

Literature Review

Chronic rhinosinusitis on radiological examination: literature review

Anshor Nugroho^{*} , Puspita Anggraini Katili, Siti Fauziyah Rahman

Universitas Indonesia, Jakarta, indonesia

 anshor.nugroho@ui.ac.id

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Abstract

Rhinosinusitis is a manifestation of the presence of inflammation in the nasal cavity and mucous membrane of the paranasal sinuses resulting in the formation of fluid or damage to the bone structures below. Radiological support examination in cases of rhinosinusitis can be done with conventional X-ray radiology examination of the paranasal sinuses, which can be combined with computed tomography (CT) or Magnetic Resonance Imaging (MRI) radiology examination. This study compares traditional imaging, CT scanning, and MRI in patients with chronic rhinosinusitis. A comprehensive literature review was employed in the study to locate, analyze and interpreting all information pertaining to chronic rhinosinusitis cases. The maxillaris, frontalis, ethmoidalis, and sphenoidalis sinuses with processus alveolar and petrous ridge can be seen without superposition on conventional x-rays. The complete paranasal sine and its surrounding anatomy can be seen with a CT scan, which has the best sensitivity and can show a difference in slice thickness of just 1 mm. MRI examination can clearly distinguish between soft tissue and body fat and is used to support therapy in cases of rhinosinusitis and does not cause radiation.

Keywords: chronic; radiology; rhinosinusitis

1. Introduction

Rhinosinusitis or inflammation of the nasal cavity and the area of the paranasal sinuses is the main cause of morbidity in daily life which can result in a decrease in the quality of life (Cheng et al., 2021). Symptoms of rhinosinusitis can be classified into three as acute rhinosinusitis, subacute rhinosinusitis and chronic rhinosinusitis. Major or more symptoms or one major symptom accompanied by two minor symptoms that last more than 12 weeks including pain in the facial area, nasal congestion, nasal obstruction, and impaired olfactory sensitivity (Zakrzewska, 2018). Rhinosinusitis can also be caused by allergies that result in allergic rhinitis, both for children and adults (Anamika A, 2019). Chronic rhinosinusitis is a disease characterized by inflammation of the nasal mucosa and paranasal sinuses with a duration of at least 12 weeks (Lintang et al., 2017). Rhinosinusitis is a manifestation of the presence of inflammation in the nasal cavity and mucous membrane of the paranasal sinuses, so that fluid formation or damage to the bone structures below occurs (Beningger, 2016). The main cause of rhinosinusitis is a viral infection that can subsequently be exposed to a bacterial infection (Wardana, 2017). Chronic rhinosinusitis is classified based on the presence or absence of polyps in the nose (Meymane & Shahabi, 2012). Acute upper respiratory tract infections caused by viruses are the biggest factor of rhinosinusitis (Husni, 2015)

Radiology has imaging modalities that are often used to help diagnose chronic rhinosinusitis. The modalities used are conventional X-rays, CT scans and MRI (Singh et al., 2020). In particular conventional x-ray examination of the paranasal sinuses in cases of chronic rhinosinusitis uses several projection methods that focus only on the paranasal sinuses. Whereas in Computerid Tomography (CT) and Magnetic resonance imaging (MRI) can display important information both in the anatomical

structure of the paranasal sinuses and the head. In conventional x-rays have a different concept from CT and MRI, conventional x-rays only provide objective information about inflammation in the paranasal sinuses (Bachert et al., 2014).

This review aims to assess chronic rhinosinusitis imaging collected from an online literature search with a review to identify, evaluate and summarize comparative studies of conventional x-ray imaging, CT scan and MRI in chronic rhinosinusitis cases. A better understanding can help determine the diagnosis of chronic rhinosinusitis will lead to the modality used. As well as providing an overview of diagnostic accuracy in chronic rhinosinusitis imaging (Acharya et al., 2017).

2. Research Methods

This research uses a literature review method that summarizes several literatures. The literature used has an interest or is relevant to the topic and uses systematic review. Research that parses the results of previous studies with predetermined eligibility criteria to answer research questions. Literature review method to identify, evaluate and interpret all findings appropriate to the research topic. The search for topic-appropriate literature is limited to articles published from 2012–2022. The article search was conducted online using the search words "Radiology of Chronic Rhinosinusitis" and "CT and MRI Chronic Rhinosinusitis". Use of keywords as searches in the databases of ScienceDirect, Sage Journals and Google Scholar. After all articles have been obtained and selected, they are reviewed and summarized based on the purpose, author's name, year of publication, and the instruments used as well as research results and suggestions for further research.

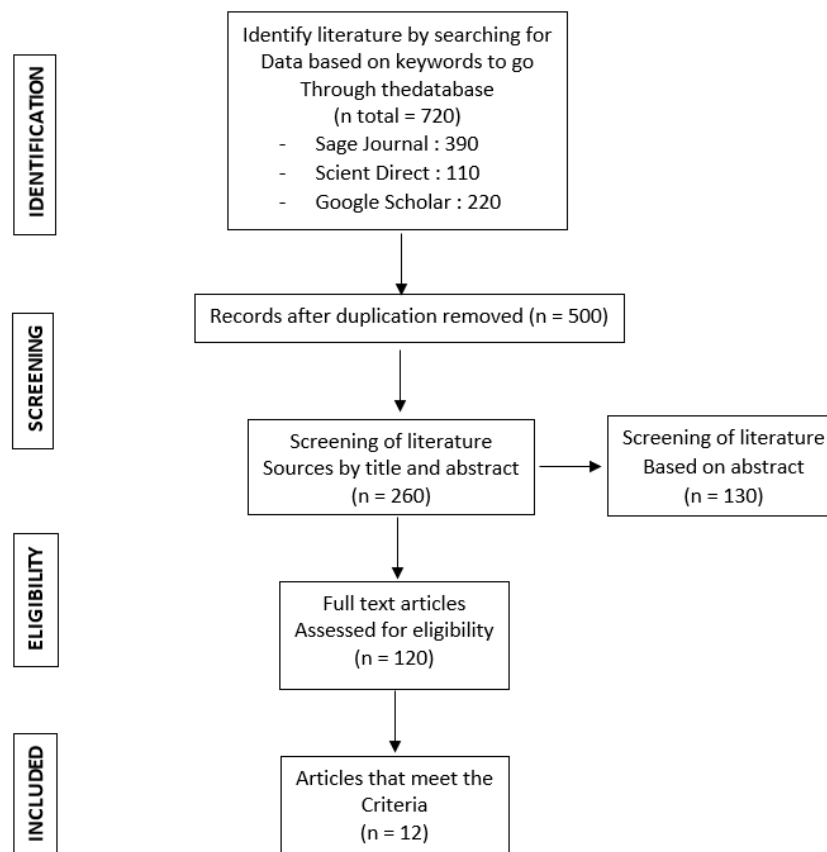


Figure 1. Prism diagram in rhinosinusitis

A search through the database resulted in a search of 39 articles from Sage Journal 6 articles, Scient Direct returned 11 articles and 22 articles from Google Scholar.

3. Results and Discussion

This review relates to clinical chronic rhinosinusitis better on conventional x-ray imaging, CT scan or MRI in steps to help determine clinical diagnosis.

3.1. Conventional X-Ray

Conventional x-ray examination in cases of chronic rhinosinusitis requires several projections to get an idea of the desired object. Projection or radiographic examination technique in cases of rhinosinusitis using paranasal sinus examination using lateral, posteroanterior axial projection (Caldwell method) and parietoacanthial (close mouth waters method) as mandatory projections. Meanwhile, the submentovertex (SMV) and transoral parietoacanthial projections (open mouth waters method) become special projections (Bontrager & Anthony, 1987). Lateral projection can provide an overview of the entire paranasal sinuses, Caldwell projection to display the frontal and anterior sinuses of ethmoidal (Santoso et al., 2017), close mouth projection to reveal the maxillaris sinus (Safitri A, 2019), open mouth projection to show the maxillaris sinus and sphenoidalis sinus and submentovertex projection to reveal the ethmoidalis sinus and sphenoidalis sinus (Setiabudi, 2021). On the projection waters can provide an overview of the diagnosis of sinusitis maxillaris which is one of the symptoms of chronic rhinosinusitis (Posumah, 2013).

In the case of chronic rhinosinusitis, conventional radiological examination uses only the projection of open mouth waters method which will provide an overview of the superposition-free maxillaris sinuses of the alveolar and petrous ridge processes. As well as appearing frontal sinuses and sphenoidalis sinuses by appearing to open the mouth (Felleaningrum et al., 2022). With this projection can give maximum results to the diagnosis of chronic rhinosinusitis. Lateral projection will better reveal the entire paranasal sinuses and provide an overview of the fluid water level in the sinus area so that it can provide a clear picture of chronic rhinosinusitis in the sinus area (Yuliati, 2017). Conventional radiological examinations have disadvantages, including using tapes, positioning patients that cause patients to be less comfortable, and still using radiation sourced from X-rays. Conventional radiology also has less diagnostic sensitivity and specificity when compared to other radiological modalities.

3.2. Computerize Tomography (CT) Scan

CT Scan examination in cases of rhinosinusitis with a repeat scanning system needs to be considered because it will cause a greater dose of radiation than the previous modality (Stölzel et al., 2020). Moreover, CT Scan examination of sensitive areas (eyes) in the area of paranasal sinusitis (Gregurić et al., 2021). CT has the advantage of 3D reconstruction and sensitivity in temporary examinations; (paranasal sinuses) (Zojaji et al., 2015). The diagnosis of chronic and acute rhinosinusitis is not only determined by CT Scan imaging (Dietz et al. 2019). There needs to be follow-up action or follow-up endoscopy action (Bhattacharyya, 2010). In the supporting examination of a CT scan of the paranasal sinuses, a picture of mucosal edema and fluid in the maxillary sinuses, ethmoidalis, sphenoidalis, frontal and rice septal deviation (Massoth et al, 2019) was obtained.

Chronic rhinosinusitis examination of the paranasal sinuses with a CT Scan cannot be done independently because the CT Scan only helps provide a clinical picture or findings that will later be used as a reference for nasal endoscopy and Functional sinus surgery [FESS] (Malaty, 2016). The collaboration between CT scans and FESS in the management of rhinosinusitis cases provides patients with good long-term prognostic indicators (Singh et al., 2020). The analysis of the CT scan can also

provide a comprehensive, objective metyode and can be used to measure the severity of chronic rhinosinusitis and the changes that occur (Likness et al., 2013).

Setting the variation of slice thickness CT Scan at a thickness of 1 mm slice thickness shows deviations in the nasal septum, mucosal thickening, and concha bullosa, 1.5 mm and 2 mm slice thickness appear more clearly on the nasal deviation of the septum and mucosal thickening, 2.5 mm appear most pronounced in the nasal deviation of the septum, 3 mm slice thickness appears clearer than the other slices on the nasal deviation of the septum and concha bullosa (Abdulhamid et al., 2022). The most optimal slice thickness reformat in the CT Scan examination of the paranasal sinuses of the coronal cut is 1 mm, because the 1 mm cut has the highest mean rank value from other slice thickness reformat variations (Safina et al., 2019) The CT Scan showed a significant result with objective findings related to comorbid conditions, complications of chronic rhinosinusitis and the impact of drug use (Ryan et al., 2011).

In the CT Scan in evaluating the image of rhinosinusitis using the Lund-Mackay score calculation method which will later provide a clear picture of the symptoms and indication values of rhinosinusitis, but the score displayed cannot be the main reference in the pathology nenentukan. CT Scan in the future will be one of the modalities that function as an informer or reference for information both before and after the action so that it can provide a clear picture or image (Gevaert et al., 2013). The severity of the CRS and paranasal sinus drainage can be accumulated from the follow-up CT Scan examination. Evaluation is included in the calculation of both the anatomy of the nasal cavity and paranasal sinuses as well as the extent of the disease (Espinosa et al., 2018). In general, CT findings show a statistically significant correlation with various objective findings, such as comorbidity conditions, CRS complications, FESS revision rates or drug use (Wabnitz et al., 2005).

3.3. Magnetic Resonance Imaging (MRI)

MRI or Magnetic Resonance Imaging uses magnets in the examination. One of the advantages of MRI is the absence of a radiation source or not using X-rays in producing body images. MRI has good soft tissue characteristics compared to other radiological modalities (Dong et al., 2019). MRI allows superior visualization and differentiation of paranasal and orbital sinus structures adjacent to the intracranial cavity (Kandemirli et al., 2021). MRI examination of the paranasal sinuses with chronic rhinosinusitis cases using T1-weighted, T2-weighted and STIR (short tau inversion recovery) imaging standards in the sagittal, coronal and axial field positions, so as to clearly distinguish between soft tissue and body fat (Sedat G et al., 2021). On the other hand, MRI also has disadvantages that are quite worrying, namely the magnetic force implanted in MRI is able to block patients who have certain metal objects so that they cannot be examined using MRI, have a long scan time, expensive costs for examination and have a low level of structure in displaying bone images (Sedat G et al., 2021).

4. Conclusion

Modalities often used in helping to determine the diagnosis of rhinosinusitis are conventional x-rays, CT scans and MRIs. Table 1 below provides an explanation of each mode.

Table 1. Advantages and disadvantages of radiological modalities in the diagnosis of rhinosinusitis

No	Modalities	Excess	Deficiency
1	Conventional X Ray	a) The projection of the open mouth waters method gives an overview of the superposition-free maxillaries sinus of the processus alveolar and petrous ridge, as well as the	a) Open mouth waters method projection, not displaying the volume of the paranasal sinuses;

No	Modalities	Excess	Deficiency
		appearance of the frontal sinus and the sphenoidalis sinus.	b) Using tapes, the patient's position resulted in less comfort; c) Less diagnostic sensitivity and specificity.
2	CT Scan	a) 3D reconstruction and high sensitivity on paranasal sinus examination; b) Variations of slice thickness CT Scan at a thickness of 1 mm can show deviations in the nasal septum, mucosal thickening and concha bullosa.	a) A greater dose of radiation than other modalities.
3	MRI	a) Can clearly distinguish between soft tissue and fat on the body; b) The absence of radiation sources or the absence of X-rays in generating body image.	a) Have a low level of structure in displaying bone images; b) It has a long scan time and is expensive.

Radiological support examination in cases of rhinosinusitis can be done with conventional X-ray radiology examination of the paranasal sinuses, can be combined with computed tomography (CT) or Magnetic Resonance Imaging (MRI) radiology examination. Conventional x-ray examination using the waters open mouth method featuring superposition-free maxillaries, frontalis, ethmoidalis and sphenoidalis sinus results with processus alveolar and petrous ridge. CT Scan examination is the modality with the highest sensitivity that can display the entire paranasal sinuses and surrounding anatomy with a variation in slice thickness of 1 mm. MRI examination can clearly distinguish between soft tissue and fat on the body and is used to support therapy in cases of rhinosinusitis and does not cause radiation.

Conventional x-ray examination has the disadvantage of using only one projection, which is that it cannot display the volume of the paranasal sinuses so that it has low sensitivity. CT Scan has the disadvantage that the radiation dose is much larger than other modalities so that it can be detrimental if done repeatedly. MRI has the disadvantage of establishing a diagnosis due to its long scan time and expensive costs. Of the three radiology supporting modalities, a CT scan is the best modality for establishing diagnoses based on sensitivity in displaying images.

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