ANTRAL RHINOLITHIASIS

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ANTRAL rhinolithiasis is a very rare condition, as shown by the fact that there have only been 13 cases recorded in the literature. Recently a patient suffering from this disease has been investigated and treated at the Edinburgh Royal Infirmary. It is the purpose of this paper to describe this case in detail, to review the previous literature, and from this data to consider the pathology and clinical features of the disease.

Case Report

A woman who is now 59 years old, developed a persistent right-sided nasal obstruction in 1949. She was seen at a peripheral hospital in 1950, when the presence of multiple right-sided ethmoidal polypi was noted, and a sinus X-ray showed a calcified opacity in the right antrum. A right proof puncture was performed, but antral lavage was impossible as the sinus ostium was completely blocked. This procedure was so painful that it deterred the patient from attending the hospital again for several years. She was again seen in 1958 after the onset of intermittent right infra-orbital pain. There was no history of a foreign body having been inserted into the nose. A full dental clearance had been performed in 1932 and the gums were all soundly healed. The findings on clinical, and radiological examination were essentially unchanged, although unfortunately the previous X-rays were not available for comparison. The sinus X-ray showed several nodular calcified opacities in the right antrum, which were dense but not quite homogeneous. On 15th August, 1958 the right antrum was explored by Dr. J. P. Stewart through the canine fossa, and 3 rhinoliths were removed from within the cavity of the antrum. The sinus was full of foul smelling pus, and the lining mucosa was very hyperæmic. The bony walls of the antrum were intact. The usual antrostomy was fashioned under the inferior turbinate, and the polypi were removed. The patient made a speedy recovery from her operation, and was sent home 6 days later. Two months later she was symptom-free and the return following antral lavage was quite clear.

The irregular surface of the rhinoliths was dark brown in colour, presumably due to the presence of altered blood. Two of the specimens were sectioned, and the other rhinolith was sent for chemical analysis. Macroscopic examination of the sections showed a marked laminated appearance,

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but there was no obvious nucleus. Microscopic examination of the slides by Dr. Ogilvie revealed the presence of a cellulose nucleus, presumably the remains of some vegetable foreign body. Special staining techniques which were specific for calcium and mucin were employed, and these showed that the concentric lamina consisted of alternate layers of calcium and organic matter. The organic matter failed to take up the mucin stain.

I am indebted to Dr. Kapeller-Adler for the chemical analysis of the specimens. "The calculus removed at operation from the maxillary sinus appeared to consist of about 10 per cent. organic and 90 per cent. inorganic matter. According to results obtained on analyses of calcium, phosphate, carbonate, and iron, the inorganic substance seemed to contain about 90 per cent. calcium phosphate, and 10 per cent. calcium carbonate with a trace of iron."

Review of the Previous Cases

CASE I.

The earliest paper on this disease was written by Franciscus Carli in 1686. The patient, who was a 55 year old man, complained of left sided cheek pain, and later developed a swelling in the gum margin which was incised revealing a small irregular hard stone about the size of a pea. A similar case history was recorded by von Lanzoni in 1738. Oppikofer made a careful study of both Latin texts, and concluded that they were both descriptions of the same case.

CASE II.

In 1892 Zuckerkandl described the post-mortem findings in a case of maxillary sinusitis. The medial sinus wall bulged into the nasal cavity, and gross dental sepsis was present. The sinus contained a stone which was similar in structure to nasal rhinoliths. Section was performed later but histological study was impossible due to gross putrefactive changes.

CASE III.

The third antral rhinolith to be recorded was also found on post-mortem examination by Hanke in 1895. The patient was a 58 year old man who had died of a gastric carcinoma. The left antrum was full of pus and contained a hard irregular concretion which was about the size of a pea.

CASE IV.

Another case was recorded by Kahnitz in 1902. The patient suffered from an antral empyema, and from time to time there were severe nose bleeds. During an antrostomy operation, a mass was uncovered in the

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antrum which was at first thought to be a sequestrum. After removal this proved to be a stone which was about the size of a hazel nut. The stone had probably eroded the internal maxillary artery.

CASE V.

The fifth case was described by Oppikofer in 1908, who for the first time submitted the rhinolith to chemical analysis. The patient was a 60 year old woman who had suffered from a right-sided maxillary sinusitis for 20 years. As the condition failed to respond to a course of antral lavage it was decided that a Caldwell Luc operation was indicated. At operation the bony walls of the sinus were intact, and there was a stone about the size of a hazel nut resting on the floor. It was very hard, had an irregular brown surface and weighed 0·98 grams. Section failed to reveal any nucleus. Chemical analysis showed that the specimen consisted of 12 per cent. organic, and 88 per cent. inorganic matter. The main inorganic salt was calcium phosphate, but there were also traces of magnesium.

CASE VI.

The sixth case was described by O. Seidal in 1919. The patient who was a 21 year old woman had suffered from a right-sided nasal obstruction for the past 7 years. She also complained of a purulent rhinorrhœa and repeated nose bleeds. Clinical examination showed that the lateral wall of the right nasal cavity had been displaced and was in contact with the septum. There was a marked opacity of the right antrum visible on sinus X-ray. A provisional diagnosis of an antral tumour was made and it was decided to perform a Denker's operation. At operation a large stone was found which completely filled the antrum and had expanded the medial wall. The rhinolith weighed 13·5 grams and was composed largely of calcium phosphate. Sections were prepared but there is no mention of a nucleus. Histologically, the rhinolith had a laminated appearance consisting of alternate rings of lime and organic matter.

CASE VII.

The seventh case was reported by R. B. Sweet in 1921. The patient who was a 50 year old woman had suffered from a right-sided maxillary sinusitis for 10 years. Shortly before the onset of her nasal symptoms she had had all her teeth removed. The clinical diagnosis of a right-sided maxillary sinusitis was confirmed by an X-ray which showed a marked opacity in the right antrum, and it was therefore decided to perform an intranasal antrostomy. This procedure failed to effect a cure, and another X-ray was taken which showed a dense opacity which was thought to be a foreign body in the right antrum. The antrum was explored by the usual Caldwell Luc approach and a cuboid calculus was removed. There is no record of a search for a nucleus and chemical analysis was not performed.

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CASE VIII.

This case was described by Wright in 1927. The patient, who was a 24 year old man, had suffered from a right-sided frontal and maxillary sinusitis for the past 8 years. As the condition failed to respond to intranasal drainage of the frontal and maxillary sinuses, it was decided to perform an external frontal operation. Six weeks after this was performed the patient blew his nose rather vigorously and expelled a foreign body. This proved to be a rhinolith and section showed that it had formed around the apex of a tooth root. A more careful examination of the pre-operative X-ray showed the rhinolith in the right antrum.

CASE IX.

This case was described by Lord in 1944. The patient, who was a 50 year old man, had complained of a left-sided nasal obstruction with a purulent discharge for the past year. Clinical examination revealed multiple left-sided ethmoidal polypi and the left antrum was dull on transillumination. A Caldwell Luc operation was performed and a calculus was found lying freely in the left antrum. Section showed that this had formed around a nucleus of paper. The rhinolith consisted mainly of calcium phosphate together with a small amount of carbonate and some organic matter.

CASE X.

The tenth case was described by Cunningham, Lord, Manley and Polson. The patient, who was a 46 year old woman, had complained of a left-sided nasal discharge for 30 years following the removal of a left upper tooth. This operation was complicated by a maxillary sinusitis and an oro-antral fistula. A sinus X-ray showed a small foreign body which was thought to be either a tooth root or a piece of bone in the left antrum. Later a rhinolith was removed by the Caldwell Luc approach. It had formed around a nucleus which was thought to be a bone fragment. Its composition as shown by chemical analysis proved to be water 1·7 per cent., organic matter 11·6 per cent., and mineral matter 86·2 per cent. The latter consisted mainly of calcium phosphate.

CASE XI.

This case was recorded by Stafner in 1947. The patient had suffered from a chronic maxillary sinusitis for several years, and a sinus X-ray showed a very small dense opacity in the antrum, which was thought to be a tooth root. However, at operation this proved to be a rhinolith which had formed around a small piece of thread.

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CASE XII.

The twelfth case was described by Marrin (1955). The patient who was a 56 year old woman, was first seen in 1948. An upper right molar tooth had been removed in 1933 and this was complicated by an oro-antral fistula with a maxillary sinusitis. The fistula persisted draining variable amounts of foul pus. An intranasal antrostomy was performed without benefit. Later a sinus X-ray showed a stone in the right antrum. Before operative treatment was performed, the stone was delivered spontaneously through the oro-antral fistula. The stone weighed 97 milligrams and careful examination failed to reveal a nucleus. Analysis showed it to consist of 38 per cent. organic matter and 62 per cent. calcium phosphate.

CASE XIII.

The thirteenth case was described by Caligaris in 1955. The patient was a 58 year old man, who had suffered from a bilateral maxillary sinusitis for many years. He had been exposed to siliceous dusts for many years whilst working in a foundry, and this was considered to be a very important ætiological factor. Intranasal antrostomies were performed in 1948 curing the condition on the right side. When seen in 1953, there was an active left-sided infection, and sinus X-rays showed a dense basal opacity in addition to a general clouding of the left antrum. A Caldwell Luc operation was performed, and the left antrum was found to contain fœtid pus with 2 rhinoliths, which were each about the size of a pea. They were sectioned but no central nucleus was found. Chemical analysis showed that the rhinolith was composed of water, organic matter, calcium carbonate and phosphate, magnesium phosphate and traces of iron.

Pathogenesis

It will be noted that all these patients suffered from a suppurative sinusitis. Stone formation elsewhere is usually associated with pus, but there must ovbiously be other factors otherwise antral stones would be much more common.

Chemical analysis has been performed on 6 occasions, and shows that the main inorganic constituent is always calcium phosphate. This proves that the chemical composition of antral and nasal rhinoliths is quite similar. The principal source of these salts is undoubtedly pus. Polson in his excellent review on rhinoliths, has given the following figures regarding the calcium content of pus. "Samples of pus were analysed and yielded the following results: (*a*) peritoneal exudate from a case of general peritonitis, complicating an appendix abscess: calcium content 0·31 per cent. dry weight; (*b*) pericardial exudate from a case of suppurative pericarditis: calcium content: 0·13 per cent. dry weight ≡ 11 mgm. Ca. per 100 c.c.; phosphate content: 32·3 mgm. inorganic P per 100 c.c. ≡ 102 mgm.

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phosphoric acid per 100 c.c.; (*c*) peritoneal exudate from another case of general peritonitis: calcium content 0·15 per cent. dry weight ≡ 17 mgm. Ca. per 100 c.c.; phosphate content: 36 mgm. inorganic P. per 100 c.c. ≡. 116 mgm. phosphoric acid per 100 c.c. Nasal pus was not available. The phosphate values were artificially raised by post-mortem change, but like changes probably occur in pus retained in the nose." Stagnation of the pus with exposure to air currents will accelerate the concentration of the pus beyond the point at which the calcium salts will remain in solution.

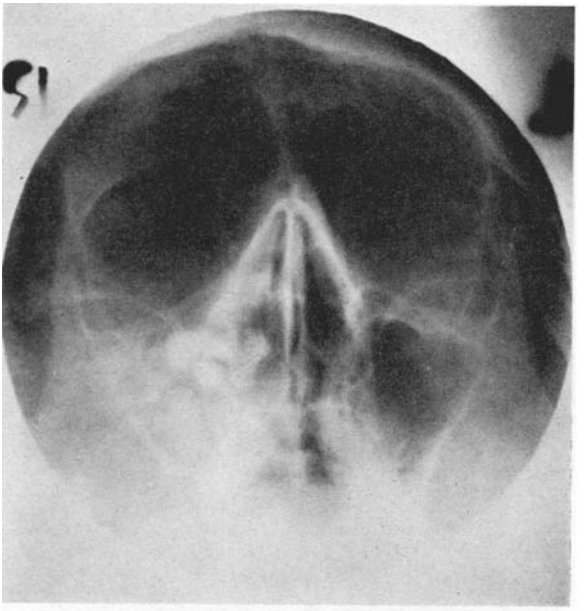


FIG. 1.
Occipito-mental view showing the rhinoliths in the right antrum.

Usually the precipitation of these salts occurs around a nucleus, and in the vast majority of rhinoliths, this nucleus is an exogenous foreign body. Spiegel Adolf has shown that under such circumstances, a nucleus owes its importance as a site of increased surface tension in a fluid with a high electrolyte content. On 5 occasions a foreign body has been identified in the centre of an antral rhinolith. In the first 5 cases it is obvious that no search was made for a nucleus, and in another 4 cases the presence of a foreign body was excluded on macroscopic evidence only. Antral foreign bodies such as those recorded by Stafner, Parker and Dunn, Reynolds, Verne, and Irvin Moore are not uncommon, and it is evident that rhinolithiasis is not an inevitable sequel. However, in all these cases there was no complicating secondary infection. When antral rhinoliths form in the

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absence of a foreign body, it is convenient to postulate an endogenous nucleus such as mucous crusts, blood clot, desquamated mucosa, or aggregations of bacteria, but there is no supporting evidence for this theory.

Many rhinoliths like vesical calculi have a laminated structure. This observation was first made by Brown in 1850, and has been confirmed on many subsequent occasions. In the case of vesical calculi it usually means that the laminae are of different chemical composition. Structural analysis of rhinoliths has been a neglected field, but on the two occasions that it has

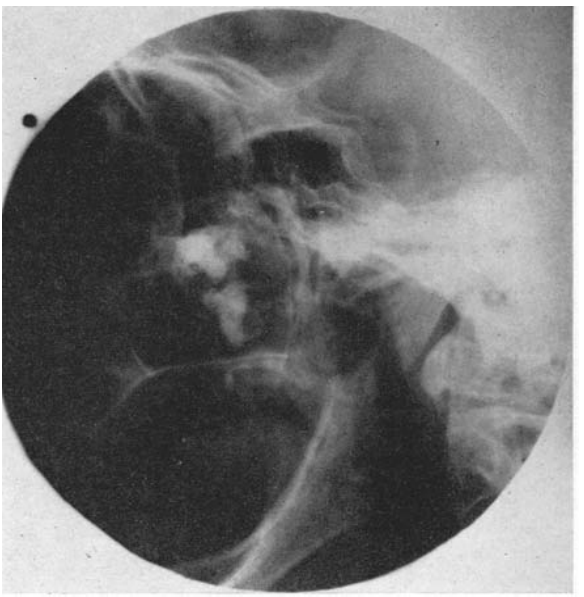


FIG. 2.
Lateral view.

been attempted, the laminae were found to consist of alternate layers of calcium salts and organic matter. Presumably the layers of calcium salts are laid down during each acute exacerbation of secondary sepsis.

The dominant factors in the genesis of antral rhinoliths appear to be foreign bodies and secondary sepsis. However, other bacterial and physico-chemical factors have been considered by some workers to be of importance. The fact that leptothrix buccalis can absorb calcium salts, has resulted in the suggestion that there may be a specific bacteriology to this disease. All the bacterial investigations carried out by such workers as Gerber, and Lantis, have failed to confirm this theory. A raising of the pH would favour the precipitation of calcium phosphate, and in the case described by Caligaris the nasal secretions were excessively alkaline. This physico-chemical change was attributed to bacterial activity.

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Clinical Features

It will be seen from these case histories, that all these patients suffered from a chronic maxillary sinusitis, and they usually presented with the symptoms and signs of this condition. Clinical examination failed to reveal any evidence of the underlying rhinolith, and this is well illustrated by the fact that on four occasions the stones were unexpectedly found during Caldwell Luc operations which were performed for chronic suppuration. In three neglected cases actual expansion of the antral walls had occurred, usually in a medial direction. On two occasions multiple ethmoidal polypi were also present on the affected side of the nose.

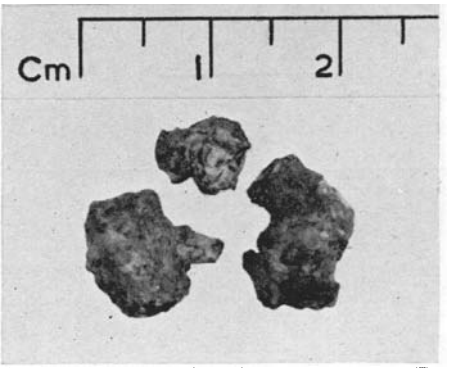


FIG. 3.
Specimens removed at operation.

Radiological Appearances

Careful radiological examination is essential for the establishment of a pre-operative diagnosis. There are eight references in the literature to the X-ray findings in this disease, and on each occasion a calcified opacity was seen in the antrum usually in association with a more generalized opacity due to the secondary sepsis. There are however several different conditions which may produce calcified opacities in the region of the antrum and these may conveniently be classified in the following way:

1. Foreign bodies in the antrum with a calcium content such as dental roots.

2. Some odontomes
   (*a*) dentigerous cysts
   (*b*) cementoma
   (*c*) osseous odontome
   (*d*) composite odontome

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3. Bone tumours
   (*a*) osteoma
   (*b*) ossifying fibroma
   (*c*) osteogenic sarcoma
4. Bone diseases
   (*a*) osteitis deformans
   (*b*) osteitis fibrosa

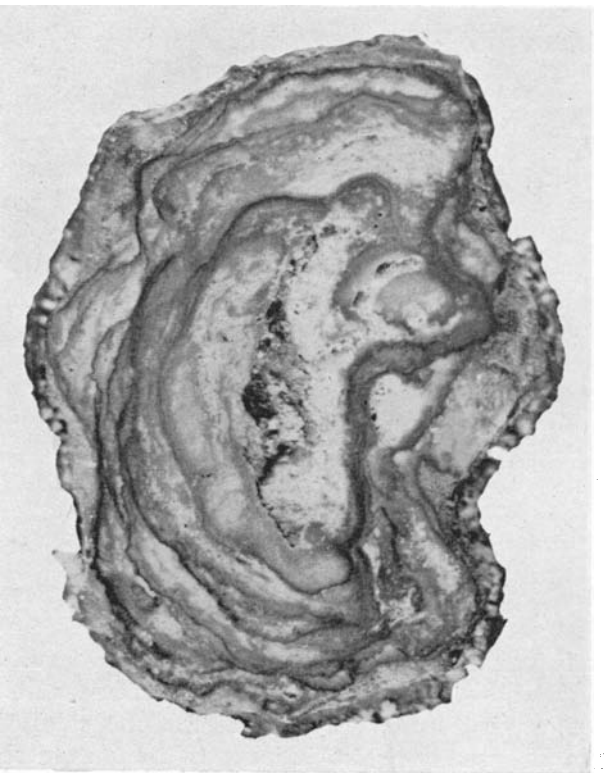


FIG. 4.
Cross-section of a rhinolith showing the laminated structure.

Confusion is only likely to occur in cases of antral foreign bodies, and osteomata, and here the practical importance of differentiation is minimized by the fact that the treatment is identical for all three conditions.

Treatment

Removal of the rhinolith with the establishment of drainage into the nose beneath the inferior turbinate, is best attained by the Caldwell Luc

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operation, although on one occasion it was apparently satisfactorily performed entirely through the nose. The results of this operation appear to be excellent.

Summary

1. A new case of antral rhinolithiasis is described, and the previous 13 recorded cases are reviewed in detail.

2. Foreign bodies, and secondary sepsis are considered to be the most important factors in the pathogenesis of this disease.

3. The limitations of clinical examination, and the importance of X-rays are stressed in the diagnosis of this disease.

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