

# Pediatric Endoscopic Pilonidal Sinus Treatment: An Effective Procedure for Children with Recurrent Pilonidal Sinus Disease After Failed Open Surgery

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## Abstract

**Background:** The traditional open excision of pilonidal sinus disease (PSD) is associated with a painful postoperative course and high recurrence rates. We recently published our technique of pediatric endoscopic pilonidal sinus treatment (PEPSiT). We aimed to report our long-term outcome including using PEPSiT for recurrent PSD after failed open repair.

**Methods:** All patients with recurrent PSD after open excision who underwent PEPSiT in our unit over the past 2 years were included in the study. During surgery a fistuloscope was introduced through the fistula's orifice. All identifiable hairs were removed using endoscopic forceps. Thereafter, the cavity was debrided with endobrush and ablated with monopolar electrode. External openings were not closed.

**Results:** In the past 2 years, 40 patients with PSD underwent PEPSiT. Ten of 40 patients (6 boys and 4 girls with an average age of 16.8 years [range=14–18]) had recurrent PSD after open surgery and were included in the study. The average operative time was 27.7 minutes (range=24–43). No perioperative complications occurred. The average analgesic requirement was 20 hours (range=16–26) and the average hospitalization was 22.4 hours (range=18–36). The average time to return to full daily activities was 2.3 days (range=1–5) and all patients were highly satisfied of postoperative course. At 1 month postoperatively, the external openings were completely healed. No recurrence was recorded at a mean follow-up of 18 months (range=6–24).

**Conclusions:** Our results demonstrated that PEPSiT is an excellent technique for surgical treatment of PSD in children and teenagers. In fact, it is technically easy and fast to perform, with a short and painless hospital stay and it allows to the operated patients an early return to full daily activities without any physical limitations compared with open repair. In addition, it is also effective for treatment of recurrent PSD after failed open repair.

**Keywords:** pilonidal sinus, fistuloscope, PEPSiT, recurrence, children, technique

## Introduction

**P**ILONIDAL SINUS DISEASE (PSD) is a common inflammatory disease of the sacrococcygeal region.<sup>1</sup> It occurs mainly in young men and teenagers with a reported incidence of 26:100,000 and common risk factors include obesity, hirsutism, sedentary occupation, and local irritation.<sup>2–4</sup> PSD is considered an acquired disorder caused by the obstruction of hair follicles in the natal cleft.<sup>5</sup> The clinical presentation is

variable, ranging from asymptomatic pits to acute abscess to chronic cyst, with a considerable negative impact on quality of life.<sup>1,3</sup> The gold standard technique for surgical treatment of PSD is still under debate. The ideal surgical technique should eradicate the cyst and remove and clean the sinus tract and secondary tracts, leading to complete and durable healing with good cosmetic outcome.<sup>6,7</sup>

The traditional open excision and healing by secondary intention is associated with a long and painful postoperative

course and high morbidity rates.<sup>1</sup> Conversely, open excision with primary closure, using different techniques including flap-based procedures, allows shorter wound healing time but also higher rates of wound-related complications, such as infection and wound dehiscence, and recurrence.<sup>8–10</sup> The recurrence of the disease after open surgical treatment remains the most serious problem, ranging from 0% to 40%, for different surgical approaches.<sup>8,11</sup> As the recurrent disease usually occurs in larger areas, larger excisions are needed with subsequent larger skin defects.<sup>12,13</sup> Because of the difficulties in primary closure of such defects, many flap methods have been used for skin closure, including complex techniques such as the cleft lift procedure described by Bascom and fasciocutaneous unilateral V-Y flap techniques, with variable outcomes and success rates and considerable risk of further recurrence.<sup>14–16</sup>

Despite the limited evidence available in the pediatric population, PSD is a common entity among children and adolescents, with complication and recurrence rates comparable with the adult population.<sup>17,18</sup> In 2014, Meinero et al. described a novel minimally invasive approach for PSD, named endoscopic pilonidal sinus treatment (EPSiT), reporting very promising results in adults such as a shorter wound healing and time off work and also improved pain control and cosmesis.<sup>19</sup> We recently published our technique of pediatric endoscopic pilonidal sinus treatment (PEPSiT).<sup>20,21</sup>

This study aimed to report our long-term outcome including using PEPSiT for recurrent PSD after failed open surgery.

## Materials and Methods

### *Patient selection and data acquisition*

The medical records of all patients with age  $\leq 18$  years who underwent PEPSiT for PSD in our unit over the past 2 years (from June 2016 to June 2018) were retrospectively reviewed. Only patients presenting with a symptomatic chronic recurrent PSD after failed open surgery were included in the study. We excluded patients who presented with primary PSD. Patients presenting with acute pilonidal abscess were not excluded from the study; however, they received antibiotic therapy and they were operated on 2–3 weeks after resolution of the inflammatory process. All PEPSiT procedures were performed by a single pediatric surgeon, who mastered proficiently the technique. All patients and their parents signed a specific informed consent before the procedure.

Demographic and clinical data including age, gender, weight, comorbidities, and previous surgical approaches to PSD were extrapolated from clinical records. Follow-up included outpatient evaluation at 1, 2, and 4 weeks postoperatively and then monthly until 6 months after surgery and then every 3 months until 18 months after surgery. During the follow-up, patients were monitored for healing, pain, complications, recurrence, and satisfaction. The primary endpoint of the study was complete wound healing, defined as closure of all external openings during the first 60 postoperative days. Disease recurrence was considered when symptoms and/or local inflammatory signs such as secretion occurred after any interval after complete wound healing. Secondary outcome parameters were healing time, operative time, and intra- and postoperative complications such as wound infections. In

addition, we compared the postoperative outcome of PEPSiT with a historic comparison group of patients with recurrent PSD who were reoperated using open technique in our Institution with the aim to further outline to the readers the difference between PEPSiT and the classic open technique.

The study received the appropriate Institute Review Board (IRB) approval at Federico II University of Naples, Italy.

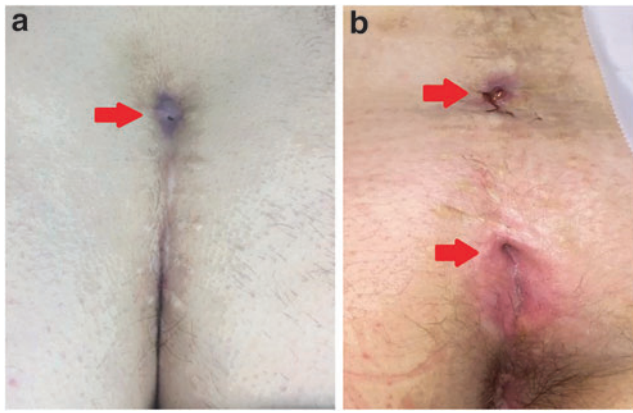
### *Operative technique*

Patients received a specific type of subarachnoid spinal anesthesia and antibiotic prophylaxis with amoxicillin 50 mg/kg. They were placed in prone position with buttocks retracted with adhesive tape. The main surgeon was at the patient's right and used a step, to achieve a better ergonomics for shoulders. Two screens were placed, one at patient's feet and the other at patient's head, and they were adopted alternatively in relation to the fistula opening. PEPSiT was performed using a fistuloscope, manufactured by Karl Storz, equipped with a monopolar electrode connected to the electrosurgical knife power unit, an endoscopic brush and an endoscopic grasping forceps. The fistuloscope has an 8° angled eyepiece and is equipped with an optical channel and a working and irrigation channel. Its diameter is 3.2 × 4.8 mm, and its operative length is 18 cm. A removable handle allowed easier maneuvering and better ergonomics for the surgeon, the handle can be used in different positions and angles, according to the surgeon's preference.

A five-phase surgical technique was used in all cases. In the first phase (fistuloscope's entry), the fistuloscope was introduced through the fistula's external orifice. If the external orifice was too small, it was widened with a spreading clamp to allow an easy introduction of the fistuloscope. In patients with multiple openings, the lower pit was used for access. In the second phase (sinus and its lateral tracts identification), a clear identification of the anatomy of the sinus cavity and its lateral tracts was allowed by a continuous jet of irrigation solution used as distension medium. In the third phase (hair removal), all the hairs and bulbs were removed under vision using the endoscopic forceps, inserted through the operative channel of the fistuloscope. In the fourth phase (sinus brushing), the sinus cavity was accurately debrided using the endoscopic brush and any necrotic material and residual granulation tissue from the previous surgery was eliminated by the saline solution flow. Finally, the fifth phase (sinus cavity ablation) was to obtain complete ablation of sinus cavity. During this step, a cautery ablation of the sinus granulation tissue was performed using the monopolar electrode, proceeding centimeter by centimeter and cauterizing all fragments of the material adhering to the wall of the sinus, commencing in the main tract and where appropriate traversing secondary tracts. All potential accessory cavities and any lateral tracts were identified and ablated and an accurate hemostasis was performed. No drain was placed at the end of procedure. External openings were not closed and were covered by a compression dressing.

### *Postoperative management*

Oral intake was allowed immediately after operation and patients were encouraged to walk after 2–3 hours and to keep a normal decubitus in the immediate postoperative period. After discharge, the patients were instructed to clean the



**FIG. 1.** Clinical presentation of recurrent pilonidal sinus disease, with one (a) or two (b) external openings in the midline. The arrows indicate the external openings of pilonidal sinus disease (PSD).

wound with sterile saline solution and apply a 2% eosin solution and a silver sulfadiazine spray three to four times a day for about 3–4 weeks postoperatively (Supplementary Video S1, “The steps of postoperative dressing”). They were also instructed to remove surrounding hairs, including at least an area 10 cm in diameter around the opening, by shaving until completion of healing process. After complete wound epithelization, they underwent radical hair depilation using pulse-dye laser technology. All patients were given no restrictions in return to daily activities.

## Results

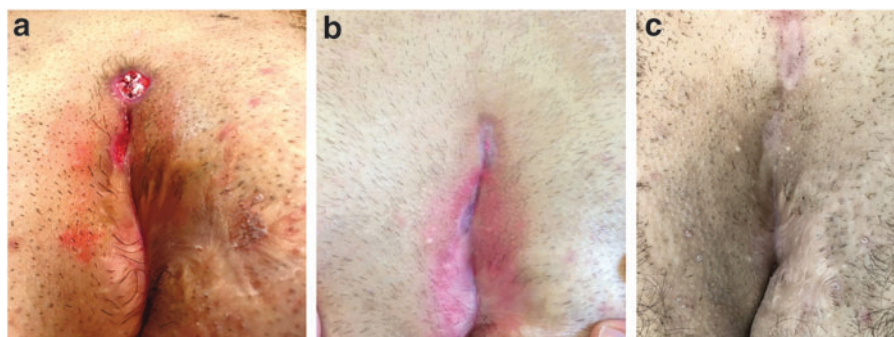
From June 2016 to June 2018, 40 patients with PSD were operated using PEPSiT in our Pediatric Surgery unit. Ten of 40 patients (6 boys and 4 girls; 25%) had a recurrent PSD after failed open surgery and were included in the study. Their average age at time of surgery was 16.8 years (range=14–18) and their average weight was 66.5 kg (range=55–92). No comorbidity was reported in any patients. All the patients had previously been operated in general surgery units and had undergone an open wide excision of the pilonidal sinus with primary closure as first-line treatment. Three patients (30%) had undergone open repair twice before coming to our observation. The average time

between the first open repair and the recurrence was 4.5 months (range=1–14). Eight of the recurrent PSD had multiple orifices, all located in the midline, whereas 2 patients presented one orifice in the midline (Fig. 1). The average operative time was 27.7 minutes (range=24–43). We did not report any intra- or postoperative complications. All patients were asked to assess postoperative pain using the visual analogue scale and the average pain score, assessed 24 hours after surgery, was 3.2 (range=2–5), whereas it was 1.1 (range=0–3) at 1 week postoperatively. The average analgesic requirement (paracetamol 15 mg/kg every 8 hours) was 20 hours (range=16–26) and the average hospital stay length was 22.4 hours (range=18–36). Most patients had an overnight hospitalization as we preferred to perform the first dressings after surgery during hospital stay, to correctly instruct the parents about wound management at their home. The average time to return to work and/or school and daily activities was 2.3 days (range=1–5), and all patients were highly satisfied with postoperative course and cosmetic outcome. The overall healing rate was 100% and the average healing time was 24 days (range=21–30). At 1 month postoperatively, complete healing of the external openings was observed in all patients (Fig. 2). No cases of recurrence or wound infection were recorded at a mean follow-up of 18 months (range=6–24). Patients’ demographics and results are summarized in Table 1.

The comparison group included 10 consecutive patients (7 boys and 3 girls) with an average age of 15.9 years (range=13.5–17) and recurrent PSD, who underwent open redo excision and healing by secondary intention in our Institution. The comparative analysis between the PEPSiT group and the historic open group showed that PEPSiT was associated with significantly shorter hospital stay, better pain control, and lower postoperative complications and recurrence rates compared with the open redo-excision technique ( $p=.001$ ). All outcome parameters of both techniques are given in Table 2.

## Discussion

Despite operative therapy dating from more than a century ago, the optimal surgical management of PSD remains still a matter of debate.<sup>1</sup> The ideal surgical technique should be easy to perform and associated with short hospitalization, minimal patient discomfort, low recurrence rate, and minimal pain and wound care to decrease time off work or school activities.<sup>6,7</sup>



**FIG. 2.** Surgical outcome of pediatric endoscopic pilonidal sinus treatment at 1 week (a), 4 weeks (b), and 8 weeks (c) postoperatively.

TABLE 1. PATIENTS' DEMOGRAPHICS AND RESULTS

	<i>Value</i>
Patients' demographics	
No. of patients, <i>n</i>	10
Male/female	6/4
Average age (years)	16.8 (range = 14–18)
Average weight (kg)	66.5 (range = 55–92)
Associated comorbidity, <i>n</i>	0
No. of previous open repair, <i>n</i> (%)	
1	7 (70)
2	3 (30)
Results	
Average operative time (minutes)	27.7 (range = 24–43)
Intraoperative complications, <i>n</i>	0
Average VAS score	
24 hours after surgery	3.2 (range = 2–5)
1 week after surgery	1.1 (range = 0–3)
Average analgesic requirement (hours)	20 (range = 16–26)
Average hospital stay length (hours)	22.4 (range = 18–36)
Average time to return to daily activities (days)	2.3 (range = 1–5)
Wound infection, <i>n</i> (%)	0
Recurrence, <i>n</i> (%)	0
Overall healing rate (%)	100
Average healing time (days)	24 (range = 21–30)
Satisfied patients (%)	100

VAS, visual analogue scale.

The traditional open excision and healing by secondary intention resulted in fewer recurrences but it was associated with longer hospitalization, longer healing time, and more acute postoperative pain.<sup>22</sup> Conversely, open excision with primary closure, using different techniques including flap-

TABLE 2. OUTCOME PARAMETERS OF PEDIATRIC ENDOSCOPIC PILONIDAL SINUS TREATMENT AND OPEN REDO-EXCISION TECHNIQUE

<i>Outcome parameter</i>	<i>PEPSiT</i> ( <i>n</i> = 10)	<i>Open redo</i> <i>excision</i> ( <i>n</i> = 10)	<i>Statistical</i> <i>analysis</i> ( <i>p</i> <i>value</i> )
Average operative time (minutes)	27.7	51.7	.001
Average VAS pain score			
24 hours after surgery	3.2	7.8	.001
1 week after surgery	1.1	6.9	.001
Average analgesic requirement (hours)	20	109	.001
Average hospital stay length (hours)	22.4	97.5	.001
Average time to full daily activities (days)	2.3	15.4	.001
Average healing time (days)	24	87.3	.001
Postoperative complications			
Bleeding, <i>n</i>	0	1 (10%)	.001
Wound dehiscence, <i>n</i>	0	3 (30%)	.001
Wound infection, <i>n</i>	0	1 (10%)	.001
Recurrence, <i>n</i>	0	1 (10%)	.001

VAS, Visual analogue scale.

based procedures, allowed shorter wound healing time but the principal problems were the high recurrence rate and the high infection rate.<sup>8–10</sup> The recurrence of the disease after open surgical treatment remains the most serious problem, ranging from 0% to 40%, for different surgical approaches.<sup>8,11</sup> Recurrent PSD is somehow more annoying than primary disease both for the patient and the surgeon, because larger excisions are needed with subsequent larger skin defects.<sup>12,13</sup> Because of the difficulties in primary closure of such defects, many flap methods have been reported for their treatment and for skin closure, including complex techniques such as the cleft lift procedure described by Bascom and fasciocutaneous unilateral V-Y flap techniques, with variable outcomes and success rates and considerable risk of further recurrence.<sup>14–16</sup> In addition, the open and flap procedures are associated with poor patient satisfaction because of the long and painful postoperative course and the presence of a large scar.<sup>14–16</sup>

Very limited data are available in the pediatric population, especially regarding the treatment of recurrent PSD.<sup>18,23,24</sup> We applied the endoscopic technique, originally described in adults by Meinero et al. in 2014,<sup>19</sup> in pediatric patients, calling it pediatric EPSiT or PEPSiT.<sup>20,21</sup> In this study, we aimed to assess the long-term outcome of PEPSiT for treatment of recurrent PSD after failed open surgery. In our hands, PEPSiT offered the possibility of obtaining the complete obliteration of the sinus cavity and sinus tracts and hair removal under direct vision and subsequent closure of the primary sinus without pain and need for prolonged hospitalization and interruption of daily activities. Before undergoing PEPSiT, all patients of our series, who had previously experienced the long and painful postoperative course of open repair, were terrified by the idea to undergo a repeat surgery. After PEPSiT, all patients were enthusiasts with this technique for the excellent postoperative course and good cosmetic outcome. Lack of pain, absence of scar, easy self-management at home, faster recovery and return to full daily activities, and a low risk of recurrence or infections may explain the high satisfaction rate reported in our study. Furthermore, PEPSiT was associated in our experience with significantly shorter hospital stay, better pain control, and lower postoperative complications and recurrence rates compared with the open redo-excision technique (Table 2).

The accurate identification of the main sinus cavity, all lateral tracts and the presence of hair in the cavity, possible thanks to the magnified view offered by the fistuloscope, explained the excellent success rate reported by PEPSiT also for recurrent PSD. In our opinion, the debridement of the sinus cavity and all secondary tracts, coupled with complete hair removal should avoid infection and early or late recurrence.

In many cases, the reason for the high recurrence rate of PSD is not likely to be an unsuccessful operative procedure and unsuccessful removal of the lesion. Rather, it is more likely owing to failure to pay strict and constant attention to the prevention of reaccumulation of hair in this area.<sup>25</sup> The role played by hair influences the management of PSD and control of hair growth in the perisinus area has shown to improve healing of PSD and preventing recurrence.<sup>26,27</sup> Hair growth can be controlled by shaving the natal cleft regularly, using depilatory cream or with laser technology.<sup>25</sup> The latter option aims at removal of hair by photothermolysis of the hair follicles.<sup>28,29</sup> Laser depilation has an advantage over conventional shaving as the light can reach deep crevices in the

natal cleft, which would otherwise be difficult to access.<sup>30</sup> We believe that the high success rate that we obtained in our series was also because of the careful postoperative wound management performed by patients themselves. We informed them about the importance to improve local hygiene and to treat the wound several times per day, using topic antiseptic solution and silver sulfadiazine (Supplementary Video S1). In addition, patients were instructed to control surrounding hair growth including at least an area 10 cm in diameter around the opening, initially by shaving and thereafter, after completion of wound healing, by pulse-dye laser depilation. The rationale of this management was to maintain a dry and clean setting to avoid the inclusion of hair and to facilitate wound healing.<sup>28–30</sup>

Some limitations of our study should be addressed. Because of the small sample size, our results need to be validated in larger series. Furthermore, because PSD is a chronic disease, our results need to be validated by a longer follow-up.

In conclusion, our results demonstrated that PEPSIT is an excellent technique for surgical treatment of PSD in pediatric population. In fact, it is technically easy to perform, with a short and painless postoperative course and it allows to the operated patients a rapid return to full daily activities without any physical limitations compared with open repair. In addition, it is safe and effective and has the potential to become the gold standard for a minimally invasive scarless approach to treatment of recurrent PSD after failure of open surgery.

#### Disclosure Statement

No competing financial interests exist.

#### Supplementary Material

Supplementary Video S1

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