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Association Between Anatomical Variations of the Sinonasal Region and Chronic Rhino-Sinusitis: A Prospective Case Series Study

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SUMMARY

Chronic rhinosinusitis is a chronic inflammation of the nasal and paranasal cavities. However, the main pathophysiology of these chronic conditions is poorly described and seems to be multifactorial.

In the present study, we reviewed the computed tomography (CT) scans of patients with chronic rhinosinusitis to identify a probable association between the anatomical variations and chronic inflammation in the sinonasal region.

Prospective study of the axial and coronal CT scans of 206 chronic rhinosinusitis patients between September 2010 and January 2012 was performed.

The study population involved 100 males (48.5%) and 106 females (51.4%) with a mean age of 39 years. The ostiomeatal complex was reported patent in 43 subjects and was blocked in 36 patients. The nasal septa were significantly deviated in 117 (56.7%) patients. Turbinate hypertrophy was reported in 55 (26.6%) patients. Retention cyst was observed in 56 (27.1%) participants. Concha Bullosa and polyps were reported in 36 (17.47%) and 38 (18.44%) patients, respectively. Maxillary sinus was the most common site of involvement (67 patients).

Our investigation revealed that there is a strong association between the presence of anatomical variations and chronic inflammation in the paranasal sinuses.

Key words: **chronic rhinosinusitis, anatomical variations, CT scan**

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INTRODUCTION

Chronic rhinosinusitis (CRS) is a disease of the nasal and paranasal cavities, which impairs the quality of life, decreases workplace productivity and causes considerable treatment costs. Although our knowledge about the etiology of CRS has progressed, the main pathophysiology of these chronic airway cases is poorly found and seems to be multifactorial (1-5).

Based on the improvement in functional endoscopic sinus surgery and coronal computed tomography (CT) imaging, anatomic variations in the paranasal sinus region are the subject of different investigations. The non-invasive cross-sectional CT imaging techniques and magnetic resonance imaging enabled soft tissue discrimination and spatial resolution in sinonasal variations. Radiologists and rhinology surgeons require guidable findings about anatomical variants with some associated pathologies for pre- and intra-operative performance. In this regard, considerable information before functional endoscopic sinus surgery provided by CT will make it safer and will reduce the complications (6).

Some anatomical variations like septal deviations, Haller cells, paradoxical curvature of the middle turbinate, and agger nasi cells have been reported as probable risk factors for obstruction of the ostiomeatal unit, development of CRS, or both. However, there is not enough literature to support these findings (7-10). Recently, Al-Qudah M has indicated no relation between anatomical variations and CRS in children on sinus CT scanning (11).

In the present article, we examined the CT scans of patients suffering from CRS to elucidate a probable correlation between some anatomical variations and chronic inflammation.

MATERIAL AND METHODS

A written informed consent to participate in the study was obtained from all the patients. This study was approved by the Ethics Committee of the Mazandaran University of Medical Sciences, Sari, IRAN. Prospective review of axial and coronal CT scans of 206 CRS participants between September 2010 and January 2012 was studied.

All patients were selected according to criteria for CRS as described by the Sinus and Allergy Health Partnership (12). All of the participants received medical treatment for three weeks, including antibiotics, nasal steroids and decongestant. Failure to medication resulted in referral for CT examination of the sinuses. Our exclusion criteria included craniofacial anomalies, facial and head trauma, nasal or facial neoplasms, immunodeficiency or cystic fibrosis (7).

CT was performed with axial and coronal views of the paranasal sinuses. The outcomes were evaluated by radiologist and rhinologist and any differences in opinions were resolved by consensus. Anatomical variation was examined as either being present or absent.

The mucosal disorders of the paranasal sinuses and the ostiomeatal complex status were scored based on the Lund - Mackay staging system (13), while a sinus with no opacification was considered zero, score of 1 for a sinus with partial opacification and score of 2 for a sinus with full opacification. A patent ostiomeatal complex was scored zero, while a blocked one received the score of 2.

RESULTS

The study group (206 cases) included 100 males (48.5%) and 106 females (51.4%) with a mean age of 39 years (mean±SD; 39±14).

The ostiomeatal complex was reported patent in 43 subjects, including 19 females and 24 males, and was blocked in 36 patients involving 10 men and 26 women.

The nasal septa were significantly deviated in 117 (56.7%) patients. Turbinate hypertrophy was discovered in 55 (26.6%) patients. Retention cyst was reported in 56 (27.1%) participants. Concha Bullosa and polyp were identified in 36 (17.47%) and 38 (18.44%) patients, respectively (Table 1).

Mostly, mucosal thickening was identified in the maxillary sinus (67 patients), followed by involvement of the ethmoidal sinuses (37 cases) (Table 2).

Table 1. *The results of CT reports*

CT findings	Total	Men	Women
Nasal Septal Deviation	117	59(50.4%)	58(49.5%)
Turbinate Hypertrophy	55	32(58.1%)	23(41.8%)
Spur	8	5(62.5%)	3(37.5%)
Concha Bullosa	36	8(22.2%)	28(77.7%)
Polyp	38	20(52.6%)	18(47.36%)
Retention Cyst	56	21(37.5%)	35(62.5%)

Table 2. *Mucosal thickening in different anatomical parts of sinuses*

Mucosal thickening	Total	Men	Women
Maxillary Sinuses	67	36(53.7%)	31(46.2%)
Ethmoid Sinuses	37	20(54%)	17(45.9%)
Sphenoid Sinuses	29	13(44.8%)	16(55.1%)
Frontal Sinuses	28	14(50%)	14(50%)

DISCUSSION

Although there are a lot of reports about the etiology of CRS, the role of anatomical variations has not been fully understood, and simultaneously, newly defined procedures such as endoscopic surgery needs valuable information on paranasal sinus anatomical variations before operation. Therefore, in this trial we investigated these variations in CT scans of patients with CRS to identify a probable role of these variants.

Hisham S Khalil et al. (14) studied CT scans of 63 patients and revealed among the study population that 15.9% had nasal septal deviation. However, in keeping with this investigation, our study indicated there is a significant correlation between anatomical variations and presence of CRS. In this regard, we established that nasal septal deviations were reported in 117 (56.7%) patients. These results showed a probable relation between CRS and septal deviations.

The definition of concha bullosa is the pneumatization of the middle, inferior and superior turbinates (15-17). Some studies have reported a relationship between the presence of concha bullosa and rhinosinusitis (18, 19), however, other researchers have shown no direct relationship (20, 21).

Halil Arslan et al. (22) reviewed CT scans in axial and coronal plane from 200 patients with CRS to identify the prevalence of anatomic variants. They reported concha bullosa in 30% and septal deviation in 36%. However, we identified the presence of concha bullosa in 17.47% of the study population. In addition, we found turbinate hypertrophy in 55 (26.6%) patients; retention cyst in 56 (27.1%) subjects was another finding in CT scans in this series. The presence of polyp was reported in 38 cases. The most common sites of involvement were maxillary sinus, followed by ethmoid, sphenoid and frontal sinuses.

CONCLUSION

Studies revealed that there are various reports and data about the presence of anatomical variations and CRS. This study proved that there is a strong association between the presence of these variants and development of chronic inflammation in the paranasal sinuses. Nasal septal deviation was the commonest variation reported. Appropriate radiologic imaging can improve the accuracy of diagnosis and management of these patients. We hope this manuscript will inspire the investigators to study more about the role of these variants in CRS. Further investigations are needed to confirm the outcomes.

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POVEZANOST ANATOMSKIH VARIJACIJA SINONAZALNE REGIJE SA HRONIČNIM RINOSINUZITISOM: PROSPEKTIVNA STUDIJA

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Sažetak

Hronični rinosinuzitis je hronična upala nazalnih i paranazalnih šupljina. Međutim, osnovna patofiziologija ovih hroničnih stanja je nedovoljno opisana i zaivisi od više faktora.

U studiji koju smo sproveli pregledali smo snimke kompjuterizovane tomografije (CT) bolesnika sa hroničnim rinosinuzitisom kako bi identifikovali moguću povezanost anatomskih varijacija i hronične inflamacije u sinonazalnoj regiji.

U periodu između septembra 2010. godine i januara 2012. godine sprovedena je prospektivna studija aksijalnih i koronarnih CT snimaka 206 bolesnika sa hroničnim rinosinuzitisom.

Studija je uključila 100 muškaraca (48.5%) i 106 žena (51.4%), pri čemu je prosečna starost iznosila 39 godina. Ostiomeatalni kompleks bio je prohodan kod 43 bolesnika, a blokiran kod 36 bolesnika. Značajna devijacija nazalnog septuma zabeležena je kod 117 (56.7%) bolesnika. Hipertrofija nosnih školjki bila je prisutna kod 55 (26.6%) bolesnika. Retenciona cista zabeležena je kod 56 (27.1%) bolesnika. Konha buloza i polipi su otkriveni kod 36 (17.47%), odnosno 38 (18.44%) bolesnika. Maksilarni sinus bio je najčešće zahvaćen (67 bolesnika).

Naše istraživanje je pokazalo da postoji jaka povezanost između anatomskih varijacija i hronične inflamacije u paranazalnim sinusima.

Ključne reči: **hronični rinosinuzitis, anatomske varijacije, CT snimci**