

The clinical presentation of pilonidal sinus and selection of the appropriate minimally invasive approach.

A retrospective evaluation of 5338 cases



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Serap Pamak Bulut*, Nihat Bengisu**

*General Surgery Department, University of Health Sciences, İstanbul, Turkey

**General Surgeon at Bengisu Proctology Clinic, İstanbul, Turkey

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OBJECTIVE: Pilonidal Sinus is a considerably problematic disease due to its recurrences which tend to become chronic and are exacerbated by abscess formation. There is little consensus regarding treatment - most probably due to limited understanding of its pathophysiology and progression. Despite this, it is accepted that accurate identification of pathogenesis and the clinical grade of PS are crucial for the determination of surgical approach.

METHOD: This study presents the surgical treatment techniques we employed for Pilonidal Sinus disease with retrospective analysis of management and follow-up data of 5338 outpatient cases from 16 years of practice.

RESULTS: At the follow-up period of 16 years, recurrence was 12.5%. All recurrences were also treated with an individualized minimally invasive surgical approach, which was proportional to the clinical presentation.

CONCLUSION: The importance of designing surgical technique according to the needs of the patient and the condition of the disease is clear. Our results with over 5000 patients indicate that effective treatment for PS is individualized minimally invasive surgery.

KEY WORDS: Classification, Grade, Minimally invasive surgery, Pilonidal sinus, Pilonidal cyst

Introduction

In addition to being a cause of significantly decreased quality of life, pilonidal sinus (PS) disease is also often considered as an embarrassing condition by patients¹⁻³. Early studies reported a 1.1% incidence in young men and 0.11% in young women during routine physical examinations⁴. In Turkey, the incidence of PS is reportedly between 6.1-8.8% in young military conscripts^{5,6}. Peak incidence is observed between 15-24 years, with a sharp decrease after 45 years of age⁷. However, recent studies show increased incidence in recent years⁸. Male

gender, young age, seated work, driving, trauma, local irritation, high BMI and family history are considered risk factors for pilonidal sinus development and recurrence^{9,10}.

The congenital/acquired origin of PS has been debated since the first description of the disease by Herbert Mayo in 1833¹¹. In 1947, King suggested that acquired mid-line pits, which he thought were derived from hair follicles and skin crypts, were the primary factors in the formation of PS; however, the debate continued for almost another half-century¹². The most important progress in the understanding of PS was arguably made by Karydakos who identified three primary factors in the etiopathogenesis of PS: (1) Invader = hair, (2) force and friction that facilitates the invasion of hair, and (3) impairment of skin strength¹³. Bascom, in an update to his article in 2006, emphasized that both follicles and hair were important in the formation of PS, and suggested that, in 90% of cases, enlarged follicles were the origin of PS development¹⁴.

Since it was described by Mayo and Herbert in 1833, many publications have been published on PS and

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Correspondence to: Sağlık Bilimleri Üniversitesi Sağlık Hizmetleri Meslek Yüksekokulu Mekteb-i Tıbbiye-i Şahane Külliyesi, Tıbbiye Cad. No: 38 Selimiye, Üsküdar, Turkey. (e-mail: serap.pamakbulut@sbu.edu.tr)

dozens of techniques have been described. However, an ideal surgical technique is still lacking and the literature demonstrates major conflicts^{2,7,15-22,34}.

In order to determine the most accurate method of surgical treatment, we aimed to determine predisposing factors and mechanisms that led to PS development. In this study, we analyzed the clinical features, surgical techniques and outcomes of 5338 patients that we have treated for the last 16 years, and presented our treatment approach to PS.

Materials and Methods

Five thousand six hundred eighty four patients who were treated in our clinic between January 2002 and June 2018 were evaluated retrospectively. The study was approved by the XXXX Scientific Research Ethics Committee of University of XXXXX with approval number of 11.3.21/75067. Two hundred sixty one grade 4 and 5 cases that had been diagnosed with hidradenitis suppurativa, 2 cases due to epidermoid cancer diagnosis and Forty seven patients due to lack of data have been excluded. Cases with recurrence have been included because one of the major advantages of the individualized minimally invasive technique is that it can be applied to any presentation of PS. Patients that had unusual PS localization (umbilical, inguinal, etc.) were separately assessed.

Patients' age, sex, disease duration, whether they had undergone surgical intervention for PS before applying to our center, the number of operations they had undergone, the presence of abscess or suppuration at admission, clinical characteristics and disease grade, treatment and recurrence status, and recurrence time were retrospectively collected from patient files. Informed consent was obtained from the patients for the surgical procedures and the use of operation images. The cases were divided into 5 grades according to the findings; grade 1, 2, 3, 4 and 5 (Table I).

TABLE I - *Sacrococcygeal PS Clinical Grade Properties.*

Grade	Characteristics
Grade 0	Non-inflammatory pits with a diameter of 0.1-0.5 mm in the midline, depth of 1-5 mm
Grade 1	Tractuses not exceeding 1 cm depth in the midline, inflamed pits
Grade 2	Inflammatory tracts 2-5 cm in the midline, <3 cm from midline
Grade 3	Inflammatory tracts > 6 cm in the midline, and > 3 cm on the sides
Grade 4	Tractuses > 7 cm of midline on the sclerotic ground and showing precoxigeal or scrotal extension
Grade 5	Hidradenitis Suppurativa

DEFINITIONS

Midline pits have been defined as entrance orifices. They were generally tiny and smooth with epithelial paving, resembling a punch hole. Irregular and larger orifices which were generally laterally placed and distant from the entrance orifices, that demonstrated purulent, granulating or inflamed characteristics have been defined as exit orifices.

SURGICAL PROCEDURES

All of our treatments were performed as daily surgery with local anesthesia. No special preparations were made. Applied procedures for every grade were summarized in (Table II).

In grade 1 and 2 cases, tracts and sinuses were not opened. Hair, granulation tissue or necrotic tissues were first curetted through entry and exit orifices (Fig. 1). The pits were then elliptically excised separately (Fig. 1), or together, with 2-6 mm incisions. This was due to our observation that excision of the pits at the beginning prevented sufficient curettage, because the curettes could not be inserted into the tract or sinus. Incisions that did not exceed 6 mm were not sutured and were closed only with a tight bandage. Dental files and ear curettes with

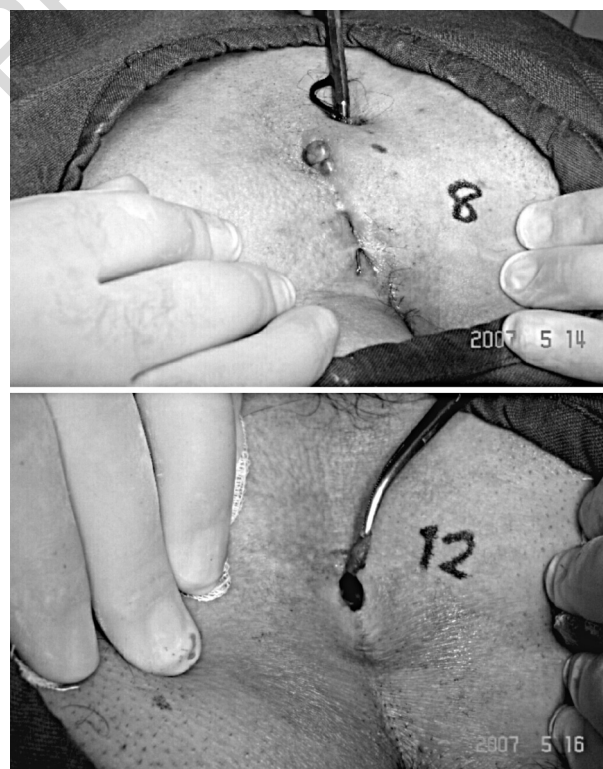


Fig. 1: Grade 1/2 PS cases surgical procedures; Curettage of hair, granulation tissue or necrotic tissues through the entrance and exit holes (pic. above) and Elliptical excision of pits separately (pic. below).

a diameter of 1-3 mm were used for curettage in cases lower than grade 2 (Fig. 2).

In grade 3 and 4 cases, radical excision was not performed in order to avoid deepening the wound, thereby preventing increased morbidity. In these patients, the lay-open and secondary healing approaches were preferred in order to provide simple and permanent recovery. When the length and depth of the tracts opened by unroofing were excessive, marsupialization was performed by suturing the wound edges to the wound base to accelerate healing (Fig. 3).

In the presence of abscess, direct drainage was achieved under local anesthesia and pits were excised and closed with one suture. The abscess pouch and tracts were irrigated with diluted H₂O₂, povidone iodine and physiologic serum, followed by placement of tight bandage.

In order to prevent seroma or hematoma formation and to accelerate cavitory healing by providing intra-wound occlusion, tight bandages were applied in all surgical procedures. The tight bandage is applied by placing the gauzes to fill the presacral sulcus and tight packing of the buttocks close together. The patients were sent home after 1 hour and called for control two days later and the tight bandage was renewed. On the 4th or 5th day, the tight bandage was removed, simple gauze pad was placed and daily dressings were recommended at home. If the incisions were sutured, they were removed at post-

op 7 to 10th days and regular dressings were stopped. In general, patients were allowed to bathe from the post-op 5th day onward.

Antibiotics were given for 3-5 days in all cases. Oral Ciprofloxacin alone or combined with metronidazole were preferred in those cases. PO paracetamol or NSAIDs were preferred for post-op pain control. Routine and regular analgesia was not required in any patient. Bed rest was not required in any of the patients; however, they were advised to rest at home for 2-5 days and to avoid active sport and exercise for 15 days.

All patients were called for follow-up at the postoperative 20th day and at the end of 3 months. Those who could not attend follow up visits were phoned and their status was assessed by detailed questioning. In case of recurrence or wound problems, the patients received correctional treatments with the same method without any problems. Wound problems seen in the first three months were accepted as late recovery rather than recurrence.

Suppurating lesions, deep tracts or sinuses that were relatively large in size (such as 2-7 cm), that had formed as the result of defective surgeries or incomplete care, were treated with simple lay-open technique and healed within a few weeks. Because the tract wall was epithelized partially or totally with the skin epithelium that progressed from distal to proximal, these tracts base were



Fig. 2: Dental files and ear curettes with a diameter of 1-3 mm for curettage in cases less than grade 2.



Fig. 3: Marsupialization of a recurrent grade 3 case, and postoperative appearance in 7th week.

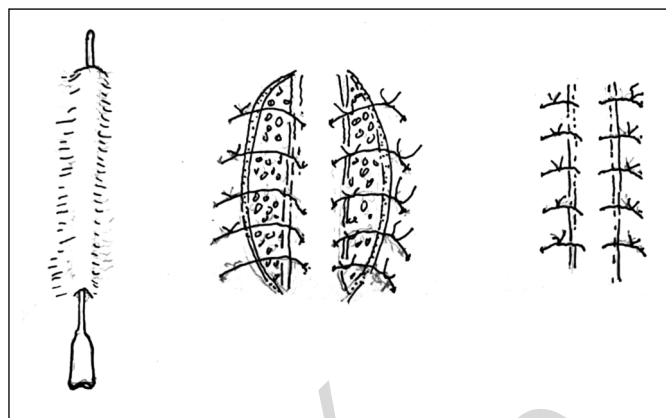


Fig. 5: "Butterflyplasty"; Suturing of lateral incision surfaces ranging from 3 to 6 cm.

not excised; only unroofing was performed. In such cases, the lateral incision surfaces ranging from 3 to 6 cm's were sutured and healed in 10 days. This process was called "Butterflyplasty" (Fig. 4 and 5). No drain was used in patients who had butterfly plasty

Open wounds that had not healed after radical techniques (such as flap rotation or open surgery), were found to improve with effective dressing and/or mini revisions. Cases with intergluteal wounds, that led to postoperative intertrigo and associated erosive wounds, were treated with limited plastic correction. Wounds with pyogenic granulation, formed as a result of insufficient care or because of hematoma and dehiscence, were abundantly curetted and received daily dressings with saline and dexpanthenol creams and healed in a few weeks.

In open wounds, after curettage and application of AgNO_3 , a dressing impregnated with antibiotic pomade was placed into the cavity. This simple and effective method provides painless and easy healing of cavitory lesions with a hard wall, which are not suitable for primary closure.

TABLE II - Demographic and clinical characteristics of cases.

n = 5338	Status	Number /rate (%)
Gender	Male	4774 (%89,4)
	Female	564 (%10,6)
Age	Mean±SD / Median (range from to)	26,90±7,85 / 26(10-79)
Initial admission status	Primer disease/recurrence	4369/858
Follow -up (month)	Mean±SD / Median (range from to)	14,86±29,34 / 1(0-204)
Disease duration	Mean±SD / Median (range from to)	28,33±44,69 / 12(0-492)
Abscess history	none	3933(%73,7)
Number of abscess attack in past medical history	1	896(%16,8)
	2	219(%4,1)
	3	39(%0,7)
	3+	251(%4,7)
Operated at initial admission	None	56(%6,5)
Number of operations in past medical history	1	594(%69,2)
	2	135(%15,7)
	3	43(%5)
	3+	21(%2,4)
Presence of abscess at first admission	yes	614 / 5338 (%11,5)
Newly drained abscess	yes	365/5338 (%6,8)
Suppurated	yes	1405/ 5338 (%26,3)

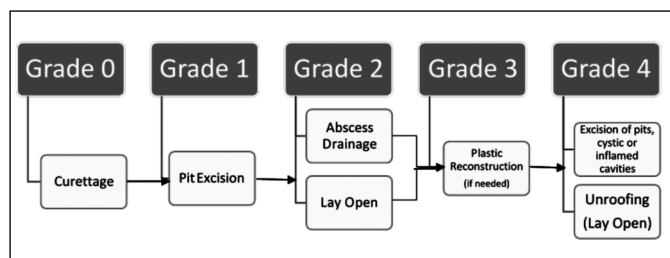


Fig. 6: Algorithm of surgical technique preferences.



Fig. 7: Laid-back sitting.

GENERAL PRECAUTIONS - PATIENT DUTIES

The patient and his or her family were warned about possible issues and provided written information that stated the following:

- In order to prevent recurrences, the tension of the intergluteal sulcus should be minimized by sitting upright, sideways or in a cross-legged manner.
- In order to reduce hair and bacterial load, frequent showers should be taken and the area should be washed with soap and sponge. Additionally, the intergluteal sulcus should be cleaned and swept dry several times a day.
- Obese patients should wear seamless underwear that does not cause friction in the intergluteal sulcus.

STATISTICAL ANALYSIS

All analyses were performed using the SPSS version 25.0 package program. Descriptive statistics of the variables were presented. Chi-square tests were used to compare categorical variables. In the analysis of results, a type 1 error of 5% ($\alpha = 0.05$) was defined and lower p-values were accepted to show statistically significant differences.

TABLE III - Chosen procedures appropriate for clinical grade.

Clinical grade	The chosen procedure
Grade 0	Curettage of epithelial debris in pits or micro sinuses, no excision and no suture.
Grade 1	Curettage and pit excision. No suture.
Grade 2	Curettage, abscess drainage and pit excision, lay open, sometimes with suture
Grade 3	Curettage, abscess drainage, excision of pits, lay open. Sutured if plastic reconstruction is needed.
Grade 4	Excision of pits, cystic or inflamed cavities, unroofing. Sutured if plastic reconstruction is needed.

TABLE IV - Recurrence status of all cases according to the selected surgical technique.

		No recurrence	Recurrence	Value	p
Silver nitrate & Curettage & Pit excision	n	374	104	478	59,004 <0,001*
	%	78,20%	21,80%	100,00%	
Unroofing	n	150	16	166	100,00%
	%	90,40%	9,60%	100,00%	
Marsupialization	n	10	2	12	100,00%
	%	83,30%	16,70%	100,00%	
Curettage& Pit excision	n	2838	406	3244	100,00%
	%	87,50%	12,50%	100,00%	
Drainage & Pit excision	n	446	52	498	100,00%
	%	89,60%	10,40%	100,00%	
Drainage	n	16	6	22	100,00%
	%	72,70%	27,30%	100,00%	
Excision	n	634	106	740	100,00%
	%	85,70%	14,30%	100,00%	
Woundcare & follow-up	n	115	1	116	100,00%
	%	99,10%	0,90%	100,00%	
Butterflyplasty	n	57	5	62	100,00%
	%	91,90%	8,10%	100,00%	
Total	n	4640	698	5338	100,00%
	%	86,90%	13,10%	100,00%	

*p<0,05

Results

Treatment characteristics according to our graded surgical approach are summarized in (Table I). Demographic and clinical characteristics of all cases are summarized in (Table III).

In our series, 858 patients (16%) had previously undergone intervention for PS and presented to us with recurrence. 87 of them had undergone flap procedures or plastic correction. One of the patients was found to have undergone 11 surgical interventions within 48 months. The mean age of our cases was 26.9 ± 7.9 years. In our series, the Male / Female ratio was 9/1. There was no difference between the genders in terms of recurrence status ($p=0.448$). There was a significant difference in recurrence status in terms of age ($p<0.001$); it was found that patients with recurrence had lower age.

Except for hair cysts, all cases (Grade1-4) were found to have suppuration. The degree of disease and inflammation was found to be directly proportional to time with disease or delay in treatment; there was a positive correlation between disease duration and grade ($r=0.234$, $p<0.001$).

Among our patients, 11.5% presented with acute abscess on first admission, 26.3% had no acute abscess but had varying degrees of purulent discharge. The percentage of recurrence was found to be different between treatment method ($p <0.001$). It was found that the recurrence rate was highest in patients who underwent 'curettage and pit excision with silver nitrate' or 'drainage only'. Whereas, those who underwent treatment with the 'Wound Care and Follow-up' and the 'Butterflyplasty' methods were found to have the lowest recurrence rates (Table IV).

Discussion

We think that, applying the same standard method to each case by ignoring the risk factors and clinical presentation of the disease is an important error, similar to the majority of authors who deal with PS. Our graded approach (Fig. 6) is a kind of technique that is tissue-respectful and provides good aesthetic results with additional advantages, including higher comfort for the patient, low complications, cost-effectivity, rapid recovery and low recurrence. There are several examples of graded approaches and minimally invasive techniques for PS treatment in the literature^{1,3,23,24}. All have promising results.

The hair pits are almost always located in the midline of the presacral sulcus. It has been speculated whether these pits exist before the disease and many have questioned whether these asymptomatic pits are the origin of the disease. Recent studies suggest that the movement of the gluteus muscles during walking or sitting at certain positions (such as a laid-back position) cause pres-

sure and vacuum effects to free-hair; thereby 'draining' or 'vacuuming' free hair into the presacral midline where the accumulated hair may penetrate the skin with the facilitating effects of natural pits and sweating. Owing to the scaly protrusions on the hair, the direction of movement is constant, regardless of activity⁹. This structural feature may be effective in penetration and invasion of the hair to the skin. Indeed, in a study by Gosselink et al which evaluated penetrating hair in patients with PS, it was shown that free-hair had entered entrance orifices head-first in 15 of the 17 patients they examined²⁵.

The main principle of treatment is to eliminate this tubule by excision, curettage or cauterizing with Phenol or AgNO₃. After we began searching for a better method to evaluate and treat patients with PS, we initially used silver nitrate solution before curettage. However, we observed that there was no significant contribution to the success of the treatment and abandoned this approach. Furthermore, we also compared the initial treatment to pits, we performed in some patients and left others to secondary healing, depending on clinical characteristics. We observed that there was no significant difference in healing between these methods and gave up the suture altogether.

In regard to conventional methods, Colov and Bertelsen followed 75 patients treated with Bascom's pit-picking technique for one year and observed 20% recurrence²⁶. Compared to this study, our results showed lower recurrence.

In Armstrong and Barcia's study, conservative follow-up was found to be superior to excisional treatment. They applied meticulous hair control by natal cleft shaving, improved perineal hygiene, and limited lateral incision and drainage. Their follow-up time was 17 years²⁷. In a systematic review, the percentage of recurrence in pit-picking procedures was reported to be 12%, mean healing time was 4-8 weeks, and the rate of wound complications was 2-8%²⁸.

To avoid recurrence, authors have preferred the 'laying open' approach to enable secondary healing; however, this leads to prolonged healing time and reduces overall comfort. On the other hand, the primary closure technique offers rapid recovery, but increases recurrence rate. Off-midline closures were found to be advantageous in a meta-analysis performed by McCallum et al²⁹. Furthermore, in a systematic review comprised of 74 publications and 10090 cases, asymmetric closure techniques were reported to have lower possibility for failure and later recurrence, compared to midline closure techniques³⁰. There is a great deal of evidence in the literature regarding the success of lay-open and curettage treatment^{31,32}.

Recently, in a review published in 2019 by Harries et al, it was emphasized that minimally invasive surgical approaches, such as the lay-open and curettage method and the pit-picking procedures, can be selected as first-

line treatment with better cosmetic results and acceptable recurrence rates²⁸. Garg et al found significant advantages with the lay-open and curettage technique in their systematic review and meta-analysis. It was stated that this technique could be applied as a daily procedure with local anesthesia in all types of PS, due to its various advantages, including high success, low recurrence, low complication, short procedure time, and shorter duration until return to normal daily activity and work²¹.

In our opinion, for definitive diagnosis and treatment, removal of pits – rather than hair – is necessary. Pits should be found and excised in all cases with PS, including those with abscesses. If not, the disease will recur within a few months or years.

The most important factors in relapse are laid-back sitting (Fig. 7), low level of hygiene, and intertrigo. Especially in obese individuals and those with poor hygienic practices, deep intergluteal maceration, intertrigo, and shallow ulcers with pyogenic granulation, have been suggested to develop more frequently. Such shallow ulcers can heal by curettage and open wound care in 2-3 weeks without any definitive surgery.

Although extremely low recurrences have been reported with flap operations, it should be kept in mind that relapses and wound complications may be worse than the initial state of the disease. Recovery time is shorter than open healing, but labor loss is similar^{21,28,33}.

Less invasive revisions, meticulous wound care, and regular hair removal are certainly more satisfactory in the treatment of PS, compared to performing radical surgical procedures that seem to provide no benefit at all. In their extensive investigations, Hull and Wu suggested that starting with the simplest possible technique for PS treatment is the best practice, with meticulous wound care and hair shaving. They also concluded that other treatment techniques should only be considered in the case of relapse⁷.

One of the most important advantages of minimally invasive techniques is the possibility for easy treatment and revisions with the same technique, due to the lack of restrictions for these methods in cases that apply with recurrence³¹.

Our surgical approach; regardless of the degree of PS, can be applied in 15-25 minutes without preparation, under local anesthesia, with short recovery time, low recurrence and complication rate, no loss of labor, high patient and physician satisfaction, suture free or fewer suture, such as curettage and lay open. However, the actual morphology and spread of the disease can only be revealed during the procedure. Therefore, the surgeon should be prepared to revise the initial plan for surgery with data obtained intraoperatively, as is the case in many operations.

In PS, many of the predisposing factors are associated with the patient's anatomic characteristics and lifestyle. Even though we report significantly reduced recurrence

with our technique, we believe that it is crucial to include patients and their relatives in the treatment by increasing their compliance and awareness.

The most important limitation of this study is that it is a retrospective case series comprised of an extensive number of patients treated in the last 16 years. On the other hand, it has the advantages of long follow-up and meticulous data recording. The high number of cases and diversities among patients provided a broad sample of PS, while long follow-up provided reliable data to examine the relationship between PS treatment and recurrence. The inclusion of cases that presented with recurrent PS can be considered as another limitation; however, we chose to include the patients due to the fact that minimally invasive procedures can be applied safely in patients with recurrence and have shown important success. Another limitation of our study is that it is a single center experience which may have caused selection bias. Further studies with control groups are required to establish stronger evidence-based results.

Conclusion

Pilonidal sinus disease is not congenital, it is an acquired local infection in subcutaneous or intertriginous ground often seen in patients who have a habit of laid-back sitting, those who are obese and have questionable hygienic practices. Our results with over 5000 patients indicate that effective treatment for PS is individualized minimally invasive surgery.

The importance of designing surgical technique according to the needs of the patient and the condition of the disease is clear. This individualized minimally invasive approach which is less invasive and tailored to disease severity should be validated in randomized prospective trials.

Acknowledgement

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Riassunto

Il seno pilonidale è una malattia notevolmente problematica a causa delle sue recidive che tendono a diventare croniche e sono esacerbate dalla formazione di ascessi. C'è poco consenso riguardo al trattamento, molto probabilmente a causa della comprensione limitata della sua fisiopatologia e progressione. Nonostante ciò, è accettato che l'identificazione accurata della patogenesi e il

grado clinico di PS siano cruciali per la determinazione dell'approccio chirurgico.

Questo studio presenta le tecniche di trattamento chirurgico che abbiamo impiegato per la malattia del seno pilonidale con l'analisi retrospettiva della gestione e dei dati di follow-up di 5338 casi ambulatoriali da 16 anni di pratica.

RISULTATI: al periodo di follow-up di 16 anni, la recidiva è stata del 12,5%. Tutte le recidive sono state inoltre trattate con un approccio chirurgico mininvasivo individualizzato, proporzionale alla presentazione clinica.

L'importanza di progettare la tecnica chirurgica in base alle esigenze del paziente e alle condizioni della malattia è chiara. I nostri risultati con oltre 5000 pazienti indicano che il trattamento efficace per la PS è la chirurgia mininvasiva individualizzata.

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