Chapter 19: Angiofibroma

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Definition

The term angiofibroma denotes a vascular swelling presenting in the nasopharynx of prepubertal and adolescent males and exhibiting a tendency to bleed. Alternative titles such as juvenile angiofibroma, nasopharyngeal fibroma, bleeding fibroma of adolescence and fibroangiomatous have largely been superseded by the simpler label of angiofibroma. They are, nevertheless, acceptable since they refer to the basic features of the condition and are not likely to be misinterpreted.

Much of the previous literature concerning aetiology and treatment was speculative and controversial, but a clearer picture of the nature of these swellings, their site of origin, behaviour, and safer management has emerged in recent years.

Background

At one time, the impression existed that the prevalence of angiofibromata was higher in certain parts of the world, for example the Middle East and the Americas, than in northwestern Europe where it was considered to be quite low. It is probable that such an assumption was arrived at by equating large reported series from specific centres with a high geographical prevalence. The series reported by Shaheen (1930), Figi (1940) and Handousa, Farid and Elwi (1954) are classical of major centres drawing cases from far and wide and suggesting a disproportionately high incidence of angiofibromata for the areas in question.

The ratio of angiofibromata to other ear, nose and throat conditions, as culled from diagnostic registers, is likely to show wide variations, even between hospitals within a single large conurbation, and is therefore valueless as a guide to the prevalence of the condition. Martin, Ehrlich and Abels (1948) reported an annual admission rate of one or two cases for the 2000 or so cases seen in the head and neck service of the Memorial Hospital, New York, but with a formidable reputation such as that of the Memorial Hospital, it would not be surprising if it received a far larger number of referrals than a lesser institution of comparable size within the same city.

In London, Harrison (1976) recorded the figure of one per 15,000 patients at the Royal National Throat, Nose and Ear Hospital which might prompt one to conclude that there are fewer angiofibromata in London than in New York. However, the two situations are not comparable and, in any case, the large number of London teaching hospitals, existing as a counterweight to the Royal National Hospital, are likely to share in a fairer distribution of cases, so that even if the influx of tumours per hospital is small, the collective total might match that of any large metropolis.

Some doubt has been cast about the authenticity of certain of the series reported in the past, the main objections being questionable history, and the inclusion of females and patients of extreme age among genuine cases.
There is now general agreement that this is exclusively a disease of males and that the mean age at presentation is around 14 years (Harrison, 1976). The range, however, is wide and varies between 7 and 19 years (Martin, Ehrlich and Abels, 1948) with isolated cases presenting earlier or later.

Many of the older reports implied that patients suffering from the condition displayed signs of delayed maturity as judged by secondary sexual characteristics, and that tumour pathogenesis was somehow linked to this. The regression which was observed with age or supposedly under the influence of hormones, was cited as evidence of an hormonal aetiology, but was never supported by objective biochemical signs of hormonal insufficiency.

The suggestion that total regression occurs in the late teens or early twenties has never been convincingly demonstrated, although most authorities concede that some shrinkage, hardening and loss of vascularity of the swellings occur with age.

The lack of complete regression could well explain the inclusion of older patients in some of the earlier reports, and would exonerate their authors of the charge of having misdiagnosed such cases.

**Pathology**

Grossly, angiofibromata appear as firm, slightly spongy lobulated swellings, the nodularity of which increases with age. The colour varies *in vivo* from pink to white. That part which can be seen in the nasopharynx and is therefore covered by mucous membrane is invariably pink, whereas those parts which have escaped to adjacent extrapharyngeal areas are often white or grey. On section, the tumour has a reticulated, whorled or spongy appearance, and lacks a true capsule. The edge, however, is sharply demarcated and easily distinguishable from the surrounding tissues.

Microscopically, the picture is of vascular spaces of varying shape and size abounding in a stroma of fibrous tissue, the relative proportions of which alter with the age of the swelling. In the younger lesion, the vascular component stands out as an all-pervasive feature, whereas in the older swellings collagen predominates. It would seem that, as one strays from the heart of the tumour, the fibrous tissue element overshadows the vascular.

The vascular pattern consists of large thin-walled sinusoidal vessels lined by flattened epithelium, unsupported by a muscular coat, and the closer these are to the surface of the swelling, the smaller they become.

In older swellings, there is a tendency towards gradual compression of the sinusoids so that the lining endothelial cells are pushed against each other like cords, while in others intravascular thrombosis occurs (Hubbard, 1958).

The stroma is composed of coarse parallel wavy or interlacing bundles of collagen in which stromal cells are seen to radiate outwards from the vessels (Steinberg, 1954) and in which localized areas of myxomatous degeneration may be observed.
Pathogenesis

A number of theories have been propounded over the years to explain the origin of angiofibromata and, although one or two are seemingly plausible, none is entirely convincing.

Ringertz (1938) suggested that the tumour arose from the periosteum of the nasopharyngeal vault, while Som and Neffson (1940) believed that inequalities in the growth of the bones forming the skull base resulted in hypertrophy of the underlying periosteum in response to hormonal influences. Bensch and Ewing (1941) thought that the tumour probably arose from embryonic fibrocartilage between the basiocciput and basisphenoid, whereas Brunner (1942) suggested an origin from the conjoined pharyngobasilar and buccopharyngeal fascia.

More plausibly, Osborn (1959) considered two alternatives, namely the possibility that the swellings were either hamartoma, or residues of fetal erectile tissue which were subject to hormonal influences.

Girgis and Fahmy (1973) noted cell nests of undifferentiated epithelioid cells or 'zellballen' at the growing edge of angiofibromata, an appearance which they likened to paragangliomata. They also commented on the existence of paragangliomatous tissue around the terminal part of the maxillary artery in the pterygopalatine fossa of stillborn infants and put forward the view that these might be the forerunners of angiofibromata.

With the possibility of vascular malformations still in mind, it would not be too far fetched to suggest that angiofibromata might arise from vestiges of the atrophied stapedial artery, although clearly it is not possible to validate such an assertion.

Site of origin and behaviour of angiofibromata

It was previously assumed that the vault of the nasopharynx was the most likely site of origin because of the broad-based attachment to the skull base which is so typical of the majority of swellings. Others considered the choana to be a more probable site in view of the frequency with which both nasopharynx and nasal fossa are involved, but failed to specify the precise point of origin.

Modern methods of investigation and ambitious surgical procedures have focused attention on the region of the sphenopalatine foramen as the site of origin which would most reasonably explain the subsequent behaviour of angiofibromata. This is based on the observation that larger tumours present as bilobed dumb-bell swellings straddling the sphenopalatine foramen, with one component filling the nasopharynx and the other extending out into the pterygopalatine and infratemporal fossae. The central stalk joining the two portions occupies the sphenopalatine foramen at the upper end of the vertical plate of the palatine bone, without appearing to enlarge it very much. In the absence of any significant degree of erosion of the sphenopalatine foramen, the only logical way that such a dumb-bell arrangement can come about is if the rudiment of the swelling were to be either in or very close to the foramen.
The seedling swelling arising from such a site would migrate medially beneath the mucous membrane of the nasopharynx, displacing it downwards in the process, and eventually growing to fill the postnasal space. As the process of growth continues, the anterior face of the sphenoidal sinus is encroached upon and eroded, and the sinus is invaded. The swelling then follows the line of least resistance and grows forwards into the nasal fossa where it may acquire secondary attachments. Having filled the nasal fossa it will displace the nasal septum over to the opposite side, so that the healthy side of the nose also becomes blocked.

Growth in a lateral direction may take place in some cases, and the starting point is once again the sphenopalatine foramen. The pterygopalatine fossa is thus invaded and, once filled, causes forward bowing of the posterior wall of the antrum. Eventually, the swelling comes to occupy the infratemporal fossa and when insufficient room remains for further expansion, it will encroach on the orbital fissures.

However, this is not to say that every angiofibroma behaves in this way; indeed, some remain confined to the nasopharynx but usually with a bias towards one side.

That portion of a bilobed angiofibroma which lies outside the nasopharynx eventually becomes very hard and nodular, and in the course of its spread into the pterygopalatine and infratemporal fossae may well erode the anterior face of the greater wing of the sphenoid so as to make contact with the dura of the middle fossa. It may displace the maxillary nerve upwards, and less commonly the optic nerve, and if it invades the orbit through the posteriorly placed fissures of that cavity, will eventually cause proptosis. The main blood supply to angiofibromata comes by way of an enlarged maxillary artery, but other arteries, such as the ascending pharyngeal, vidian, unnamed branches of the internal carotid and rarely the vertebral, may contribute to its vascularization.

**Symptoms and signs**

The two cardinal symptoms of angiofibroma are nasal obstruction and intermittent epistaxis. The latter may vary in severity from the occasional show to an alarming and sometimes life-threatening torrent. Chronic anaemia is thus a common feature of the established condition.

It should be stressed that the bleeding which is so characteristic of much of the surgery of angiofibroma is caused by breaking into the parenchyma of the swelling or by disrupting the feeding vessels, whereas the bleeding which occurs prior to operation is entirely spontaneous and usually unconnected with trauma.

The completeness of nasal obstruction is such that stasis of secretions and sepsis are virtually inevitable, followed by hyposmia and anosmia.

The voice acquires a nasal intonation and, if the swelling is large enough to force the soft palate down, there may be an added plummy quality to it. Blockage of the eustachian tube is not uncommon in such a situation and leads to deafness and otalgia.

Anterior rhinoscopy is likely to confirm the presence of abundant purulent secretions together with bowing of the nasal septum to the uninvolved side. Posterior rhinoscopy in the
cooperative relaxed patient should display a pink or red mass filling the nasopharynx, but the bulk of the lesion is generally such that it is not often possible to ascertain the site of attachment.

Gross physical signs are evident when extensive disease has involved the nose and infratemporal fossa, the nasal bones being splayed out and there is obvious swelling in the temple and cheek. Intraoral palpation in the interval between the ascending ramus of the mandible and the side of the maxilla may also reveal the tell-tale thickening of disease which has crept round the back of the antrum.

Impaction of bulky disease in the infratemporal fossa results in extreme signs such as trismus and bulging of the parotid gland, while proptosis is a definite sign that the orbital fissures have been penetrated. The classical frog face as displayed in older publications is the ultimate picture of massive escape of disease.

Headache is not uncommon in long-standing cases and is attributable to chronic sinusitis in some patients. In other instances the cause is not so obvious and explanations, such as dural compression at sites of bone erosion or invasion of the sphenoidal sinus, can only be speculative.

Failing vision has been seen by the author on two occasions and indicates tenting of the optic nerve over a substantial extrapharyngeal extension of the tumour.

**Investigations**

Standard X-rays of the paranasal sinuses taken in the occipitofrontal or lateral projections may sometimes be misleading in that opacity of the maxillary sinus, in association with a soft tissue shadow of the postnasal space, may be mistaken for an antrochoanal polyp.

On the other hand, tomography in the frontooccipital plane may be helpful in localizing the position of the mass, and showing areas of bone destruction or invasion of the sphenoidal sinus - findings which are inconsistent with an antrochoanal polyp. Lateral tomograms are desirable as they may reveal forward bowing of the posterior antral wall which is typical of angiofibroma filling the pterygopalatine fossa.

The introduction of computerized tomographic scanning with enhancement, and more recently, the technique of magnetic resonance imaging, has to some extent pre-empted the routine use of arteriography (Levine et al, 1979).

Invasion of the sphenoidal sinus, erosion of the greater wing of the sphenoid, and extension into the pterygopalatine and infratemporal fossae is detectable with remarkable clarity on the latest generation of scanners. When doubt exists about the accuracy of the imaging, or in cases of recurrent angiofibroma, selective arteriography should be performed and the results displayed to the best advantage using subtraction techniques.

The vascular blush, which shows up in the postnasal space and adjacent areas, is diagnostic of the condition and obviates the need for biopsy. Useful information is obtained from the arteriograms on the size and site of the lesion and the size and location of feeding
vessels, some of which arise from unusual sources such as the internal carotid or vertebral arteries (Thomas and Mowat, 1970; Ward et al, 1974).

Biopsy is no longer justifiable in view of the risk of severe and protracted haemorrhage and since modern radiological techniques will establish the diagnosis with a high degree of accuracy.

**Differential diagnosis**

The list of possible diagnoses with which angiofibroma may be confused includes antrochoanal polyp, large adenoids, tumours of the postnasal space and chordoma. In practice there is rarely any doubt about the issue once the patient has been fully investigated.

**Treatment**

The treatment of angiofibroma has been subject to considerable change over the years, but appears to be coming round full circle.

In the earlier part of the century treatment comprised surgery, but one suspects only because safer alternatives were not available. These surgical efforts were thwarted by the inadequacies of preoperative investigations and the torrential haemorrhage which accompanied the surgical endeavours. The anaesthetics of the era were unsophisticated or poorly administered, often adding to the problem of bleeding, and septic complications were all too common.

It was not universally appreciated that the severe bleeding which accompanied operations for angiofibroma was, in large measure, due to the surgeons' failure to avoid breaching the surface of the swelling during the course of the dissection. This is hardly surprising in the light of present knowledge about its tendency to fill nooks and crannies and to invade adjacent areas. Even as late as the 1960s, the practice of grasping angiofibromata with giant bone-holding forceps and wrenching them out was still in evidence in some centres.

The disillusionment created by the uncertainties and dangers of surgery led to a search for alternative and safer methods of treatment.

Attention was directed at hormone therapy and external beam irradiation, often as a preliminary to surgery, on the basis that such treatment promoted collagen formation and thereby reduced vascularity.

Testosterone was used on its own (Martin, Ehrlich and Abels, 1948) for the treatment of some swellings, as were oestrogens (Patterson, 1973; Jafek et al, 1973), and a combination of the two was advocated by Schiff (1959). There is some evidence, in fact, to support the view that either type of hormone may encourage maturation of collagen while, at the same time, reducing vascularity (Arolde and Schatzle, 1971), but whether this contributes significantly to the safety of surgery is impossible to determine. It makes no sense, however, to use hormones prior to radiotherapy since the latter is known to be an effective method of reducing the vascularity of tissues when used on its own.
Therefore, the case for using radiotherapy exclusively as a definitive treatment for angiofibroma is not without merit. Briant, Fitzpatrick and Book (1970) advocated it on the grounds that surgery carries a high recurrence rate, but others have felt that radiotherapy should be reserved for selected patients, such as those with inoperable intracranial extensions and recurrent tumours (Ward et al, 1974). The effect of ionizing radiation on angiofibromata has been studied in those patients who subsequently undergo surgery, and is judged to bring about a shrinkage and hardening of the tumours with a resultant reduction of their vascularity. Many clinicians, however, view the prospect of irradiating young adolescents with considerable diffidence and feel that it cannot be justified in the face of possible future carcinogenicity.

The resurgence of interest in surgery as definitive treatment has gathered momentum in recent years, largely because of improvements in preoperative assessment and a better understanding of the condition. There is some reason to suppose that preoperative embolization may reduce bleeding provided that the timing is right, although its hazards should not be minimized (Lasjaunias, 1980; Lang, McKellar and Lang, 1983).

The argument as to which surgical approach is best for the removal of angiofibromata implies that all swellings are identical - a notion which is nonsensical. Empiricism has no part in surgical judgments, and each case should be approached on the results of the preoperative findings. The transpalatal operation, favoured exclusively by many, would be rational if all angiofibromata were confined to the nasopharynx, a state of affairs which borders on the exceptional (English, Hemenway and Cundy, 1972).

An alternative and possibly more adaptable approach combines a transpalatal route with a gingivobuccal incision for access to the pterygomaxillary region (Jafek et al, 1973), but even this entails a degree of empiricism which is incompatible with the philosophy of tailoring the operation to the disease.

Clearly, every case is judged on its merits and the surgical approach planned on the basis of the preoperative findings. A tumour which is confined exclusively to the postnasal space should be removed transpalatally, but one which has escaped into the pterygopalatine fossa, or beyond, requires a more ambitious approach. This must entail adequate access to the extensions in question and allow dissection between swelling and surrounding structures in such a way as to ensure that the tumour parenchyma is not breached in the process (Shaheen, 1984). It should also provide the surgeon with sufficient room to ligate the principal feeding vessel to the tumour, and not compromise his ability to deal with major haemorrhage.

For tumours which encroach on the nasal fossa and just spill over in to the pterygopalatine fossa, a lateral rhinotomy combined with resection of the medial antral wall may suffice to deliver the tumour and its extensions. For larger angiofibromata which invade the infratemporal fossa, a Weber-Ferguson incision combined with a transmaxillary-nasal approach is favoured (Shaheen, 1982).

Once the cheek flap has been reflected, the anterior, lateral, posterior, and medial walls of the maxilla are removed, leaving the orbital floor and upper alveolar arch as two intact shelves separated by a void. By ensuring that all of the medial antral wall is removed - including the vertical plate of the palatine bone - the nasal cavity, antrum, infratemporal fossa,
The pterygopalatine fossa and nasopharynx are thrown into one large continuous space, a state of affairs which affords access to both the components of the swelling and its central stalk.

Starting laterally, the infratemporal part of the swelling is first identified and the maxillary artery found and ligated. The tumour is then mobilized in a medial and forward direction towards the antrum and nasopharynx. Removal of the perpendicular plate of the palatine bone serves to uncap the central stalk of the dumb-bell, which previously occupied the sphenopalatine foramen, and facilitates the subsequent mobilization of the nasopharyngeal component of the swelling.

The latter is dissected free from the base of the skull and from within the sphenoidal sinus, and the mucous membrane covering its undersurface is then divided at its periphery in order to complete the detachment of the tumour. No attempt is made to strip the mucous membrane off the inferior aspect of the swelling because of the intimacy of attachment between the two.

**Complications**

A palatal fistula may result when the transpalatal route is used, especially if the incision is sited directly over the junction of hard and soft palates. With the Weber-Ferguson approach, anaesthesia of the cheek is inevitable, although it rarely assumes troublesome proportions in this age group. Slight ectropion of the lower lid occasionally results and crusting of the nose may occur in some cases for some time afterwards.

The frequency of recurrence is very much dependent on the adequacy of the approach, the conditions at operation, and the experience of the surgeon.