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ORIGINAL ARTICLE

Torus palatinus in end-stage renal disease patients receiving peritoneal dialysis: Does renal osteodystrophy play a role?

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KEYWORDS

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torus palatinus

Abstract *Background:* Our aim was to investigate the prevalence, size, locations, and shapes of torus palatinus (TP) in end-stage renal disease (ESRD) patients receiving peritoneal dialysis (PD) in order to analyze the relationship between the TP size and duration of PD.

Materials and methods: During 2007, 91 ESRD patients receiving PD were studied using dental examinations at our outpatient clinic.

Results: The prevalence of TP was 41.7% ($n = 38$). Most cases of TP were < 2 cm in size (81.6%) and spindle-shaped (78.9%). The duration of PD was statistically higher in patients with TP size > 2 cm (6.8 ± 3.6 years) than patients with TP size of < 2 cm (3.5 ± 2.6 years).

Conclusions: The higher prevalence of TP and different TP shape (spindle) in comparison with our previous study and the significant relationship between duration of PD and TP size might be due to an underlying disorder, such as renal osteodystrophy.

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Introduction

Torus palatinus (TP) is an exostosis of the hard palate that is localized along the median palatine suture and involves both the processi palatini and os palatinum. TP contains compact and cancellous bone and is formed by hypertrophy

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of the spongy and oral compact layers, while the nasal compact layer remains unchanged.¹ TP is asymptomatic, grows slowly during the second and third decades of life, and often goes unnoticed until middle age.^{2,3} Although a lot of research has tried to clarify the influence of genetic, environmental, nutritional, and climatologic factors, there is still no consensus regarding the etiology of TP.^{1,2,4,5} TP occurs in about 20% of the population. However, some studies have reported marked differences between racial groups.¹ Its prevalence has been reported to be 4.1–30.9% of the Turkish population.^{6–8} It has also been reported that females demonstrate a higher prevalence of TP.^{2,3,6,9,10}

Chronic renal failure is associated with a decrease in the glomerular filtration rate. It is a progressive disease characterized by the increasing inability of the kidneys to function, ultimately causing end-stage renal disease (ESRD). Abnormal calcium (Ca), phosphorus (P), and vitamin D metabolism are very common in patients with ESRD.^{11–13} Metabolic disturbances in these patients result in the prolonged stimulation of the parathyroid glands. This results in the increased synthesis and release of parathyroid hormone (PTH); therefore, it causes parathyroid hyperplasia/secondary hyperparathyroidism (SHPT). SHPT causes the skeletal disturbances that are characteristic of renal osteodystrophy (RO).^{13–17}

In the present study, our aim was to investigate the prevalence, size, locations, and shapes of TP in ESRD patients undergoing peritoneal dialysis (PD) and analyze the relationship between the TP size and duration of PD. According to a search of the medical literature, this is the first study to evaluate TP in ESRD patients.

Materials and methods

In 2007, 91 ESRD patients with PD were received dental examinations at the Department of Dentomaxillofacial Radiology, Faculty of Dentistry, Erciyes University (Kayseri, Turkey). All of these patients were examined by the senior author (Y.S.) to determine the presence of TP. The examination for TP consisted of clinical inspection and palpation, which were performed by the same author. Patients who had questionable TP status were not included in this study. For diagnosis, TP was defined as a raised bony exostosis along the midline of the hard palate. The maximum elevation of the outgrowth of TP, which is usually consistent with the width and length of TP,¹⁸ was used to measure the size of TP. TP was graded according to a previous description⁸ as being > 2 cm or < 2 cm using a periodontal probe, as described by Gorsky et al.¹⁹ The shape of TP was classified as flat, spindle, nodular, or lobular according to the criteria described by Jainkittivong et al.⁹ The TP locations were classified as being in the incisor, incisor-premolar, premolar-molar, molar, or incisor-premolar-molar regions. The duration of PD was noted for each patient.

Statistical analyses

The observed results were analyzed using SPSS 15.0 (SPSS, Chicago, IL, USA). The Chi-square test and *t* test

were used to analyze group differences. *P* values < 0.05 were considered statistically significant.

Results

Ninety-one ESRD patients receiving PD were enrolled in the present study. This study enrolled 43 females and 48 males with a mean age of 45.9 ± 13.1 years (range: 19–81 years). No significant difference in terms of the mean age between females (44.3 ± 14.4 years) and males (47.3 ± 11.8 years) was detected (*P* = 0.278).

Table 1 presents the distribution of TP in relation to the genders of these patients. Of the 91 patients with ESRD, 38 (41.7%) were found to have TP. The 38 individuals with TP included 21 females and 17 males, demonstrating a female-to-male ratio of 1.4:1 for TP. The prevalence of TP was not significantly higher in female patients (48.8%) compared with the male patients (35.4%) (*P* = 0.195).

The distribution of TP size according to gender, age, and duration of PD is shown in Table 2. Of the 38 TP cases, most (81.6%) were < 2 cm in size. No significant difference in terms of the mean age was found between patients with a TP size > 2 cm (45.6 ± 13.3 years) and those with a TP size < 2 cm (43.6 ± 13.6 years) (*P* = 0.731). The duration of PD was statistically higher in patients with a TP size > 2 cm (6.8 ± 3.6 years) than those with a TP size < 2 cm (3.5 ± 2.6 years) (*P* = 0.009) (Fig. 1).

Table 3 shows the TP locations along the hard palate of these 38 patients. The most common site where TP was found was the premolar-molar region (44.7%), followed by the premolar (26.3%) and incisor-premolar regions (21.1%). A less common location was the incisor-premolar-molar region (7.9%).

Table 4 shows the distribution of TP according to shape and in relation to gender. The most common TP shape was spindle (78.9%). A less common TP shape was flat (21.1%). However, none of these cases of TP were classified as nodular or lobular.

Discussion

TP is a bony prominence that occurs along the middle third of the midline of the hard palate. It forms different shapes, including flat, spindle, nodular, and lobular.^{1,9,20} This oral exostosis is not a disease or a sign of disease. However, if TP is large, it may be problematic for the construction or wearing of dentures.²⁰ Although, TP is not pathologically significant, surgical removal is required if it causes chronic trauma or interferes with oral function or the replacement of a denture base or framework.^{18,20} Although several

Table 1 Prevalence of TP in relation to gender in patients with ESRD.

	Women	Men	<i>P</i>
Total	43	48	
TP	21	17	
(%)	(48.8)	(35.4)	0.195

Table 2 Distribution of TP in relation to size, gender, age, and duration of PD.

TP size	Women (n = 21)	Men (n = 17)	Total (n = 38)	Age (y)	Duration of PD (y)
< 2 cm	16	15	31	45.6 ± 13.3	3.5 ± 2.6
(%)	(76.2)	(88.2)	(81.6)		
> 2 cm	5	2	7	43.7 ± 13.0	6.8 ± 3.6
(%)	(23.8)	(11.8)	(18.4)		
P				0.731	0.009

studies have tried to clarify the influence of various genetic, environmental, nutritional, and climatologic factors, the exact etiology of TP is still unknown.^{2,4,5,21} Abnormal Ca, P, and vitamin D metabolism are very common in patients with ESRD.^{11–13} Metabolic disturbances in these patients cause the prolonged stimulation of the parathyroid glands. This results in the increased synthesis and release of PTH; therefore, it causes parathyroid hyperplasia-SHPT. SHPT develops as a result of hypocalcemia, hyperphosphatemia, and reduced 1,25-dihydroxyvitamin D₃ (vitamin D) production. SHPT also causes the skeletal disturbances that characterize RO.^{12–17} RO is classified as osteitis fibrosa, osteomalacia, or mixed, mild, or adynamic disease.¹³

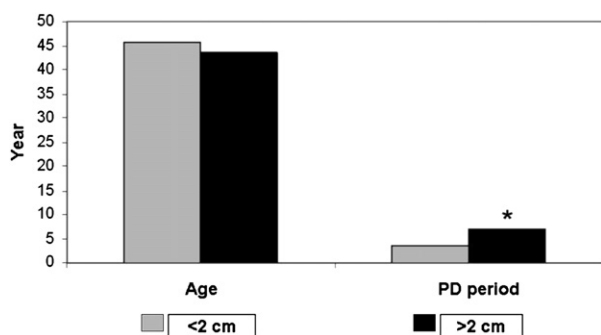
TP occurs in about 20% of the population, although different studies have reported marked differences between various ethnic groups.^{2,7,8,10,22–24} However, to the best of our knowledge, no study is available in the literature that investigated the prevalence of TP in patients with ESRD. In a Turkish study,⁸ the prevalence of TP was 30.9% among 1943 school children (range: 5–15 years old). Cagiran-kaya et al⁷ pointed out that the prevalence of TP was 20.9% among 253 consecutive patients (range: 17–49 years old). In another study, Sisman et al⁶ investigated 2660 Turkish patients (range: 13–85 years old) who were admitted to a dental clinic for routine examinations and reported the prevalence of TP in the Cappadocia region to be 4.1%.⁶ In the present report, the prevalence was 41.7% among 91 patients with ESRD in the same region. The marked difference between the prevalences reported in these two studies might be due to an underlying disorder, such as RO, and not the small sample size.

These different prevalences between different populations may be due to the different ethnicities that were studied. It has been reported that similar ethnic groups living in different areas^{10,23} and different ethnic groups

living in the same areas^{19,25} demonstrate different prevalences of TP. The formation of TP has been attributed to various factors by different authors. Several investigators evaluated the effects of environmental^{11,21} and genetic factors,^{2,5} including masticatory stress^{4,26} and nutritional factors.¹⁰ The prevalence of TP within the same race has been reported to vary greatly by different authors.^{6–8} These inconsistent results between various studies are possibly due to differences in the number of subjects, different geographic locations, and different diagnostic criteria for TP.

Dietary factors may play a role in the prevalence of tori. Eggen and Natvig²⁷ investigated the influence of nutrients on the etiology of tori. It was suggested that the consumption of saltwater fish in Norway possibly supplies higher levels of polyunsaturated fatty acids and vitamin D, which are involved in bone growth, and this may increase the prevalence of tori. Gorsky et al² investigated the inheritance of TP using segregation analysis. Their results suggest that TP is an autosomal dominant trait. Belsky et al²⁰ reported that the presence and especially the size of TP are correlated with increased bone mineral density. A high bone mass may be associated with genetic mutations. Genetic factors are a probable cause of the low TP prevalence among the general Turkish population. Seafood consumption is not as common in central Anatolia (Cappadocia region) as in other parts of the world that have more abundant water resources. These factors may explain the low TP prevalence (4.1%) among the Turkish population living in the Cappadocia region.⁶

In our study, 91 ESRD patients receiving PD living in the same region demonstrated a TP prevalence of 41.7%. Abnormal Ca, P, and vitamin D metabolism are very common in patients with ESRD.^{11–13} SHPT and reduced vitamin D production also cause RO.^{12–17} Therefore, instead of reduced vitamin D production, the high prevalence of ESRD patients receiving PD in this region might be due to SHPT (osteitis fibrosa). However, further studies and larger samples are needed to support this hypothesis.

**Figure 1** Age and duration of PD in relation to TP size.**Table 3** TP location according to region in the mouth.

TP (n = 38)	Location				
	I-P region	P region	P-M region	M region	I-P-M region
n	8	10	17	0	3
(%)	(21.1)	(26.3)	(44.7)	(0.0)	(7.9)

I, incisor; P, premolar; M, molar.

Table 4 Distribution of TP shape in relation to gender.

TP shape	Women (n = 21)	Men (n = 17)	Total (n = 38)
Flat (%)	6 (28.6)	2 (11.8)	8 (21.1)
Spindle (%)	15 (71.4)	15 (88.2)	30 (78.9)
Nodular (%)	0 (0.0)	0 (0.0)	0 (0.0)
Lobular (%)	0 (0.0)	0 (0.0)	0 (0.0)

In the study by Sisman et al,⁶ the prevalence of TP was significantly higher among women (5.7%) than men (1.8%) in the general Turkish population living in the Cappadocia region ($P < 0.001$). In the present study, the female-to-male ratio was 1.4:1 for TP in patients with ESRD. In this study, the ratio difference between the normal population and ESRD patients in the same region might be due to an underlying disorder rather than the small sample size. The findings of our study, namely that the prevalence of TP is higher in females than males, is consistent with other studies.^{2,4,6–10,18,22,25,26} There is no certain explanation for this difference, but genetics could be a major factor.

In the study by Sisman et al,⁶ most cases of TP (75.4%) were < 2 cm and were located in the premolar-molar area (66.4%). Yildiz et al⁸ reported that 91.5% of TP cases are < 2 cm and 62% are located in the molar area among 5–15-year-olds. This suggests that the prevalence of TP in the molar and molar-premolar areas tends to increase with age. King and More,²⁸ who studied 400 individuals in the United States and United Kingdom, reported that 67% of TP cases are < 2 cm. In the current study, most cases of TP (81.6%) were < 2 cm, and the majority (44.7%) of these cases were located in the premolar-molar area of ESRD patients receiving PD. These findings are consistent with the study by Sisman et al.⁶ We also investigated the relationship between the duration of PD and TP size. We found that the duration of PD was statistically higher in patients with a TP size > 2 cm (6.8 ± 3.6 years) than patients with a TP size < 2 cm (3.5 ± 2.6 years) ($P = 0.009$). This significant difference might have been due to an underlying disorder, such as RO, in these patients.

Most studies^{24,29,30} agree with the study by Sisman et al⁶ and report that flat TP is the most common type, but the studies by Reichart et al⁵ and Jaikittivong et al⁹ reported spindle-shaped TPs. However, in the present study, the most common type was spindle-shaped TP (78.9%) in contrast with the study by Sisman et al⁶ that reported flat TP as the most common (62.7%). This difference in TP type between these two studies, which were conducted in the same region, might be due to an underlying disorder such as RO.

In conclusion, the prevalence of TP in ESRD patients undergoing PD was higher (41.7%) compared with other Turkish reports and, most especially, the study by Sisman et al⁶ (4.1%), which was performed in the same region but in the general population. Our results demonstrate a significant relationship between TP size and duration of

PD. Most cases of TP were classified as spindle-shaped (78.9%), < 2 cm in size (81.6%), and located in the premolar-molar region (44.7%). The high prevalence of TP and different TP shape (spindle) compared with the study by Sisman et al⁶ might be due to an underlying disorder, such as RO. Also, the significant relationship between duration of PD and TP size might be due to ESRD. To the best of our knowledge, this is the first study to be conducted that investigated the prevalence of TP among ESRD patients undergoing PD.

Disclosure

The authors have no financial interests related to the materials discussed in this manuscript.

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