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ORIGINAL ARTICLE

Control of hair growth using long-pulsed alexandrite laser is an efficient and cost effective therapy for patients suffering from recurrent pilonidal disease

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Abstract Pilonidal sinus (PNS) and its surgical management have a profound impact on hospital resources in terms of finances and productive man-hours. Surgical treatment has been the mainstay of treatment of both acute and chronic pilonidal sinus but recurrence is common. The control of hair growth in the sinus region plays an important role in preventing recurrence. Here, we discuss our experience of treating 19 patients suffering from recurrent pilonidal sinus with laser depilation and its long-term cost effectiveness. This is a retrospective study on patients who had recurrence of pilonidal sinus following multiple surgical treatments. They were treated using long-pulsed alexandrite laser for depilation in the sinus area, an outpatient procedure. Their clinical characteristics and outcomes were then evaluated. There was a significant reduction in hair density after laser treatment ($p < 0.001$). The disease-free period after laser treatment was significantly longer than that one after surgical treatment ($p < 0.001$). The average cost of repeated surgical treatment per disease-free month was significantly higher than that of laser treatment ($p < 0.001$). Evidence suggests the role of natal cleft hair growth in the evolution of the pilonidal disease; therefore, control of hair growth should be considered as an adjunct to the initial treatment via surgery. Compared to surgical treatment of recurrences, laser depilation is an efficient and cost-effective method of preventing recurrence and reducing morbidity and loss of man-hours. We suggest that laser depilation of the pilonidal sinus should be funded by clinical commissioning groups.

Keywords Pilonidal sinus · Recurrent pilonidal sinus · Laser treatment · Laser depilation · Cost reduction

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Introduction

There have been 17,355 hospital admissions in England alone for the treatment of pilonidal sinus between 2011 and 2012. The total number of days for which these patients occupied hospital beds during the same period was 19,045. The ages of 98 % of the patients admitted with this disease were between the ages of 15 and 59 [1]. Thus, treatment of pilonidal sinus has considerable effects on hospital resources and loss of productive man-hours.

Surgical treatment of pilonidal sinus is often complicated by recurrence of the disease. The reason for this troubling incidence is not likely to be an unsuccessful operative procedure and unsuccessful removal of the lesion. Rather, it is more likely to be due to failure to pay strict and constant attention to the prevention of re-accumulation of hair in this area [2]. Recently, laser depilation of the natal cleft has been tried successfully. However, most of the clinical commissioning groups in South West England consider laser depilation as a "cosmetic procedure" and thus may not fund these procedures, even though these might be categorized under "exceptional circumstances". Here, we discuss our

experiences in treating 19 patients by laser depilation of the pilonidal sinus and its cost implications.

Materials and methods

This is a retrospective study involving 19 patients with pilonidal sinus, referred by plastic surgeons or general surgeons for control of hair in and around the sinus area in the natal cleft. All patients presented with non-healing sinuses or ulcers following multiple unsuccessful surgical attempts at curing the disease. Any disease-free period during the surgical treatment was recorded. The senior author evaluated the sinus area during the initial consultation. The type of skin and the density of the hair growth were noted. The density of hair distribution was categorized on the number of hair per centimeter square; 1: <5 hair/cm^2, 2: 5–10 hair/cm^2, 3: 10–20 hair/cm^2, 4: 20–40 hair/cm^2, and 5: 40–60 hair/cm^2. The suitability for laser treatment was decided according to the skin type and color of the hairs, and all patients underwent laser treatment for control of the hair. The area to be treated was photographed prior to treatment on each visit. An alexandrite laser with a wavelength of 755 nm was used to treat these patients, diameter of the spot being 12.5 mm. The pulse duration of the laser pulse ranged between 10 and 40 ms depending on the texture of the hair. No form of analgesia was used, and cold air was used as an epidermal cooling agent. The interval between subsequent treatment sessions was 6 to 8 weeks.

The skin reaction from the previous laser treatment and progress of the healing of the pilonidal sinus were recorded on each visit along with density of hair per square centimeter. The cost of surgical and laser treatment was calculated according to the Hospital Episode Statistics (HES) codes from the finance department of the hospital.

All patients had previously had several surgical procedures for the control of the pilonidal disease. Given that laser treatment is not routinely funded by any trusts or insurance companies; eight patients were funded by their primary care trust after consideration as exceptional circumstances while the remainder paid for their treatment on their own.

Results

Sixteen (84.2 %) of the patients were males, and the mean age of all patients described in our study was 28.6 years. The duration of pilonidal sinus before laser treatment ranged from 2 to 30 years. All patients used shaving as a method of hair control prior to the laser treatment. Seventeen (89.4 %) patients were referred by plastic surgeons, and two (10.6 %) were referred by general surgeons. The number of surgical procedures these patients underwent for recurrent pilonidal sinus before being referred for laser depilation ranged between two and eight. Seven (36.8 %) patients reported no disease-free period between surgical procedures while two (10.5 %) had a disease-free period of equal to or more than 1 month between consecutive surgical procedures (Table 1).

Following laser treatment, 16 (84.2 %) patients had a reduction in the amount of hair to less than five hairs per square centimeter, and three (15.8 %) had a reduction of hair density to between five and ten hairs per square centimeter. There was a significant reduction in hair density per square centimeter with laser treatment when compared to the baseline hair density prior to commencement of laser treatment ($p < 0.01$) (Fig. 1).

The number of laser treatments each patient received varied between four to 12 treatments, and no complications were described by the patients. Following laser treatment, one patient required further surgical treatment for recurrent disease, and two had recurrence that healed after conservative management using dressings. These three patients were all found to have chronic deep infections at the time of therapy. The mean disease-free interval in these three patients was 80.0 months. Nine (47.3 %) patients, including the three requiring further management stopped laser treatment and are on review while ten (52.7 %) patients are still receiving treatment (Table 1).

The disease-free time during the course of laser treatment was compared with disease-free time during the surgical treatment. Our data demonstrated a significant increase in disease-free period during laser treatment ($p < 0.01$) when the percentages of the disease-free periods of these patients in these two phases of therapy were compared (Table 1). The median in-patient stay during the surgical treatment was 4.7 days while the laser treatment was done as an outpatient procedure (Fig. 2).

The cost of surgical treatment and laser treatment for each patient was recorded. Patients who had surgical procedures in private sector were not included in the surgical costs analysis. The average cost per disease-free month, as defined by the ratio of total cost of treatment and the number of disease-free months for surgical treatment was £26,316 as compared to the average cost per disease-free month of £115.54 for laser treatment (Table 2).

Discussion

In 1833, Herbert Mayo described a sinus containing hair [3], and later in 1880 Hodge suggested the term “pilonidal” (Latin: pilus = hair and nidus = nest) for this hair containing lesion in the sacrococcygeal area [4]. The etiology has been much debate upon with earlier theories focusing on an underlying congenital cause. The more recent acquired theory considers hair in this region to be a causative agent in pilonidal sinus (PNS). Bascom concluded that the midline pits in the natal cleft are enlarged and contain distorted hair follicles [5].

Table 1 Characteristics of patients and their course of management

	Mean ± SD	Median
Duration of disease (months)	93.7 ± 76.6	60
Surgery		
No. of surgeries	4 ± 1.8	3
Duration of therapy (months)	93.7 ± 76.6	60.0[a]
Disease-free interval (months)	0.2 ± 0.5	0[a]
Inpatient stay (days)	18.7 ± 13.3	15
Cost (£)	4155.2 ± 1221.2	3984
Laser treatment		
No. of treatments	7.7 ± 2.8	8
Duration of therapy (months)	24.3 ± 8.6	24.0[a]
Disease-free interval (months)	17.7 ± 8.1	20.0[a]
Inpatient stay (days)	0	0
Disease-free interval (months)	17.7 ± 8.1	20
Cost (£)	2049.3 ± 852.5	2058
Outcomes after treatment		
Completion of therapy, currently on review		6
Therapy incomplete, currently still receiving therapy		10
Required surgical treatment, given early recurrence of disease		1
Required conservative management of recurrent disease		2

[a] Comparison of median duration of therapy and disease-free interval was found to be statistically significant ($p < 0.01$, Wilcoxon signed rank test)

The causes of this distortion are accumulated keratin and mechanical forces. The secondary role played by the hair in pilonidal sinus was explained by Bascom et al. [6]; hairs in the distorted follicles are pushed down through the floor of the follicle, which is already distended with keratin [7], which then join other follicle content in creating inflammation of

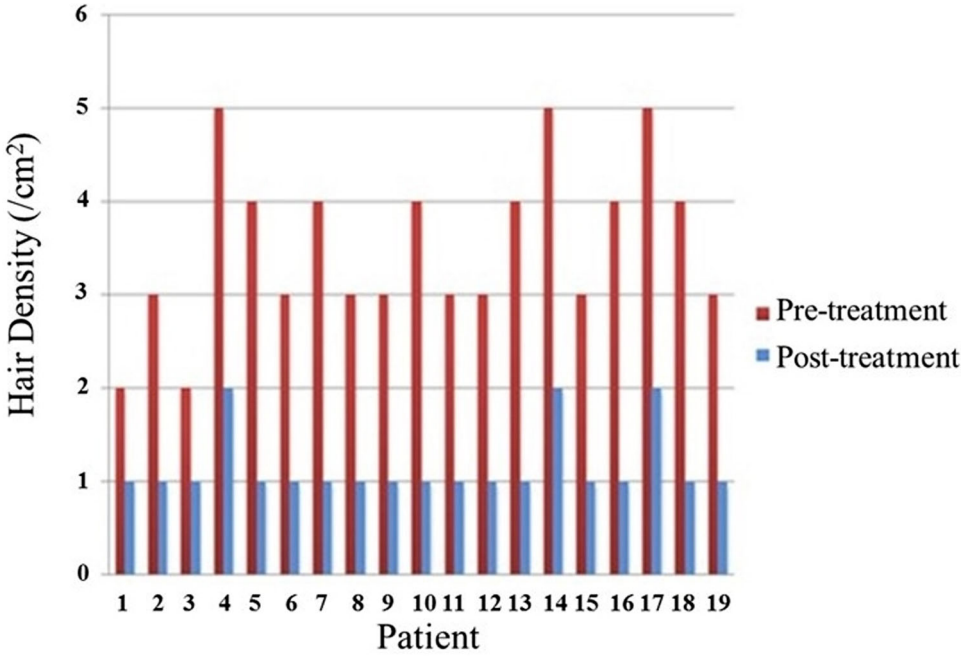

Fig. 1 Variation of hair density (cm^2)—before and after laser therapy

Hair density (1: <5 hair/cm², 2: 5-10 hair/cm², 3: 10-20 hair/cm², 4: 20-40 hair/cm², 5: 40-60 hair/cm²) Change in hair density after treatment was found to be statistically significant (p-value <0.01, Wilcoxon signed rank test)

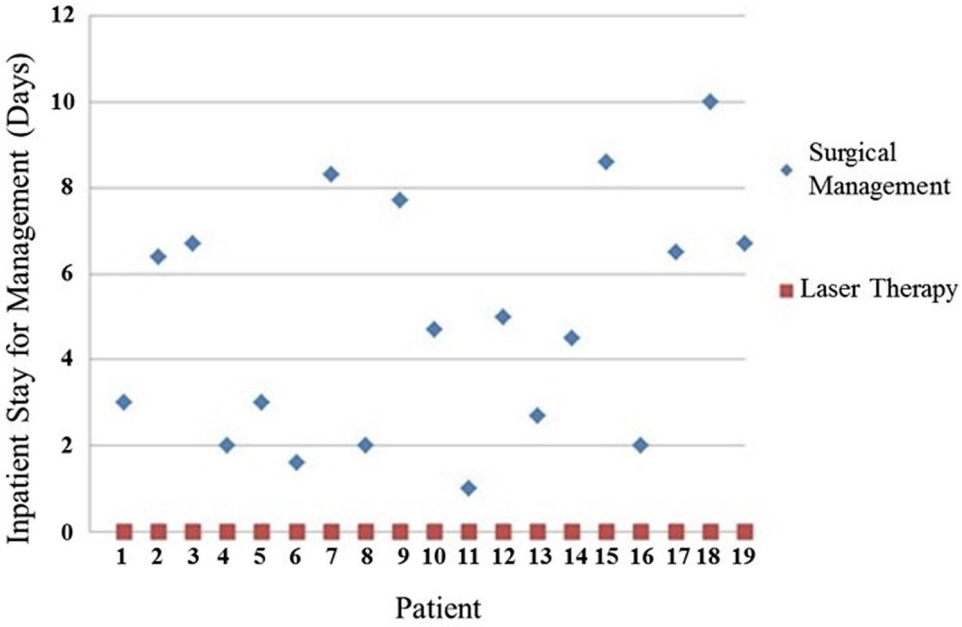

Fig. 2 Average inpatient stay (days) following treatment

Median in-patient stay was 4.7 days vs. 0.0 days between the two groups (P-value <0.01, Wilcoxon signed rank test)

subcutaneous tissue, thus leading to formation of a pilonidal abscesses [8]. Hairs that originate elsewhere on the body do not penetrate intact skin but enter through an existing hole in the skin of the cleft [5, 9], which had formed by the perforating folliculitis. Local hairs attached to the surrounding skin bend their tips into open pilonidal wounds and then interfere with skin healing [10].

It is a debilitating disease that commonly young men suffer from and it causes considerable morbidity and follows a chronic course [11]. It is more common in obese people with thick and stiff body hair in the inter-gluteal sulci [12]. The role played by hair influences the management of pilonidal sinus and control of hair growth in the peri-sinus area has shown to help in healing of the pilonidal sinus and preventing recurrence [7, 13]. Hair growth can be controlled by shaving the natal cleft regularly. Other methods of hair control are depilatory creams, electrolysis, and waxing [7, 13]. Patients often find these methods inconvenient and, access to the area is difficult. Whatever means of eradication is used, there will always be a risk of recurrence unless due attention is given to prevention of further collection of hair. There are reports suggesting recurrences of pilonidal sinuses are due to lapse of adherence to these measures in the long term presence of existing disease and failure to eliminate hair [2].

There are multiple treatment options available, most common being surgical aspiration or drainage, with or without curettage [8, 12]. However, given its high failure rates and high risk of recurrence, patients remain dissatisfied [8]. For chronic and recurrent PNS, various techniques have been described: laying open of tracks, wide excision and primary drainage, wide excision and primary closure, and limited excision. In a series by Bascom et al., 17 % of all patients had return visits within 5 years following follicle removal [6]. In the Kitchen et al. series, recurrence rate was found to be 4 % following the Karydakis procedure [14].

Lasers have been used for hair control since 1996 [15] for cosmetic purposes as well as chronic follicular diseases and hirsutism [16–18]. It aims at removal of hair by photothermolysis of the hair follicles [19]. Laser depilation has an advantage over conventional shaving as the light can reach deep crevices in the natal cleft, which would otherwise be difficult to access [7]. Aftercare of the skin following laser treatment is simple, and if done by trained people, complications are rare [7, 8, 20–23]. Side effects that have been reported are hypopigmentation and hyperpigmentation of the skin, erythema, and crusting which are all temporary and dependant on the wavelength, fluence, and pulse duration of the laser [20, 24, 25]. Of these, hypopigmentation in some cases is harder to treat [26]. These side effects are more commonly seen in patients with Fitzpatrick skin type IV–VI, for whom other aforementioned options may be used [19, 20, 26, 27]. The endpoint of treatment should be the observation of ablation of the thick and coarse hair from the sacrococygeal area [12], and typically multiple treatments are required to achieve this. Studies have reported a 60 to 80 % reduction of the hair growth for up to 6 months after treatment [28]. In one study, Linda et al. reported that one of the six patient treated by their team resorted to laser therapy as the primary treatment, and subsequently, the folliculitis improved. The laser

Table 2 Total cost of treatment and total number of disease-free period (months)

Surgery		Laser	
Cost (£)	Disease-free months	Cost (£)	Disease-free months
4520	1	1140	26
6217	0	3092	20
2541	0	3028	20
2315	0	1400	28
2294	0	1013	0
4225	0	810	26
3984	0	2058	3
2835	0	850	8
3964	0	1350	20
3856	0	1250	23
2968	2	3190	20
3875	0	2860	15
3798	0	2254	18
5987	0	3067	23
4996	0	1690	16
4698	0	2160	20
5585	0	2990	7
5895	0	1950	28
4395	0	2785	16
Mean cost per disease-free month[a]			
£26,316.00		£115.54	

[a] Mean ratio of the cost of procedure and number of disease-free month

treatment can be carried out as an outpatient procedure and is a rapid and effective method of reduction of if not the complete removal of hair in the cleft [7, 13, 29]. Given the outpatient nature, there is a considerable decrease in the burden on hospitals catering to these patients, in terms of finances and man power, as shown by our findings (Table 1—duration of therapy, Table 2). In our patients, there was a significant difference in the duration of therapy when these patients received surgical care as opposed to laser therapy ($p < 0.01$) which suggests that the latter is a more time-efficient form of therapy and if adopted would help decrease the burden on our current healthcare systems. In context of the cost to our healthcare systems, the average cost of surgical therapy was found to be approximately twice that of laser therapy (4155.2 vs 2049.3) (Table 1). When further analysis was performed on the cost of therapy and the disease-free interval of these patients, an exponential increase was observed; the average cost per disease-free month for patients being treated by surgery for recurrent disease was over 200 times that of treatment via laser therapy (Table 2). This drastic difference in cost to the healthcare system along with improved outcomes warrants a need to shift our current approach to patients with recurrent disease from a surgical to laser therapy based one.

Eighteen of our 19 patients required no further surgical treatment after laser depilation. These patients initially had laser treatment every 6 to 8 weeks. When control of hair growth was achieved, the interval between the treatments was increased to 6 to 12 months, often referred to as "top up" or "touch up" treatments, thus making laser depilation more practical and acceptable for patients and cost effective.

The drawbacks of this study are that the cost calculation did not include the inflation rate, the cost of outpatient visits and dressings used in these visits, and the cost of private surgical treatment could not be included, and therefore, our results significantly underestimates the total surgical cost. The quality of life was not measured during or after laser depilation, but disease-free interval we believe is still a good indicator of quality of life experienced by these patients given the chronic nature of the disease. Further studies with larger study populations are needed to evaluate the effectiveness of laser depilation in preventing recurrences of PNS. In addition, while our study demonstrated a significant advantage of using laser hair removal for recurrent pilonidal sinus disease, alexandrite laser is effective in patients with Fitzpatrick skin type I–IV. Similar studies should be conducted in the future on use of other lasers that are optimal for use in patients with Fitzpatrick skin types V–VI.

Conclusion

Use of laser hair removal in patients suffering from pilonidal disease is a cost-effective technique which results in improved outcomes in these patients and should be considered as an option in patients with recurrent disease. All primary care physicians, general surgeons, and plastic surgeons involved in the care of these patients should be made aware of this treatment modality. The funding sources in the healthcare industry (e.g., clinical commissioning groups) should consider it as an effective treatment option and fund these procedures in this unique subset of patients.

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