the history of acute left otitis media for four days, and unconsciousness for a few hours on the day of admission.

The patient died before operation could be performed. The *post mortem* examination showed a purulent basal meningitis involving the convexity of both the cerebrum and cerebellum. Gram-positive diplococci of the pneumococcal type were found in the pus. The dura and tegmen tympani were markedly injected and this indicated the probable route of infection.

ROYAL SOCIETY OF MEDICINE—SECTION OF LARYNGOLOGY

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President—LIONEL COLLEDGE, F.R.C.S.

The treatment of Acute Frontal Sinusitis

By F. HOLT DIGGLE

ACUTE frontal sinusitis, especially the virulent pyrexial type, presents problems totally different from those of the purely chronic types of infection. I would define the subject under discussion as an acute frontal sinus infection, catarrhal or suppurative, apyrexial or pyrexial, clinically manifested by pain and tenderness over the anterior wall, the floor, or both of these regions of the frontal sinus, with or without œdema of the overlying soft parts or orbital tissues, of a few days' to a few weeks' duration, either with or without a homolateral maxillary sinus infection. Experience has shown that a frontal sinus may be grossly infected with pus, of a few days' or a few weeks' duration without any pyrexia. We are all familiar with a similar condition in cases of acute mastoiditis. Occasionally frontal sinus infections may be occult, with no pus visible in the nose, and yet with pain and tenderness over the frontal bone. Although a skiagram is of great assistance in the majority of instances, at times—though fortunately rarely—it is misleading. I have had more than one case in which the frontal sinus, though full of pus, was not radiologically opaque. J. S. Fraser, in a discussion on this subject some few years ago, expressed a similar opinion. I place no reliance on transillumination of the frontal sinus as a means of diagnosis.

The question has been asked in past discussions by members of this Section whether a frontal sinus infection can be present without, at the same time, an infection of the homolateral maxillary sinus. Opinions have varied, but on the whole, the majority have considered that a homolateral maxillary sinus infection is always associated with a frontal sinusitis.

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Pathologically it was contended that the antral mucosa, by virtue of its continuity with an inflamed nasal mucous membrane always shared in the inflammation, or, if the mucosa was not actually inflamed, the antrum acted as a reservoir for pus from a frontal sinus. Whichever theory we choose to embrace, the fact remains that a frontal sinusitis can exist without any maxillary sinus infection.

From my records, which have been verified either by skiagrams or proof puncture, the number of cases associated with and without an infection of the homolateral maxillary sinus is about equal.

I classify frontal sinus infections into two groups, pyrexial and apyrexial. The former embraces those virulent toxic types associated with a temperature between 100° F. and 104° F., or even higher, whilst in the apyrexial group I include not only the true apyrexial types, but also the subacute varieties with temperatures certainly no higher than 100° F., and with no evidence of toxæmia. I admit that any classification is arbitrary, but I prefer this to the more general one of catarrhal and suppurative. Moreover the presence of severe pyrexia, in my opinion, undoubtedly considerably modifies and complicates our treatment.

Many cases of acute frontal sinusitis treated on conservative principles make a complete recovery. The semi-recumbent posture, the external application of heat, with the inhalation of warm mentholated vapours and the application to the ethmoidal region of such astringent preparations as ephedrin, endrine, adrenaline, or a 5 per cent. solution of cocaine hydrochloride and adrenaline (1 : 1,000) in equal parts, either by the spray or with a cotton-tipped probe, all tend to promote frontal drainage. In my series of cases 40 per cent. recovered completely by such conservative measures alone, but all were of the apyrexial or subacute type, not always catarrhal, as in some there was a purulent nasal discharge.

In the apyrexial group, provided the frontal headache and tenderness are gradually subsiding under conservative treatment, there is obviously no need for any surgical drainage. If, on the other hand, the headache and tenderness are severe and persist in spite of a few days of conservative treatment—and particularly if they are increasing in severity and œdema of the frontal or orbital tissues is developing—then some form of surgical drainage is imperative.

The pyrexial group, however, presents a more difficult problem, for we have not only to consider the local infection in the frontal sinus, but also to recognize and treat the severe blood infection.

As in the similar virulent types of otitic inflammation, I am convinced that hasty surgical treatment in these severe pyrexial types may be disastrous. Our energies, in addition to facilitating free frontal drainage along conservative lines, should be directed to

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treatment of the blood infection by the appropriate antiserum, antitoxin or bactericide. In streptococcal infections I prefer the polyvalent antistreptococcal serum, given into the flank in large doses up to 40 to 60 c.cm. Frequently I divide such a dose into 20 c.cm. intravenously and the remainder in the flank, and repeat this on the third day if necessary.

A throbbing pulsating headache, with persistent or increasing tenderness, and a temperature not responding to serum therapy and other conservative measures, constitute indications for surgical drainage. Signs of œdema of the soft parts is an obvious indication. Should the frontal sinusitis be of the closed pyrexial variety, without visible intranasal purulent discharge, and one in which conservative treatment does not soon promote drainage, no time should be lost in establishing surgical drainage.

Unfortunately, in frontal sinusitis we have no minor surgical treatment—comparable to a paracentesis tympani—at our command to promote continuous frontal sinus drainage.

In apyrexial cases when conservative measures have failed, I would straighten a grossly deflected nasal septum, and I would remove a hypertrophied, misplaced, or cystic middle turbinate, but I would associate this with removal of the anterior ethmoidal cells in order to catheterize the frontal sinus. I never use a frontal raspatory, because I consider that stenosis, rather than increased patency is thus produced. I do not believe that anterior middle turbinectomy can to any great degree facilitate frontal drainage. I place more reliance on intranasal drainage by removal of the ethmoidal cells. External œdema in apyrexial cases is often relieved by simple intranasal drainage. If, however, there be actual abscess formation externally, or if in a day or so following intranasal drainage, the œdema and tenderness do not subside, I resort to external drainage by the method I am about to describe in pyrexial cases.

In the toxic pyrexial group, I would not now, after bitter experience, adopt any form of intranasal drainage, neither would I resect the nasal septum, or remove a middle turbinate. Such procedures in these vascular areas, richly supplied with lymphatics and perineural spaces, are too dangerous in toxic states. They are fraught with the risk of septicæmia or spreading osteomyelitis, and may induce an intracranial complication. Moreover, in some cases, for anatomical reasons, one cannot always be certain that a cannula has satisfactorily entered the frontal sinus, even after the ethmoidal cells have been removed, and it is imperative in these virulent cases, that once surgical drainage is decided on, it should be efficient. Conservative treatment having failed, in pyrexial cases I resort to external drainage, making the usual curved incision below the eyebrow, passing on to the nasal bone. After carefully elevating the

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soft parts so as to expose the inner portion of the floor of the frontal sinus, I open the sinus through its floor, just above the nasal ostium, making an aperture large enough to admit the tip of the little finger. An external abscess, which almost invariably tracks through the thin floor of the sinus, is opened by this incision. I respect the frontal mucosa, never syringing or mopping out the sinus contents, for I seek, with the provision of free drainage, complete resolution of the inflamed frontal mucosa, with re-establishment of infundibular patency. Before inserting drainage material, which I believe is better provided by rubber-dam tissue than by ordinary rubber tubing, I smear the bony edges with pure carbolic acid, as I believe that the risk of an osteomyelitis is thus lessened. The drainage tissue is engaged only just within the bony aperture and not passed up into the cavity of the frontal sinus. After lightly smearing the soft parts with thin Bipp, the outer edges of the wound are brought together with stitches, and the rubber drainage tube is anchored to the lower nasal end of the incision.

On the tenth to the fourteenth day, I usually remove the rubber drainage tube, as by then, in most cases, the discharge is no longer purulent but mucoid. If pus tends to collect or œdema recurs, the rubber drainage tube can be replaced for a further few days. I never carry out post-operative lavage of the sinus.

Although at first I expected that at a later date, because of a persistent external fistula, it might be necessary to establish infundibular patency by an intranasal operation, or even to carry out a complete obliterative procedure, I have only in one instance had to perform an obliterative operation. I prefer this method of external drainage in pyrexial cases, whether œdema of the soft parts is present or not, as I consider it safer than intranasal surgery. An external obliterative operation on the frontal sinus in the presence of a severe infection is, I believe, not only unnecessarily mutilating, but fraught with risk. The presence of a spreading frontal osteomyelitis might necessitate such an operation.

Those who believe that a suppurative frontal sinusitis is always associated with suppuration in the ethmoidal cells will no doubt question the wisdom of a simple external frontal drainage without at the same time removal of the ethmoidal cells by either the external or intranasal route. With an anterior ethmoidal region bathed in pus from a definite frontal sinus infection, and possibly also a maxillary sinusitis, I find it difficult to decide that there is actually suppuration in the ethmoidal cells. Inspection in these acute cases is of no help, and not infrequently a skiagram is of little assistance. The fact remains that after the provision of free external drainage of the frontal sinus, and an intranasal antrostomy if required, with no surgical treatment directed to the ethmoid, the results in pyrexial cases are far better than when the ethmoidal

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cells also have been removed. The relief of ethmoidal œdema afforded by free drainage of the frontal and maxillary sinuses facilitates natural drainage of any residual ethmoidal suppuration in the ethmoidal cells. Should there, however, be œdema of both upper and lower eyelids, with perhaps some ocular displacement or proptosis—signs indicating a severe ethmoidal suppuration—there is no alternative to opening the ethmoidal cells, but the prognosis is grave.

The antrum should always be aspirated, if only to relieve ethmoidal œdema and promote frontal drainage.

The treatment of Acute Frontal Sinusitis

By TERENCE CAWTHORNE

THERE is an increasing tendency to adopt a conservative attitude towards acute frontal sinusitis. The reasons for this are (1) that a large majority of cases clear up with simple conservative treatment, and (2) that extensive surgical procedures on the frontal and ethmoidal sinuses in the early stages of acute infection, before protective barriers have been set up, may start a spreading osteomyelitis, meningitis, or sometimes a cavernous sinus thrombosis.

What exactly is meant by a conservative attitude depends upon the individual. On the one hand some consider that puncture and lavage of an antrum full of pus in the acute stage are definitely on the side of rashness, whilst others are certain that a limited opening of the floor of the frontal sinus in acute suppuration is the essence of caution.

Acute frontal sinus suppuration is practically always accompanied by suppuration in the ethmoidal cells or antrum, or both, and it is towards these cells that the first therapeutic efforts should be directed. The amount of drainage afforded to the infected frontal sinus will depend upon the degree of obstruction of the fronto-nasal duct due to the anatomical state of the nose, together with the amount of swelling caused by the infected ethmoidal cells and antrum. Should this obstruction be complete, then the retained pus in the frontal sinus may cause a periostitis, usually in relation to the thin floor. This will cause a certain amount of external swelling. Should the obstruction continue to be unrelieved, the pus may spread from the confines of the frontal sinus to the neighbouring regions and, if left to itself, this pus will burst through the thin floor to invade the orbit.

If, however, sufficient nasal drainage can be afforded to prevent the retention of pus under pressure in the frontal sinus, then any external swelling will subside and the likelihood of pus bursting the bounds of the frontal sinus is remote.

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There are some who consider that most of the cases which develop complications after operation during the acute stage do so despite the operation. If this is so, then why is it that in nearly all cases the complication develops, or at any rate is discovered, some few days after the operation? So far I have never seen any serious complications develop because an external operation had not been performed.

It is a simple matter to advocate conservative measures in the abstract, but the local appearance and general state of a patient with an acute frontal sinusitis are often such that he, his friends and—more often than not—his medical attendant, eagerly await the benefit and relief which they feel must follow an external operation. When we add to this the uneasy thoughts of the surgeon as he pictures the possible routes which the pus may take, it is evident that to maintain a conservative attitude in these circumstances often calls for a high degree of surgical self-control.

I feel strongly that, unless there is definite evidence that pus has escaped from the frontal sinus into the surrounding tissues, conservative measures should be given a thorough trial before any form of external operation is even considered. Such measures should include frequent steam inhalations, antral puncture and lavage, if necessary daily. The removal of any pus from the antrum is of the greatest importance in these cases; I puncture the antrum as a routine and it is only in exceptional cases that I find it free from infection.

In young patients and in those who are unable to tolerate repeated antrum punctures it is permissible to make a limited opening into the antrum through the inferior meatus, which will be sufficient to admit an antral cannula. In addition to these measures the application of shrinking solutions to the middle meatus and turbinate should be used. Ten per cent. protargol is probably the safest but it may sometimes be necessary to precede this with a pack of ten per cent. cocaine although I think that the latter should be avoided if possible, because of the after-dilatation it produces. External heat in the shape of fomentations, electrically heated pads, or light baths may be of great help. Occasionally it is possible to pass a catheter into the frontal sinus and the pus can be removed by lavage or suction. I have only found this possible in relatively few cases. Normal drainage may sometimes be assisted further by inward displacement or infraction of the middle turbinate.

I do not think that, as a general rule, the removal of the anterior end of the middle turbinate is a good practice, for two reasons: (1) It violates the principle of not opening up tissue spaces in the early stages of acute infection, and (2) the reactionary swelling of the mucous membrane around the fronto-nasal duct which

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inevitably follows this procedure tends to obstruct the duct even further, at any rate for a day or two.

If, after ten days, the condition remains stationary or if, during that time, there is reason to suppose that pus has spread beyond the confines of the frontal sinus, then some form of external operation will be necessary. The exact nature of such an operation will naturally be governed by the extent of the disease. Unless the disease has attacked the diploë of the frontal bone or the meninges, it should be limited to a small opening in the floor of the frontal sinus. At a later date when the acute symptoms have subsided, it is usually necessary to enlarge the fronto-nasal duct and exenterate any diseased ethmoidal cells. The application of a Thiersch skin-graft to that part of the orbital periosteum which bounds the enlarged fronto-nasal duct is a useful addition to the operation which prevents any tendency to subsequent stenosis.

I should like to pay tribute to the operations of Howarth and Kisch which, by avoiding the dangerous antero-superior and posterior walls of the frontal sinus, have done much to lessen the incidence of post-operative complications both in subacute and in chronic cases. Similar operations with the addition of a skin-graft, as I have just mentioned, have been more recently described by Seiffert and Ferris Smith.

If the disease has invaded the frontal bone or meninges the amount of bone to be removed will depend upon the extent of the disease. In any case it should include a generous margin of healthy tissue, but I am quite convinced that many, if not most, of the serious complications which occur are the direct result of untimely operative interference.

Discussion

Walter Howarth said that he did not quite follow Mr. Diggle's classification into pyrexial, and apyrexial, because so many of the cases were pyrexial, the rise of temperature depending on the virulence of the infection and the degree of blockage of the fronto-nasal duct. He was very much in sympathy with Mr. Cawthorne's advocacy of a more conservative line of treatment for these cases than the textbooks suggested. He considered that Mr. Diggle's forty per cent. of cures by the conservative method was much too low; he himself would have placed it nearer eighty per cent., and he considered that if surgeons held their hands a little longer even that figure would be improved. He did not believe even in removal of the anterior end of the middle turbinate, but he thought some attempt should be made, where the blockage was complete, to enter the fronto-nasal duct. He supposed that the cases in which frontal sinusitis arose were those in which there was some anatomical abnormality or some unusual anatomical configuration of the duct,

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so that one or more of the anterior ethmoidal cells impinged upon it, and that if this obstruction could be overcome without a cutting operation, free drainage from the duct could probably be established. He usually passed a large metal sound into the frontal sinus, beneath the middle turbinate, so as to crush away the impinging anterior ethmoidal cells, and in that way enter the frontal sinus without a cutting operation which would damage the mucosa. A small Hartmann cannula was useless for this purpose.

External operations were necessary in only a few cases; even cases showing marked œdema of the eyelids and of the inner canthus settled down after conservative treatment. Should operation be necessary, it should be limited to letting out the pus.

C. A. Scott Ridout said that he also would strongly emphasize the importance of conservative treatment of acute frontal sinusitis. He said this because in an acute case in which he removed the anterior part of the middle turbinate and passed a raspatory into the frontal sinus many years ago, the patient had developed meningitis and died. In acute cases it was very seldom that packing and re-packing the nose with ten per cent. cocaine did not bring relief.

There was another type of frontal sinusitis, one showing marked obstruction by a high and greatly deflected septum. There were cases in which the surgeon dared not try to get into the sinus because of the obstruction of the septum, and because the patient was in appalling pain; in some cases he had been obliged to make an external incision, doing as little as possible, in order to let out the pus which was under pressure.

Harold Kisch said that he had looked up the records at the Central London Throat, Nose and Ear Hospital, and found that a conservative policy was followed in almost all the cases. The routine followed always included lavage of the antrum, and he himself considered this of the greatest importance. Lavage of the antrum, with simple intranasal treatment, would result in the cure of a considerable percentage of acute frontal sinusitis cases. This was in contradistinction to chronic cases, as the treatment of the antrum never resulted in the cure of frontal sinus trouble.

Injections of lact-albumin were of use in hæmolytic streptococcal cases.

The records at the Central London Throat, Nose and Ear Hospital showed that in the great majority of cases of frontal sinusitis with external swelling the patients recovered. Treatment was conservative at first, followed by operation for drainage of the abscess.

The use of small doses of intensive X-rays might be of use, as in the case of osteomyelitis of the frontal bone which he had demonstrated at the last meeting of the Section.

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T. B. LAYTON said he had seldom seen the Section so harmonious over any subject of discussion. He would like to agree with what every speaker had said; but he would add that his conservatism went further than that of any of them. He did not to-day even wash out the antrum, and he had long given up removal of the front end of the middle turbinate. He thought one of their colleagues was lucky to be alive, being the last patient but one in whom he had removed the front end of the middle turbinate in acute frontal sinusitis; the subsequent and last patient had developed a fatal meningitis.

In acute infections surgical interference was indicated only when there was an impending or threatened spread of the infection to a lethal area. Mr. Holt Diggle had mentioned the sequelae—septicæmia, osteomyelitis, meningitis, but he (the speaker) doubted whether they ever occurred in cases of acute frontal sinusitis, if left alone. He was not saying that every case would recover, but it was a false line of thought that because one case might die it was justifiable to interfere in many.

Pathologically, he thought all these operations were wrong. Lister taught that an inflammation tended to get well by itself if the cause of the irritation was removed. In the acute invasive stage the organism itself was the cause of the irritation.

Anatomically, there was no such condition as a frontal sinusitis. The frontal sinus was merely one of a group of anterior ethmoidal cells, all of which grew up towards the angle where the face and the cranial and nasal cavities met. One went a little further than the rest and was named the frontal sinus. Therefore there was no such disease as frontal sinusitis. In every case some of the other cells were involved; he thought that the maxillary sinus was always involved, even if pus could not be found in it the lining was inflamed.

MUSGRAVE WOODMAN said that he could not agree with Mr. Layton. He had recently seen a patient who had streptococcal septicæmia, associated with joint effusion due to an acute frontal sinus which had been allowed to incubate for nearly a fortnight. The nose cleared up with local treatment.

He believed that ninety per cent. of cases would clear up on conservative lines. The most important element was the provision of the right atmosphere, notably a tent with benzoin in a steam kettle. If operation had to be undertaken, he thought Mr. Holt Diggle's method of making a small opening beneath the eyebrow to be the correct one. It should be a rule that the intranasal operation should not be performed in acute cases.

W. A. TROUP said he agreed as to the value of radiotherapeutic methods in the treatment of acute cases.

By radiotherapy he meant treatment by infra-red irradiation, ultra-violet irradiation, and short-wave therapy. Treatment by

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diathermy was contra-indicated in these acute cases: and short-wave therapy, especially if the treatment was prolonged, was liable to give rise to secondary toxæmic manifestations.

The treatment consisted of: (1) Infra-red rays applied locally over the affected sinuses. (2) Ultra-violet rays applied intranasally and postnasally by means of quartz applicators attached to the Kromayer mercury vapour lamp. (3) General ultra-violet irradiation from a suitable source. (4) Short-wave therapy in selected cases.

These radiations produced: (*a*) Relief of headache; infra-red rays were the finest pain killers and therefore obviated the necessity of giving sedative drugs. (*b*) Establishment of drainage unless gross obstruction was present. (*c*) Increased flow of blood and lymph to the affected sinuses. (*d*) Bactericidal action of the ultra-violet rays intranasally and postnasally. (*e*) Increased bactericidal properties of mucus and restoration of function of the cilia. (*f*) Increased bodily resisting powers.

H. G. DOWNER, himself a sufferer from the condition, said that he had obtained relief, not so much from the use of inhalations as from the steam tent. At a later stage submucous resection had saved further trouble.

With regard to the question of external operation: He had recently operated upon a patient who, twenty-six years previously, had had an external frontal sinus operation, which had given no trouble. He had treated her for three weeks, and had then operated. He found a small quantity of pus in the frontal sinus. No attempt had been made to enlarge or dilate the fronto-nasal duct, and he thought that if an external operation was carried out without some attempt to maintain drainage, possibly in later years some of the cases would be failures.

E. D. D. DAVIS said that conservative treatment was the ideal. For many years he had carried out precisely the plan outlined by Mr. Holt Diggle. Nevertheless, there were cases in which a timely operation with a gentle and moderate hand, cut short the illness, and the results were excellent. An operation was indicated when the patient was not responding to treatment, e.g. when the temperature remained stationary and there was definite suppuration. There were also more severe cases in which one's hand was forced; for example, a previous attack, or an acute exacerbation of a chronic sinusitis, intense pain preventing sleep, a narrow nose arising from a high deviation of the septum, called for a middle turbinectomy gently done to give access to the fronto-nasal duct. He had not seen any disadvantage in a middle turbinectomy. Simple œdema of the eyelids disappeared with ordinary conservative treatment, but cases were seen in which it was difficult to determine whether pus was present in the orbit. Extensive œdema and

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redness of the eyelids, with œdema of the conjunctiva and a proptosed fixed eyeball indicated an orbital abscess and one could not safely hesitate to operate. He had had at least forty cases of orbital abscess in which the Howarth operation had been successful, but there were ten cases which had been left too long. Of these ten, six died of meningitis before he saw them. There was one case of osteomyelitis in a young girl. In a case of pyæmia the patient died; in one of optic atrophy with a dilated pupil at the time of operation, the patient survived. Another patient nearly died after a simple incision, and at a later operation a quantity of deep-seated pus was found. Complete recovery followed its evacuation.

V. E. NEGUS said he also was in agreement with conservative treatment of acute frontal sinusitis. He would, however, like to comment on the lavage of the antrum. One advantage of it, often overlooked, was that it cleared the natural ostium, which was often plugged at the start. By re-establishing the natural opening and setting up ciliary drainage again, a chance of recovery was given. He did not think that aspirating the fluid would be successful in re-establishing natural drainage.

He would make an external incision only in cases of real necessity, and then usually after ten days or more, when there was an extension through the outside of the frontal sinus, and when it seemed impossible to re-establish drainage through the natural fronto-nasal duct. The incision was just sufficient to expose the floor of the sinus and allow an opening to be made through the non-diploetic bone. That could be left open, with free drainage. The completed operation followed the technique of Seiffert, which differed slightly from that of Howarth and Kisch and Ferris Smith. It was finished, after external drainage had been maintained for one or two weeks, by making a free communication between the frontal sinus and the nasal fossa and inserting a big rubber tube, lying free in the nose, and covering it with a small layer of ribbon gauze soaked in iodoform. A piece of oiled silk was inserted over this and was tucked under the edges of the nasal, frontal, and maxillary bones, and back to the ethmoid. The skin graft was taken from the leg, cut to the size of the area to be covered. The opening was sewn up, and the tube taken out after a week. When using this method he had never had a skin graft come out, nor had the opening closed in any case. In chronic cases the operation, including skin-grafting, was completed in one stage, without preliminary external drainage.

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