

**P. A. ZATOLOKA, K. N. USTINOVICH**

# **ACUTE BACTERIAL SINUSITIS**

Minsk BSMU 2023

МИНИСТЕРСТВО ЗДРАВООХРАНЕНИЯ РЕСПУБЛИКИ БЕЛАРУСЬ  
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**П. А. Затолока, К. Н. Устинович**

**ОСТРЫЙ БАКТЕРИАЛЬНЫЙ СИНОСИТ**  
**ACUTE BACTERIAL SINUSITIS**

Учебно-методическое пособие



Минск БГМУ 2023

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Отражены основы современных представлений об этиологии и патогенезе острого синусита. Рассматриваются вопросы классификации, клинико-рентгенологические особенности заболевания, а также современные методы лечения острого бактериального синусита и его осложнений.

Предназначено для студентов 4-го курса медицинского факультета иностранных учащихся, обучающихся на английском языке.

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## **ОСТРЫЙ БАКТЕРИАЛЬНЫЙ СИСУСИТ ACUTE BACTERIAL SINUSITIS**

Учебно-методическое пособие

На английском языке

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## LIST OF ABBREVIATIONS

ABS — acute bacterial sinusitis  
b.i.d. — twice daily  
CRP — C-reactive protein  
CT — computerized tomography  
ESR — erythrocyte sedimentation ratio  
IM — intramuscular  
IV — intravenous  
q.d. — once a day  
t.i.d. — three times a day

## MOTIVATIONAL CHARACTERISTIC OF THE TOPIC

### **Quantity of study hours: 2.**

Sinusitis is a highly prevalent disease. About 5–15 % of adults and 5 % of children suffer from different forms of sinusitis. Acute sinusitis is the most common complication of an acute respiratory infection. At the same time the signs and symptoms of acute bacterial sinusitis (ABS) and prolonged viral upper respiratory infection are similar, which makes accurate clinical diagnosis difficult. Thus, the ability to distinguish between acute viral infection and bacterial sinusitis is essential for every clinician. The diagnosis and treatment of acute sinusitis present particular challenges in the pediatric age group. Sinusitis has a negative impact on the quality of life, professional activity. Treatment of sinusitis is accompanied by significant financial costs.

Acute bacterial sinusitis can lead to severe, life-threatening intracranial and orbital complications. Early diagnosis and surgical treatment of such complications are of great importance.

**The purpose of the practical lesson** is to gain knowledge about etiopathogenesis, clinical course, methods of laboratory diagnostics, principles of conservative and surgical treatment, possible complications of acute bacterial sinusitis in pediatric and adult patients.

### **Lesson objectives** is to:

- study the actual predisposing factors and etiology of ABS;
- study the main clinical manifestations of ABS;
- study the modern diagnostic options for ABS;
- study the principal features of ABS in pediatric patients;
- study rhinogenic orbital and intracranial complications and methods of early diagnostic of this pathology;
- study up-to-date methods of treatment of ABS and its complications in paediatric and adult patients.

**Baseline knowledge requirements. Repeat:**

- 1) from the course of *Human Anatomy*:
  - structure of the nose and paranasal sinuses;
  - age features of the nose and paranasal sinuses;
  - innervation and blood perfusion of the nose and paranasal sinuses;
- 2) from the course of *Normal Physiology*:
  - function and physiology of the nose and paranasal sinuses;
  - concept on the physiological condition of the cell, activation, inhibition, parabiosis, pain, selective irritation response of the cell;
- 3) from the course of *Histology, Cytology, Embryology*:
  - microstructure of the mucous membranes of respiratory tract and olfactory region of the nasal cavity;
- 4) from the course of *Pathological Anatomy*:
  - morphological changes of the mucous membranes of the nasal cavity in case of inflammation;
- 5) from the course of *Pathological Physiology*:
  - manifestation and consequences of impairment of nasal breath and barrier function of the nasal cavity;
- 6) from the course of *Radiodiagnostics and Beam Therapy*:
  - assessment of the results of roentgenography, tomography, magnetic resonance imaging and computer tomography;
  - basic methods of roentgenologic diagnostics of the diseases of paranasal sinuses and their interpretation; roentgenologic symptoms of sinusitis;
- 7) from the course of *Microbiology, Virology, Immunology*:
  - nasal cavity microbiology;
  - technics of sampling of microbiological material;
  - microbiological diagnostics of infectious diseases;
- 8) from the course of *Pharmacology*:
  - characteristics and action mechanism of antimicrobial drugs;
  - the mechanism of action of antiseptics and analgesics.

**Control Questions from Related Disciplines:**

1. Enumerate the paranasal sinuses.
2. Identify the structures of the nasal cavity.
3. What is the function of the mucous membrane that lines the nasal cavity and paranasal sinuses.
4. What are the 5 cardinal signs of inflammation?
5. What are the different types of inflammation?
6. What are the radiological signs of purulent effusion, edema, cysts in paranasal sinus?
7. Explain the importance of nasal breathing.
8. Enumerate the main groups of antibacterial drugs. Explain the mechanism of their action, activity, side effects.

### **Control Questions on the Topic:**

1. Definition of acute bacterial rhinosinusitis according to the European Position Paper on Rhinosinusitis and Nasal Polyps.
2. Classification of Sinusitis.
3. Causative microorganisms of ABS.
4. Odontogenic sinusitis bacteriology.
5. Symptoms of ABS.
6. Differentiation of ABS and common cold.
7. The main types of X-ray imaging applied in ABS.
8. Treatment tactics for ABS.
9. Indications for surgical treatment of ABS.
10. Symptoms of orbital complications of ABS.
11. Possible intracranial complications of ABS.

### **Tasks for independent work of students:**

1. Determine the required minimum of examinations for a patient with suspected ABS.
2. Analyze the results of X-ray for curated patients.
3. Analyze the results of cultural methods for the patients with ABS.
4. Plan the treatment of the patient with ABS.
5. Determine the required minimum of examinations for a patient with suspected intracranial complications of ABS.
6. Plan the treatment of the patient with suppurative orbital complications of ABS.

## **DEFINITION**

Sinusitis (synonym rhinosinusitis) — is inflammation of mucus membranes that lines paranasal sinuses.

According to the European Position Paper on Rhinosinusitis and Nasal Polyps 2020, acute sinusitis is defined as sudden onset of two or more symptoms, one of which should be either nasal congestion/blockage/obstruction or nasal discharge (anterior or posterior nasal drip), while the others could be either facial pain/pressure or reduction/loss of smell, lasting up to 12 weeks. In children, acute sinusitis should be considered when there are two or more of the following symptoms: nasal blockage/congestion, discolored nasal discharge, and cough.

Acute bacterial sinusitis is defined by the presence of three or more of the following clinical findings: fever ( $\geq 38$  °C), severe local pain, double sickening, unilateral disease (with discolored mucus), or elevation of C-reactive protein (CRP) / erythrocyte sedimentation ratio (ESR) in blood test (fig. 1).



## Definition of Acute Rhinosinusitis

Increase in symptoms after 5 days, or persistent symptoms after 10 days with less than 12 weeks duration

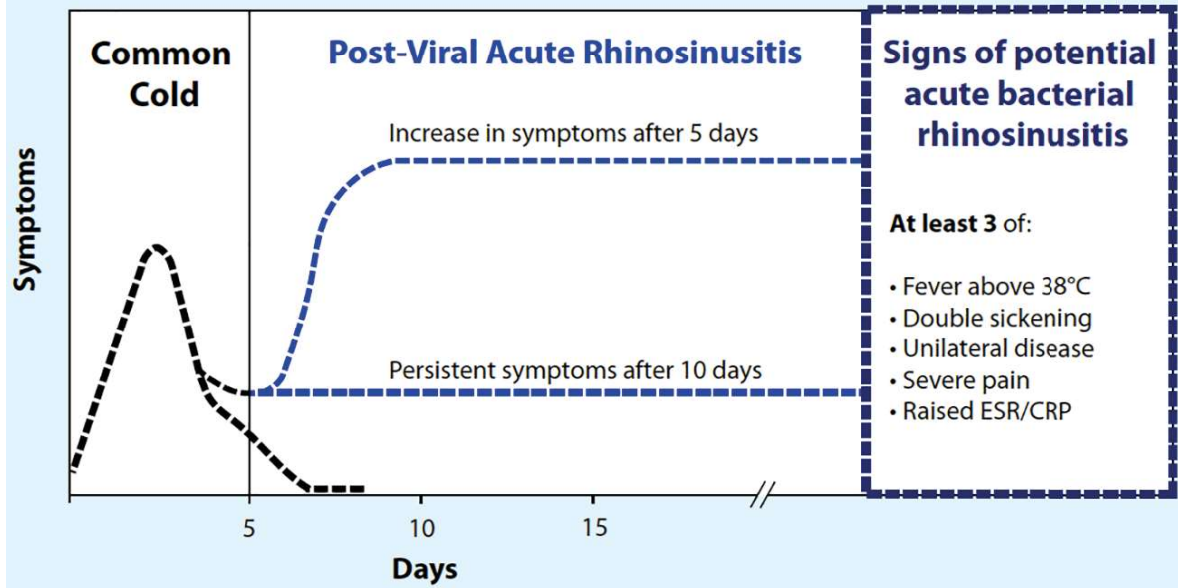


Fig. 1. Definition of acute rhinosinusitis (source: EPOS 2020)

## CLASSIFICATION

Acute sinusitis can be classified according to the:

- 1) affected sinuses:
  - maxillary sinusitis;
  - ethmoid sinusitis;
  - frontal sinusitis;
  - sphenoid sinusitis;
  - pansinusitis — when all listed above sinuses are involved;
- 2) pathogenic organism:
  - viral;
  - bacterial;
- 3) presence of complications:
  - complicated;
  - noncomplicated.

Acute sinusitis is defined as recurrent if there are more than 4 episodes per year with symptom free intervals.

## ETIOPATHOGENESIS

Acute bacterial sinusitis more often develops as a complication of common cold, when infection from the nasal cavity spreads to the paranasal sinuses (rhinogenic sinusitis). Anatomical changes in the nasal cavity, decreased patient's immune state or high virulence of causative microorganism may increase the risk of progression rhinitis to sinusitis. Allergy, environmental factors or swimming may also predispose to infection.

Fractures of the paranasal sinuses may be followed by sinusitis (post-traumatic sinusitis).

Unilateral maxillary sinusitis may develop due to dental infection or previous dentoalveolar procedures (odontogenic sinusitis).

Rhinogenic sinusitis is often caused by *Streptococcus pneumoniae*, *Moraxella catarrhalis*, *Haemophilus influenzae* and more rarely by *Staphylococcus aureus*.

Odontogenic sinusitis has other bacteriology. It is often polymicrobial with a predominantly anaerobic organisms, commonly including *Peptostreptococcus*, *Prevotella*, and *Fusobacterium*. Medical management and treatment of the underlying dental pathology is a critical initial step in the treatment of odontogenic infection.

## CLINICAL FEATURES

Typical symptoms of sinusitis similar to rhinitis and include blocked nose, muco-purulent nasal discharge, postnasal drip, persistent coughing, pharyngeal irritation, hyposmia, general malaise and fever. Differentiation between acute viral rhinitis and acute bacterial sinusitis need to be done. A change in the color or characteristic of the nasal discharge is not a specific sign of bacterial rhinosinusitis. As a rule, duration of these symptoms in acute bacterial sinusitis longer than 10 days. There is no improvement in general patient's condition, quite the contrary, worsening of symptoms within the first ten days could be observed. In contrast, in acute viral rhinitis, these symptoms subside after 5–7 days.

Also, the development of ABS can be indicated by pain over forehead or cheek, increasing when tilting the head down and tenderness to pressure over the affected sinus. In case of maxillary sinusitis the pain may be located over the upper jaw or it could be irradiated to the gums or teeth. Pain in acute frontal sinusitis usually intense and localized over the affected sinus. Pressure over the floor of the frontal sinus immediately above the inner canthus or over the anterior wall of frontal sinus may be painful in this case. In acute ethmoid sinusitis the pain is localized



over the bridge of the nose and it may be aggravated by movements of the eyeball. Headache in case of sphenoiditis is localized in the occiput and deep in the head, less often — in the orbit, crown or temples.

## DIAGNOSTICS

Anterior rhinoscopy with or without endoscopic examination is necessary to assess the nasal mucosa appearance and the presence and color of nasal discharge. Predisposing anatomical variations can also be noted during anterior rhinoscopy.

Purulent secretions in the middle meatus may indicate the development of bacterial maxillary, frontal or ethmoid sinusitis (fig. 2).



*Fig. 2.* Endoscopy of nasal cavity. Track of pus going down from the middle meatus is seen on the picture

Nasal discharge is usually absent in sphenoid sinusitis. In this case, the discharge flows from the sphenoid sinus ostium, located in the superior meatus, directly into the nasopharynx and then along the posterior pharyngeal wall. These secretions can be seen with pharyngoscopy and posterior rhinoscopy (fig. 3). It should be remembered that such postnasal discharge can also be observed in many other diseases (see section «Differential diagnosis»).

In laboratory tests leucocytosis, left shift, elevated ESR and CRP could be revealed.

Diagnostic imaging is indicated if ABS is suspected. Conventional X-ray of paranasal sinuses is preferable in this case. Sinus X-rays may show evidence of

ABS in the form of mucosal thickening, fluid levels or total opacity. An opaque sinus may also be due to thickening of the bony walls or improper rotation of the head leading to difficulty in interpreting radiological appearance.



*Fig. 3.* Pharyngoscopy: mucopurulent discharge on the posterior pharyngeal wall

Conventional X-ray could be done in four projections (fig. 4):

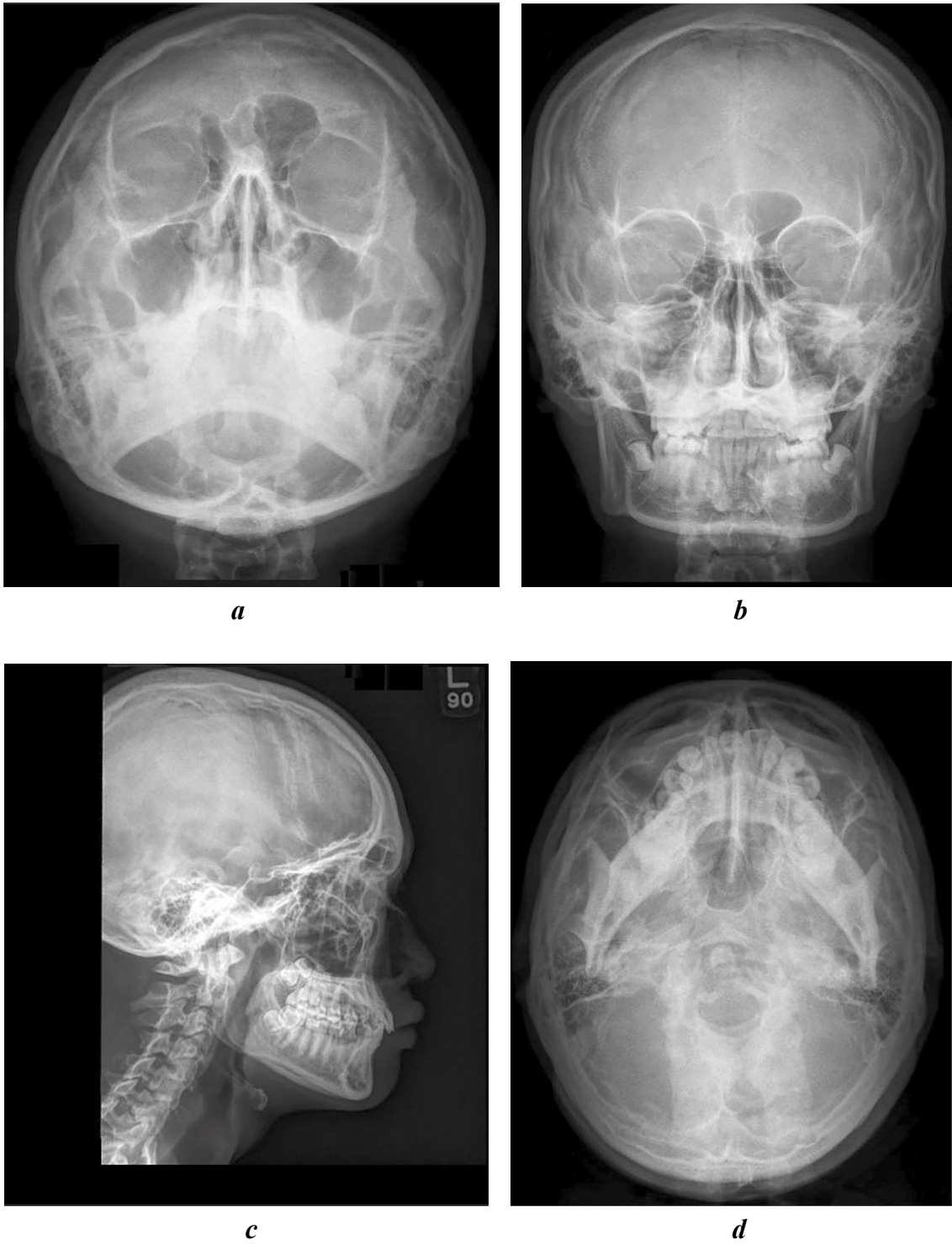
- occipitomental (Waters) view;
- occipitofrontal (Caldwell) view;
- lateral view;
- submentovertex view.

Occipitomental view is the best projection for evaluating maxillary sinuses. The frontal sinus is projected obliquely, the ethmoid air cells are obscured, although a few may be seen along the medial walls of the orbit and within the nose. The sphenoid sinus could be partly seen through the opened mouth.

Occipitofrontal view, is used primarily for the frontal and ethmoid sinuses. The maxillary sinuses are worse visible than in the occipital view. The sphenoid sinus is obscured.

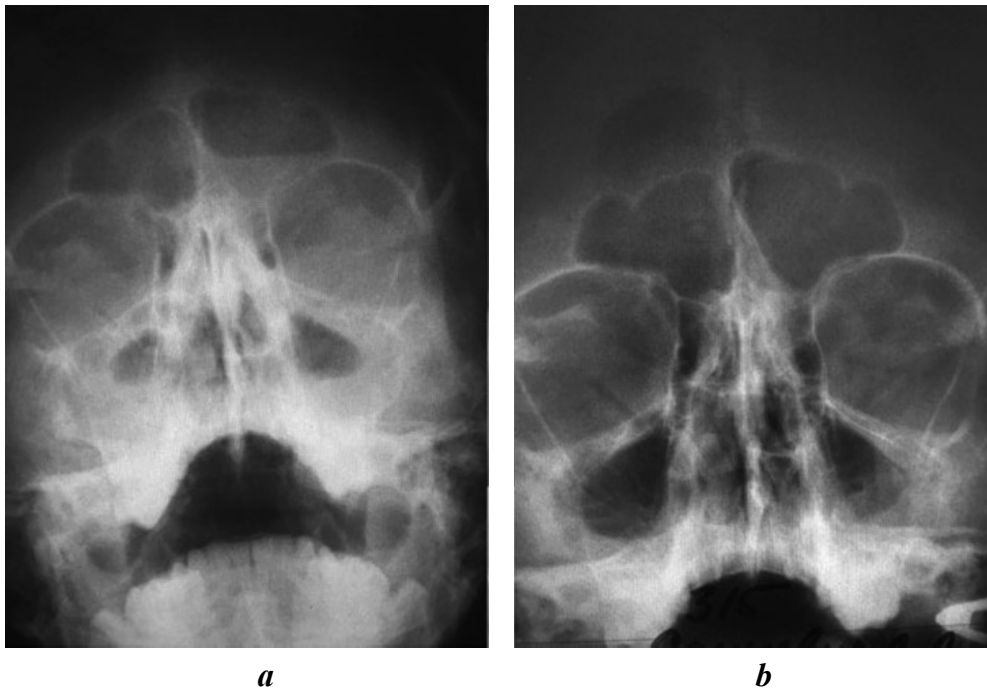
In the lateral view, the sphenoid and frontal sinuses are visualized. The rest of the sinuses are superimposed. This view is necessary to assess the depth of the frontal sinus.

Submentovertex view may be a useful for assessing sphenoid sinus.



*Fig. 4.* Conventional X-ray in occipitomental (*a*), occipitofrontal (*b*), lateral (*c*) and submentovertex (*d*) view (source: Radiology Reference Article <https://radiopaedia.org>)

Taking in account, that maxillary sinus is most often being involved in inflammation in adults, occipitomental view became the most widely used in clinical practice (fig. 5).



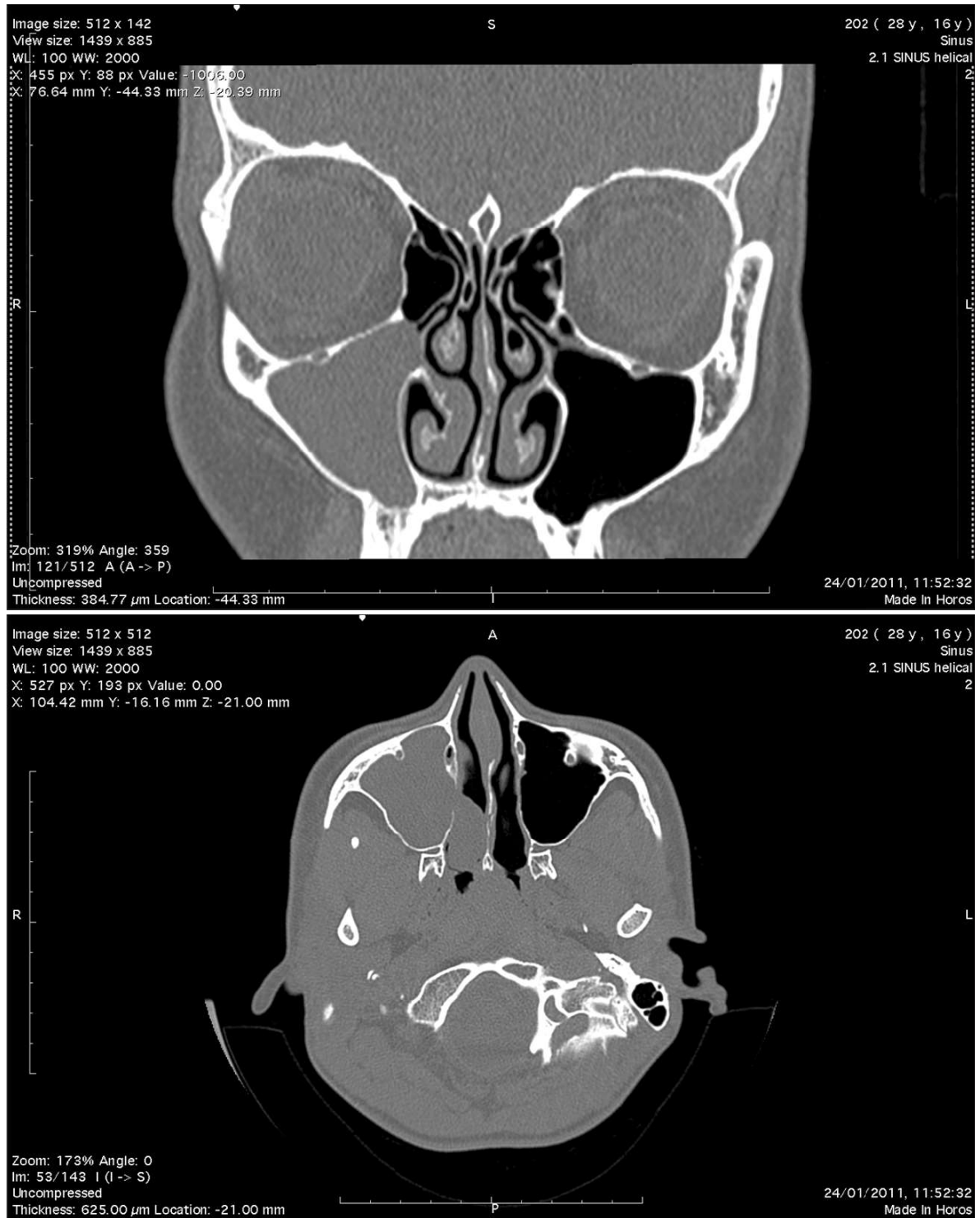
*Fig. 5.* Conventional X-ray of the patient before (*a*) and after (*b*) treatment. Horizontal fluid level in left frontal sinus, partial opacification of both maxillary and anterior ethmoid cells were observed before treatment. Control X-ray demonstrates significant improvement: remains non intense near-wall opacification of the maxillary sinus due to residual oedema of the mucous membranes

Although computerized tomography (CT), cone beam CT and magnetic resonance imaging most relevant for chronic sinusitis, these diagnostic tools could be also indicated in severe or complicated cases of ABS (fig. 6).

## **DIFFERENTIAL DIAGNOSIS**

Diseases to consider in the differential diagnosis include:

- acute viral rhinitis;
- chronic rhinitis, sinusitis;
- allergic and vasomotor rhinitis;
- nasal foreign body;
- enlarged or infected adenoids;
- nasal septum deviation;
- tumors of nose and paranasal sinuses;
- dental infections;
- migraine headache;
- disorders affecting ciliary function (cystic fibrosis, primary ciliary dyskinesia).



*Fig. 6.* CT of paranasal sinuses demonstrates total opacification of the right maxillary sinus in patient with choanal polyp

## TREATMENT

Antibacterial therapy is indicated in case of ABS. First-line therapy is amoxicillin with or without clavulanic acid. In case of allergy to penicillins or if the patient has recently received them, cephalosporins of 2nd and 3rd generation, macrolides or respiratory fluoroquinolones (only for adults) may be prescribed (table). Duration of the treatment vary depending on involved sinuses, severity of the process, and can range from 7 to 14 days.

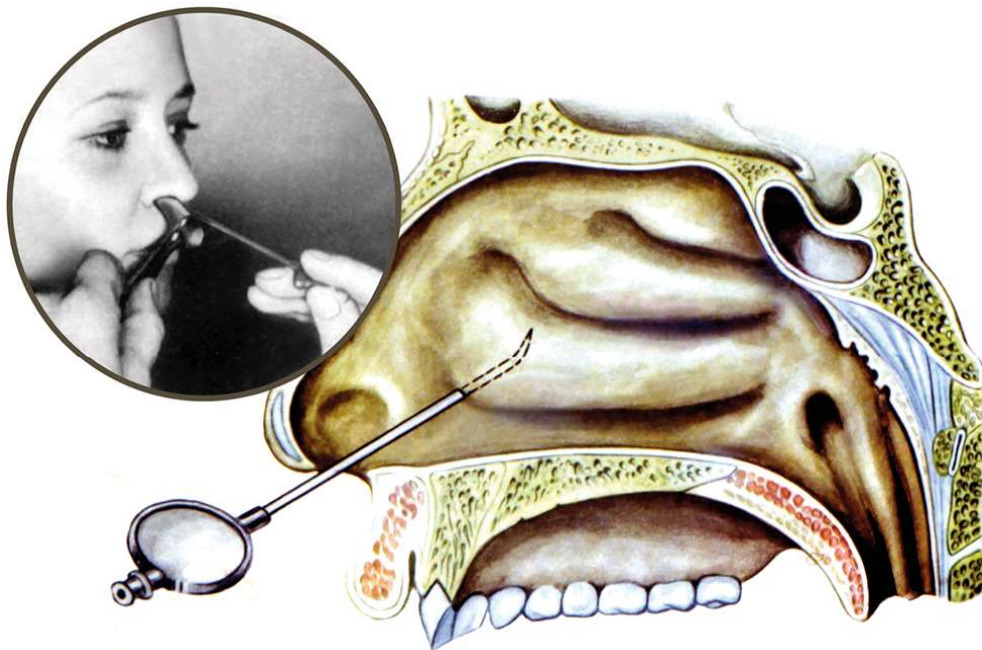
**Doses of antibiotics recommended for treatment of ABS**

Antibiotic	Dosage for adult	Dosage for children
Amoxicillin	Orally: 1000 mg b.i.d., or 500 mg t.i.d.	Orally (b.i.d. or t.i.d.): 45–90 mg/kg/day
Amoxicillin/ clavulanic acid	Orally: 875/125 mg b.i.d., or 500/125 mg t.i.d.	Orally (b.i.d. or t.i.d.): from 45/6,4 mg/kg/day up to 70/10 mg/kg/day
Cefuroxime axetil	Orally: 250 mg b.i.d.	Orally (b.i.d.): 20 mg/kg/day
Cefdinir	Orally: 600 mg q.d. or 300 mg b.i.d.	Orally (q.d. or b.i.d.): 14 mg/kg/day
Cefixime	Orally: 400 mg q.d. or 200 mg b.i.d.	Orally (q.d. or b.i.d.): 8 mg/kg/day
Cefpodoxime	Orally: 200 mg b.i.d.	Orally (b.i.d.): 10 mg/kg/day
Cefotaxime	IM or IV: 1000 mg b.i.d.	IM or IV (b.i.d.): 50–100 mg/kg/day
Ceftriaxone	IM or IV: 1000 mg b.i.d. or 2000 mg q.d.	IM or IV (q.d. or b.i.d.): 20–70 mg/kg/day
Cefepime	IM or IV: 1000–2000 mg b.i.d.	IM or IV (b.i.d.): 50 mg/kg/day
Azithromycin	Orally: 500 mg q.d.	Orally (q.d.): 5–10 mg/kg/day
Clarithromycin	Orally: 250–500 mg b.i.d.	Orally (b.i.d.): 15 mg/kg/day
Ciprofloxacin	Orally: 500–750 mg b.i.d.	Contraindicated in paediatrics
Levofloxacin	Orally: 500 mg q.d.	Contraindicated in paediatrics

Symptomatic therapy may include decongestant nose drops, non-steroidal anti-inflammatory drugs, saline nasal rinsing. Adequate hydration, balanced nutrition and avoidance of hazards (supercooling, tobacco, alcohol, etc.) are also of great importance. Intranasal corticosteroids have demonstrated benefits in management of ABS (could be used in sinusitis from 12 years of age). Mucolytics can be also used to thin secretions.

Surgery for acute sinusitis is undertaken when the infection fails to respond to conservative therapy, as well as for orbital or intracranial complications of sinusitis.

Maxillary sinus puncture and lavage could be performed both under local or general anesthesia (fig. 7). The inferior meatus is optimal drainage site because of its ease of accessibility, relative safety and thin bone that is easy to puncture. In more severe cases of orbital or intracranial complications external approaches to the maxillary sinus is needed: maxillary antrostomy. Frontal sinus trepanation, ethmoidectomy are also indicated in such cases if corresponding sinuses are involved.



*Fig. 7.* Puncture of maxillary sinus

In the past decades, with progression of endoscopic sinus surgery combined with understanding of the importance of mucosal preservation, there has been a shift away from external approaches in the management of inflammatory sinus disease. Modern functional endoscopic sinus surgery is a minimally invasive technique in which sinus air cells and sinus ostia are opened under direct visualization (fig. 8). The goal of such procedures is to restore ventilation and normal function of the sinus. In spite of this, traditional external surgical approaches still preferable in cases of intracranial or purulent orbital complications of sinusitis.



*Fig. 8. Functional endoscopic sinus surgery (source: <https://www.npr.org>)*

## **FEATURES OF ABS IN PEDIATRIC PATIENTS**

In a newborn child ethmoid air cells are the most developed. Maxillary sinus in such children very small and narrow, frontal and sphenoid sinuses are not developed. Later, as the child grows up, the maxillary sinus also develops, and the frequency of maxillary sinusitis increases. Pneumatization of frontal sinuses starts typically after 4 years of age. Therefore in different age groups sinusitis affects different sinuses.

Acute sinusitis in 0–3 years old children predominantly affects the ethmoid air cells due to incomplete pneumatization of the other sinuses. Diagnosis of sinusitis in this age is hard because of dominance of general signs and lack of local symptoms. ABS in these children is characterized by more frequent and earlier development of orbital complications comparing with other age groups.

Combined lesion of ethmoid and maxillary sinuses is typical for ABS in 4–7 years old children. Sinusitis usually develops on the basis of acute respiratory disease. In this age group adenoids also play important role as predisposing factor. In older children, inflammation can involve any sinus due to the development of the frontal and sphenoid sinuses. Development of ABS and its course becomes similar to those in adults.



## COMPLICATIONS

The complications of ABS refer to orbital, intracranial and osseous clinical conditions which are uncommon potentially life-threatening events. The incidence of ABS complications has been shown to be approximately three per million of the population per year despite very different utilization of antibiotics in the various countries and this number has not been reduced by the advent of widespread antibiotic prescribing.

With regard to age predilection, orbital complications seem to be more common in small children while intracranial complications can occur at any age, with a preponderance of young adults.

### Orbital rhinogenous complications

Orbital complications more often arise from ethmoid air cells and frontal sinus, while maxillary and sphenoid sinuses less commonly cause them. Spreading of the sinus infection to the orbit occur more often in children under 6 years of age. However, orbital complications may develop at any age.

Orbital complications may be divided in 2 major groups:

- nonpurulent (orbital edema, preseptal cellulitis);
- purulent (orbital cellulitis, subperiosteal abscess, retrobulbar abscess, orbital phlegmon).

Patients with nonpurulent complications usually present with unilateral eyelid swelling and edema (fig. 9). In contrast, patients with purulent process present with similar findings and ocular symptoms such as eye pain, proptosis, limited ocular mobility and decreased vision. Treatment and management differs based on the exact diagnosis. So, for differentiation between purulent orbital complications not only clinical exam but also CT of the orbits and sinuses is needed.



*Fig. 9.* Upper eyelid oedema in patient with ABS

Nonpurulent complications usually being treated conservative way. Prior treatment of such pathology includes broad-spectrum antibiotics at high doses. Response to antibiotics is usually rapid. If conservative therapy fails to show improvement after 24 to 48 hours, surgery may be indicated. Surgical drainage is compulsory for all cases of purulent inflammation of the orbit.

### **Intracranial rhinogenous complications**

The intracranial complications include epidural empyema, subdural empyema, brain abscess, meningitis, encephalitis, superior sagittal and cavernous sinus thrombosis. These may present both with nonspecific signs and symptoms (high fever, headache, lethargy, reduced consciousness) and with specific central nervous system signs due to focal neurologic damage or increased intracranial pressure. Diagnosis requires high clinical suspicion from practitioners, especially in children, because it is not uncommon for any of these complications to either present with non-specific symptoms including high fever accompanied by headache, or even to be silent. The majority of the intracranial complications of ABS however, present with more specific signs and symptoms that suggest the intracranial inflammatory involvement, such as nausea and vomiting, neck stiffness and altered mental state.

Intracranial complications are usually associated with frontoethmoidal or sphenoid rhinosinusitis. Infections can proceed from the paranasal cavities to the intracranial structures by two different routes:

- haematologically — pathogens can pass through the diploic veins to reach the brain;
- tissue continuity spread— pathogens can reach the intracranial structures by eroding the thin osseous walls of the sinuses.

A CT scan with contrast is required for diagnosis as it allows for precise definition of osseous tissue involvement. Magnetic resonance imaging has additional diagnostic value to exclude or confirm cavernous sinus thrombosis and also in cases with soft tissue involvement.

Studies show a high incidence of anaerobic organisms or mixed aerobic-anaerobic in patients with intracranial complications. In cases where meningitis is suspected and provided that any intracranial abscess has been definitely excluded by imaging, a lumbar puncture can be performed to properly determine the underlying pathogens and to customize antimicrobial therapy. Pathogens most commonly isolated following lumbar puncture are Streptococcus and Staphylococcus species including methicillin-resistant (MRSA) and anaerobes.

Treatment consists of long-term intravenous antibiotics in high doses followed by drainage of the affected paranasal sinuses (always) and neurosurgical drainage procedures (if they are indicated). The rationale is to evacuate the intra-

cranial collection and manage the source of infection using a rhinological approach which will provide microbiological samples.

The prognosis of intracranial complications of acute bacterial rhinosinusitis depends on the severity of neurological signs and on the delay in diagnosis and management. The mortality rate varies from 0 % up to 19 %, and is related to cortical veins thrombosis and to cerebral vascular infarction.

### **Cavernous sinus thrombosis**

Cavernous sinus thrombosis is a rare complication and has been estimated at a rate of less than 10 % of all the intracranial complications. The highly anastomotic venous system of the paranasal sinuses allows retrograde spread of infection to the cavernous sinus causing sepsis and multiple cranial nerve involvement. Proptosis, ptosis, diplopia, chemosis, involvement of the eye motor nerves and impairment in the ophthalmic and maxillary branches of cranial nerve (ophthalmic nerve neuralgia) papilloedema and signs of meningeal irritation associated with spiking fevers and prostration establish the diagnosis. Symptoms start in one eye and progress to the other (fig. 10).



*Fig. 10.* Cavernous Sinus Thrombosis Caused by Sinusitis (source: Emergency Medicine News. <https://journals.lww.com>)

Full blood count may show increased white blood cell count with left shift, CRP, ESR and D-dimer while lumbar puncture may show elevated opening pressure and pleocytosis even in culture negative samples while blood cultures are frequently positive. Screening for thrombophilia may give false results during anticoagulation therapy and should be delayed until the treatment is completed.

The cornerstone of diagnosis is an MR venogram, demonstrating absence of venous flow in the affected cavernous sinus. High resolution CT scan with contrast can also show filling defects.

Cavernous sinus thrombosis has very poor prognosis: approximate mortality rate is 30 % in the adult population.

## SELF-CONTROL

### TESTS

*Select 1 or more answers.*

**1. Question: maximal duration of acute sinusitis:**

- a) 4 weeks;
- b) 6 weeks;
- c) 8 weeks;
- d) 12 weeks.

**2. Question: acute sinusitis in 0–3 years old children predominantly affects:**

- a) maxillary sinus;
- b) frontal sinus;
- c) ethmoid air cells;
- d) sphenoid sinus.

**3. Question: acute sinusitis in 4–7 years old children predominantly affects:**

- a) maxillary sinus;
- b) frontal sinus;
- c) ethmoid air cells;
- d) sphenoid sinus.

**4. Symptoms of rhinogenic orbital edema include:**

- a) eyelid swelling;
- b) limited ocular mobility;
- c) eyelid edema;
- d) decreased vision.

**5. Mucopurulent discharge on the posterior pharyngeal wall is typical for:**

- a) acute maxillary sinusitis;
- b) frontal sinusitis;
- c) ethmoid sinusitis;
- d) sphenoid sinusitis.

**6. Odontogenic sinusitis may affect:**

- a) maxillary sinus;
- b) frontal sinus;
- c) ethmoid air cells;
- d) sphenoid sinus.

**7. Specific features of acute bacterial sinusitis in children below 3 years of age:**

- a) often involves both maxillary and ethmoid sinuses;
- b) local symptoms dominate;
- c) general symptoms dominate;
- d) typically affect ethmoid air cells.

**8. Advantages of functional endoscopic sinus surgery comparing to external approaches:**

- a) cheapness;
- b) less invasive;
- c) simplicity;
- d) do not require general anaesthesia.

**9. The best projection for evaluating maxillary sinuses is:**

- a) submentovertex view;
- b) occipitofrontal view;
- c) occipitomenal view;
- d) lateral view.

**10. In the lateral view the following sinuses are visible:**

- a) maxillary sinus;
- b) frontal sinus;
- c) ethmoid air cells;
- d) sphenoid sinus.

**Answers:** 1 — d; 2 — c; 3 — a, c; 4 — a, c; 5 — d; 6 — a; 7 — c, d; 8 — b; 9 — c; 10 — b, d.

**SITUATIONAL TASKS**

**Task 1**

A 20-year-old patient have been ill for 2 weeks. Disease started with nasal discharge, difficult nasal breathing, low grade fever, general malaise. He had been used decogestant nose drops and saline sprays for 5 days, but there were no improvement. Patient have been suffering from the marked permanent headache for the last 2 days.

Physical examination: body temperature — 37.8 °C; the external nose and other parts of the face are not changed, pain on palpation in the projection of the right frontal sinus is marked. The mucous membranes of the nasal cavity are hyperemic, edematous. There is a purulent discharge in the middle nasal meatus of the right half of the nose.

On the X-ray of the paranasal sinuses — a homogeneous darkening of the both maxillary sinuses, fluid level being observed in right frontal sinus.

1. What is the diagnosis?
2. Prescribe treatment for the patient.

### **Task 2**

A 5-year-old girl complains of headache, pain in the area of the right eye, swelling of the eyelids on the right. She cannot open right eye. In addition, the patient indicates difficulty in breathing through the nose. Body temperature — 38.6 °C. She has been sick for 8 days. The onset of the disease is associated with a common cold.

Physical examination: the external nose is not changed. Breathing through the nose is difficult. There is pain in the region of the right cheek during palpation. The eyelids of the right eye are hyperemic, edematous. She cannot open her right eye on her own. The eyeball is not displaced. Its movement is not limited. The lower wall of the right orbit is not painful on palpation.

Anterior rhinoscopy: the mucous membrane of the right half of the nose is hyperemic, edematous. Nasal turbinates are enlarged. Pus goes down from the middle meatus on the right.

On the X-ray of the paranasal sinuses: a decrease in the transparency of the right maxillary sinus is determined.

Blood test: hemoglobin — 108 g/l, leukocytes —  $20.0 \cdot 10^9/l$ , eosinophils — 3 %, stab neutrophils — 11 %, segmented neutrophils — 52 %, leukocytes — 28 %, monocytes — 6 %, ESR — 45 mm/h.

1. What is the diagnosis?
2. Prescribe treatment for the patient.

### **Task 3**

A 38-year-old patient was treated for acute bacterial pansinusitis for 1 week. He have been using amoxicillin for 5 days, intranasal corticosteroids and saline sprays. Despite the ongoing treatment there is worsening of the condition: fever and headache appeared again, swelling and hyperemia of both eyelids of the left eye have been developed.

Physical examination: the patient's condition is moderately severe. Pulse — 110 beats per minute. Swelling of both eyelids of the left eye, exophthalmos, limit-

ed mobility of the eyeball, prolapse of the edematous conjunctiva and a significant decrease in vision on the left are determined.

Anterior rhinoscopy: the mucous membranes of the nasal cavity are edematous, copious amount of mucopurulent secretions being observed in the left half of the nose.

1. What is the diagnosis?
2. What additional methods of examination should be carried out to clarify the diagnosis?
3. What is the treatment tactics?

**Answers:**

**Task 1**

1. Bilateral acute bacterial maxillary sinusitis, acute bacterial frontal sinusitis on the right.
2. Treatment includes:
  - Amoxicillin/clavulanic acid 875/125 mg — 2 times per day for 10–12 days;
  - Decongestants: oxymetazoline 0,05 % 2–3 drops 3 times per day for 5 days;
  - NSAID: Ibuprofen 400 mg — 2–3 times per day in case of headache or fever;
  - Intranasal corticosteroids: Mometasone 2 sprays — 2 times per day for at least 10 days;
  - Consider puncture of the affected sinuses.

**Task 2**

1. Right-sided acute bacterial maxillary sinusitis, complicated by the eyelids edema.
2. Treatment includes:
  - Amoxicillin/clavulanic acid up to 90 mg per kg for amoxicillin per day for 10 days;
  - Decongestants: oxymetazoline 0,025 % 2–3 drops 3 times per day for 5 days;
  - NSAID: Ibuprofen 5–10 mg per kg — 2–3 times per day in case of headache or fever;
  - Puncture of the affected maxillary sinuses.

**Task 3**

1. Acute bacterial pansinusitis, complicated by the phlegmon of the left orbit.
2. CT of the orbits and sinuses, blood tests, ophthalmologist consultation.
3. Treatment:
  - Conservative treatment: high doses of board spectrum antibiotics intravenously, decongestants, anti-inflammatory drugs, supportive measures;
  - Surgical drainage of the affected sinus and orbit.

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## CONTENTS

List of abbreviations .....	3
Motivational characteristic of the topic .....	3
Definition .....	5
Classification.....	6
Etiopathogenesis .....	7
Clinical features .....	7
Diagnostics.....	8
Differential diagnosis.....	11
Treatment .....	13
Features of abs in pediatric patients.....	15
Complications .....	16
Self-control .....	19
Literature.....	23