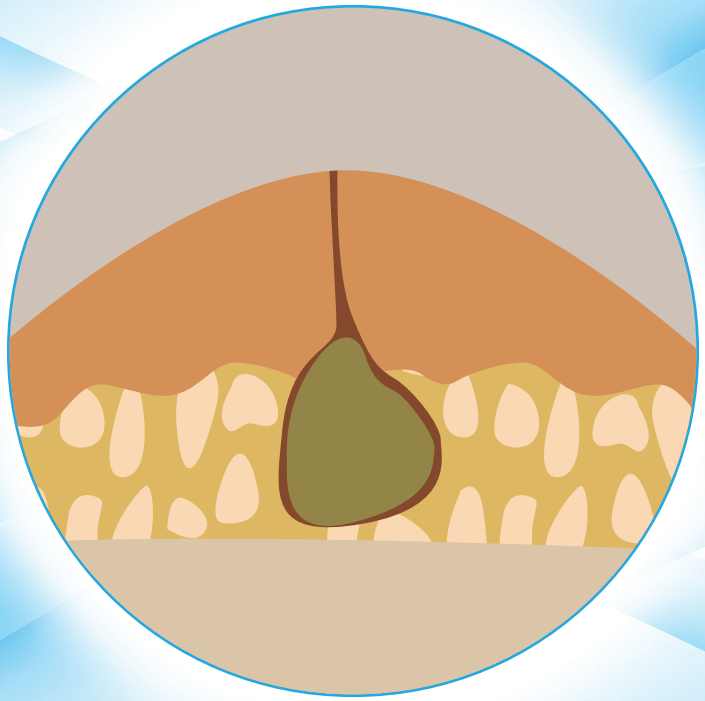
The Association of Colon and Rectal Surgeons of India
(A Section of ASI)



PILONIDAL SINUS
PRACTICE GUIDELINES 2021

The Association Of Colon And Rectal Surgeons Of India

Practice Parameters Consensus Meeting - 11th Nov 2021, Hotel Renaissance Mumbai

SITTING - (Left to Right) - Roy V Patankar, Mrs Kumkum Singh, Kushal Mital, Niranjan Agarwal, Parvez Sheikh, Pradeep P Sharma, Nisar A Chowdri

STANDING 1st ROW (Left to Right) - Rajashekar Mohan, Pravin P. Gore, Fazlul Qadir Parray, Tamonas Chaudhuri, R Kannan, Ajit Naniksingh Kukreja, Arshad Ahmad, M Kanagavel

DING 2nd ROW (Left to Right) - Kamal Gupta, C P Kothari, Ashok Kumar, Atul Deshpande, Ajay K Khanna, Bhanwar Lal Yadav, Prajesh Bhuta, Avanish Saklani, Shekhar Suradkar

List of Contributors

Shekhar Suradkar
MS, FICS, FAIS, FAMS, FACRSI
Chief, Dept of Surgery
WIALS Center, Highway Hospital and multispeciality clinic, Thane (W) MS 400 604

Pradeep P Sharma
MS, MNAMS, DNB, FACRSI, FAIS, FIAGES, FALS, FIMAS, PGTM (Israel)
Senior Consultant Surgeon
Purunanda Clinic (Laparoscopy and Lasers)
Jehangir Hospital and Medical Centre, Pune, Maharashtra, India

Atul Deshpande
MS
Proctologist
Prestige Hospital
Aurangabad (MS), India

Bhanwar Lal Yadav
MS, FAIS, FMAS
Professor
Dept of Surgery
SMS Medical College & Hospital, Jaipur, Rajasthan, India

C P Kothari
MS, FICS, FIAGES, FMAS
Sr Consultant Surgeon
Deptt of General, GI & Laparoscopic Surgery
CHL Hospitals, Indore, MP, India

Clinical Practice Guidelines Committee

Ajay K Khanna
Ajit Naniksingh Kukreja
Arshad Ahmad
Ashok Kumar
Ashok Ladha
Avanish Saklani
Brij B. Agarwal
Deepak Govil
Fazlul Qadir Parray
K.S. Mayilvaganan
Kamal Gupta
Kushal Mital
M Kanagavel
Mrs Kumkum Singh
Mrs Shalu Gupta
Niranjan Agarwal
Nisar A Chowdri
Parvez Sheikh
Prajesh Bhuta
Pravin P. Gore
R Kannan
Rajashekar Mohan
Roy V Patankar
Tamonas Chaudhuri
Varughese Mathai
Venkatesh Munikrishnan

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Foreword

Disorders of the colon and rectum are not only very common but complex too and many a time difficult to treat. The urge to provide best treatment amongst the vast majority available is even more perplexing and frustrating at times. This gets further compounded by the lack of supporting evidences locally. Our members are more guided by evidences produced by other part of the world though it is a well known fact that colorectal disorder occurrences, behaviour and treatment responses may differ across the continents. A need was therefore felt to compile various available literature for some common colorectal disorders and produce them in the form of Practice Guidelines suitable for our members. It is an established fact that treatment modalities guided by the explicit, careful and judicious use of the best evidence available serves as a guide for most appropriate clinical decision making and patient care.

The Association of Colon and Rectal Surgeons of India lead by its team of expert faculties in their respective fields have done some excellent literature search and collated the available experiences to prepare this guidelines for you. We hope this will serve as a ready reckoner for our members in their times of need and help them to combat many litigations too.

I take this opportunity to thank all the contributors for their constant support in this endeavour.

Dr. Niranjan Agarwal
President-ACRSI

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PILONIDAL SINUS

PRACTICE GUIDELINES 2021

Summary of recommendations

Treatment of Asymptomatic PNS

- For patients with asymptomatic PNS, prophylactic surgery should not be advised. Rather the wait-and-watch approach with the advice to avoid repeated trauma and maintain daily personal hygiene should be recommended (Strong recommendation based on moderate-quality evidence, Grade 1B)

Shaving and laser depilation

- Elimination of hair from the gluteal cleft and the surrounding skin, either by shaving or laser depilation, can be advocated for PSD. (Weak recommendation with low- quality of evidence, Grade 2B)
- Laser depilation should be preferred as a safe adjuvant to surgery, as it reduces the rate of recurrence, whereas shaving may increase the recurrence. (Weak recommendation with low- quality of evidence, Grade 2A)

Phenol application

- In patients with chronic PSD, single or multiple applications of phenol (crystal or liquid) can be an effective adjunctive treatment with lesser recurrence rate. (Weak recommendation based on moderate-quality evidence, Grade 2B)
- Phenol application as an adjunct to the surgery (excision, flap, or minimum invasive procedures [endoscopy]) resulted in rapid healing and reduced recurrence and could be used in patients with chronic PNS. (Weak recommendation based on moderate-quality evidence, Grade 2B)

Fibrin glue

- In patients with chronic PSD, fibrin glue can be effective in reducing the time to healing, duration of hospital stay, and recurrence rate. However, current evidence is uncertain regarding its benefit either as monotherapy or as an adjunctive therapy. (Weak recommendation based on high-quality evidence, Grade 2A)

Antibiotics in PSD

- Benefits of prophylactic intravenous and topical antibiotics in PSD surgery are not clear. Individualized consideration of their use is recommended. (Strong recommendation based on high-quality evidence, Grade 1A)

Pilonidal abscess: Incision and Drainage

- Patients with pilonidal abscess should be treated with incision and drainage (off-midline incision), regardless of whether it is a primary or recurring episode. (Strong recommendation based on low-quality evidence, 1C)
- The lay-open and curettage technique could help reduce recurrence, complication, and time off work in acute and chronic PSD. (Strong recommendation based on high-quality evidence, Grade 1A)
- Avoid flap surgeries and excision in the presence of abscess as they are associated with high rates of wound infection, morbidity, and recurrence. (Strong recommendation based on low-quality evidence, Grade 1C)

Surgical procedures for chronic PSD

- Patients who require surgery for chronic PSD may undergo excision and primary repair (preferably off-midline closure), or excision with healing by secondary intention (Marsupialization, Saucerization, or Sinusectomy/ Sinusotomy) based on the surgeon's skills and patient's preference. (Strong recommendation based on high-quality evidence, Grade 1A)
- When closure of PNS is desired, off-midline closure should be the standard management. (Strong recommendation based on high-quality evidence, Grade 1A)
- Pit picking and its variations (Gips/trephines) could be used in previously untreated patients with minimal or early disease condition. (Weak recommendation based on moderate-quality evidence, Grade 2B)

Summary of recommendations

- Marsupialization or Sinusectomy/Sinusotomy should be preferred based on the patient's characteristics and surgeon's preference. (Strong recommendation based on moderate-quality evidence, Grade 1B)
- Flap-based procedures should be performed especially for complex and recurrent chronic PSD when other techniques have failed. (Strong recommendation based on high-quality evidence, Grade 1A)
- There are no significant differences in outcome between the 3 most frequently used off-midline procedures—the Limberg flap, Karydakis flap, and Bascom cleft lift procedure. Either can be chosen if the off-midline procedure is the desired surgical option. (Strong recommendation based on high-quality evidence, Grade 1A)
- Modified surgical procedures such as the V-Y flap has a lower complication rate compared to the Limberg flap and Bascom cleft lift but may have longer operation time and hospital stay. (Strong recommendation based on low-quality evidence, Grade 1C)
- Multiple Z-plasty is associated with less recurrence and better cosmetic appeal (less disfigurement of the gluteal area) compared to other surgical modalities (Limberg flap). (Strong recommendation based on moderate-quality evidence, Grade 1B)

Minimal invasive approach

- Endoscopic treatment of PSD provides a minimally invasive alternative to the traditional/excision procedures and offers reduced morbidity, minimal patient inconveniences, high satisfaction, and good aesthetic outcomes. (Weak recommendation based on high-quality evidence, Grade 2A)
- Minimally invasive approaches, namely, EPSiT, require specialized equipment and expertise. (Strong recommendation based on high-quality evidence, Grade 1A)

Management of recurrent PSD

- The choice of operative strategies for recurrent PSD should be based on characteristics such as presence of an acute abscess or whether the disease is chronic, and the experience and expertise of the surgeon. (Strong recommendation based on low-quality evidence, Grade 1C)
- The Limberg flap and V-Y flap could be effective procedures in patients with recurrence and who have been operated for PSD previously. (Weak recommendation based on low-quality evidence, Grade 2C)
- Endoscopic PNS treatment could be an effective, safe, minimally invasive procedure; however, data on comparative clinical outcomes are scarce. (Strong recommendation based on low-quality evidence, Grade 1C)
- Bascom cleft uplift closure technique is useful for midline unhealed wounds. (Strong recommendation based on high-quality evidence, Grade 1A)

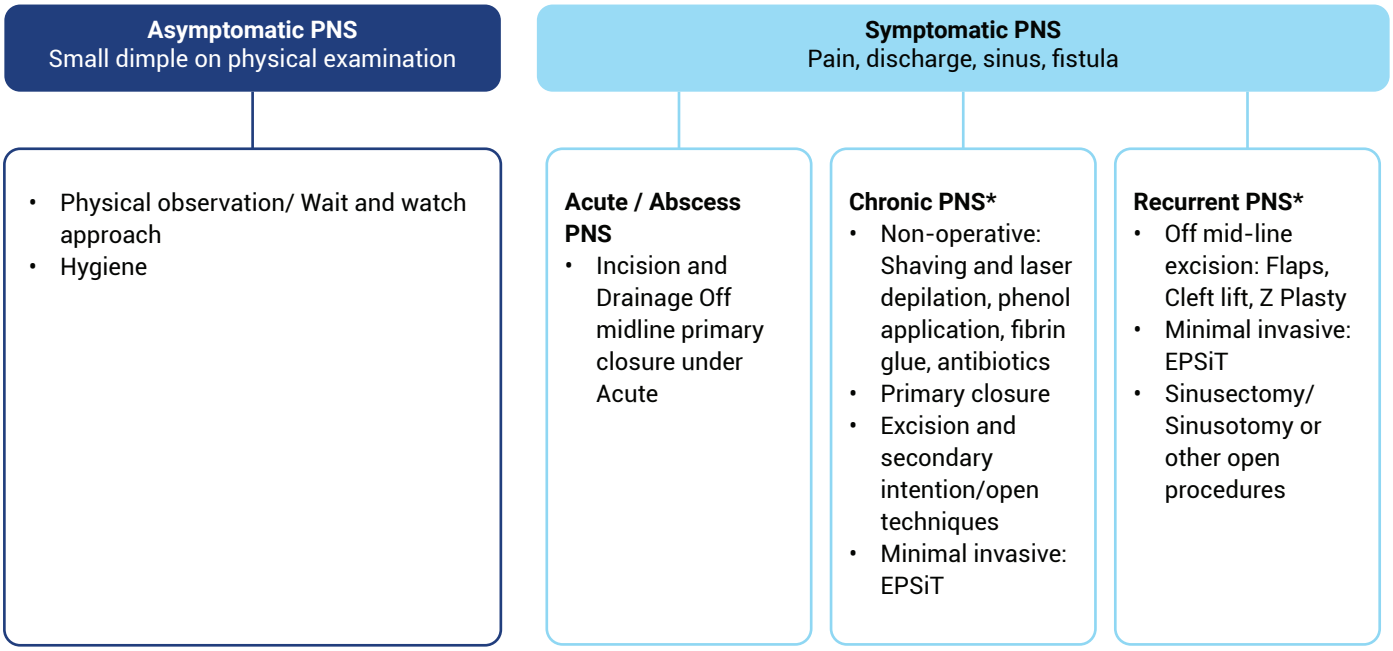
Introduction

Pilonidal sinus disease (PSD) —a term derived from the Latin words pilus (hair) and nidus (nest)—is characterized by sinus formation in the cleft of the buttocks, i.e., the inter-gluteal region. In brief, loose hair trapped in the natal cleft traumatize and penetrate the skin, inducing a foreign body reaction that ultimately leads to formation of midline pits and, in some cases, a secondary infection. (1) The prevalence of PSD is increasing globally, with an estimated incidence of 26 per 100,000 people and men being at a 2-fold higher risk than women. (2, 3) Patients with a pilonidal sinus (PNS) often present with an acute painful swelling associated with an abscess, and some patients may have bloody purulent material (pus) oozing from the sinus opening in the natal cleft. PNS is associated with significant morbidity and adversely affects the patient's quality of life. A PNS may be asymptomatic in the early phases, with patients usually presenting with pain and discharge and a painless lump or swelling discovered occasionally on physical examination. Symptomatic PNS can be classified as an acute pilonidal abscess, chronic PNS, or recurrent PNS. Risk factors associated with these conditions are male gender, obesity, sedentary lifestyle, repetitive trauma to the sacrococcygeal region, excess body hair, and poor hygiene. (4, 5)

The management of PNS typically depends on the stage of the condition and patient's treatment choice. (6) The management strategy should aim at patient's comfort and convenience and minimal chances of complication and recurrence, thus enabling early recovery, return to work, and return to social activities. Various non-operative and operative options are available for treating PNS **(Figure 1)**.

The Association of Colon and Rectal Surgeons of India (ACRSI) formed an expert group to draft and finalize the evidence-based clinical practice guidelines for the treatment and management of PSD in India. The purpose of these guidelines is to provide surgeons with a strong basis for making treatment decisions, thus avoiding preference-based treatment, while considering patient characteristics and choice.

Figure 1 Summary of management of pilonidal sinus as per the disease presentation



*Treatment should be based at surgeons' discretion and patients' choice

Methodology

To draft the present guideline, the authors carried out a literature search for the American Society of Colon and Rectal Surgeons (ASCRS), Clinical Practice Guidelines, German National Guidelines, and Italian Society of Colorectal Surgery (SICCR) guidelines, and for other relevant high-quality literature available for PSD management. (7-9) The present guidelines were drafted and reviewed by an expert panel committee of the ACRSI, and common consensus statements were derived after discussion and gathering committee's views during a virtual consensus meeting. The draft was developed after conducting an organized literature search performed using PubMed, Cochrane database reviews,

and Google Scholar search engines. A search on recommendations from regulatory resources, guidelines, and international societies was also performed. The searches were restricted to official literature on the topic and on articles and abstracts published in English. The following keywords were used: "Pilonidal sinus," "Pilonidal sinus + Saucerization," "Pilonidal sinus + Lay-open," "Pilonidal sinus + Marsupialization," "Pilonidal sinus + Sinusectomy," "Pilonidal sinus + Bascom," "Pilonidal sinus + Z-plasty," "Pilonidal sinus + Gips," "Pilonidal sinus + Laser depilation," "Pilonidal sinus + Fibrin glue," "Pilonidal sinus + Endoscopy," and "Pilonidal sinus recurrence." Prospective randomized controlled trials (RCTs), systematic reviews, and meta-analyses were the preferred evidence used for developing this guideline. A method adopted by American Society of Colon and Rectal Surgeons (ASCRS) was used to derive quality of evidence, wherein 1 was assigned to strong recommendation and 2 was assigned to weak recommendations. These recommendations were again categorized based on the level of evidence as A for RCTs without important limitations or overwhelming evidence from observational studies, B for RCTs with important limitations (inconsistent results, methodologic flaws, indirect or imprecise) or exceptionally strong evidence from observational studies, and C for observational studies or case series or consensus opinion of the expert group. (10)

Table 1 The GRADE system for grading recommendations

Supporting evidence	Quality of evidence	Grade of recommendation	Quality of evidence
RCTs without important limitations or overwhelming evidence from observational studies	Benefits clearly outweigh risk and burdens or vice versa	1	A
	Benefits closely balanced with risks and burdens	2	A
RCTs with important limitations (inconsistent results, methodologic flaws, indirect, or imprecise) or exceptionally strong evidence from observational studies	Benefits clearly outweigh risk and burdens or vice versa	1	B
	Benefits closely balanced with risks and burdens	2	B
Observational studies or case series or consensus opinion of the panel	Benefits clearly outweigh risk and burdens or vice versa	1	C
	Uncertainty in the estimates of benefits, risks and burden; benefits, risks, and burden may be closely balanced	2	C

Management of PNS

Treatment of asymptomatic PNS

Asymptomatic PSD is defined as an incidentally detected midline pit that does not threaten painful discharge, especially to the patient. However, an incidental PSD could be a sub-clinically inflamed PNS containing hair and showing signs of chronic infection. (11) Doll et al. reported that prophylactic surgery offers no advantage over therapeutic surgery performed for chronic PSD, suggesting that observational treatment is sufficient for asymptomatic PSD. (11) Further, a large observational study found that duration of chronic PSD was not linked to sinus formation. (12) Therefore, surgery is not advocated for asymptomatic PSD; instead, conservative approach including maintaining daily personal hygiene and hair removal in the gluteal cleft should be considered. (13, 14)

ACRSI recommendation

- For patients with asymptomatic PNS, prophylactic surgery should not be advised. Rather the wait-and-watch approach with the advice to avoid repeated trauma and maintain daily personal hygiene should be recommended (Strong recommendation based on moderate-quality evidence, Grade 1B)

Non-operative treatment options

Shaving and laser depilation

Shaving along the intergluteal fold and the surrounding regions can be considered as the first intervention in cases without abscess, and as a standard component of postoperative management to prevent recurrence. (14) However, a study of 1960 patients who were recommended regular hair removal with a razor after surgery reported an increased long-term recurrence for PSD (30.1% with epilation vs. 19.7% without epilation, *P* = 0.01). (15) In contrast, systematic reviews reported that the recurrence rate of PSD after laser depilation ranged from 0% to 28% for a mean follow-up of 6 months to 5 years. (16, 17) Similar results (0%-12% recurrence rate) have also been reported in a small prospective study with a 13-month follow-up period and another prospective database study with a 43-month follow-up period. (18, 19) Overall, laser depilation appears to be a safe and effective adjunct to surgery for minimizing PSD recurrence. Patients with primary PSD and those undergoing minimally invasive procedures may also benefit from adjuvant laser depilation. (19)

ACRSI recommendations

- Elimination of hair from the gluteal cleft and the surrounding skin, either by shaving or laser depilation, can be advocated for PSD. (Weak recommendation with low-quality of evidence, Grade 2B)
- Laser depilation should be preferred as a safer adjuvant to surgery, as it reduces the rate of recurrence, whereas shaving may increase the recurrence (Weak recommendation with low- quality of evidence, Grade 2A)

Phenol application

Excision with phenolization is preferred to other invasive procedures owing to its easy applicability, lack of tissue loss, and lower complication rates. This treatment, which is performed under local anesthesia, has a healing rate of 62%-95% and complication rates of 0%-2%, although considerable recurrence of 2%-14% has been observed with significant inter-study variability. (20) In a prospective randomized trial by Calikoglu et al., 147 patients were assigned to either excision with phenol treatment or to excision with open healing treatment; healing occurred in 100% of patients in each group at 6 months, but faster healing, less pain, faster resuming of normal activities, and similar recurrence rate were observed in patients receiving phenol treatment ($P < 0.001$ for each comparison except recurrence rate where $P = 0.92$). (21) A recent single-center randomized trial by Pronk et al. compared pit excision with phenolization and radical excision. They found that the mean time to return to normal daily activities was significantly shorter after phenolization (5.2 ± 6.6 vs. 14.5 ± 25.0 days, $P = 0.023$). (22) Furthermore, compared with radical excision, pit excision with phenolization resulted in faster resuming of normal activities (100% vs. 85.4% in 2 weeks, $P = 0.026$), less pain ($P = 0.003$), and faster wound epithelialization (at 6 weeks: 69% vs. 37%, $P = 0.03$; at 12 weeks: 81% vs. 60.9%, $P = 0.039$). (22) Another study retrospectively compared patients with PSN treated with the modified Limberg flap (N = 37) and those treated with phenol application (N = 44) (23), and found that phenolization significantly reduced the length of hospitalization without any postoperative complains. The safety and efficacy of phenol treatment during an endoscopic procedure for PNS were prospectively investigated by Gecim et al. in 23 patients. They found

no or minimal pain with same-day discharge and early (2 days) return to work after surgery. (24) Moreover, endoscopy with phenolization was well tolerated, with no recurrence observed up to 22 months of follow-up. (24)

ACRSI recommendations

- In patients with chronic PSD, single or multiple applications of phenol (crystal or liquid) can be an effective adjunctive treatment with lesser recurrence rate. (Weak recommendation based on moderate-quality evidence, Grade 2B)
- Phenol application as an adjunct to the surgery (excision, flap, or minimum invasive procedures [endoscopic]) resulted in rapid healing and reduced recurrence and could be used in patients with chronic PNS. (Weak recommendation based on moderate-quality evidence, Grade 2B)

Fibrin glue

Application of fibrin glue alone or as an adjuvant to primary repair or the flap procedure can be considered in patients with chronic PNS. A systematic review by Kayaalp et al. and a Cochrane-based systematic review reported no benefits of fibrin glue either alone or as an adjuvant in PSD management. (25, 26) In contrast, a randomized prospective study of 50 patients with primary PNS treated with a Karydakis flap, adjuvant drain, or fibrin glue under the flap showed equal efficacy with respect to healing. Although the duration of hospital stay was lower in the adjuvant drain group (2 vs. 4 days), wound fluid collection increased in the fibrin group (24% vs. 8%). (27) Another randomized controlled study evaluated 40 young adult patients with PNS who received excision with primary closure with (cases) or without (controls) platelet-rich plasma and fibrin glue (PRP-FG) application: reduction in the pain score was higher in the cases compared to the controls at weeks 1 and 2 post-surgery. (28) In addition, a recently published retrospective study reported that fibrin glue could be an effective first-line option in pediatric cases, with a 95% success rate and lower (5.6%) recurrence rate at 12 months. (29)

ACRSI recommendation

- In patients with chronic PSD, fibrin glue can be effective in reducing the time to healing , duration of hospital stay, and recurrence rate. However, current evidence is uncertain regarding its benefit either as monotherapy or as an adjunctive therapy. (Weak recommendation based on high-quality evidence, Grade 2A)

Antibiotics in PSD

The efficacy of intravenous and topical prophylactic antibiotics in PSD has been evaluated in various studies. Popeskou et al. analyzed the risk factors associated with surgical site infection and reported that after excision and primary closure of PSD, the rate of surgical site infection was higher in smokers and could be reduced by antibiotic prophylaxis. (30) Surgical site infection significantly prolongs healing time in patients more than 25 years old. (30) In a randomized pilot study, 50 patients undergoing primary closure received either single-drug (intravenous [IV] metronidazole 500 mg preoperatively) or a multi-drug cover (IV cefuroxime 1.5 g and IV metronidazole 0.5 g preoperatively and oral co-amoxiclav 375 mg 8 hours postoperatively for 5 days). (31) Patients in the multi-drug cover group demonstrated significantly reduced wound infections at 4 weeks (12% vs. 44%, $P < 0.03$). (31) Two prospective randomized trials assessing perioperative antibiotic therapy in patients undergoing rhomboid (Limberg) flap surgery for PSD showed no benefits in terms of surgical site infection, wound healing, duration of hospital stay, or disease recurrence between patients who received and those who did not receive antibiotic prophylaxis. (32, 33)

A systematic review of 11 studies (N = 886 participants) assessed the effects of systemic and topical antibiotics and topical antiseptics in healing of surgical wounds by secondary intention. (34) There is no robust evidence on the relative efficacy of any antiseptic/antibiotic/ anti-bacterial preparation evaluated to date for use in surgical wound healing by secondary intention. A systematic review and meta-analysis of 6 studies (N = 669 patients) evaluated effects of gentamicin collagen sponge on the outcomes after surgical excision in patients with sacrococcygeal PSD. (35) Among them, a meta-analyses of 3 eligible RCTs (N = 319 patients) demonstrated a trend of reduced surgical site infections after administration of the gentamicin collagen sponge (absolute relative risk [RR] 20%, 95% CI: 1-41, $P = 0.06$). (35) However, they did not show any significant influence of the sponge on wound healing and recurrence rates. (35)

Despite limited evidence, adjunctive antibiotic use should be considered in cases of severe cellulitis, underlying immunosuppression, or concomitant systemic illness. (7)

ACRSI recommendation

- Benefits of prophylactic intravenous and topical antibiotics in PSD surgery are not clear. Individualized consideration of their use is recommended (Strong recommendation based on high-quality evidence, Grade 1A)

Operative Treatment

Pilonidal abscess: incision and drainage

Acute PSD is defined as the presence of a pilonidal abscess with or without associated cellulitis. (7, 9) An abscess in acute-on-chronic PSD manifests as considerable pain and tenderness with an area of fluctuance and coexistent local cellulitis. (7) As with any abscess, the mainstay of treatment of a pilonidal abscess is adequate surgical drainage via incision (I&D) over the point of fluctuance without addressing the midline pits. (7) Several studies including randomized trials, retrospective studies, and meta-analyses have reported on the efficacy of different procedures in treating pilonidal abscess, specifically in reducing healing time and recurrence rate. A retrospective cohort study (N = 151 patients) showed that I&D is associated with about 40% chances of recurrence that can be attributed to the unaddressed underlying debris, epithelization, granulation tissue, and sinus tract. (37) A randomized trial with 102 patients with pilonidal abscess compared pit excision with healing by secondary intention versus I&D followed by delayed cyst excision with primary closure at 3 weeks, as an attempt to reduce the recurrence rate. (38) No difference in the disease recurrence was observed between these 2 procedures after 6 months. However, the I&D group showed significantly high recurrence compared with pit excision group (14% vs. 0%, $P < 0.05$) at the 12-month follow-up. (38) An RCT compared patients undergoing I&D with or without curettage of the abscess cavity and removal of the inflammatory debris; the curettage group had significantly more patients showing complete healing (96 vs. 79%, $P < 0.001$) at 10 weeks and a lower incidence of recurrence at 65 months postoperation (11% vs. 42%, $P < 0.001$). (39) In a meta-analysis (N = 1445 studies) by Garg et al., the recurrence rate after curettage for both acute and chronic PSD cases was 4.5% and the complication rate was 1.4%; moreover, patients returned to their normal routines in 8.4 days, thereby reinforcing the benefits of lay-open and curettage techniques. (40) A retrospective database study by Webb et al. included 243 cases of abscess that were drained either by lateral (N = 134) or midline (N = 74) incision; they found that abscesses drained by lateral incision healed 3 weeks earlier than those with the midline incision (43 days vs. 66 days, $P = 0.02$). (41)

ACRSI recommendations

- Patients with pilonidal abscess should be treated with incision and drainage (off-midline incision) regardless of whether it is a primary or recurring episode. (Strong recommendation based on low-quality evidence, Grade 1C)
- The lay-open and curettage technique could help reduce recurrence, complication, and time off work in acute and chronic PSD. (Strong recommendation based on high-quality evidence, Grade 1A)
- Avoid flap surgeries and excision in the presence of abscess as they are associated with high rates of wound infection, morbidity, and recurrence. (Strong recommendation based on low-quality evidence, Grade 1C)

Surgical procedures for chronic PSD

Surgical treatment for PSD can be divided into 2 main types: excision with primary closure (midline closure: pit picking; off-midline closure: surgical flaps); and excision with healing by secondary intention or other open techniques (saucerization, marsupialization, and sinusectomy/sinusotomy).

Randomized trials showed that surgical treatment was superior in terms of cure rate and relapse rate compared to conservative treatment, whereas complications and recurrence rates were similar among the different surgical techniques. (43, 44) Therefore, surgeons could use modalities they are most familiar with in non-complicated PNS cases. (44) Several studies have evaluated the efficacy and safety of different surgical modalities for PSD management.

Excision with primary closure

Midline closure

A Cochrane-based systematic review by Al-Kamis et al. reported that primary midline closure was associated with significantly higher recurrence rate compared to excision with healing by secondary intention (8.7% vs. 5.3%). An overall reduction in recurrence rate by 35% was observed in patients undergoing excision with healing by secondary intention; thus, the review suggested abandoning the midline closure procedure. (2) In a prospective randomized study that compared excision with primary closure versus excision with healing by secondary intention in 60 patients, significantly higher wound healing was observed at 4 weeks in the latter group, although recurrence was similar at 5 years. (45) In addition, a systematic review and meta-analysis of 12 out of 18 trials compared open versus closed procedures, and showed that open procedure resulted in a longer off-work period compared to the closed procedure. (46) Recently, Brown et al. reviewed 26 studies (N = 2530); 17 of 26 studies compared open wound healing with primary closure and showed faster healing after primary closure; however, higher recurrence rates were observed with primary closure (RR 0.60, 95% CI: 0.42-0.87). (47) Another systematic review and meta-analysis by Enriquez-Navascues et al. included 10 randomized studies that compared midline with off-midline primary closure procedures; significantly higher wound dehiscence (RR 1.63, 95% CI: 1.13-2.36) and recurrence rate (RR 2.32, 95% CI: 0.98-5.45) were noted after midline closure. (48) Open radical excision and primary midline closure should therefore be abandoned. Sinusotomy/sinusectomy or en bloc resection with off-midline primary closure are the preferred approaches. Moreover, in a meta-analysis by Brown et al., 6 of 26 studies compared the surgical midline and off-midline closures and found faster healing with the latter (mean duration 5.4 days, 95% CI: 2.3-8.5), whereas midline closure had more surgical site infections (RR 3.72, 95% CI: 1.86-7.42) and higher recurrence (Peto odds ratio [OR] 4.54, 95% CI: 2.30-8.96). (47) Excision and primary closure compared to the Bascom procedure was studied in patients (N = 60) with chronic PSD, higher postoperative pain (P = 0.049) by the first postoperative week and a higher recurrence rate (16.7% vs. 3.3%) during the 12-week follow-up was seen in excision and primary closure group. (50) Another prospective randomized study compared excision with tension-free primary closure and excision with the Limberg flap in 60 patients, and found that both procedures had similar hospital stay (1.2 ± 0.6 vs. 1.5 ± 0.6 days, respectively; P = 0.05) and similar complication rates (46.6% vs. 43.3%, respectively; P = 0.79). (51) However, higher recurrence was observed with tension-free primary closure compared to that with Limberg flap, but the overall patient satisfaction was similar between the 2 groups (86.6% vs. 76.6%, respectively; P = 0.05). (51)

Overall, open healing had no tangible benefits over primary closure, but off-midline closure was more effective than midline closure. Therefore, when PNS closure is desired, off-midline closure is recommended for use.

Pit picking (Gips/trephines) and Bascom surgery

The pit picking method has been reported in many articles. In 2008, Gips et al. used trephines in 1358 patients and reported complete healing within 3.4 ± 1.9 weeks, with an overall recurrence of 16.2% after 10 years and fewer cases of postoperative infection (1.5%), secondary bleeding (0.2%), and early failure (4.4%). The 1- and 5-year disease-free probability estimate was also 93.5% and 86.5%, respectively. (52) Di Castro et al., in 2016, reviewed a prospectively maintained database of 2347 patients operated using the Gips procedure and confirmed its safety and feasibility: recurrence rate at 16 months of median follow-up was 5.8%, 77% of patients resumed their normal activities within 2 days postoperatively, and 63% of patients reported no need for analgesics postoperatively. (53) Similarly, in the same year, Levinson et al., in their 10-year review, compared the Gips minimal surgery/trephine technique performed at an Israeli Army clinic with a spectrum of other techniques employing wide excision performed at public hospitals on 3407 military officers. They reported that patients treated in the Army Clinic took fewer (average: 13 days) sick leaves. (54) A prospective randomized study compared pit picking using the Bascom surgery (N = 29) with the Bascom cleft lift technique (N = 26) and found 8% recurrence at 36 months in patients treated with the former. (55) Majeski et al. reported rapid healing (12 [8-30] days) and less recurrence (N = 3) at 2 years with Bascom surgery in 127 consecutive patients. (56) A retrospective study by Prieto et al. showed that trephination, compared to open or closed techniques, in 150 pediatric patients was associated with lower wound complication rate (3% vs. 17% vs. 29%, respectively; P = 0.006) and fewer postoperative visits (1.4 vs. 4.4 vs. 2.4, respectively; P < 0.001). (57) Similarly, the pit-picking procedure resolved PSD in 92% (N = 58) of adolescents within an average of 5 months. (58) Pit excision, combined with phenol application, in 83 patients had a mean procedure time of 22.2 ± 7.4 minutes and mean wound closure time of 28.5 ± 14.9 days; moreover, 86.7% of patients were asymptomatic at a mean follow-up duration of 25.7 ± 8.5 months. (59) Recently, Veysi Hakan Yardimci compared the Karydakis technique (N = 28) with a combination of pit excision

and sinus tract ablation using a 1470-nm diode laser (N = 30) in patients with early PNS. Pit excision and laser ablation techniques were associated with shorter operative time (15.1 [12-20] vs. 36.4 [25-50] minutes, *P* < 0.0001), rapid resuming of normal activities (2.6 ± 1.1 [1-5] vs. 12.8 ± 2.9 [10-20] days; *P* < 0.0001), less pain (visual analog scale [VAS] 2.1 ± 0.8 vs. 4.4 ± 1.3, *P* < 0.0001), and higher patient satisfaction (Likert scale 4.8 ± 0.5 vs. 3.8 ± 0.8, *P* < 0.0001) compared to the Karydakis procedure. (60)

Excision with healing by secondary intention or open techniques—saucerization and marsupialization

In a systematic review and meta-analysis by Garg et al. that included 1445 patients with simple or complex PNS, the lay-open with curettage procedure led to a pooled recurrence rate of 4.47% (95% CI: 0.029-0.063), complication rate of 1.44% (95% CI: 0.005-0.028), operating time of 34.59 minutes (95% CI: 13.58-55.61), healing time of 21-72 days; and time to resume work after treatment of 8.4 days (95% CI: 5.23-11.72). (40) Another study assessed patients (N = 44) treated with the Karydakis flap (N = 17) or the lay-open procedure (N = 27) and reported similar postoperative morbidity for the 2 procedures, although the cost of treatment (€1601 ± 399 vs. €941 ± 178, *P* = 0.0001) and healing time (59 ± 22 vs. 32 ± 17 days, *P* = 0.0001) were more and the operation time was less (25 ± 4 vs. 16 ± 7 minutes; *P* = 0.001) in the lay-open group compared to the Karydakis flap group. (61) However, Dumville et al., in a Cochrane systematic review, highlighted the need for rigorously designed studies that would establish the clinical efficacy of the negative pressure technique in treating surgical wounds with healing by secondary intention; they also showed the uncertainty of potential benefits and the harms of using this treatment. (62) Prospective randomized trials showed that for treating chronic PNS, the modified lay-open procedure was superior to excision with primary closure with regard to morbidity (2.7% vs. 13%, *P* = 0.028), recurrence rate (1.4% vs. 17.4%, *P* < 0.001), and time off-work (3 vs. 21 days, *P* < 0.001). However, the healing time was longer with the modified lay-open procedure (7 vs. 2 weeks). (63) A retrospective study of 68 patients treated with lay-open (unroofing) and marsupialization (N = 42) or wide local excision (N = 26) and were followed-up for over 5 years showed that wide local excision led to longer healing time (21 vs. 6 weeks, *P* < 0.01), higher complication rate (54% vs. 9.5%, *P* < 0.01), and higher reoperation rate (35% vs. 2%, *P* < 0.01) compared to lay-open and marsupialization. (64) In a prospective randomized trial, lay-open and marsupialization (N = 70) was compared with excision and Limberg flap (N = 70) procedure. The former had significantly shorter operating duration (53.1 ± 20.4 vs. 89.3 ± 31.0 minutes, *P* < 0.001), shorter hospital stay (1.3 ± 0.5 vs. 1.6 ± 0.8 days, *P* = 0.009), shorter time to resume normal activities (7.8 ± 4.3 vs. 15.8 ± 8.0 days, *P* < 0.001), less pain (VAS at week 1: 6.1 ± 1.7 vs. 4.4 ± 1.9, *P* < 0.001), and lower complication rate (2.9% vs. 12.9%, *P* = 0.028) compared to the latter, which had significantly shorter healing time (23.7 ± 11.2 vs. 43.8 ± 20.9 days, *P* < 0.001) and higher quality-of-life score on the Cardiff Wound Impact Schedule (CWIS) (7.6 ± 1.5 vs. 5.7 ± 1.7, *P* < 0.001) at 3 months postoperatively. (65) Similarly, another study where patients (N = 63) were treated with excision and marsupialization reported that in the absence of inflammation or recurrence, marsupialization is the surgical method of choice owing to the associated lower recurrence rate (primary closure: 57.8%; marsupialization: 6.35%; open excision: 3.44%) and an acceptably short healing period (primary closure: 11.7 days; marsupialization: 27.3 days; open excision: 46.4 days), whereas open excision is preferred in the apparently large, inflamed, and recurrent PNS cases. (66) A randomized trial in patients treated with either negative pressure therapy (N = 24) or standard open procedure (N = 25) showed similar rates of healing, pain score, time to resume normal activities, and disease recurrence at 6 months (all *P* > 0.05) between treatments. (67)

Sinusectomy/Sinusotomy

In 2008, Soll described sinusectomy/sinusotomy as a limited excision technique for PNS performed to avoid wide open excision (open en bloc excision), and reported faster resuming to normal activities and lower recurrence with sinusectomy/sinusotomy. (68) Two other prospective studies also reported the benefits of sinusectomy/sinusotomy compared to excision with/without marsupialization by showing no recurrence after 10 months (69) and only 3% recurrence after more than 15 months. (70) A meta-analysis of 4 RCTs by Enriquez-Navascues et al. compared conservative sinusectomy with radical/en bloc excision with open wound in 153 patients and found no significant differences in the recurrence rate between the 2 treatments (RR 0.63, 95% CI: 0.17-2.38); however, a significantly earlier return to work and a lower pain score were found with sinusectomy compared to open excision. (48) Recently, 2 studies compared sinusectomy and primary closure and reported contrasting results. (71, 72) In a randomized trial of patients with chronic PSD (N = 58), compared to primary closure, sinusectomy showed slower healing rate (50% vs. 13% at 3 weeks, *P* = 0.01) and similar 12-month recurrence rate (11.1% vs. 16%, *P* = 0.548). (71) However, a single-center retrospective cohort study of 351 patients showed that sinusectomy was associated with faster healing (17.0 [IQR 11.0-28.0] vs. 9.0 [IQR 8.0-10.0] days, *P* < 0.001) and lower recurrence rate (18.7% vs. 5.5%). (72)

Excision with off-midline procedures

Off-midline procedures include plastic procedures and advancement flap procedures. Four most common off-midline procedures are the Karydakis flap, the Limberg flap, Z plasty, and Bascom's cleft lift. These procedures offer the advantage in that they eliminate the limitations of open healing. Recurrence rates at 12 to 36 months after these procedures are reportedly between 0% and 7%.

Comparison with other techniques

A meta-analysis by Stauffer et al. showed that primary midline closure exhibited a long-term (24 months) recurrence of up to 67.9% compared to off-midline procedure, irrespective of the other techniques used. (73) Moreover, an RCT of the Karydakis and Bascom procedures demonstrated recurrence of only up to 0.6% for a similar follow-up period when compared to other procedures. (73) Another meta-analysis by Bertheir et al. showed a lower risk of recurrence, shorter duration of incapacity to work (mean difference 4.21 [6.26-2.16] days, $P < 0.0001$), lower risk of wound infections (RR 0.37 [0.25-0.55], $P < 0.00001$) and wound complications (RR 0.43 [0.28-0.66], $P = 0.0001$), and shorter duration of hospitalization (MD 1.87 [2.88-0.85] days, $P = 0.0003$) with the flap procedure compared to direct closure. (74) Moreover, in this meta-analysis, compared to the lay-open technique, the flap procedure had shorter time to complete wound healing (MD 43.69 [72.60-14.79] days, $P = 0.003$), shorter duration of incapacity to work (MD 5.63 [10.87-0.40] days, $P = 0.03$), and lower rates of complications (RR 0.57 [0.39-0.83], $P = 0.004$). (74) Boshnaq et al., in their systematic review of 68 studies (22 case series, 35 comparative studies, 9 RCTs, and 2 meta-analyses), demonstrated that the Limberg flap presents a safe and effective method for patients with primary or recurrent PSD. (75) This review also reported a recurrence rate of 0%-7.4% in case series and 0%-8.3% in comparative studies for the Limberg flap compared to 4%-37.7% for primary closures and 0%-11% for the Karydakis flap. (75)

A prospective RCT also compared the Limberg flap and excision with other primary closure techniques and showed that the Limberg flap had very low recurrence rate (0% vs. 20%, $P < 0.02$) and comparable complication rates (43.3% vs. 46.6%, $P = 0.79$) and duration of hospitalization (1.5 ± 0.6 vs. 1.2 ± 0.6, P = 0.05) compared to primary closure in patients with PSD. (51) The authors of this study also suggested that as excision and primary closure offered advantages such as shorter operating time, faster healing time, earlier resuming of daily activities, and better cosmetic results, and that it is more suitable for patients with a low risk for recurrence. (51) Several retrospective and prospective studies also compared the Karydakis and Limberg flap procedures with primary closure or lay-open and marsupialization techniques, and showed better results with flap procedures than their comparators. (61, 76-80) Conversely, some studies have also reported a similar recurrence rate between the flap procedures and other primary closure methods. A multicenter study (N = 102) previously reported that excision and primary wound closure with the Limberg flap had no advantages over that with healing by secondary intention, because of the relatively high complication rates including recurrence (13% vs. 6%). (81) Another RCT reported similar ($P = 0.739$) postoperative wound infection rates between the Limberg flap (16.7%) and open procedures (20%). (82)

A long-term prospective study compared endoscopic PNS treatment (EPSiT) and Limberg flap treatment in patients with complicated PSD, and reported higher success rate with the Limberg flap (94.1%) than with EPSiT (57.7%) at a long-term follow-up of 27 months. (83) Additionally, the Limberg flap showed a lower recurrence (5.9% vs. 26.9%) but a higher complication rate (26.5% vs. 11.5%) compared to EPSiT. (83)

Comparing different flaps, cleft lift, and Z plasty procedures

Limberg and Karydakis flaps: A randomized prospective study (N = 150) reported similar findings without any substantial difference in the recurrence rate (6%, 6%, and 4%) between the Limberg flap, Karydakis flap, and tension-free primary closure procedures. (49) A systematic review and meta-analysis by Prassas et al. assessed 8 RCTs comparing Karydakis flap (N = 554) with the Limberg flap (N = 567), and showed similar recurrence (OR 1.07, 95% CI: 0.59-1.92, $P = 0.83$) for both but significantly a higher post-operative seroma occurrence with the Karydakis flap (OR 2.03, 95% CI: 1.15-3.59, $P = 0.01$). (84) An update of the systematic review and meta-analyses with 5 RCTs (Limberg flap N = 367, Karydakis flap N = 360) by Sahebally et al. also showed similar efficacy outcomes between the Limberg and Karydakis flaps for primary PNS; however, higher seroma formation was reported with the Karydakis flap. (85) Another systematic review and meta-analysis including 9 RCTs (N = 1421; Limberg flap: 54.4%, Karydakis flap: 45.6%) by Gavriilidis et al. also reported similar findings for the Karydakis and Limberg flaps in patients with chronic PNS. (86) It also reported a significantly higher seroma formation in the Karydakis cohort (OR 0.36, 95% CI: 0.24-0.56); however, sensitivity analysis after excluding studies with a high risk of bias showed no significant differences in the seroma formation rate between the 2 techniques (OR 0.76, 95% CI: 0.31-1.85). (86) Studies have also shown that the Karydakis flap offered lowest complication rates compared to the Limberg flap and primary closure ($P < 0.01$); (78) lower recurrence and early return to work compared to lay-open and marsupialization; (79) and faster healing time compared to the lay-open technique. (61) A single-blinded parallel randomized study also compared the Limberg flap with the Karydakis flap and found the latter to have shorter duration of surgery (23.03 ± 6.06 vs. 29.15 ± 7.69, $P < 0.001$) and similar hospital stay (1.48 ± 0.50 vs. 1.41 ± 0.49, $P = 0.540$); It also reported that Karydakis flap led to faster complete wound healing (9.56 ± 1.31 vs. 11.51 ± 3.16, $P = 0.023$), shorter period of incapacity for work (9.15 ± 2.52 vs. 11.59 ± 3.44, $P = 0.005$), and higher patient satisfaction (8.26 ± 0.94 vs. 7.62 ± 1.32, $P = 0.035$). (87)

Bascom cleft lift:

Several studies have shown the efficacy of Bascom procedure in managing PSD. (88-91) A prospective RCT that compared the Limberg flap and Bascom cleft lift techniques showed shorter operative time (29 vs. 36 minutes, $P < 0.0001$), and better quality of life/patient satisfaction during the early postoperative period with the Bascom cleft lift compared to the Limberg flap. (92)

Modified flap surgeries:

Few authors who studied modified flap (Limberg flap and Karydakis flap) surgeries (93, 94) found that the modified Karydakis flap had significantly shorter operative time, lower full-thickness wound disruption rate, and higher patient satisfaction rate over the 3-year period compared to modified Limberg flap in the RCT (N = 154). (95)

V-Y flap advancement and Z-plasty: Several procedures including the V-Y flap advancement and Z-plasty techniques, as plastic surgery reconstruction patterns, have also been used. Longer hospital stay and operating time, along with no complications and less recurrence, have been reported with V-Y advancement compared to the Limberg flap (96) and the Bascom cleft lift techniques. (97) The Z-plasty technique has been described in numerous studies. A randomized study compared Z-plasty with excision and secondary healing, and reported faster healing with Z-plasty but similar complication rates. (98) A recent retrospective study comparing Z-plasty with conventional simple excision (N = 67) revealed shorter hospital stay and fewer postoperative complications with Z-plasty. (99) A prospective study by Sharma P. also showed lesser recurrence and better cosmetic appeal with multiple Z-plasty compared to other surgical modalities. (100)

Collectively, the Limberg flap or Karydakis flap may be the preferred surgical option for off-midline closure owing to their low recurrence rate, higher patient comfort, and aesthetic appeal. (78) However, these flap techniques commonly require surgical skills; thus, selection should be based on surgeon's discretion and patient's choice.

ACRSI recommendations

- Patients who require surgery for chronic PSD may undergo excision and primary repair (preferably off-midline closure), or excision with healing by secondary intention (Marsupialization, Saucerization, or Sinusectomy/Sinusotomy) based on the surgeon's and patient's preferences. (Strong recommendation based on high-quality evidence, Grade 1A)
- When closure of PNS is desired, off-midline closure should be the standard management. (Strong recommendation based on high-quality evidence, Grade 1A)
- Pit picking and its variations (Gips/trephines) could be used in previously untreated patients with minimal or early disease condition. (Weak recommendation based on moderate-quality evidence, Grade 2B)
- Marsupialization or Sinusectomy / Sinusotomy should be preferred based on the patient's characteristics and surgeon's preference. (Strong recommendation based on moderate-quality evidence, Grade 1B)
- Flap-based procedures should be performed especially for complex and recurrent chronic PSD when other techniques have failed. (Strong recommendation based on high-quality evidence, Grade 1A)
- There are no significant differences in outcomes between the 3 most frequently used off-midline procedures—the Limberg flap, Karydakis flap, and Bascom cleft lift procedures. Either can be chosen if the off-midline procedure is the desired surgical option. (Strong recommendation based on high-quality evidence, Grade 1A)
- Modified surgical procedures such as the V-Y flap, has a lower complication rate compared to the Limberg flap and Bascom cleft lift but may have longer operation time and hospital stay. (Strong recommendation based on low-quality evidence, Grade 1C)
- Multiple Z-plasty is associated with less recurrence and better cosmetic appeal (less disfigurement of the gluteal area) compared to other surgical modalities (Limberg flap). (Strong recommendation based on moderate quality evidence, Grade 1B)

Minimal invasive approach

Minimal invasive treatment of PNS includes EPSiT (101) and video-assisted ablation of the PNS. (102) The objective of these treatments is to reduce the morbidity arising from traditional surgical excision procedures and to evaluate treatment efficacy in eliminating the factors leading to disease progression. (103) Results from 2 landmark studies indicated a short-term recurrence rate of about 3% at 6 to 12 months of follow-up and rapid resuming of normal activities. (101, 102) Both the study groups further reported larger trials in 2016. In the first prospective multicenter study of EPSiT in 250 patients with chronic PSD, the healing rate was 95% by 26.7 days, with a 5% recurrence rate. (104) In the second randomized trial of 145 patients, VAAPS (N = 76) when compared with the Bascom cleft lift procedure (N = 69) showed significantly reduced time off work (1.6 ± 1.7 vs. 8.2 ± 3.9

days, $P < 0.001$), caused less pain ($P < 0.001$ up to 1 month postoperatively), greater patient satisfaction ($P < 0.001$ at 1 and 6 months postoperatively), and similar complication rates (1.3% vs. 7.2%, $P = 0.10$) compared to the Bascom cleft procedure. (105) Results of the 5-year follow-up of these patients showed similar long-term recurrence rate between both the procedures. (106) Higher patient satisfaction and better cosmetic results with VAAPS were reported with much lower mean global cost, as shown in the cost analysis. (106) In a study by Gecim et al., endoscopic application of phenol led to no recurrence (100% success rate) in 23 patients over 2 years of follow-up. (24) Similarly, retrospective and prospective studies suggested that EPSiT is a safe and effective procedure that can be performed as a day surgery and has early return to daily activities, better aesthetics, and lower recurrence rate. (107-109)

Several systematic reviews and meta-analyses have demonstrated the benefits of minimally invasive procedures in PSD. A systematic review by Kalaiselvan et al. compared studies with EPSiT to that with the other minimally invasive surgeries such as sinusectomy, sinotomy, and trephining in 820 patients. (110) The complication rates were similar between EPSiT and the other minimally invasive surgeries (EPSiT vs. minimally invasive surgeries: RR 0.59, 95% CI: 0.35-1.01, $P = 0.05$; EPSiT vs. traditional/excision surgeries: RR 0.35, CI: 0.17-0.74, $P = 0.006$). A systematic review by Tien et al. showed that patients undergoing EPSiT or VAAPS had reduced time off work, lower short-term recurrence, and higher satisfaction scores but with longer operating time and the need for special expensive equipment. (111) Emile et al., in their systematic review and meta-analysis of 9 studies (N = 497), reported a treatment failure rate of 8%, recurrence rate of 4%, complication rate of 1.1%, mean duration of resuming work of 2.9 days, and mean time to healing of 32.9 days. (112)

Although EPSiT may prove to be effective in terms of healing, early return to normal routine, cosmetic appeal, and less recurrence, these techniques require expertise and specialized equipment. Lack of large-scale data for EPSiT compared to other treatment modalities, restricts definitive recommendations favoring EPSiT over other procedures.

ACRSI recommendations

- Endoscopic treatment of PSD provides a minimally invasive alternative to the traditional/excision procedures and offers reduced morbidity, minimal patient inconveniences, high satisfaction, and good aesthetic outcomes. (Weak recommendation based on high quality evidence, Grade 2A)
- Minimally invasive approaches, namely, EPSiT, require specialized equipment and expertise. (Strong recommendation based on high-quality evidence, Grade 1A)

Management of recurrent PSD

Patient characteristics and surgical procedures used are the main attributes determining recurrence of PSD. (113-115) Ray et al. conducted a systematic review and meta-analyses of RCTs (N = 2073) and showed that the Limberg flap reduced the risk of recurrence (RR 0.52, 95% CI: 0.29-0.93) more prominently compared with the Karydakis flap and Bascom cleft lift techniques. (116) Stauffer et al. performed a meta-analyses of common surgical procedures to assess PSD recurrence; they found that long-term recurrence of up to 67.9% was associated with primary closure at 240 months, and up to 0.6% with flaps and Bascom procedures at 12-24 months. (73) Similarly, a systematic review and meta-analyses for the long-term follow-up of surgical procedures in PSD reported that a follow-up of at least 5 years should be considered as gold standard in PNS surgery benchmarking. (117)

Management of patients with PSD recurrence is similar to that for de novo PSD, and the treatment goal is to allow patients to return to their normal lifestyle as early as possible. Although recurrence remains a common problem, as is evidenced by the reported recurrence rates with various surgical procedures (described in previous sections), there is little evidence to guide management of this issue. Some recent pieces of evidence may support treatment of recurrence in PSD. A recent prospective database study reported that laser depilation had 12% recurrence at 172 weeks and could be a safe and effective adjuvant to surgical procedures for minimizing the recurrence; (19) however, a review reported inconclusive evidence on its utility in reducing recurrence postoperation. (118) Reconstruction with contralateral Limberg flap could be effective and feasible in recurrent PNS cases that were initially treated with the Limberg flap. (119) A retrospective study compared unilateral fasciocutaneous V-Y flap with the cleft lift procedure in treating recurrent PSD, and demonstrated less operating time, no wound dehiscence, and no recurrence with the V-Y flap; therefore, the V-Y flap appears to be the preferred technique to prevent recurrence, despite a longer drain time and hospital stay associated with it. (97) Another retrospective study compared the V-Y flap with the Limberg flap; the Limberg transposition flap had lower recurrence rate and less hospital stay time, and, in cases of recurrence, it showed early return to work; however, the fasciocutaneous V-Y advancement flap could close larger defects in recurrent cases. (96)

A prospective, international, multicenter study of 122 consecutive patients with recurrent and re-recurrent PSD assessed the efficacy of EPSiT; it showed that the quality of life significantly improved 30 days after the EPSiT procedure compared to the preoperative scores (45.3 vs. 7.9, $P < 0.0001$), with return to normal activity on the same day, less recurrence (5.1%), and complete healing rate (95%); EPSiT was suggested to be safe and effective in treating complex recurrent PSD. (120) However, comparative assessment of EPSiT and other surgical procedures in recurrent PSD should be conducted to document definitive short-term and long-term clinical benefits. (118, 120)

Owing to the lack of specific evidence in the setting of PSD recurrence, the underlying disease condition, treatment goals, and surgeon's experience should be considered in decision-making. Patient should be counseled for making life-style changes that would help manage the risk factors postoperatively, and the known modifiable risk factors for surgical site occurrence should be optimized before embarking on repeat procedures.

ACRSI recommendations

- The choice of operative strategies for recurrent PSD should be based on characteristics such as presence of an acute abscess or whether the disease is chronic, and the experience and expertise of the surgeon. (Strong recommendation based on low-quality evidence, Grade 1C)
- The Limberg flap and V-Y flap could be effective procedures in patients with recurrence and who have been operated for PSD previously. (Weak recommendation based on low-quality evidence, Grade 2C)
- Endoscopic PNS treatment could be an effective, safe, minimally invasive procedure; however, data on comparative clinical outcomes are scarce. (Strong recommendation based on low-quality evidence, Grade 1C)
- Bascom cleft uplift closure technique is useful for midline unhealed wounds. (Strong recommendation based on high-quality evidence, Grade 1A)

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The Association of Colon and Rectal Surgeons of India

Contact Us

B/Gr. Floor, Salasar Classic,
Near Nagar Bhavan Hall, Fatak Road
Bhayander (West) Thane 401101

+91 93723 81974

secretary@acrsi.org