Title: **Recurrence rates after uncommon surgical procedures for pilonidal sinus disease: a merged data analysis**

Short title: Recurrence in uncommon surgical procedures for PSD

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Zusammenfassung

Hintergrund: Pilonidalsinus ist eine häufige Erkrankung bei jungen Männern. Die Rezidivrate hängt stark vom gewählten chirurgischen Verfahren und der Nachbeobachtungszeit ab. Wir suchten systematisch nach Literatur und verfügbaren Daten bezüglich Rezidivraten bei ungewöhnlichen Therapieverfahren und verglichen diese dann mit denen etablierter Techniken.

Methoden: Wir analysierten 13 Studien, die zwischen 1949 und 2017 für seltene chirurgische Eingriffe veröffentlicht wurden (davon eine randomisierte kontrollierte Studie (RCT) und 12 nicht randomisierte kontrollierte Studien mit insgesamt 566 Patienten).

Ergebnisse: Die Rezidivraten nach endoskopischen Therapien zeigen in den zusammengeführten Daten nach 12 Monaten Rezidivraten von 8,5% bzw. von 3,9%, wenn nur das eine verfügbare RCT berücksichtigt wurde. Die Seton-Technik zeigte 12 Monate nach der Erstbehandlung eine mittlere Rezidivrate von 6,9%. Die Rezidivrate nach konservativer Behandlung betrug 1,0% nach 18 Monaten, 4,7% nach 24 Monaten, 8,8% nach 60 Monaten und 15,3% nach 112 Monaten.

Schlussfolgerung: Rezidivraten bei ungewöhnlichen Techniken entsprechen jenen von etablierten chirurgischen Ansätzen. Die Daten sind jedoch spärlich und Langzeitergebnisse fehlen. Zukünftige Studien könnten ein differenzierteres Bild bezüglich neuerer Techniken wie z.B. endoskopischen Verfahren ergeben.

Abstract

Background: Pilonidal sinus disease is a frequent disorder in young men. Recurrence highly depends on both the surgical procedure selected and follow-up time. We systematically searched the literature and analyzed available data for recurrence rates after uncommon therapy techniques, specifically endoscopic approaches, the seton technique, and conservative treatment. We then compared recurrence rates with those of well-established techniques and established the relationship between recurrence and follow-up time for uncommon therapies.

Methods: We analyzed 13 studies published between 1949 and 2017 for uncommon surgical procedures and found one randomized controlled trial (RCT) and 12 non-randomized controlled trials including 566 patients. As there was only one RCT, we conducted a merged data analysis including both the RCT and the non-RCTs.

Results: Recurrence rates following endoscopic approaches show recurrence rates of 8.5% after 12 months in the merged data and 3.9% after 12 months when considering only the available RCT. The seton technique showed a mean recurrence rate of 6.9% at 12 months after initial treatment. Recurrence rates following conservative treatment were 1.0% after 18 months, 4.7% after 24 months, 8.8% after 60 months and 15.3% after 112 months.

Conclusion: Recurrence rates following uncommon techniques fall within a range of well-established surgical approaches. However, data are sparse, with long-term results missing, and future studies may reveal a more differentiated picture for newer techniques such as endoscopic procedures.

Introduction

Pilonidal sinus disease (PSD) is a frequent disorder occurring primarily in young men between the ages of 15 and 30.[1] Given the manifold treatment options, PSD therapy is associated with a wide range of recurrence rates, with available evidence suggesting a high correlation with the surgical procedure chosen and time to follow-up.[2] In a recent systematic review of the literature, we reported on recurrence rates for common surgical procedures, among them primary median closure and flap techniques. [2] In the meta-analysis and merged data analysis of that study, recurrence rates varied between very low numbers such as 1.8% after 24 months for Limberg and Dufourmentel techniques and rates of up to 67.9% 240 months after primary midline closure (Table 1).[2] However, uncommon surgical procedures for PSD have not yet been studied. Therefore, we aimed to systematically analyze the effect of follow-up time on recurrence rates of endoscopic techniques, seton techniques, and conservative approaches.

	RCTs						RCTs + non-RCTs					
Procedure / Follow up time [months]	*Patients included*	*12*	*24*	*60*	*120*	*240*	*Patients included*	*12*	*24*	*60*	*120*	*240*
Overall	11,730	**1.5**	**4.3**	**20.3**	NA	NA	89,583	**2.0**	**4.4**	**10.8**	**16.9**	**60.4**
Primary open	1,713	**1.0**	**3.2**	**16.5**	NA	NA	10,166	**1.5**	**4.2**	**13.1**	**19.9**	NA
Primary midline closure	4,626	**2.1**	**7.0**	**21.9**	NA	NA	21,583	**3.4**	**7.0**	**16.8**	**32.0**	**67.9**
Primary asymmetric closure	119	**7.3**	NA	NA	NA	NA	3,121	*1.0*	**1.6**	**3.2**	**6.7**	NA
Karydakis/Bascom**	1,457	**1.5**	**2.4**	**10.2**	NA	NA	16,349	**0.2**	**0.6**	**1.9**	**2.7**	NA
Limberg / Dufourmentel	2,380	**0.6**	**1.8**	NA	NA	NA	12,384	**0.4**	**1.6**	**5.2**	**11.4**	NA
Other flap techniques	283	**0.4**	**7.5**	NA	NA	NA	4,257	**1.1**	**1.9**	**7.9**	NA	NA
Marsupialisation	343	1.0	**14.3**	NA	NA	NA	3,207	*1.8*	**5.6**	**9.4**	**16.3**	NA
Limited excision	384	**1.3**	**1.7**	NA	NA	NA	6,366	**5.0**	**6.8**	**16.2**	**34.0**	NA
Pit picking***	98	**4.3**	**8.3**	NA	NA	NA	6,272	*2.7*	**6.5**	**15.6**	NA	NA
Partial closure	73	NA	NA	NA	NA	NA	530	**2.8**	**5.1**	**19.0**	NA	NA
Incision and drainage	0	NA	NA	NA	NA	NA	360	**10.4**	**25.9**	**40.2**	NA	NA
Phenol treatment	70	NA	NA	NA	NA	NA	1,947	**1.9**	**14.1**	**40.4**	NA	NA
Laser treatment	0	NA	NA	NA	NA	NA	125	**1.9**	**5.1**	**36.6**	NA	NA

* Data of homogeneous recurrence rates ($I^2 < 5\%$, $p > 0.2$) are printed in bold, heterogeneous data in italic numbers; **includes Bascom cleft lift; ***includes Bascom Pit Picking

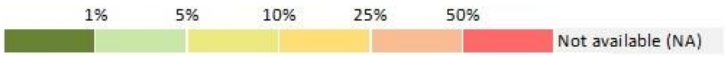

Table 1: Common PSD treatment options and therapy-specific recurrence rates [%] derived from RCTs (meta-analysis) and overall from RCTs and non-RCTs (merged data analysis). Adapted from Stauffer et al.[2]

Methods

Data were derived from our database used for the previous analysis.[2] To set up this collection we systematically searched the Cochrane Central Register of Controlled Trials (CENTRAL), Embase, MEDLINE, Ovid, PubMed, PubMed Central, and Scopus for the NCBI Medical Subject Heading (MeSH) term, "pilonid*", as well as "dermoid" AND "cyst".[2] Documents retrieved included both randomized controlled trials (RCTs) and non-RCTs, including prospective, retrospective, and observational studies such as cohort, case-control, and cross-sectional studies, and case reports published between 1833 and 2017.[2]

Studies including the dimensions definitive treatment strategy, recurrence rates, and follow-up time were considered for analyses, as described previously.[2]

As described in the first study, the data were collected in a spreadsheet (Microsoft Excel Version 2016, Microsoft Corp., Redmond, WA), and correct transfer was controlled by two authors (VKS and DD).[2] For each therapeutic strategy reported in a paper, a separate row was defined.[2] Columns included details about citation, number of patients studied with the specific therapeutic procedure, reported follow-up time(s), recurrence rates, and remarks on study details.[2] Given that PSD occurs predominantly in young adults, thus a narrow age group, mean and median reports were treated as equivalent, and data covering a range of follow-up times was handled with the center of the given range, and data reporting on minimum follow-up times were considered as is.[2]

Therapeutic procedures were stratified into subgroups: 1) conservative approaches such as ayurveda therapy, the seton stitch, and endoscopic approaches, and 2) remaining techniques such as cryotherapy, histoacryl glue injection, aspiration and antibiotic treatment.

We considered follow-up times and respective recurrence rates in a merged data analysis including both RCTs and non-RCTs, as described in detail before.[2] In brief, the software R (version 3.1.0) in the R-studio framework (version 0.98.982) was used for both statistical analysis and visualization of the results.[2] $P < 0.05$ was assumed as statistically significant for results and all respective tests were considered in a two-tailed set-up.[2] Recurrence-free outcome as a function of time was plotted according to Kaplan-Meier with pointwise 95% confidence intervals (CI), as standardly implemented in the R package 'survival' (version 2.40-1).[2]

To standardize data, we aimed for linear interpolation of recurrence-free outcome according to the two nearest observed follow-up times, as described previously. [2] However, for uncommon therapeutic other than the endoscopic, seton and conservative approaches, there was too little data. Therefore, the timepoints in the current alanyses are not uniquely standardized to 12, 24, 60 and 120 months.

Multiple publications of the same data by an author, neoplasic ethiologies, data on PSD in other than presacral location, previous meta-analyses, and review articles were excluded, as described before.[2]

Results

After the process of exclusion, we analyzed uncommon surgical procedures (endoscopic surgery, seton approach and conservative treatment) in 13 studies published between 1949 and 2017: 1 RCT[3] and 12 non-RCTs including a total of 566 patients.

Recurrence after conservative treatment

Conservative treatments were defined as approaches aiming to convert an acute PSD to a chronic fistulation PSD by aspiration and concomitant antibiotic treatment, as described by Hussain[4], as well as approaches aiming to widen the hair tract, or to enable healing or shaving / depilating without laser technique.[5]

Data on recurrence rates and follow-up times of 167 patients undergoing conservative PDS treatment were extracted from 3 non-RCTs[4,6,7], whereas no RCTs were available. Recurrence rates were 1.0% (95% CI 0.0-2.2%) after 18 months, 4.7% (95% CI 2.1-7.3%) after 24 months, 8.8% (95% CI 5.1-12.1%) after 60 months and 15.3% (95% CI 9.9-20.6%) after 112 months (Figure 1).

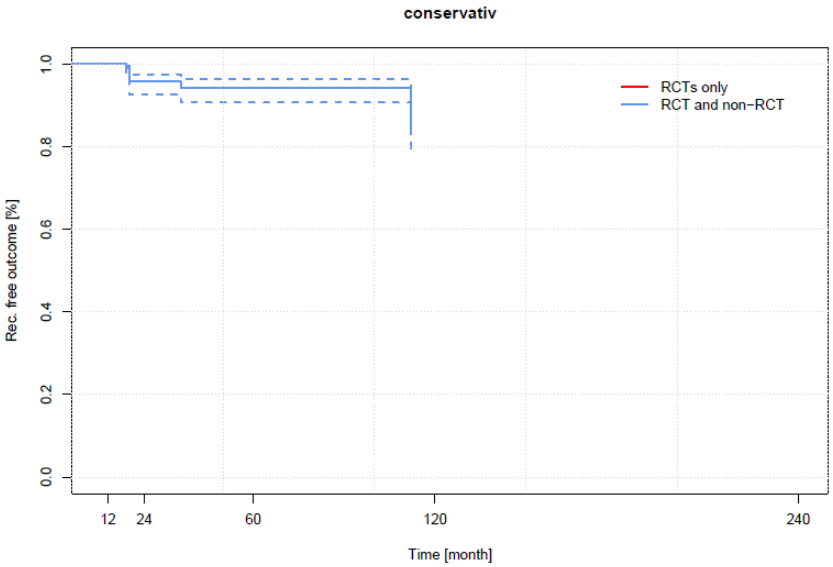

Figure 1: Conservative treatment and respective recurrence free rates pertaining to 167 patients deriving from 3 non-RCTs.

Recurrence in endoscopic procedures

Recently developed endoscopic approaches aim at minimally invasive treatment of PSD with a video-assisted ablation of the pilonidal sinus tract under local anesthesia.[3]

Data on recurrence rates and follow-up times of 369 patients following endoscopic PDS treatment were extracted from 1 RCT[3] (76 patients) and 5 non-RCTs[8-12] (293 patients). The RCT reveals a recurrence rate of 3.9% (95% CI 0.0-8.6%) after 12 months, whereas the merged data analysis of RCT and non-RCT studies indicates a recurrence rate of 8.5% (95% CI 5.2-11.8%) after 12 months (Figure 2).

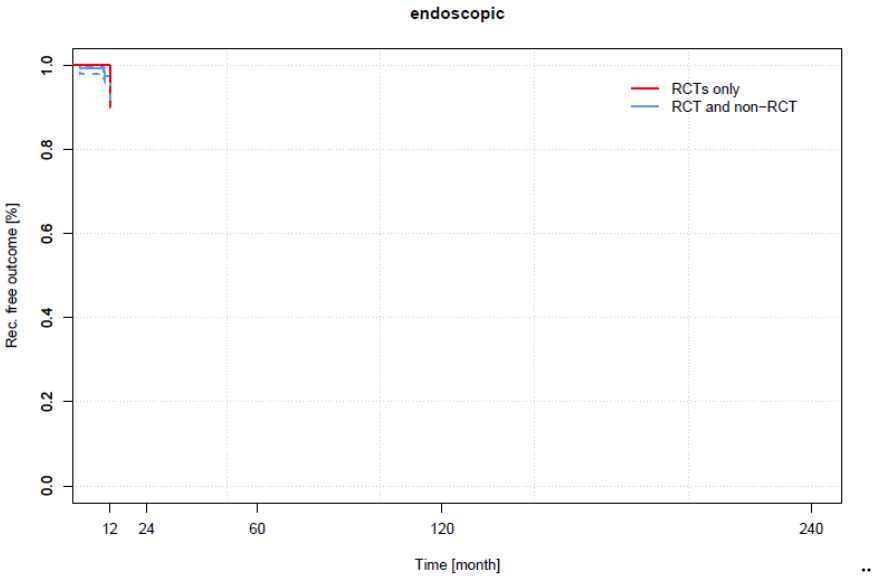

Figure 2: Endoscopic treatment and respective recurrence rates of 369 patients deriving from 1 RCT and 5 non-RCTs.

Recurrence following the seton technique

The seton approach aims at creating a midline incision using electrocautery, with sinus tracts then opened for drainage into this midline incision. A seton stitch is then created by inserting a heavy monofilament suture into a rubber catheter and placing it into the previously tunneled tracks with the use of a Kelly clamp.[13]

Data on recurrence rates and follow-up times of 30 patients following seton PSD treatment were extracted from 4 non-RCTs[13-16]. A recurrence rate of 6.9 % (95% CI 0.0-17.0%) after 12 months was observed (Figure 3).

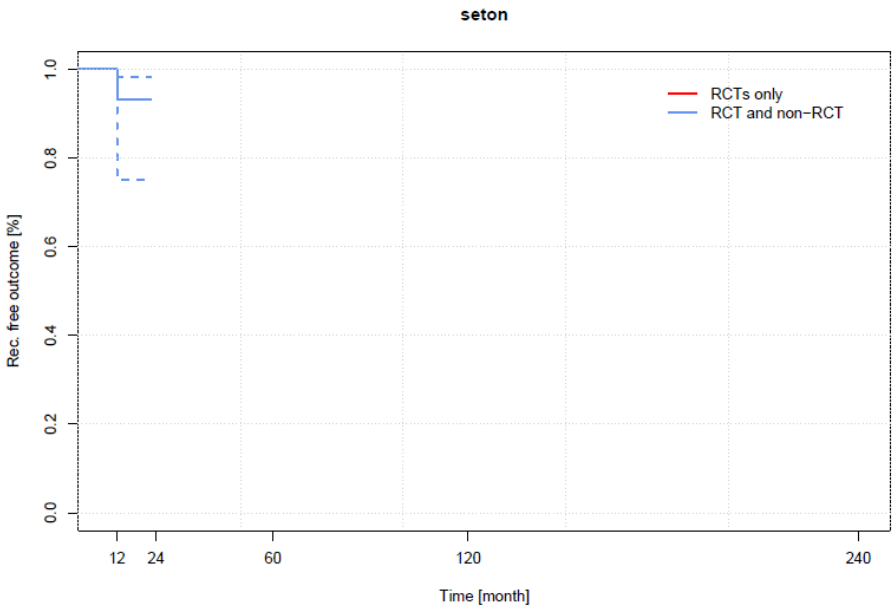

Figure 3: The seton approach and recurrence rates of 30 patients deriving from 4 non-RCTs.

Discussion

Our systematic review of available studies reporting recurrent PSD following uncommon therapeutic procedures considered data published from 1949 to 2017. We found recurrence rates ranging from 1% 18 months after starting conservative treatment to 15.3% (95% CI 9.9-20.6%) 112 months after initial consultation. Results for the seton and endoscopic approaches were similar to those published previously for common surgical techniques (Table 1).

Our study has several limitations. First, we studied uncommon surgical procedures, resulting in fewer data available than for common techniques. In particular, extremely few RCTs are available. Consequently, linear interpolation between the follow-up intervals to standardize follow-up times was not possible for all data. This makes it difficult to compare the different techniques with regard to the specific recurrence rates. For some techniques (seton, endoscopic), data were only available for a follow-up time up to 12 months. This lack of sufficient data and the short follow-up are potential reasons for the higher recurrence rates seen with these techniques.

Further, our database only extended into the middle of the year 2017. In the meantime, more studies have been published which might have qualified for analysis. For example, Milone et al. observed only one recurrence out of 27 patients with follow-up of more than 1 year in a study of endoscopic pilonidal sinus treatment combined with crystalized phenol application[17] and some other investigations in endoscopic procedures followed since. Such minimally invasive approaches would probably call into question not only current surgical guidelines but also minimizing perioperative efforts such as anesthesia,[18] since both the endoscopic and the seton approach can be performed under local anaesthesia not requiring the presence of a costly anaesthesia team.

In conclusion, we found that recurrence rate appears to be a function of follow-up time for every PDS therapy. Further, recurrence rates following uncommon techniques are within the range described for common techniques in our previous study. However, further studies are needed to make a reliable statement about recurrence rates following newer techniques such as endoscopic approaches.

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