Jurnal Ilmiah Mahasiswa Kedokteran Universitas Airlangga

JUXTA: Jurnal Ilmiah Mahasiswa Kedokteran Universitas Airlangga
2025 January, XVI (01)

ORIGINAL ARTICLE

Profile of Rhinosinusitis Patients with Orbital Complications at the Ear, Nose, and Throat (ENT) Outpatient Unit, Dr. Soetomo General Academic Hospital, Surabaya, from January 2015 to April 2022

Made Ayu Rheina Putri[1], Budi Sutikno[2,3*], Yulia Primitasari[4,5], Puguh Setyo Nugroho[3,6]

[1]Faculty of Medicine, Universitas Airlangga, Surabaya, Indonesia.
[2]Department of Otolaryngology-Head and Neck Surgery, Faculty of Medicine, Universitas Airlangga/Dr. Soetomo General Academic Hospital, Surabaya, Indonesia.
[3]The Indonesian Otorhinolaryngology-Head Neck Surgeon Association (PERHATI-KL), North East Java Chapter, Surabaya, Indonesia.
[4]Department of Ophthalmology, Faculty of Medicine, Universitas Airlangga/Universitas Airlangga Hospital, Surabaya, Indonesia.
[5]The Indonesian Ophthalmologist Association (PERDAMI), East Java Chapter, Surabaya, Indonesia.
[6]Department of Otolaryngology-Head and Neck Surgery, Faculty of Medicine, Universitas Airlangga/Universitas Airlangga Hospital, Surabaya, Indonesia.

* Correspondence: budi-s@fk.unair.ac.id

ABSTRACT

Introduction: Rhinosinusitis is an inflammation of the mucosa of the nasal cavity and/or paranasal sinuses. The most common complication is orbital. The limited data available does not account for the high number of cases of rhinosinusitis. This study examined the profile of rhinosinusitis patients with orbital complications.
Methods: This was an observational descriptive study with a retrospective design. It used secondary data from medical records of patients with rhinosinusitis and orbital complications at the Ear, Nose, and Throat (ENT) Outpatient Unit, Dr. Soetomo General Academic Hospital, Surabaya, from January 2015 to April 2022.
Results: There were 40 samples that met the inclusion and exclusion criteria (n=40). As many as 80% of cases were chronic rhinosinusitis, and 20% were acute. The average age of chronic rhinosinusitis was in 6th decade, while acute rhinosinusitis (ARS) was in 3rd decade. The majority of patients were males and reside outside Surabaya. Signs and symptoms that ARS patients often experienced were eye pain and swelling, nasal congestion, persistent runny nose, and decreased vision. Meanwhile, chronic rhinosinusitis included eye swelling and pain, persistent runny nose, and facial pain. The most common Chandler's degree was orbital cellulitis (Chandler II). The most common treatment for ARS was a combination of medicamentosa and non-medicamentosa or medicamentosa and surgery, while chronic rhinosinusitis was a combination of medicamentosa, non-medicamentosa, and surgery.
Conclusion: There were outcome differences between patients with acute and chronic rhinosinusitis regarding age, manifestations, and treatments, but there were similarities in sex, domicile, and Chandler's degree predominance.

Highlights:
1. Most rhinosinusitis patients with orbital complications were diagnosed as chronic rhinosinusitis.
2. Orbital cellulitis (Chandler II) was the most common orbital complication degree.
3. Rhinosinusitis patients with orbital complications commonly experience eye pain, swollen eyes, and persistent runny noses.

ARTICLE INFO

Article history:
Received 08-09-2023
Received in revised form 05-12-2024
Accepted 19-12-2024
Available online 10-01-2025

Keywords:
Chandler,
Chronic respiratory diseases,
Orbital complications,
Rhinosinusitis.

Cite this as:
Putri MAR, Sutikno B, Primitasari Y, Nugroho PS. Profile of Rhinosinusitis Patients with Orbital Complications at the Ear, Nose, and Throat (ENT) Outpatient Unit, Dr. Soetomo General Academic Hospital, Surabaya, from January 2015 to April 2022. *JUXTA J Ilm Mhs Kedokt Univ Airlangga* 2025; 16: 50–56.

JUXTA: Jurnal Ilmiah Mahasiswa Kedokteran Universitas Airlangga
p-ISSN: 1907-3623; e-ISSN: 2684-9453
DOI: https://doi.org/10.20473/juxta.V16I12025.50-56

Introduction

Rhinosinusitis is mucosal inflammation of the nasal cavity and/or paranasal sinuses. Paranasal sinuses are cavities between bones of the nose, cheeks, and eyebrows that function to produce mucus.[1] Mucosal inflammation of the nasal cavity and/or paranasal sinuses causes mucosal edema and obstruction of the sinus ostium, disrupting drainage and ventilation and accumulating mucus produced by the paranasal sinuses.[2] Rhinosinusitis can be caused by various pathogens, including viruses and bacteria, and is influenced by several predisposing factors, such as allergies, asthma, immunodeficiency, smoking, pollution, and so on.[3] It is categorized into acute, chronic, and chronic with acute exacerbations based on the duration of symptoms.[1]

Rhinosinusitis is the most common disease in most parts of the world.[1] Based on epidemiological studies, 5-12% of the world's population suffers from chronic rhinosinusitis, while 6-15% experience acute rhinosinusitis (ARS).[1,4] Acute rhinosinusitis is the most prevalent type compared to other forms of rhinosinusitis.[5] Chronic rhinosinusitis affects all age groups, with an incidence of 12.3% in the United States (US), 10.9% in Europe, and 13% in China.[6] In Indonesia, specific epidemiological data on this disease is lacking. However, according to the Basic Health Research (RISKESDAS), the prevalence of acute respiratory infections (ARI) was reported at 9.3%.[7] Data from the Ministry of Health of the Republic of Indonesia in 2003 indicated that nose and sinus diseases ranked 25th out of 50 main disease patterns in Indonesia.[7] Information gathered from various major educational hospitals in Indonesia revealed the mean percentage of adult patients with chronic rhinosinusitis (CRS) in rhinology clinics over three years: Dr. Mohammad Djamil General Hospital, Padang, 83.8%; Dr. Kariadi General Hospital, Semarang, 83.5%; Dr. Saiful Anwar General Hospital, Malang, 85.9%; and Dr. I Goesti Ngoerah Gde Ngoerah General Hospital, Denpasar, 28.9%.[8]

The high prevalence of rhinosinusitis cases significantly impacts the economic burden on society.[9] The costs associated with treating rhinosinusitis are categorized into direct and indirect costs. Direct costs for CRS include hospital treatment, therapy, and surgical treatment if necessary. Meanwhile, indirect costs represent the expenses incurred to compensate for the losses in the quality of human life, such as reduced working hours in the productive age group.[1] In the US, patients with CRS and nasal polyps underwent a notably higher number of medical procedures than the control cohort.[10] Those who underwent functional endoscopic sinus surgery (FESS), the primary surgical procedure, accrued incremental costs of 13,532 USD.[10] Additionally, patients with CRS and nasal polyps demonstrated 3.7 times higher utilization of ambulatory care services and significantly more office visits than the control group.[10] The mean total healthcare cost per patient was 11,507 USD higher than that of the control group.[10]

All types of rhinosinusitis can lead to complications, mostly manifesting locally in the infected sinus area.[11] The most prevalent complications associated with rhinosinusitis are orbital, intracranial, and osseous. Meanwhile, rare complications include lacrimal gland abscesses, mucoceles, and nasal septum perforation.[12]

Anatomically, the paranasal sinuses are closely related to the orbit. The lateral wall of the ethmoidal sinus consists of lamina papyracea, which also serves as the medial wall of the orbit. Additionally, the orbit's floor forms the roof of the maxillary sinus, and the frontal sinus occasionally extends into the orbit roof.[13] Orbital complications of rhinosinusitis occur when the infections extend through the paranasal sinus into the orbital wall.[1] The spread of the infection can occur through the lamina papyracea, local thrombophlebitis, or through infected thromboembolism.[14] Rhinosinusitis with orbital complications is the most common complication of rhinosinusitis, with the percentage of orbital complications reaching 60-80% of all cases in rhinosinusitis.[15] Acute rhinosinusitis is a type of rhinosinusitis with the most common orbital complications.[16] In a study conducted from 2004 to 2016, 57% of cases of orbital complications were related to ARS.[17] Orbital complications are classified into five stages: preseptal cellulitis (Chandler I), orbital cellulitis (Chandler II), subperiosteal abscess (Chandler III), orbital abscess (Chandler IV), and cavernous sinus thrombosis (Chandler V).[1]

Rhinosinusitis constitutes a significant global health concern, contributing to many cases worldwide. This prevalence not only imposes a burden on society but also has a profound impact on lowering the patients' quality of life and productivity. Additionally, orbital complications of rhinosinusitis should not be underestimated, as they represent the most common complications associated with this condition. Unfortunately, existing studies providing data on the profile of rhinosinusitis patients, especially those with orbital complications, remain scarce. Consequently, it becomes necessary and intriguing to delve deeper into the profile of rhinosinusitis patients experiencing orbital complications. This exploration is crucial because profile data is a vital foundation for subsequent interventions and further studies on this disease. Therefore, this study examined the profile of rhinosinusitis patients with orbital complications.

Methods

This was an observational descriptive study with a retrospective study design. It utilized secondary data extracted from medical records of patients with rhinosinusitis and orbital complications at the Ear, Nose, and Throat (ENT) Outpatient Unit, Dr. Soetomo General Academic Hospital, Surabaya, from January 2015 to April 2022. The sampling process employed a total sampling technique. The inclusion criteria for this study encompassed medical records of patients with rhinosinusitis and orbital complications at any age. Meanwhile, the exclusion criteria excluded medical records that did not fulfill all variables necessary for this study. This study adhered to the Strengthening the Reporting of

Observational Studies in Epidemiology (STROBE) guidelines for cross-sectional studies.[18]

Data Analysis

Data obtained from the medical records that passed the inclusion and exclusion criteria were analyzed descriptively and presented in tables containing the profiles of the patients studied.

Results

This study received 50 medical records, of which 10 did not meet the inclusion and exclusion criteria and were therefore not included in the research sample. Hence, this study included 40 data sets from medical records that passed the inclusion and exclusion criteria. Variables in this study were divided into three groups: demographic profile, signs and symptoms, and treatment. Each group was further divided into ARS and CRS.

Demographic Profile

Based on Table 1, it was found that most cases of rhinosinusitis with orbital complications were CRS. The table also showed a significant difference in average age between patients with ARS and CRS.

Table 1. Demographic profile of rhinosinusitis patients with orbital complications

Profile	Number of Cases, n(%)		
	ARS	CRS	Total
Total	8 (20%)	32 (80%)	40 (100%)
Age (years old), mean±SD	29.6±22.1	50.6±16.9	46.4±19.6
Sex			
Male	5 (62.5%)	18 (56.2%)	23 (57.5%)
Female	3 (37.5%)	14 (43.8%)	17 (42.5%)
Domicile			
Surabaya	0 (0%)	1 (3.1%)	1 (2.5%)
Non-Surabaya	8 (100%)	31 (96.9%)	39 (97.5%)

Source: Research data, processed
ARS: acute rhinosinusitis; CRS: chronic rhinosinusitis

Rhinosinusitis patients with orbital complications sampled in this study exhibited a wide range from 3 to 86 years old, with an overall average age of 46.4 years old and a standard deviation of 19.6 years old. The average age differed between ARS and CRS patients. Acute rhinosinusitis patients had an average in the 3rd decade, while CRS patients were in the 6th decade.

Table 2. Signs and symptoms of rhinosinusitis patients with orbital complications

Signs and Symptoms	ARS	CRS	Total
Nasal blockage	6 (75%)	14 (43.8%)	20 (50%)
Persistent runny nose	6 (75%)	22 (68.8%)	28 (70%)
Face pain	3 (37.5%)	19 (59.4%)	22 (55%)
Hyposmia	0 (0%)	2 (6.3%)	2 (5%)
Cough	0 (0%)	2 (6.3%)	2 (5%)
Eye pain	7 (87.5%)	26 (81.3%)	33 (82.5%)
Swollen eye	7 (87.5%)	27 (84.4%)	34 (85%)
Decreased vision	5 (62.5%)	15 (46.9%)	20 (50%)

Source: Research data, processed
ARS: acute rhinosinusitis; CRS: chronic rhinosinusitis

In terms of gender distribution, among overall cases, both ARS and CRS, it was found that the number of male patients exceeded that of female patients. Regarding the domicile variable, the majority of rhinosinusitis patients with orbital complications, both ARS and CRS, reside outside Surabaya.

Table 2 displays signs and symptoms observed in rhinosinusitis patients with orbital complications. The frequently experienced signs and symptoms include a swollen eye, eye pain, persistent runny nose, and face pain, whereas hyposmia and cough were the least frequently reported. Among ARS patients, eye pain, swollen eyes, nasal blockage, and persistent runny nose were commonly found, while face pain was rarely reported, and neither hyposmia nor cough was observed. For CRS patients, frequently observed signs and symptoms were swollen eyes, eye pain, persistent runny nose, and face pain. Some CRS patients experienced decreased vision and nasal blockage, while hyposmia and cough were rarely reported.

Treatment of Acute Rhinosinusitis

Table 3 presents the types of treatment administered to patients at each severity degree (Chandler). This table indicates that non-medicamentosa and medicamentosa treatments were implemented across all Chandler degrees, while surgery was exclusively performed at Chandler II, III, and IV. In addition to the treatment modalities, the table also displays the distribution of patients within each of Chandler's degrees. Based on the table, it was observed that the most common degree of orbital complication among ARS patients was orbital cellulitis (Chandler II). In contrast, cavernous sinus thrombosis (Chandler V) was not identified among ARS patients.

Table 3. Types of treatment for acute rhinosinusitis patients with orbital complications

Type of Treatment	Chandler				
	I (n=2)	II (n=4)	III (n=1)	IV (n=1)	V (n=0)
NM	2 (100%)	2 (50%)	1 (100%)	1 (100%)	0 (0%)
M	2 (100%)	4 (100%)	1 (100%)	1 (100%)	0 (0%)
S	0 (0%)	2 (50%)	1 (100%)	1 (100%)	0 (0%)

Source: Research data, processed
NM: non-medicamentosa; M: medicamentosa; S: surgery

Table 4 outlines combinations of treatment administered to ARS patients with orbital complications. The treatment exclusively consisted of non-surgical approaches for Chandler I patients. In Chandler II cases, the number of patients was evenly distributed across all combination categories. Conversely, for grade III and IV orbital complications, all patients received a comprehensive treatment combination involving medicamentosa, non-medicamentosa, and surgery. If the patients are not stratified into Chandler stages, it can be deduced that the most prevalent treatment combinations of

ARS are both M and NM combination and M, NM, S combination.

Table 4. Treatment combination for acute rhinosinusitis patients with orbital complications

Treatment Combination	Chandler				
	I (n=2)	II (n=4)	III (n=1)	IV (n=1)	V (n=0)
M	0 (0%)	1 (25%)	0 (0%)	0 (0%)	0 (0%)
M+NM	2 (100%)	1 (25%)	0 (0%)	0 (0%)	0 (0%)
M+S	0 (0%)	1 (25%)	0 (0%)	0 (0%)	0 (0%)
M+NM+S	0 (0%)	1 (25%)	1 (100%)	1 (100%)	0 (0%)

Source: Research data, processed
NM: non-medicamentosa; M: medicamentosa; S: surgery

Treatment of Chronic Rhinosinusitis

Table 5 illustrates the types of treatment administered to CRS patients at each severity degree. This table reveals that medicamentosa is the most prevalent treatment for Chandler II and III patients. For CRS patients with Chandler I, IV, and V, medicamentosa is administered as frequently as surgery. Aside from the treatment, the table indicates that orbital cellulitis (Chandler II) was the most common degree of orbital complications among CRS patients. Meanwhile, preseptal cellulitis (Chandler I) was the least common.

Table 5. Types of treatment for chronic rhinosinusitis patients with orbital complications

Type of Treatment	Chandler				
	I (n=2)	II (n=11)	III (n=8)	IV (n=8)	V (n=3)
NM	1 (50%)	9 (81.8%)	4 (50%)	6 (75%)	2 (66.7%)
M	2 (100%)	11 (100%)	8 (100%)	8 (100%)	3 (100%)
S	2 (100%)	10 (91%)	7 (87.5%)	8 (100%)	3 (100%)

Source: Research data, processed
NM: non-medicamentosa; M: medicamentosa; S: surgery

Table 6 outlines treatment combinations for CRS patients based on Chandler's degree. According to the table, medicamentosa, non-medicamentosa, and surgery constituted the most common treatment combination for CRS patients with Chandler II, III, IV, and V. In contrast, there was no variation in the number of patients who received each treatment combination among CRS patients with Chandler I. If the patients are not stratified into Chandler stages, it can be observed that the most prevalent treatment combination of CRS is the M, NM, and S combination.

Table 6. Treatment combination for chronic rhinosinusitis patients with orbital complications

Treatment Combination	Chandler				
	I (n=2)	II (n=11)	III (n=8)	IV (n=8)	V (n=3)
M	0 (0%)	0 (0%)	1 (12.5%)	0 (0%)	0 (0%)
M+NM	0 (0%)	1 (9.1%)	0 (0%)	0 (0%)	0 (0%)
M+S	1 (50%)	2 (18.2%)	3 (37.5%)	2 (25%)	1 (33.3%)
M+NM+S	1 (50%)	8 (72.7%)	4 (50%)	6 (75%)	2 (66.7%)

Source: Research data, processed
NM: non-medicamentosa; M: medicamentosa; S: surgery

Discussion

In this study, 40 cases of rhinosinusitis with orbital complications were identified, with the majority of diagnoses being CRS. This result contrasts a study by El Mograbi, *et al*. (2019) which reported 70 cases of rhinosinusitis with orbital complications, with the majority of the diagnoses being ARS.[17] This difference may arise from the inclusion of CRS cases with acute exacerbations, which, in some countries, are classified as ARS diagnoses, while in Dr. Soetomo General Academic Hospital, Surabaya, these cases are categorized as CRS.[1]

The average age of patients in this study was 46.4 years old. Acute rhinosinusitis patients averaged in the third decade, while CRS patients averaged in the sixth decade. The overall average age in this study is comparable to the research by Diallo, *et al*. (2021), which reported an average patient age of 34.25 years old.[19] Another study indicated that increasing age correlated with decreased physical function, leading to various health problems, including infection.[20]

This study found that rhinosinusitis with orbital complications, both acute and chronic, was more common in males than females. This could be related to men's outdoor activities, which make them more susceptible to infections. These results align with several other studies, which reported a higher incidence of rhinosinusitis with orbital complications in males than females.[21,22] However, in a study conducted on samples of rhinosinusitis patients with or without orbital complications by Snidvongs, *et al*. (2021), it was found that females were predominated.[23]

The domicile variable in this study indicated that the majority of rhinosinusitis patients, both acute and chronic, reside outside Surabaya. This can be attributed to multiple factors, including lower knowledge and awareness among individuals outside Surabaya. Based on data from the Central Bureau of Statistics (BPS), the education level in Surabaya is higher than in other regions in East Java.[24] This contributes to a lower awareness among individuals

outside Surabaya of the need to seek health services, leading to a higher incidence of complications in rhinosinusitis patients. Furthermore, delayed treatment also plays a significant role. Factors contributing to delayed treatment may include patients not perceiving the disease as bothersome, fear, financial constraints, family reluctance to seek healthcare or inaccessible health facilities.[25] This variable has not been extensively discussed in other studies in Indonesia or Surabaya, making it challenging to compare this data with findings from previous studies.

Signs and symptoms of rhinosinusitis patients with orbital complications, both acute and chronic, share some similar findings. Both ARS and CRS patients commonly experience eye pain, swollen eyes, and persistent runny nose. In addition, the majority of ARS patients also experience nasal blockage and decreased vision, while the majority of CRS patients experience face pain. Previous studies on patients' signs and symptoms have also shown varied findings. As cited by Fokkens, *et al*. (2020), Chandler divided orbital complications into five stages based on the disease progression.[1] In Chandler I, the eyeball is not involved. Hence, patients may complain of severe swollen eyes and eye pain. Chandler I may also present signs and symptoms of erythema, fever, no evidence of proptosis, and no limitation of eye movement.[1] Since Chandler I is not related to the involvement of the orbit and globe, signs and symptoms occurring in this degree are dominated by eyelid edema and erythema.[26] Chandler II shows proptosis and a limitation of ocular movement as the inflammation spreads through the orbit. Other typical signs of Chandler II are ocular pain, ophthalmoplegia, and chemosis or conjunctival edema.[1] Conjunctiva plays a role in the eye, protecting it and making it susceptible to infections.[27] Chandler III and IV manifest as edema, erythema, chemosis, proptosis, and limitation of ocular motility. Chandler V may present with non-specific signs and symptoms of systematic inflammatory response, such as high fever, headache, lethargy, and reduced consciousness, or with specific central nervous system signs due to focal neurologic damage or increased intracranial pressure.[1]

This study found some differences in treatment used for ARS and CRS patients. Combination treatment of medicamentosa, non-medicamentosa, and surgery is more often used in CRS patients than in ARS patients. Moreover, surgical treatment for ARS is performed at a higher degree (Chandler II, III, and IV), while for CRS, it is performed at all degrees (Chandler I to V). In terms of maintaining the life and visual function of patients with orbital diseases, making a correct diagnosis is very important.[28]

Previous studies usually present treatment data for rhinosinusitis patients as a single therapy, not as combinations. A retrospective study conducted by Trivić, *et al*. (2019) showed that of 61 ARS patients with orbital complications, 97% were given antibiotic therapy, 50% underwent further action in the form of surgery, and 3% underwent immediate surgery.[29] The results of this study are consistent with the results of the study conducted by Trivić, *et al*. (2019), which stated that medicamentosa therapy is often performed in ARS patients with orbital complications.[29] Among CRS patients in this study, the most frequently used treatment was a combination of medicamentosa, non-medicamentosa, and surgery. This is in line with a retrospective study conducted by Tadros, *et al*. (2023), which stated that 63 of 64 cases of CRS with orbital complications in the research sample received surgical intervention.[30] Another study that divided the patients into five Chandler degrees, conducted by El Mograbi, *et al*. (2019), showed that conservative therapy was enough to treat Chandler I and II patients, while drainage surgery was performed in almost all patients with Chandler III, IV, and V.[17]

Strength and Limitations

The strength of this study lies in the extensive and detailed examination of numerous variables. However, the study faced several limitations. The medical records used as samples were challenging to obtain due to the long time span of the research. Additionally, as a retrospective study, the data was confined to what was documented and could not be further explored.

Conclusion

Based on the data collected in this study, most rhinosinusitis patients with orbital complications were diagnosed with CRS. In terms of demographic profiles, on average, CRS patients were older than ARS patients. Additionally, rhinosinusitis patients with orbital complications, whether ARS or CRS, commonly reside in cities outside Surabaya. Signs and symptoms observed in ARS and CRS patients with orbital complications shared some similarities but also exhibited differences. Both ARS and CRS patients commonly experienced eye pain, swollen eyes, and persistent runny nose. Furthermore, the majority of ARS patients also reported nasal blockage and decreased vision, while the majority of CRS patients experienced face pain.

This study also classified patients based on Chandler's classification for orbital complications. According to this classification, orbital cellulitis (Chandler II) was the most common degree in all patients, both ARS and CRS. Treatments used in ARS and CRS patients showed slight differences. The most common treatments for ARS patients were a combination of medicamentosa and non-medicamentosa or a combination of medicamentosa and surgery. Meanwhile, in CRS patients, the most common treatment was a combination of medicamentosa, non-medicamentosa, and surgery.

Acknowledgments

The first author would like to thank the supervisors and the staff of the Department of Otolaryngology-Head and Neck Surgery, Dr. Soetomo General Academic Hospital, Surabaya, for their assistance in conducting this study.

Conflict of Interest

The authors declared there is no conflict of interest.

Funding

This study did not receive any funding.

Ethical Clearance

This study had received ethical clearance from the Ethics Committee, Dr. Soetomo General Academic Hospital, Surabaya (No. 1089/LOE/301.4.2/X/2022) on 20-10-2022.

Authors' Contributions

Conceptualization: MARP, BS, YP. Methodology: MARP, BS, YP. Formal analysis and investigation: MARP. Writing – original draft preparation: MARP, BS, YP, PSN. Writing – review and editing: MARP, BS, YP, PSN. Resources: BS, YP, PSN. Supervision: BS, YP, PSN.

References

1. Fokkens WJ, Lund VJ, Hopkins C, Hellings PW, Kern R, Reitsma S, *et al*. European Position Paper on Rhinosinusitis and Nasal Polyps 2020. *Rhinology* 2020; 58: 1–464. [PubMed]
2. Sharma GK, Lofgren DH, Hohman MH, Taliaferro HG. Recurrent Acute Rhinosinusitis. Treasure Island (FL), 2025. [PubMed]
3. Czerwaty K, Piszczatowska K, Brzost J, Ludwig N, Szczepański MJ, Dżaman K. Immunological Aspects of Chronic Rhinosinusitis. *Diagnostics (Basel, Switzerland)*; 12. September 2022. [PubMed]
4. Dietz de Loos D, Lourijsen ES, Wildeman MAM, Freling NJM, Wolvers MDJ, Reitsma S, *et al*. Prevalence of Chronic Rhinosinusitis in the General Population based on Sinus Radiology and Symptomatology. *J Allergy Clin Immunol* 2019; 143: 1207–1214. [PubMed]
5. DeBoer DL, Kwon E. Acute Sinusitis. Treasure Island (FL), 2024. [PubMed]
6. Albu S. Chronic Rhinosinusitis-An Update on Epidemiology, Pathogenesis and Management. *Journal of Clinical Medicine*; 9. July 2020. [PubMed]
7. Ministry of Health of the Republic of Indonesia (Kementerian Kesehatan Republik Indonesia). *Hasil Utama RISKESDAS 2018*. Jakarta, (2018). [Website]
8. Ministry of Health of the Republic of Indonesia (Kementerian Kesehatan Republik Indonesia). Keputusan Menteri Kesehatan Republik Indonesia Nomor HK.01.07/MENKES/1257/2022 tentang Pedoman Nasional Pelayanan Kedokteran Tata Laksana Rinosinusitis Kronik. Indonesia, (2022). [Website]
9. Chapurin N, Khan S, Gutierrez J, Soler ZM. Economics of Medical and Surgical Management of Chronic Rhinosinusitis with Nasal Polyps: A Contemporary Review. *Am J Rhinol Allergy* 2023; 37: 227–231. [PubMed]
10. Bhattacharyya N, Villeneuve S, Joish VN, Amand C, Mannent L, Amin N, *et al*. Cost Burden and Resource Utilization in Patients with Chronic Rhinosinusitis and Nasal Polyps. *Laryngoscope* 2019; 129: 1969–1975. [PubMed]
11. Asiri MA, Almusallam MH, Almashari Y, Allarakia Y, Alhedaithy RA. Orbital and Intracranial Complications of Acute Rhinosinusitis in a Tertiary Center, Saudi Arabia. *Cureus* 2023; 15: e42866. [PubMed]
12. Searyoh K, Lubbe D. Complications of Rhinosinusitis. *South African Fam Pract* 2018; 60: 17–20. [Journal]
13. Salgado-López L, Campos-Leonel LCP, Pinheiro-Neto CD, Peris-Celda M. Orbital Anatomy: Anatomical Relationships of Surrounding Structures. *J Neurol Surg B Skull Base* 2020; 81: 333–347. [PubMed]
14. Lipe DN, Afzal M, King KC. Septic Thrombophlebitis. Treasure Island (FL), 2025. [PubMed]
15. Bennett S, Meghji S, Syeda F, Bhat N. Neurological Complications of Acute Rhinosinusitis: Meningitis. *Allergy & Rhinology (Providence, R.I.)* 2021; 12: 2152656721996258. [PubMed]
16. Ramadan HH, Baroody FM. *Pediatric Rhinosinusitis*. Springer International Publishing, (2020). [Book]
17. El Mograbi A, Ritter A, Najjar E, Soudry E. Orbital Complications of Rhinosinusitis in the Adult Population: Analysis of Cases Presenting to a Tertiary Medical Center Over a 13-Year Period. *Ann Otol Rhinol Laryngol* 2019; 128: 563–568. [PubMed]
18. Cuschieri S. The STROBE Guidelines. *Saudi J Anaesth* 2019; 13: S31–S34. [PubMed]
19. Diallo AO, Balde R, Diallo OR, Dabo I, Sinayoko A, Diallo KP. Epidemiological, Clinical and Therapeutic Profiles of Ophthalmological Complications of Rhino-Sinusitis in a Tertiary Facility in Black Africa. *Int J Otolaryngol Head Neck Surg* 2021; 10: 222–228. [Journal]
20. Hanum FM. Patient Assessment of Interpersonal Quality in Outpatient Installation Clinic Hospital Eye Undaan. *Indones J Public Heal* 2020; 15: 133–145. [Journal]
21. Trbojević T, Penezić A, Sitaš I, Grgić MV, Ravlić MM, Štefanović IM. Interdisciplinary Care in Orbital Complications of Acute Rhinosinusitis in Children. *Indian J Ophthalmol* 2023; 71: 242–248. [PubMed]
22. Syauqie M, Rahman A. Manifestasi Klinis Okular dan Orbital pada Penyakit Sinus Paranasal dan Manajemennya di RS Dr. M. Djamil Padang. *Ophthalmol Indones* 2019; 45: 90. [Journal]
23. Snidvongs K, Chitsuthipakorn W, Akarapas C, Aeumjaturapat S, Chusakul S, Kanjanaumporn J, *et al*. Risk Factors of Orbital Complications in Outpatients Presenting with Severe Rhinosinusitis: A Case-Control Study. *Clin Otolaryngol* 2021; 46: 587–593. [PubMed]
24. Central Bureau of Statistics of Surabaya (Badan Pusat Statistik Kota Surabaya). *Penduduk 10 Tahun Ke atas Menurut Kabupaten/Kota dan Tingkat Pendidikan Tertinggi yang Ditamatkan di Jawa Timur, 2012 (persen)*. Surabaya, (2020). [Website]
25. Naimatuningsih N, Soebagjo H, Setiawati R, Loebis R. The Correlation between Family Socioeconomic Status and the Delayed Treatment of Retinoblastoma Patients at Dr. Soetomo General Hospital Surabaya. *JUXTA J Ilm Mhs Kedokt Univ Airlangga* 2019; 10: 53–56. [Journal]
26. Anastasia R, Zuhria I, Fatmariyanti S. Comprehensive Management of Preseptal Cellulitis with Massive Palpebral Abscess in 72-year-old Man. *Vis Sci Eye Heal J* 2022; 2: 1–5. [Journal]
27. Hartadhi A, Zuhria I, Hermanto B. Conjunctivitis Patients in the Ophthalmology Outpatient Clinic Dr. Soetomo General Academic Hospital, Surabaya, in 2017. *JUXTA J Ilm Mhs Kedokt Univ Airlangga* 2023; 14: 17–19. [Journal]

28. Sudrajat N, Lutfi D. Difficulty in Management of Advanced Pediatric Orbital Tumor. *Vis Sci Eye Heal J* 2021; 1: 6–9. [Journal]
29. Trivić A, Cevik M, Folić M, Krejovic-Trivić S, Rubino S, Micić J, *et al*. Management of Orbital Complications of Acute Rhinosinusitis in Pediatric Patients: A 15-Year Single-Center Experience. *Pediatr Infect Dis J* 2019; 38: 994–998. [PubMed]
30. Tadros D, Tomoum MO, Shafik HM. Orbital Complications of Chronic Rhinosinusitis: Two Years' Experience in a Tertiary Referral Hospital. *Ocul Immunol Inflamm* 2023; 31: 292–297. [PubMed]