ORIGINAL SUMMARY

From Radical Excision to Laser Precision: A Data-Driven Look at the Evolution of Pilonidal Surgery

ABSTRACT

Background: Pilonidal sinus disease (PSD) is an acquired condition that primarily affects young adults, with an estimated incidence of up to 26 per 100,000 people in the United States and a peak prevalence among men aged 15–30 years.[1] For over a century, PSD was misclassified as a congenital condition, resulting in radical surgical excision becoming the standard approach.While radical excision can be curative, it often leads to substantial morbidity, extended wound healing, and high long-term recurrence rates.[2-5] Advances in the understanding of PSD as an acquired condition have driven a shift toward minimally invasive techniques that emphasize sinus tract destruction with minimal collateral damage.[6-10] **Objective:** To summarize the evolution of PSD treatment, comparing the outcomes of historical radical techniques with modern minimally invasive approaches. **Methods:** This review examines historical and contemporary studies, including cohort studies, randomized trials, and systematic reviews reporting outcomes for open excision, midline closure, flap-based reconstructions, and tract destruction using laser systems. **Results:** Open excision with secondary intention healing requires a mean of 70 days (28-266) to heal, with recurrence rates of up to 20% at 10 years.[11-14] Midline closure shortens wound healing but increases recurrence risk, exceeding 60% at 20 years.[5,13,15,16] Asymmetric closure and flap-based techniques, such as the Karydakis or Bascom methods, lower recurrence to below 3% at 20 years but require inpatient care and high morbidity for an otherwise healthy cohort.[14,16-20] Endoscopic Pilonidal Sinus Treatment (EPSiT) and Video-Assisted Ablation (VAAPS) were the first minimally invasive approaches to PSD.[7-10] Laser tract and sinus destruction, specifically by systems delivering 1470 nm energy via radial fibers from within the sinus cavity, have shown healing rates of 88-90% and recurrence rates around 2–4%.[21-29] **Conclusion:** Growing evidence supports a paradigm shift from radical excision to precision-based, minimally invasive PSD management. Laser treatment embodies this shift as an effective, patient-centered method with repeatability, minimal downtime, and low recurrence, while preserving all future treatment options if needed.

Keywords: Pilonidal Sinus Disease · Pilonidal Laser Surgery · SiLaT/PiLat · 1470 nm Diode Laser · Radial Laser Fiber

INTRODUCTION

Pilonidal sinus disease was first described by Mayo in 1833 and named by Hodges in 1880.[2,3] For decades, the theory that PSD was congenital shaped radical surgical practices aimed at completely removing suspected embryonic remnants.[5,16] However, the classic open excision approach led to prolonged recovery, disfiguring scars, social and economic burden, and frustratingly high recurrence rate.[11-20] Modern consensus now recognizes PSD as an acquired condition driven by hair shafts that penetrate the natal cleft skin under mechanical pressure.[5,16,17]

PATHOGENESIS & EPIDEMIOLOGY

The acquired theory highlights three factors: loose or broken hairs, local mechanical forces that drive penetration, and skin vulnerability. Karydakis described how the depth of the natal cleft acts as a trap for hair, facilitating re-insertion and reinfection.[17] PSD primarily affects young men, with a male-to-female ratio of 2.2:1. Risk factors include obesity, sedentary work, local trauma, and family history.[30] Doll et al. showed family history increases recurrence risk by 50%.[31] The incidence of PSD has risen steadily in recent decades. A German military cohort saw rates increase from 29 to 48 per 100,000 between 2000 and 2012.[32-34]

HISTORICAL SURGICAL APPROACHES

Radical Excision with Healing by Secondary Intention

Radical excision with healing by secondary intention, the earliest approach, involves wide elliptical removal of all tracts down to the presacral fascia, and leaving the wound open for granulation.[11,12] This procedure is performed under general anesthesia and requires hospitalization. With a mean healing time of 70 days (28-266 day range), this technique is especially difficult on patients as it requires painful dressing changes as well as prolonged time off of work (17-28 days).[13] Recurrence rates are 1.5% at 12 months, 4.2% at 24 months, 13.1% at 60 months, and 19.9% at 120 months.[14] The open approach's substantial morbidity results from prolonged healing and frequent, uncomfortable dressing changes. For these patients, who are typically young, otherwise healthy, and active, these wounds cause considerable social and economic disability.[11]

Primary Midline Closure

To reduce healing time, midline closure was introduced in the 1930s.[15] Described as early as 1933, in this technique the surgeon excises an elliptical wedge of skin and subcutaneous tissue down to the pre-sacral fascia, designed to remove all the inflamed. The edges of the wound are then approximated togeth er at the midline.[1] Though wound healing time drops to a mean of 14 days (14-112 day range), and shorter time off of work (10-15 days), midline closure increases wound dehiscence and infection due to tension along the gluteal cleft.[13,5] Recurrence rates were also unacceptably high; 3.4% at 12 months, 7.0% at 24 months, 16.8% at 60 months, 32.0% at 120 months, and 67.9% at 240 months.[14] In an attempt to decrease patient recovery time and discomfort associated with healing by secondary intention, surgeons inadvertently increased the risk of recurrence by 60% with primary midline closure.[14]

Asymmetric Closure & Flap Procedures

Understanding the hair insertion process, the importance of avoiding midline incisions, and placing any healing wounds off midline was instrumental to the treatment of PSD. Flap-based treatments aim to excise the disease, provide healthy tissue coverage for the defect, and alter the contour of the natal cleft to reduce additional disease recurrence.[16] Karydakis described an asymmetric technique that flattens the cleft and shifts the scar laterally, reducing hair re-entry.[17] Bascom refined the approach with a cleft lift.[18] These techniques are associated with a mean healing time of 16 days, 14-17 days off of work, and lower wound morbidity (compared to primary midline closure).[19,20] Recurrence rates are 0.2% at 12 months, 0.6% at 24 months, 1.9% at 60 months, and 2.7% at 120 months.[14] Despite an improvement in recurrence rates, patients remained unsatisfied with disfiguring scars, hospital stay and an uncomfortable healing process.

FROM EXCISION TO PRECISION: THE MINIMALLY INVASIVE ERA BEGINS

Due to the acquired theory gaining general acceptance, the socioeconomic impact and decreased quality of life for patients recovering from conventional PSD surgery, physicians shifted their approach from radical excision to precision.[6] Endoscopic pilonidal sinus treatment (EPSiT) and Video-Assisted Ablation of Pilonidal Sinus (VAAPS) techniques enabled a minimally invasive approach which drove the creation of new minimally invasive surgical tools.[7-10] Laser emerged as the next evolution: preserving the precision of endoscopic approaches while delivering predictable, reproducible results. Lasers offer internal destruction without external disruption.

Laser Tract and Sinus Destruction

The natural next step in the evolution of precision surgery for PSD is a minimally invasive technique for delivering laser energy to the sinus and tracts from within, obviating the need for a large external wound. The main principles are; destruction of the pilonidal sinus, obliteration of the tracts, and promoting the production of new granulation tissue.[24]

The 1470 nm Wavelength

The most widely used, and clinically appropriate, laser for PSD is the 1470 nm wavelength. The 1470 nm wavelength has a local peak absorption in water, allowing for a good balance of precision and coagulation. Studies show that the thermal penetration depth of the 1470 nm laser is only 2–3 mm, limiting injury of the surrounding tissue. In comparison, electrocoagulation is less efficient and less easy to control, leading to greater thermal effect on the surrounding tissue.[1]

The Technique

In this technique, physicians start by thoroughly identifying the tracts, cleaning, flushing and pit picking. After the cavity is cleaned, a specially designed radially emitting fiber (Infinite Ring Fiber, NeoLaser, Israel) is introduced into the cavity (Figure 1A). Once in position, a 1470 nm wavelength laser (NeoV1470, NeoLaser, Israel) is activated in continuous mode and energy is radially emitted through a 360 degree fiber. As the fiber is gradually withdrawn, the energy uniformly collapses and destroys the epithelial lining of the sinus tracts (Figure 1B).

Figure 1A

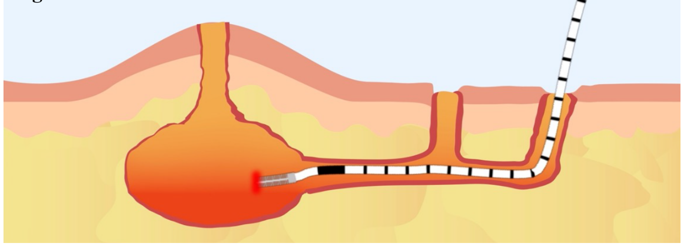
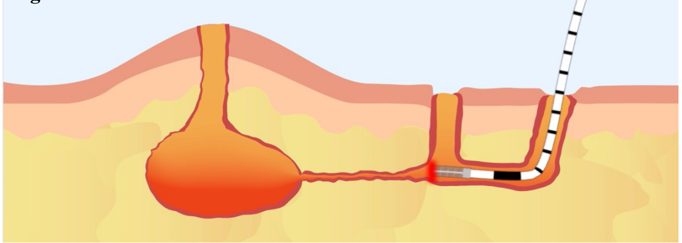


Figure 1B



Laser Outcomes

Reported healing rates across prospective studies and case series range from 88% to 95%, with recurrence rates between 2.0% and 3.3% in studies with follow-up periods of 24 months.[24,21,22] The procedure is typically performed under local anesthesia in an outpatient setting, with mean time off work reported between 2 and 5 days.[21] In one study 92.8% of 237 patients returned to daily activities the same day as laser surgery.[21] Because laser treatment does not involve wide tissue removal or complex closure techniques, patients retain the full range of surgical alternatives, including flap procedures or formal excision, should recurrence occur. This makes it especially valuable as a first-line or early intervention strategy, as it imposes no limitations on future surgical planning and avoids the anatomical distortion or scarring that can complicate re-operations.

Table 1 Outcomes associated with open excision (Radical Excision with Healing by Secondary Intention), midline closure, flap reconstruction and laser surgery in the treatment of PSD.

Approach	Time Off Work	Recurrence	Anesthesia	Scar	Re-Treatment Feasibility
Open Excision	17-28 Days[13]	4.2% at 24 months[14]	General/Spinal	Large Scar	Limited, large tissue loss
Midline Closure	10-15 Days[13]	7% at 24 months[14]	General/Spinal	Large Scar	Limited, large tissue loss
Flap Reconstruction	14-17 Days[19,20]	0.6% at 24 months[14]	General/Spinal	Large Scar	Limited, more complex
Laser Surgery	2-5 Days[21]	3.3% at 24 months[22]	Local	Minimal or None	Easy, repeatable

Conclusion

PSD was long misclassified as congenital, leading to radical excision as the dominant treatment. Though often effective, this approach came with significant downsides- prolonged healing, painful wound care, disfiguring scars, and months away from normal activity. Recurrence frequently required further, more invasive operations. While flap procedures improved recurrence rates, they still involved hospitalization, discomfort, and anatomical disruption. As PSD came to be understood as an acquired condition, the clinical goal shifted toward removing or destroying sinus tracts in a way that limits morbidity and preserves future treatment options. Laser therapy using a 1470 nm diode system reflects this shift. By collapsing tracts internally through a radially emitting fiber, it avoids external incisions and reduces damage to surrounding tissue. Compared to open or flap-based techniques, laser treatment is repeatable, tissue-conserving, and associated with less pain, scarring, and cosmetic disruption. Healing rates exceed 90%, recurrence remains low (3.3%), and patients typically return to work within 2–5 days. These results reinforce the movement toward precision-guided, minimally invasive pilonidal care - offering effective treatment with faster recovery and lower overall burden.

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