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## Original Article

### Characteristics of Chronic Sinusitis Based on Non-Contrast CT Scan at the ENT-Head and Neck Surgery Polyclinic of Regional General Hospital Dr. Zainoel Abidin Banda Aceh

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#### ABSTRACT

Chronic sinusitis is a long-term inflammation that occurs in the nasal and paranasal mucosa for 12 weeks. Non-contrast CT scan is gold standard in diagnosing chronic sinusitis. This study aims to determine the characteristics of chronic sinusitis based on non-contrast CT scan at the ENT-Head and Neck Surgery Polyclinic of RSUDZA Banda Aceh in 2019. This research was a descriptive study with retrospective data, medical record. The sample of this study was taken by consecutive sampling method in October 2020 and obtained 111 samples. The results showed that most patients with chronic sinusitis were 30-39 years, as many as 42 people (37.8%). Most of the sexes suffering from chronic sinusitis were women, as many as 59 people (53.2%). Based on the non-contrast CT scan, the location of the sinuses most affected was the maxillary sinuses, as many as 110 people (99.1%). The number of sinuses that were most affected was single sinusitis, which was 58 people (52.3%). Most patients with chronic sinusitis without polyps were found, as many as 89 people (80.2%). The most common anatomical variation found was septal deviation as many as 25 people (22.5%). The conclusions in this study indicate that women, late adulthood, maxillary sinus, single sinusitis, chronic sinusitis without nasal polyps, and septal deviation are characteristics of chronic sinusitis patients based on non-contrast CT scan.

**Keywords:** Chronic Sinusitis, Non-contrast CT Scan, RSUDZA, Aceh

#### ABSTRAK

Sinusitis kronis merupakan inflamasi jangka panjang yang terjadi pada mukosa nasal dan paranasal selama 12 minggu. Pemeriksaan penunjang gold standard dalam menegakkan diagnosis sinusitis kronis adalah CT Scan tanpa kontras. Penelitian ini bertujuan untuk mengetahui karakteristik penderita sinusitis kronis berdasarkan gambaran CT Scan tanpa kontras di Poliklinik THT-KL RSUDZA Banda Aceh pada tahun 2019. Jenis penelitian ini adalah penelitian deskriptif dengan rekam medis. Sampel diambil dengan teknik consecutive sampling dan didapatkan 111 sampel. Hasil penelitian ini mendapatkan bahwa penderita sinusitis kronis paling banyak dialami pada umur 30-39 tahun yaitu sebanyak 42 orang (37.8%). Jenis kelamin yang paling banyak menderita sinusitis kronis yaitu perempuan sebanyak 59 orang (53.2%). Berdasarkan gambaran CT Scan tanpa kontras, letak sinus yang paling banyak terkena yaitu sinus maksilaris sebanyak 110 orang (99.1%). Jumlah sinus yang paling banyak terkena yaitu single sinusitis sebanyak 58 orang (52.3%). Penderita sinusitis kronis tanpa polip nasi paling banyak ditemukan yaitu sebanyak 89 orang (80.2%). Variasi anatomi yang paling banyak ditemukan adalah deviasi septum nasi yaitu sebanyak 25 orang (22.5%). Kesimpulan pada penelitian ini menunjukkan bahwa perempuan, usia dewasa akhir, sinus maksilaris, single sinusitis, sinusitis kronis tanpa polip nasi, dan deviasi septum merupakan karakteristik dari penderita sinusitis kronis berdasarkan gambaran CT Scan tanpa kontras.

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**Kata kunci:** Sinusitis kronis, CT Scan tanpa kontras, RSUDZA, Aceh

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## INTRODUCTION

Sinusitis, better known as rhinosinusitis, is an inflammation that occurs in the paranasal sinuses.<sup>1</sup> The cause can be due to infection, allergies, or autoimmune problems. In some case studies, viral infection was the most common cause and resolved within 10 days.<sup>2</sup> Sinusitis was classified by duration as acute if less than four weeks and chronic if more than 12 weeks with or without acute exacerbations.<sup>3</sup>

Chronic sinusitis has two or more the following symptoms, such as nasal congestion, nasal discharge (anterior/posterior nasal drip), facial tenderness or facial pain, and a decreased sense of smell.<sup>4</sup> The most common risk factor is allergies. While others are asthma, pollution and smoke exposure, immune deficiency, and septal deviation.<sup>5</sup>

Sinusitis and chronic sinusitis are the most common public health problems worldwide.<sup>4</sup> On 107 million people who suffer from chronic sinusitis in mainland China in 2015 showed that chronic sinusitis is common among people with certain medical conditions, including allergic rhinitis, asthma, chronic obstructive pulmonary disease, and gout. The prevalence of men (8.79%) is higher than women (7.28%). The independent risk factors for chronic sinusitis were active smokers and passive smokers. Therefore, it is necessary to develop health promotion related to chronic sinusitis, especially in developing countries.<sup>5</sup>

According to the 2007 National Health Interview Survey data, sinusitis is one of the ten most diagnosed diseases in the United States.<sup>6</sup> In Europe, about 10.9% of people have symptoms of chronic sinusitis.<sup>7</sup> In Canada, 5% of the general population suffers from chronic sinusitis.<sup>8</sup>

In Indonesia, based on data from the Ministry of Health of the Republic of Indonesia in 2003, there were 102,817 sinus patients undergoing outpatient

treatment, while nasal and sinus disease was ranked 25th out of 50 major disease patterns. A study by Amelia et al.<sup>7</sup> in 2017 showed 73 patients with chronic sinusitis for one year at Dr. Mohammad Hoesin Palembang.<sup>7</sup> The Aceh provincial health profile noted that sinusitis was ranked 11th out of the 20 most diseases for outpatients in Aceh Provincial hospitals in 2012 with 8,183 cases.<sup>9</sup> A study by Husni and Pradista<sup>10</sup> in 2012 at the Dr. Zainoel Abidin Hospital, Banda Aceh, Indonesia showed that there were 33 sufferers of chronic sinusitis from October to December 2010.<sup>10</sup>

In establishing the diagnosis of chronic sinusitis, an objective examination is necessary because the symptoms that appeared could be non-specific.<sup>4</sup> The essential examinations for sinusitis are anterior rhinoscopy, nasoendoscopy, and radiological imaging. Radiological imaging involved paranasal sinuses x-ray, paranasal sinuses Computed Tomography (CT) Scan, and Magnetic Resonance Imaging (MRI). The radiologic examination is often necessary to confirm chronic sinusitis.<sup>11</sup> However, the CT scan of the paranasal sinuses is the gold standard in confirming the diagnosis of chronic sinusitis.<sup>12</sup> Mucosal abnormalities, sinus ostium obstruction, anatomic variations, and nasal polyps can be depicted well by CT scan.<sup>3</sup> However, the disadvantages of CT scan are its relatively high cost and the large radiation dose.<sup>13</sup>

This study was conducted at the Regional General Hospital Dr. Zainoel Abidin (RSUDZA) Banda Aceh, a referral hospital in Aceh. There has never been such a similar study before. Based on the description above, we are interested to learn more about the characteristics of patients with chronic sinusitis based on CT scan images without contrast at the ENT-Head and Neck Surgery polyclinic, RSUD Dr. Zainoel Abidin, Banda Aceh, Indonesia.

## MATERIALS AND METHODS

This descriptive study was conducted using retrospective data from medical records, describing age, gender, location of the affected sinus, number of affected sinuses, presence of nasal polyps, and anatomical variations based on non-contrast CT scan. This study was located at the Regional General Hospital DR. Zainoel Abidin Banda Aceh, precisely at the ENT-Head and Neck Surgery Polyclinic and Radiology Installation. This study was held from May to December 2020, with data collection time from 23 September to 13 October, 2020.

The population in this study were adults with symptoms of chronic sinusitis. The patients were treated at the ENT-Head and Neck Surgery Polyclinic, RSUD DR. Zainoel Abidin Banda Aceh in 2019. The sample in this study was patients with chronic sinusitis who met the inclusion and exclusion criteria. The sampling method of this study was using a non-probability side method or the consecutive sampling method. Univariate analysis was used to obtain the frequency distribution and the percentage of the variables studied.

## RESULTS AND DISCUSSION

This study was conducted at the ENT-Head and Neck Surgery Polyclinic and the Radiology Installation of RSUD Dr. Zainoel Abidin Banda Aceh, in September and October 2020. The number of outpatients who had symptoms of chronic sinusitis and went to the ENT-Head and Neck Surgery Polyclinic RSUDZA in 2019 amounted to 146 people; however, there were 35 samples that could not be used because they did not meet the inclusion criteria, so that the total sample in this study amounted to 111 people with the following characteristics as shown in Table 1.

Based on Table 1, the majority of the respondents were aged 30-39 years among 42 people (37.8%). The results of this study are in accordance with the study conducted by Julyanti that most chronic sinusitis occurs at the age of 31-40 years in a sample of 30 people (25.2%).<sup>17</sup> A study by Sogebi<sup>18</sup>

**Table 1.** Characteristics of Patients with Chronic Sinusitis by Age

Age (year)	n	%
20-29	24	21.6
30-39	42	37.8
40-49	23	20.7
50-59	22	19.8
Total	111	100

found that the age group of 31-45 years was often affected by chronic sinusitis using a sample of 48 people (33.6%).<sup>18</sup> Moreover, a study by Pirzadeh et al.<sup>19</sup> found chronic sinusitis mostly occurred in the age group of 30-39 years in a sample of 25 people (30.1%).<sup>19</sup> Adults are more involved in outdoor activities and more at risk of exposure to the allergens or pollution that may cause or exacerbate chronic sinusitis.<sup>20</sup>

**Table 2.** Characteristics of Chronic Sinusitis by Gender

Gender	n	%
Male	52	46.8
Female	59	53.2
Total	111	100

Based on Table 2, 59 female patients (53.2%) had chronic sinusitis in line with the study by Trihastuti et al.<sup>21</sup> of 38 women (60.32%), compared to 25 men (39.68%).<sup>21</sup> In a sample of 42 people, Aritonang<sup>22</sup> also found that more women (52.5%) suffer from chronic sinusitis.<sup>22</sup> A study by Pirzadeh et al.<sup>19</sup> of 49 subjects (women 55.4%, men 44.6%)<sup>19</sup> found women are more likely to have a high level of concern for health, thus, women visit health services more often.<sup>14</sup> Women were also more susceptible to infection and obstruction due to the small size of the sinus ostium.<sup>23</sup> However, Amelia et al.<sup>7</sup> found that of 73 people, chronic sinusitis was more commonly found in men (43, 58.9%) than women (30, 41.1%) with the ratio of male and female with chronic sinusitis 1.4:1.<sup>7</sup> Men have more smoking habit and are more often exposed to pollution than women.<sup>23</sup>

Based on the non-contrast CT scan, the characteristics of patients with chronic sinusitis showed the location of the affected sinus, the number of affected sinuses, the presence of nasal polyps, and anatomical variations. The characteristics of patients with chronic sinusitis based on a non-contrast CT scan shown in Table 3.

**Table 3.** Distribution of Affected Sinuses

Location of the affected sinus	Yes		No	
	n	%	n	%
Sinus frontalis	32	28.8	79	71.2
Sinus ethmoidalis	51	45.9	60	54.1
Sinus maksilaris	110	99.1	1	0.9
Sinus sphenoidalis	26	23.4	85	76.6

Based on Table 3, it was found that the location of the sinus that was most affected was the maxillary sinus in a sample of 110 people (99.1%). Fadda and Aversa explain that the maxillary sinus is the sinus that is most often involved in chronic sinusitis.<sup>15</sup> Kurniasih and Ratnawati<sup>24</sup> also found that the maxillary sinus was the most common sinus in a sample of 106 people (86.89%).<sup>24</sup> Enema Job also remarked that the maxillary sinus was the most frequently involved sinus in a sample of 49 people (81.7%), followed by the ethmoid sinus in 41 people (68.3%), frontal sinus in 24 people (40%), and the least was the sphenoid sinus in 12 people (20%).<sup>25</sup> The maxillary sinuses have an ostium that is located higher than the sinus base, thus the maxillary sinus drainage depends on the ciliary function. If an infection occurs, it will impair the ciliary function and interfere with sinus drainage which will eventually lead to chronic sinusitis.<sup>26</sup> The inferior wall of the maxillary sinus is also adjacent to the roots of the 1st and 2nd molars, which can cause minor elevations or spots. Protruding along the maxillary sinus. The anatomic relationship of the maxillary molars to the maxillary sinus may facilitate the development of periapical or periodontal odontogenic infection within the maxillary sinus. Maxillary sinus may facilitate the development of periapical or periodontal odontogenic infection within the maxillary sinus.<sup>27</sup>

**Table 4.** Distribution of the Number of Sinuses Affected

Sinuses affected	n	%
Single sinusitis	58	52.3
Multisinusitis	35	31.5
Pansinusitis	18	16.2
Total	111	100

Table 4 shows the number of sinuses affected was single sinusitis, which was 58 people (52.3%). Makusidi found that single sinusitis often occurred in 86 people (58.9%).<sup>28</sup> Nova Sitinjak also found 104 cases of single sinusitis (63.8%).<sup>29</sup> However, Multazar et al.<sup>30</sup> stated that chronic sinusitis was more common in multiple sinuses (multisinusitis) in a sample of 22 people (88%). This may be related to the osteomeatal complex (KOM) as the final route of drainage from the frontal sinus, maxillary sinus, and ethmoidal sinus. Thus, if there are some disturbances in KOM, such as inflammation or edema, this will allow the occurrence of chronic sinusitis in several sinuses (multisinusitis).<sup>16,30</sup>

**Table 5.** Distribution of Nasal Polyps

Nasal Polyps	n	%
Chronic Sinusitis With nasal polyps	22	19.8
Chronic Sinusitis without nasal polyps	89	80.2
Total	111	100

Based on Table 5, it was found that chronic sinusitis without nasal polyps was more common than chronic sinusitis with nasal polyps in a sample of 89 people (80.2%). This is in accordance with Benjamin et al who also found that 507 people (82%) had chronic sinusitis without nasal polyps while 111 people (18%) had chronic sinusitis with nasal polyps.<sup>31</sup> Cho et al.<sup>32</sup> also stated that chronic sinusitis without nasal polyps is more common than chronic sinusitis with nasal polyps.<sup>32</sup> However, Rowe<sup>33</sup> also stated that nasal polyps are only involved in 15-20% of patients.<sup>33</sup> Chronic sinusitis without nasal polyps is more common than chronic sinusitis with nasal polyps. Chronic sinusitis without nasal polyps is characterized by edema and



inflammation of the sinuses which can be caused by several factors, such as allergies, irritation, and infection, while chronic sinusitis with nasal polyps is characterized by a soft mass formed from the mucous membrane in the nasal cavity called nasal polyps. These polyps can become large enough to block the sinuses and cause sinusitis symptoms.<sup>34</sup> The inflammatory reaction in chronic sinusitis without nasal polyps is Th1 and Th2 mediated, whereas chronic sinusitis with nasal polyps is Th2 dominant, which is characterized by high tissue eosinophilia. It is generally accompanied by an increase in tissue mast cells, innate lymphoid cells, immunoglobulin E, and Th2 cytokines.<sup>35</sup> Chronic sinusitis without nasal polyps shows basal membrane thickening, goblet cell hyperplasia, subepithelial edema, and mononuclear cell infiltration. Meanwhile, chronic sinusitis with nasal polyps shows epithelial damage, edema, and a reduced number of blood vessels and glands.<sup>31</sup>

**Table 6.** Distribution of Anatomical Variations

Anatomical Variation	Yes		No	
	n	%	n	%
Septal Deviation	25	22,5	86	77.5
Konka bulosa	3	2.7	108	97.3
Konka media paradoks	0	0	0	0
Haller Cell	0	0	0	0
Agger Nasi Cell	0	0	0	0
Onodi Cell	0	0	0	0

Table 6 shows that the most anatomical variation was the septal deviation among 25 people (22.5%). This is in accordance with Shivakumar et al, that the most common anatomical variation was the septal deviation among 98 people (71%).<sup>36</sup> Moreover, Ratnawati<sup>37</sup> stated that septal deviation was the most common anatomical variation among 24 people (77%).<sup>37</sup> Aramani et al.<sup>38</sup> also found that 40 people (74.1%) had a deviated septum and 18 people (33.3%) were chronic sinusitis patients.<sup>39</sup> Septal deviation is an anatomical variation that is often found and one of the predisposing factors for chronic sinusitis. The presence of nasal septal deviation

increased airflow around the osteomeatal complex (KOM), which can result in disruption of the mucociliary clearance process.<sup>5,40</sup> Ajmal<sup>41</sup> found that C-shaped deviation was the type that caused the most chronic sinusitis of 62.5% of 150 patients with chronic sinusitis, while the S-shaped deviation can cause pansinusitis because the S-shaped deviation can block the flow of air in both noses.<sup>41</sup> While concha bullosa is pneumatization that occurs in the concha media and can narrow the semilunar hiatus and block the infundibular drainage, resulting in sinusitis.<sup>42</sup> The bullous conchae are small with a vertical height of less than 50% of the total median conchae as measured on a coronal CT scan. While the bullous conchae are said to be large if the vertical height is more than 50% with an increase in the volume of the media conchae. Do Santos<sup>43</sup> found large bullous turbinates were more than small bullous cones in a sample of 222 people (80%).<sup>43</sup>

The paradoxical middle turbinate is a condition when the median turbinate bends laterally and can lead to narrowing of the COM and chronic sinusitis.<sup>38</sup> Haller cells or infraorbital ethmoid cells are located between the maxillary and orbital sinuses. It can increase the risk of orbital injury during ethmoidectomy. Haller cells potentially narrow the maxillary sinus ostium or ethmoid infundibulum which can obstruct the ostium.<sup>16</sup> Agger nasi cells are the most anterior ethmoidal cells that can narrow the frontal recess and block the frontonasal duct causing sinusitis.<sup>40</sup> Onodi cells are the rarest anatomical variation and can extend to the sphenoid sinus and surround the optic nerve. It is necessary to be careful in performing functional endoscopic sinus surgery.<sup>39</sup>

## CONCLUSIONS

Patients with chronic sinusitis mostly are aged 30-39 years and primarily women. Based on a CT scan without contrast, the most affected sinus is the maxillary sinus. The number of sinuses affected in chronic sinusitis is single sinusitis. Chronic sinusitis without nasal polyps is more common than chronic sinusitis with nasal polyps. The most anatomical variation is nasal septal

deviation. The number of patients with chronic sinusitis based on CT scan images without contrast in 2019 was 111 patients.

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## CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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