karydakos', description of his technique [30] and his encouraging results in 6545 patients, this technique has been repeated by others in different countries [69–71]. The sinus is excised using a vertical eccentric elliptical incision. A thick flap is created by undercutting the medial edge and advancing it across the midline to produce a lateral, vertical scar so that the whole suture line is lateralised to reduce the risk of recurrence. In the Kitchen series of 141 patients, only 4% of patients needed further surgery [70].

### Limited excision

A different approach has been put forward by Bascom [50]. He argued that radical excision is unwarranted even in recurrent disease, and described two operations. He advocated a "drainage and pit excision" for chronic pilonidal sinus. The chronic sinus cavity is drained through a long lateral incision 2.5 cm away from the midline, the cavity is entered and the hair and granulation tissue are curetted. All the pits are excised as "rice grains". The pit excision sites are closed with subcuticular suture and the drainage site is left open. For unhealed midline wounds from a previous operation, he employs a "cleft closure". Here the affected area of skin including the affected midline is excised and extended laterally on one side. The defect is closed by mobilising a flap of skin from the opposite buttock and sutured over a suction drain. In his series of 161 patients who had a drainage and pit excision, he described healing in three weeks, disability of one day, no hospitalisation and satisfactory long-term control of pilonidal disease [29]. These results have been repeated by others [72, 73].

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## Conclusions

From the profusion of studies, it is apparent that various methods are being tried and no one method is universally acceptable. Recurrence rates vary with the technique, oper-

ator and length of follow-up. Primary closure with a lateral approach appears to give the best results. This was described by Karydakakis and by Bascom and the results are encouraging and repeatable in other hands too. The ideal operation should be performed as a day case or on outpatients, should be simple to perform and have a low recurrence rate with healing being rapid and complete with minimal requirement for after care such as shaving or dressings. Furthermore it should not compromise the treatment of any future recurrence [74]. This ideal has yet to be demonstrably reached.

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