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SINUSITIS-RELATED ORBITAL COMPLICATIONS IN CHILDREN: FREQUENCY, DIAGNOSIS, AND MANAGEMENT TACTICS

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Abstract.

Sinusitis-related orbital complications in children are life-threatening conditions that require timely diagnosis and appropriate management, yet their incidence varies and optimal management protocols in pediatric practice remain debated.

Objective. *To assess the frequency of orbital complications of acute sinusitis in a pediatric otorhinolaryngology (ENT) hospital, analyze diagnostic and therapeutic measures in this patient group, and identify ways to improve management protocols.*

Materials and Methods. *A retrospective analysis was conducted of 210 medical records of patients admitted to the Pediatric Otorhinolaryngology (Department of Bukhara Regional Clinical Hospital between 2022 and the first quarter of 2025 with a diagnosis of acute sinusitis, of which the records of 18 patients with orbital complications were analyzed in detail, with complication type determined according to the Shevrygin and Chandler classification. The study was conducted in accordance with the principles of the World Medical Association Declaration of Helsinki (2013 revision), and the protocol was approved by the Local Bioethics Committee of Bukhara State Medical Institute (Protocol No. 139, dated November 10, 2022), with patient data confidentiality maintained at all stages. Data are presented as absolute numbers and percentages, and statistical analysis was performed using Microsoft Office Excel 2019. This study was conducted as part of the research plan of Bukhara State Medical Institute entitled «Advancing Diagnosis and Treatment Strategies for Inflammatory Otorhinolaryngological Diseases in Pediatric Practice» (2023-2026).*

Results. *Orbital complications of sinusitis were identified in 18 of 210 children (9%), with boys predominating (11 cases, 61.1%) and a mean age of 5.2 years; 72% of cases occurred in preschool-aged children, and the duration of illness prior to admission ranged from 1 to 4 days. Reactive eyelid edema was diagnosed in all 18 cases, and ceftriaxone served as the primary antibacterial therapy (77.8%). Surgical intervention (sinus puncture) was performed in 4 cases (22.2%), and all patients were discharged with clinical recovery.*

Conclusions. *Sinusitis-related orbital complications account for a substantial proportion of ENT pathology in children and occur most commonly in preschool-aged boys, with timely antibacterial therapy playing a key role. Diagnostic and treatment protocols should be reviewed against modern standards, including the implementation of CT and MRI, withdrawal of medications without an established evidence base, and development of clear algorithms for surgical intervention.*

Keywords: *Rhinosinusitis; Orbital Complications; Children; Pediatrics; Reactive Eyelid Edema; Antibacterial Therapy; Diagnosis; Chandler Classification.*

Introduction

Global Context. Acute rhinosinusitis (ARS) is among the most common childhood diseases prompting medical consultations in pediatric and ENT practice. Anatomical features of the pediatric organism – an immature immune system, thin orbital walls, and communication of the ethmoid sinus with the orbit via the porous lamina papyracea – together with the high frequency of viral upper respiratory tract infections, create conditions favorable to bacterial invasion and orbital spread of inflammation [1, 2]. International studies indicate that orbital involvement is the most common complication of sinusitis in children, accounting for 74-85% of all ARS complications [3, 4], and orbital complications of rhinosinusitis (OC) are classified as life- and vision-threatening conditions [5].

In the United States, a paradoxical trend has emerged: although the overall number of hospitalizations for ARS decreased from 8,312 cases in 2006 to 5,592 in 2016, the proportion of orbital complications among hospitalized patients increased from 8.9% to 19.3% over the same period ($p < 0,001$) [6]. Analysis of the National Inpatient Sample yielded similar findings, with an average of approximately 4,500-5,300 pediatric hospitalizations for OC annually [7], and children with orbital complications were significantly younger (mean age 8.6 years) than those with intracranial complications (12.4 years) [6, 8].

European data demonstrate a comparable pattern. The National Pediatric Prospective Study in Sweden found that most preschool-aged children hospitalized for ARS had orbital complications, which were more common among boys and younger children [9]. A retrospective study conducted in Heidelberg, Germany (2014-2023) identified 30 boys (68%) among 44 patients, with 52% of all cases occurring in the post-pandemic period (2022-2023), representing a 30% increase in orbital complications compared with pre-pandemic years [10]. In Italy, a systematic review and meta-analysis of 35 studies identified clinical markers indicating the need for surgical intervention: age older than 9 years, large subperiosteal abscess, reduced visual acuity, ophthalmoplegia, CRP level> 7 mg/dL, and neutrophilia [11].

Experience with orbital complications of ARS in children across the post-Soviet space reveals similar patterns, including a predominance of preschool-aged boys, ethmoidal origin of inflammation, and rapid development of orbital symptoms, with a median of 3 days from disease onset [12]. A multidisciplinary study conducted in Zagreb, Croatia, underscores the need for coordinated

interaction among pediatricians, ENT surgeons, and ophthalmologists, supported by modern imaging methods – MRI and CT – for timely differentiation of preseptal and postseptal forms [12].

In the Central Asian region, orbital complications of sinusitis in children remain a pressing problem because of limited modern diagnostic resources in outpatient settings, delays in seeking specialized care, and continued reliance on outdated treatment regimens. Data from ENT hospitals in the region indicate that polysinusitis (pansinusitis) predominates in the structure of pediatric sinusitis, correlating with a higher risk of orbital spread [13]. Clinical centers in Uzbekistan have likewise observed an increasing frequency of orbital complications of ARS in children during the post-pandemic period, underscoring the need to revise diagnostic algorithms and standards of care [14, 15].

Modern guidelines – primarily the European Consensus on Rhinosinusitis and Nasal Polyps (EPOS 2020)— recommend a stepwise diagnostic approach with mandatory use of neuroimaging when orbital or intracranial spread is suspected [1]. Antibacterial therapy constitutes a key element of management, with its type, dose, and duration determined by the Chandler classification of complications [8, 16], and surgical intervention is indicated when a purulent process – subperiosteal or orbital abscess – is present [11, 16].

Objective

To assess the frequency of orbital complications of acute sinusitis in a pediatric otorhinolaryngology (ENT) hospital, analyze diagnostic and therapeutic measures in this patient group, and identify ways to improve management protocols.

Materials and Methods

A retrospective analysis was conducted of 210 medical records of patients in the Pediatric Otorhinolaryngology Department of Bukhara Regional Clinical Hospital between 2022 and the first quarter of 2025 with a diagnosis of acute sinusitis (all forms), and the records of patients with a documented orbital complication at admission were analyzed in detail, with the form of orbital complication determined according to the Shevrygin classification (9 forms) and the Chandler classification (5 stages). The distribution of patients by sinusitis form is presented in Table 1.

Table 1

Distribution of children by form of acute sinusitis

Form of sinusitis	ICD-10 Code	Boys	Girls
Acute maxillary sinusitis	J01.0	23	34
Acute frontal sinusitis	J01.1	3	1
Acute ethmoidal sinusitis	J01.2	6	2
Other acute sinusitis (polysinusitis)	J01.8	72	60
Total		104	97
Orbital complications (reactive eyelid edema)	-	11	7

Note: Under code J01.8, medical records predominantly documented polysinusitis.

The study was conducted in accordance with the principles of the World Medical Association Declaration of Helsinki (2013 revision), and the protocol was approved by the Local Bioethics Committee of Bukhara State Medical Institute, with patient data confidentiality maintained at all stages.

Data are presented as absolute numbers and percentages, and statistical analysis was performed using Microsoft Office Excel 2019.

This study was conducted as part of the research plan of Bukhara State Medical Institute entitled «Advancing Diagnosis and Treatment Strategies for Inflammatory Otorhinolaryngological Diseases in Pediatric Practice» (2023-2026).

Results and Discussion

During the study period, 210 children with a diagnosis of acute sinusitis were hospitalized in the Pediatric Otorhinolaryngology Department of Bukhara Regional Clinical Hospital, and orbital complications were diagnosed in 18 children (9%); this figure does not reflect the true population frequency of OC, as it excludes outpatients.

Boys predominated, accounting for 11 cases (61.1%) versus 7 girls (38.9%), and patient age ranged from 1 to 14 years. The age distribution is presented in Table 2.

Table 2

Distribution of children with orbital complications by age

Age group	Number of children, n	Proportion of all complications, %
1-3 years	2	11.1
4-6 years	11	61.1
7-10 years	4	22.2
11-14 years	1	5.6
Total	18	100

The predominant age group was children aged 4-6 years (11 cases, 61.1%), and preschool-aged children (1-6 years) accounted for 13 of the 18 patients overall (72.2%). The duration of illness prior to admission was 1-4 days in 15 children (83.3%), indicating rapid involvement of orbital tissues in the inflammatory process.

Among the forms of sinusitis, polysinusitis (J01.8) predominated, accounting for 14 of the 18 cases (77.8%), while 3 children had ethmoidal sinusitis (J01.2) and 1 had maxillary sinusitis (J01.0); this finding aligns with literature data on the predominant role of ethmoiditis in the pathogenesis of orbital spread of inflammation [3, 17].

In all 18 cases (100%), reactive eyelid edema (Form I) was diagnosed according to the Shevrygin classification, which corresponds to Chandler Stage I – preseptal (periorbital) cellulitis. One patient presented with bilateral edema, and one presented with concomitant cheek edema; no purulent forms of orbital complications (subperiosteal abscess, orbital phlegmon) were registered.

Diagnosis was based on clinical data and radiography of the paranasal sinuses; CT or MRI of the orbit and sinuses was not performed in any patient in this series, representing a significant limitation of the diagnostic process.

Antibacterial therapy was prescribed to all 18 patients, and the structure of prescriptions is presented in Table 3.

Table 3

Antibacterial therapy in children with orbital complications

Antibacterial agent	Number of prescriptions, n	%
Ceftriaxone	14	77.8
Amoxicillin/clavulanate	2	11.1
Azithromycin	1	5.6
Other	1	5.6
Total	18	100

Ceftriaxone was used as initial therapy in 14 of 18 patients (77.8%), and a stepwise transition to oral antibiotic administration was performed in 12 patients (66.7%) after 5-6 days of parenteral administration, given positive clinical dynamics.

In addition to antibacterial therapy, all patients received topical decongestants, antihistamines were used in 14 children (77.8%) despite the absence of confirmed allergic rhinitis, and saline irrigation therapy was performed in 11 patients (61.1%).

Surgical and procedural interventions on the paranasal sinuses were performed in 13 of 18 children; the structure of interventions is presented in Table 4.

The predominant age group was children aged 4-6 years (11 cases, 61.1%), and preschool-aged children (1-6 years) accounted for 13 of the 18 patients overall (72.2%). The duration of illness prior to admission was 1-4 days in 15 children (83.3%), indicating rapid involvement of orbital tissues in the inflammatory process.

Table 4

Types of interventions on the paranasal sinuses

Type of intervention	Number of cases	%
Maxillary sinus puncture	4	22.2
Proetz displacement («cuckoo» method)	9	50.0
Conservative treatment only	5	27.8
Total	18	100

The Proetz displacement («cuckoo» method) was used in 9 children (50.0%); puncture of the maxillary sinus was performed in 4 patients (22.2%) in whom radiographic opacification of the sinus was detected. All 18 children were discharged with clinical recovery, after a mean inpatient stay of 8.3 days (range 5-14 days); no recurrences of orbital complications were recorded during follow-up.

The obtained results generally agree with data from international studies: the predominance of boys (61.1%) and preschool age (72.2%) reproduces a consistent demographic pattern described in Swedish, German, and Italian cohorts [9, 10, 11], and the short preceding history (83.3% of patients presenting 1-4 days after onset) aligns with data from Croatian and Serbian authors, who reported a median of 3 days from symptom onset to the development of OC [12].

The proportion of orbital complications in our sample (9%) is somewhat higher than in international population cohorts (4-8%) [3], a difference explained by the hospital-based nature of the sample and the inclusion of only patients with a confirmed diagnosis at admission. The predominance of mild complication forms (Chandler Stage I, 100%) reflects both timely patient presentation and the absence of a referral system directing severe cases to the regional center.

A central limitation of the diagnostic process in this series is the complete absence of neuroimaging (CT/MRI). The EPOS 2020 guidelines and systematic reviews recommend mandatory use of orbital and sinus CT when postseptal forms (Chandler Stages II-V) are suspected, primarily to exclude subperiosteal abscess [18], while MRI is the preferred method in children when

radiation exposure can be limited [10]. Without imaging verification, a hidden purulent process behind the orbital septum cannot be excluded, which may lead to delayed surgical intervention.

Antibacterial therapy with ceftriaxone aligns with current recommendations for managing Chandler Stages I-II complications, although amoxicillin/clavulanate is widely recognized as a first-line agent for moderately severe forms in several European protocols [16, 19]. The prescription of antihistamines (77.8%) in the absence of allergic rhinitis lacks an evidence base and is not recommended by current guidelines [1, 20]. The use of the Proetz displacement method (50% of cases) remains controversial, as this method is not included in current clinical recommendations and data on its efficacy in sinusogenic complications are conflicting [21, 22].

Conclusions

1. Sinus-related orbital complications account for 9% of cases in the pediatric ENT hospital, with the highest risk observed in preschool-aged boys (72.2%), consistent with international data.

2. Orbital complications in children are characterized by a short disease history (1-4 days in 83.3% of cases) and rapid involvement of orbital tissues, with polysinusitis representing the predominant form of sinusitis (77.8%).

3. The absence of CT and MRI in the diagnostic algorithm precludes reliable differentiation between preseptal and postseptal forms of complications. Modern neuroimaging methods must become a mandatory component of the diagnostic protocol for pediatric sinusitis-related orbital complications.

4. Timely antibacterial therapy plays a key role in resolving inflammation: initial use of ceftriaxone followed by a stepwise transition to oral administration ensured clinical recovery in all cases, and switching to oral administration is justified after 5-6 days of parenteral therapy, given positive clinical dynamics.

5. Current treatment regimens require revision, as prescribing antihistamines in the absence of allergy and using the Proetz displacement method for orbital complications lack an evidence base; a clinical algorithm for selecting surgical interventions, with clear indications, timing, and scope based on the Chandler classification, should be developed.

Avenues for Future Research. Development of a standardized regional protocol for managing orbital complications of rhinosinusitis in children represents a promising direction, incorporating mandatory neuroimaging criteria along with CRP and neutrophilia assessment for patient stratification according to the risk of purulent complications. Optimization of initial antibacterial therapy regimens requires a prospective evaluation of the bacteriological profile of pathogens in the Bukhara region. A comparative analysis of clinical outcomes using modern imaging protocols would further justify infrastructure investments in the regional pediatric ENT service.

Author Contributions. N. Narzullayev: scientific supervision, study concept and design, clinical management of patients, critical manuscript editing; B. Rahmonqulov: collection and analysis of medical record data, database development, statistical processing, manuscript preparation; A. Husinov: database development, statistical processing, manuscript preparation. All authors reviewed the final version of the manuscript and gave their consent for its publication.

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РИНОСИНУСИГЕННІ ОРБІТАЛЬНІ УСКЛАДНЕННЯ У ДІТЕЙ: ЧАСТОТА, ДІАГНОСТИКА ТА ТАКТИКА ЛІКУВАННЯ

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Резюме.

Риносинусогенні орбітальні ускладнення у дітей є станами, що загрожують життю, які вимагають своєчасної діагностики та адекватної лікувальної тактики. Частота їх виникнення варіюється, а оптимальні протоколи ведення в педіатричній практиці, як і раніше, залишаються предметом дискусій.

Мета. Оцінити частоту орбітальних ускладнень гострого синуситу в дитячому ЛОР-стаціонарі, провести аналіз діагностичних та лікувальних заходів у даній категорії пацієнтів і визначити шляхи вдосконалення протоколів ведення.

Матеріали та методи. Проведено ретроспективний аналіз 210 історій хвороби пацієнтів дитячого оториноларингологічного відділення Бухарської обласної клінічної лікарні за період з 2022 року по I квартал 2025 року з діагнозом «гострий синусит». Детальний аналіз проведено у 18 пацієнтів з орбітальними ускладненнями. Форма ускладнення визначалася за класифікацією Шевригіна та Чандлера. Дослідження виконано відповідно до принципів Гельсінської декларації ВМА (редакція 2013 року). Протокол схвалено локальним комітетом з біоетики Бухарського державного медичного інституту (Протокол № 139, 10.11.2022). Конфіденційність даних пацієнтів дотримано на всіх етапах дослідження. Дані представлено у вигляді абсолютних значень та процентних часткою. Статистична обробка виконана з використанням Microsoft Office Excel 2019. Робота виконана в рамках плану НДР Бухарського державного медичного інституту за темою «Удосконалення методів діагностики та лікування запальних захворювань ЛОР-органів у педіатричній практиці» (2023-2026 рр.).

Результати. Орбітальні ускладнення синуситу виявлено у 18 із 210 дітей (9%). Переважали хлопчики – 11 (61,1%), середній вік – 5,2 року. У 72% випадків це були діти дошкільного віку. Анамнез захворювання до госпіталізації становив 1-4 доби. У всіх 18 випадках діагностовано реактивний набряк повік. Провідною антибактеріальною терапією був цефтріаксон (77,8%). Хірургічне втручання (пункція пазухи) виконано в 4 випадках (22,2%). Усі пацієнти виписані з клінічним одужанням.

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Висновки. Орбітальні ускладнення синуситу становлять значну частку в структурі ЛОР-патології у дітей і найчастіше зустрічаються у хлопчиків дошкільного віку. Ключову роль відіграє своєчасна антибактеріальна терапія. Потрібен перегляд протоколів діагностики та лікування з урахуванням сучасних стандартів: впровадження КТ та МРТ, відмова від препаратів з недоведеною ефективністю, розробка чітких алгоритмів хірургічних втручань.

Ключові слова: риносинусит; орбітальні ускладнення; діти; педіатрія; реактивний набряк; антибактеріальна терапія; діагностика; класифікація Чандлера.

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