Current Practice

RESPIRATORY TRACT DISEASE

Diagnosis and Treatment of Sinusitis

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Many patients complaining of aches and pains in the face and head are inaccurately diagnosed and loosely labelled as suffering from a "sinus." Consequently, management is often incorrect and the treatment of sinusitis brought into disrespect. However, true sinusitis may be cured by correct therapy. Poor history-taking and incomplete examination account for most of the errors.

Aetiology and Pathology

Sinusitis is an inflammatory lesion of the mucous membrane lining one or more of the paranasal sinuses. The common infecting organisms, aerobic and anaerobic pyococci and *Haemophilus influenzae*, are usually secondary invaders following an initial virus infection. Thus sinusitis frequently complicates upper respiratory tract infections and exanthemata. Traumatic lesions involving the sinuses may be followed by infection; prolonged nasal packing and nasal douching are occasionally important aetiological factors. Narrowing of sinus ostia, possibly from oedema, becomes important when the patient is subjected to the rapid changes in barometric pressure encountered in flight and deep-sea diving. When air pressures within the nasal cavity and sinuses cannot be equalized quickly enough negative pressure develops within the sinus, the lining is damaged, and bleeding into the mucosa and the sinus cavity may occur. This injured tissue is then readily infected.

Jumping feet-first and sometimes diving head-first into an infected swimming-pool or a polluted river may force water under pressure into the sinuses; insult to the mucosa and primary bacterial infection may follow, especially if the patient already has a common cold. Primary bacterial infections are often very virulent—for example, in the frontal sinus infection may within hours of onset produce extensive osteitis of the skull with grave risk of intracranial suppuration. Anaerobic streptococci are usually the cause.

As the maxillary sinus is closely related to the teeth, in particular the second premolar and the first two molars, dental conditions are a common cause of maxillary sinusitis. Apical abscesses or infected dental cysts may rupture into the antrum, and tooth roots may be displaced into it. Oro-antral fistulae may result from these lesions. Anaerobic streptococci and *Escherichia coli* are often the infecting agents and produce the fetid pus so characteristic of the "dental antrum."

Acute Attacks

The severity of the individual acute attack varies greatly from a mild inflammatory reaction with slight mucosal swelling to a cellulitic-like lesion with immense, even gangrenous, mucosal swelling, which fills the whole sinus and herniates

through the ostium to form an acute nasal polyp. More often the mucosal swelling is moderate and pus is secreted into the remaining cavity; this may overflow or be squeezed into the nasal cavity. The acute lesion may spontaneously recover or go on to a subacute phase. Should the infection continue the mucosa suffers permanent damage, becomes incapable of functional recovery, and behaves little better than a "pus factory." Pathologically this state is characterized by submucosal abscesses, polypi, and fibrosis.

Chronic Sinusitis

Clinically chronic sinusitis is a lesion which does not respond to medical or simple surgical treatment and requires major surgical intervention to clear the disease. Chronic sinusitis is subject to recurrent acute exacerbations and must be distinguished from recurring acute sinusitis, in which the sinus mucosa fully recovers between attacks.

Although the acute-chronic sequence is usual, chronic sinusitis can arise at the moment of secondary infection if the initial virus lesion produces irreversible mucosal damage. In children this primary chronic sinusitis is occasionally seen complicating measles and whooping-cough. The same virus may also injure the lower respiratory tract mucosa and so cause bronchiectasis. Chronic sinusitis is therefore often associated with bronchiectasis, although each may occur independently.

All the sinuses (pansinusitis) or several of them (multisinusitis) may be affected at the same time. The anterior group of sinuses, comprising the maxillary, anterior and middle ethmoidal, and frontal, drains into the middle meatus. Commonly in acute sinusitis all three are infected to a variable degree. In chronic antral disease continual bathing of the middle meatus by pus may induce polypoidal changes in the neighbouring ethmoid cells and cause oedema of the fronto-nasal duct. In the latter case an acute exacerbation may lead to acute frontal sinusitis complicating a chronic maxillary lesion. Similarly nasal polypi arising from chronic ethmoiditis or allergy may obstruct drainage of the maxillary and frontal sinuses and lead to secondary infection within them. The posterior group of sinuses—namely, the posterior ethmoid and sphenoid—are infrequently affected by acute or chronic disease.

Even though multisinusitis is present, infection of one sinus usually dominates the clinical picture. Fortunately the maxillary sinus, which is most commonly affected, rarely leads to serious complications directly. Osteitis of the maxilla may follow a gangrenous lesion in the antrum but much more frequently complicates dental infection. Pus overflowing into the nose from the antrum is swept into the nasopharynx by ciliary action; when it streams over the eustachian orifices oedema and secondary middle-ear deafness may follow. Should a large polyp develop in the antrum it may herniate into the middle meatus, and as it enlarges it may project backwards into

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the nasopharynx to form a choanal polyp. Acute ethmoiditis in children often ruptures externally to form a subperiosteal abscess but in adults it is frequently overshadowed by acute lesions in neighbouring sinuses. Characteristically, chronic suppurative ethmoiditis produces nasal polypi; but occasionally, as a result of total obstruction of the ostia, mucocoeles or pyocoeles may develop within the ethmoidal labyrinth. As the frontal sinus develops between the cortical plates of the frontal bone in close contact with the diploe, acute frontal sinusitis readily spreads into the bone to cause osteitis. The cortical bone forming the frontal floor is very thin, so that acute lesions often rupture externally to form an orbital subperiosteal abscess. Indolent infections such as mucocoeles and pyocoeles may follow obstruction of the frontonasal duct by polypi or fibrosis. These indolent swellings, which rise and fall with each exacerbation of infection, may expand and rupture the sinus walls to displace orbital contents or expose the anterior cranial fossa dura. Inflammatory lesions of the frontal and ethmoid sinuses may, by virtue of their close relationship to the anterior fossa, produce intracranial suppuration directly or through thrombophlebitis.

Allergic or vasomotor rhinitis, by causing oedema of the sinus ostia or by producing nasal polypi, may contribute to delayed recovery from acute sinusitis. In patients who develop allergic reactions to bacteria or their disintegration products a sinusitis may be the important aetiological factor. The allergic reaction itself may be of intranasal origin, and control of the sinusitis in these exceptional cases may rid the patient of the allergy.

Symptoms and Signs

As the symptoms of sinusitis closely resemble and immediately follow those of the initial upper respiratory infection, it may be difficult to establish the moment when secondary sinusitis has become important. Mere prolongation of the coryzal symptoms, nasal obstruction, and lack of vocal resonance (paradoxically the patient is said to talk through his nose) should suggest the persistence of paranasal oedema. A feeling of fullness, an ache, pain or tenderness over the infected sinuses, the production of purulent nasal discharge, recurrent rise of temperature, or deterioration in the sense of well-being are more definite and readily recognizable evidence. Examination may demonstrate a swollen red mucosa, and pus may be blown out or seen in the nasal cavity or nasopharynx. The absence of pus at the time of the examination does not necessarily exclude sinus disease.

The development of these symptoms after flying, diving, swimming, trauma, nasal packing, or douching provides certain evidence of sinusitis.

Severe infections, whether primary or secondary, may present with severe headache, high temperature, restlessness, and delirium and the syndrome may be regarded as pyrexia of unknown origin. Careful observation may note the lack of vocal resonance, the nasal obstruction, a serous nasal discharge, or even epistaxis. As the patient improves and oedema decreases purulent nasal discharge may appear, and blowing the nose hard may produce a little pus flecked with blood.

Inadequate treatment of the acute lesion may relieve the patient of the persistent pain but nasal obstruction and purulent discharge continue. Intensive treatment may produce resolution of the disease. If therapy is inadequate the symptoms continue unabated and pain reappears with exacerbations or relapses of the infection. Mere relief of pain is no indication of cure; if treatment then ceases the patient is at risk of developing chronic sinusitis. During the subacute and chronic phases of the disease pus and nasal polypi may be seen in the nose or nasopharynx. Recurring acute exacerbations may physically and mentally exhaust the patient to the point of chronic illness, and, failing relief, irritability and anxiety may incur the label

of neurosis. A dramatic change in personality and sense of well-being may follow cure of the sinusitis.

Cacosmia, a foul smell noticed by the patient but perhaps not by the observer, accompanies sinusitis—particularly when of dental origin—and indeed it may be the only complaint. Anosmia may result from the virus infection or because nasal polypi obstruct the olfactory fissure.

A choanal polyp develops from chronic antral disease, and at first the patient may be able to breathe in through the nose better than out because of the ball-valve obstruction; but later obstruction may be total when the polyp fills the nasopharynx.

The pain, ache, and tenderness of sinusitis are seldom vague and diffuse but rather localized to the infected sinus. In antral disease pain may be referred to the temple because of irritation of the zygomatico-temporal division of the maxillary nerve. Ethmoid pain is deep seated behind the eye, and frontal pain and tenderness are localized directly over the floor and anterior walls of the sinus and must not be confused with migraine.

Abscess Formation

The anterior group of sinuses are close to the surface, and infection by direct osteitic extension may produce a subperiosteal abscess with acute inflammatory swelling of the overlying tissues. Although the maxillary sinus is the most commonly infected, it rarely causes swelling of the cheek—the usual reason for a subperiosteal swelling over the maxilla is a dental infection or cyst. Acute ethmoiditis ruptures externally in children to form an abscess near the inner canthus. The commonest external rupture in adults is seen in frontal sinusitis and this occurs either through the floor to produce swelling of the upper lid and displacement of orbital contents, or through the anterior wall to form a subperiosteal abscess of the forehead. Diffuse tender swellings over the frontal bone are due to osteitis secondary to frontal sinusitis.

Mucocoeles and pyocoeles develop in the fronto-ethmoid group of sinuses. When localized to the ethmoid cells an enlargement of the middle turbinate or a bulge into the middle meatus may be found. Frontal mucocoeles enlarge slowly by expansion, mainly through the floor, pushing the orbital contents downwards and outwards; the patient may have diplopia and the examiner notices a displacement of the globe. As the mucocoele enlarges it may become palpable and readily seen as proptosis develops. Pyocoeles are infected mucocoeles, and are accompanied by pain, acute inflammatory swelling, and possibly a rise in temperature. They may rupture on the surface, producing a fistula, which is usually situated at the inner canthus above the medial tarsal ligament.

The development of a grave illness, diffuse headache, vomiting, rigors, and fits indicates that intracranial suppurative lesions have begun.

Acute sphenoiditis is a rare disease but when present it produces central headache, and pus is seen in the nasopharynx streaming over the basisphenoid. Occasionally a pyocoele develops which produces retrobulbar neuritis. Abscess formation and proptosis may follow.

Sinusitis in Children

Sinusitis in children can usually be recognized by a bilateral purulent nasal discharge. The association of sinusitis and bronchiectasis has been mentioned, and it is worth adding that a wet productive cough accompanying chronic sinusitis often means bronchiectasis. In this sinus-bronchiectatic group wax-keratosis is often found in the external auditory meatus. However, the majority of the cases of sinusitis in children are acute cases, which recover fully with treatment and recur with further upper respiratory infections. Provided each attack fully recovers with treatment, chronic sinusitis should not develop.

The clinical diagnosis is usually confirmed by radiography, but, although an x-ray may demonstrate opacity, thickened mucosa, polyps, fluid levels, fractures, foreign bodies, dental cysts, or bone destruction, it cannot determine whether sinusitis is acute or chronic. Sinusitis, particularly frontal, may not be demonstrated radiologically. Transillumination of the sinuses has its advocates and is sometimes useful.

Antral lavage through a proof-puncture needle inserted beneath the inferior turbinate establishes the presence of pus or fluid, may puncture a cyst, contributes to treatment, and provides suitable material for bacteriological study. Proof-puncture is unnecessary in the acute stage. Moreover, it may be difficult to find the antral cavity amidst so much mucosal oedema, and fluid pressure during the intervention may cause intense pain and distress. Osteitis is also a possible hazard in severe acute lesions.

Cannulation or bouginage of the fronto-nasal duct, a tortuous canal wandering among the anterior ethmoid cells, should never be attempted by the unskilled and seldom even by the expert. Damage to anterior ethmoid cells and duct mucosa must follow such a traumatic procedure, and the end result of oedema, local osteitis, adhesions, scarring, and new bone formation may finally obstruct the duct and produce the opposite effect to that desired.

Treatment

The possible need for treatment of sinusitis should be anticipated during the management of upper respiratory infections. Prophylactic antibiotics are not indicated, but the patient must be warned against flying, parachuting, and jumping or diving into water.

Fractures involving the ethmoid and frontal sinuses require treatment with antibiotics, since the fracture line may communicate with the anterior cranial fossa. Oro-antral fistulae recognized at the time of dental extraction should be sutured immediately and antibiotics given, as primary healing is usual; but if sinusitis should develop the patient is probably best managed under specialist observation. Probably the most useful prophylactic antibiotics are either tetracycline or ampicillin, 0.25 g. six-hourly, for seven to ten days.

Mild cases of sinusitis usually require no treatment, but if the severity of the disease warrants treatment the majority will respond to tetracycline, 0.5 g. six-hourly, given for seven to ten days. Erythromycin or ampicillin, 0.5 g. six-hourly, are suitable alternatives. Bed rest in the acute stages is helpful. Failure to respond may be due to insensitivity of the organisms or the presence of a chronic lesion delaying recovery. It is wiser, therefore, to refer these cases to hospital so that more intensive and bacteriologically guided treatment may be given and the underlying chronic disorder treated.

There is no doubt that the most efficient treatment for the majority of pyococcal cases is intramuscular benzylpenicillin given in doses of 0.5 to 1 million units six-hourly. Bacteriological evidence is rarely available when treatment is begun, so that this method is reserved for the severe cases requiring hospitalization. As mixed flora of Gram-positive and negative organisms may be present in severe cases, streptomycin, 0.5 g. twice daily, should also be given. Penicillin and streptomycin have difficulty in crossing the blood-brain barrier; sulphadimidine, 0.5 g. six-hourly, should therefore be added when there is grave risk of impending intracranial invasion. Methicillin or cloxacillin and chloramphenicol are used only when there is definite bacteriological evidence to suggest that there is no satisfactory alternative.

Antral Lavage

Correct antibiotic treatment alone cures the acute case and controls the acute exacerbation of the chronic disease so that a

planned attack can be made under the best conditions. Antibiotics are also used to cover routine major explorations of the maxillary and frontal sinuses. If recovery from acute maxillary sinusitis should be delayed antral lavage on one or more occasions may be required to remove pus which cannot escape through a blocked ostium. The washings are useful for bacteriological study and provide a guide to further antibiotic therapy. Subacute antral lesions respond as a rule to intensive antibiotic treatment supplemented by several antral washouts. Any causative dental disease should be treated once the acute lesion is under control. Failure of response to antral lavage and antibiotics suggests irreversible change in the mucosa, and the treatment of choice is surgical.

Operative Treatment

The Caldwell-Luc operation allows of exploration of the antrum through its buccal wall, inspection and assessment of the mucosa, and stripping if proved to be necessary. The technique includes provision of counter-drainage into the nose through the antro-nasal wall beneath the inferior turbinate. Intranasal antrostomy has its advocates but the Caldwell-Luc approach provides much better assessment of the mucosa and visual control when cutting the drainage window. A persistent oro-antral fistula is frequently associated with chronic antral disease and it is necessary to do a Caldwell-Luc when the fistula is repaired.

Associated chronic ethmoidal suppuration, nasal polypi, and chronic sphenoidal disease can also be treated by the transantral approach.

When polypi are allergic in origin sinusitis may be mild and secondary, and simple removal of polypi with repeated antral lavage may clear the disease.

As frontal sinusitis is frequently secondary to maxillary sinusitis, nasal polypi, or cysts of the middle turbinate, once the acute lesion is settling on antibiotics adequate treatment of the associated sinus disease usually produces a rapid cure.

Subperiosteal abscesses arising from external rupture of frontal ethmoid sinusitis or pyocoeles may need drainage. Because it is unwise to interfere with the fronto-nasal duct during acute disease, drainage of the frontal sinus is best done through the thin floor, using an incision at the inner canthus. Once function of the fronto-nasal duct has returned, as determined by excretion of a dye into the nose, the drain may be removed. During the drainage period any disease in the neighbouring sinuses should be treated. Failure of the fronto-nasal duct to recover its function indicates the need for an external fronto-ethmoidectomy or an obliterative operation. Pyocoeles, after the acute phase has settled, and mucocoeles are also treated similarly.

Sinusitis in children is managed in the same way, but in chronic sinusitis a Caldwell-Luc operation is avoided as far as possible because it may interfere with growth of the dental buds. Those cases associated with bronchiectasis require carefully planned management in co-operation with the paediatrician and thoracic surgeon.

Nose drops have not been mentioned, for they have little part to play in the treatment of sinusitis. Ephedrine, 1% in normal saline, remains the safest and cheapest form of nose drops, but should be used only during the acute stage of the disease and never for more than a week or two. The treatment of sinusitis is largely medical; surgery may be necessary occasionally.

"Health Centres and Group Practices."—This booklet (price 3s. 6d. including postage), based on recent articles in the *B.M.J.* and with an introduction by Lord Cohen of Birkenhead, is now available from the Publishing Manager, *British Medical Journal*, B.M.A. House, Tavistock Square, London W.C.1.