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ARAŞTIRMA YAZISI / RESEARCH ARTICLE

ORTA ANADOLU'DA KRONİK RİNOSİNÜZİTİN BİREYSEL ÖZELLİKLER VE ÇEVRESEL FAKTÖRLERLE İLİŞKİSİ

RELATIONSHIP OF CHRONIC RHINOSINUSITIS WITH INDIVIDUAL CHARACTERISTICS AND ENVIRONMENTAL FACTORS IN CENTRAL ANATOLIA

Zeynep ERHUNER TENGİRŞENK[1], Uğur TOPRAK[2], Müge ÖZCAN[3]

[1]Ankara Şehir Hastanesi Radyoloji Kliniği
[2]Eskişehir Osmangazi Üniversitesi Tıp Fakültesi, Radyoloji Anabilim Dalı
[3]Ankara Şehir Hastanesi Kulak Burun Boğaz Hastalıkları Kliniği

ÖZ

AMAÇ: Bu çalışmanın amacı, nazal polipli veya polipsiz kronik rinosinüzit (KRS) nedeni ile paranazal sinüs bilgisayarlı tomografisi (BT) yapılan hastalarda sinonazal hastalıkların prevalansını ve dağılımını araştırmak; KRS ile sinonazal varyasyonlar arasındaki ilişkiyi ve çevresel faktörlerin etkisini araştırmaktır.

GEREÇ VE YÖNTEM: Ankara'da üçüncü basamak sağlık merkezine başvuran 1000 hastanın paranazal sinüs BT görüntüleri ve dosyaları retrospektif olarak incelendi. BT bulguları, sigara içme durumu, allerji varlığı, ikamet yeri (kentsel/kırsal) ve fonksiyonel endoskopik sinüs cerrahisi öyküsü kaydedildi.

BULGULAR: En sık maksiller sinüslerde (%53) olmak üzere, hastaların %68'inde KRS tespit edildi. KRS'li nazal polipler olguların %11'inde kaydedildi. KRS ayrıca sigara içenler arasında daha yaygındı (p<0.001). Nazal poliplerin eşlik ettiği KRS açısından kentsel ve kırsal yerleşimli olanlar arasında fark bulunmadı. Bununla birlikte, nazal polipli KRS olgularının çoğu kentlerde yaşamaktadır (%81.4, p=0.006). Allerji ile nazal polipozis veya polipli KRS arasında; sinonazal varyasyonlar ile KRS gelişimi arasında fark saptanmadı.

SONUÇ: İncelenen bölgede, nazal polipli KRS prevalansı kentsel yerleşimde (hava kirliliği olan) daha yüksek iken, nazal polipsiz KRS bölgesel farklılık göstermemektedir. Sigara içenlerde KRS daha yaygındı ancak, nazal polipozisin eşlik ettiği KRS daha yaygın değildir. KRS, allerjik kişilerde daha yaygın değildir.

ANAHTAR KELİMELER: Kronik sinüzit, Bilgisayarlı tomografi, Epidemiyoloji, Hava kirliliği, Sigara içme, Allerjik rinit

ABSTRACT

OBJECTIVE: The aims of this study were to investigate the prevalence and distribution of sinonasal diseases in patients that underwent paranasal sinus computed tomography (CT) due to chronic rhinosinusitis (CRS) with or without nasal polyps, and to explore the association between CRS and sinonasal variations and the effect of environmental factors.

MATERIAL AND METHODS: The paranasal sinus CT images and files of 1000 patients that referred to a tertiary health center in Ankara were retrospectively evaluated. The CT findings, smoking status, presence of allergies, place of residence (urban/rural), and history of functional endoscopic sinus surgery were noted.

RESULTS: CRS was seen in 68% of the patients, and most common in maxillary sinuses (53%). Nasal polyps with CRS were noted in 11% of the cases. CRS was also more common among smokers (p<0.001). In CRS accompanied by nasal polyps, no difference was found between urban and rural residence. However, most cases of CRS with nasal polyps lived in urban areas (81.4%, p=0.006). There was no difference between allergy and CRS with and without nasal polyps or between sinonasal variations and CRS development.

CONCLUSIONS: In the region investigated, the prevalence of CRS with nasal polyps was higher in the urban area (higher air pollution); however, the prevalence of CRS without nasal polyps did not change according to the place of residence. CRS was generally more common among smokers, but there was no significant difference in patients with CRS accompanied by nasal polyps. CRS was not more common in people with allergies.

KEYWORDS: Chronic sinusitis, Computed tomography, Epidemiology, Sir pollution, Smoking, Allergic rhinitis

Geliş Tarihi / Received: 22.03.2020
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Yazışma Adresi / Correspondence: Prof.Dr.Uğur TOPRAK
Eskişehir Osmangazi Üniversitesi Tıp Fakültesi, Radyoloji Anabilim Dalı
E-mail: ugurtoprakk@gmail.com
Orcid No (Sırasıyla): 0000-0001-6174-9312, 0000-0002-1244-2485, 0000-0001-7485-5915

INTRODUCTION

Chronic rhinosinusitis (CRS) is the most common inflammatory and infectious disease seen in the nose and paranasal sinuses, as well as being the most commonly diagnosed disease in the upper respiratory tract (1). CRS is a heterogeneous group of diseases, with the etiology, pathology, clinical findings, severity and clinical prognosis varying from one patient to another. CRS is a widespread medical condition affecting approximately 11% of adults in Europe and 12% of adults in the United States (2, 3).

The prevalence of CRS with nasal polyps is estimated to be 2.1-4.4% in Europe and 4.2% in the United States (4 - 6). However, there is no statistical data on the prevalence of sinonasal diseases in Turkey.

Tobacco is known to have an effect on CRS. The effect of air pollution has been shown more at the molecular level, and clinical effects have remained of secondary importance, gaining more attention only in recent years (7). Although it is suggested that occupational and environmental risk factors have an impact, the particular role of environmental factors and individual characteristics in the development and progression of the disease are not well known (7).

In surveys based on social and personal reports, the prevalence of the disease may be exaggerated due to CRS being diagnosed according to symptoms (8). In such symptom-based surveys, headaches that are not associated with sinusitis, such as migraine, can also be mistakenly classified as CRS. Therefore, the accuracy of diagnosis should be increased by objective findings based on direct examination and radiological imaging (9).

The current study investigated the prevalence and distribution of sinonasal diseases in patients that underwent paranasal sinus computed tomography (CT) due to CRS with or without nasal polyps, and to examine the relationship of CRS development with sinonasal variations and environmental factors.

MATERIAL ANDS METHODS

Prior to the research, written approval was obtained from the ethics committee on scientific studies. A total of 1000 cases that underwent paranasal sinus CT due to CRS with or without nasal polyps were retrospectively evaluated. After the exclusion of cases with images of insufficient quality due to dental artifacts, and those diagnosed with acute rhinosinusitis, CRS with acute episodes, chronic paranasal sinus fungal disease or sinonasal malignant tumors, a total of 926 patients were included in the study.

The patients' age, gender, smoking and allergy status, place of residence (urban/rural), and history of functional endoscopic sinus surgery (FESS) were recorded. Participants who smoked one or more cigarettes a day were considered as smokers.

The study was conducted at a single tertiary healthcare facility in Ankara Province, Turkey. The patients mostly came from Ankara and other cities in the Central Anatolia Region of Turkey.

The urban group consisted of those that lived in the city center with a higher level of air pollutants. The rural settlement group consisted of those that lived in villages and towns. The allergic cases were identified based on Prick test positivity, history of acute nasal congestion and urticaria, and presence of immunoglobulin against specific antigens in blood.

The paranasal sinus CT was performed with a spiral technique using a single-detector CT device (Hitachi Radix Turbo, Japan, 1997) in the prone position on the coronal plane perpendicular to the hard palate. The scanning area covered anterior anastomotic nasal cavity and frontal sinus and posterior sphenoid sinus wall.

Scanning was performed with a 3 mm section thickness, 18 cm FOV, 175 mAs, 120 kV and 1 mm rotation speed and reconstructed in 1 mm thickness. The CT images were evaluated by a radiologist experienced in head and neck radiology. In CT, thickening of the sinus mucosa, reshaping of the sinus wall, and new bone formation; i.e., osseous thickening (osteitis) in response to respiratory inflammation, were considered to be CRS (10). Variations such as the presence of nasal septum deviation, Haller's cell, and bullous and paradoxical congenital anomalies were also noted, and their association with CRS was investigated.

ETHICAL COMMITTE

Ethics committee approval was obtained from the Ethics Committee of SBU Ankara Numune Training and Research Hospital on July 19, 2018, with the number E-18-2115.

STATISTICAL ANALYSIS

Data analysis was undertaken with SPSS version 18 (SPSS Chicago, 2009). Demographic data was presented as mean and standard deviation. The difference between the groups was investigated by the Wilcoxon test, and the Mann-Whitney U test was used to determine whether the difference between the groups was significant. If the p value was less than 0.05, the difference was considered significant.

RESULTS

In this study, the paranasal sinus CT images of 926 patients, 456 female (49.2%) and 470 male (50.8%), were evaluated. The mean age of the patients was 40.03 ± 15.04 years for women and 38.06 ± 15.00 years for men, with no significant difference between the two genders.

Ninety nine of the patients (10.7%) lived in rural areas and 827 (89.3%) lived in urban areas. There was no correlation between the place of residence and presence of CRS with nasal polyps ($p > 0.05$). However, CRS with nasal polyps was significantly more common in urban areas (19 cases; 18.6%) than in rural areas (83 cases; 81.4%) ($p = 0.006$).

CRS with nasal polyps was found in 102 patients (11%). The polyp was on the right side in 30 patients (3.2%), on the left in 26 patients (2.8%), and bilateral in 46 patients (5%). CRS with nasal polyps was seen in 28 women (27.5%) and 74 men (72.5%), with a significantly higher prevalence among men ($p < 0.001$).

The percentage of smokers was 40.7. Although CRS without nasal polyps was significantly more common among smokers ($p < 0.001$), there was no significant relationship between CRS with nasal polyps and smoking status ($p > 0.05$).

Allergy positivity was found in 31 patients (3.3%), of whom 23 (74.2%) had CRS without nasal polyps and 6 (19.4%) had CRS with nasal polyps. Of the patients with lower conchal hypertrophy, 15 (48.4%) had an allergy while 352 (39.3%) had no allergies. There was no significant relationship between having an allergy and CRS, CRS with polyps or conchal hypertrophy ($p > 0.05$).

CRS was detected in 630 patients (68%) with or without polyps in the paranasal sinus CT. CRS was most commonly located in maxillary sinuses (right 52.2%, left 53.4%); however, there was no difference between the right and left sides in terms of the rate of sinusitis ($p > 0.05$). Presents the distribution of CRS according to sinuses **(Table 1)**.

Table 1: Distribution of CRS by the affected sinus

Affected sinus	Left	Right
	n (%)	n (%)
Maxillary	494 (53.4)	483 (52.2)
Ethmoid	285 (30.8)	277 (30.0)
Frontal	196 (20.1)	181 (19.5)
Sphenoid	157 (17.0)	147 (15.9)

Concerning the paranasal sinus variations, the number of patients with Haller's cell was 18 (1.9%). The rate of maxillary sinusitis was 69.2% and 64.2% in patients with and without Haller's cell, respectively.

Concha bullosa of the middle turbinate was present in 252 patients (27.2%), paradoxical middle turbinate was seen in 68 patients (7.3%), and septum deviation was observed in 613 patients (66.2%), **(Figure 1 and 2)**.

Figure 1: Coronal CT images showing bilateral concha bullosa (asterisks).

Figure 2: Coronal CT image shows polypoid and or linear mucosal disease in both maxillary and ethmoidal sinuses.

There was no significant relationship between sinusitis and the presence of Haller's cell or concha and septum variations (p> 0.05). The overall distribution of the variations is summarized in **(Table 2)**.

Table 2: Findings on paranasal variations

Anatomic variations	n (%)	
Haller's cell	18	1.9
Concha bullosa of the middle turbinate	252	27.2
Paradoxical middle turbinate	68	7.3
Septum deviation	613	66.2

Thirty-nine patients (4.2%) underwent FESS, of whom 37 (94.9%) had maxillary or ethmoid sinusitis **(Figure 3)**. There was no difference between the place of residence and their FESS history.

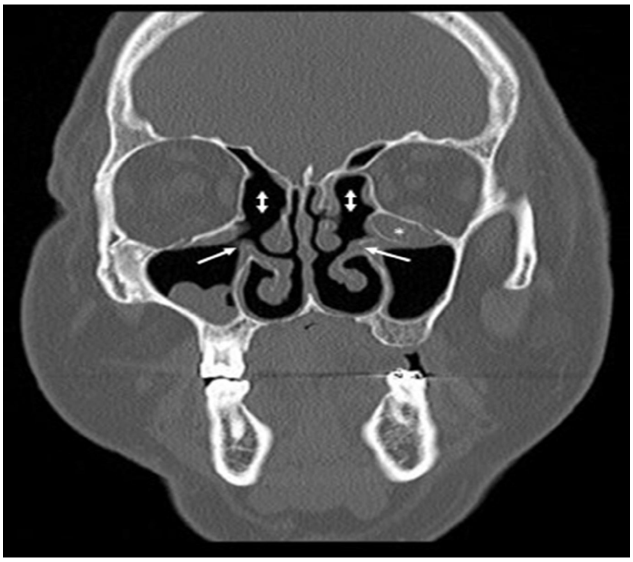

Figure 3: Coronal CT image shows bilateral uncinectomies (arrows) and ethmoidal bullectomies (two head arrows), mucosal disease in maxillary sinus and left Haller cell (asterisk).

DISCUSSION

In the current study, the prevalence of CRS without nasal polyps was similar in urban and rural areas. However, CRS with nasal polyps was significantly more commonly seen in people living in urban areas. Only a limited number of studies have investigated the relationship between air pollution and CRS. In a recently published study, CRS with nasal polyps was found to be more common in the city center (7). In another study, six environmental pollutants were identified in urban areas: lead, carbon monoxide, ozone, sulfur dioxide, nitrogen dioxide, and black carbon (11). Two other studies (12, 13) reported a relationship between severity of sinusitis and particles and sulfur dioxide suspended in the air. In the current study, the similar prevalence of CRS without nasal polyps in urban and rural areas may have been due to the individually varying levels of exposure to pollution and the amount of particles in polluted areas. Variability in the level of particles and seasonal pollution exposed at different times of day may also lead to unpredictable differences (7). It is considered that nasal polyposis is more affected by perennial exposure than seasonal allergens, which results in increased prevalence of CRS with nasal polyps in people living in cities (13). Similarly, Min et al., reported nasal polyposis to be more common in urban areas (14).

Another factor that plays a role in the epidemiology of CRS is allergy. In this study, 3.3% of the patient had allergies. Robinson et al. (15) also detected atopy in 30% of CRS patients, but did not find the CRS-atopy relationship to be significant. In contrast, another study emphasized the close association of common CRS with asthma and allergy (16). It has been reported that CRS without nasal polyps is more common in women and in patients with a history of allergy.

A relationship between perennial allergic rhinitis and nasal polyps has also been shown (17).

However, nasal polyposis was more common in males similar to the study of Toledano et al. (18).

The prevalence of nasal polyposis in atopic individuals was reported to be less than 5%, similar to the ratio in general population (19), but in the current study, approximately 20% of allergic patients had CRS with nasal polyps. This higher prevalence can be attributed to our study group consisting of patients that underwent paranasal CT. Similarly, post-mortem studies that provide the most reliable ratios report the prevalence of nasal polyps as 25 to 40% (20).

In their study investigating the relationship between blood eosinophil levels and nasal polyps, Soler et al. (21) did not observe a significant association between allergy and nasal polyps.

Similarly, we did not find an association between nasal polyposis and allergy in our patients.

Furthermore, there was no significant relationship between allergy and concha hypertrophy, which is an important finding of allergic rhinitis.

As previously reported (7), we also found a relationship between smoking and CRS. Active smoking is associated with decreased mucociliary clearance, measured based on saccharin transit time (22), and it has been shown to have a negative effect on mucosal healing after endoscopic sinus surgery in adults (23). Lieu and Feinstein (24) examined the relationship between CRS, active smoking and secondhand smoke exposure, and reported that active smoking was associated with increased risk of sinus disease; however, the authors did not find an increased risk associated with secondhand smoke exposure. In another study (25), secondhand smoke exposure was reported to be associated with a high risk of CRS. In the current research, we did not inquire about secondhand smoke, and there was no relationship between smoking status and CRS with nasal polyps, similar to previous studies (7, 13).

In this study, CRS was mostly located in maxillary sinuses, followed by ethmoid, frontal and sphenoid sinuses. This order of frequency is similar to the findings of the previous research (26).

Nevertheless, we did not observe a relationship between paranasal sinus variations and CRS. It has been suggested that some anatomical variants, such as septum deviation, Haller's cell and bullous or paradoxical middle turbinate, are likely to obstruct the ostiomeatal unit or lead to the development of CRS, or both. However, there is little evidence today that these variations play a role in the majority of CRS cases (27).

Furthermore, studies performed in pediatric populations have found no correlation between anatomic anomalies and the prevalence of CRS in the CT images of sinuses (28). A recently published study concluded that paranasal sinus variations (except ethmoidal bulla), and the type and length of ethmoid infundibulum did not pose a risk for maxillary sinusitis, and mucociliary activity should be prioritized (29).

In cases of CRS without nasal polyps, requirement for FESS was reported to be higher among people living in cities due to a higher level of air pollution (7). In contrast, we did not find a significant difference between urban or rural residence in terms of a history of FESS. This may have been due to the relatively smaller percentage of the patients that had undergone FESS.

CRS is a complex disease; it is likely to contribute to the pathogenesis of both genetic and environmental factors (30). Gene studies or genome-wide association studies have been undertaken to investigate the genetic basis of CRS.

Various cytokines, cytokine receptors and immune-related molecules have been associated with CRS. Among these, only two polymorphisms in the IL1A (rs17561) and TNFA (rs1800629) genes have been found to be repeated (31). The differences in genetic findings between ethnic groups have also been attributed to their different transcription in CRS accompanied by eosinophilic, non-eosinophilic nasal polyps (32).

However, epigenetic mechanisms seem to provide more reasonable explanations by focusing on environmental factors (33).

The number of eosinophils in nasal polyps, as well as the IgE levels, varies between continents, countries and ethnic groups (34). This indicates that the treatment cannot be standardized and the appropriate treatment options may vary. Therefore, identification of the inflammation type (eosinophilic-neutrophilic) that is common in a region or country may affect the treatment decision (9). This research has certain limitations. Since healthy individuals do not usually undergo CT, we did not have a control group to compare prevalence. The calculation of prevalence with a control group based on endoscopic examination can be planned in a project with a larger budget. Furthermore, the patients included in the study lived in different cities and rural areas; thus, they were not exposed to the same types of pollutants and allergens. In addition, the variability of seasonal pollution at different times of day may have caused unpredictable differences (7). It seems unlikely that these variables could be stabilized except for selecting a specific city or rural area.

In conclusion, although CRS with nasal polyps was more common in urban areas (with a higher level of pollution), there was no difference between urban or rural residence in terms of the prevalence of CRS without nasal polyps.

CRS without polyps was more frequently seen in smokers. CRS with polyps was not more common among patients with an allergy but was seen at a higher rate among men. The requirement for FESS due to CRS was not found to be higher in areas with higher levels of air pollution. In general, our findings were consistent with those reported in the literature. The results of the current study can guide future large-budget studies investigating epigenetic and genetic variables at the country level.

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