



A DETAILED REVIEW OF CURRENT MANAGEMENT TECHNIQUES FOR PILONIDAL SINUS

Surgery

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ABSTRACT

Pilonidal sinus is an infection of the subcutaneous fatty tissue in the intergluteal cleft. Over the years it has presented surgeons with various therapeutic challenges. Many clinicians first thought the condition was congenital, resulting from remnants of the medullary tube, dermoid traction, inclusion dermoid, or preen glands but in recent years pilonidal sinus has been established as an acquired condition. Having a deep gluteal cleft, compromised hygiene, and sitting posture for long hours attribute to a greater chance of its development. Pilonidal sinus has a range of treatment options available none of which are widely accepted, in most cases the treatment is reserved for symptomatic patients and is surgical in nature. This literature review explores clinical presentation, diagnosis and treatment options available currently for pilonidal disease. It also touches upon novel techniques for its treatment.

KEYWORDS

Pilonidal sinus, Laser surgery, Nd:YAG, Video-assisted ablation

INTRODUCTION

Pilonidal sinus or Pilonidal disease is an infection of the subcutaneous fatty tissue, usually in the natal (intergluteal) cleft, that can be acute or chronic.^[1] It can appear as a tender lump, swelling, abscess, or cyst containing pus or blood. Histopathologically, pilonidal cysts are not real cysts as they lack an internal epithelial lining. Hair, debris, and granulation tissue are typically found in the cavity, along with foreign-body large cells.^[2] It has an estimated frequency of 26 per 100,000 people and affects men nearly two times more than women and mostly affects people in the age group of 15-30 years.^[3,4]

Clinical Presentation

The initial presentation of a pilonidal sinus can vary. An acute pilonidal abscess may present similar to other superficial abscesses on the body. Chronic abscesses may contain retained hair and may have ongoing drainage from sinuses.^[2] To go into further detail the clinical presentation can be as follows:

Acute Pilonidal Sinus

Most individuals experiencing pilonidal disease typically present with symptoms such as pain, swelling, tenderness, and redness in the gluteal cleft, sometimes accompanied by drainage from the affected area. Primary pits in the midline of the gluteal cleft may be visible, though they may also be hidden. If visible, this supports a diagnosis of pilonidal disease. In some cases, secondary tracts or pits off the midline may also be present, often accompanied by multiple complex sinuses and secondary openings.^[2]

Chronic Pilonidal Sinus

This condition is essentially a chronic pilonidal sinus cavity with recurrent drainage due to retained hair and infected residue. It may be difficult to recognize the sinus pits in the presence of acute inflammation and swelling. Regardless of whether abscess is acute or chronic, it should be drained with an incision at least one to two cm lateral to the intergluteal cleft.^[2]

Diagnosis

Pilonidal disease is diagnosed clinically based on the history of the patient, physical exam (including anorectal exam), including

assessment of symptoms and risk factors.^[5] Pilonidal sinus is diagnosed clinically, with no additional labs, tests, or imaging necessary. Imaging, on the other hand, may be useful in circumstances where the diagnosis is unclear or there is need for differential diagnosis.^[6]

Methylene blue can be used in combination with surgery to assess the extent of pilonidal sinuses.^[7] Pilonidal disease can be assessed using ultrasound as well. It has been shown that both external and endoanal ultrasound were proven to help assess the amount of pilonidal disease and rule out perianal sepsis.^[8] MRI can be used as it can help in the detection of inflammatory bowel disease, fistula-in-ano, pelvic sepsis, or neoplastic processes.^[9]

Physiopathology

The physiopathology of Pilonidal disease is debated on by various authors. There are two principal theories, Congenital theory

The infection was formerly thought to have developed from a congenital subcutaneous pilonidal sinus that was present at birth and caused by the absence of coalescence of the primordial ectoderm. In actuality, typical pits are frequently seen in asymptomatic patients.^[3,10]

Acquired Theory

This idea, proposed in the middle of the twentieth century, is based on the primordial role of the hair follicle. Thus, recurrent micro traumatism, rubbing, and/or crushing, as seen in heavy-duty drivers, maybe the cause of tension on the pilous follicles in the gluteal cleft in predisposed patients, as mentioned above. The pits correspond to swollen and enlarged follicles that have been exacerbated by the recurrent sources of friction. The ingrowth of one or more hair strands beneath the skin through these pits causes local inflammation and a foreign body reaction, creating a subcutaneous cavity surrounded by granulation tissue. This pilonidal cyst becomes infected at some point, resulting in a pilonidal abscess that drains through a pilonidal sinus; the cavity includes a varied amount of hair, often fragmented, with no conventional hair follicles or sebaceous glands. Post-puberty onset is explained by changes in the hair strand caused by sex hormones.^[11]

Furthermore, alterations in the cleft microenvironment, such as

elevated humidity, anaerobic environment, and bacteria in the natal cleft, amplify epidermal and deep tissue damage. In the development of follicular infection, abscess formation, and eventual wound breakdown following surgery, anaerobic bacteria (*Bacteroides* and *Enterococci*) predominate.^[12]

Histopathology

Hair within pilonidal cysts originates from the overlying, surrounding skin, although the follicles are never detected within the cyst wall, but rather free in granulation and scar tissue.^[13] In 1984, Stelzner noted hairs collected from pilonidal pits exhibited a hook structure and concluded hair migration was unidirectional using light microscopy.^[14] Dahl et al. validated the hook morphology and argued that sharp ends contribute to hair piercing the skin, with hooks inhibiting retraction.^[15]

Treatment Modalities

Treatment can be split into two major categories: conservative vs. operative, and often a combination of the two. Pilonidal disease is primarily regarded as a surgical condition, particularly in cases of acute infection and abscess. Infections and abscesses necessitate incision and drainage. When there is an acute infection or abscess, definitive therapy is usually deferred until the infection has been treated. There are numerous methods available when it comes to the operative procedure of pilonidal sinuses. The surgical intervention must be tailored to the patient. Lifestyle adjustments, recurrence rate and possible risk factors should be considered and included in the treatment protocol.^[6] With lifestyle changes and timely diagnosis, the general prognosis for pilonidal disease is quite good.

Conservative Techniques

Conservative procedures are typically conducted under local anesthesia, whereas excision frequently necessitates locoregional or general anesthesia. The patient is positioned prone, with the sacrococcygeal prominence elevated and the buttocks taped apart if necessary.^[16]

Simple incision and drainage: Simple incision and drainage plays a significant part in the treatment of acute pilonidal disease by reducing pain and stress. Off-midline incisions have been suggested because the ensuing closures performed better against shear forces delivered to the cleft by the gluteal muscles. As a result, even though the cyst is directly on the gluteal cleft, the incision is frequently made off-midline from the cleft.^[17]

Epilation: In the lack of an abscess, epilation and hair reduction may be utilized as a primary or adjunct treatment due to the significance of hair in the etiology of pilonidal disease.^[5] Epilation can be done through waxing, shaving, laser, or cream. In cases of chronic pilonidal disease patients are suggested to keep the gluteal cleft free of hair.^[6]

Phenol injections: Injections of liquid or crystalline phenol have been used to treat mild to moderate pilonidal cysts. Curettage is used to remove excess debris, and phenol is delivered without pressure through the preexisting orifices or pits. Before aspiration, the phenol stays in the cavity for one to three minutes. The residual cyst contents are removed via tissue manipulation, and the sinus is saline cleansed. The average recovery time is around 20 days.^[18]

Historically phenol injections have reported a failure rate of around 30-40%, especially in cases with multiple sinuses present. The success rate improves if the disease is limited i.e., no more than one to three sinuses are present. With multiple sessions, a recurrence rate of as low as two percent can be achieved over a period of 25 months.^[19,20]

Excision and unroofing: There are two types of techniques for excision and unroofing without primary closure: wide and limited. The wide approach entails an inwardly slanted excision that is deepest inside the cavity's center. An inward-sloping angle of the incision promotes healing by allowing granulation to progress uniformly from the wound's base upward. While resecting the entire cavity and associated pits, the incision depth should spare the fascia and leave as much fatty tissue as possible. Limited incision procedures, which are commonly combined with curettage, aim to decrease the healing time by making smaller incisions into the sinuses, pits, and secondary passages.^[17] Notable disadvantages include the necessity for skilled wound treatment, extended medical supervision, and an increased healing period.^[2]

Excision and Primary Closure: An elliptical excision is made down to

the fascia level, including a portion of the lateral edge. By widening the incision, adjacent lateral tracts can be removed. To close the incision, deep and superficial sutures are used to approximate the edges. Wound healing is often faster than secondary granulation, as evidenced by a randomized controlled trial that found a mean of ten days for primary closure and 13 weeks for secondary intention.^[21]

However, postoperative problems, like with any surgical operation, might cause wound healing to be delayed. The risk of recurrence following primary closure varies greatly, ranging from 10% to 38%.^[21,22]

Surgical Techniques

Skin flaps are frequently necessary for severe or recurring pilonidal disease. Advancement, Bascom cleft lift, Karydakias, and modified Limberg flap are some of the flaps that have been developed. Flaps require a vascular pedicle however allow for tension-free closure.^[23] Flap techniques usually cost more than conservative techniques or excisions but have far less recurrence rates of pilonidal sinus.

Advancement Flaps: The V-Y advancement flap and Z-plasty are the most often used advancement flaps. The V-Y advancement flap makes a full-thickness V-shaped incision down to the gluteal fascia, which is then closed to form a Y-shaped post-repair suture line. The flaps can be used unilaterally or bilaterally, depending on the magnitude of the lesion. A deficiency of eight to ten cm can be repaired unilaterally; however, defects larger than ten cm usually necessitate a bilateral flap.^[2, 23] A Z-plasty requires the removal of diseased tissue and the recruitment of lateral flaps incised down to the fascia level. To increase transverse length, the lateral edges are transposed.^[23]

Cleft Lift Closure: Bascom pioneered the cleft lift closure for recurrent pilonidal disease in 1987. This treatment tries to lessen or eliminate lateral gluteal stresses on the wounds by filling the gluteal cleft.^[2,24]

The sinus tracts are excised, and a full-thickness skin flap is stretched and closed off-midline across the cleft. The adipose tissue fills in the gluteal cleft's prior space. In the initial study, no recurrences were observed in 30 patients who received this operation at a two-year follow-up; similarly, no recurrences were noted in another case series of 26 patients who underwent the procedure at a median follow-up of three years.^[25] The Bascom cleft lift revealed a reduction in wound healing time when compared to excision with secondary wound healing and primary closure on the midline.^[26]

The Limberg flap: Limberg flap is the most commonly utilized off-midline procedure in the treatment of pilonidal disease. A rhomboid subcutaneous flap is mobilized and transferred to cover the defect after a rhomboid excision of sick tissue.^[27]

The Limberg flap, like the other flaps, includes flattening the natal cleft and lateralization of the incision, but the bottom section of the wound spans the natal cleft. This is the most common site of wound disintegration and recurrence in some circumstances. As a result, many authors have changed the method to ensure that the lower end of the flap and the subsequent scar are completely outside the natal cleft.^[27]

Recurrence rates ranging from zero to eight percent have been documented, with a four to six percent reduction after the modified Limberg technique.^[27]

The Karydakias flap: The classic Karydakias flap involves an oblique elliptical excision of diseased tissue with flap base fixation to the sacral fascia. Suturing the edge of the flap off-midline closes it. This technique avoids a midline cut while attempting to reconstruct and flatten the natal cleft. In the modified Karydakias flap, the same excision and closure are performed without tacking the flap to the sacral fascia, with the goal of preventing the creation of a new vulnerable raphe by flattening the natal cleft.^[28]

Laser Therapy

Despite the success rates of classical excision and surgical techniques, these methods include a large amount of tissue gluteal tissue removal leading to a prolonged healing period, which led to the introduction of minimally invasive surgeries such as endoscopic laser ablation of pilonidal sinuses. The main motive behind these techniques is to remove the infected tissue and minimize factors such as post-operative pain, longer hospital stays, recovery period, and burden on the patient's lifestyle.^[29]

Laser ablation of the sinus tract has recently become possible thanks to developments in laser technology. The aim is to use thermal energy generated by a radial emitting laser probe to burn and eradicate sinus tracts.^[29]

Soft tissue lasers provide monochromatic beams with high energy density and a well-defined wavelength. The thermal effect of lasers on tissue is a complex process that involves three independent phenomena: light conversion to heat, heat transmission, and tissue reaction. Because the wavelength of a laser impacts how it is absorbed by different types of tissue, a target structure absorbs the light of the wavelength employed more intensely than the surrounding tissue.^[29]

Other factors which contribute to the depth of tissue penetration include laser power (measured in watts), beam precision, spot size, and mode/duration. The key to lasers' success in medicine is their capability to coagulate or cut diseased soft tissue while causing the least amount of thermal injury to good tissue around it.^[30]

The use of a laser in the treatment of Pilonidal disease began in the early 1990s, and various types and techniques of laser have been reported: CO₂ laser for tissue cutting or elliptical excision,^[31] laser epilation for a decrease in recurrence rate,^[32] and Nd:YAG laser treatment of primary and recurrent PD.^[33,34]

In 2017, the first report of pilonidal sinus destruction with a radial laser probe was reported. Dessily et al. treated 40 patients, with an 87.5% success rate.^[35] The number of research and patients who have been treated with this laser is increasing. However, there is insufficient high-level evidence on short- and long-term results to develop evidence-based guidelines for laser treatment in chronic Pilonidal disease.^[35,36,37,38]

Pilonidal laser treatment since 2017 has been considered the definitive treatment for chronic pilonidal sinus by many clinicians, while the treatment of acute Pilonidal disease remains standard (excision and drainage).^[29] Existing medical literature has shown the treatment of chronic Pilonidal disease has shown promising results with a 94% healing rate, around four percent success rate, and minimal risks involved laser treatment can be considered a safe and efficient technique for the treatment of Pilonidal disease, adding to the safety and efficacy it offers advantages such as it's easy to learn and perform, can be performed under local anesthesia in a day, the recovery period is shorter and it allows the patient to get back to daily activities faster compared to traditional techniques.^[39,40] Laser therapy allows for easy retreatment with better success rates in case of recurrence.

Along with laser treatment, there has been a shift toward endoscopic techniques due to the high morbidity and recurrence rates of traditional invasive techniques. The goal of these techniques is to maximize efficacy and reduce morbidity. Endoscopic pilonidal sinus treatment (EPSiT) and Video-assisted ablation of pilonidal Sinus (VAAPS) are techniques based on a diagnostic and interventional phase. After the exterior orifice is excised, a Fistuloscope is placed through a half cm annular incision. The initial phase detects hair, debris, and accessory tracts, which aids in the planning of the interventional phase. Following that, hair and hair follicles are removed using endoscopic forceps under direct view, followed by electrocautery ablation of the granulation tissue lining the main and accessory routes, and ultimately excision of necrotic tissue. Thus, the goal of EPSiT/VAAPS is to target the hair invagination that drives pilonidal sinus disease pathogenesis and inhibit further growth in the tract, which cures by secondary intention. Furthermore, it is performed under local anesthesia and does not necessitate regular packing changes, although it does necessitate wound evaluation and compliance with wound hygiene guidelines.^[41,42]

Even though studies have shown encouraging results regarding the treatment of pilonidal sinus with laser, future randomized trials comparing open, endoscopic, and laser treatment techniques are required to come up with favorable outcomes to support evidence-based treatment decision-making.

CONCLUSION

Pilonidal sinus or Pilonidal disease is an infection of the subcutaneous fatty tissue, usually in the natal (intergluteal) cleft, that can be acute or chronic. Mild pilonidal disease can be treated with more conservative techniques; but, in situations of recurring or suppurative disease, or significant scarring, excision with flap closure is usually required. Although no single surgical approach has been identified as superior, studies found that off-midline procedures outperform midline closure

in terms of healing time, operative site infection, and recurrence rate. Laser therapy is one of the new techniques being used to treat pilonidal disease. Even though studies show encouraging results for laser treatment of pilonidal sinus, a single technique cannot be considered optimal considering the variations in the representation of pilonidal sinus which can be present as a shallow pit or extensive bilateral tracts and inflammatory changes to the tissue. Future studies directed at other evaluating critical issues concerning use of lasers in chronic pilonidal sinus treatment, such as optimal timing for laser treatment after acute abscess, the definition of the type of chronic pilonidal sinus amenable to laser therapy, adequate laser setting, and the optimal amount of energy delivered during the procedure, patient-related risk factors for failure, and optimal management of failures after primary laser treatment, are recommended.

Key Messages

There are various surgical options available for treatment of pilonidal sinus. It essentially depends on the grade of disease and preference of the surgeon. Each option has its pros and cons. This article reviews the various surgical options.

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