

REVIEW ARTICLE

Diagnosis of acute rhinosinusitis

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Abstract

Rhinosinusitis is almost always a complication of a viral infection involving the upper respiratory tract. A common cold is the first symptom of rhinosinusitis, but infectious processes involving the nose inevitably affect the paranasal sinuses because of their anatomical contiguity. The symptoms remain those of a common cold as long as nasal phlogosis is moderate and the ostia between the nose and sinuses are patent. If the inflammation is intense, edema may obliterate the ostia and isolate the sinuses, thus stopping the removal of the exudates. The duration of symptoms makes it possible to distinguish acute (10–30 days) from subacute (30–90 days) and chronic rhinosinusitis (>90 days). The diagnosis of rhinosinusitis should only be based on anamnestic and clinical criteria in children with serious or persistent symptoms of upper respiratory tract infection, or which appear within a short time of an apparent recovery. Computed tomography and magnetic resonance images of the paranasal sinuses should be reserved for children reasonably considered to be candidates for surgery. Antibiotics are recommended in cases of mild acute bacterial rhinosinusitis as a means of accelerating the resolution of symptoms. The use of antibiotics is mandatory in severe acute bacterial rhinosinusitis to cure the disease and avoid the possible onset of severe complications.

The importance of rhinosinusitis (RS) finally reached pediatricians' attention a few years ago (1–3). Until the late 1980s, it was considered a rare childhood disease because the paranasal sinuses (too small or even undetectable in children) were thought to have no pathological relevance, but it is now known that RS may also occur even in very young pediatric patients because the maxillary and ethmoidal sinuses are consistently present from birth (4). The sphenoid sinuses are pneumatized at the age of about 5 yr, and the frontal sinuses appear between the ages of 7 and 8 yr. Moreover, the paranasal sinuses are easily infected because of their contiguity with the structures frequently involved in the common mild or severe infectious processes of the first years of life.

RS is almost always a complication of a viral infection involving the upper respiratory tract (1–3). Children have at least 6–8 respiratory infections per year especially in the first years of life, and as 5–13% of these evolve into acute bacterial RS, it is not difficult to understand its medical importance and socio-economic impact.

Clinical findings

RS is defined as the inflammation of one or more paranasal sinuses. The most common cause of RS is an infection. RS is classified on the basis of the duration of symptoms and/or the involved sinus. A common cold is the first symptom of RS, but infectious processes involving the nose inevitably affect the paranasal sinuses because of their anatomical contiguity (2–4). The symptoms remain those of a common cold as long as nasal inflammation is moderate and the ostia between the nose and sinuses are patent. The mucosal ciliary epithelium moves the exudates produced in the inflamed sinuses to and eventually outside the nose. If the inflammation is intense, edema may obliterate the ostia and isolate the sinuses, thus stopping the removal of the exudates. This is the pivotal moment favoring the establishment of RS because the exudate accumulates in the sinuses and tends to be superinfected, while the mucosal alterations because of the previous viral infection provide an ideal environment for saprophytic floral growth and pathogenicity

(4). This sequence of events justifies the use of the term rhinosinusitis instead of sinusitis as it highlights the fact that the nose and paranasal sinuses are simultaneously involved.

The clinical appearance of RS may be heterogeneous and change with patient age, the duration of symptoms, and, above all, the seriousness of the illness (5). The duration of symptoms makes it possible to distinguish acute (10–30 days) from subacute (30–90 days) and chronic RS (>90 days). The subacute and chronic forms are less frequent in children than in adults, but the acute forms are quantitatively relevant. Acute RS (ARS) may easily become complicated because of the direct extension of the infective process to the orbits and endocranial structures as a result of contiguity or blood-borne disease (2–4). Complications are more frequent in children mainly because of their distinctive anatomical characteristics: thin sinus walls, larger vascular foramina, more porous bones, and unsoldered sutures. Orbital complications are the most frequent, accounting for 90% of the total (1–3). In general, 3% of ARS cases may be complicated by the onset of orbital cellulitis.

Diagnostic recommendations

The diagnosis of RS should only be based on anamnestic and clinical criteria in children with serious or persistent symptoms of upper respiratory tract infection, or which appear within a short time of an apparent recovery (1–3). This recommendation is based on the fact that most viral infections of the upper respiratory tract recover spontaneously within 5–7 days and, if not, significantly improve within 10 days. Furthermore, upper respiratory tract infections never begin as a severe illness. The mucosal alterations induced by the infectious process altered drainage from the paranasal ostia to the nose predispose to bacterial superinfections of the sinuses. It is important to stress that infectious viral agents may not only induce inflammation, but also directly damage the mucociliary function of the mucosal ciliary epithelium.

Acute and subacute bacterial RS in children are most frequently caused by *Streptococcus pneumoniae*, followed by *Haemophilus influenzae* and *Moraxella catarrhalis*, which are usually present in the nasopharynx of healthy children (2, 3). Acute bacterial RS can be diagnosed if:

- (1) the upper respiratory tract infection does not recede or improve within 10 days, and all or most of the symptoms present at the beginning (rhinorrhea, night cough, fever) persist for more than 10 days;
- (2) the upper respiratory tract infection begins with severe symptoms (high fever, purulent rhinorrhea, headache, face pain, impaired general conditions) that persist for 3–4 days and tend to develop into ocular or endocranial complications;
- (3) the upper respiratory tract infection completely recedes within 3–4 days but recurs with all of the symptoms (fever, cough, rhinorrhea) within 10 days of its first appearance.

It is therefore important that pediatricians distinguish variants 1 and 3 of acute bacterial RS from recurrent respiratory

tract infections, especially in young children. This is possible because, even if they are frequent, recurrent respiratory infections with no rhinosinusal involvement are always separated by free intervals of more than seven days.

Considering the relatively low number of pathogens usually involved in ARS and the well-defined sensitivity to antibiotics of these pathogens, no microbiological investigation is usually performed in children with a single episode of acute disease. However, in patients with recurrent acute episodes or with subacute or chronic RS in whom a different etiology or the presence of resistance to commonly used antibiotics could be present, microbiological evaluation might be useful. Sinus taps are difficult to perform in children but endoscopically directed middle meatal cultures can efficiently substitute this technique in collecting respiratory specimens useful to identify the infecting pathogen(s). However, at this regard, it has to be remembered that in comparison with a nasal swab, aspiration technique can significantly enhance the reliability of endoscopy cultures (6).

Imaging studies are not necessary to confirm a diagnosis of uncomplicated acute bacterial RS in children. This recommendation is based on the results of a small number of trials showing that imaging may be superfluous or even misleading (7). In particular, it has been demonstrated that:

- (1) the presence of ARS symptoms in children is predictive of alterations in standard X-ray findings considered indicative of paranasal sinus inflammation (complete opacification, mucosal thickening of at least 4 mm, or air–fluid level) in 88% of children aged ≤6 yr and 70% of those aged >6 yr (8). Furthermore, in 60% of cases, the clinical symptoms are associated with a high density of the bacteria (10^4 colony-forming units/ml) responsible for the sinus disease;
- (2) radiological images considered indicative of RS can be seen in patients without any suggestive symptoms who undergo imaging for other reasons, or may be found 2 wk after an upper respiratory tract infection in patients with no obvious sinus involvement (9);
- (3) given the difficulties of performing paranasal sinus radiography, the images may under- or overestimate alterations, especially in younger children (10);
- (4) the radiographic alterations observed during ARS are not specific and may indicate phlogosis because of various etiologies (bacterial, viral, allergic or chemical) (10).

Moreover, in doubtful cases, instead of radiography, ultrasonography can be used. A recent study (11) has found that in children older than 4 yr, the two techniques gave the same results in 112 of 134 evaluated sinuses (83.5%). Compared with the standard radiography, ultrasonography had a 94.9% sensitivity and a 98.4% specificity, although the evaluation of the thickening of the mucosa was wrong in over 50% of the cases.

Computed tomography (CT) of the paranasal sinuses should be reserved for children reasonably considered to be candidates for surgery (1–3). The latest-generation MR images provides a more analytical definition of the soft tissues possibly involved in the inflammatory process and is therefore essential in the case of orbital and extra-orbital (endocranial) complications (12).

Therapeutic recommendations

Antibiotics are recommended in cases of mild acute bacterial RS as a means of accelerating the resolution of symptoms (1–3). The use of antibiotics is mandatory in severe acute bacterial RS to cure the disease and avoid the possible onset of severe complications. Mild ARS should be treated with amoxicillin 50 mg/kg/day divided into three oral doses (1–3). Amoxicillin should be replaced by amoxicillin–clavulanic acid (80–90 mg/kg/day in three doses) or cefuroxime-axetil (30 mg/kg/day in two doses) or cefaclor (50 mg/kg/day in two doses) in the case of patients who have received antibiotic therapy in the previous 90 days, who attend school, or who have local or systemic diseases that favor infections because of antibiotic-resistant pathogens (1–3). Complicated severe ARS should be treated with intravenous antibiotics that are active on the causative bacteria, bearing in mind possible resistances (1–3). Ceftriaxone (100 mg/kg/day in a single dose), cefotaxime (100 mg/kg/day in three doses), amoxicillin–clavulanic acid (100 mg/kg/day as amoxicillin in three doses), and ampicillin–sulbactam (100 mg/kg/day as ampicillin in three doses) can be considered as first choice (1–3). However, treatment of severely complicated cases has to be decided with the ENT specialist who has to evaluate whether and when surgical procedure have to be applied. Severe ARS without any obvious complications can be treated orally with amoxicillin–clavulanic acid (80–90 mg/kg/day

as amoxicillin in three doses), switching to intravenous therapy if there is no improvement after 24–48 h (1–3). Therapy of 10–14 days is recommended in mild ARS, and 14–21 days in severe acute and subacute RS (1–3). Antibiotic prophylaxis is not recommended for the prevention of RS (1–3).

Conclusions

A diagnosis of bacterial RS in children is established by the persistence of purulent nasal or post-nasal draining lasting at least 10 days, especially if accompanied by supporting symptoms and signs, at which point treatment with an antibiotic has to be recommended. Appropriate antibacterial therapy should also be recommended if the draining has been present for less time (3–5 days), but is concomitantly associated with significant fever and localized signs of sinus inflammation in a child who appears ill. Imaging studies are not necessary to confirm the clinical diagnosis of RS for the purposes of treatment, but should be reserved for cases in which the diagnosis is in doubt or a complication is suspected, and for patients with recurrent or chronic RS. These suggestions, which provide guidance in diagnosing RS in children, should be useful for pediatricians together with their clinical judgment.

Conflict of interest

The authors declare no conflict of interest.

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