



# Video-assisted ablation of pilonidal sinus (VAAPS) versus sinusectomy for treatment of chronic pilonidal sinus disease: a comparative study

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## Abstract

Since its first description in 1883, different treatments for pilonidal sinus disease have been proposed, but we are still far from the identification of an ideal approach. The objective of this study is to determine if video-assisted ablation of pilonidal sinus (VAAPS) could be considered superior/non-inferior to standard sinusectomy for treatment of pilonidal sinus disease. After applying propensity score analysis, data from 40 patients who underwent sinusectomy and 40 patients who underwent VAAPS, from March 2011 to August 2013, were collected. The two groups were similar in terms of sex, age, BMI, smoking status and complexity of sinus. The mean operative time was less for the sinusectomy group compared with the minimally invasive treatment group ( $30.38 \pm 6.23$  vs  $44.39 \pm 7.76$ ;  $p=0.001$ ). On the other hand, the recurrence rate (7.5% vs 25%;  $p=0.035$ ) was significantly lower in the VAAPS group and the infection rate showed a trend toward reduction in the endoscopically treated patients (12.5% vs 30%;  $p=0.057$ ). No differences were found in terms of pain score at 1 week from surgery ( $3.71 \pm 1.24$  vs  $3.76 \pm 1.39$ ;  $p=0.883$ ), satisfaction at 6 months ( $8.3 \pm 1.2$  vs  $8.2 \pm 1.3$ ;  $p=0.78$ ) and time off work ( $2.01 \pm 1.30$  vs  $2.08 \pm 1.24$ ;  $p=0.620$ ). The effectiveness of our new technique can be assessed again and the comparative analysis with the conventional sinusectomy shows the feasibility of VAAPS, suggesting that this procedure is the best way to perform a sinusectomy.

**Keywords** Pilonidal sinus · Sinusectomy · VAAPS · Minimally invasive surgery

## Introduction

Pilonidal sinus disease (PSD) is a common disease of the natal cleft with an incidence of 26 per 100,000 population, affecting predominantly young male adults of working age; the disease usually causes pain and can lead to complications such as abscess formation and recurrent acute or chronic infection [1].

Since its first description in 1883 by Mayo, a multitude of treatment for PSD has been proposed [2], but we are still far from the identification of an ideal approach; so the management of chronic pilonidal disease remains controversial.

Sinusectomy, which is one of the most validated techniques, follows the concept that “less is more” and consists of the circumferential incision of the pilonidal orifices avoiding wide cutaneous margins and a selective subcutaneous extirpation of the sinus without closure of the wound. Recently, a new endoscopic video-assisted ablation of the pilonidal sinus (VAAPS) has been proposed, following the same concept of this minimal invasive approach [3].

Both procedures demonstrated to be effective in terms of reduction of complications and shorter time off work.

For the first time, we designed a study to determine if VAAPS could be considered superior/non-inferior to standard sinusectomy for treatment of PSD.

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## Materials and methods

### Study population

We retrospectively analyzed the data of 107 patients who underwent sinusectomy or VAAPS for PSD from March 2011 to August 2013, admitted to the General Surgery Unit of the University Federico II (Naples, Italy) and Embryos Fertility Center (Battipaglia, Salerno, Italy); we only included patients with a follow-up of at least 5 years. The last date of follow-up for this analysis was July 2018. The study was approved by our institutional review board and informed consent was obtained from all subjects before enrollment. All investigations complied with the principles of the Declaration of Helsinki (64th WMA General Assembly, Fortaleza, Brazil, October 2013).

Patients were included in the study if their chronic nonrecurrent sacrococcygeal pilonidal sinus was identified by an outpatient clinical evaluation. No patients previously treated by incision and drainage for the presence of an abscess were included in the study. In addition to a general indication for surgery, if signs of inflammation in the surrounding tissues were detected, antibiotic treatment was given to all patients, and the treatment was undertaken 2 or 3 weeks later when the inflammatory process was controlled. No restriction on return to work was imposed on any of the patients in either study group. The exclusion criteria were the inability to consent to participate in the study, acute pilonidal disease and the presence of any comorbidity.

All patients were examined during follow-up with a standard physical examination after 1 day, 1 week, 1 month, 6 months and every year thereafter for at least 5 years.

### Outcomes

The evaluated end points of the study were time off work, operative time, perioperative complications (infection and recurrence), pain score and patients' satisfaction. The criteria for returning to work was the absence of any limitation to normal daily activities, including no pain while resting or moving, no pain while walking and sitting, and the lack of a need to dress the wound more than once a day. Patients were also asked to report their pain on a 10-cm visual analog scale, which ranged from 0 for no pain to 10 for severe pain, for their pain 1 day and 1 week after surgery and for their satisfaction 1 month and 6 months after surgery. The scale was constructed with numeration, thus allowing patients to mark a point along the scale that best represented their health status at that time. An independent observer, unaware of the surgical intervention, collected the visual analog scale evaluation at each time point.

Demographic data (age, sex, BMI, smoking status) and sinus characteristics (the presence of multiple orifices and the distance of the lateral orifice from the midline) were also recorded.

### Operative technique

All patients were operated on with standardized operation techniques. All operations were performed with the patient under local anesthesia with 30–60 mL of mepivacaine (Carbosen, 20 mg/mL; Galenica Senese). All patients were placed in the prone position with the hips slightly flexed. The buttocks were retracted with adhesive tape. The sinusectomy procedure was performed in the conventional treatment group [4] and the VAAPS procedure was performed in the minimally invasive treatment group [5].

About conventional sinusectomy, the orifices of the pilonidal sinus were probed, and diluted methylene blue was injected to mark the subcutaneous tract. After that, the orifices and sinus were closely excised with the scalpel or scissor following the methylene-marked track. After hemostasis, the wounds were left open for secondary wound healing.

All VAAPS procedures were performed by means of a 4-mm continuous flow operative hysteroscope (Bettocchi Office Hysteroscope “size 4”, Karl Storz) with a 30° grade optic, which incorporated a 5-Fr working channel. Firstly, the endoscope is inserted through the external opening (orifice). The skin around the external opening is removed with the electric scalpel; the endoscope is advanced along the pathway using slow movements which allow the sinus cavity to accommodate the endoscope. Additionally, mechanical adhesiolysis and hair removal with the grasping forceps are done. Finally, the sinus cavity and its lateral tracks are destroyed with the 5-Fr bipolar electrode under continuous vision.

The conventional sinusectomy procedure was performed by expert surgeons (> 200 conventional treatments of pilonidal sinus) and the minimally invasive treatment was performed by one surgeon with the highest level of skill in VAAPS (M.M.).

### Statistical analysis

Continuous variables are compared by the Mann–Whitney *U* test and categorical variables are reported as percentages and compared by the  $\chi^2$  test. A *p* value of <0.05 was defined as statistically significant.

A propensity score analysis was performed to exclude any bias related to the allocation of each patient into the different surgical technique groups. The covariates supposed to be determinants of selection bias inherent in a retrospective analysis were included in the analysis: age, sex, smoking status, BMI, complexity of disease. Baseline

**Table 1** Characteristics of the study population

Characteristics	VAAPS (n=40)	Sinusectomy	p value
M/F sex	33/7 (82.5%/17.5%)	30/10 (75%/25%)	0.419
Age (years)	26.49 ± 5.53	25.22 ± 6.04	0.330
BMI (kg/m <sup>2</sup> )	32.49 ± 3.55	32.11 ± 3.12	0.610
Smoking	18 (45%)	16 (40%)	0.656
Complex disease	27 (67.5%)	24 (60%)	0.492
Operative time (min)	44.39 ± 7.76	30.38 ± 6.23	0.001
Infection	5 (12.5%)	12 (30%)	0.057
Recurrence	3 (7.5%)	10 (25%)	0.035
Time off work (days)	2.00 ± 1.30	2.08 ± 1.24	0.769

characteristics and operative and postoperative variables were compared using a multivariate analysis. Statistical analysis was performed with SPSS version 20.0 (IBM, Armonk, NY).

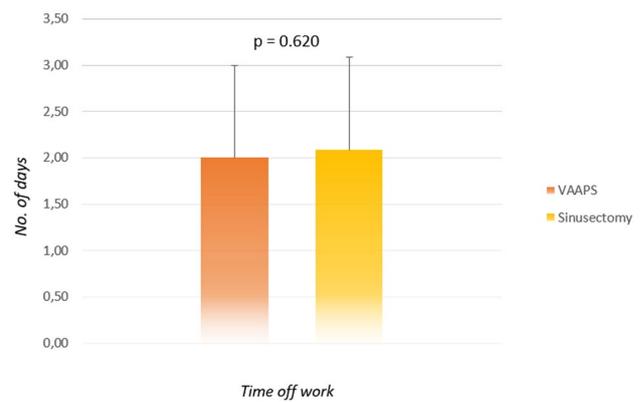
### Results

The data of 107 patients were analyzed: 100 patients satisfied the inclusion criteria for this study and, after applying propensity score analysis (Online Appendix), a total of 80 patients with chronic nonrecurrent pilonidal sinus were enrolled to minimally invasive (40 patients) or sinusectomy (40 patients) treatment for PSD. The follow-up rate was 100% at 5 years. The two groups were similar in terms of sex, age, BMI, smoking status and complexity of sinus (Table 1).

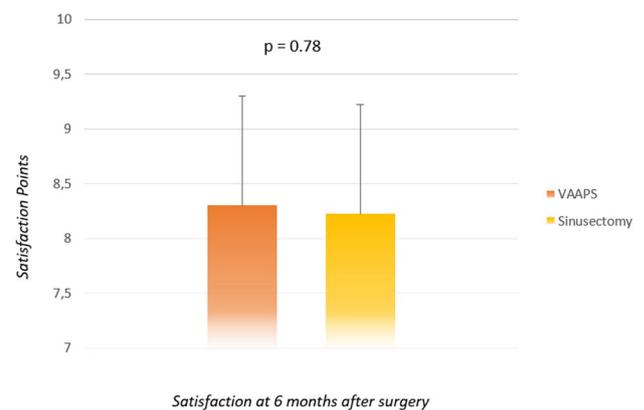
The mean operative time was less for the sinusectomy group compared with the minimally invasive treatment group (30.38 ± 6.23 vs 44.39 ± 7.76;  $p = 0.001$ ). On the other hand, the recurrence rate (7.5% vs 25%;  $p = 0.035$ ) was significantly lower in the VAAPS group and the infection rate showed a trend toward reduction in the endoscopically treated patients (12.5% vs 30%;  $p = 0.057$ ).

No differences were found in terms of pain score at 1 day from surgery (3.71 ± 1.24 vs 3.76 ± 1.39;  $p = 0.883$ ) and at 1 week from surgery (1.40 ± 0.41 vs 1.53 ± 0.30;  $p = 0.106$ ), satisfaction at 6 months (8.3 ± 1.2 vs 8.2 ± 1.3;  $p = 0.78$ ) and time off work (2.01 ± 1.30 vs 2.08 ± 1.24;  $p = 0.620$ ) (Figs. 1, 2, 3, 4, 5). The mean recurrence time over follow-up was 45.33 ± 10.21 months for the VAAPS technique and 44 ± 8.98 months for sinusectomy (Fig. 6).

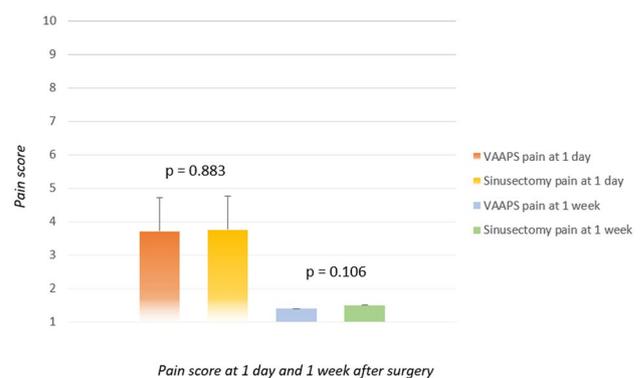
After adjusting for all other variables (sex, age, BMI, smoking status, sinus complexity), no parameters showed an influence on the risk of postoperative complications.



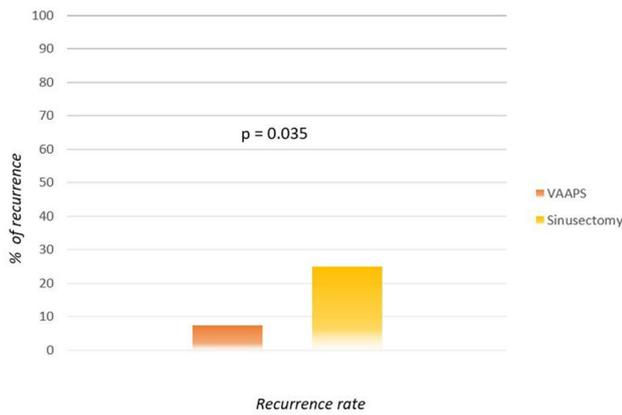
**Fig. 1** Comparison between VAAPS and sinusectomy in terms of time off work



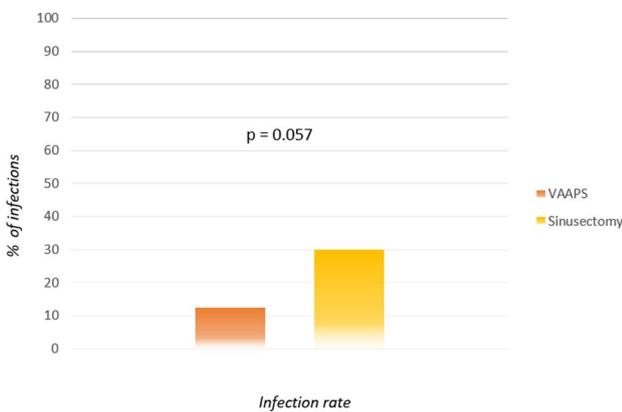
**Fig. 2** Comparison between VAAPS and sinusectomy in terms of patients' satisfaction



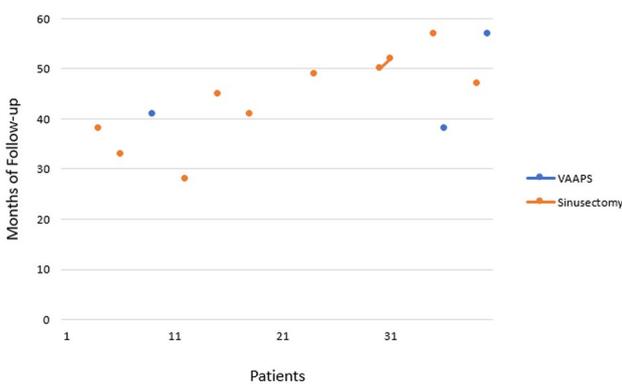
**Fig. 3** Comparison between VAAPS and sinusectomy in terms of patients' pain



**Fig. 4** Comparison between VAAPS and sinusectomy in terms of recurrence rate



**Fig. 5** Comparison between VAAPS and sinusectomy in terms of infection rate



**Fig. 6** Distribution of recurrences over the follow-up years

## Discussion

Although numerous surgical treatments for PSD have been proposed and a recent meta-analysis suggests that sinusectomy or complete resection with off midline primary closure are the preferred approaches to chronic PSD [6], we are still far from the identification of a gold standard.

In the last few years, the general trend for surgery to move from open to minimally invasive techniques has interested also PSD treatment [7].

Minimally invasive strategies for PSD treatment are not novel: in 1983, Bascom et al. described a new technique that combined a local excision and a lateral incision for cavity debridement [8].

The sinusectomy proposed by Soll [4] was introduced as a novel minimally invasive technique for pilonidal sinus to avoid open wide (en bloc) excision and it has demonstrated a low recurrence rate and a fast return to normal daily activities.

Following the Soll concept that “less is more”, the endoscopic treatment of chronic PSD has been introduced: Meinero et al. [9] described endoscopic pilonidal sinus treatment (EPSiT) and, similarly, Milone et al. [5] demonstrated the feasibility of VAAPS. Independently by the name given to the endoscopic approach to PSD, the mechanism of treatment is analogous and focused on the utilization of the endoscope without cutaneous tissue damage.

Minimally invasive treatments for pilonidal sinus consist of circumferential incision of the pilonidal orifices, avoiding wide cutaneous margins and a selective subcutaneous extirpation of the sinus without closure of the wound.

Indeed, the rationale of the video-assisted ablation of pilonidal sinus technique is based on the concept of complete removal by ablation of the sinus with a minimal surgical wound. Whereas in the conventional surgical treatment an elliptical wedge of skin and subcutaneous tissue is created to remove the sinus and its lateral tracks, the theory of our new treatment is to create a minimal elliptical wedge of the subcutaneous tissue, including all the inflamed tissue and debris, leaving the overlying skin intact. The video-assisted magnified view by the endoscope makes possible an accurate identification of the sinus cavity and all lateral tracks with their complete removal; moreover, the minimal scar (5-mm wide and 2-mm deep) caused by this minimally invasive treatment (left to heal by secondary intention) allows for very fast healing [5].

The validation of this technique, consolidated by a randomized controlled trial [3], was recently confirmed by the study of Emile et al. [7] on the endoscopic pilonidal sinus treatment: in their meta-analysis on 497 patients,

the authors found a low surgery failure rate (8.04%) and recurrence rate (4.02%), concluding that the new endoscopic approaches were a promising and safe method of treatment of PSD.

Starting from the assumption that the sinusectomy has to be considered as the preferred approach and considering that VAAPS could be read as the natural evolution of sinusectomy, which of the two techniques is preferable remains to be clarified.

To our best knowledge, this is the first study designed to compare an endoscopic minimally invasive treatment with a conventional sinusectomy for PSD.

Interestingly, our results indicate that the VAAPS procedure is more effective than the sinusectomy treatment in terms of recurrence rate and shows a trend toward reduction for infections registered; opposed evidence has been obtained for operative time which was shorter in the sinusectomy approach. The reduction of recurrences and infections is probably due to a better visualization of all sinus tracts obtained with the device used during the VAAPS technique which is coupled with the hair identification and removal.

In this setting it is worth mentioning that, as suggested by Doll [10], a long-term follow-up should be considered essential to reach reliable assumptions. Few studies had analyzed the postoperative outcomes of PSD surgery with a consistent follow-up and it has to be considered that the recurrences of PSD may manifest from immediate postoperative time up to 22 years or more [11]. As we already underlined in our recent meta-analysis [12], since 60% of all recurrences are concentrated within 5 years from operation [13], a long-term follow-up of at least 5 years should be considered the gold standard in PSD surgery benchmarking. Moreover, in previous literature only open invasive techniques had reached a long-term evaluation of patients so, for the first time, we realized a study in which minimally invasive approaches are analyzed with a proper follow-up.

## Conclusions

In conclusion, the effectiveness of our new technique can be assessed again and the comparative analysis with the conventional sinusectomy shows the feasibility of VAAPS, suggesting that this procedure is the best way to perform a sinusectomy.

Although our results appear to encourage the introduction of VAAPS in daily practice to perform a sinusectomy, some limitations of our study should be addressed. Because of the relatively small sample size and the retrospective design, our results need to be validated in larger studies. Thus, the present work should be considered a preliminary study, additionally providing the rationale for future randomized prospective trials.

**Author contributions** MM: conception, design, interpretation of the data and drafting of the article; MM, MM, NV, FM, LMSF: acquisition, analysis and interpretation of the data; FM, GDDP: interpretation of the data and critical revisions; GDDP: critical revisions and final approval.

## Compliance with ethical standards

**Conflict of interest** The authors declare that they have no conflict of interest.

**Ethical approval** All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

**Informed consent** Informed consent was obtained from all individual participants included in the study.

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