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Does the use of the dominant hand affect the direction of sinus extension to orient towards the right and left in pilonidal disease?

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ABSTRACT

Objectives: The etiology of pilonidal sinus disease is still controversial. Acquired theory in its etiology has become more popular nowadays. The aim of this study was to investigate the effects of dominant hand use on sinus features and sinus direction.

Methods: Eight hundred and sixty-five patients with diagnosis of primer pilonidal sinus disease were included. Data on patients' ages, BMI, over-sitting histories, duration of disease, dominant hand use histories, the condition of their sinuses at the time of presentation, the number of sinus openings, sinus directions, and sinus extension directions were collected. Relationship was evaluated between dominant hand use and sinus direction or sinus extension direction.

Results: There was no statistically significant difference between the patients' ages, sexes, BMI figures, the durations of disease and over- sitting history and dominant hand use. While the sinus directions of patients who had shorter duration of disease were towards the midline, it was seen that as the duration of disease increased the sinus extensions were oriented any side ($p = 0.01$). There was, however, a significant relationship between the sinus extension direction and dominant hand use. It was observed that the sinus extension direction of the patients who dominantly used their right hands was towards the left, while the sinus extension direction of the patients with dominant left hands was towards the right ($p = 0.04$, RR:2.05).

Conclusions: The fact that sinus extension directions can change against factors affecting body positions proves to be another factor which shows that pilonidal sinus disease is an acquired disease.

Keywords: Dominant hand, acquired theory, pilonidal disease, sinus direction

Pilonidal sinus disease (PSD), a chronic inflammation affecting the skin on the intergluteal cleft and the posterior of the anus, is one of the most common diseases in surgical practice. It had been previously suggested that the disease was congenital as it led to the entrapment of hair follicles in the sacrococcygeal area due to fusion failure on the dorsal midline. However, recent studies have been strongly supporting an acquired etiology [1]. According to Bascom, hair follicles in the gluteal cleft get infected by keratin leading to local infection and abscess formation, and their local suction force causes the hair to enter the infected pit and settle in the abscess cavity [2]. On the other hand, Karydakis [3] argues that it brings the disease

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about by loose hair penetrating the normal tissue which leads to foreign body reaction followed by additional hair inserting into the subcutaneous tissue from the secondary openings.

It has published an ample number of studies on the factors that played a role in its etiology as it is regarded to be an acquired disease today. The results of these studies have revealed many cofactors including body weight, sweating, repeated exposure to trauma (e.g., truck drivers, over-sitting history), body hygiene, hair type, and right sacrococcygeal angle might have contributed to this disease [4, 5]. However, over-sitting history is the most important cofactor among its because of loose hair penetrating the normal tissue and repeated exposure to trauma [6-8]. Although many studies have been conducted to find out the factors that caused PSD, there has been no study in literature to determine the factors affecting sinus features.

Individuals use their right or left hands according to the dominant side in their brains. We have thought that the gluteal area is prone to positioning according to the surface on which one sits based on the dominant hand, especially in individuals who carry out desk jobs by sitting as clinical observation. Moreover, we observed that sinus abscess openings are more frequently on the left side of gluteal area in the crystallized phenol treatments we have been applying for about 20 years. Therefore, we hypothesized that it can be suggested that individuals tilt their gluteal areas towards the dominant hand side causing the abscess to incline towards that direction because the pressure on the other side is lower. The aim of this study was to investigate the effects of dominant hand use on sinus direction and sinus extension direction, thereby, to contribute to the acquired theory.

METHODS

The study was conducted in accordance with the Declaration of Helsinki of the World Medical Association. Ethics committee approval numbered 2018/015 was obtained by the Ethic Committee of Karatay University. It made an informed consent form to all patients before procedure. The data of 1,089 patients, who had presented to Konya Training and Research Hospital's General Surgery Clinic because of PSD between January 2005 and February 2015, were prospectively collected, and retrospectively analyzed. A total of 224 patients were excluded from the study including 160 postoperative recurrence patients and 64 patients whose data on dominant hand use were available but data on sinus direction were unavailable. Eight hundred and sixty-five (79.4%) patients were included in the study. Data on patients' ages, body mass index (BMI, kg/m^2), working or travel with prolonged sitting histories (over-sitting histories), duration of disease, dominant hand use histories, the condition of their sinuses at the time of presentation, the number of sinus openings, sinus directions, and sinus extension directions were collected.

Demographic Features of the Patients

Body mass index of the patients were calculated as kg/m^2. The patients were classified according to whether they had an over-sitting history in daily life because of their professions. Sitting anamneses of those who spent at least 6 hours of their working or travelling sitting because of their professions were regarded to be positive. Duration of the disease (month) was calculated as the time from the first onset of the disease to the presentation time. The patients' hands that they used to write were regarded to be their dominant hands.

Sinus Features

The sinus features of the patients at the time of presentation were evaluated according to be chronic PSD or acute PSD with abscess. If patients had sinus openings supporting abscess like drained abscess opening and exerting purulent fluid in the sacrococcygeal area at the time of presentation, their cases were regarded to be pilonidal sinus with acute abscess. The patients' number of primary openings and secondary openings were recorded individually. Moreover, primary and secondary opening directions were classified into 4 groups as cephalad, caudal, sacral, and multiple. Sinus extension directions were classified according to the extension direction of the sinus as right, left, and the midline when the patients were laid down in the prone position (Table 1). However, since we aimed to examine the sinus extension direction in our study, midline direction was neglected in the analyzes.

Statistical Analysis

Mean, standard deviation, the lowest and the high-

Table 1. The classification of sinus directions and sinus extension directions

Sinus directions	
Cephalad	Upward sinus extension
Caudal	Downward sinus extension
Sacral	Sinus deepening towards the sacrum not towards the cephalad or the caudal
Multiple	Cases in which the sinus incorporates more than one of the above-mentioned localizations
Sinus extension directions	
Right	Sinus extension extending towards the right lateral to midline or secondary openings located on the right lateral to midline
Left	Sinus extension extending towards the left lateral to midline or secondary openings located on the left side
Midline	Sinus extension or secondary openings on the midline like pores in the natal cleft

est values, median, frequency, and ratio figures were used in the descriptive statistical analyses of the collected data. The distribution of the variables was measured with the Kolmogorov-Smirnov test. The Mann-Whitney U test was used for the analyses of quantitative independent data. Chi-square Test was used for the analyses of qualitative independent data, while Fischer's Exact Test was conducted when the conditions of the Chi-square Test were not met. Relative risk (RR) and Confidence Interval (CI) was calculated for risk ratio of dominant hand use. SPSS 22.0 software was used in the analyses.

RESULTS

The mean age of the patients was 26 ± 8.2 (12-67) years. Seven hundred and forty-one of the patients were males (85.7%). The mean BMI was 26.3± 3.9 (13.9-44.3). The median duration of disease was 12 (0-240) months. Five hundred and six (58.5%) patients had over-sitting anamneses. Eight hundred and twelve (93.8%) of the patients covered by the study were right-hand dominant, while 53 (6.2%) were left-hand dominant.

There was no statistically significant difference

Table 2. Distribution of demographic data according to dominant hand use of patients

	Right Hand		**Left Hand**		***p value***
	Mean ± SD/ N-%	**Median**	**Mean ± SD/ N-%**	**Median**	
Age	26.1 ± 8.3	25.0	24.2 ± 7.3	22.0	0.057[m]
Sex					
Male	696 (85.7%)		45 (84.9%)		0.871[X²]
Female	116 (14.3%)		8 (15.1%)		
Height (cm)	174.1 ± 8.0	175.0	175.2 ± 8.3	174.0	0.611[m]
Weight (kg)	80.0 ± 14.1	80.0	80.2 ± 15.9	78.0	0.646[m]
BMI	26.3 ± 3.9	26.0	26.0 ± 4.0	25.2	0.282[m]
Duration of disease complaint (Month)	21.3 ± 32.5	12.0	21.9 ± 33.3	12.0	0.658[m]
Over-sitting History					
None	342 (42.1%)		17 (32.1%)		0.151[x²]
Yes	470 (57.,9%)		36 (67.9%)		
Total	812 (100.0%)		53 (100.0%)		

[m] Mann-whitney u test / [X²] Chi-square Test

between the patients' ages, sexes, BMI figures, the durations of disease complaint, over-sitting history, and dominant hand use (Table 2). Physical examination at the time of first presentation revealed that 757 (87.5%) of the patients had chronic, while 108 (12.5%) had acute PSD.

It showed the sinus extensions and sinus directions extensions in Table 3. The sinus directions extended towards the right side in 139 (16.1%) patients, towards the left side in 198 (22.9%) patients, and towards the midline in 528 (61.0%) patients (Table 3).When the sinus extension direction was grouped as midline and other extension directions (left and right direction), the average duration of disease was 15.63 ± 32.85 in the midline group, 23.96 ± 32.01 months in the other directions group, and duration of disease was significantly shorter in the midline group than the other directions ($p = 0.001$).

It is shown that evaluation of sinus characteristics according to dominant hand use in Table 3. We found no statistically significant difference in the number of primary openings and the number of secondary openings according to dominant hand use ($p = 0.304$ and p = 0.507, respectively). We found no relationship between acute presentation and dominant hand use either ($p = 0.488$). There was no relationship between sinus directions and dominant hand use as well ($p = 0.628$).

There was, however, a significant relationship between the sinus extension direction and dominant hand use. It was observed that the sinus extension direction of the patients who dominantly used their right hands was towards the left, while the sinus extension direction of the patients with dominant left hands was towards the right ($p = 0.04$, relative risk is 2.05 [%95 CI 0.97-4.30] (Table 3).

DISCUSSION

Congenital and acquired theories have been still argued in the pathogenesis of PSD [9-11]. During the period beginning with the description of PSD until the last quarter of the 20th century, the idea that the congenital theory played a role in its etiology was dominant. However, it has been recently suggested that PSD is an acquired disease rather than a congenital one. This idea has been supported by various observations like it was formed in different areas of the body with skin folding such as the axilla, umbilicus, the penis and fingers of barbers; it was also seen in adults, and the recurrence seen in the related tissue despite total excision [12-14]. In this study, we aimed to evaluate a hypothesis that we observed based on our clinical experience which we believe will contribute to the

Table 3. Evaluation of sinus characteristics according to dominant hand use

	Right Hand		Left Hand		*p value*
	Mean±SD/ N-%	Median	Mean±SD/ N-%	Median	
Number of primer opening	2.1 ± 1.6	2.0	2.3 ± 1.6	2.0	0.304[m]
Number of seconder opening	0.5 ± 0.7	0.0	0.5 ± 0.8	0.0	0.507[m]
Sinus presentation					
Chronic	709 (87.3%)		48 (90.6%)		0.488[x²]
Acute	103 (12.7%)		5 (9.4%)		
Sinus Direction					
Cephalad	687 (93.9%)		45 (6.1%)		
Caudal	47 (96.0%)		2 (4.0%)		0.628[x²]
Sacral	35 (89.7%)		4 (10.3%)		
Multipl	42 (95.5%)		2 (4.5%)		
Direction of sinus extention					
Right	127 (91.4%)		12 (8.6%)		**0.040**[x²]
Left	193 (97.5%)		5 (2.5%)		

[m] Mann-whitney u test / [X²] Chi-Square test

acquired theory with a unique perspective.

According to acquired theory, it is known that however a lot of factors affecting etiology (local trauma, obesity, family history, and over-sitting history etc.) the major cause of the disease was the penetration of loose hair in both theories [15-17]. Loose hairs get chronic inflammation to enter the vulnerable skin because of recurrent trauma [18]. The sinus formed is in the midline in the first stage. However, sinus moves forward because of reasons we do not know. Although PSD is frequently seen in cephalad direction after formation, it may be caudal, sacral, and rarely in multiple directions in some patients. Also, sinus extension direction is towards the right or left gluteal region after recurrent abscess attacks. To date, it has connected no studies on the factors affecting sinus extension direction in the literature. This is the first study that performed on risk factors affecting sinus extension direction.

Undoubtedly, one of the most important factors accused in the etiology of PSD is over-sitting [6, 7, 19]. Bolandparvaz *et al*. [6] reported that the risk of PSD development increased in individuals who sat daily for 4 or more hours on average. Moreover, many studies have demonstrated the relationship between profession and the PSD disease [7, 20]. Kaymakcioglu *et al*. [7] in their study investigating the relationship between PSD and profession found that it was most seen in office staff (24.4%). The reason for this is the fact that over-sitting leads to trauma in the sacrococcygeal area.

We saw in our clinical observations that especially right-handed patients' sinus openings extended towards the left gluteal area. So, we developed a hypothesis like this: During sitting for a long time, especially writing, we are positioned on the gluteal region toward the dominant hand used. This situation leads to an increase in pressure in the gluteal area on that side while bringing about a decrease in pressure on the opposite side. According to the acquired theory, the increase in pressure causes the loose hair in the sacrococcygeal area to penetrate the skin [3, 21]. We believe that this is caused because the sinus abscess orients towards the opposite side where there is less pressure, and the sinus tract moves along that side since the pressure increases in the gluteal area on the dominant hand side during writing in office staff and students. Nevertheless, this situation is not only related to over-sitting because of one's profession because individuals lean towards the side of their dominant hands in their daily activities when sitting.

The results of our study revealed that the SPD initially developed on the midline in lots of patients (61%) but as the duration of disease complaint got longer sinus extension oriented towards the right or the left according to the dominant hand. The duration of disease of patients who sinus extension direction is midline was significantly shorter than patients with any sinus extension direction ($p = 0.01$). Therefore, we excluded patients who have midline sinus extension direction to analyze whether dominant hand use is a risk marker that affects the sinus extension direction in our study. The direction of sinus extension has already been more towards the left side because of the dominance of the right hand is widespread (Table 3). Also, we have revealed that the fact that patients with dominant hands had sinus extensions towards the opposite side was statistically significant ($p = 0.04$, RR= 2.05). In our study we have contributed to the acquired theory by explaining that the SP disease was an acquired disease and acquired factors changed the development of the disease.

CONCLUSION

Consequently, the fact that sinus extension dimensions can change against factors affecting body positions proves to be another factor which demonstrates that PSD is an acquired disease.

Authors' Contribution

Study Conception: SK, OD; Study Design: SK; Supervision: OD, RSK; Funding: SK, ET; Materials: SK, ET, RSK; Data Collection and/or Processing: SK, OD, ET; Statistical Analysis and/or Data Interpretation: OD, RSK; Literature Review: SK, OD; Manuscript Preparation: SK and Critical Review: OD, ET.

Conflict of interest

The authors disclosed no conflict of interest during the preparation or publication of this manuscript.

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