



## CHARACTERISTIC CHANGES IN IRON METABOLISM IN SINUSITIS

Kosimov Kobil Kosimovich  
Andijan State Medical Institute  
Department of Lore manager, Professor:  
Kosimov Khayotbek Kobulovich  
Andijan State Medical Institute  
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**Abstract:** Specific changes in iron metabolism during sinusitis are closely linked to the body's response to the inflammatory process. Inflammation of the paranasal sinus mucosa leads to functional changes in the absorption, transport, and storage of iron. Under the influence of inflammatory mediators, particularly cytokines, hepcidin levels rise, which in turn reduces iron absorption from the intestines and enhances its accumulation in macrophages. Consequently, serum iron levels decrease, potentially leading to functional iron deficiency.

**Keywords:** sinusitis, iron metabolism, inflammation, hepcidin, cytokines, iron deficiency, anemia, chronic sinusitis, pathogenesis, immune response.

### Relevance

Acute sinusitis is a sudden inflammation of the sinuses that lasts for at least four weeks. The synonym "rhinosinusitis" is also used. This term indicates that the inflammation is a process affecting not only the mucous membrane of the sinuses but also the nasal cavity. The main causes of acute sinusitis are viruses or bacteria. Therefore, viral and bacterial forms of the disease are distinguished. Less commonly, anaerobes and intracellular microorganisms are the causative agents of acute inflammation in the paranasal sinuses. Viral sinusitis often presents like a common cold and is seasonal. It usually occurs in the autumn, winter, and spring, and rarely in the warm season. Viruses that cause inflammation of the upper respiratory tract include: rhinoviruses, influenza and parainfluenza viruses, respiratory syncytial viruses, adenoviruses, and coronaviruses.

Typically, viral sinusitis does not require specific treatment and resolves on its own. However, sometimes recovery does not occur. This is due to the proliferation of bacterial flora residing in the sinuses. Most often, *Streptococcus pneumoniae* and *Haemophilus influenzae* are found in acute sinusitis - they account for 70-75% of all cases.

### Factors that create conditions for the development of bacterial sinusitis:

- deviation of the nasal septum;
- polyps;
- chronic rhinitis;
- adenoids in children;

Structural features of the ostiomeatal complex: the uncinat process, the middle nasal concha, and the ethmoid bulla. In acute sinusitis, an anaerobic infection can lead to pathology of the maxillofacial system or chronic sinusitis. In such cases, it is difficult to determine whether it is an acute or chronic form. An allergic process and fungal flora can also cause sinusitis. In this case, if the disease is in its acute form, it can progress to a chronic form.

Difficulty breathing is accompanied by many nasal disorders, therefore this symptom does not confirm acute rhinosinusitis. There must be at least two signs for diagnosis. Headache in sinusitis is compressive in nature and often occurs when the head is tilted down. After the

use of drop medications, it may decrease. Pain with inflammation in the maxillae and frontal sinuses occurs in the face, nasal bridge, eyebrows, and temporoparietal region. Diffuse toothache on affected side with maxillary sinusitis is manifested as. Inflammation of mucous membrane of sphenoid sinus (sphenoiditis) of head is characterized by pain in the center and back of the head. A runny nose with acute sinusitis does not always occur. Mucus discharge to viral inflammation is characteristic, if bacterial flora is added, purulent discharge appears. Good drainage of sinus in children function and open anastomosis, with secretion during blowing the nose and coughing manifests itself. Secretions upon irritation of the posterior portions of the sphenoid sinus and ethmoid labyrinth. It flows to the posterior pharyngeal wall, causing coughing fits.

The physician assesses the condition of the mucous membrane of the nasal turbinates and passages, and the absence or presence of discharge. Signs of sinusitis include the presence of purulent or mucopurulent discharge in the area of the affected sinus orifices. It is accompanied by redness and swelling of the nasal mucosa.

When examining the posterior wall of the oropharynx and the nasopharynx with a spatula and a nasopharyngeal swab (posterior rhinoscopy), and during an examination of the pharynx (pharyngoscopy), pathological secretions may be visible.

Endoscopic examination of the nasal cavity. This allows for a detailed examination of the turbinates of the nasal passages and nasopharynx, detecting even the smallest anatomical changes. Often, video endoscopy is performed and the result is recorded, which later helps to assess the progression of the disease.

#### **X-ray of the sinuses.**

This is used only for a prolonged runny nose and headache lasting approximately 7-10 days. During the procedure, the head is fixed in a specific position - in nasomental, nasofrontal, and lateral projections. The position of the head is determined by the radiologist. With sinusitis, the mucous membrane thickens, a horizontal fluid level is detected, and the pneumatization of the sinus is significantly reduced. The position of the head is determined by the radiologist.

Computed tomography (CT) is used for chronic pathology of the paranasal sinuses, as well as for orbital and intracranial complications. Its use for diagnosing acute sinusitis is not advisable. Neither an X-ray nor a computed tomography scan can differentiate between viral and bacterial sinusitis. It is not advisable to use it for the diagnosis of acute sinusitis.

#### **Ultrasound examination (US).**

This is a non-invasive screening method. It allows for the detection of effusion in the lumen of the frontal and maxillary sinuses and the assessment of therapy effectiveness. It is actively used in the examination of children and pregnant women.

The effect of ultrasound is based on the reflection of the ultrasonic signal at the boundary of two substances

with different acoustic properties (bone-air, air-exudate, etc.) in linear and two-dimensional modes.

In the first case, ultrasound scanners for the paranasal sinuses ("Sinuscope", "Sinuscan") are used, and in the second case, standard ultrasound machines are used.

#### **Diagnosis by Puncture**

Sinus puncture (from the Latin "punctio") is not a routine diagnostic method due to the high risk of complications. It is used when there are contraindications to radiography, such as during pregnancy.

**Laboratory Diagnostics:**

Includes a complete blood count and the determination of C-reactive protein (CRP).

**It allows for:**

differentiating viral sinusitis from bacterial sinusitis and thus determining the need for antibiotics;

assessing the severity and dynamics of the disease.

**Microbiological Examination:**

This is performed in cases of long-term forms of sinusitis and the ineffectiveness of antibiotic therapy. The examination requires discharge from the nasal cavity or material obtained by puncture from the affected sinus.

The reliability of the method is relative, and its informational content is low. Firstly, the microflora of the nasal cavity and the sinuses are inherently different. Taking a smear, even if all conditions are met, does not guarantee that the bacterium grown in the culture media is the cause of the inflammation in the sinus and not a random "hitchhiker" picked up when removing the cotton swab from the nose. The informational content of microbiological studies in children is even lower. This is due to the child's negative reaction to the procedure and the inability to perform it correctly.

Secondly, reliability can be affected by non-compliance with the storage and transportation conditions for the biomaterial. Therefore, evaluating the results of microbiological studies is complex and ambiguous.

**Diaphanoscopy:**

An outdated, non-invasive method for diagnosing maxillary sinusitis. It is performed using a special lamp. If the cavity is air-filled, the sinus is illuminated in red. If there is pus in the sinus, the glow turns black.

**Treatment of Acute Sinusitis:**

The choice of treatment tactics depends on the form and severity of acute sinusitis. Mild and moderate exudative sinusitis is often treated using conservative or invasive sinus drainage methods.

**Conservative Treatment:**

The goal of treating acute sinusitis is to restore the patency of the inflamed sinus ostium and to prevent orbital and intracranial complications. For this, vasoconstrictors are used in the first days of treatment, but for no more than seven days, and the nasal mucosa is moistened and irrigated with a saline solution (0.9% sodium chloride).

Such measures prevent the proliferation of bacteria. Intranasal glucocorticosteroids (INGCs) reduce mucosal swelling and the production of mucus and pus (exudate). This improves nasal breathing and restores the drainage of exudate from the sinuses. They can be used as monotherapy for mild forms and in combination with other drugs in more severe cases.

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