Lay open versus methylene blue injection for identification of side branches in pilonidal sinus: a prospective controlled study

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Background
Pilonidal sinus is a common disease with high recurrence rate mostly due to residual unexcised side branches. As a result, methylene blue is injected in the sinus at the time of surgical excision.
Patients and methods
A total of 40 patients were recruited for the proposed techniques of complete lay-open of all branches before excision and methylene blue dye injected at the start of the operation. The excised specimens were examined for the accuracy of both techniques to delineate all sinus tracts.
Results
Unstained side branches could be excised when using the preliminary lay-open technique.
Conclusion
Lay-open technique is feasible with better postoperative outcome when compared with the current methylene blue injection technique in cases of pilonidal disease.

Keywords:
methylene blue, pilonidal disease, preliminary lay open, side-branch excision

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Introduction

With a rapidly increasing incidence of occurrence among all nations, pilonidal disease is a chronic disease with a substantial burden on health care systems because of both its consequences on patient's life as well as the complications of treatment modalities [1,2]. In its simplest definition, pilonidal or 'jeep' disease is an inflammatory condition, most commonly, within the natal cleft caused by entrapped hair (*pilus*) nests (*nidus*) with chronic waxing and waning discharge as long as it is not complicated [3]. With an epithelialized tract, the external opening leads to a subcutaneous cavity filled with hair nests and granulation tissue [4]. The etiology is still controversial, with recent acceptance of three theories: the foreign body response hypothesis of 'Karydakis,' the 'Bascom' hypothesis of midline pits, and the Stelzner theory of retention dermatopathy sharing the same basic idea of inflammatory response for retained keratin debris under the skin [3]. This fact may explain the male predominance for that disease, especially hirsute ones. Furthermore, this fact became the cornerstone for recent treatment modalities, that is, eliminating the hair, or more precisely, the keratin nidus [5]. Despite various techniques for treatment, pilonidal disease is famous for its high rate of recurrence. The cause of recurrence is estimated to be retained sinus tracts, either from the initial operation or newly formed tracts caused by wound infection and reinvagination of hair debris [6,7]. Consequently, identification of the main tract as well as the side branches became paramount for a sound surgical management of pilonidal disease, either with open or closed methods [8]. Since its proposal, methylene blue injection technique has been a common practice for tract identification during pilonidal excision surgery [9]. However, drawbacks of that technique appeared with practice up to the extent of questioning its role in reducing recurrence in some research [10]. We introduce the technique of limited lay-open all tracts before the specimen excision as an alternative technique.

Patients and methods

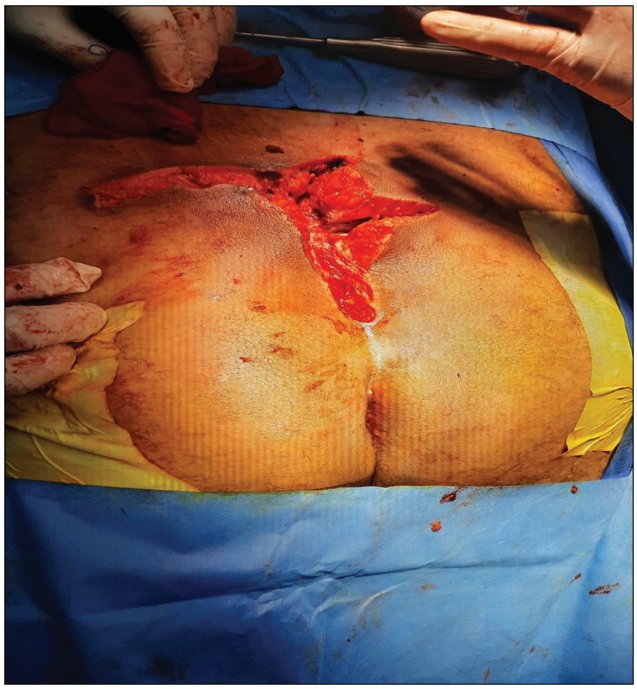
After receiving the acceptance of the ethical committee board of General Surgery Department, 40 patients with pilonidal disease who presented to our outpatient clinic in Ain Shams University Hospital were recruited for our research. Informed consent about the whole procedure was acquired from all of the patients. No specific prerequisites were needed as long as the patient was fit for anesthesia and patient was accepting surgical treatment of his/her disease. Patients presenting with pilonidal abscess had an initial incision and drainage of their abscess with 1 month of daily wound dressing before being included in the

study. The demographic data of the study population were recorded. Smoking, obesity, and deep natal cleft are assumed to be risk factors for recurrence as well as complications occurrence in pilonidal disease [11–13]. So, they were recorded in our study population. The depth of the natal cleft was measured as described by Akinci *et al.* [12], that is, 'the deepest point in the middle line before the turn of the anus with the patient in prone position,' and 3 cm was taken as a cut-off value for patients to be assigned as having superficial (≥3 cm) or deep (>3 cm) natal cleft (depending on personal experience of the researchers). Under general or spinal anesthesia, patients were put in prone position with plaster retraction of the buttocks apart. The primary sinus opening was probed to estimate the direction of the main tract. Methylene blue was injected within the sinus using a 22-G cannula. Lay-open of the sinus tract was then done followed by curettage of the opened fibrous sinus searching for side tracts (seen as spouting granulation tissue after curettage) using a scalpel minimizing the initial use of diathermy (for better assessment of granulation tissue). Side branches were probed and laid open. The whole process was repeated until no side branches could be detected by either the probe or the spouting granulation tissue. An ellipse, including all of the laid-open tracts, was drawn on the natal cleft before being excised till the presacral fascia if the affected area was small (can be included within an ellipse of diameter 20 cm vertical and 10 cm horizontal). Otherwise, the laid-open tracts were excised directly (in a fistulectomy pattern), and the edges of the wound were approximated with wide deep sutures to decrease healing time, that is, in a manner similar to that described by Rogers *et al.* [14], but the whole fibrous tract was eventually excised (Figs 1–4). The excised specimens were examined for the degree of correlation between the extent of the excised tracts and the reach of the methylene blue dye within those tracts.

Figure 1

Preoperative patient with recurrent pilonidal disease and multiple external openings along and off the midline.

Figure 2



Laying open of sinus main tract and side branches.

Figure 3

After complete lay open and excision of the sinus tracts with specimen oriented on the patient.

Figure 4

Immediate postoperative picture.

Results

In the period between January 2020 and February 2022, 40 patients were included in our study. The demographic data of the study population are shown in Table 1. The study population included 29 males and 11 females. We had 21 cases with primary lesions and 19 patients whose disease was recurrent. There were 15 patients who presented with initial abscess that needed drainage before the definitive management (Table 2). All of them had multiple openings not confined to the midline (Table 3, Fig. 5), with marked branching of the tracts, and all of them needed fistulectomy and approximating sutures (Table 4, Fig. 6). Most of the cases of initial abscess drainage are of recurrent pilonidal disease (11 out of 15) (Table 2). There was a positive correlation between the BMI and the depth of natal cleft (Table 5 and Fig. 7). Unstained side branches within the excised specimen, that is, failure of methylene blue injection technique to delineate all side branches (29/40 cases) tends to exist with obesity, increased depth of natal cleft more than 3 cm, cases with multiple openings (more than or equal three openings), cases with external openings not confined to the midline, and recurrent cases. These cases were associated with longer operative time (~88 vs. 58 min) due to multiple branching as evident by the fact that most of them had multiple openings outside the midline necessitating fistulectomy for complete excision of all fibrous tracts. However, the effect of age, sex, and smoking was nonsignificant (Table 6). The operative time for both techniques adopted are shown in Table 7.

Table 1 Preoperative data

	Total no.=40
Age	
Mean±SD	29.88±5.32
Range	20–43
Sex	
Female	11 (27.5)
Male	29 (72.5)
BMI	
Nonobese (BMI<30)	19 (47.5)
Obese (BMI>=30)	21 (52.5)
Mean±SD	30.53±3.18
Range	24–38
Natal cleft depth (cm)	
Mean±SD	3.40±0.47
Range	2.7–4.3
Superficial (<=3)	10 (25.0)
Deep (>3)	30 (75.0)
Smoking	
No	17 (42.5)
Yes	23 (57.5)
Primary/recurrent	
Primary	21 (52.5)
Recurrent	19 (47.5)
Number of pits	
Median (IQR)	3 (2–4)
Range	1–7
<3	16 (40.0)
>=3	24 (60.0)
Midline only pits	
No	26 (65.0)
Yes	14 (35.0)
Technique of operation	
Lay open	21 (52.5)
Fistulectomy	19 (47.5)
Operative time	
Mean±SD	79.63±24.29
Range	40–120
Initial abscess presentation	
No	25 (62.5)
Yes	15 (37.5)
Excision beyond dye	
Unstained tracts found	29 (72.5)
Only Stained tracts	11 (27.5)

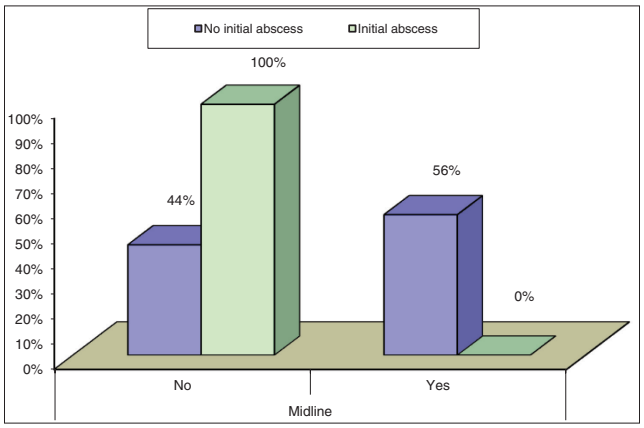
Table 2 Deep analysis of operative data

	Primary cases (*N*=21)	Recurrent cases (*N*=19)
Natal cleft depth	Less than or equal 3 cm=8, more than 3 cm=13	Less than or equal 3 cm=2, more than 3 cm=17
Operative technique	Lay open=15, fistulectomy=6	Lay open=6, fistulectomy=13
Operative time (min)	~50–110	~55–120
Initial abscess drainage	4/21	11/19
Number of pits	Single=5, double=6, 3 or more=10	Single=2, double=3, 3 or more=14
Midline only pits (*N*=14)	11	3
Excision beyond stained sinuses (*N*=29)	Yes=11, No=10	Yes=18, No=1

Table 3 Site of pits of cases with initial abscess presentation

	Initial abscess		Test value	*P* value	Significance
	No *N*=25	Yes *N*=15			
Midline					
No	11 (44.0)	15 (100.0)	12.923	0.000	HS
Yes	14 (56.0)	0			

Figure 5



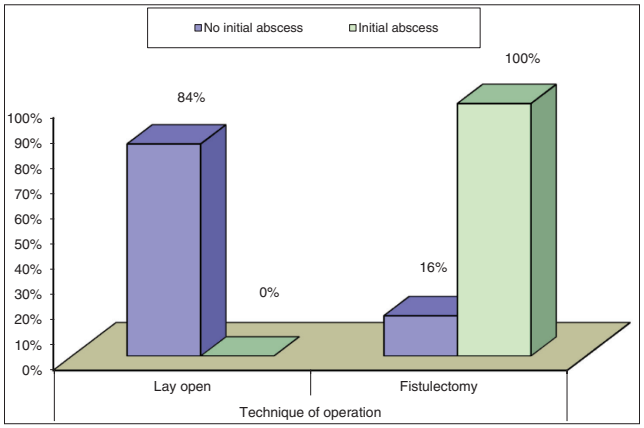
Site of pits in cases with initial abscess presentation.

Table 4 Operative technique for cases with initial abscess

	Initial abscess		Test value	*P* value	Significance
	No No.=25	Yes No.=15			
Technique of operation					
Lay open	21 (84.0)	0	12.923*	0.000	HS
Fistulectomy	4 (16.0)	15 (100.0)			

P value more than 0.05: nonsignificant; *P* value less than 0.05: significant; *P* value less than 0.01: highly significant. *χ^2 test.

Figure 6



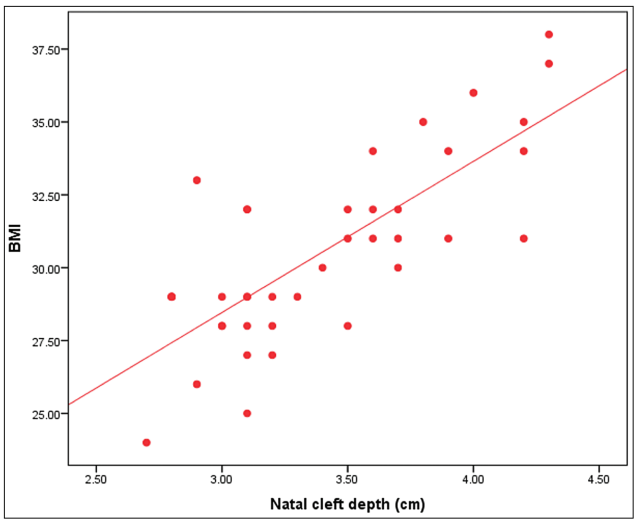
Operative technique for abscess presenting cases.

Table 5 BMI versus depth of natal cleft

	BMI	
	r	*P* value
Natal cleft depth (cm)	0.705**	0.000

P value more than 0.05: nonsignificant; *P* value less than 0.05: significant; *P* value less than 0.01: highly significant. **Spearman correlation coefficient.

Figure 7



BMI versus natal cleft depth.

Discussion

Being famous for its high recurrent rate, pilonidal disease represents a challenge for surgeons all over the world. Incomplete excision of side branches of the main tract, leaving 'a keratin nidus' for a new sinus reproduction, is considered the main cause of recurrence [14,15]. Consequently, methylene blue injection technique was proposed by many authors to help better intraoperative visualization of those tracts for better excision [16]. This was evidenced by increased specimen volume excised when compared with nonstained cases [17]. However, failing to eliminate recurrence, deep analysis of the 'dye injection' technique was done searching for possible causes. 'Side spreading' of the injected dye through sinus perforation leading to failure of actual sinus complete exposure, besides peripheral staining of normal tissue, was proposed [8]. The possibility of having 'the terminal cyst' of the sinus ruptured during injection is another cause [18]. Unstained tracts were found due to inadequate dye distribution caused by the entrapped hair, debris, and acute inflammation [10,19]. As a result, it was recommended to excise the whole macroscopically visible, inflamed area and not to be confined to the 'blue stained' region to avoid the false sense of confidence caused by that blue dye [10]. There is a recent trend to limit excision to only affected tissue to decrease healing time and facilitate 'wound closure' technique application [5,20]. In our research, we proposed to lay-open all fistulous tracts

Table 6 Risk factors for methylene blue injection technique failure

	Excision beyond dye		Test value	*P* value	Significance
	Yes *N*=29	No *N*=11			
Age					
Mean±SD	30.55±4.61	28.09±6.79	1.318	0.195	NS
Range	23–40	20–43			
Sex					
Female	8 (27.6)	3 (27.3)	0.000	0.984	NS
Male	21 (72.4)	8 (72.7)			
BMI					
Mean±SD	31.17±3.11	28.82±2.82	2.191	0.035	S
Range	26–38	24–33			
Nonobese	11 (37.9)	8 (72.7)	3.872	0.049	S
Obese	18 (62.1)	3 (27.3)			
Natal cleft depth (cm)					
Mean±SD	3.55±0.45	3.00±0.25	3.817	0.000	HS
Range	2.8–4.3	2.7–3.6			
Superficial (≤3)	3 (10.3)	7 (63.6)	12.079	0.001	HS
Deep (>3)	26 (89.7)	4 (36.4)			
Smoking					
No	14 (48.3)	3 (27.3%)	1.440	0.230	NS
Yes	15 (51.7)	8 (72.7)			
Primary/recurrent					
Primary	11 (37.9)	10 (90.9)	8.976	0.003	HS
Recurrent	18 (62.1)	1 (9.1)			
Number of pits					
Median (IQR)	3 (3–4)	2 (1–2)	–3.492	0.000	HS
Range	1–7	1–3			
<3	7 (24.1)	9 (81.8)	11.055	0.001	HS
>=3	22 (75.9)	2 (18.2)			
Midline-only pits					
No	24 (82.8)	2 (18.2)	14.618	0.000	HS
Yes	5 (17.2)	9 (81.8)			
Technique of operation					
Lay open	11 (37.9)	10 (90.9)	8.976	0.003	HS
Fistulectomy	18 (62.1)	1 (9.1)			
Operative time					
Mean±SD	87.76±22.90	58.18±11.68	4.065	0.000	HS
Range	50–120	40–75			
Initial abscess					
No	14 (48.3)	11 (100.0)	9.103	0.003	HS
Yes	15 (51.7)	0			

Table 7 Operative time for both techniques adopted

	Technique of operation		Test value	*P* value	Significance
	Lay open *N*=21	Fistulectomy *N*=19			
Operative time					
Mean±SD	59.76±9.93	101.58±14.15	–10.902	0.000	HS
Range	40–75	75–120			

guided by fistula probe before complete excision to assure that all the side branches were included in the excised specimen. It was proposed that lay-open technique guided by the fistula probe and visual localization of the granulation tissue would avoid most of the forementioned possible causes of failure in the 'methylene blue injection' technique while limiting the excision of the collateral normal tissue. To explore our hypothesis, the excised specimens were re-examined for the degree of correlation between the laid-open tracts and the extent of staining within the same case, whether it was a primary or recurrent case. For primary cases, 11 out of 21 had unstained terminal branches (nearly half of the cases). Those cases had thick plugs

of hair imbedded within their sinus tracts, and so, the dye could not reach the most terminal branches. The ratio was markedly shifted, when analyzing the recurrent cases (18 out of 19). The recurrent attacks of inflammation leading to stenosis of the tracts, besides the retained hair and debris, can explain that finding. Deeper analysis of the data of the study population confirmed our explanation. Most of the cases with unstained terminal branches were obese (BMI more than or equals 30), that is, 18 cases out of 29 versus three out of 11 cases, where the dye exactly determined the extent of tracts. This could be explained by the direct correlation between obesity and depth of natal cleft. Deep natal cleft was found to be another factor. Among 30 patients with natal cleft of more than 3-cm deep, 26 had unstained terminal branches (89.7% of failure cases). These two factors, that is, obesity and deep natal cleft, would facilitate retention of hair and keratin debris within the natal cleft paving a pathway for recurrence [11,15]. They would, also, promote local infection making the skin more vulnerable to hair invagination [12]. With such high rate of failure to delineate the whole tract and its side branches in cases of pilonidal disease, whether primary or recurrent, that is, failure rate of 52.4% (11 out of 21) and 94.7% (18 out of 19), respectively, we recommend to double check the sinus tracts intraoperatively via methylene blue injection and then preliminary lay-open of all tracts before complete excision of the affected region, especially in obese patients, patients with deep natal cleft, and cases of recurrent disease. Some authors advocate performing preoperative ultrasound examination before excision for adequate preoperative planning of the procedure [18,19]. However, being an operator-dependent technique that needs a high-resolution device not readily available at every center, recommending preoperative ultrasound investigation for managing such a common disease, like pilonidal sinus, cannot be generalized beyond tertiary and highly specialized secondary care centers with available facilities, bearing in mind the personal fallacies due to subjectivity of such investigation. Methylene blue was proposed to have antibacterial effect, which would theoretically, decrease the incidence of wound infection and consequently, the recurrence rate [21]. In our study, we still apply methylene blue, but it was not our sole guide for the extent of excision. This point has to be further investigated in dedicated research over a long follow-up period, especially with the recent doubt of the role of antibiotics in preventing recurrence of pilonidal disease [22,23]. In our research, we found that age, sex, and smoking had no significant role to determine the complexity of the operation and liability to 'dye injection' technique failure, a finding not expected by the researchers, taking into account the role of these three factors in the disease recurrence and postoperative complications via their effect on local hygiene, hirsute status, and local inflammation occurrence [15]. It is worth to mention that Oetzmann von Sochaczewski and Gödeke [2] reached similar results concerning the role of age and sex in pilonidal disease in their study on a German population. International-based study about the role of those factors is recommended. In our research, we found that thorough clinical examination of the pilonidal disease preoperatively can add much to the surgical decision, paying attention to points that may have been overseen before, that is, the number of external pits and their relation the midline, the initial presentation with abscess, and the depth of natal cleft. We adopted the direct lay-open or 'the fistulectomy' technique for highly branched cases with some modification to the previously described technique by Rogers *et al.* [14]. The efficacy of this modification is to be studied on later dedicated research taking in consideration the longer operative time when compared with the classical lay-open technique. However, the proposed technique is much faster than most of the reconstructive techniques described in the literature. This debate should be settled by further future research.

Conclusion

The use of methylene blue dye alone for identification of side branches in case of pilonidal disease in not sufficient to allocate, and so, excise all tracts. Lay-open should be done, as an adjunct or a stand-alone technique, instead. Risk factors for methylene blue injection technique failure include obesity, deep natal cleft, recurrent cases, and cases with multiple off-midline pits.

Limitation

The possibility to eliminate the application of methylene blue dye without affecting the rate of wound infection and thus disease recurrence, has to be studied separately in dedicated research, especially with the inconsistent evidence for the role of antibiotics in managing pilonidal disease. The effect of methylene blue on healing of pilonidal wounds should, also, be investigated. Assumption of 3 cm as a cut-off point when determining the depth of natal cleft depends on personal experience of the researchers, a point that has to be validated in a community-based survey. The role of age and sex and pilonidal disease occurrence should be studied in a country-based survey.

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Conflicts of interest

There are no conflicts of interest.

References

1 Mahmood F, Hussain A, Akingboye A. Pilonidal sinus disease: Review of current practice and prospects for endoscopic treatment. Ann Med Surg (Lond) 2020; 57:212–217.

2 Oetzmann von Sochaczewski C, Gödeke J. Pilonidal sinus disease on the rise: a one-third incidence increase in inpatients in 13 years with substantial regional variation in Germany. Int J Colorectal Dis 2021; 36:2135–2145.

3 Choy KT, Srinath H. Pilonidal disease practice points: an update. Aust J Gen Pract 2019; 48:116–118.

4 Spalding MC, Straus JP. (2021): Pilonidal disease. At Medscape. Availabel at: https://emedicine.medscape.com/article/192668-overview#a9. [Accessed July 27, 2022].

5 Azhough R, Azari Y, Taher S, Jalali P. Endoscopic pilonidal sinus treatment; a minimally invasive surgical technique. Asian J Endosc Surg 2021; 14:458–463.

6 Osman G. Recurrent sacrococcygeal pilonidal sinus treatment by rhomboid excision with Limberg flap vs lay open method. AAMJ 2015; 13:26–31.

7 Dupuis A, Christou N, Teterycz D, Balaphas A, Robert-Yap J, Zufferey G, *et al*. Sacro-coccygeal hygiene, a key factor in the outcome of pilonidal sinus surgical treatment. BMC Surg 2021; 21:197.

8 Strevinas A, Reid AJ, McGrouther DA. Sinus tract identification by methylene blue gel. J Plast Reconstr Aesthet Surg 2013; 66:e297.

9 Kueper J, Evers T, Wietelmann K, Doll D, Roffeis J, Schwabe P, *et al*. Sinus pilonidalis in patients of German military hospitals: a review. GMS Interdiscip Plast Reconstr Surg DGPW 2015; 4:Doc02.

10 Idiz UO, Aysan E, Firat D, Bozkurt S, Buyukpinarbasili N, Muslumanoglu M. Safety and/or effectiveness of methylene blue-guided pilonidal sinus surgery. Int J Clin Exp Med 2014; 7:927–931.

11 Kasim K, Abdlhamid NM, Badwan BR, Allowbany A. Is there a relation between natal cleft depth and post-operative morbidity after different methods of excision of sacro-coccygeal pilonidal sinus? Indian J Surg 2015; 77:201–205.

12 Akinci OF, Kurt M, Terzi A, Atak I, Subasi IE, Akbilgic O. Natal cleft deeper in patients with pilonidal sinus: implications for choice of surgical procedure. Dis Colon Rectum 2009; 52:1000–1002.

13 Iesalnieks I, Deimel S, Zülke C, Schlitt HJ. Smoking increases the risk of pre- and postoperative complications in patients with pilonidal disease. J Dtsch Dermatol Ges 2013; 11:1001–1005.

14 Rogers P, Platell C, Levitt M. Minimal tissue excision in the treatment of pilonidal sinus disease: results from a single surgical unit. ANZ J Surg 2020; 90:529–532.

15 Elalfy K, Emile S, Lotfy A, Youssef M, Elfeki H. Bilateral gluteal advancement flap for treatment of recurrent sacrococcygeal pilonidal disease: a prospective cohort study. Int J Surg 2016; 29:1–8.

16 Doll D, Novotny A, Rothe R, Kristiansen JE, Wietelmann K, Boulesteix AL, *et al*. Methylene blue halves the long-term recurrence rate in acute pilonidal sinus disease. Int J Colorectal Dis 2008; 23:181–187.

17 Ardelt M, Kocijan R, Dittmar Y, Fahrner R, Rauchfuss F, Scheuerlein H, Settmacher U. Effects of methylene-blue staining on the extent of pilonidal sinus excision. J Wound Care 2016; 25:342–347.

18 Mentes O, Oysul A, Harlak A, Zeybek N, Kozak O, Tufan T. Ultrasonography accurately evaluates the dimension and shape of the pilonidal sinus. Clinics (Sao Paulo) 2009; 64:189–192.

19 Youssef AT. The value of superficial parts and endoanal ultrasonography in evaluating pilonidal disease and exclusion of perianal sepsis. J Ultrasound 2015; 18:237–243.

20 Soll C, Hahnloser D, Dindo D, Clavien PA, Hetzer F. A novel approach for treatment of sacrococcygeal pilonidal sinus: less is more. Int J Colorectal Dis 2008; 23:177–180.

21 Sahin A, Olcucuoglu E, Seker D, Kulacoglu H. The effect of using methylene blue in surgical treatments of pilonidal disease: a prospective randomized study. Eur Surg 2014; 46:148–154.

22 Iesalnieks I, Ommer A, Petersen S, Doll D, Herold A. German national guideline on the management of pilonidal disease. Langenbecks Arch Surg 2016; 401:599–609.

23 Johnson EK, Vogel JD, Cowan ML, Feingold DL, Steele SR and Clinical Practice Guidelines Committee of the American Society of Colon and Rectal Surgeons. The American Society of Colon and Rectal Surgeons' Clinical practice guidelines for the management of pilonidal disease. Dis Colon Rectum 2019; 62:146–157.