

Sinusitis in children

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Sinusitis is very common in infants and young children. If the maxillary or ethmoid sinuses are not visible in properly positioned radiographs, the sinuses are diseased!

Sinusitis in infancy and early childhood is underdiagnosed because of the following widely held beliefs.

1. It is commonly believed that sinuses do not develop until two years of age.

2. It has been suggested, and generally accepted, that normal mucosa is redundant in infants and that this, together with tears entering the sinuses because of crying, can lead to "normal" sinus opacification (2).

3. It has been suggested that since sinuses are opacified in patients examined for other problems (*i.e.*, head injury, etc.), the finding of an obliterated sinus is of no practical value (7).

4. There is general belief that clinical findings of sinusitis in infancy and childhood are similar to those in adults.

5. It is believed that technical difficulties are too great to allow one to obtain satisfactory sinus radiographs in infants. *Our experience, however, suggests that none of these concepts is true.*

Introduction

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Introduction

To refute the foregoing concepts, we offer the following observations.

1. The paranasal sinuses, mainly the maxillary and ethmoid sinus cavities, are present at birth and can be visualized routinely by three months of age.
2. There is no scientific basis for the claim that tears or normal redundant mucosa can opacify the sinuses of infants.
3. The only normal sinus is the completely clear sinus; a sinus may be obliterated, and the patient may not be acutely ill, but the sinus still is abnormal.
4. The symptoms of sinusitis in infancy and early childhood are not the same as in older children and adults (1, 3, 4, 6).
5. With proper technique and attention, it is possible to evaluate the sinus cavities in infants and young children adequately.

Anatomic Aspects

Anatomic concepts of importance in the evaluation of the paranasal sinuses in infants and children include the following.

1. The maxillary and ethmoid sinus cavities are present and aerated at birth.
2. The maxillary sinuses are triangular in shape; the ethmoids, oval.
3. The frontal sinuses usually do not develop until 7–10 years of age.
4. The sphenoid sinuses develop shortly after the maxillary and ethmoid sinus cavities (3) but are not as important in the assessment of sinusitis. They are best visualized on the lateral view.

Clinical Aspects

The following clinical observations are also relevant to the evaluation of the paranasal sinuses in infants and children.

1. Sinusitis, acute or chronic, was found in 2.5% of all patients seen in our pediatric clinic.
2. Our experience indicates that sinusitis can occur as early as one month of age.
3. Forty percent (40%) of the children in our study were two years of age or less (Table I).
4. Nighttime cough from postnasal drip is very common (4). It was present in 73% of our patients (Table I).
5. Rhinorrhea is common and was present in 87% of our patients (Table I). Rhinorrhea may be clear or purulent. It is not possible, however, without radiographs to determine whether it is due to rhinitis or sinusitis. These conditions can occur together or separately.
6. Allergic sinusitis may produce milky, turbid rhinorrhea which may suggest purulent sinusitis.
7. Recurrent otitis media is common.
8. Headache is not common, except in older children (*i.e.*, adolescents). Only 24% of our patients had headache (Table I).

9. Fever often is absent or low grade in infants and young children. They may just not be thriving well. Only 39% of our patients had fever (Table I).

10. There is a high incidence of sinusitis in asthma, immunologic deficiency and cystic fibrosis. In our ongoing study of sinusitis, approximately 40% of the children have some type of allergic history.

11. A small percentage (2.4%) of our patients with sinusitis have very few, if any, obvious symptoms.

12. Nasal smears are useful in confirming purulent (neutrophils predominate) and allergic (eosinophils predominate) sinusitis. The smear cannot distinguish between rhinitis and sinusitis, however; only the x-ray can make this distinction.

TABLE I
Sinusitis in Children (3)

Sinusitis*	Age Distribution of Patients		
	Less than 2 years	3-6 years	7 years and over
Acute	20 (32%)	13 (21%)	30 (47%)
Chronic	88 (47%)	48 (26%)	50 (27%)
Total	108 (40%)	61 (24%)	80 (37%)

	Frequency of Symptoms (%)		
	Acute	Chronic	Totals
Cough	60	77	73
Nasal discharge	76	90	87
Fever	46	36	39
Headaches	48	16	24

* Clinically, radiographically, and therapeutically proved.

The following observations concerning the therapy of sinusitis in infants and children are also of importance to the radiologist.

1. Once sinusitis is diagnosed, one must determine whether the basic problem is allergy or infection.

2. The usual treatment of acute bacterial sinusitis consists of three weeks of antibiotic and decongestant therapy. Antibiotic therapy should be chosen to include treatment of *S. pneumoniae* (pneumococcus), and *H. influenzae*, the two most common infecting organisms.

3. Patients with underlying allergies may be refractory and may require more than one course of antibiotic and decongestant therapy. Indeed, therapy often is prolonged and some patients' sinuses never really clear completely.

4. Approximately 10% of patients may require irrigation of the sinuses (3).

**Sinus
Radiography
in Infants
and Children**

1. Technical aspects of the examination:

The modified Water's and lateral views usually suffice. The modified Water's view is the most useful view because the maxillary and ethmoid sinuses are best visualized on that view, and they are the most important sinus cavities to assess. The lateral view yields information relating primarily to the sphenoid sinuses, the nasopharynx and adenoidal tissue bulk. The Water's view should be obtained with slightly less angulation than is utilized in older children and adults (Figures 1A and B). Very young infants are examined by tabletop technique, and the head is immobilized by lead-gloved hands. Upright views in very young infants usually are not required. If needed, however, they can be obtained on a regular head unit in children as young as one year of age.

2. The major pitfall in sinus radiography:

Radiographically, the major problem encountered is too much angulation on the Water's view. If it is obtained as in the adult, it will be too steep and the sinuses will either not be visualized or will falsely appear to be obliterated (Figure 1A). This situation commonly leads to the erroneous statement that "the sinuses are not yet developed in this infant, and thus, cannot be evaluated." With proper positioning, however, even small sinus cavities become visible (Figure 1B). We hasten to add that this does not imply that these cavities are easy to assess, but only to state that they are demonstrable.

**Radiologic
Interpretation**

1. Abnormal radiographic findings consist of: 1, complete sinus opacification (Figures 2, 3), 2, mucosal thickening (Figures 4, 5) and 3, air-fluid levels (Figure 6). Complete sinus opacification is the most common, of these findings, mucosal thickening is the next most common and air-fluid levels are least common. The latter finding usually is seen in older children.

2. In our experience, in the acute stages of a viral upper respiratory tract infection, although coryza is present, the sinuses usually are clear. They become obliterated later, and then the finding is due to a superimposed bacterial infection.

3. *The only normal sinus is a completely clear sinus.* If it is obliterated, it is diseased whether the patient is very sick or not. It is not the role of the radiograph to determine how sick the patient is; only to determine whether the sinus cavity is clear or diseased.

4. Except for those cases where air-fluid levels are present, the radiograph cannot accurately reflect the degree of clinical symptomatology in a given patient.

**Pitfall in
Radiographic
Technique**



Figure 1A
A Water's view that is angled too steeply falsely suggests opacification of the left maxillary sinus.



Figure 1B
With proper positioning, however, both maxillary sinus cavities and ethmoid air cell areas are completely clear and normal.

**Complete
Opacification**

SINUSITIS: MOST COMMON MANIFESTATION



Figure 2A
A three month old infant with total opacification of both the maxillary and ethmoid sinuses. Would you be tempted to say that the sinuses are not present?

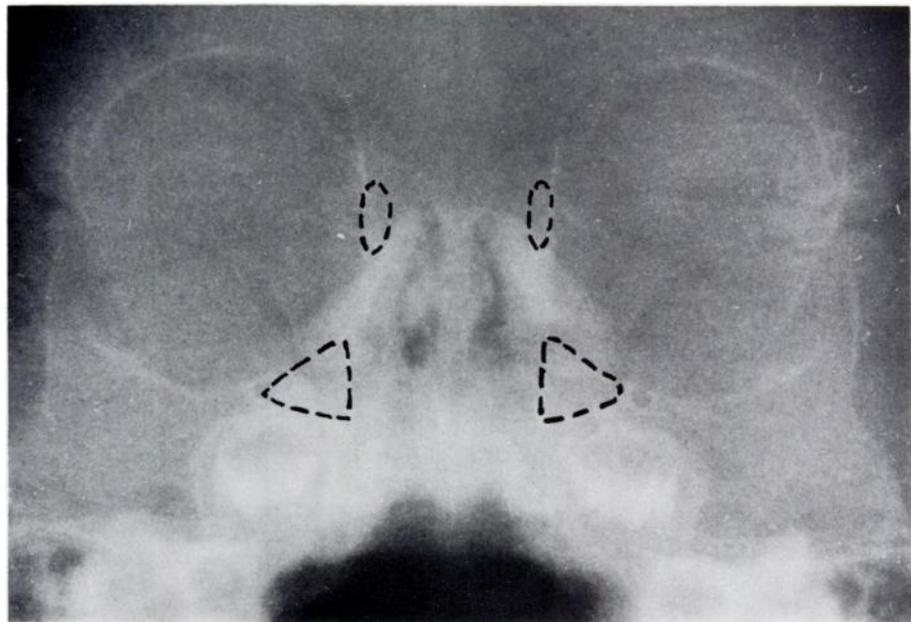


Figure 2B
Diagrammatic outline of sinus cavities to show their actual limits.

**Complete
Opacification**

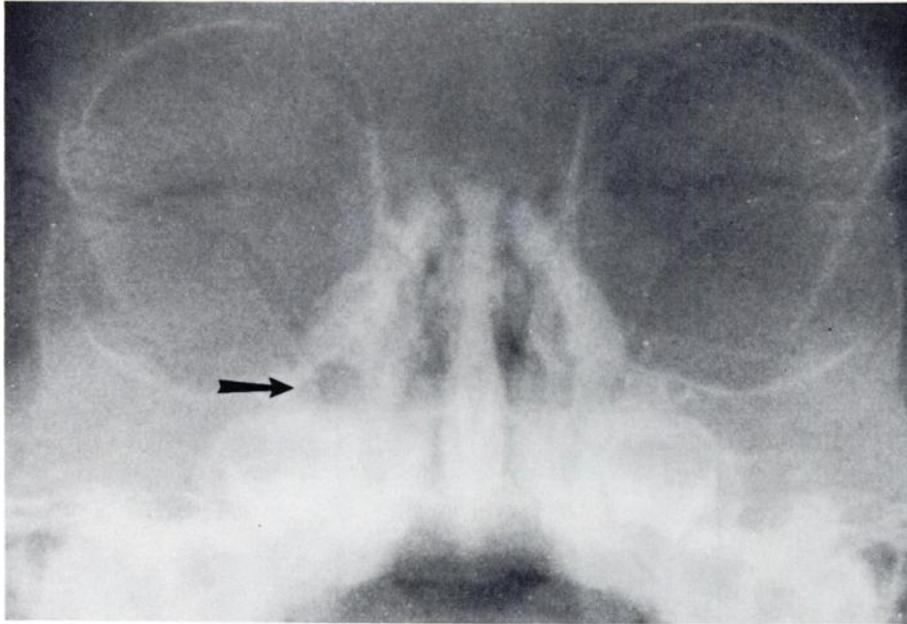


Figure 2C
After one course of therapy (antibiotics and decongestants), the right maxillary sinus (arrow) and both ethmoid cavities have cleared, but the left maxillary sinus remains opacified. Now, you can tell how large the sinus cavities really are.



Figure 2D
After a second course of therapy, both maxillary and ethmoid sinus cavities are clear. If this sequence of radiographs were not available, would you really believe that the sinus cavities were present, but opacified in Figure 2A?

**Complete
Opacification**

Figure 3A

A ten month old infant with complete opacification of the right maxillary sinus and partial opacification of the left maxillary and ethmoid sinus cavities. The right ethmoid cavity is completely clear.

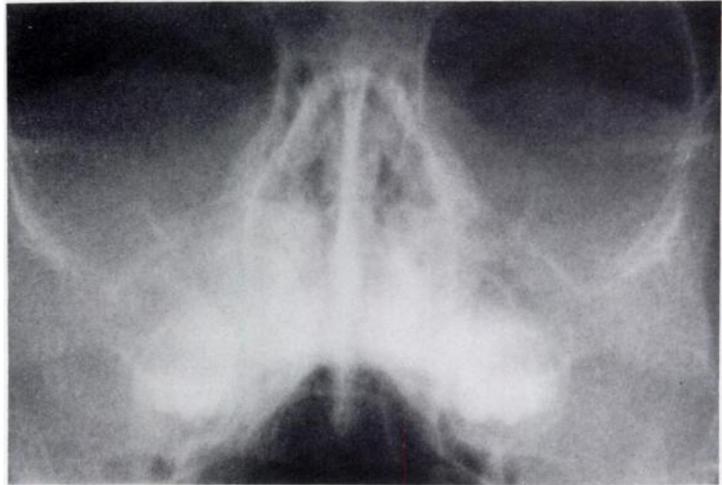


Figure 3B

Diagrammatic outline of sinus cavities to show their actual size.

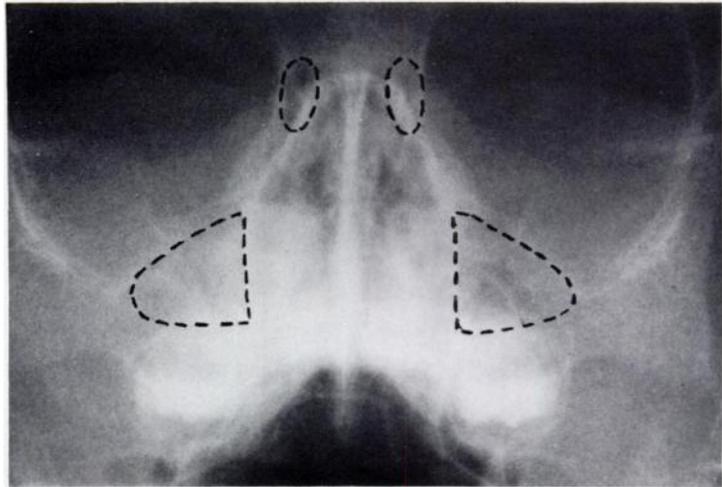


Figure 3C

After therapy, all sinus cavities are clear.



SINUSITIS: NEXT MOST COMMON MANIFESTATION

Mucosal
Thickening

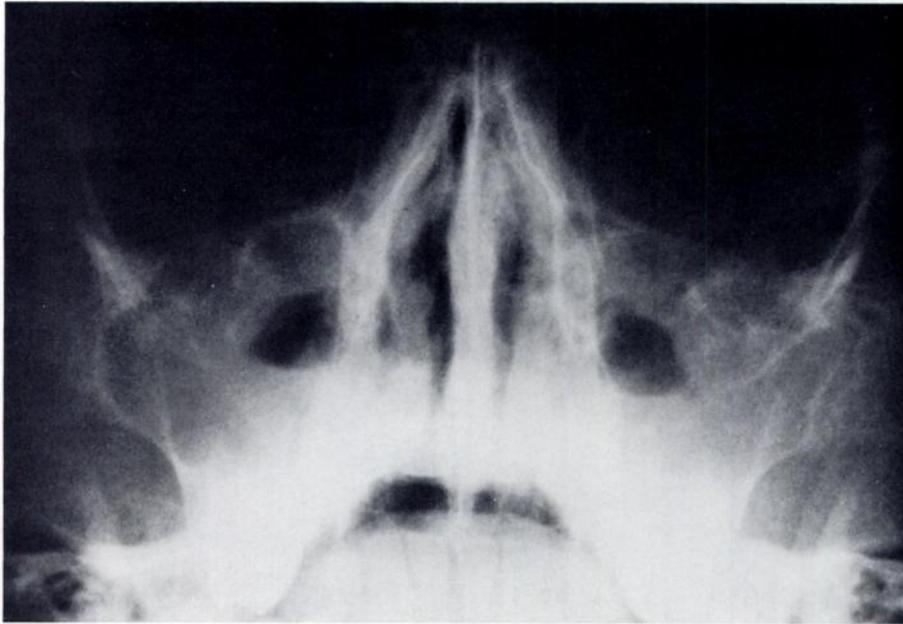


Figure 4A
On first glance, in this older child, the sinus cavities might appear clear, but just a little small. On closer inspection, however, it becomes quite apparent that extensive mucosal thickening is present.

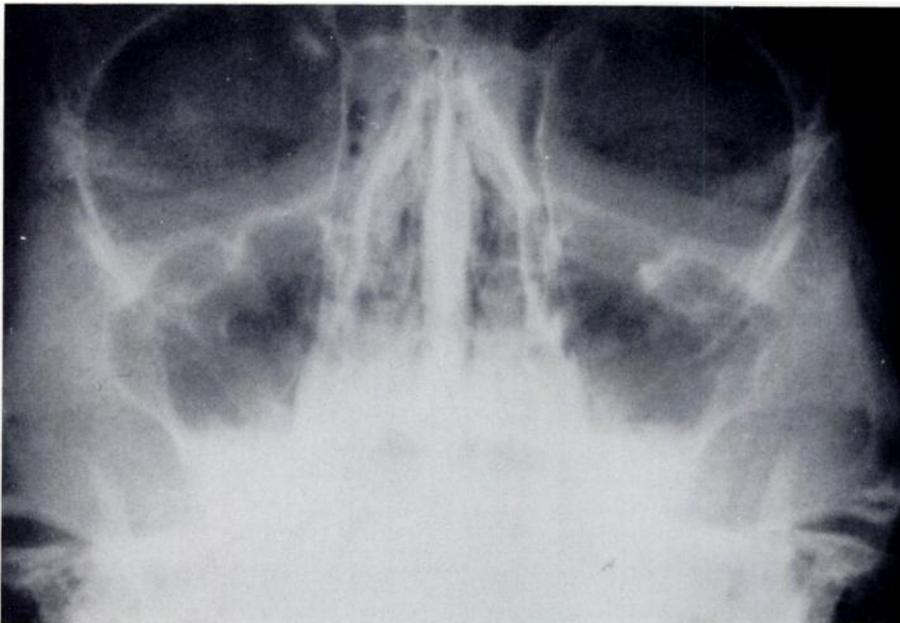


Figure 4B
After treatment, the true size of the sinus cavities is apparent.

**Mucosal
Thickening**

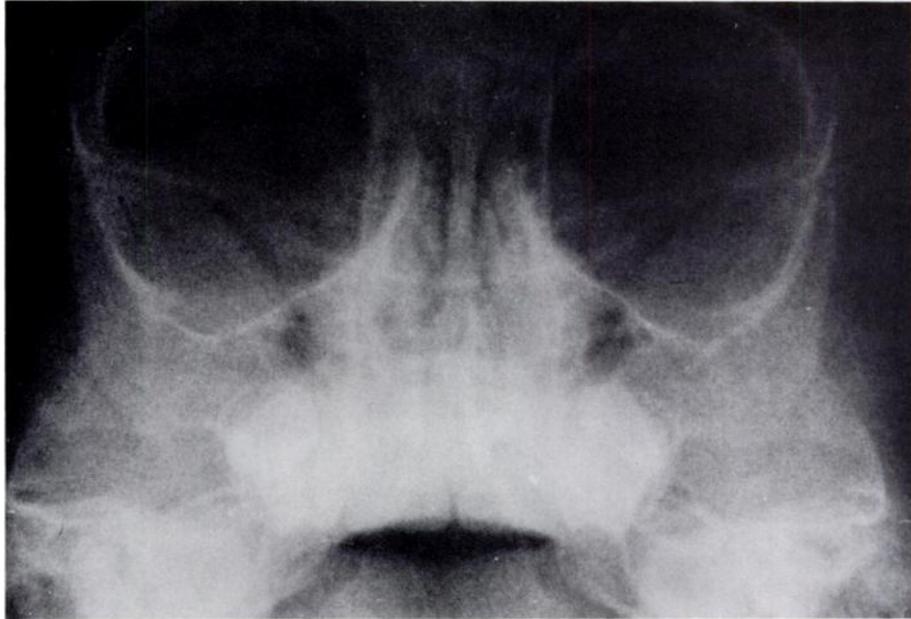


Figure 5A
In this young infant, one could easily misinterpret the findings as normal and assume that the sinus cavities are just small. In truth, however, the sinuses show minimal to moderate mucosal thickening.

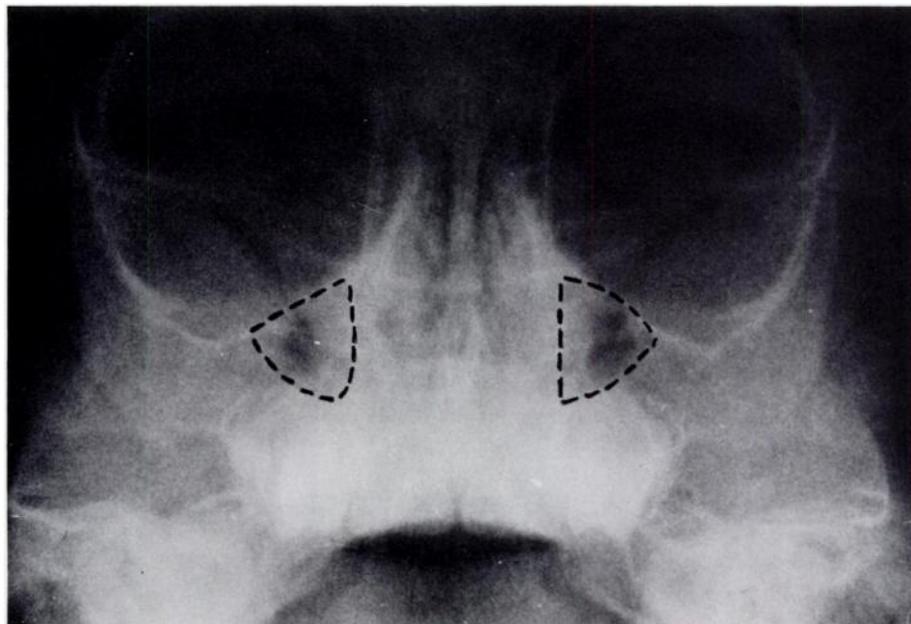


Figure 5B
Diagrammatic outline of the actual size of the sinus cavities. It is this type of patient whose radiographs might be misinterpreted as showing redundant, but normal mucosa. We do not believe this occurs. This patient was symptomatic and was proved to have sinusitis.

SINUSITIS: LEAST COMMON MANIFESTATION

Air-fluid
Levels



Figure 6A
Note the air-fluid level in the right maxillary sinus (arrow). This configuration is seen more often in older children.

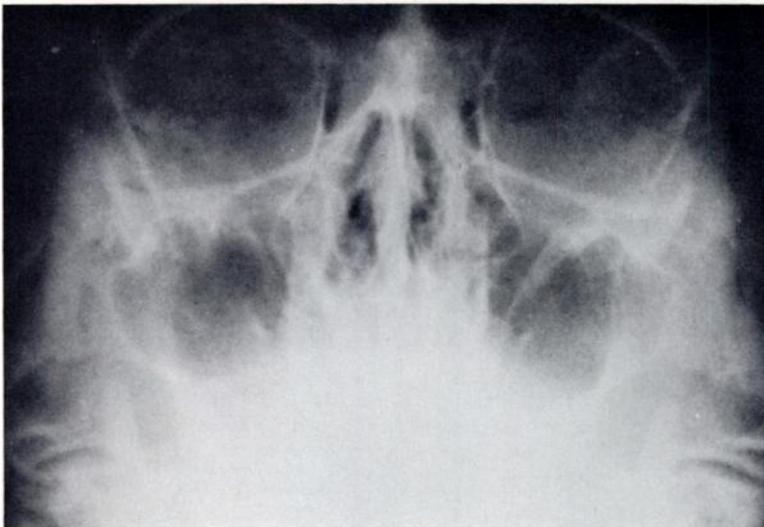


Figure 6B
After successful therapy, the sinuses are clear and no air-fluid level is present.

Summary

Our experience suggests that sinusitis is very common in infants and young children, but is usually missed because of the common, though erroneous, beliefs outlined in the introduction. Indeed if one maintains these beliefs, one never will diagnose sinusitis in infancy; one never will treat sinusitis in infancy; and one never will see sinuses clear radiographically. On the other hand, once these concepts are reversed, one will come to appreciate sinusitis as a common disease in infancy and childhood.

In most cases, the disease can be suspected on clinical grounds; but it is not always possible to differentiate acute rhinitis from sinusitis without radiographs. This is not a cause for alarm, however, inasmuch as both conditions require approximately the same treatment. The only difference is that sinusitis is treated longer (*i.e.*, three weeks as opposed to 10 days). Treatment, for the most part consists of antibiotic therapy and decongestants. Treatment is less successful in patients with underlying allergic problems. Only occasionally is lavage of a sinus cavity required.

The maxillary and ethmoid sinuses are the most important to assess radiographically. They are readily visualized on modified Water's projections. When analyzing the sinus cavities, one should recognize that the only normal sinus cavity is the one that is completely clear. Bilateral hypoplasia of the maxillary and ethmoid sinuses is virtually unheard of, and thus, one should always see the sinus cavities. If they are not visible, and the view is satisfactory, they are diseased.

References

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