

A modern look at pilonidal disease and endoscopic approach to its treatment

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A – research concept and design; B – collection and/or assembly of data; C – data analysis and interpretation; D – writing the article; E – critical revision of the article; F – final approval of the article

The aim of the work is to review the literature on the modern view of pilonidal disease and to evaluate the effectiveness of endoscopic methods of treatment based on the results of research in recent years.

Results. The data of the world literature convincingly testify to the high effectiveness of treatment of pilonidal disease by endoscopic techniques. The endoscopic approach is associated with a painless postoperative period, good cosmetic results, a short period of disability and high patient satisfaction. Despite the short-term benefits obtained, randomized controlled trials are needed to definitively confirm the effectiveness of this technique to more accurately determine its effectiveness in the long-term follow-up period.

According to the recommendations of the Italian Society of Colorectal Surgery, it can be considered the gold standard in the treatment of unbranched pilonidal disease.

Conclusions. The endoscopic approach has significant advantages over other standard surgical methods: minimal pain, absence of early postoperative complications (seroma, hematomas, bleeding), short hospital stay (up to 1 day), rapid wound healing and return to everyday life, good cosmetic effect and a small percentage of relapses with short-term observations.

Keywords:

pilonidal cyst, minimally invasive surgery, laser coagulation, EPSiT, VAAPS, SiLaT.

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Сучасний погляд на пілонідальну хворобу та ендоскопічний підхід до її лікування

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Мета роботи – здійснити огляд відомостей наукової літератури щодо пілонідальної хвороби й оцінити ефективність ендоскопічних методів лікування за результатами досліджень останніх років.

Результати. Згідно з даними фахової літератури, ефективність лікування пілонідальної хвороби ендоскопічними методами висока. Ендоскопічний підхід асоційований із безболісним післяопераційним періодом, хорошими косметичними результатами, коротким терміном непрацездатності та високим задоволенням пацієнтів. Незважаючи на визначені короткострокові переваги, для остаточного підтвердження ефективності цієї методики необхідні рандомізовані контрольовані дослідження, аби точніше оцінити ефективність застосування ендоскопічного підходу у віддаленому періоді спостереження. Згідно з рекомендаціями Італійського товариства колоректальної хірургії, ендоскопічний підхід можна вважати золотим стандартом у лікуванні нерозгалуженої пілонідальної хвороби.

Висновки. Ендоскопічний підхід має істотні переваги перед іншими стандартними хірургічними методами, зокрема викликає мінімальний больовий синдром, не спричиняє ранні післяопераційні ускладнення (сероми, гематоми, кровотечі), має короткий термін перебування в стаціонарі (до 1 доби), сприяє швидкому загоєнню рани та поверненню до повсякденного життя, отриманню хорошого косметичного ефекту, а також характеризується невеликим відсотком рецидивів, що зафіксовані під час короткострокових спостережень.

Ключові слова:

пілонідальна хвороба, мінімальна інвазивна хірургія, лазерна коагуляція, EPSiT, VAAPS, SiLaT.

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Pilonidal disease (PD) is a chronic inflammatory pathology of the intergluteal fold of the sacrococcygeal region, which is characterized by the presence of a fistulous passage. This passage opens in the intergluteal fold with one or more pinholes, in the thickness of which the hair shafts may be contained. PD was first described by Herbart Mayo in 1833 [1]. In 1880, R. M. Hodges not only singled out this disease as a separate nosology, but also gave it the name "pilonidal sinus", which reflected the basic nature of the disease associated with hair and nesting [2].

It occurs with approximately the same frequency in the United States, Great Britain and Italy with 26 cases per 100,000 inhabitants [3,4], and in Germany 48 cases per 100,000 population [5]. Lyshavsky O. V. et al. in their work, they claim that 5 % of the population of Ukraine has pilonidal disease [6]. The disease affects more often men

between the ages of 15 and 30 [7,8]. The effects of PD affect patients' quality of life and can have a significant impact on their ability to work and social interaction. PD becomes a significant socio-economic burden for people, especially during their most productive period of life [9].

Etiology and pathogenesis. From the middle of the nineteenth century to the present day, there have been ongoing discussions about the nature of the origin of pilonidal disease. During this period, a large number of theories with experiments and justifications were proposed.

Tsema E. V. conducted an analysis of the literature on the etiopathogenesis of PD and his own studies based on the pathological examination of excised pilonidal sinuses and hair follicles found inside the sinuses [10,11]. He structured and supplemented with his own results the existing theories of the origin of PD. All theories of origin will be divided into 2 large groups.

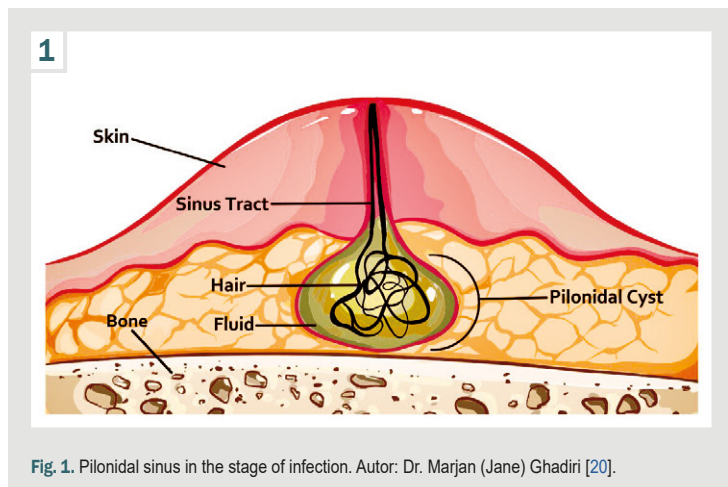


Fig. 1. Pilonidal sinus in the stage of infection. Autor: Dr. Marjan (Jane) Ghadiri [20].

Theories of the congenital origin of PD:

- empirical theory;
- neurogenic theory;
- ectodermal theory (ectodermal intussusception, origin, traction diverticulum, caudal ligament);
- the theory of the acquired origin of PD;
- theory of secondary trichogenic etiopathogenesis;
- theory of adipogenic origin;
- theory of constitutional trichogenic etiology;
- theory of inflammatory origin;
- theory of trichogenic epithelial origin;
- theory of the pump mechanism of hair penetration;
- theory of primary trichogenic etiopathogenesis;
- theory of follicular retention origin;
- theory of hydrogen-retentional mechanism of formation of acute pilonidal abscess.

Summing up the results of her research, Tsema E. V. confirms the recognized scientific opinion that the etiopathogenesis of pilonidal disease is based on follicular-retention and trichogenic-pump mechanisms, the key principles of which were developed by J. Bascom in 1980 [15,16,17,18,19]. In his study, he describes in detail step by step the process of formation of all elements of pilonidal disease: primary fistulous tract, pilonidal sinus, as well as secondary passages. According to the follicular-retention theory, the following stages are distinguished:

1. The hair follicle in the area of the intergluteal fold, provoked by a change in hormonal levels during puberty, begins to increase in size as a result of excessive accumulation of keratin. Impaired keratin outflow from the follicle is caused by prolonged sitting and swelling of the surrounding soft tissues, post-traumatic or due to skin inflammation due to poor hygiene;

2. There is a multiplication of bacteria due to a disturbed outflow of keratin and a decrease in the oxygenation of the contents of the follicle. The spread of the inflammatory process into the surrounding fatty tissue leads to complete stenosis of the outlet of the follicle, acute purulent folliculitis is formed (Fig. 1);

3. The infected follicle ruptures, the purulent exudate of the hair follicle enters the subcutaneous tissue, which leads to the formation of an abscess. It should be noted that the follicle is always destroyed in the bottom area. In a sitting position, pressure acts on the intergluteal fold,

which contributes to the breakthrough of the contents of the follicle not outward, but towards the subcutaneous tissue [15]. In the standing position, gravity forces act on the follicle from the intergluteal fold, and the bottom of the follicle is tightly fixed by connective tissue cords to the sacrococcygeal junction. Due to traction and contraction, the bottom of the follicle, as the thinnest area, is torn;

4. Formation of the primary fistulous tract. An acute abscess drains on its own to the surface or with surgery. After that, the inflammatory process decreases, and the excretory duct of the follicle, through which drainage occurs, opens, but the epithelium of the latter prevents healing. Thus, an acute pilonidal abscess becomes chronic and constitutes a primary fistulous passage (Fig. 2);

5. The stage of the primary epithelialized course. There is an ingrowth of epithelium from parts of the destroyed hair follicle, which leads to the formation of an epithelialized tract that ends blindly in the subcutaneous tissue. This is how J. Bascom described the process of formation of the primary pilonidal sinus as a “secondary fistula”, which occurs by drainage of a pilonidal abscess of follicular origin through the physiological excretory canal of the hair follicle in the area of the intergluteal fold;

6. The stage of development of secondary fistulous tracts and repeated cases of pilonidal abscesses is characterized by a key process: retraction of hair into the main cavity, which occurs due to the accumulation of hair shafts in the area of the intergluteal cavity. This phenomenon is based on the action of the so-called trichogenic pump mechanism.

Secondary epithelial passages. The process of formation of secondary fistulous passages is based on the trichogenic-pump mechanism, which consists of the following sequential stages.

The intergluteal fold in a sitting position closes, it is sealed from the pressure created by the weight of the body. At the same time, the walls of the primary course are also compressed by the same force. Hair shafts from other parts of the body, once in the intergluteal fold, are clamped between its walls.

With the transition of the body position to vertical, the intergluteal fold opens, the pressure on the walls of the epithelial passage decreases, the latter straightens and “sucks” hair shafts and other foreign bodies into the middle.

When returning to a sitting position, the process is repeated. The cuticular scales of the hair shafts are fixed in the lumen of the primary epithelial coccygeal passage and make it impossible for them to move in the opposite direction with an increase in intraluminal pressure.

Against the background of increased intraluminal pressure, the hair shaft mechanically perforates the lateral wall of the primary pilonidal sinus and enters the subcutaneous tissue.

The presence of a foreign object, such as a hair shaft, in the subcutaneous fat layer causes the development of a perifocal inflammatory response and the formation of a secondary acute pilonidal abscess.

The next phase of a secondary pilonidal abscess is its drainage. The abscess breaks outward through the skin, mainly on the side of the central axis of the body, which leads to the creation of a secondary patho-

logical course. In this passage, chronic inflammation is constantly maintained as the body's response to the presence of foreign material. Under the influence of proteolytic enzymes in a purulent outpouring, some hair shafts can dissolve. However, the possibility of complete healing of the secondary fistula is hindered due to the repeated ingress of hair into it from the intergluteal region through the primary epithelialized passage, which is the result of the relentless activity of the trichogenic pump mechanism.

Secondary fistulous passages with prolonged existence can be epithelialized by spreading the epithelium of the skin surface along the walls of the secondary fistulous tract, similar to the mechanism of epithelialization of the primary epithelial fistulous tract (Fig. 2). However, in this case, the epithelialization time is slower due to the lower mitotic potential of the skin epithelium compared to the epithelium of the hair follicle [10,11,12,13,14,15,16,17,18,19].

Choy K., and Srinath H., in their paper "Pilonidal disease practice points: An update" (2019), emphasize that the etiology of pilonidal disease is still a matter of debate [13]. However, the three most popular theories claim that the main mechanism for the occurrence of pilonidal disease is a response to foreign bodies. Karydakakis G. E., Bascom J. describe the follicular-retention and trichogenic-pump theories, Stelzner singles out retention dermatopathy as the main factor in the occurrence of pilonidal sinus.

The clinical picture of pilonidal disease consists of three forms:

1. asymptomatic sinus – patients are only concerned about the presence of fistulous passages, which bring cosmetic discomfort. Under certain conditions, one of which is meticulous hygiene, the disease regresses after 40 years.

2. Acute pilonidal abscess – patients complain of ball-shaped swelling and hyperemia of the skin, intense pain in the area of the latter. Often this focus is localized in the intergluteal fold. Treatment involves opening and debridement, abscess drainage, and curettage to remove hair follicle remnants and foreign bodies.

3. Chronic pilonidal sinus – patients usually have recurrent pain, swelling, and discharge, more often in the intergluteal region. There is a history of acute pilonidal abscesses that have either drained spontaneously or by surgery.

In this group of patients, it is possible to consider various surgical methods for the treatment of chronic symptomatic pilonidal sinus. These include classic radical excision of fistulous passages or new techniques using laser treatment or endoscopic treatment of the pilonidal sinus (EPSIT).

Aim

The aim of the work is to review the literature on the modern view of pilonidal disease and to evaluate the effectiveness of endoscopic methods of treatment based on the results of research in recent years.

Methods of surgical treatment of chronic pilonidal sinus. The number and variety of published techniques testify to the complexity of the treatment of pilonidal disease. At the same time, no procedure is the best in all respects.

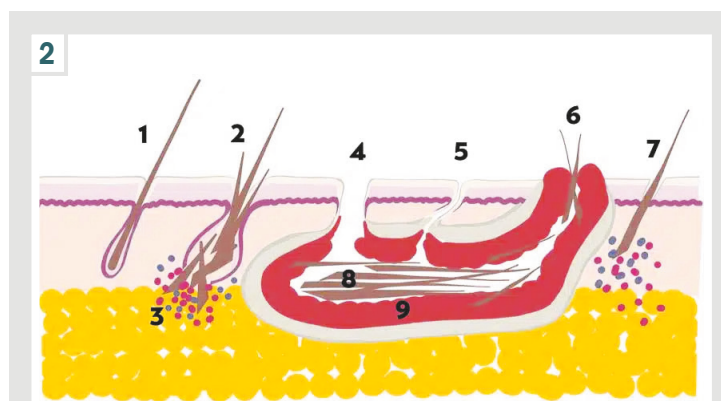


Fig. 2. Scheme of pilonidal sinus formation according to the follicular-retention theory. Autor: Dr. Bernhard Hofer [21]. 1: normal hair follicle; 2: enlarged follicle with broken hairs; 3: spread of the inflammatory process into the surrounding adipose tissue; 4: large hole; 5: small hole; 6: secondary fistula passage; 7: loose hair shaft; 8: pilonidal sinus with hair; 9: granulation tissue.

The most effective emergency treatment for acute pilonidal abscess is a simple incision and drainage. However, the surgical treatment of chronic pilonidal sinus and its recurrence is controversial. There have been numerous studies that have favored one excisional therapy over another, but many are characterized by a lack of control groups or a short follow-up period. In addition, excision of the pilonidal sinus, with or without primary closure, can be performed in a variety of ways, through a middle or lateral incision. Recurrent pilonidal sinus disease after surgery presents a complex problem with a long-term recurrence rate of 5 % to 34 % [22,23,24]. Relapses can be divided into two groups: early and late. Early recurrence occurs because one or more sinuses could not be identified during surgery, while late recurrence usually occurs due to secondary infection, high body mass index, remnants of hair shafts or foreign bodies that were not removed during initial surgery, inadequate wound care, or lack of attention to waxing [25].

Excision of the pilonidal sinus with open wound management. The method consists in complete maximum excision of the pilonidal sinus and secondary fistulous passages, after preliminary staining with methylene blue or brilliant green solution. The advantages of this method include technically simple surgical intervention, a lower number of relapses of up to 18 %. Disadvantages include a long wound healing time of 4 to 7 weeks (delayed healing caused by infection, particularly anaerobic), which reduces the quality of life of patients and causes long-term disability [26,27,28].

Excision of the pilonidal sinus with primary reconstruction. Due to the disadvantages of open wound management after excision of the pilonidal sinus, options for closing the wound defect have been discussed since the early mid-nineteenth century. Stauffer V. K. et al. published a paper that analyzed 740 studies from 1833 to 2017, which included a total of 83,000 patients undergoing surgical treatment for pilonidal disease. The main goal of the study was to compare the number of relapses after 5 years. It should be noted that the results of wound closure by Karydakakis and Bascom II methods were better compared to midline closure of the intergluteal fold 15.0 % versus 21.9 % [29].

After analyzing 33 studies with 3667 patients, it was concluded that closing the defect outside the midline of the intergluteal region promotes better wound healing, reduces pressure on the suture area, reduces the frequency of wound opening, and speeds up return to work [30]. The most common plastic-reconstructive methods are Karydakias flap and Bascom II (cleft-lift) surgery.

Reconstruction according to the Karydakias flap method. Excision of the pilonidal sinus and secondary fistulous passages is performed with an elliptical incision, the apices of which are located 2 cm to the left or right of the midline of the intergluteal fold. The skin flap is isolated 1 cm medially and 2 cm laterally, the next stage is the installation of aspiration drainage and suturing the wound in several rows (the first row is fixed to the sacral fascia), the skin is sutured according to Donati. As a result, the primary suture is located laterally to the midline of the intergluteal region [31].

Oskar Hemmingsson et al. presented a study involving 116 patients, dividing them into two groups. The mean wound healing time for the first group after debridement with midline sutures was 49 days (32 to 66 days), in the second group after excision and closure with the Karydakias flap technique – 14 days from 12 to 20 days. Each group had five relapses after a median follow-up period of 11 years [32].

Maria Bubenova and Zdeněk Kala published a paper outlining the observation of 12 patients after excision of the pilonidal sinus with Karydakias flap plasty. Based on the data obtained, the authors conclude that the reconstruction technique according to G. Karydakias is a very good example of methods that successfully solve the problem of deep intergluteal folds in patients with pilonidal disease. However, for greater evidence, it is necessary to increase the patient group and monitoring time [33].

Peiliang Wu et al. conducted a systematic search and analysis of articles in the PubMed database regarding relapses and infection in the early postoperative period of surgical uncomplicated pilonidal disease. The study included 54 articles with 3612 patients. The results are consistent with previous studies with midline closure. The incidence of wound infection and divergence of wound margins in the early postoperative period was significantly higher compared to Limberg flap and Karydakias flap. At the same time, a comparison of the latter with each other did not show significant differences [34].

Thus, the Karydakias flap method is effective in the treatment of pilonidal disease, but it has two limitations. In patients with secondary fistula passages too far away, the procedure was technically difficult to perform. The same difficulties were present in opening the fistulous passages on both sides of the midline, which required volumetric excision on both sides of the midline. The work conducted Qi Zou et al., involved 100 patients who underwent MRI of the soft tissues of the coccygeal area before surgery to accurately measure the main parameters of the pilonidal sinus (size, volume, location and relationship with the surrounding tissues). The data were analyzed to select a surgical method of treatment and predict complications during surgery and in the postoperative period, showing a significant positive effect [35].

Operation Bascom II (cleft-lift). The “cleft-lift” technique proposed by J. Bascom is an improved version of the Karydakias flap technique and in translation explains the main intention of the procedure – the lifting of the intergluteal fold, which, according to the author, acts directly on the trichogenic-pump etiopathogenesis of pilonidal disease [15,16,17,18,19].

The technique of surgical intervention Bascom II (cleft-lift) consists in asymmetrical excision of the skin flap together with the pilonidal sinus on one side of the midline of the intergluteal fold, the next step is the skin-subcutaneous flap mobilized on the other side to this place. The subcutaneous tissue of both sides is juxtaposed and stitched together, forming a “fat pad” at the site of the previous deep intergluteal fold [17,18,36].

Steaven Immerman, together with colleagues at Evergreen Surgical, Eau Claire, USA, published a paper with their own experience, performing 700 operations between 1993 and 2020 using the “cleft-lift” technique. At the same time, 332 patients, who already had surgical interventions for pilonidal disease in the anamnesis. The most common complication was the lag of the skin from the subcutaneous tissue – 76 (10.9 %) people. No measures were taken in this regard, the only thing that patients were advised to keep the area clean and dry. Wound infection was noted in 18 (2.6 %) people, of which 2 patients required additional debridement, irrigation and drainage of the wound; the latter had enough antibiotic therapy and drainage for a few more days. Postoperative hematoma occurred in 8 (1.1 %) people, which was associated with postoperative falls, taking anticoagulants, or blood clotting disorders. Divergence of wound edges – 5 (0.7 %) people, which was associated with trauma, poor wound care, technical error, or seroma that appeared after drainage removal. Treatment required repeated surgery. Also, the authors found that each of the complications was more common in the case of previously operated patients [37].

Quinton Hatch et al. published a paper in which they presented the results of their own observations of the treatment of pilonidal disease by the Bascom II (cleft-lift) method. In total, between 2013 and 2018, they operated 235 patients in more than 30, with a BMI of 45 %, 24 % were smokers, and 103 patients already had a history of surgery for pilonidal disease. All complications were divided into two groups: small and large. The second group required repeated surgical interventions, and the first group could limit itself to taking antibiotics and outpatient drainage. The number of recorded relapses was 4.7 %. The group of major complications included repeated surgical intervention in the scope of drainage and revision – 23 (9.7 %) patients, the need to use VAC systems – 7 (3.0 %) and prolonged wound non-healing – 37 (15.6 %), other significant complications – 46 (19.4 %). Minor complications included separation of the skin from the subcutaneous tissue – 62 (26.2 %) patients, hematomas – 6 (2.5 %), seroma – 12 (5.1 %), wound infection (treatment limited to antibiotics) – 7 (3.0 %) and other minor complications – 81 (34.2 %). Given the above data, the authors conclude that the number of complications and relapses is relatively high compared to other publications. However, such results were obtained in a high-risk patient population. A BMI of more than 30 and previous surgical

interventions for pilonidal disease are unfavorable factors for postoperative complications. Patients in these groups should be adequately informed about the high risks prior to surgery [38].

Ojo D. et al. published their work, in which they demonstrated the results of the treatment of pilonidal disease using the Cleft-Lift method from 1995 to 2021 in two different clinics. A total of 714 surgeries were performed, but only 656 patients were continuously monitored. Among them, 293 had a history of surgery for pilonidal disease. The authors note the following results: primary wound healing in 398 (60.7 %) patients, secondary healing – 230 (35.1 %), repeated surgery required – 19 (2.9 %), minor complications (opening and drainage of abscess, hematoma) – 23 (3.5 %) and recurrence rate – 23 (25.0 %). Considering the results and analysis of the work carried out by the authors conclude that this technique has good results of healing by primary and secondary tension with a maximum period of up to 16 weeks and note the advantage over wide excision of the pilonidal sinus with closure along the midline of the intergluteal fold [39].

Endoscopic pilonidal sinus treatment (EPSiT) / Video assisted ablation of pilonidal sinus (VAAPS). The general medical trend towards minimally invasive surgical interventions has also affected pilonidal disease. Radical methods of excision and plastic surgery of the intergluteal area have a number of disadvantages: a high percentage of relapses and complications of the early postoperative period, such as wound infection, divergence of the wound edges, prolonged healing, and others. Taking into account the above factors, over the past 20 years, research and improvement of new methods of treatment of pilonidal disease have been ongoing aimed at minimal surgical aggression and rapid recovery of patients with a return to work. With the shift to minimally invasive surgery, video-assisted pilonidal sinus ablation (VAAPS) and endoscopic pilonidal sinus treatment (EPIST) have gained popularity.

Endoscopic treatment of pilonidal disease was first described by P. Meinero et al. in 2014. Having obtained good results using the technique of treating complex rectal fistulas with video assistance [40], the authors decided to improve this technique for the treatment of pilonidal disease using fistuloscopy and ablation of the primary sinus and secondary fistulous passages.

To perform the procedure, a fistula was required equipped with an optical channel, a working channel for instruments and an irrigation system (glycine-mannitol solution 1 %), forceps, a brush, and a monopolar coagulator.

The operation consists of two stages: diagnostic and operational. The cutaneous opening of the fistula is expanded to 0.5 cm with a scalpel to insert a fistuloscope, the primary sinus is examined, and all branching paths are determined (Fig. 3). The next step is to start the forceps, with the help of which all hair shafts, follicles and side objects are carefully evacuated. Further, with the help of an electrocoagulator, ablation of the granulation tissue of the pilonidal sinus and all secondary fistulous passages occurs. All necrotic lobules are removed with a brush or Volkmann's spoon, if possible. A continuous

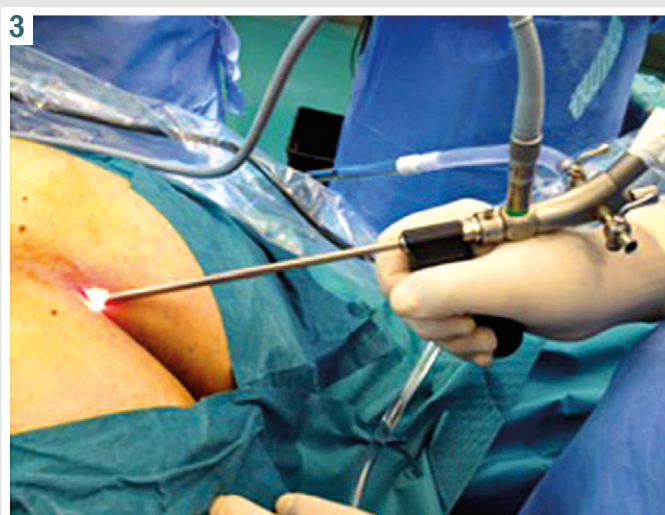


Fig. 3. Use of a fistula in EPSiT. Authors: Meinero P., Mori L., Gasloli G. [41].

stream of glycine-mannitol solution during the procedure provides a clear field of vision and flushing out of small foreign bodies and necrotic particles. Then hemostasis and dressing on the wound, the patient was discharged home on the same day [41,42].

In the period from March to November 2012, 11 patients were operated on using this technique, 8 already had a history of surgery in this area. There were no serious complications or relapses within 6 months. In the early postoperative period, pain syndrome almost did not bother patients on the VAS scale, the average result was 1.9 points, on the first day only 2 patients needed anesthesia. After 1 month, the external opening closed in all patients. Based on their experience, the authors positively note the technique due to the complete removal of hair during visual control, aesthetic result, low pain syndrome and rapid healing and return to work in 2–3 weeks [41].

In 2013, simultaneously with the development and first studies of the EPSiT technique by Meinero [41], Marco Milone and his colleagues, having adopted the experience of surgical interventions using video-assisted ablations of complex rectal fistulas [40], also decided to apply a similar approach in the treatment of pilonidal disease. Milone called his technique VAAPS, the equipment, method and sequence of the procedure were almost exactly similar to EPSiT technique, which was described earlier. One of the small details is the use of a physiological solution instead of a 1 % glycine-mannitol solution for constant irrigation during surgery. Given the similarity of these methods, they can be considered as synonymous with new technology, the main purpose of which is the use of endoscopic methods in the treatment of pilonidal disease [43,44].

In the period from September 2011 to February 2012, Milone, together with colleagues from the University of Naples, performed the first surgical interventions using the VAAPS method. A total of 28 surgical interventions were performed. In the early postoperative period, all patients noted a low pain syndrome, a maximum of 2 points on VAS, and were also satisfied with the visual appearance. Only one patient noticed a recurrence within one year. In

general, patients returned to work after 2 weeks. Summing up, the authors noted that the results of the work indicate the high efficiency of the method, the rapid stage of rehabilitation, the absence of complications in the early postoperative period, such as wound infection, divergence of wound edges, seromas, and hematomas [43].

Ramin Azhough and Swivaut published the results of their work, in which they performed 100 surgical interventions using the EPSiT technique from 2017 to 2019. Patients reported low pain during the 1st postoperative week. On the VAS scale, the maximum is 6 points (4 %), most patients gave 2–3 points, 28–37 %, respectively. Wound healing lasted from 2 to 4 weeks, a longer period is associated with greater branching of fistulas. Patients returned to work in 2–5 days. The total follow-up period ranged from 8 to 24 months, during this period no patients noted conclusions such as hematomas, seroma, wound infection, recurrence was seen in 4 %. The authors conclude that the EPSiT technique is an effective method of treating uncomplicated pilonidal disease, has a low recurrence rate, minimal time spent in the hospital and return to work as early as the 2nd day after surgery [45].

In 2019, Kalaiselvan, together with colleagues from Whiston Hospital, UK, presented the results of their observations on 74 patients who underwent treatment for pilonidal disease using the EPSiT method between 2014 and 2018. The median follow-up period was 52 weeks (range 2 to 114 weeks), 8 patients were out of sight, so the results were given for 66 people, among them only 31 this surgical intervention was the first in the treatment of pilonidal disease. During the follow-up, the authors noted complete recovery after surgery in 67 % (44 patients); 22 patients required reoperation. At the second stage, it was decided to perform various methods: 8/22 patients underwent repeated EPSiT, after which only 1 patient had complaints, he underwent reconstruction using the Karydakis flap method at stage 3, after which the patient noted a complete recovery. The second group of re-operated patients (5 people) underwent reconstruction using the Karydakis flap method in the second stage, after which all fully recovered. The third group (9 people) was the second stage of excision of superficial granulation tissue, at the time of publication they were still under observation. It should be noted that of the 31 patients who did not have a history of previous pilonidal disease surgeries, 28 achieved complete recovery after the first EPSiT procedure (90 %). The authors support Meinero's position and believe that this technique can be used as the first stage in an unbranched fistula system, and in difficult cases it can be supplemented with a reconstructive stage [46].

Short-term research results have been successful. There are no or low rates of early complications such as wound infection, wound margin divergence, seromas, hematomas, and low recurrence rates. The obtained results needed long-term confirmation, an increase in the number of patients and randomized trials. Milone M., together with colleagues from the University of Naples, based on previous positive experience with the use of VAAPS, conducted a large study involving two groups with a long follow-up period of 5 years. The first group included 74 patients who underwent minimally invasive surgery

using the VAAPS method, the second group consisted of 67 patients who underwent surgery using the Bascom II (cleft-lift) technique. The main goal of the study was to compare 2 methods under the same conditions, namely the presence of chronic non-recurrent pilonidal disease, and the absence of comorbidities. The ratio between men and women, the age and complexity of branching of the pilonidal sinuses in percentage comparison were as close as possible in each group. As for relapses after the first year of follow-up, 3.9 % in the minimally invasive group, 5.8 % in the classical method, and 24.3 % and 23.8 % after 5 years, respectively. The results indicated similar relapse rates of the two techniques. All patients underwent quality of life and cosmetic satisfaction testing, in which the minimally invasive group received the highest scores. Also, patients after VAAPS in the early postoperative period needed fewer dressings, follow-up examinations by a doctor, and returned to work faster.

Although VAAPS has been found to be safe and effective in the treatment of chronic pilonidal sinus [42,43,44,45,46,47,48], less is known about the use of this method in the treatment of acute pilonidal abscess. In 2020, a paper was published in which Michele Manigrasso et al. evaluated the results of observation of two groups of patients with acute pilonidal abscess. Each patient group consisted of 41 people. In the first group in the first stage, surgery was performed according to the VAAPS method with a course of antibiotic therapy (ciprofloxacin 500 mg 2 times a day – 3 days and metronidazole 250 mg 3 times a day), in the second group, the first stage was the opening and drainage of the abscess and the second stage a month later, with a decrease in the inflammatory process, VAAPS was performed. The follow-up lasted for 5 years. The results were collected in the early postoperative period and at 1, 3 and 5 years after surgery, the main criteria were the presence of relapses, time of disability, wound healing time, and the presence of wound infection. Unfortunately, during the study, patients fell out of sight and in the third year, the early VAAPS group consisted of 20 patients, and the delayed VAAPS group consisted of 18 patients, and in the 5th year, 8 patients remained in each group. As for relapses, the results were similar, so after 1 year their percentage was 4.9 % and 7.3 %, after 3 years – 10 % compared to 16 %, and after 5 year – 25 % compared to 37.5 %. Usually in the group with early VAAPS, the time to return to work was significantly faster (median 3 days) compared to autopsy and abscess drainage (median 3 weeks). Evaluation on the pleasure scale, in which the patients of the first group scored higher. It should also be noted that the mean wound healing time, the number of incomplete wound healed, and postoperative wound infections were similar in both groups. Therefore, the authors concluded that the use of the VAAPS technique in acute pilonidal abscess can be applied in practice, since during the first year the group with early minimally invasive treatment showed better data. But this topic requires a more extensive study, because only 8 patients underwent 5 years of follow-up [47].

In 2018, A. Pappas together with D. Christodoulou published their first experience of using a diode laser in the treatment of pilonidal disease.

The procedure was performed under local anesthesia, after dilating the outlet of the pilonidal sinus to 1 cm, a thorough cleaning of the fistulous passages with a curette was performed. A radial fiber connected to a diode laser at a wavelength of 1470 nm was injected into the sinus tract, and the laser energy was supplied continuously. The laser probe was removed from the tract at a rate of 1 mm/s. If the tract did not close after the first insertion and output, the procedure was repeated. The authors reported an efficacy of 90.3 % in their prospective study of 237 patients. In recent years, there has been an increased interest in laser therapy for the treatment of pilonidal sinus disease due to its simplicity and ease of application [49]. A systematic review study showed that laser treatment of patients with pilonidal sinus disease resulted in complete healing in 94.4 % and a recurrence rate of 3.8 % [50].

In 2023, Turkish surgeons Cenk Ersavs et al. published a study on the comparative efficacy of EPSiT and SiLaT, which included 73 patients with chronic pilonidal sinus. The follow-up period was 2 years. Postoperative examination was performed weekly. The assessment of pain on a visually analogue scale, the need for analgesia, the day of discharge, and the time of wound healing were recorded. Follow-up examinations were carried out 3, 6 and 12 months after surgery. 36 patients underwent EPSiT and 37 patients underwent SiLaT procedure, the number of fistula passages and the complexity of branching were approximately equally distributed. In the early postoperative period, bleeding and necrosis of adipose tissue were recorded in two patients in the SiLaT group. The mean wound healing time and rate of return to daily activity were similar in both groups. Relapses were detected in 4 people from the EPSiT group and in 3 people from the SiLaT group. The authors noted the high effectiveness of the two methods, a short hospital stay and a quick return to work. The use of a laser does not significantly increase wound complications, however, the use of a laser increases the use of analgesics in the postoperative period [51].

The Italian Society of Colorectal Surgery (SICCR) released a consensus statement at its 2020 annual meeting, based on the experience of the members of the society and the analysis of more than 110 publications on surgical treatments for pilonidal disease. In their report, studies of the most used surgical interventions for pilonidal disease are discussed and presented, the pros and cons of each procedure are given. With regard to endoscopic treatment, the effect of the method exclusively on the pilonidal sinus and secondary fistulas, rapid postoperative recovery and wound healing, return to work and patient satisfaction was positively noted. In summary, the authors note that in the treatment of pilonidal disease, it is possible to use excision with open healing, with primary closure in the midline and an endoscopic approach. Although many surgical aspects of the treatment of pilonidal disease remain controversial, panelists recommend adopting minimally invasive techniques in cases of unbranched pilonidal sinus and using conventional treatment in complex cases [52].

Conclusions

1. Pilonidal disease is a factor in treatment due to frequent complications in the postoperative period,

hematomas, seromas, wound infection, divergence of wound edges, and frequent relapses. Due to the fact that PD is more common in men aged 15 to 30 years, the long time of their treatment is a direct burden on health care facilities, and an indirect burden for the country due to the long-term disability of the population. For the treatment of acute pilonidal abscesses, dissection and drainage with curettage are recommended. Wide excision with primary closure or healing by secondary tension is the currently accepted treatment for most chronic diseases of the pilonidal sinus. None of the methods of surgical interventions has been universally recognized. Relapse of the disease and complications remain an urgent problem today. Excision and primary closure outside the midline by various methods showed better results in the percentage of recurrences and early complications. Wide, excessive excision with different reconstruction options can be complicated by infection or divergence of the wound edges, which significantly increases the duration of treatment and disability.

2. The transition to endoscopic techniques solves most of the shortcomings of classical surgical interventions, although at the moment there is not enough data to support this method, especially in the conditions of our country. The disadvantages include the potential cost of equipment, the need for specific training. In addition, patient selection is key, as endoscopic treatment will provide the greatest benefit for a minimally branched pilonidal sinus with few secondary fistulous passages. In this case, the procedure can be performed through one skin hole. For some patients, wide excision is still the surgery of choice, but with endoscopic techniques, the number of these patients can be reduced.

Prospects for further research. The presented results of the use of endoscopic methods of treatment of pilonidal disease seem to be better than the results of classical surgical interventions. However, favorable short-term results and lack of reliable long-term follow-up data should provide an incentive for further high-quality studies to draw definitive conclusions about this technique.

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