PNEUMOSINUS FRONTALIS

By M. SPENCER HARRISON (Lincoln) and A. YOUNG (Sheffield)

A VERY small number of cases have been described in the literature (Benjamins, 1918; Boenninghaus, 1919; Ferreri, 1922; Gruenwald, 1923; Iglauer, 1930; McNally, 1943; Tamari and Bear, 1954) in which at operation a considerably dilated frontal sinus has been found, usually to the surgeon's astonishment, to contain air only.

Pneumosinus frontalis usually presents itself as a very slowly developing swelling appearing above the supra-orbital margin. The anterior wall is intact and bony hard and shows no response to external pressure. There is no history of trauma or of nose trouble but the patient may complain of low-grade frontal headache. X-ray plates demonstrate an obvious translucent dilatation of the frontal sinus on the affected side. A bougie may in some cases be passed with little difficulty into the sinus but no secretions are evacuated and the swelling is unaffected. The following is a description of such a case observed for more than eight years and of two further cases first seen more recently.

R.B., male, æt. 31 years. First seen March 28th, 1946.

Patient complained of swelling in the forehead on the left side which had been present for eight years. He had no pain and no other trouble with the condition or with his nose, but stated that he had been blind on the left side since birth. He had never had any unusual discharge from his nose.

Examination showed little abnormality in the nose or throat. There was a diffuse swelling present above the superciliary ridge on the left side (this condition has changed little over eight years). X-rays showed what appeared to be an enlargement of the left frontal sinus, but the cavity appeared to be filled with air.

The patient was not seen again until August, 1950, when he returned complaining of headaches in the left frontal region. As other measures failed to relieve the pain the fronto-nasal duct was thus dilated with some improvement in the patient's headaches. No fluid was found in the sinus. Dilatation was repeated several times, but as the patient was still complaining of headaches, the frontal sinus was explored at operation in September, 1951, through an external incision below and medial to the left eye. The dimensions of the sinus were considerable and the mucous membrane lining the floor of it was a little thickened and a small polyp was found near the opening of the fronto-nasal duct. A large communication with the nose was made and lined with a Thiersch graft.

Since operation, the headaches have been less troublesome though still present at times. The fronto-nasal opening remains widely patent (Figs. 1-4).

https://doi.org/10.1017/S0022215100050489 Published online by Cambridge University Press



FIG. 1.

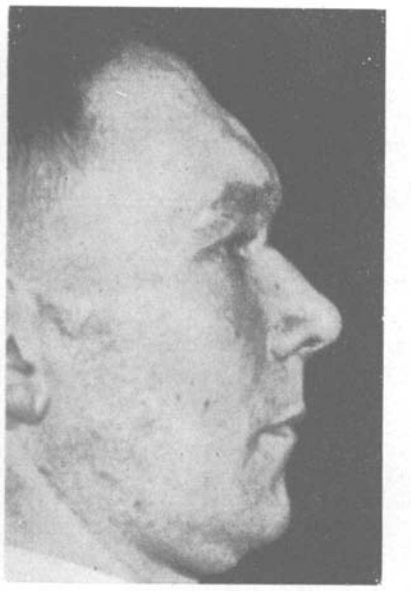


FIG. 2. CASE I.

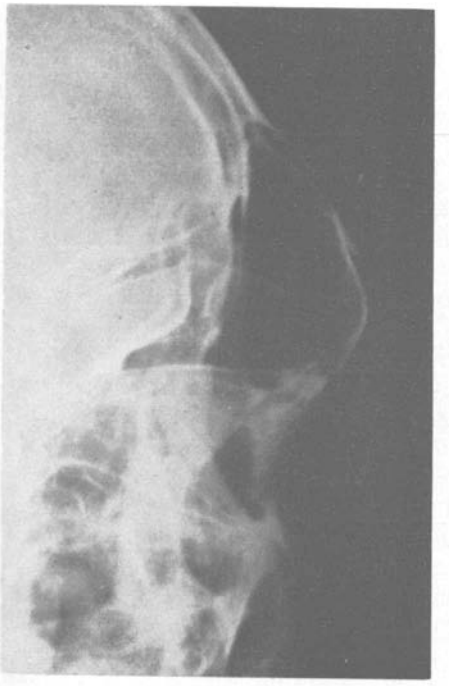


FIG. 3.
Lateral X-ray view of affected sinus in Case I.

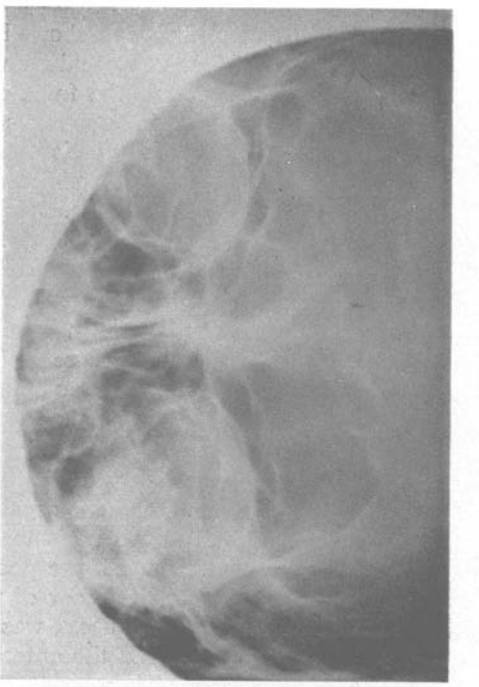


FIG. 4.
Case I. Showing dilated frontal sinus on left side.

https://doi.org/10.1017/S0022215100050489 Published online by Cambridge University Press

B.L., male, æt. 15 years. First seen January 2nd, 1952.

Patient complained of a prominence over the bridge of his nose which he and his parents thought was increasing slowly in size. He had no nasal trouble and the swelling was not painful.

Examination showed a healthy nose on both sides. The swelling was smooth in outline and appeared to be related to the medial portion of the left frontal sinus. X-ray showed the prominence to be associated with dilatation of the left frontal sinus which seemed to contain air.

The patient was kept under observation for six months but as the swelling appeared to be increasing and the parents were becoming concerned the sinus was explored and found to contain only air. The mucosa appeared healthy. The outer wall was infracted. The patient's condition has continued satisfactory since the operation.

S.N., male, æt. 28 years. First seen July 13th, 1953.

This patient complained of a swelling of his forehead which was unsightly and causing comment. It had appeared two years previously and had gradually increased in size without causing any pain or discomfort. There was no history of trauma nor of any discharge of fluid from his nose such as might have occurred if a mucocele had suddenly ruptured. The swelling was to one side of the forehead and involved the supra-orbital margin but not the floor of the sinus. Vision was unaffected.

The straight radiograph showed an abnormally translucent and distended frontal sinus. Under Pentothal anæsthesia a bone marrow trocar and cannula was easily inserted into the front of the sinus through bone which was thin and almost soft, and by this means sinusography could be done with Diodone Viscous Solution (M & B Viskiosol Six). The fluid ran easily through into the opposite frontal sinus and down the nostril on that side. Nothing came down the nostril on the affected side. On the radiograph taken in the upright position the diodone outlines the floor of the sinus and distinguishes a dilated ethmoid cell lying below.

Inflation tests were done out of interest and to complete the investigation, though from the easy way in which the diodone had run from the opposite nostril it was obvious that there could be no valvular obstruction. On Valsalva's inflation the fluid in the manometer attached to the trocar rose and fell immediately on beginning and ending the inflation, so confirming the free outflow from the sinus.

The convex anterior wall of the frontal sinus was exposed at operation through an incision in the line of one of the forehead creases and then elevated and swung laterally on a periosteal attachment. The hole in the inter-sinus septum was quite large, as the photograph shows. Nothing could be seen of the fronto-nasal duct, the floor of the sinus being flat and neither distended nor eroded. The lining mucosa was normal. The remainder of the inter-sinus septum was removed and the anterior wall split and fractured into a concave shape and replaced. There seemed to be no indication for making a new fronto-nasal duct.

https://doi.org/10.1017/S0022215100050489 Published online by Cambridge University Press

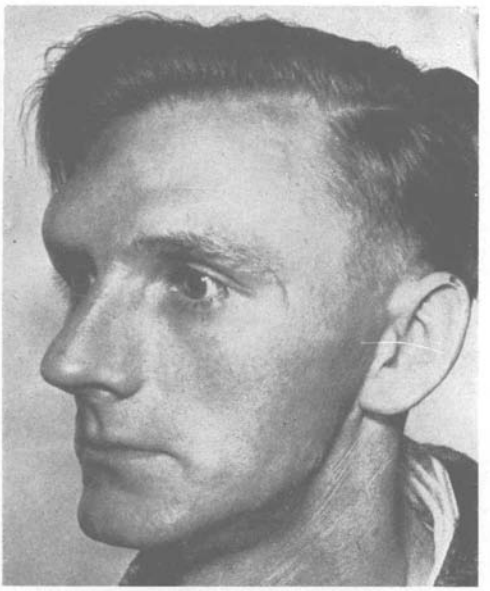


FIG. 5.
Case III. Enlarged right frontal sinus.



FIG. 6.
Case III. Straight radiograph.



FIG. 7.
Case III. Contrast radiograph patient lying on the unaffected side.

https://doi.org/10.1017/S0022215100050489 Published online by Cambridge University Press



FIG. 8.
Case III. The Inflation Test.

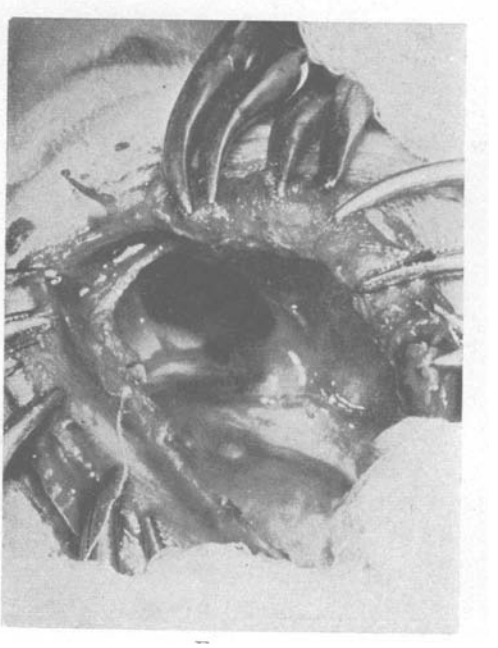


FIG. 9.
Case III. To show the opening in the inter-sinus septum.

https://doi.org/10.1017/S0022215100050489 Published online by Cambridge University Press

Differential Diagnosis

A pneumatocele of the frontal sinus is a sac of air under the soft tissues extending through a gap in the wall of the sinus usually as the result of an injury and is easily differentiated.

A mucocele usually extends downwards and soon affects the position of the eyeball, whereas the swelling of the pneumocele appears to have more effect on the anterior wall which is very hard and smoothly rounded. Radiologically the two types of dilatation will usually be distinguishable and percussion may differentiate them. Any confusion of the conditions can have few untoward consequences, though pneumocele is less likely to require active surgical treatment.

Treatment

Treatment may well be unnecessary if the symptoms are not marked, but surgery may be called for to restore the normal appearance of the forehead. Exploration may be undertaken by means of the coronal incision and osteoplastic flap, or the fronto-nasal duct enlarged from below. Infraction of the bulging anterior wall of the sinus may at times be difficult because of the denseness of the bone.

Discussion

Since the beginning of the century several theories have been suggested to explain the dilated yet air-filled sinus. The hypothesis that the expansion of the sinus is due to gas forming organisms inside it has no bacteriological evidence in its support. Abnormalities in the development of the sinus or the fronto-nasal duct might explain the appearances but are unlikely to do so when the condition commences in the adult. The formation in the fronto-nasal duct of a valve preventing air leaving the sinus after it had entered on forcible nose blowing has been suggested and in one of the present cases a small polyp was present in the frontal sinus with its base near the opening of the fronto-nasal duct. Yet though the history in this case was long it is not easy to conceive of such a marked dilatation occurring from this cause alone.

It appears most likely that the dilatation occurs in a mucocele different from the more common form in that its inferior boundary wall is sufficiently hard to resist expansion and that the anterior and medial walls expanded until such time as the fluid content could be evacuated down one or other fronto-nasal duct.

It is unusual for a history of a sudden profuse discharge of cavity contents to be given and Benjamins (1918) states that he was able to demonstrate an histological difference between the lining of a mucocele and that of pneumosinus frontalis. Both Baurowicz and Benjamins state

https://doi.org/10.1017/S0022215100050489 Published online by Cambridge University Press

that it is well recognized that after a mucocele has discharged spontaneously an infection appears in the cavity, though no confirmation of this has been discovered in the literature.

The authors wish to acknowledge with thanks the help of Dr. E. B. Brennan and Dr. John Wilkie, consultant radiologists, to the Lincoln County Hospital and Royal Infirmary, Sheffield, respectively.

REFERENCES

BAUROWICZ, A. (1902) *Arch. Laryng. Rhin., Berlin*, **12,** 303.
BENJAMINS, C. E. (1918-19) *Acta otolaryng., Stockh.*, **1,** 412.
BOENNINGHAUS (1919) *Beitr. Anat. etc., Ohr.*, **13,** 41.
FERRERI, G. (1922) *Arch. int. Laryng.*, **28,** 973.
GRÜNWALD (1923) *Zbl. Hals.-Nas.-u. Ohrenheilk.*, **3,** 224 (*abstract*).
IGLAUER, S. (1930) *Ann. Otol., etc., St. Louis*, **39,** 56.
KITAMURA, T., and ISHIURA, J. (1951) *Otolaryngology (Japan)*, **23,** 14; *abstracted in Excerpta med.* (Sect. xi), 1952, **5,** 362.
MCNALLY, W. J., STUART, E. A., and CHILDE, A. E. (1943) *Arch. Otolaryng. (Chicago)*, **38,** 574.
TAMARI, M. J., and BEAR, S. H. (1954) *Ann. Otol., etc., (St. Louis)*, **63,** 226.

https://doi.org/10.1017/S0022215100050489 Published online by Cambridge University Press