3. Preoperative Diagnosis

Endoscopic surgery of the paranasal sinuses is indicated for the treatment of tumors or trauma, the removal of foreign bodies, but mainly for chronic sinusitis and recurrent acute infection of the sinuses and its complications. A diagnosis of chronic hyperplastic sinusitis is not always an automatic indication for surgery, since not all these lesions need surgical treatment. Only a small proportion of patients with inflammatory mucosal lesions present to the otorhinolaryngologist. If a symptom-free sinusitis is discovered coincidentally, careful assessment is required to determine whether surgery is advisable, because it carries risks and complications which may make the patient worse. On the other hand, symptom-free chronic sinusitis contributes more often than is commonly thought to the genesis of a wide range of serious diseases including lesions of the orbit and the optic nerve, otitis, laryngotraceobronchitis, and inflammation of the heart, the joints, the urinary tract and the skin.

History Taking

The typical symptoms of sinusitis (Table 3.1) include anterior nasal discharge, postnasal drip, catarrh and nasal obstruction. The cause and effect often overlap: septal deviation may cause nasal obstruction, which is made worse by the resulting hypertrophy of the turbinates and thickening of the mucosa due to sinusitis. Pain, a feeling of pressure and loss of the sense of smell, are not universal symptoms, and are more common in acute than in chronic sinusitis. Questioning should be systematic and encompass the most important symptoms, and should also cover the symptoms of ear disease (such as variable hearing loss, crackling and itching in the ears, feeling of pressure, etc), pulmonary symptoms (cough, spit, wheeze, etc), diseases of the teeth and jaws, allergic symptoms, inflammatory disease of the joints, the urogenital system, the orbital apparatus, the skin and autonomic disorders, dizziness and fatigue. Chronic throat symptoms such as pain and dryness in the throat, hawking, globus and hoarseness are often due to discharge from a chronic sinusitis flowing down the pharynx. Thus the ear, nose and throat area should always be examined carefully.

Table 3.1. Main symptoms in chronic sinusitis. Data from 234 patients before operation.

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nasal obstruction</td>
<td>64%</td>
</tr>
<tr>
<td>Facial pain, pressure or headache</td>
<td>51%</td>
</tr>
<tr>
<td>Troublesome nasal discharge</td>
<td>44%</td>
</tr>
<tr>
<td>Discomfort in the throat and hawking</td>
<td>9%</td>
</tr>
<tr>
<td>Bronchitis and cough</td>
<td>9%</td>
</tr>
<tr>
<td>Globus</td>
<td>9%</td>
</tr>
<tr>
<td>Disorders of smell</td>
<td>7%</td>
</tr>
<tr>
<td>Eustachian tube dysfunction</td>
<td>7%</td>
</tr>
<tr>
<td>Hay fever</td>
<td>5%</td>
</tr>
<tr>
<td>Bronchial asthma</td>
<td>5%</td>
</tr>
</tbody>
</table>
Rhinoscopy and Nasal Endoscopy

Inspection of the nose by anterior and posterior rhinoscopy, preferably with a 30° angled telescope, may show a stream of pus running from the semilunar hiatus over the inferior turbinate, tenacious plugs of mucus lying in the ostium of the antrum, or polyps. These cases are almost always associated with a polypoid ethmoiditis if small granulations or large polyps are found protruding from under the middle turbinate or lying in the superior meatus in the region of the posterior ethmoids. Isolated nasal polyposis without sinusitis is exceptional, although edematous swellings of the end of the turbinates can occur. The pedicle of a choanal polyp often arises in the antral cavity, but can originate from the posterior ethmoid. Nasal mucosa that appears normal does not exclude chronic sinusitis: conversely it is not possible to deduce anything about the sinus mucosa from the swelling or color of the nasal mucosa. Nevertheless, reddening, lichenification or eczma of the nasal vestibule and the external skin at the nasal introitus strengthen suspicions arising from the history.

Ultrasound Scan

Although ultrasound using A scan can prove useful in identifying an empyema or an isolated antral cyst and in follow-up, it has proved unreliable for the assessment of maxillo-ethmoidal polyposis. Furthermore a B scan has not proved useful for precise localization of a circumscribed or diffuse mucosal hyperplasia nor for demonstrating the recesses of the frontal and antral cavities. However, ultrasound is indicated for follow-up after conservative treatment of sinusitis, particularly of patients who should not be subjected to irradiation, such as pregnant women and children.

Radiography and Computer Tomography (CT)

Precise information about the type and extent of chronic sinusitis is usually obtained from radiography. The occipitomental view is very suitable for demonstrating mucosal swellings or round shadows of the antral and frontal sinuses. Imaging of the sphenoid cavity is unsatisfactory and of the ethmoid is unreliable. For this purpose, plain films in other planes can be used, for example posteroanterior sagittal views with highlighting of the ethmoid, Rhese's projection, and the tilted axial views described by Hirtz and Welin. Lateral views of the frontal sinus are seldom useful. A concave or straight edge shadow indicates fluid, whereas round or half round convex shadows indicate mucosal hyperplasia, cysts or polyps. These findings should be taken into consideration when deciding whether a puncture alone, a sinusotomy for drainage or ventilation, or removal of a pedicled mass is indicated. Diffuse, complete opacity of one frontal or antral cavity may indicate a collection of fluid, hyperplasia or both. In this case puncture or endoscopy can help to establish the cause. In the author's experience isolated disease of the antral or frontal cavity is unusual, and imaging of the superimposed ethmoid is always necessary.

Imaging of the cells by plain films in various projections is of limited value because of the unavoidable overlap of the shadow of the turbinate on the ethmoids. Tomography provides more information per unit of radiation dosage.

Precision polycyclical tomography is very useful. For many years the author has depended on polycyclical tomography using four 1.5 cm sections from the root of the nose
to the sphenoid sinus. This technique provides excellent images of all three dimensions and is very reliable for the assessment of disease of the sphenoid and ethmoids. It is also the most suitable for assessment of fractures and tumors of the facial skeleton and the anterior base of the skull; it can be refined by intermediate cuts. This view has taught us that an apparently normal plain film does not exclude massive polyposis of the antral cavity and ethmoids.

*Computer tomography* provides incomparably clearer information with relatively low radiation exposure, particularly using coronal sections, which allow excellent comparison between the sides. Axial sections with suitable aperture settings provide an almost perfect imaging of the bony party walls and of the thickness of the mucosa. The rhinologist must therefore familiarize himself with the basics of computer tomography, the settings and avoidance of artifacts. For example he must know the slice thickness and intervals most suitable for special conditions and that a soft tissue setting rather than bone settings must be used to demonstrate subtle mucosal lesions.

The figure serve as an example of the ability of computer tomograms to demonstrate discrete lesions. The patient had undergone several radiographic investigations over a long period for posttraumatic anosmia, but the results were always negative. A *coronal CT scan* clearly showed bilateral circumscribed ethmoiditis and opacity of one frontal sinus, requiring ethmoidectomy and exposure of the frontal duct. Coronal sections also provide important information about the variable involvement of the nasal cavities in diffuse polypoid pansinusitis.

The *axial CT projection* is also suitable for demonstrating localized ethmoid disease. However, since the skull base which forms the roof of the ethmoids is flat it can be confused with opaque cells. Coronal sections are therefore indispensable for assessment of the anterior skull base. Also the ostia and the maxillo-ethmoidal outflow tract into the ethmoid infundibulum are less well shown in axial than in coronal cuts. The latter demonstrate the lateral extent of pneumatization and anomalies of the floor of the nose clearly. However, both projections are equally useful in the demonstration of diffuse pansinusitis.

The rhinologist must master this relatively new imaging technique, so that he can make precise requests to the radiological department and provide information about the questions to be answered and the choice of settings. Otherwise a general radiology department will deliver overexposed bone images which do not show the mucosa, and provide many useless views of the calvaria, the skull base and the brain, and too few of the nasal sinuses. The glut of unsuitable exposures in conventional radiography could be reduced by more expertly chosen CT scans, to the great benefit of our patients and the economy.

The value of tomography in the recognition of disease of the paranasal sinuses cannot be overestimated. It uncovers many cases of occult sinusitis, and places the treatment of disease due to focal infection on a sound basis. In view of the often long-standing unsuccessful treatment of mucosal disease of the upper and lower airway including chronic bronchitis and asthma, the additional costs of more frequent CT imaging of the paranasal sinuses is fully justified.
Magnetic Resonance Imaging (MRI)

This technique is still in its developmental phase, and personal experience of a limited number of cases does not allow any conclusions to be drawn. However, the poor bone signal is a grave disadvantage in the diagnosis of inflammatory lesions of the paranasal sinuses, although MRI appears to be useful in the assessment of tumors.

Functional Tests

Nasal respiration and the paranasal aeration are not always correlated. Improvement of the nasal air passage, however, will basically contribute to the recovery of the sinuses from sinusitis. Besides that, a correction of the septum or a conchotomy must often be combined with endoscopic sinus surgery in order to widen the surgical field for necessary manipulations. Functional measurements of nasal viability are, therefore, welcome for the planning of therapy.

Active anterior rhinomanometry is a valuable accessory method for assessing the patency of each side of the nose at a given instant. The curve is very dependent on difference of pressure between the nasal introitus and the choana, but it does not give any detailed information about the ventilation of individual parts of the nasal cavity and the paranasal sinuses. Ostial manometry demands a puncture of the sinuses, and is little used clinically.

Often the symptoms of nasal obstruction conflict with the findings of endoscopy or radiology. If a CT scan demonstrates narrowing of the nasal passages with deformity of the middle turbinate, and the patient has symptoms such as headache, recurrent acute sinusitis, chronic ethmoiditis, etc, a septal correction should be considered.

Pre- and postoperative olfactometry is very valuable for assessing disorders of function of the olfactory mucosa and the results of ethmoid operations in diffuse polyposis. Dysosmia is often caused by inflammation, and improves after opening up or reconstruction of the olfactory cleft. Recurrent dysosmia is the first, and very sensitive, indication of recurrent swelling or adhesion of the mucosa or of recurrent polyps demanding endoscopic management or revision surgery.

Semiquantitative olfactory testing by Elsberg’s method using increased concentrations of the olfactory substance has been valuable. The results are displayed in an olfactogram, showing the disorder of olfaction and its extent. After ethmoidectomy, olfactometry can be very useful in assessing the loss of olfactory mucosa, aeration of the olfactory cleft, the value of conservative treatment, and in detecting recurrence.

Further Investigations

Allergy testing of patients with chronic hyperplastic sinusitis is reasonable, even if the yield of desensitization of appropriate cases has so far been low. The demonstration and elimination of allergens can be a useful supplement to surgery.

The value of allergy testing can be assessed from the history and local findings. Patients with chronically thickened sinus mucosa should be investigated before surgery.
especially for the effect of perennial allergens. If the skin tests, intranasal provocation and in-vitro investigations identify the allergen, the patient should be treated conservatively by avoidance of the allergen, systemic medication or desensitization. In addition, anatomical obstructions of the upper airway should be corrected surgically.

However, allergic diagnosis and treatment are disappointing for patients with true polyposis of the sinus mucosa which can be combined with endogenous bronchial asthma and sensitivity to analgesics (the aspirin triad). In these cases surgical clearance is the treatment of choice, and allergic management is a useful supplement.

Dental examination should never be omitted in chronic maxillary sinusitis. A panorex view of the upper jaw is a useful screening test, and suspect cases should always be assessed by a dentist. Dental causes are said to account for 10%-20% of cases, but in the author's personal series dental granulomas requiring treatment are unusual. Nevertheless, exclusion of a potential focus is necessary to create optimal conditions for healing of the maxillary mucosa. Conversely an extensive dental infection does not exclude the affected sinus from consideration for intranasal surgery. The best treatment may be dental treatment of the root combined with intranasal endoscopic treatment of the antrum.

Pulmonary function tests are essential for medical advice of the patient with asthma or bronchitis, and allow the anesthetist to recognize peri- and post-operative risks and to arrange prophylactic breathing exercises. A test for non-specific bronchial hyperreactivity also helps the surgeon to identify patients with a subclinical asthma. Whereas about 25% of asthmatics suffer chronic hyperplastic sinusitis, this proportion rises to 40% of those who also have analgesic sensitivity. This sensitivity is often unrecognized, but can be uncovered by pulmonary function tests after an oral dose of aspirin. Patients sensitive to analgesics have a worse prospect of healing of their sinus mucosa. The individual patient should have a peak flowmeter to demonstrate exogenous bronchial asthma, and to optimize long-term medication.

Supplementary investigations by other specialties are often needed especially in:

- children with sinusitis, particularly those with mucoviscidosis, by the pediatrician;
- patients with unexplained pain or disturbances of sensation, by the neurologist;
- women with unexplained swelling of the skin and mucosa or pregnancy, by the gynecologist;
- patients with stridor and other systemic disorders, by the internist.

The interdependence of disease of the respiratory mucosa with other systems is close, and demands a familiarity with neighboring specialties.

The treatment decision is based on evaluation of the history, endoscopic findings and imaging. The latter also decides the type of procedure, its extent and the choice of anesthesia.

Naturally the surgeon should not fall into the trap of regarding every opacity or thickening as indicating tissue hyperplasia requiring surgery. Collections of fluid (blood, secretion or pus) foreign bodies and fungus infections are impressive, but can usually be recognized from the typical convex fluid level or dense opacity. A much more difficult
question to answer is the reversibility of visible mucosal swellings if a decision must be made between conservative or surgical treatment. In this case the length of the history, the failure of serious attempts at treatment, etc, are often more helpful than imaging. Lesions in children, and post-traumatic mucosal thickening are both capable of remarkable remission.

The demonstration of mucosal lesions by radiography or CT scan is also an important indication of the prognosis. For example, loss of bony outlines and massive scarring preventing the maintenance of patency of hollow spaces casts doubt upon the prospects for a revision operation. This applies also to patients with immunological diseases, a systemic disorder such as mucoviscidosis or sensitivity to analgesics. Therefore complete investigation demands additional functional tests: the results may not affect the therapeutic decision, but can indicate that it must be supplemented by further measures.