

Sinonasal Anatomical Variation in Chronic Rhinosinusitis Patients Based on CT-Scan Finding

Nikita Frinadya¹, Delfitri Munir¹, Andrina Y.M. Rambe¹,
Ferryan Sofyan¹, Askaroellah Aboet¹ and Taufik Ashar²

¹Department of Otorhinolaryngology Head and Neck Surgery, Faculty of Medicine Universitas Sumatera Utara/H. Adam Malik General Hospital, Medan Indonesia

²Department of Environmental Health Faculty of Public Health Universitas Sumatera Utara, Medan, Indonesia

Corresponding Author E-mail: frinadya@gmail.com

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Abstract

Background: Sinonasal disease, especially rhinosinusitis, is the most prevalent disease in the Otorhinolaryngology Head and Neck Surgery Department. Different anatomical variations of the lateral walls of nose play important role in contributing to osteomeatal complex obstruction, and drainage and ventilation disruption, which eventually causes inflammation of the sinus mucosa.

Objective: To discover the characteristics of sinonasal anatomical variations in patients with chronic rhinosinusitis based on their CT scan findings.

Method: This is an observative descriptive study using cross-sectional design. All chronic rhinosinusitis patients who came to department of Otorhinolaryngology in H Adam Malik General Hospital and Universitas Sumatera Utara Hospital, Medan, Indonesia, will undergo CT Scan examination to explore their anatomical variation. The inclusion criteria of this study is patient diagnosed with chronic rhinosinusitis who are not diagnosed with nasal polyp, who do not have history of nasal trauma, and do not have history of previous nasal surgery.

Result: Of 40 patients with chronic rhinosinusitis, 21 patients were male and 19 patients were female. The most prevalent anatomical variation found is septal deviation (18 patients/45%), with maxillary sinus as the most involved sinus (85%).

Conclusion: From the CT scan findings of chronic rhinosinusitis patients, the most prevalent anatomical variation is septal deviation that is found in 18 patients (45%). This high incidence of anatomical variation need for proper preoperative assessment for save and effective endoscopic sinus surgery.

Keywords: Chronic rhinosinusitis, anatomical variation, CT scan.

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Introduction

Sinonasal disease, especially rhinosinusitis, is the most prevalent disease in the Otorhinolaryngology Head and Neck Surgery Department. Several anatomical variation such as septal deviation, agger nasi cell, and Haller's cell are among the most prevalent anatomical variations found. CT scan and nasal endoscopy are preferred diagnostic approaches to determine mucosal abnormalities or anatomical variations of paranasal sinuses that would potentially cause rhinosinusitis (Gouripur *et al.*, 2017).

Chronic rhinosinusitis has high prevalency. According to National Health Interview Survey 1996 in the United States, chronic rhinosinusitis is estimated to be suffered by 12,5% of total population which corresponds to about 31 million patients yearly. The prevalence of chronic rhinosinusitis in Indonesia varies. In 2000–2006, the number of cases of chronic rhinosinusitis in Dr. Sardjito Hospital, Jogjakarta was as much as 2,5–4,6 %. Chronic rhinosinusitis patients in H. Adam Malik General Hospital Medan in 2008-2009 was as much as 296 patients of 783 registered patients in Rhinology Division (Hamilos, 2011; Harrowi *et al.*, 2011; Multazar, 2011). Several writers have assessed the correlation between sinonasal anatomical variation and rhinosinusitis incidence. Different anatomical variation found in the lateral walls of the nose play important role in causing obstruction of the osteomeatal complex and contributing to drainage and ventilation disruption, which eventually cause sinus mucosa inflammation (Fadda *et al.*, 2012).

Sinonasal anatomical variation as the etiology of sinusitis is mostly debatable. It is still widely accepted that the obstruction of the osteomeatal complex causes obstruction of the air flow, thus causing further obstruction. From previous study, it is found that anatomical variation of the sinonasal can cause osteomeatal complex obstruction, which is the predisposing factor of rhinosinusitis. The most prevalent anatomical variations that may cause sinusitis is agger nasi cell (98%), followed by septal deviation (70%) consecutively (Gouripur *et al.*, 2017). CT scan assessment is the most common workup in oromaxillofacial cases. Anatomical variation of paranasal sinuses found through CT examination is important to decrease the risk during surgery and to find predisposing factor that may potentially cause pathological condition (Kamble, 2016).

The development of surgical therapy as chronic rhinosinusitis treatment, using endoscopy, require thorough knowledge of the anatomy of nose lateral walls, paranasal sinuses, other important surrounding structures, and other anatomical variations that may be assessed through CT scan (Aramani *et al.*, 2014).

2. Method

This is an observational study in descriptive form with a cross-sectional design, aiming to evaluate the anatomical variation characteristics of nose that may potentially cause obstruction on sinus ostium. The study was conducted in Haji Adam Malik General Hospital, Medan, and Universitas Sumatera Utara Hospital. The population of this study are the chronic rhinosinusitis patients that came to Otorhinolaryngology (ENT)/Head and Neck Surgery polyclinic in Haji Adam Malik General Hospital, Medan, and Universitas Sumatera Utara Hospital. Chronic rhinosinusitis is an inflammation of nasal mucosa and paranasal sinuses mucosa that last more than 12 weeks, diagnosed with 2 major symptoms or 1 major symptom with 2 minor symptoms from the list of symptoms according to Task Force. The major symptoms are mucopurulent nasal secretion, nasal obstruction, facial pain, post-nasal drip, and smelling disturbance. The minor symptoms are headache, halitosis, toothache, sensation of pain/ fullness in ear, cough, and fever.

This study samples are the chronic rhinosinusitis patients in Haji Adam Malik General Hospital, Medan, and Universitas Sumatera Utara Hospital who meet the inclusion and exclusion criteria starting from April 2018 until the number of required study participants was met. Through calculation, the number of sample needed was 40 samples. The inclusion criteria of this study is the total patient diagnosed with rhinosinusitis and patients who are not diagnosed with nasal polyp, who do not have history of nasal trauma, and who do not have history of previous nasal surgery. The exclusion criteria of this study are patients who withdrawn themselves from the study.

The samples who met the criteria and agreed to take part in the study signed a written informed consent and subsequently went through an anamnesis. After that, a non-contrast coronal paranasal sinus CT scan was conducted. CT scan results were then evaluated and analyzed using SPSS (Statistical Package for the Social Science).

3. Results

The characteristics of study subjects were age and sex.

Table 1. Study Subject Characteristics

Characteristics	n = 40	%
Age		
< 16 years old	5	12,5
16 – 30 years old	15	37,5
31 – 45 years old	7	17,5
46 – 60 years old	10	25,0
> 60 years old	3	7,5
Sex		
Men	21	52,5
Women	19	47,5

This study was participated by 40 subjects who fulfilled the inclusion criteria. The majority of subjects were men, which comprises of 21 people (52,5%). The most prevalent age group of 16 – 30 years old comprises of 15 people (37,5%).

Table 2. Major and Minor Symptoms Distribution

Symptoms	(+)		(-)		Total	
	n	%	n	%	n	%
Major Symptoms						
Mucopurulent Rhinorrhea	21	52,5	19	47,5	40	100
Nasal Obstruction	34	85	6	15	40	100
Facial Pain	14	35	26	65	40	100
Post Nasal Drip	27	67,5	13	32,5	40	100
Smelling Disturbance	1	2,5	39	97,5	40	100
Minor Symptoms						
Headache	34	85	6	15	40	100
Halitosis	0	0	40	100	40	100
Toothache	0	0	40	100	40	100
Sensation of fullness in ear	1	2,5	39	97,5	40	100
Cough	0	0	40	100	40	100
Fever	0	0	40	100	40	100

The most prevalent major symptom found in chronic rhinosinusitis patients are nasal obstruction found in as much as 34 people (85%). The second most prevalent major symptom is post nasal drip, which was reported by 27 patients (67,5%), followed by mucopurulent rhinorrhea in 21 patients (52,2%).

Table 3. Characteristics of Paranasal Sinus CT Scan Findings

Characteristics	(+)		(-)		Total	
	n	%	n	%	n	%
Anatomical Variation						
Haller's Cell	4	10	36	90	40	100
Hipertrophic Ethmoidal Bulla	0	0	40	100	40	100
Uncinate Process Deviation	16	40	24	60	40	100
Paradoxical middle tubinate	2	5	38	95	40	100
Concha Bullosa	9	22,5	31	77,5	40	100
Septal Deviation	18	45	22	55	40	100
Onodi Cell	2	5	38	95	40	100
Frontal Cell	0	0	40	100	40	100
Agger Nasi Cell hypertropic	2	5	38	95	40	100
Paranasal Sinuses						
Right Frontal	3	7,5	37	92,5	40	100
Left Frontal	8	20	32	80	40	100
Right Maxillary	33	82,5	7	17,5	40	100
Left Maxillary	34	85	6	15	40	100
Right Ethmoid	20	50	20	50	40	100
Left Ethmoid	20	50	20	50	40	100
Right Sphenoid	6	15	34	85	40	100
Left Sphenoid	11	27,5	29	72,5	40	100

Paranasal sinuses CT scan findings show septal deviation as the most prevalent anatomical variation in 18 patients (45%). Uncinate process deviation falls onto second place with 16 patients (40%), followed by concha bullosa with 9 patients (22,5%). Evaluation on paranasal sinuses shows left maxilla sinus to be the most prevalent, with 34 patients (85%). The second most prevalent abnormality is found in right maxillary sinus, which is found in 33 patients (82,5%). The third most prevalent abnormality is that of the right and left ethmoid, which was found in 20 patients (50%).

4. Discussion

This study shows that chronic rhinosinusitis is most prevalent in the 16 – 30 years old age group (37,5%). In this study, the youngest patient is 8 years of age, where the oldest is 73 years of age. It is almost similar to the study conducted in Canada where it is most prevalently found in the 20 –29 years old age group and decreases after 60 years of age.

According to European Position Paper on Rhinosinusitis and Nasal Polyps (2012), chronic rhinosinusitis mostly affects young adults; its prevalence increases after puberty and gradually decreases in the middle age group and elderly (Fokkens *et al.*, 2012). Previous study cited by Firman showed that the increase of chronic rhinosinusitis cases in young adult is affected by various factors, such as environment, lifestyle changes, diet, and infection (Firman, 2011). Its case is found more in men than women (52,5% and 47,5% consequently).

Similar report was made by Multazar (2011) and Dewi (2013), where the patients comprises of more men than women (Multazar, 2011; Dewi *et al.*, 2013). Based on previous study by Fadda *et al.*, (2012), 140 of 200 chronic rhinosinusitis patients at least have 1 anatomical variation found from their paranasal sinus CT scan finding, where men (60,7%) were also more than women (39%). Study conducted by Amodu *et al.*, (2014) shows that of 60 patients diagnosed with chronic rhinosinusitis in the study, men were found as much as 36 people (57%), where women were found as much as 24 people (43%); the ratio of men:women is 1,5:1. The age range of the study subjects was 18 – 60 years of age (Fadda *et al.*, 2012).

It is found that men may potentially suffers more from chronic rhinosinusitis than women, possibly because the different activities done by men and women, where men mostly spend their time outdoor, thus more prone to pollution, dust, cold air, and dry air that cause disruption of mucociliary clearance (Kamble, 2016).

This study also shows that the most common rhinosinusitis symptom is nasal obstruction (85%), followed by post nasal drip (67,5%), and the rarest symptom is smelling disturbance (2,5%). The most prevalent minor symptom encountered in this study is headache (85%).

The result of this study is almost similar to that of Multazar, Dewi, Lal et al, in United States and Azis et al, in Saudi Arabia, where the most prevalent symptom found was nose congestion. The study conducted by Bubun et al, in Makassar found that the most prevalent symptom in chronic rhinosinusitis patients was mucopurulent rhinorrhea (83%), followed by nasal obstruction (81,1%), and the rarest symptom was smelling disturbance (30,2%). Study by Nair *et al.*, found post nasal drip to be the most prevalent symptom (95%) followed by headache (91%), runny nose (90%), and nose congestion (86%) consequently (Multazar, 2011; Dewi *et al.*, 2013; Lal *et al.*, 2009; Azis *et al.*, 2006; Bubun *et al.*, 2009).

Based on paranasal sinus CT scan finding in this study, the most prevalent anatomical variation found is septal deviation (45%), followed by uncinata process deviation/hypertrophy (40%) and concha bullosa (22,5%). This is consistent with the result showed by Fadda's study, where the most prevalent anatomical variation found was septal deviation (58,5%), followed by bullous media conchae (49,3%). Study done by Aramani, found 74,1% patients suffered from septal deviation. Similar result was found in Perez's study, which showed 80% patients suffered from septal deviation. In various other studies, septal deviation range between 14,1–80%.

In study done by Kamble, the most prevalent variation found was septal deviation (63%). Septal deviation plays an important role in causing sinusitis and complications during endoscopic sinus surgery. The asymmetrical position of nasal septum pushes medial conchae more laterally, causing medial meatus to narrow, thus disrupting the drainage from maxillary sinus, anterior ethmoid sinus, and frontal sinus (Kamble, 2016). The correlation between septal deviation and chronic rhinosinusitis is due to the accumulation of secret in the sinus cavity caused by narrowing of the osteomeatal complex, which obstruct sinus cavity secretion and thus accumulating infection in the sinus cavity which will eventually causes chronic rhinosinusitis (Hasan *et al.*, 2017). This study found that abnormality is mostly found in the left maxillary–found in 34 patients (85%), followed by right maxillary (82,5%), and right and left ethmoidal sinuses (50%). Similar finding was also reported by Fadda et al, which shows that, based on the CT scan result of 106 sinusitis patients, sinusitis is mostly found in maxillary sinus (67,1%), anterior ethmoid sinus (54,3%), frontal sinus (22,1%), posterior ethmoid sinus (10%), and sphenoid sinus (10%) (Fadda *et al.*, 2012).

Anatomical structure of maxillary made it susceptible to sinus drainage disruption, which is shown in Munir, Bubun et al, and Nair et al study. Their study resonated the same result where maxillary sinus is the most prevalent site of sinusitis. The high incidence of sinusitis that is found in maxillary sinus and ethmoid sinus may happen because the drainage of maxillary sinus, ethmoid sinus, anterior and frontal sinus disembogues through medial meatus. So, when an anomaly happens in the osteomeatal complex, drainage and ventilation disruption on these three sinuses will happen and develop into sinusitis (Munir, 2006; Bubun *et al.*, 2009; Nair *et al.*, 2010; Hwang and Abdhalkani, 2009).

5. Conclusion

It is concluded that anatomical variation found in chronic rhinosinusitis patients are those that interfere with osteomeatal complex. Septal deviation is the most prevalent, followed by uncinata process deviation/ hypertrophy and concha bullosa. CT scan examination needs to be done to assess the sinus and anatomical variation involved before sinus endoscopic surgery is performed.

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