



# Another common sharp hair fragment disease – barbers’ anterior disease (BAD)

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## ORIGINAL ARTICLE

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## ABSTRACT

**Introduction:** There is suspicion that sharp cut hair fragments cause intergluteal pilonidal sinus disease. Barbers, exposed daily, have not been systematically investigated for risk.

**Methods:** One hundred barbers in Northern Germany were interviewed regarding site and incidence of hair penetration as well as methods/frequency of self-epilation, using a structured questionnaire.

**Results:** Ninety-two percent of barbers experience foreign hair penetration, mostly when cutting short dry hair. Despite daily showering and changes of clothing, 43% need monthly and 25% weekly hair removal using forceps. Left index and middle fingers as well as palms are prone to penetration, followed by feet, anterior chest and elbow groove. While 12 barbers reported intergluteal pilonidal sinus disease within their families, none had it themselves. Self-epilation was not linked to a higher incidence of hairs in the axilla, arms, legs or genital region.

**Conclusion:** The overwhelming majority of barbers need to remove penetrating foreign hair fragments regularly, despite changing clothes and daily showering after work. Fingers, hands, feet and the anterior chest are particularly at risk. Preventive measures should be considered in their workplace. The newly coined term “Barbers’ Anterior Disease” could be used to describe sharp hair fragments affecting hair care professionals. Anterior hair exposure is not linked to posterior pilonidal hair disease in hair dressers. Posterior exposure in clients may be one – if not the - reason for pilonidal disease in young adults.

**Keywords:** barbers’ disease, sharp cut hair, intergluteal pilonidal sinus disease, scalp, electron microscopy, pathogenesis

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## INTRODUCTION

It was Hodges in 1880 who first called attention to the fact that “. . . hair cutters are continually in trouble from the short hairs which penetrate the skin of their fingers and their hands.”[1] In 1946, “Barbers’ disease” and “Barber’s hand” were described by Patey and Scarff, toppling the developmental sinus theory [2]. The authors reported the case of a barber with a sinus in between the little finger and ring finger of his right hand, which healed after hair removal. Following Patey and Scarff’s case report in 1946, Ewing reported one patient with a similar diagnosis in 1947, and Patey and Scarff encountered two more in 1948, so that the subject regained attention. The term “Barber’s hand” was coined [3,4], and recurrent disease was reported, as regular exposure continued in this profession [5].

Hair is a longitudinal structure with oval diameter, containing fibrillar tubes and vacuoles. It is covered by scales which lift from the surface gradually with distance from the root [6-9]. Hair is different in people of different races; it changes with age; there can be distinct interindividual variation; and it differs in microscopic appearance and macroscopic strength [7,10]. Hair from the head is among the strongest in humans, with the ability to transmit several grams of force axially onto an area smaller than  $50 \mu\text{m}^2$ , which equals a pressure of  $800 \text{ kg/m}^2$  [11]. In addition, electron microscopy has shown that cut hair fragments generated by regular haircuts can have razor sharp ends that easily pierce healthy skin, further increasing local penetration force [12] (Figure 1).

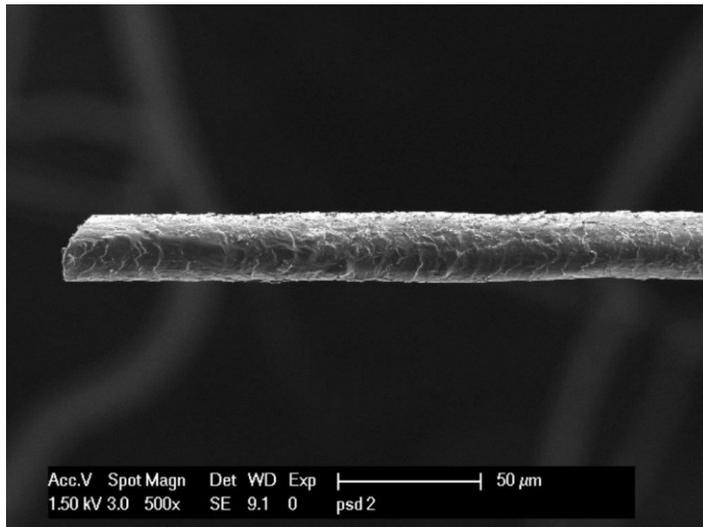


Figure 1. Electron micrograph showing sharp end of cut hair

Given the shape and axial strength of cut hair fragments, it is hardly surprising that cut hair penetrates the skin – especially in concave areas such as the palms, the umbilicus, interdigital grooves and intermammary and submammary folds. In sheep shearers [13] and dog shearers [14], occupational exposure to large quantities of dry cut hair fragments leads to increased hair penetration on the anterior side of the body.

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Because this effect has not been systematically studied in persons exposed to human hair, we investigated whether barbers' massive exposure to sharp cut hair fragments (partially wet and partially dry, depending on the type of haircut) leads to increased penetration of the skin of the hands, and how often this occurs. Furthermore, we studied other areas of the body to determine whether they are affected at all.

## METHODS

### Interviews

Between May and December 2017, 100 northern German barbers in the Oldenburger Münsterland region (Lower Saxony, Germany) were visited at their workplace and interviewed using standardized questionnaires. They were asked about professional education, work experience, and their experience with penetrating hair in the skin of the hands and other parts of the body. Key elements investigated were number of penetrations, site of hair penetration, and frequency of hair removal. Measurement and reporting were by the barbers themselves. The findings were documented on paper and fully anonymized at the interview site. Digital high-resolution photos were taken after oral and written consent were obtained. The participants' birthdates were recorded in order to calculate age at the time of the interview but no names, addresses, or other personal details were noted or stored.

### Literature search

We conducted a search of PubMed for the phrases [barber\* [All Fields] AND Pilonidal\* [All Fields]], [barber\* AND hand\*], [barber\* AND disease\*], and [barber\* AND hair\* AND penetrat\*]. Additionally, a search for case reports and case series reporting hair penetration in extra-sacrococcygeal body regions was conducted in PubMed, Science Direct, Scopus, Embase, and further internet search engines.

The articles found were analyzed and grouped into body regions as follows: head and neck, face, scalp, arm, hand, back, chest, intermammary, submammary, abdominal, umbilical, inguinal, genital, perianal and anal, gluteal, leg and thigh and foot.

### Ethics

The ethics committee of the medical association of Niedersachsen, Berliner Allee 20, 30175 Hannover, Germany (Prof. Dr. med. Andreas Creutzig, chair), completely and unanimously denied the necessity for ethical approval, based on §15 of the Niedersachsen Medical Association's professional code of conduct, as this study did not involve any treatment or investigation of a medication or medical device in humans. All participants involved gave written consent before being interviewed.

### Statistics

Excel (Microsoft Office Professional 2007 from Microsoft Corporation, Redmond, WA, USA) and GraphPad Prism (Graph Pad Prism for Windows, Version 5.02, Dec 2008, from GraphPad Software Inc., La Jolla, CA, USA) were used to protocol, process, and analyze data as well as to design graphics. Values

are given using mean, median and range. T tests were conducted to compare two groups of data, and significance was set at  $p < 0.05$ . There was no follow-up and no loss to follow-up.

## RESULTS

At hair salons in the northern German region we interviewed all barbers available and willing to be interviewed (87 female/13 male), using a structured questionnaire. The mean age was 35 years (range 17-68 years). BMI was  $24.18 \pm 4.14 \text{ kg/m}^2$  [mean  $\pm$  SD]. Barbers were a mean of 18 years on the job (range 0-52 years).

Fourteen of the 100 barbers were apprentices. They gave an average of six haircuts per day and reported one penetrating hair fragment removal per month. Fifty-nine certified barbers gave 12 haircuts a day and had between two and three episodes of hair removals per month. Twenty-seven master barbers gave 13 haircuts a day and reported the same removal frequency as the other experienced barbers (Figure 2).

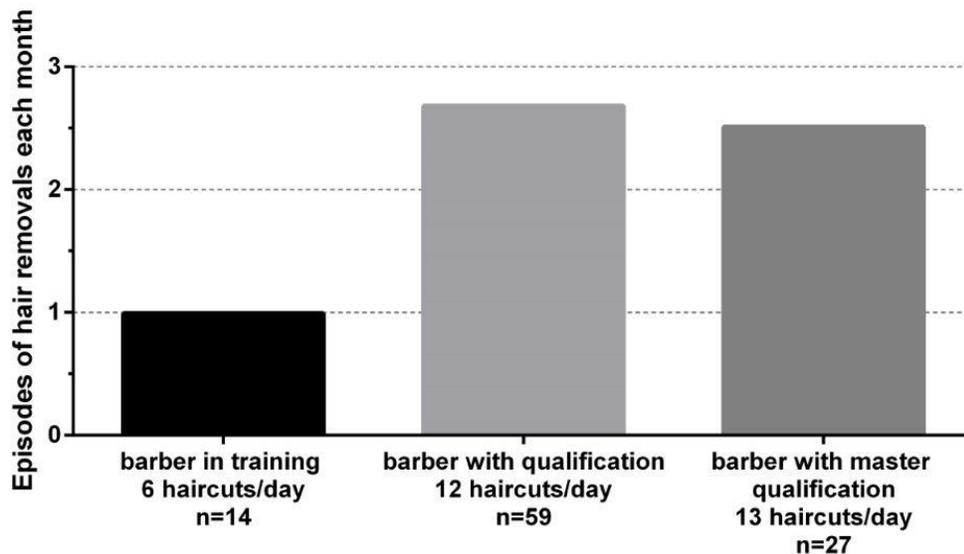


Figure 2. Episodes of hair removal

On average, male barbers gave 14 haircuts a day and female barbers gave 11. Male barbers cut men's hair 82% of the time, while female barbers cut men's hair 47% of the time. Eighty-five percent of male barbers (11/13) and 93% of female barbers (81/87) had penetrating hairs.

### Details of penetration sites

In total, 91% of all barbers experienced penetration of allogenic hair into their skin. Of the 87 female barbers and 13 male barbers together, 88% had penetrating hairs in the skin of the hands. Second most

common was penetrating hairs in the feet. The face was only affected in three barbers. A breakdown of all locations is shown in Figure 3.

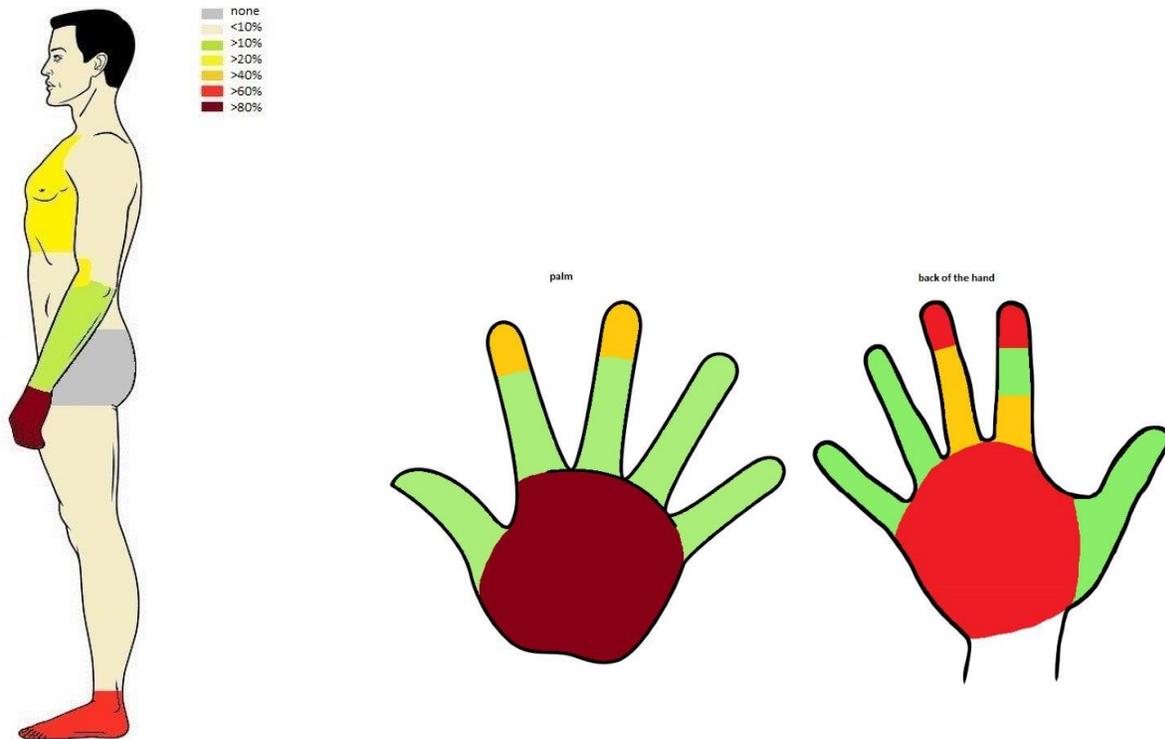


Figure 3. Sites of hair penetration Figure 4. Palmar and a dorsal view of the hand showing sites of hair penetration.

Palmar penetration was the most common form, occurring in 15% to 20% of all barbers interviewed as shown in Figure 4. The dorsum of the hand and the tips of the index and middle fingers of the non-dominant hand were affected in 10% to 15% of all barbers (the hair is run between those fingers before cutting).

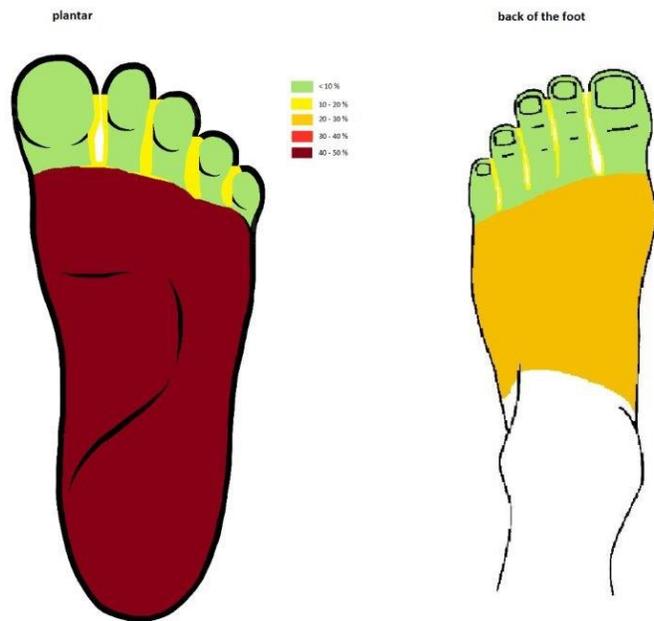


Figure 5. Plantar and a dorsal view of the foot showing sites of hair penetration

The second most frequently affected part of the body was the foot (Figure 5). Interestingly, sole (plantar) penetration was the most common, occurring in 41% of barbers, followed by hair fragments piercing the dorsum of the feet (22%). Interdigital penetration was seen in 12%. Digital involvement exceeding the interdigital penetration (the toe itself) was quite uncommon, with less than 10% of barbers affected.

The third most involved region was the anterior upper chest, including the inframammary crease and submammary fold. Umbilical involvement was seen six times. Genital (1), facial (4), and neck (2) involvement was rare.

#### Hair removal

Although 92% of barbers changed clothing after work, and 89% took a shower, removal of individual hairs one by one had to be done once a week in 29 barbers and multiple times a week in 40 barbers. Twenty-three barbers (23%) needed to remove hairs every day. This was mostly done using a forceps (89%) or fingers (11%) as illustrated in Figure 6.

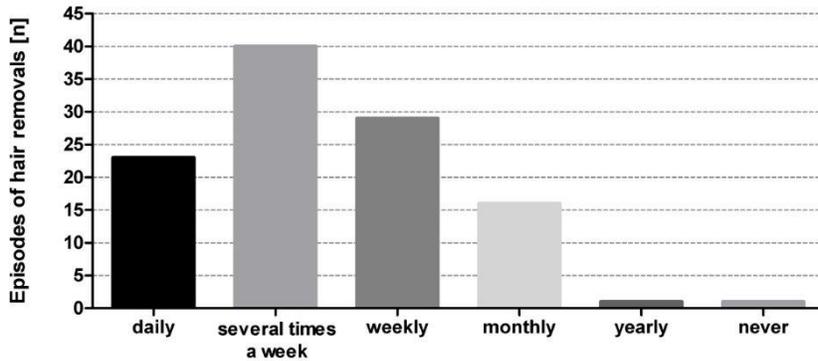


Figure 6. Episodes of hair removal

Barbers used a razor for self-epilation at the axilla (89/100), arms (13/100), legs (77/100) and genital area (85/100). Penetrating hair was found in 23% of shaved arms (n=3) and 37% of non-shaved arms (n=28), as well as in 12% of legs with razor epilation (n=9) and zero without. In barbers who shaved their axilla, 1/89 had hair penetration (zero without), while no inserted hairs were present in 85 barbers with shaved genitalia (1/15 without shaving). Thus, razor epilation does not seem to correlate in our study with a higher rate of penetration.

Sick leave

Although the barbers had a combined total of 1,740 work years, only four had ever sought medical attention for penetration by cut hairs, and three of those had taken sick leave. This amounts to less than one period of sick leave per 500 years of work. Twelve of the 100 barbers reported having a relative with pilonidal sinus disease but none had pilonidal sinus disease themselves.

The presence or absence of animals in the household, smoking, and the body mass index of the barber did not show any correlation with the rate of penetration. Participation in sports showed a negative correlation, however (Sports and consecutive showers more often equals less hair injections; Table 1).

Sports per week	Subjects with penetrating hair [n]	All [n]	%
0	48	49	98
1-2	31	33	94
3-4	11	14	79
>4	2	4	50

Table 1: Sports activities and rate of penetrating episodes.

Results of literature search

Our search of PubMed produced 34 results for [barber\* [All Fields] AND Pilonidal\* [All Fields]], 433 for [barber\* AND hand\*], 4,468 for [barber\* AND disease\*], and 12 for [barber\* AND hair\* AND penetrat\*].

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In all, we found 6,954 articles for consideration, 5,160 of which were screened after exclusion of duplicates. We excluded 4,191 articles focusing on presacral pilonidal disease, penetrating trauma, or other diseases not due to hair penetration, leaving 249 eligible to be followed up. Eighteen articles covering hair injections in other occupations were also excluded. The remaining 231 studies published between 1833 and 2017 covered a total of 894 patients, with case series including between 1 and 134 patients (average 4). A PRISMA flow chart (Preferred Reporting Items for Systematic reviews and Meta-Analysis) [15] describing the selection of literature sources is illustrated in Figure 7.

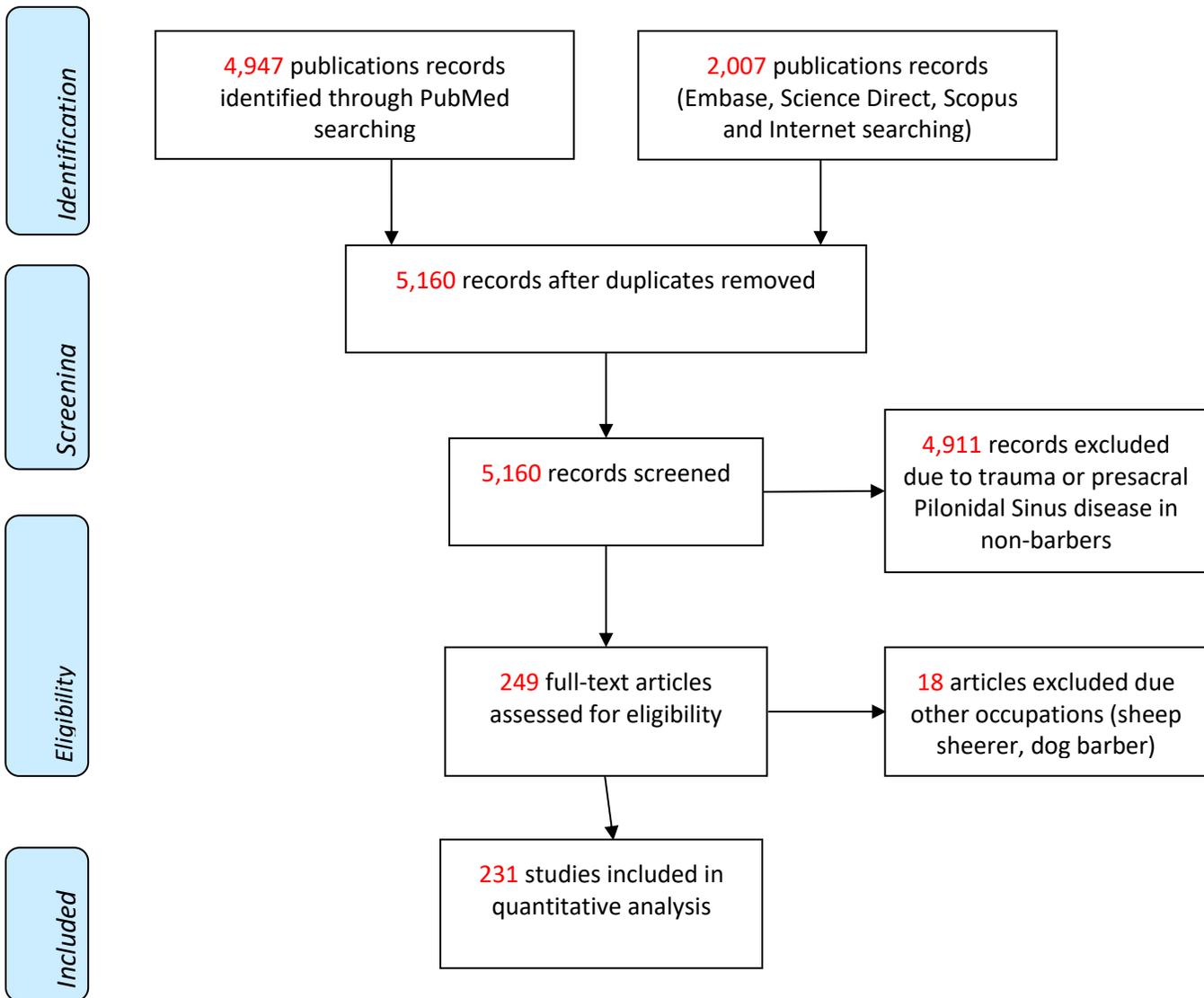


Figure 7. PRISMA flow chart

In our review of the remaining 231 studies we found 894 patients with extrasacral pilonidal sinus disease. The regional distribution of atypical pilonidal sinus is shown in Table 2. Whereas the world literature reports 894 patients with penetrating hairs between 1833 and 2018, our study alone reported 242 penetration episodes in 100 barbers, suggesting that atypical penetrations are gravely underreported.

region	Literature		Our findings	
	sum [n]	%	sum [n]	%
head and neck	10	<b>1</b>	1	<b>0</b>
face	16	<b>2</b>	4	<b>2</b>
scalp	16	<b>2</b>	0	<b>0</b>
arm	0	<b>0</b>	35	<b>14</b>
hand	88	<b>10</b>	83	<b>34</b>
back	2	<b>0</b>	0	<b>0</b>
chest	10	<b>1</b>	28	<b>12</b>
intermammary	16	<b>2</b>	2	<b>1</b>
submammary	0	<b>0</b>	2	<b>1</b>
axilla	54	<b>6</b>	1	<b>0</b>
abdomen	10	<b>1</b>	7	<b>3</b>
umbilical	526	<b>59</b>	8	<b>3</b>
inguinal	9	<b>1</b>	1	<b>0</b>
genital	75	<b>8</b>	0	<b>0</b>
perianal and anal	47	<b>5</b>	1	<b>0</b>
gluteal	2	<b>0</b>	0	<b>0</b>
leg and thigh	3	<b>0</b>	9	<b>4</b>
foot	10	<b>1</b>	60	<b>25</b>
total	894	<b>100</b>	242	<b>100</b>

Table 2: Number and percentage of penetrating hairs and body region involved, shown for the literature (left) and for our study (right)

## DISCUSSION

Our investigation found that 91/100 hairdressers interviewed in northern Germany experienced penetration of their skin by client hair. Daily showering and changing of clothing did not offer sufficient protection, so hairs had to be removed mechanically at regular intervals to avoid conversion into persistent and purulent disease of the skin (Figures 8a and 8b).



Figure 8a. Forearm hair penetration



Figure 8b. Abdominal hair penetration

Not only fingertips and palms but also feet, the anterior chest and elbow grooves are at risk of penetration by client hairs. Thus whereas the term “barber’s hand” correctly describes penetration of the hand by sharp hair fragments (Figures 9a and 9b), it ignores the wider range of the disease, which affects the anterior and plantar parts of the body as well.



Figures 9a and 9b. Finger hair penetration

In 1880 Hodges proposed three elements as characteristic of pilonidal sinus disease: the presence of a congenital opening, an adult male, and insufficient cleanliness [1] (Figure 10). However, the group of 100 barbers we studied included 87 women of all ages. Professionally, barbers wash their hands more than ten times a day; 87/100 reported taking showers one or more times a day, and 92/100 change clothing on a daily basis. Thus lack of cleanliness as a characteristic of pilonidal disease can be rejected outright for practicing barbers.

to which, for the sake of designation, I venture to give the name of pilo-nidal (*pilus*, a hair, *nidus*, a nest) sinus, the following elements are necessary: —

- (1.) The presence of a congenital coccygeal dimple.
- (2.) Abundant pilous development; hence, adult age, and almost of necessity the male sex.
- (3.) Insufficient attention to cleanliness; consequently its subjects, as a rule, must be persons of the lower class, and the affection one met with in hospital, or dispensary, rather than private practice.



Figure 10. Excerpt from Hodges' publication.

Penetration of foreign hairs can occur during working hours, but also afterwards through small hair fragments still present on the skin or in the clothes. Interestingly, participation in sports was negatively associated with hair penetration in our population of barbers, which is astonishing, as it was thought that wetness might damage the integrity or resistance of the skin. Sports participation is associated with more frequent showering, however, and a substantial proportion of fragments at the skin surface can be removed successfully through sweating plus showering. This was reflected in the smaller number of penetrating hairs seen in the group doing sports most often.

In sacral pilonidal sinus disease, regular bathing has been shown to be a protective factor [18-20]. This may be due less to the reduction of the sebaceous content and the increase of water-retaining capacity of the stratum corneum [21] than to the amount of cut hair removed. Taking a shower following every hair cut could be considered by clients as a preventive measure. This is especially true in patients already diagnosed with pilonidal disease, which may be more prone to recurrence.

#### Progression to disease

In the pilonidal disease seen in barbers there is no folliculitis at first, but folliculitis-like lesions can be seen following hair penetration (Figure 11), so the folliculitis theory – suggesting that sebaceous plugs lead to pilonidal intrusion – seems highly unlikely [22,23]. According to the plug/folliculitis theory, finding a full-length hair with a root within the sinus nest would be most likely, but this is the exception rather than the rule [11,24]. It is not yet clear whether hair pierces the skin preferentially with the root end first, using hair surface scale effects to be driven deeper. Recent scanning electron microscopy studies by Gosselink and co-workers have shown this effect in detail [25-27].



Figure 11. Folliculitis-like lesions.

What does pilonidal sinus of the anterior body surface have in common with intergluteal pilonidal sinus? Both originate through hair fragments from the head. While in intergluteal sinus the hair is autologous, in barbers' anterior disease this hair is allogenic. Analyzing 949 pilonidal sinus patients treated between 2006 and 2011, Ciftci and Abdurrahman found that 2.2% had extrasacral pilonidal sinus disease [28]. In our study with 100 barbers we did not see any sacral pilonidal disease. Thus extrasacral and sacral pilonidal disease are two separate entities occurring strictly at either the front or posterior side of the body.

#### Preventive measures

Our study has shown that the entire anterior surface of the barber's body is at risk. Penetration by client hairs in the face and neck, although infrequent, has been reported. Given the number of barbers affected, the question is not whether preventive measures need to be taken, but how far they should go, and how they could be enforced into daily practice. Prevention at the workplace is worth considering, and there may be a big market for protective clothing designed to keep out the hairs.

A second consideration is the fact that wet hair exhibits 30% less strength than dry hair, and wet skin is weaker as well [12]. If wet haircuts are found to result in reduced hair fragment generation, dry haircuts could be limited or completely avoided. This would have to be balanced against increased exposure of barbers' hands to moisture and its effect on their skin.

Education about hair removal and skin care seems to be passed on through communication with peers, with women being more communicative than men. As the overwhelming majority of barbers in our study were female, there should be few barriers to the exchange of health information.

Interesting questions remain, such as why some barbers experience daily penetration and others don't. Also to be clarified is whether shaving the legs with a razor is an independent risk factor [30] or enables

the penetration of allogenic hair into microtraumatized skin. Doing sports often – and showering often – seems to have a protective effect in barbers, which could be evaluated in the future.

### Limitations

Limitations of this study include the small sample size of 100 interviewees and the non-randomized selection of the participants. The cohort represents a northern German barber population with female predominance, so data may not be applicable to Mediterranean or other populations outside Northern Europe. While barbers are exposed to the cut hair fragments of their customers, we did not characterize the hair the barbers were exposed to. The customers were predominantly northern Germans with associated hair properties, although 10-12% of customers in this region have a migration background [24]. In addition to hair factors of the customers already discussed, skin factors of the barbers (softness, elasticity, ease of penetration) were not tested.

Some numeric precision may be lacking, as most of the information regarding number of haircuts and frequency of hair removal was reported by the barbers themselves based on memory, and was not measured by us. However, these limitations are not expected to call into question the overall study findings – that hair penetration is overwhelmingly present and that everyday measures are taken by every barber to dispose of the myriad loose hairs, and to remove the few fragments already penetrating the skin.

We did not investigate skin factors which may enable hair penetration. Nevertheless, with such a large percentage of barbers affected, interindividual differences may be minor. Due to the small sample size, an effect of BMI was not detectable. This may be different with larger cohorts, and may be an interesting topic to pursue, as the incidence of sacral pilonidal sinus is rising [29]. Whether there is a trend in extrasacral hair penetration is unknown.

In conclusion, we found that “barber’s hand” is the most common disease affecting barbers, with razor-sharp hair fragments able to penetrate the anterior skin from head to toe. Given the number of people working as barbers, development of preventive measures could contribute to improved quality of life for many workers. Based on our findings, we propose the use of the term “barbers’ anterior disease”. Furthermore, gross anterior hair exposure is not linked to a posterior hair injection or pilonidal disease.

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### **MULTIMEDIA**

N/A

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