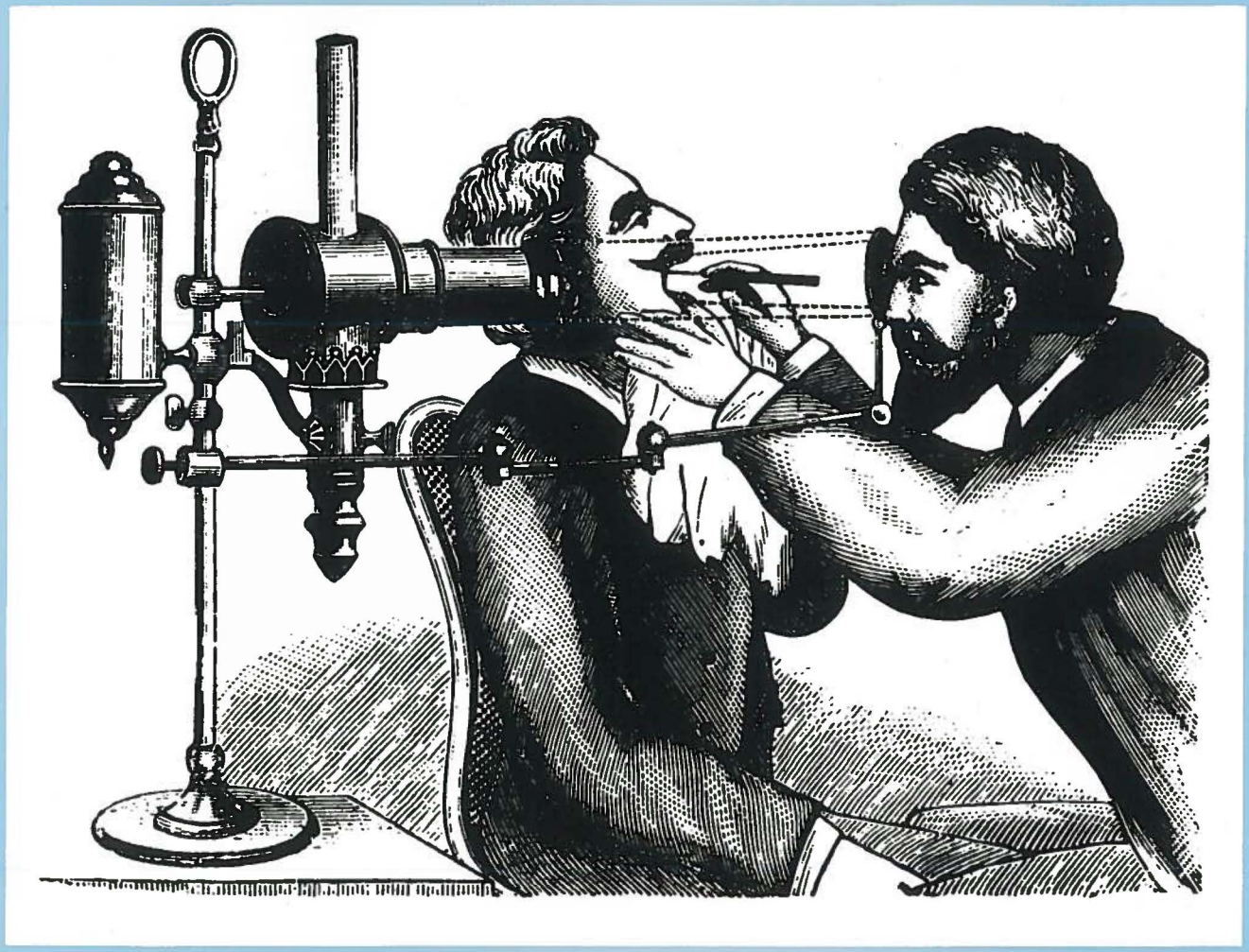
c.t. buiter

endoscopy of the upper airways



excerpta medica

Endoscopy of the upper airways

Stellingen

1 Als sanerende ooroperatie is een "combined approach tympanoplasty" niet altijd te verkiezen boven een radicale mastoidectomie.

2 Het verdient aanbeveling de patient bij wie een tympanoplastiek verricht is post-operatief te verplegen in anti-Trendelenburg houding van 20 – 25° ten opzichte van horizontaal.

3 Voor het röntgenologisch aantonen van een vloeistofspiegel in één der kaakholtes leent zich de combinatie van schedelfoto's: een opname volgens Waters (occipitomentale projectie), waarbij de patient ligt op de éne zijde, samen met een opname volgens Waters, waarbij de patient ligt op de andere zijde, het beste.

4 De eis dat een arthroscoop een diepte scherpte heeft van 1 tot bijna oneindig is onredelijk. (H. R. Eikelaar: Arthroscopy of the knee)

5 Verwacht mag worden dat in de toekomst het fonetogram een reden tot ontraden van een bepaalde beroepskeuze kan vormen, zoals dat nu reeds geldt voor het audiogram.

6 Bij patienten met een voor een maligne proces suspecte klier aan de hals dienen de bovenste luchtwegen röntgenologisch èn endoscopisch onderzocht te zijn alvorens extirpatie van deze klier pro diagnosi plaatsvindt.

7 Aan de operatieve reconstructie van de traanwegen dient rhinologisch onderzoek vooraf te gaan.

8 Een proefschrift dient niet te ontaarden in een prentenboek!

Stellingen behorende bij het proefschrift van C. T. Buiter, "Endoscopy of the upper airways", Groningen 1976.

Samenvatting

Nadat in de inleiding verklaard is welk gebied bedoeld wordt met de term 'bovenste luchtwegen' worden de anatomie en de functies van de nasopharynx, de neus en de neusbijholten besproken in de hoofdstukken 1 en 3.

De bovenste luchtwegen vormen een gebied dat moeilijk toegankelijk is voor onderzoek, ook voor de geoefende specialist. Bij dit onderzoek neemt de inspectie een alles overheersende plaats in.

In hoofdstuk 4 worden een aantal voorbeelden getoond van de vele hulpinstrumenten welke in de loop van de geschiedenis werden ontwikkeld om de mogelijkheden tot inspectie van de bovenste luchtwegen te verbeteren. Slechts een klein aantal van al deze ontwikkelingen zijn in gebruik gebleven: de electrische lamp en de voorhoofdspiegel voor de verlichting van de van nature donkere bovenste luchtwegen, het neusspeculum voor de inspectie van de neus van voren, de tongspatel en het spiegeltje voor de rhinoscopia posterior. Lange tijd stonden voor het onderzoek van de neusbijholten slechts de onbetrouwbare methode van het doorlichten met electrisch licht en de proefpunctie ter beschikking.

Vooral voor het onderzoek van de neusbijholten betekende de ontwikkeling van de röntgendiagnostiek een grote verbetering.

In hoofdstuk 5 wordt de ontwikkeling van het endoscopisch onderzoek van de bovenste luchtwegen besproken. Dankzij de moderne endoscopie bestaan er nauwelijks meer beperkingen voor het visuele onderzoek van de nasopharynx *(nasopharyngoscopie)*, neus *(neusendoscopie)*, en de sinus maxillaris *(antroscopie)*.

De endoscoop-optieken van het Hopkins- en Lumina-type, voorzien van koud licht door middel van glasvezels, maken de fotografische documentatie van de endoscopische bevindingen tot een gemakkelijk uit te voeren handeling.

De voordelen van deze fotodocumentatie zijn:

1) Een objectief beeld vervangt de subjectieve beschrijving.
2) Aan de hand van objectieve beelden zijn besprekingen en beslissingen in teamverband beter mogelijk.

RIJKSUNIVERSITEIT GRONINGEN

Endoscopy of the upper airways

Proefschrift

ter verkrijging van het doctoraat in de geneeskunde
aan de Rijksuniversiteit te Groningen
op gezag van de Rector Magnificus Dr. M. J. Janssen
in het openbaar te verdedigen op
woensdag 17 maart 1976
des namiddags te vier uur

door

Cornelis Tekke Buiter

geboren te Almelo

1976

EXCERPTA MEDICA, AMSTERDAM

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Promotor: Prof. Dr. P. E. Hoeksema

Co-referent: Drs. E. Th. Edens

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Printed in The Netherlands

Contents

CHAPTER 1

Introduction

Of the four methods of physical examination: inspection, palpation, percussion and auscultation, inspection is by far the most important in oto-rhino-laryngology. By adding a new method of inspection to those already known, it would seem that a further improvement of oto-rhino-laryngological examination can be obtained.

More and more organs of the human body are being examined endoscopically. To start on the endoscopic examination of the upper airways seemed a logical step.

The glottis is generally accepted as the line of division between the upper and lower airways. The trachea, the bronchi and its branchings up to the alveoli are called the lower airways, and the nose with the paranasal sinuses and the whole of the pharynx are classed with the upper airways.

The middle ear and the auditory tube ought to be classed with the upper airways, since they are connected with the nasopharynx and covered with respiratory epithelium. They have no function in breathing, however, and are therefore generally omitted from the concept of airways.

There does not seem to be much sense in classing the oropharynx and the hypopharynx with the upper airways either, since food, too, passes through these two areas.

There is also a major histological difference: in the oro- and hypopharynx the mucous membrane does not consist of respiratory ciliary epithelium, but of non-keratinizing squamous cell epithelium.

By the term 'upper airways' is here meant that part of the airways which is situated above the palatal level.

CHAPTER 2

Some anatomical notes*

The external nose bears some resemblance to a three-sided pyramid, the apex of which points forward. The skeleton of the external nose consists of a bony part: the nasal bones and the frontal processes of the maxillae, and a cartilaginous part: the upper lateral cartilages (upper nasal cartilages), the lateral crura of the greater alar cartilages (lower nasal cartilages) and the lesser (small) alar cartilages (fig. 1).

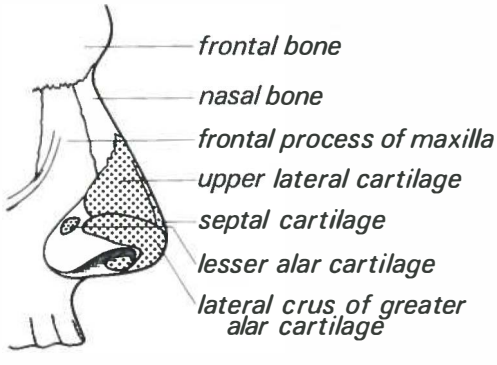


Fig. 1. The skeleton of the nose.

The nasal bones are grown together mutually, as well as with the perpendicular plate of the ethmoid bone. The upper lateral cartilages are linked to each other and to the septal cartilage by means of connective tissue. At both sides the lateral crura of the greater alar cartilages form a whole with the medial crura (septal processes of the lower nasal cartilages); these medial crura together form the front part of the nasal septum.

* In the text the nomenclature has been used as it is customary in oto-rhino-laryngology. Whenever this varies from the Nomina Anatomica, the latter nomenclature is added between brackets, when it is used for the first time.

The nose is divided internally into two by the nasal septum: the nasal cavities. As a rule it is not situated exactly in the median plane, but very often (in 75% of the subjects) there is a deviation, which is more frequently to the right side.

The skeleton of the nasal septum consists chiefly of two bones, the perpendicular plate of the ethmoid bone and the vomer, and three cartilages, the septal cartilage and the two medial crura of the greater alar cartilages (fig. 2).

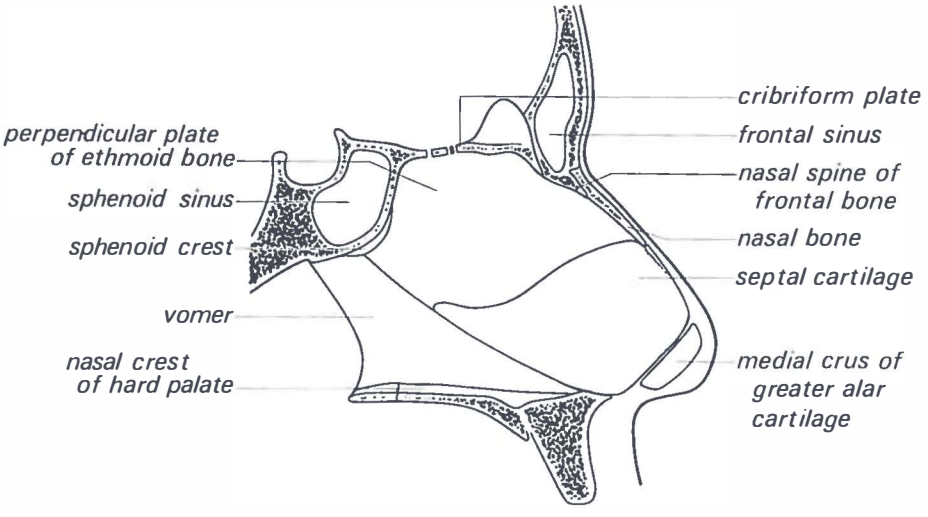


Fig. 2. A diagram of the nasal septum.

The perpendicular plate of the ethmoid and the vomer are connected with the anterior wall and the floor of the sphenoid sinus (or sinuses). The posterior border of the vomer is at the same time the posterior border of the nasal septum. Caudally the nasal crest of the hard palate and dorsocranially the sphenoid crest are also part of the nasal septum.

The floor of the nose is composed of the upper side of the hard palate, which consists of the palatine processes of the maxillae with the horizontal plates of the palatine bones at the back of it. Dorsally the hard palate passes into the soft palate, which is made up of muscle fibres (of the left and right palatoglossus, the left and right palatopharyngeus, the left and right tensor veli palatini, the left and right levator veli palatini and the uvulae muscles).

The bony lateral wall of the nose is composed of the nasal, frontal, ethmoid, sphenoid, maxillary and palatine bones. In the bones which form the major part of the lateral wall, i.e. the ethmoid bone and the maxilla, there are cavities filled with air, which are connected with the nasal cavity, and which are known as paranasal sinuses: the ethmoidal cells and maxillary sinus. Thus the lateral wall of the nasal cavity is at the same time the medial wall of these paranasal sinuses.

A frontal section of this area gives a good impression of this mutual connection (fig. 3). When a frontal section is made, the nasal cavities are triangular as far as the

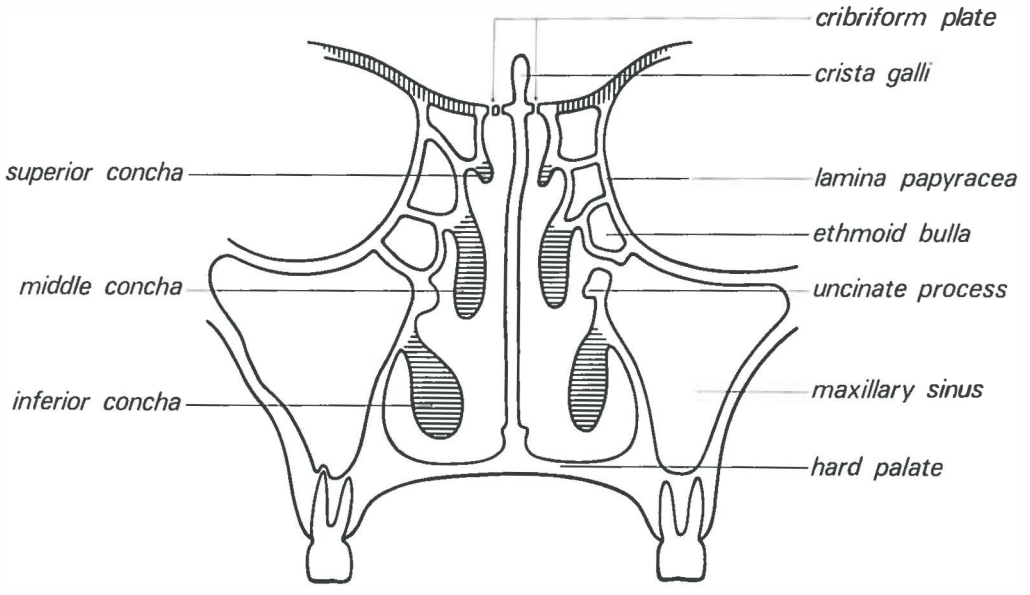


Fig. 3. Frontal section (schematic).

level of the sphenoid sinus; there the roof of the nose descends, which makes that the choanae have a more oval shape.

The roof of the nose is very narrow, only 1–2 mm wide. From front to back it is made up of the frontal bone, the cribriform plate of the ethmoid bone, and the anterior wall and the floor of the sphenoid sinus (see fig. 2).

Against the lateral walls of the nose there are three curled plates of bone, turbinals or conchae, termed the superior, the middle and the inferior concha from top to bottom. The nasal cavities are divided into three passages, meati, by the middle and inferior conchae. The superior meati lie above the middle conchae, the middle meati occupy an inferior and lateral position with regard to the middle conchae, and the inferior meati occupy an inferior and lateral position with regard to the inferior conchae.

The ethmoid bone consists of the perpendicular plate, the crista galli, the cribriform plate, and a mass formed by the ethmoidal cells, to which the superior and middle conchae are attached. The medial wall of this labyrinth of cells is at the same time part of the lateral wall of the nose. The lateral wall, lamina papyracea, is part of the medial orbital wall. The roof of the upper layer of cells is part of the frontal bone.

The anterior and middle ethmoidal cells communicate with the nose in the middle meatus, the ostia of the posterior ethmoidal cells are situated in the superior meatus.

The maxilla consists of a body and four processes, the frontal, zygomatic, alveolar and palatine processes. The frontal process is part of the lateral wall of the nose, the zygomatic process is connected with the zygomatic bone. The teeth are rooted in the alveolar process, the palatine process forms part of the hard palate. Medially

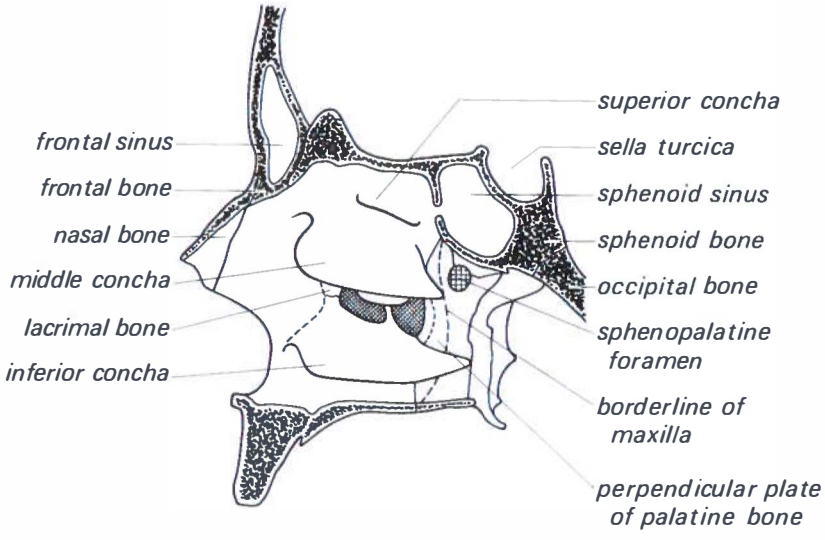


Fig. 4. The lateral nasal wall.

in the hard palate, immediately behind the alveolar process the incisive foramen is found.

In adults the body of the maxilla is almost entirely taken up by the maxillary sinus. This cavity is shaped somewhat like a triangular pyramid, the base of which is formed by the medial wall of the sinus. In the floor of the orbit, which is at the same time the roof of the maxillary sinus, the infraorbital canal is situated, which leads to the infraorbital foramen. Through this canal runs the infraorbital nerve, a branch of the trigeminal nerve. The posterior wall of the maxillary sinus is also the anterior boundary of the infratemporal and pterygopalatine fossae.

The medial bony wall of the maxillary sinus has a large hole, the maxillary hiatus. This hole is covered by a membrane of connective tissue and by parts of the inferior concha and palatine, ethmoid and lacrimal bones. Posteriorly the perpendicular plate of the palatine bone lies against the medial wall of the maxillary sinus, and it reduces the maxillary hiatus from the back. The lacrimal bone does the same from the ventral, the inferior concha from the caudal side (fig. 4). The lacrimal process of the inferior concha is connected with the caudal end of the lacrimal bone. Together they form part of the medial wall of the nasolacrimal duct, which opens into the inferior meatus. The ethmoid process of the inferior concha, which is connected with the uncinate process of the ethmoid bone, is situated more dorsally. These two processes divide the membranous part of the lateral nasal wall into the so-called anterior and posterior fontanelle (see fig. 5). Furthermore the maxillary hiatus may be partly closed by the ethmoid bulla cranially, when it strongly bulges over the hiatus. The opening of the maxillary sinus to the nose, the maxillary ostium, lies between the ethmoid bulla and the uncinate process (see the following).

The bony lateral wall of the nose is only slightly lengthened backwards by the

perpendicular plate of the palatine bone, because the latter lies against the dorsal part of the medial wall of the maxilla (see the dotted line, which indicates the borderline of the maxilla in fig. 4). Cranially in the perpendicular plate the sphenopalatine foramen is found. The major part of the blood and nerve supply of the nose passes through this sphenopalatine foramen from the pterygopalatine fossa.

On the level of the choanae the lateral wall of the nasal cavities is formed by the medial lamina of the pterygoid process of the sphenoid bone. The roofs of the nasal cavities are formed by the floors of the sphenoidal sinuses.

The two sphenoidal sinuses occupy the body of the sphenoid bone in whole or in part, according to their size, which greatly varies. They are separated by a bony septum, which is seldom in the midline; frequently one sinus is larger than the other. The openings to the nasal cavities are situated in the upper parts of the anterior walls of the sinuses, in the superior meati, medial to the superior conchae. In the nose these regions are known as the sphenoethmoidal recesses. The ostia of the posterior ethmoidal cells are located laterally to the superior conchae.

The sphenoid bone has several processes, the most important of which will be mentioned. On the bottom there are the pterygoid processes on either side. The medial lamina of the pterygoid process is the most dorsal part of the lateral nasal wall, the lateral lamina forms the posterior border of the pterygopalatine fossa. On the top there are the dorsum sellae at the back of the sella turcica, and the greater and lesser wings of the sphenoid bone, which are directed laterally, and which are part of the base of the skull. The sharp posterior margins of the lesser wings are the posterior border of the anterior cranial fossa. Since the greater wings are weakened as a result of the many foramina, this area of the base of the skull is a common site of fracture.

In the frontal bone, right above the orbits, the frontal sinuses are found. These

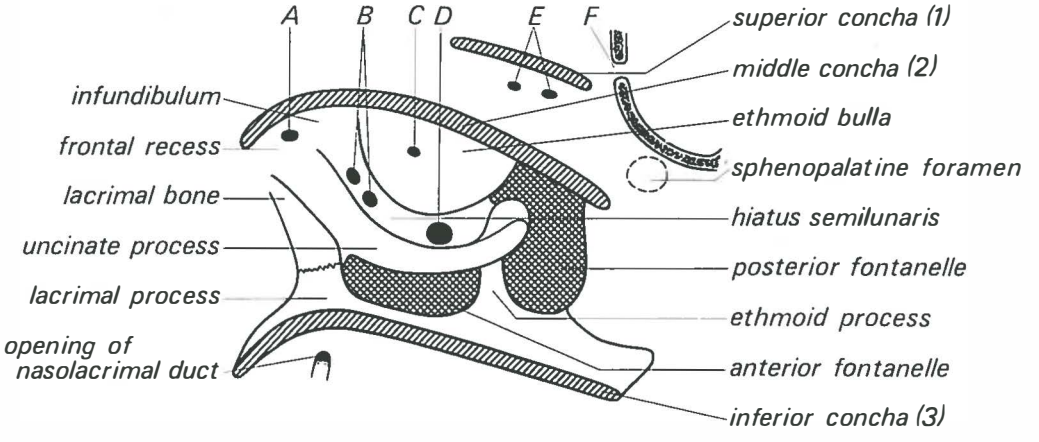


Fig. 5. Openings in the lateral nasal wall. A = ostium of frontonasal duct; B = ostia of anterior ethmoid cells; C = ostia of middle ethmoid cells; D = ostium of maxillary sinus; E = ostia of posterior ethmoid cells; F = ostium of sphenoid sinus.

paranasal sinuses strongly vary in size as was the case with the sphenoidal sinuses, and they may even be totally absent. The communication of the frontal sinus with the nose, the frontonasal duct, opens into the middle meatus, usually by the infundibulum into the hiatus semilunaris, sometimes in front of the infundibulum (see further down).

The most interesting and challenging region of the lateral nasal wall is the lateral wall of the middle meatus, i.e. between the attachments of the middle and inferior conchae. In fig. 5 the cut edges of the superior (1), middle (2) and inferior (3) conchae are shaded.

Between the ethmoid bulla and the uncinate process there is a deep groove, the hiatus semilunaris. The anterior part of the hiatus is called the infundibulum. Anterior and superior to the infundibulum there is the frontal recess. Ventrally, in front of the middle concha, the lateral nasal wall bulges somewhat, which area is called the agger nasi.

The frontal ostium (i.e. the opening of the frontonasal duct) is situated in the frontal recess or in the infundibulum. Sometimes it may even open high into the hiatus semilunaris. In that case it is not in fact a 'real' frontal sinus, but strongly developed anterior ethmoidal cell. The maxillary ostium lies more dorsally in the hiatus semilunaris. Quite often, however, there is no real maxillary ostium, and the maxillary sinus, together with one or more anterior ethmoidal cells, communicates with the nose through a maxillo-ethmoido-nasal canal, which opens more anterio-cranially into the hiatus semilunaris (Prott[137]). In about 10 percent of the cases the maxillary sinus has an accessory ostium, usually situated in the posterior fontanelle, sometimes, however, in the anterior fontanelle, caudal to the uncinate process (see plate 48). As a rule the openings of the ethmoidal cells are situated as indicated in fig. 5: the anterior ethmoid cells in the hiatus semilunaris, the middle cells in the ethmoid bulla, and the posterior cells in the superior meatus. The sphenoidal sinuses have their ostia in the sphenoethmoidal recess, which may be bordered medially by a fourth concha, the supreme concha.

Through the choanae the nasal cavities freely communicate with the nasopharynx, the form of which may be best compared to a prompter's box, the palate being the stage floor and the nasal cavities the stage. An anterior wall of the nasopharynx does not exist therefore. The roof of the nasopharynx is formed by the underside of the sphenoid bone and the occipital bone. The posterior wall lies against the uppermost part of the spine, i.e. against the prevertebral fascia, which covers the prevertebral muscles (rectus capitis anterior, longus capitis and longus cervicis (longus colli) muscles on each side). The pharynx as a whole is only loosely connected with the prevertebral fascia, by means of loose connective tissue. Because of this the pharynx can move independently of the spine in swallowing (Bosma[22]; Tagaki et al.[162]). The space between the pharynx and the prevertebral fascia is called the retropharyngeal space and is connected with the mediastinum. An infection in this space may easily lead to mediastinitis.

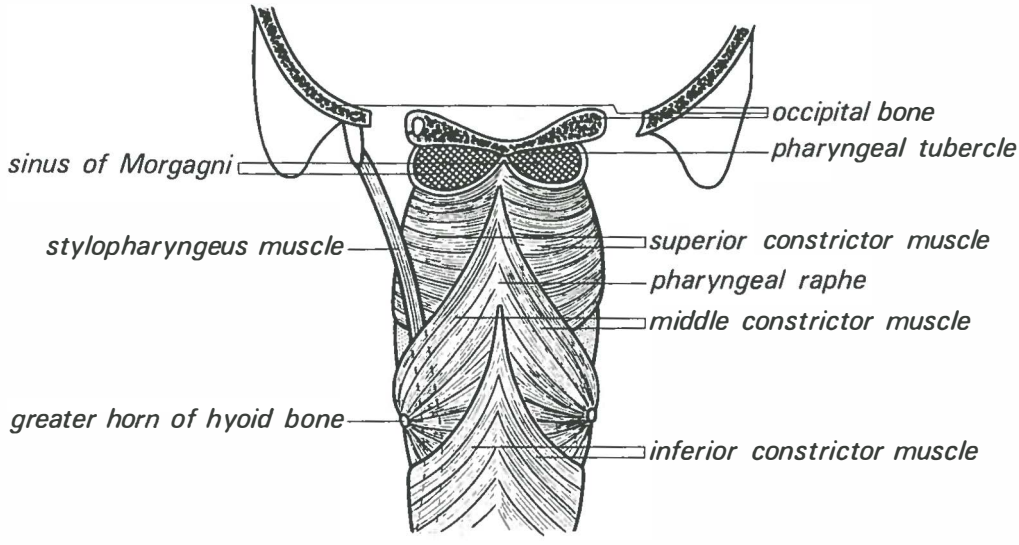


Fig. 6. Posterior view of the pharynx.

The posterior wall of the nasopharynx is formed by the superior constrictor muscle, which also forms a great part of the lateral walls of the nasopharynx. On each side this superior constrictor muscle is attached anteriorly to the lower part of the posterior border of the medial pterygoid lamina, the pterygoid hamulus, the pterygoidmandibular raphe and the posterior end of the mylohyoid line of the mandible. Both sides meet posteriorly in the pharyngeal raphe, which is attached cranially to the pharyngeal tubercle on the occipital bone. Between the edge of the superior constrictor muscle and the base of the skull there is a gap, known as the sinus of Morgagni, which is closed by the basipharyngeal fascia (fig. 6).

The lateral walls are also formed principally by the superior constrictor muscle (see fig. 7). In the anterior part of the lateral wall the gap between the superior

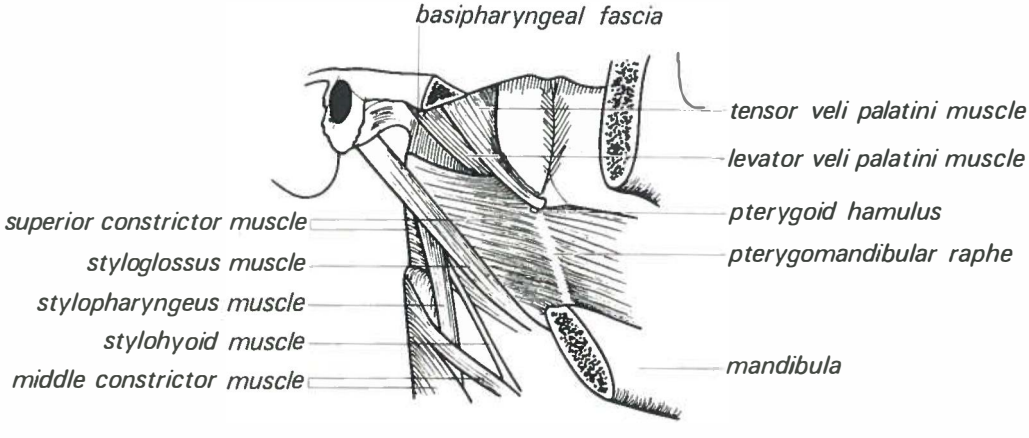


Fig. 7. The lateral pharyngeal wall.

muscle and the base of the skull is closed by the tensor veli palatini and the levator veli palatini muscles, and the auditory tube. The tensor veli palatini muscle runs laterally to the anterior part of the superior constrictor muscle. The levator muscle crosses the latter, and passes through the sinus of Morgagni. Between the levator and the tensor veli palatini muscles the auditory tube also enters the nasopharynx laterally through the sinus of Morgagni. The most ventral part of the lateral walls of the nasopharynx is bony, and is formed by the posterior border of the medial pterygoid lamina, to which the superior constrictor muscle is attached. Caudally the medial pterygoid lamina ends in the pterygoid hamulus (fig. 7).

The most prominent feature of the lateral wall is the inverted J-shaped torus tubarius, which is caused by the invagination of the inverted J-shaped end of the cartilage of the auditory tube (Eustachian tube). To the end of the long leg (medial lamina) of the cartilage the salpingopharyngeus muscle is attached, passing downwards and causing the salpingopharyngeal fold. Immediately behind the torus tubarius there is a lateral recess, the pharyngeal recess or fossa of Rosenmüller. It strongly varies in size (Khoo et al.[83]). The tensor veli palatini muscle is inserted into the edge of the lateral lamina of the auditory cartilage over its whole length. It first runs horizontally (in the soft palate), then round the pterygoid hamulus, and afterwards cranially and laterally towards the auditory cartilage (and the base of the skull), as is shown schematically in fig. 8. The auditory tube runs at an angle

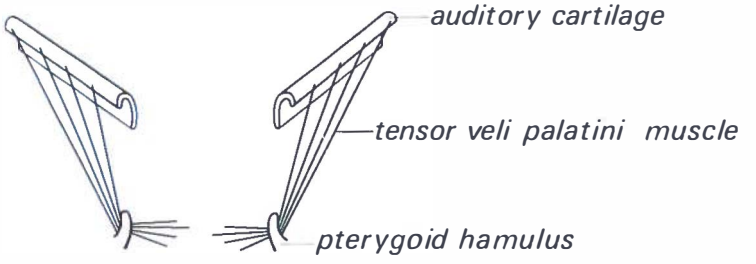


Fig. 8. The tensor veli palatini muscles and the auditory cartilages (schematic – after Paff[128]).

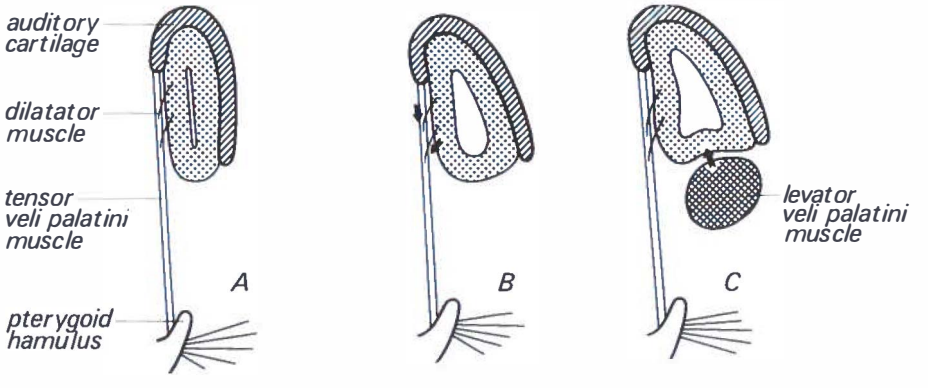


Fig. 9. Scheme of the opening mechanism of the auditory tube.

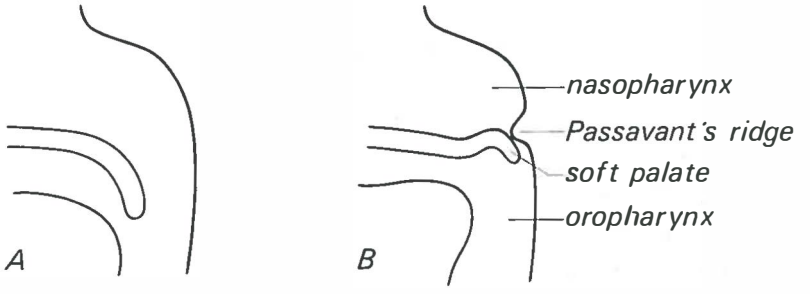


Fig. 10. The closing mechanism of the nasopharynx.

of about 45° with the median plane, and at an angle of about 40° with the horizontal plane. Normally the auditory tube is closed (see fig. 9A). When the tensor veli palatini muscle is activated the auditory cartilage is rotated and the slitlike lumen opens. This is also caused by some fibres of the tensor muscle passing into the membranous part of the auditory tube. These fibres are sometimes called the dilatator muscle (fig. 9B). In adults the levator veli palatini muscle, which is closer to the auditory tube than it is in children, also has a function in opening the auditory tube when swallowing takes place (Holborrow[68]; fig. 9C). The transformation of the torus tubarius during its growth is thought to be connected with this (Branchi[24]).

Caudally the nasopharynx freely communicates with the oropharynx (fig. 10A). In swallowing, the soft palate separates the nasopharynx from the oropharynx. During this act the soft palate is pulled backwards and upwards, and touches a local vault of the posterior wall: Passavant's ridge (fig. 10B). According to Passavant[131, 132] this ridge is caused by the contraction of the superior constrictor muscle. This theory is still accepted. Some authors, however, (Wood-Jones[181], i.a.) are of the opinion that the ridge is caused by the palatopharyngeus muscle, which does not seem likely (cf. plates 8 and 9).

The essentiality of Passavant's ridge in speech is contradicted by Calnan[32]. In a number of cases it seems to play a part, however, in closing off the nasopharynx, for instance in patients with a too short palate.

In the greater part of the nasal and paranasal cavities and the nasopharynx the walls are covered with respiratory ciliary epithelium, whereas the nasal vestibule is covered with skin, i.e. keratinizing squamous epithelium. In the neighbourhood of the posterior border of the nasal vestibule, the limen nasi, this keratinizing squamous epithelium transcends via non-keratinizing squamous epithelium into respiratory ciliary epithelium. In the nasopharynx the place of the transition from ciliary epithelium into the non-keratinizing squamous epithelium of the oropharynx varies greatly (Ali[4]). Quite often non-keratinizing squamous epithelium can be found in the pharyngeal recesses (Khoo et al.[83]). In the upper parts of the nose, on the superior concha and the lateral wall above, and on the same level on the nasal septum the mucous membrane consists of a non-ciliated pseudostratified epithelium. In this area, the olfactory area, the receptors of the olfactory sense are found. In

the nose and the paranasal cavities the mucous membrane is closely blended with the periosteum and perichondrium, which lie underneath, and it is therefore called mucoperiosteum and mucoperichondrium respectively. Everywhere in the mucous membrane of the nose, paranasal sinuses and nasopharynx mucous glands are found. When the mucous membrane is thin, as is the case in the paranasal cavities, it has a yellowish colour as a result of the bone underneath. When the mucous membrane becomes thicker and more strongly vascularized, its colour becomes increasingly red, or even livid in the case of congestion. The latter is often seen on the inferior conchae. The mucous glands are also greater in number and more strongly developed there.

The nasal opening of the nasolacrimal duct is covered from above with a mucosal flap, the valve of Hasner. It has been thought that this valve prevents nasal secretion from being pressed into the nasolacrimal duct by an increased air pressure in the nose, when it is blown.

The blood supply of the internal nose takes place through the following arteries (see fig. 11):

1) the anterior ethmoidal artery;
2) the posterior ethmoidal artery;
3) the sphenopalatine artery;
4) the greater palatine artery;
5) the septal branch of the superior labial artery.

The anterior and posterior ethmoidal arteries are both branches of the ophthalmic artery; they enter the anterior cranial fossa through the anterior and posterior ethmoidal canals, and subsequently reach the nose through the cribriform plate. The anterior ethmoidal artery also supplies the mucous membrane of the frontal sinus and the anterior and middle ethmoidal cells. The posterior ethmoidal artery also supplies the posterior ethmoidal cells and the sphenoidal sinus with blood. The sphenoidal sinus is further supplied by small vessels from that part of the dura mater which lies immediately above. Each ethmoidal artery has both a lateral and a septal branch.

The sphenopalatine and greater palatine arteries are branches of the internal maxillary artery. The sphenopalatine artery enters the nose through the sphenopalatine foramen and divides into a lateral and a septal branch. The branchings of the lateral branch are sometimes called posterior lateral nasal arteries, the branches in the nasal septum posterior septal nasal arteries. The lateral branch again branches off towards the maxillary sinus, which is supplied besides by small vessels from the infraorbital artery and the superior posterior alveolar artery.

In its course through the greater palatine canal the greater palatine artery has a branch, which supplies the inferior concha and the inferior meatus. A terminal branch of the greater palatine artery, which further supplies the palate, passes the incisive canal and contributes to the blood supply of the nasal septum.

The shaded area (in fig. 11) is Kiesselbach's area (*K*), where 90% of all nose bleeds

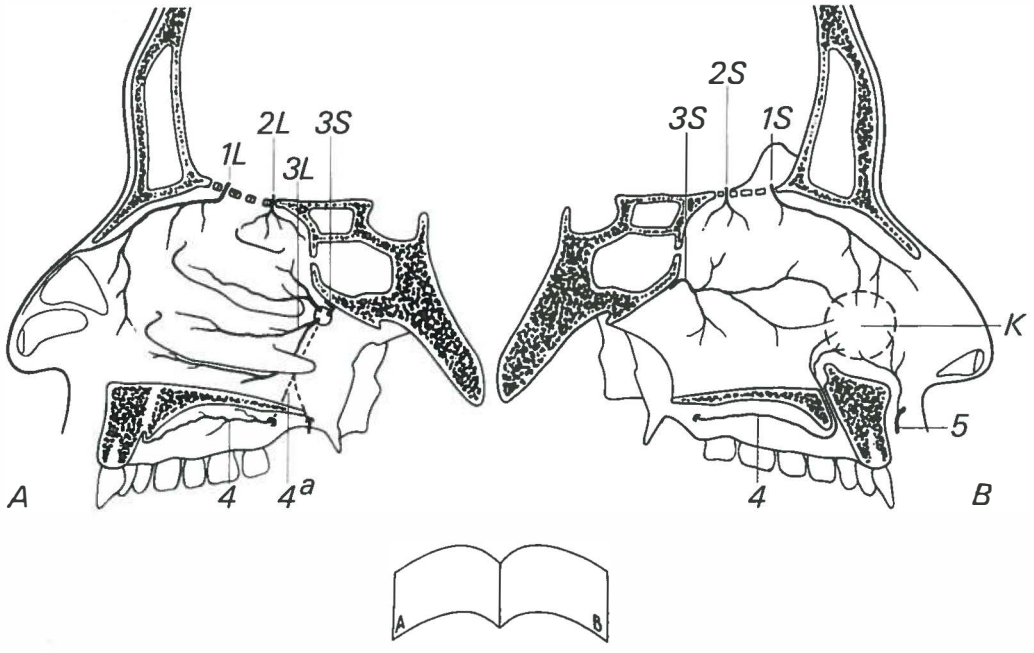


Fig. 11. The blood supply of the internal nose. 1L = lateral branch; 1S = septal branch of anterior ethmoidal artery; 2L = lateral branch; 2S = septal branch of posterior ethmoidal artery; 3L = lateral branch; 3S = septal branch of sphenopalatine artery; 4 = greater palatine artery; 4^a = greater palatine canal; 5 = superior labial artery.

take place. It is supplied by the sphenopalatine, anterior ethmoidal, greater palatine and superior labial arteries. Apart from capillaries the nasal mucosa also contains a cavernous venous plexus, whose size is subject to great variations. This venous plexus is found especially in the inferior concha and the posterior part of the middle concha, which makes that the inferior concha in particular can react like a corpus cavernosum. Usually the nasal air flow is decreased on one side as a result of swelling of the conchae, whereas the other nasal cavity is wide. Some time afterwards the situation is reversed; the wide nasal cavity has become stuffed up, and the narrow nasal cavity has become wide due to decongestion of the mucosa. This phenomenon of alternating swelling of the mucosa is called the nasal cycle. The duration of this cycle shows great variation, but is fairly constant for each individual (Kayser[79], Stoksted[158, 159]; Keuning[80]; Masing[101]).

The venous drainage is parallel to the arterial supply. The blood of the anterior and posterior ethmoidal veins passes through the superior ophthalmic vein to the cavernous sinus. Both the sphenopalatine vein(s) and the greater palatine vein are connected with the veins of the pterygopalatine fossa, from where the blood is transported via the pterygoid venous plexus either to the maxillary vein or to the cavernous sinus (via emissary veins). Besides, there are numerous collateral connections with the surroundings, for instance between the veins of the frontal sinuses and those of the dura mater, between the veins of the nasal mucosa and the

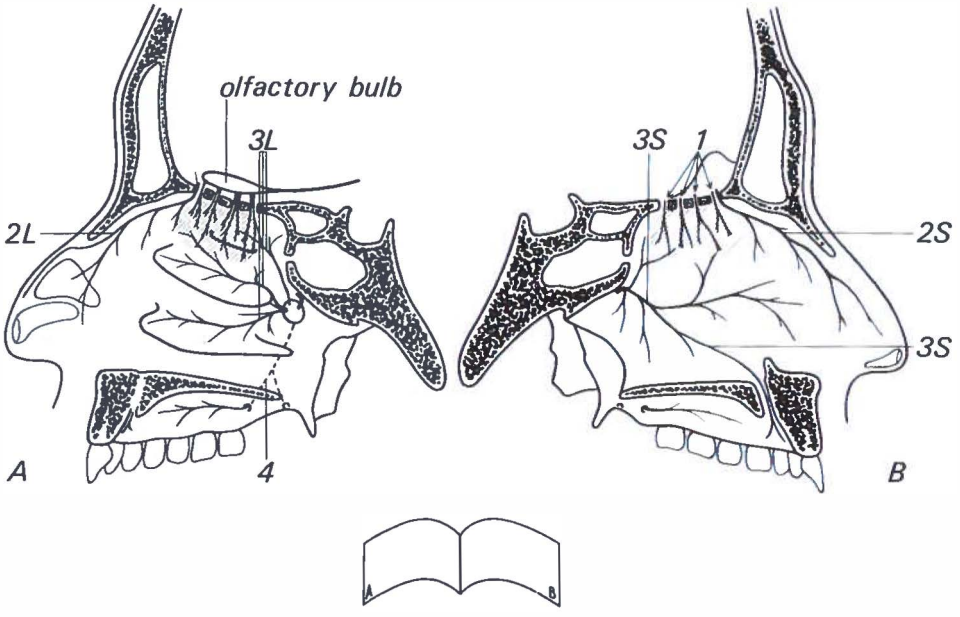


Fig. 12. The nerve supply of the internal nose. 1 = fibres of the olfactory nerve, connected with the olfactory bulb; 2L = lateral nasal branch; 2S = septal nasal branch of anterior ethmoidal nerve; 3L = lateral posterior superior nerves; 3S = nasopalatine nerve; 4 = greater palatine nerve.

ethmoidal cells, and the venous plexus in the nasolacrimal canal, between the anterior part of the nose and the face, between the posterior part of the nose and the nasopharynx.

The arterial blood supply of the nasopharynx takes place mainly through the ascending pharyngeal artery, which branches off from the external carotid artery at a low level. The nasopharynx also receives blood from branches of the ascending palatinal and the internal maxillary artery.

The venous drainage is directed to the pharyngeal plexus from where the blood comes into the internal jugular vein, either directly or via a pharyngeal vein.

The flow of lymph from the nose, the paranasal sinuses and the nasopharynx is towards the retropharyngeal lymph nodes, and from there to the upper deep cervical nodes. There also exist lymph vessels that unite with the tonsillar lymph vessels, which end up in the jugulodigastric lymph nodes. From the anterior part of the nasal cavities and the nasal vestibules the lymphatics join those of the external nose to the submandibular lymph nodes.

The nasal mucosa is supplied by the following nerves (fig. 12):

1) the olfactory nerve
2) the anterior ethmoidal nerve
3) the nasal branches of the sphenopalatine ganglion
4) the nasal branches of the greater palatine nerve

The olfactory nerve is composed of small bundles of nerve fibres, which pass from the receptor cells through the cribriform plate to the olfactory bulb. It serves the sense of smell. The area where the receptor cells are found has been shaded in fig. 12.

The anterior ethmoidal nerve is a branch of the ophthalmic division of the trigeminal nerve. It is a sensory nerve (pain, temperature, touch) of the anterior part of the nose. It divides into a lateral nasal branch, which also supplies the distal part of the external nose, and a septal branch.

The nasal branches of the sphenopalatine ganglion enter the nose through the sphenopalatine foramen from the pterygopalatine fossa, and they contain: a) fibres of the maxillary division of the trigeminal nerve (pain, temperature, touch); b) fibres of the facial nerve (parasympathetic fibres, which are secretory to the nasal glands); c) fibres of the thoracic segments T_1 to T_3 of the spinal cord (sympathetic fibres, which cause vasoconstriction in the nasal mucosa).

The nasal branches of the sphenopalatine ganglion divide into two groups: 1) The lateral posterior superior nasal nerves, which supply the lateral nasal wall except the inferior meatus (3L in fig. 12); 2) the nasal branches of the septum. The most important of these, the nasopalatine nerve, finally runs through the incisive canal, and supplies that part of the hard palate and gums immediately behind the incisor teeth (3S in fig. 12).

The greater palatine nerve is a branch of the sphenopalatine ganglion. As it passes through the greater palatine canal towards the palate it gives off two nasal branches, which supply the inferior meatus and part of the inferior concha, and one or two lesser palatine nerves, which supply the soft palate after passing through the lesser palatine canal(s).

The paranasal sinuses are supplied as follows: The frontal sinuses by the anterior ethmoidal nerves. The ethmoidal cells and the sphenoidal sinuses by the posterior ethmoidal nerves and branches of the lateral posterior nasal nerves. The maxillary sinuses by branches of the superior alveolar nerves.

The innervation of the nasopharynx is supplied by the pharyngeal nervous plexus, which is situated on both sides of the pharynx and which receives fibres from the glossopharyngeal nerves, the vagal nerves and the cervical sympathetic trunk. This plexus supplies both the motor and the sensory innervation of the nasopharynx and the soft palate, with the exception of the tensor veli palatini muscle, which is innervated by a branch of the trigeminal nerve.

CHAPTER 3

Functions of the nose, the paranasal sinuses and the nasopharynx

The principal characteristic of the upper airways is contained in the very name: the way by which the inspired and expired air is transported. In the lung the inspired air meets the alveolar epithelium – with a surface area of 60 m^2 – where the gas exchange takes place. In order to have this gas exchange take place under optimal conditions there has to be an 'air conditioning' of the inspired air (Huizing[72]). This 'air conditioning' occurs mainly in the nasal cavities, and consists of:

1) The heating and moistening of the air. The nasal mucosa has a large surface area due to the presence of the conchae. The degree to which the venous plexus of the submucosa is filled with blood can vary greatly, by which the release of heat to the inspired air can be regulated. The moist mucus layer on the mucous membrane saturates the air with water (Perwitzschky[133]; Negus[117, 119]; Ingelstedt[76, 77]; Cole[38, 39]; Fischer[53]). Every 24 hours 1–1.5 litres of water are released to the inspired air. A considerable amount of water, however, condenses again upon the relatively cold nasal mucosa, during expiration. Thus the body is prevented from losing too much water to the respiratory air.

2) The purification of the inspired air. Particles in the air, larger than 10 μ are deposited on the mucosa. The deposited material, together with the mucus is transported by the ciliary epithelium to the oropharynx, at the rate of about 1 cm per minute (Proetz[136]; Ewert[51]; Lippmann[94]).

Particles from 10 to 2 μ are caught upon the mucous membrane of the lower airways, and are also conveyed to the hypopharynx, together with the mucus. Particles smaller than 1 μ mainly remain suspended in the air, and leave the body again together with the expired air.

The materials from the upper and lower airways are swallowed eventually and are rendered harmless by gastric acid.

Bacteria and viral particles will also come into contact with the mucous membrane via the respiratory air. The rapid transport of the mucus usually prevents pathogenic organisms from penetrating into the mucous membrane. Besides, goblet cells and

mucus producing glands secrete immunoglobulines, which already in the mucus layer offer protection against these germs. These immunoglobulines are formed by plasma cells in the submucosa, are then attached to a 'secretory piece' in the mucus producing cells and are subsequently secreted. This applies especially to IgA, which is present in the mucus in the form of SIgA in a relatively far higher concentration than in serum (Tomasi[169]).

3) Changes of the airflow resistance in the respiratory tract. Half the total airflow resistance during inspiration is formed by the nose (Butler[31]; Ferris[52]). Part of this resistance is variable and depends on the degree to which the venous plexus is filled, possible swellings of the nasal mucosa, secretions, etc. In the healthy nose the variable degree to which the venous plexus is filled is the most determining factor for the changes of the airflow resistance. It is likely that these changes are connected with the adaptation of the 'air conditioning' of the inspired air to the changing atmospheric conditions outside the body. Among other things the airflow resistance is influenced by: a) posture and hydrostatic pressure; b) changes in ventilation and gas exchange; c) thermal stimuli, e.g. on the skin, in the nose (inhaled air), in the mouth (food); d) the relative humidity of the inspired air; e) emotions; f) medicaments, e.g. hypotensives.

Another important function of the nose is olfaction. For many animals smelling is a vital function for preserving the individual and the species. The olfactory area in these animals indeed occupies a far greater part of the nasal mucosa than in man. In man smelling can hardly be called of vital importance. We smell evil only in a proverbial sense, although smelling fire or harmful gases can sometimes save lives. We test our food by smelling whether it is fresh or has gone bad, and when we taste our food the taste of what is offered is in fact also determined by our sense of smell. No one will deny the great influence of a tasty or a tasteless meal on one's mood. The enormous proportions assumed by the sale of scents, deodorants and air-fresheners are the result of the influence of smelling.

Together with the nasopharynx and perhaps to a lesser degree the paranasal cavities the nose functions as a resonator in humming and when nasal sounds are formed during speech. When these nasal sounds (n, m, ng, French 'un') are produced the soft palate does not separate the nasopharynx from the oropharynx, which is the case, however, when guttural sounds are formed.

By means of the ciliary movement of the respiratory epithelium the nose, the paranasal cavities and the nasopharynx in part, are cleansed of secretion. Investigations by Messerklinger[105, 106, 107]; Naesson[116] and Bleeker[18] have shown that this transport of mucus is a complex happening.

In the nose this transport is mainly directed dorsally and caudally, but in the superior meatus the caudal direction predominates until the level of the middle concha is reached, after which the transport is bent to a more dorsal direction. This is most clearly the case on the nasal septum. In the area immediately behind the nasal vestibule the direction of the mucus transport is completely backwards.

In the nasopharynx the secretion coming from the superior and middle meati is transported over the torus tubarius (tubal elevation) through the pharyngeal recess; the secretion from the inferior concha and the inferior meatus turns downward in front of the torus tubarius, together with the secretion from the septum.

The mucus transport from the nasopharynx to the oropharynx depends on deglutition.

In the sphenoidal sinuses and the ethmoidal cells the transport goes more or less directly towards the ostia. In the maxillary sinuses the ciliary beat movement diverges, star-like, from the bottom and converges likewise towards the ostium. On the lateral wall, therefore, the transport is directed upwards.

In the frontal sinuses there exists an 'open drive round'. The cilia on the medial wall of the frontonasal duct transport the secretion upwards, into the sinus; the secretion then passes upwards along the interfrontal septum, then laterally, and subsequently over the floor of the sinus again to the frontonasal duct. The dorsal part of the secretion is transported to the middle meatus, the anterior part reaches the medial wall of the frontonasal duct again via a kind of swirl, and arrives in the frontal sinus again.

The nose is considered by some people an important reflex-organ. Thus Willemot[179] distinguishes nasolaryngeal, nasobronchial, nasophrenic and nasothoracic reflexes, which he thought were involved in the regulation of the depth and frequency of respiration and the airflow resistance in the respiratory tract. Many of these mechanisms are yet to be proved, however. Thus there are both advocates and opponents of these theories concerning nasopulmonary reflexes (Ogura et al.[121, 122, 123]; Cowen[40]; Frey et al.[57]; Drettner[48]; Chüden[35]; Cohen[37]; Whicker et al.[177]).

Other reflexes triggered in the nose are the sneezing reflex and the nasooculary reflex, the latter of which plays a part in the secretion of tears.

In this enumeration of the functions of the nose the fact should not be omitted that its outward form is loaded with emotion. Very many people are not satisfied with the outward appearance of their nose (Rümke[143]). Also in many sayings such as 'to cut off one's nose to spite one's face', 'to poke one's nose into something', 'to put someone's nose out of joint' and 'to count noses' we find these inherent emotions expressed. This phenomenon sometimes leads to an overestimation of the number of functions of the nose (e.g. Osterwald[127]).

Apart from its function as a resonator for the voice the nasopharynx plays an important part because of its connection with the middle ear. In the middle ear the air is partially resorbed. This air is replaced by a fresh supply from the nasopharynx via the auditory tube, so that the air pressure in the middle ear constantly equals the atmospheric pressure. The auditory tube is open almost exclusively in swallowing (see page 11). When a difference in pressure is eliminated in swallowing, this sounds like a 'plop' in the ear. If there is a somewhat larger under-pressure in the middle ear as a result of a disturbance in this mechanism, however, a conductive hearing loss occurs, caused by an impaired mobility of the eardrum. Rundcrantz[144]

described the great influence of the posture upon the opening mechanism of the auditory tube in healthy people.

In addition to the supply of air to the middle ear the drainage of secretions from the middle ear to the nasopharynx also takes place via the auditory tube. This mucus transport is brought about by the ciliary movement of the respiratory epithelium. The transport of these secretions from the nasopharynx to the oropharynx mainly depends on swallowing, as is the case with mucus from the nose and paranasal cavities.

Many functions have been ascribed to the paranasal sinuses, although none of these is generally accepted (Negus[118]; Blanton et al.[17]; Sato[145]). Thus it has been said that they: 1) act as resonators in speech and singing; 2) aid facial growth and architecture; 3) exist as evolutionary remains and/or unwanted air spaces; 4) lighten the bones of the skull for the maintenance of a proper balance of the head.

The most important functions of an organ can be derived from the disturbances that occur when the organ fails. When, for instance, a malignant tumor develops in one of the paranasal cavities there are no disturbances usually, until a spread beyond these sinuses occurs, e.g. diplopia caused by displacement of an eye by pressure of the tumor, nasal obstruction by spread into the nose. On the other hand, a paranasal sinus can be completely filled with tumor tissue without giving rise to any disturbances.

On this ground descriptions of passive functions are to be preferred to descriptions that imply some kind of activity.

CHAPTER 4

Methods of examination

The method of examination which is by far the most common in oto-rhino-laryngology is inspection. This applies especially to the nose and the nasopharynx. These two cavities are naturally dark, like almost all areas examined by the otolaryngologist. One of the first conditions for inspection of the nose and nasopharynx is that light is brought into these cavities. For a proper illumination of the areas to be examined it is preferable for the axis of the beam of light to coincide with the visual axis. This can be achieved by means of indirect light: the examiner looks through a hole in the centre of a concave mirror reflecting the light into the regions that are to be examined. Fig. 13 shows how initially this mirror was attached to the source of light.

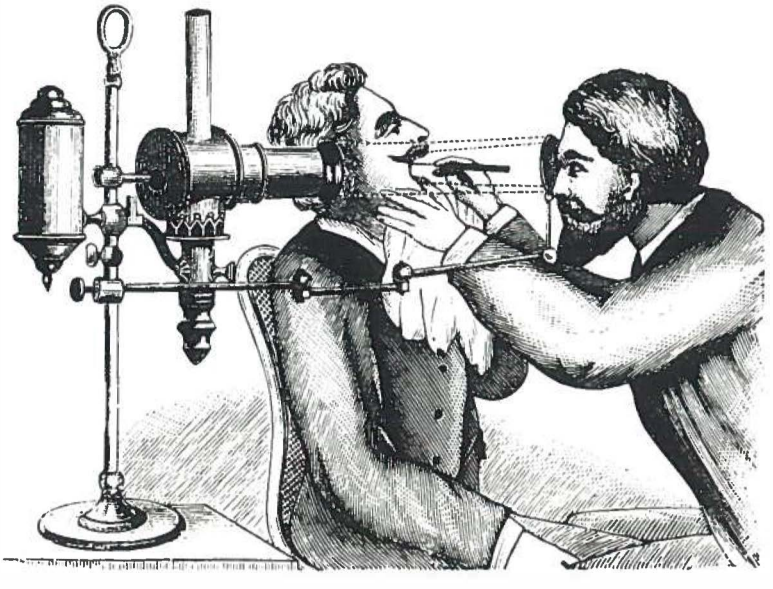


Fig. 13. Examination with the aid of the lamp after Tobold[168].

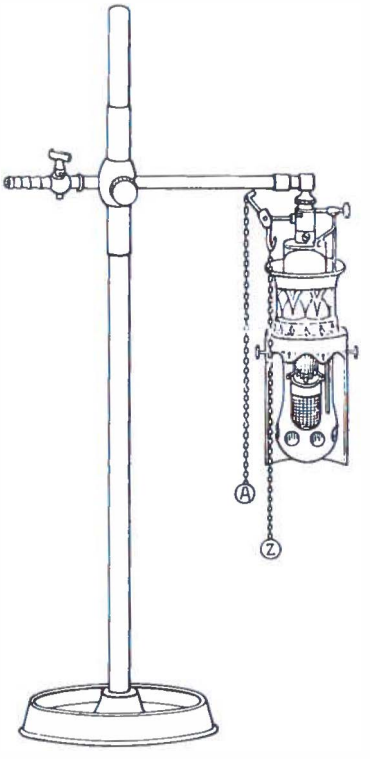


Fig. 14. Examining lamp after Brünings.

The use of the so-called headmirror, which was first employed in 1841 by Friedrich Hofman at Burgsteinfurt, is still the most common method in routine examinations in oto-rhino-laryngology (cf. picture 10, page 63).

At first the otolaryngologist did not have at his disposal a satisfactory source of artificial light. In his 'die Krankheiten der Nase und des Nasenrachens', Zarniko[187], in 1910, mentioned various sources of light from which a choice could be made: the electric arc-lamp, electric incandescent light, lime-light (where a piece of lime is made to glow by a gas-flame), gas-light and paraffin-light (where a gas mantle after Auer is heated by the flame), light of the acetylene flame, light-gas, etc. In 1925 he still preferred the lamp after Brünings; a gas-lamp with a pendent gas mantle, which was said to give twice as much light as the upright mantle (fig. 14).

The electric bulb was rejected by Zarniko as it was still too delicate and too unreliable. Gradually the electric lamp with wolfram (tungsten) filament proved superior. As headlight the electric light has won a permanent place by the side of the head mirror, after the electric bulb had been made sufficiently small.

For a good inspection of the nasal cavities (anterior rhinoscopy) it is necessary to widen the nostrils and to lift the apex. After Dionis[45] had described a speculum for the nose as early as 1714, it was not until 1886 that Duplay developed the first nasal speculum[49], which came to be widely used (fig. 15, left). The speculum indicated by

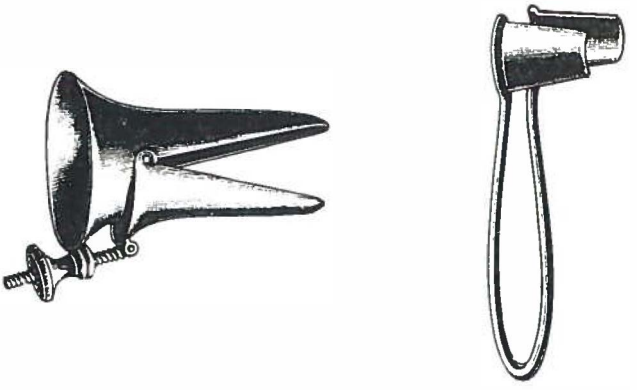


Fig. 15. Left, nasal speculum after Duplay. Right, idem after Thudichum.

Fig. 16. Nasal specula after Fränkel.

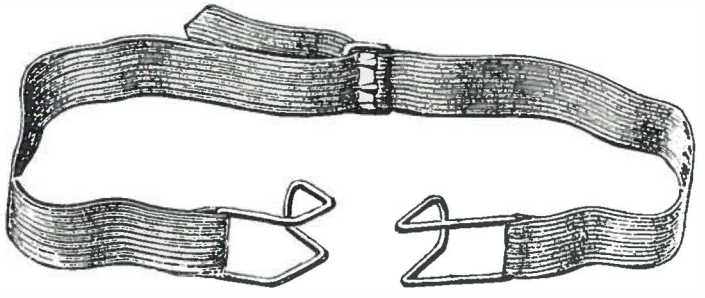


Fig. 17. Self-retaining speculum after Creswell Barber.

Thudichum (fig. 15, right) was not nearly so well-known. Especially in French literature the speculum after Duplay was highly valued for a long time (Escat[50]; Laurens et al.[91]).

In the course of time several self-retaining nasal specula have been developed, among which those of Fränkel[56], and the bizarre speculum after Creswell Barber[41] which keeps both nostrils open and consists of an elastic band, which is wrapped round the head of the patient and which ends on either side in a hook made of wire that pulls each nostril outwards.

In 1888 Cholewa first described the speculum used in Hartmann's clinic[33]. This type of nasal speculum, which gives the examiner greater freedom of movement in the nose than Duplay's speculum, and which can be introduced single-handed in contrast to the self-retaining specula, is still most commonly used throughout the world (see fig. 18 left: nasal speculum after Hartmann-Halle – the original speculum

Fig. 18. Left, nasal speculum after Hartmann-Halle. Right, idem, after Killian.

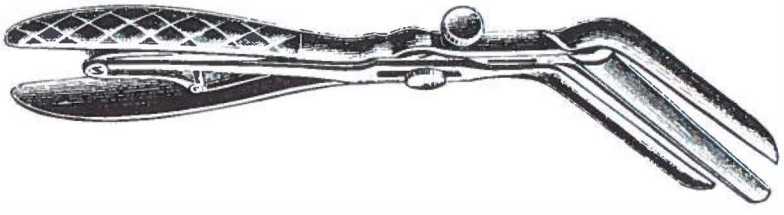


Fig. 19. Nasal speculum after Zaufal.

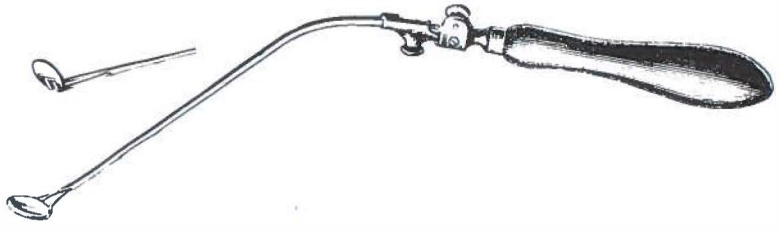


Fig. 20. Movable mirror after Réhti[140].

after Hartmann had a ribbed grip). In 1896 Killian[81] lengthened the blades of the speculum to 5 cm and 7.5 cm for the sake of medial rhinoscopy. With the aid of the longer blades it is possible to push aside soft parts that lie more backwards in the nose and limit the field of vision.

Naturally various nasal specula have been developed since the turn of the century, for instance the speculum after Zaufal, where the blades can be pushed apart with some force with the aid of a screw, so that a wider view is obtained.

The application of cocaine, which not only acts as a local anaesthetic but also has a decongestive effect, has made many of these instruments redundant. Other aids in

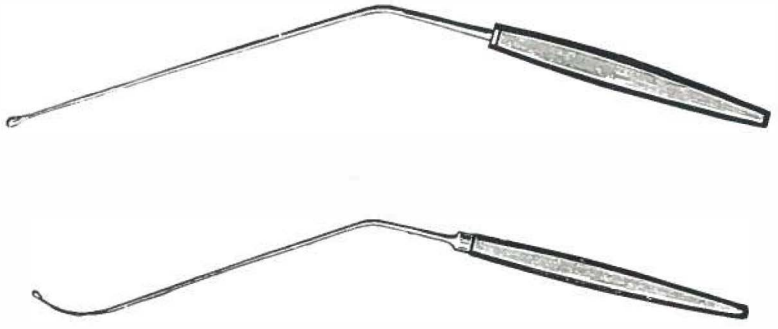


Fig. 21. Nasal probes.

anterior rhinoscopy were also short-lived. Among them we find the mirror after Réthi (fig. 20), which can be moved by turning a small wheel attached to the grip, and which was meant to enable inspection of the area below the conchae.

In addition to the specula after Hartmann (with possible insignificant modifications) and Killian, probes are indeed still used in diagnostic anterior rhinoscopy nowadays. At the end of the 19th century the use of these probes had already become wide-spread. They can roughly be divided into two groups: straight probes, which are used for 'internal palpation' and curved ones, with which the ostia of the paranasal sinuses were probed (fig. 21). Nowadays the latter procedure is hardly followed anymore because of the effects of possible injuries to the mucosa near the ostia.

Apart from illumination, there are two other difficulties connected with the inspection of the nasopharynx through the mouth: the reflexes of the patient caused by the great sensitivity of the mucosa in the pharynx, and the narrow space between the soft palate and the posterior wall of the oropharynx, through which the nasopharynx is to be examined. Moreover, when inspecting the nasopharynx through the mouth, it is necessary to 'look round the corner'.

In 1807 Bozzini was the first to indicate the principle of 'looking round the corner', an idea for which he received great recognition, as testified by the epitaph on his gravestone (Spiess[156]):

> Piis Manibus Phillipi Buzzeni med. doct. qui natione germanus, postquam omnium primus interna vivi corporis cava lumine arte insinuato perlustrare coeperat, crassante maligna febri, quam ab aliis fortiter propulsaverat, multis arte et pietate restitutis morte IV ti ad V ti Aprilis MDCCCIX anno aetatis XXXVI mortem arcessivit sibi victor.
>
> Eheu jam victo!

Yet it was not until this principle had found an advocate in the person of Czermak [42, 43] and had been further developed by Semeleder[150] and Türck and Voltolini[172] that it was more widely applied. Posterior rhinoscopy is still part of the routine of every E.N.T.-specialist (fig. 22).

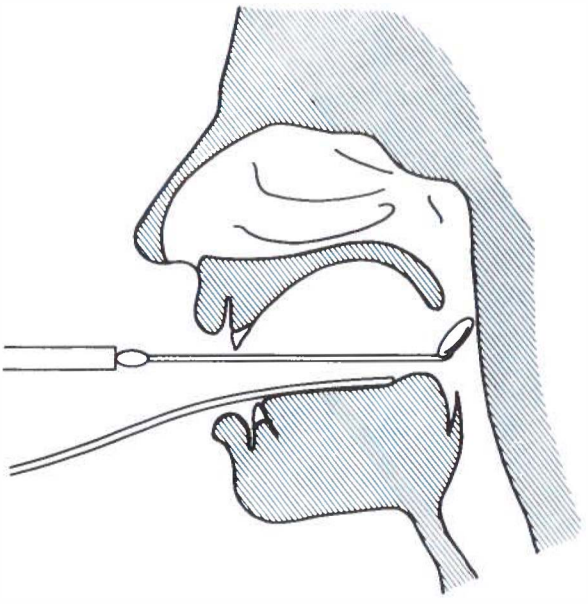


Fig. 22. Posterior rhinoscopy.

Fig. 23. Left, tongue depressor after Türck. Right, idem after Fränkel.

The depressing of the tongue of the patient in posterior rhinoscopy was also an idea of Czermak's. He used a flat tongue depressor. In order to be able to depress the tongue more forcibly Türck and Fränkel developed tongue depressors with firm handles. These handles are directed downwards when the depressors are used. A further advantage of this is that the hand holding the tongue depressor does not obstruct the view of the mirror (fig. 23).

In the years round 1875 there was no agreement as to the angle at which the mirror ought to be fixed to the shank. Krishaber was of the opinion that one ought

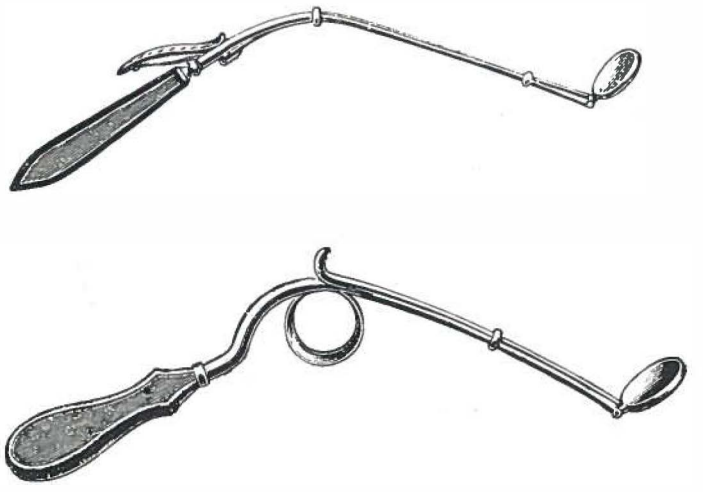


Fig. 24. Above, postnasal mirror after Michel. Below, idem after Fränkel.

to have several mirrors at one's disposal, which were attached to the shank at various angles[87, 88]. This led to the development of movable postnasal mirrors.

Much has been written about the difficulties caused by the narrow velo-pharyngeal space. In order to enlarge this space as far as possible Czermak had the patient bend his head far backwards. Voltolini (1861), however, asked the patient to incline his head slightly forward; it was expected that the soft palate would thus be pulled further away from the posterior pharyngeal wall by gravitation. Many others (Czermak among them) tried to obtain more room by having the patient produce nasal sounds during the examination. Others (Fränkel, Krishaber) attempted to achieve this by letting the patient inhale deeply as if to smell. To this purpose Krishaber even offered his patients a handkerchief with scent on it.

All these tricks, however, did not bring about the result desired, so that mechanical devices were resorted to in order to pull the soft palate forward. Naturally

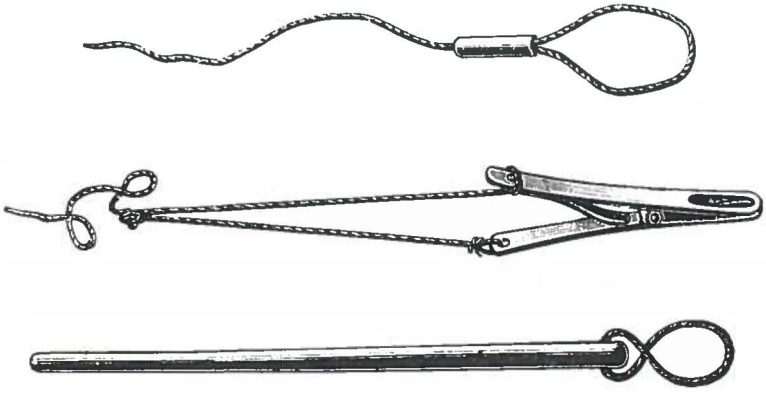


Fig. 25. Top, 'Zäpfchenschnürrer' after Türck. Middle, uvula-clasp after Löri. Bottom, uvula-noose after MacKenzie.

Fig. 26. Palate-retractor after Voltolini.

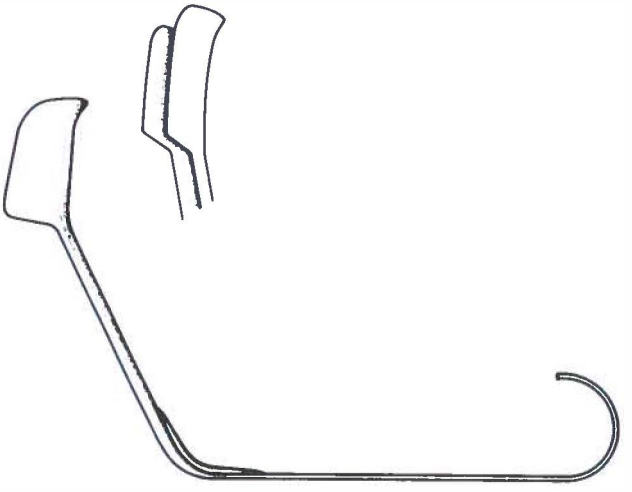


Fig. 27. Nasopharyngeal speculum after Senturia.

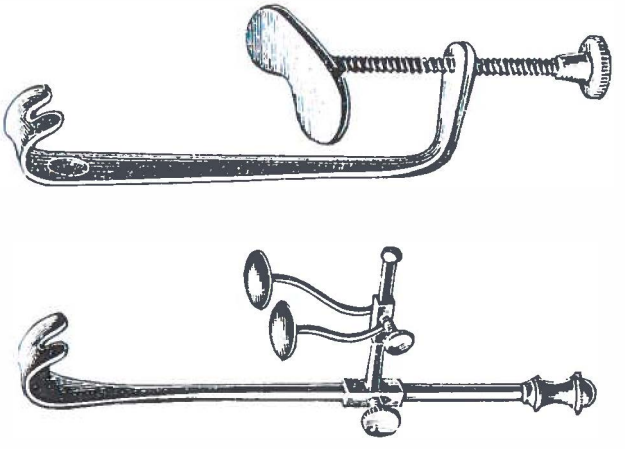


Fig. 28. Above, self-retaining palate-retractor after Krause. Below, idem after Schmidt.

these devices could only be used after the introduction of local anaesthesia by means of cocaine.

The first in a long series of palate retractors were instruments with which the uvula can be pulled forward; presumably because the uvula often obstructed the view of the mirror. Some of these are shown in fig. 25.

The noose after Türck is tightened by pushing the canula along the cord. With the noose after MacKenzie the uvula is clasped by turning the rod. How the uvula-

clasp after Löri is to be used can be deferred from the picture. None of these uvula-clasps was used long.

The palate-retractor, invented by Voltolini (1861) was far more successful.

In the course of time many 'new' palate-retractors have been described, especially round the middle of the twentieth century (among others Baron[8]; Senturia[151]; Brunar[26]; Manning[100]; Lazlo[90]), an example of which is given in fig. 27.

This great diversity of palate-retractors is presumably connected with small individual differences in examination techniques. Several of these instruments are still in use.

In order to free the hand that holds the palate-retractor, models were designed which can be fixed in the position in which they were introduced. Usually this is done by means of a support which rests against the upper lip. Instances of these are the self-retaining palate retractors after Krause[86] and Schmidt (fig. 28). Luc[95], too, had a self-retaining palate-retractor made. In contrast to the above mentioned this instrument is held in its place because two hooks are pressed against the posterior pharyngeal wall.

These hooks are brought into position after the instrument, while closed, has been introduced behind the soft palate (fig. 29).

Modifications of the type of self-retaining palate-retractor after Krause and Schmidt (e.g. the Haslinger self-retaining soft palate-retractor) are still being used.

A different method to pull the soft palate forward is that which makes use of 'reins' (at first silk ribbons, later rubber drains) which are introduced through the two nasal cavities and led outside again via the oropharynx through the mouth. By means of these reins the soft palate is pulled forward. Desgranges (1859) was the first to make use of this technique although he applied it in order to carry out minor blind operations in the nasopharynx with his fingers. Wales[174], in the U.S.A. and Störk[157] in Europe, were the first to put this principle of the reins at the service of posterior rhinoscopy. At first the patient himself or a nurse were made to tighten the reins. Later on an artery forceps was used to keep them in position. It was Hopmann's merit (1887) to be the first to fix the reins to a metal plate, which rests against the upper lip. Thus a constant symmetrical traction upon the soft palate is obtained, which is independent of the co-operation of the patient or the attention of the assistant (fig. 30). Until recently this retractor after Hopmann was still on the market.

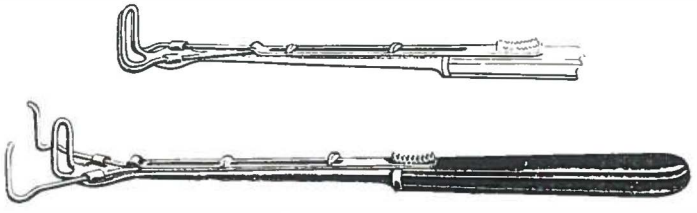


Fig. 29. Self-retaining palate-retractor after Luc.

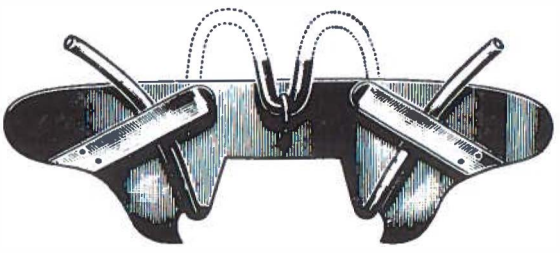


Fig. 30. Retractor after Hopmann.

Fig. 31. Self-retaining tongue depressors after Ash (left) and Gutsch (right).

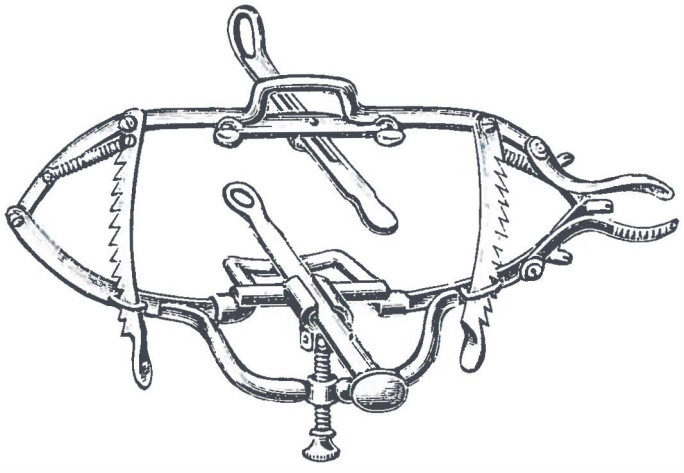


Fig. 32. Combined mouth gag after Whitehead-Fränkel.

One also wanted to regain the use of the hand holding the tongue depressor to be able to carry out operations in the nasopharynx under optical control. The other hand of the examinor keeps the mirror in position, and with the hand that has been freed a biopsy forceps can be introduced, for instance. To make this possible self-retaining tongue depressors were developed. Two examples of these are shown in fig. 31. The tongue depressor after Ash is kept down by means of the hollow blade at the bottom, which is placed under the chin. The depressor after Gutsch is kept in place because the curved metal plate attached to it at the same time acts as a mouth gag.

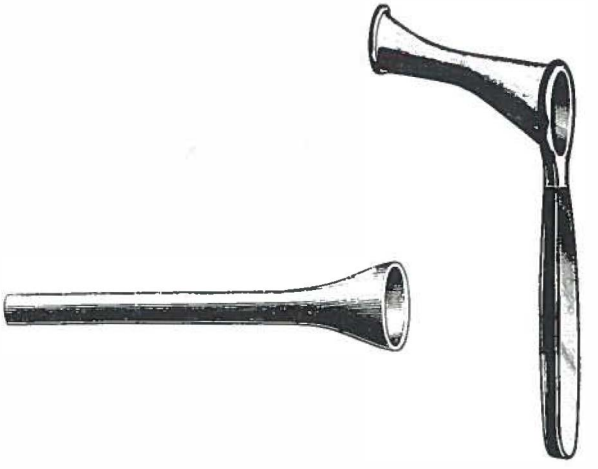


Fig. 33. Instruments for the inspection of the tubal elevation. Left, lengthened ear speculum for transnasal inspection. Right, speculum after Yankauer.

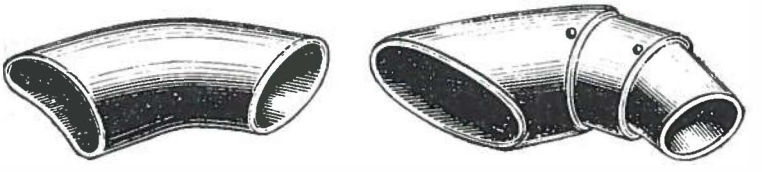


Fig. 34. Finger protectors.

The self-retaining palate-retractor and the self-retaining tongue depressor were combined by Whitehead and Fränkel (1889) by fitting them in the mouth gag after Whitehead (fig. 32).

Of the self-retaining tongue depressors mentioned here only a modified tongue depressor, attached to a mouth gag after Whitehead has remained in use.

At an early stage already the opening of the auditory tube into the nasopharynx was a subject of special interest to the E.N.T.-specialist. This led to the development of instruments for the inspection of this area. There are two ways of approach. For transnasal inspection several 'scopes' with only slight variations were used, which had been derived from the ear speculum (fig. 33, left). For the oral approach Yankauer[185] among others designed a speculum with which the soft palate is to be pushed forward for the inspection of the tubal orifice.

All instruments discussed in this chapter so far serve for the inspection of the nose and the nasopharynx. Of the other physical diagnostic methods auscultation and percussion can be left aside although some seem to have 'heard' a stenosis, and others thought they could establish whether the frontal sinus contained air or whether it was filled with secretion by means of percussion.

Palpation has already come up for discussion in connection with the examination of the internal nose with the aid of probes. Especially for the examination of the nasopharynx palpation was for a long time thought to be essential (Meyer[113],

Honiss[71]). This method, however, is extremely disagreeable for the patient, who therefore tries to struggle against it. This has led to the use of finger protectors (fig. 34), which prevent the patient from biting the palpating finger of the physician. Nowadays the palpation of the nasopharynx is almost completely out of use and has been replaced by X-ray examination (lateral view, see fig. 41).

At first the paranasal sinuses could only be inspected by means of an operation in which part of the bony wall of that sinus was taken away, as with the diagnostic Caldwell–Luc operation, which is still carried out. Auscultation, percussion and palpation give hardly or no information, although palpation can establish a defect in the bony wall of the sinus, for instance when there is a fracture with dislocation, or destruction by a malignant process. At times it is also possible to find out whether palpation and percussion are painful in the case of sinusitis.

A method which has remained in use is the transillumination of the paranasal sinuses. After Voltolini had applied this method for the first time in the nose and the nasopharynx, Heryng[65] used it for examining the paranasal sinuses. To this purpose he had a handle with a bulb constructed, provided with changeable hoods that can be cleaned. Vohsen further improved this method for the frontal sinus by using rubber hoods that protect the patients against the heat[171] (fig. 35). Throughout the years the method of transillumination has remained in use without essential modifications, in spite of the fact that quite soon it proved rather unreliable (Spiess[155]). In transilluminating the maxillary sinuses the lamp is placed about 3 cm behind the teeth in the mouth, after which the patient closes his lips. In transil-

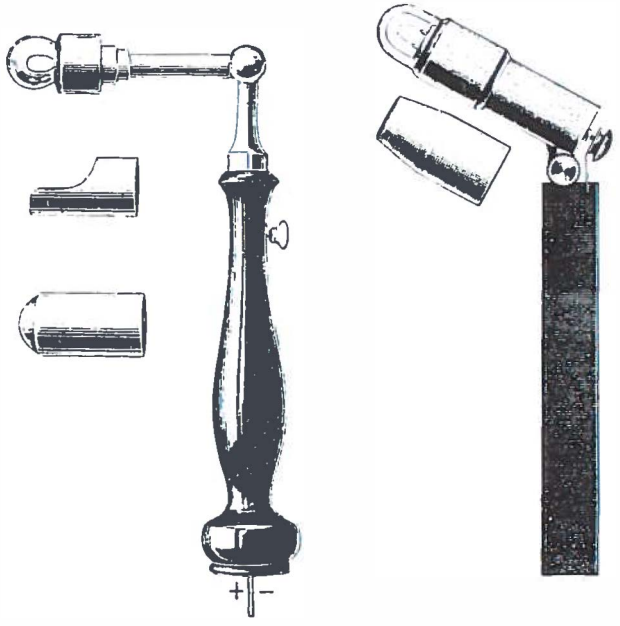


Fig. 35. Lamps for the transillumination of the paranasal sinuses. Left, after Heryng. Right, after Vohsen.

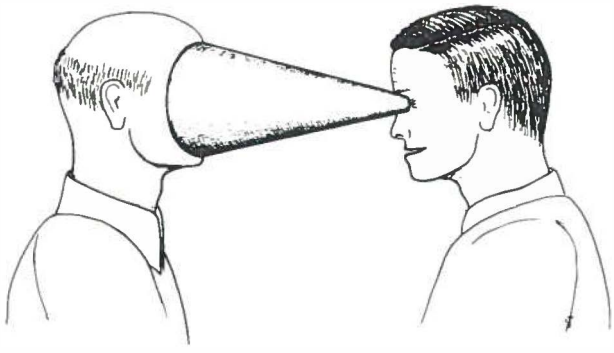


Fig. 36. Instrument of Aboulker.

luminating the frontal sinuses the lamp (with protective hood) is placed high in the medial corner of the orbit with the light directed upward against the roof of the orbit while the patient closes his eyes. Naturally, it is only possible to obtain information with this method in a totally dark examining room. Since this is not always available, accessories were devised such as that of Aboulker[1], who with the aid of a cone created a small dark room as it were between the patient's head and the examiner's eye (fig. 36). The application of cold light, using glass-fibres for the conduction of light, is a recent improvement of the transillumination-method (Binner[15]).

Another method still in use is the diagnostic rinsing of the paranasal cavities. At first this rinsing took place with the aid of a canula, which is passed through the natural ostia. Later this method was replaced by puncturing with a needle or a trocar. For puncturing the maxillary sinus several places were indicated*: via the middle meatus, the inferior meatus, or through the lateral wall (canine fossa) via the mouth. Of these three only the approach via the inferior meatus has remained in use. This way is said to have been indicated as early as 1780 by Gooch, but not until Mikulicz's publication[114] did it become generally known. In fig. 37 some trocars and a puncturing needle are represented.

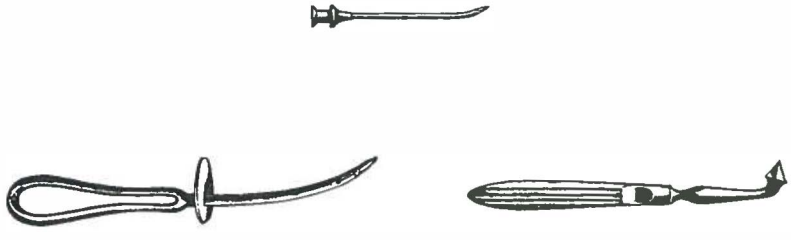


Fig. 37. Top, puncturing needle after Schmidt. Left, trocar after Jurasz. Right, trocar after Mikulicz.

* As early as 1721 Cowper is said to have been the first to describe the approach via the alveolar process. With a drill a hole was bored towards the sinus between the two premolars or between the second premolar and the first molar.

The development of X-ray examination proved a welcome addition to the methods of examining the upper airways. A description of the development of this method would seem superfluous here, and only the most current projections are therefore discussed. These are (Young[186]; Meschan[104]; MacMillan[97]; Merrel et al.[103]; Yanagisawa et al.[182, 183, 184]):

1) The Waters view = occipitomental projection
2) The Caldwell view = occipitofrontal projection
3) The base view = submentovertical projection
4) The lateral view

The Waters view allows the best judgement of the frontal and maxillary sinuses. The Caldwell view gives most information about the structure of the ethmoid cells and the frontal sinuses. The submentovertical projection is especially valuable for studying the base of the skull and the sphenoidal sinuses, as well as the nasal cavities and the posterior ethmoidal cells. The lateral view in particular gives information about the sphenoidal sinuses and the contour of the nasopharynx. In the following examples the projection or the part covered by the X-ray photograph is not always 'strictly according to the rules'. In spite of this these photographs were chosen because endoscopic pictures of these patients are inserted under the heading 'plates', enabling a comparison between X-ray and endoscopic findings.

The Waters view with the mouth opened ought to be preferred to the same projection with the mouth closed, since in the former way the sphenoid sinuses become clearly visible underneath the outline of the upper jaw.

There are numerous other projections in addition to the four projections mentioned, each with its own specific advantages. Good surveys are given by Mayer[102] and Psenner[138].

When there is a suspicion of the existence of soft tissue swelling in the nose, paranasal sinuses and nasopharynx, which shows up poorly on the normal X-ray picture, they can be made clearly visible by introducing contrast material into the relevant cavity. Fluids containing iodine are mostly used for this, such as Lipiodol®. On the X-ray photograph subsequently made (which is then called e.g. nasopharyngogram) these soft tissue swellings show up as dark areas.

With the aid of tomography many details can be made visible which cannot be seen on normal X-ray photographs because of superimposition. A certain area is sliced up radiographically, as it were. Mutually parallel planes are depicted reasonably clearly on the successive tomographic sections, whereas structures outside these planes are represented only vaguely. Generally tomography is carried out in two directions, at right angles to each other, creating a good spatial impression. The most common combination for the nose and the paranasal sinuses is the anterior–posterior with the transverse projection, for the nasopharynx the lateral view with the submentovertical view. Fig. 42 shows two tomographic sections in an

1. Waters view – occipitomental projection (fig. 38)

The patient rests his chin against the case, and keeps his head back so far that the orbitomeatal line (OM) and the case make an angle (40–45°). The nose remains at a distance of 1–2 cm from the case. The central ray (CR) is directed at a right angle to the centre of the case. The centering point (CP) is the inferior nasal spine (fig. 38A).

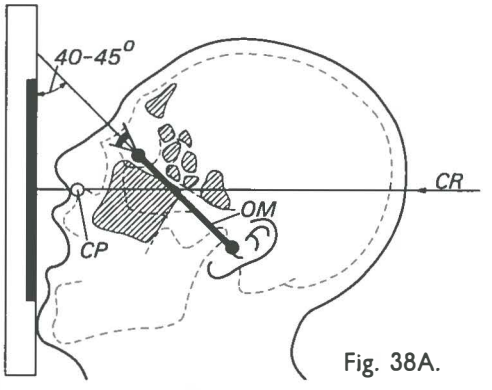


Fig. 38A.

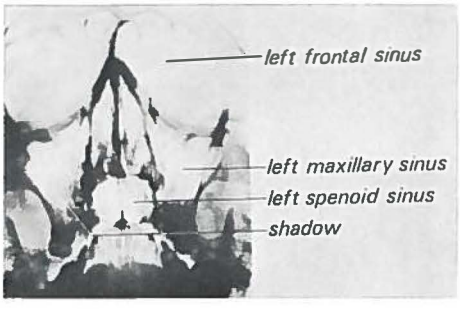


Fig. 38B. Key to fig. 38C.

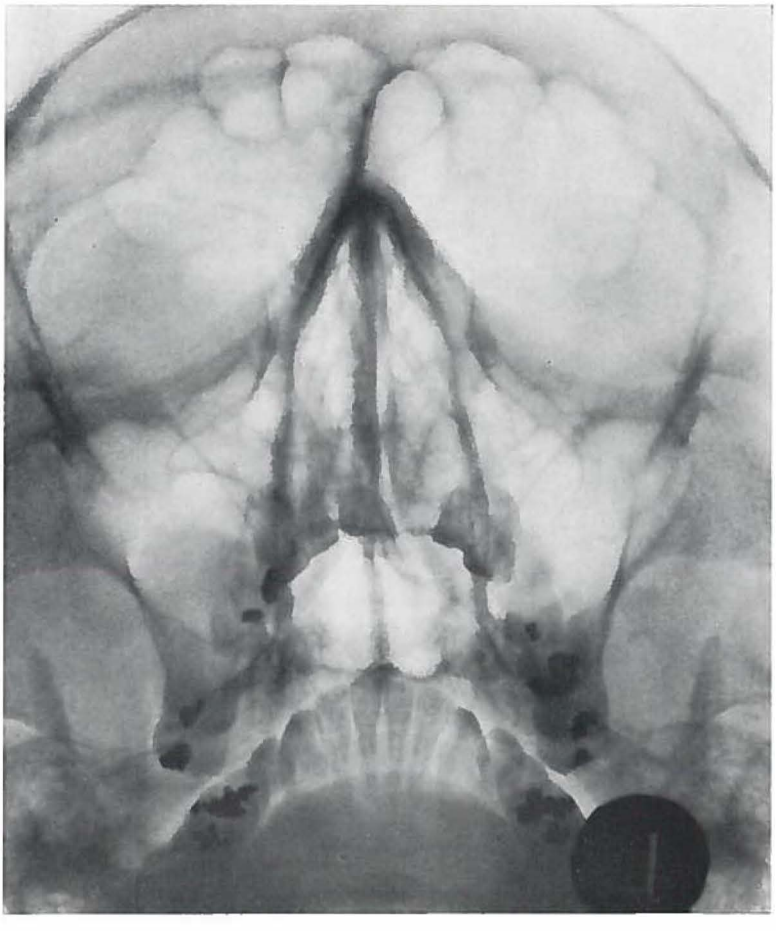


Fig. 38C. Waters view of patient E.B. See also plate 104.

2. The Caldwell view – occipitofrontal projection (fig. 39)

The nose and the forehead are rested against the case. The orbitomeatal line (OM) is at right angles to the case. The centering point (CP) is the nasion. The central ray (CR) makes an angle of 25° (Young[186]), 27° (MacMillan[97]) or 15° (Meschan[104]; Yanagisawa and Smith[184]), caudally to the OM line.

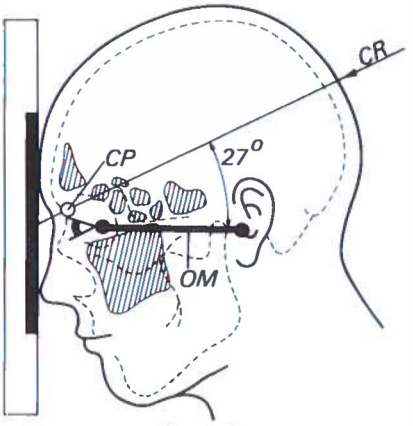


Fig. 39A.

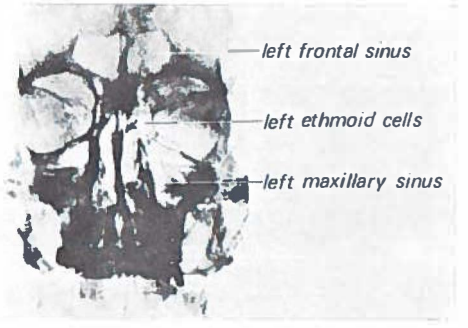


Fig. 39B. Key to fig. 39C.

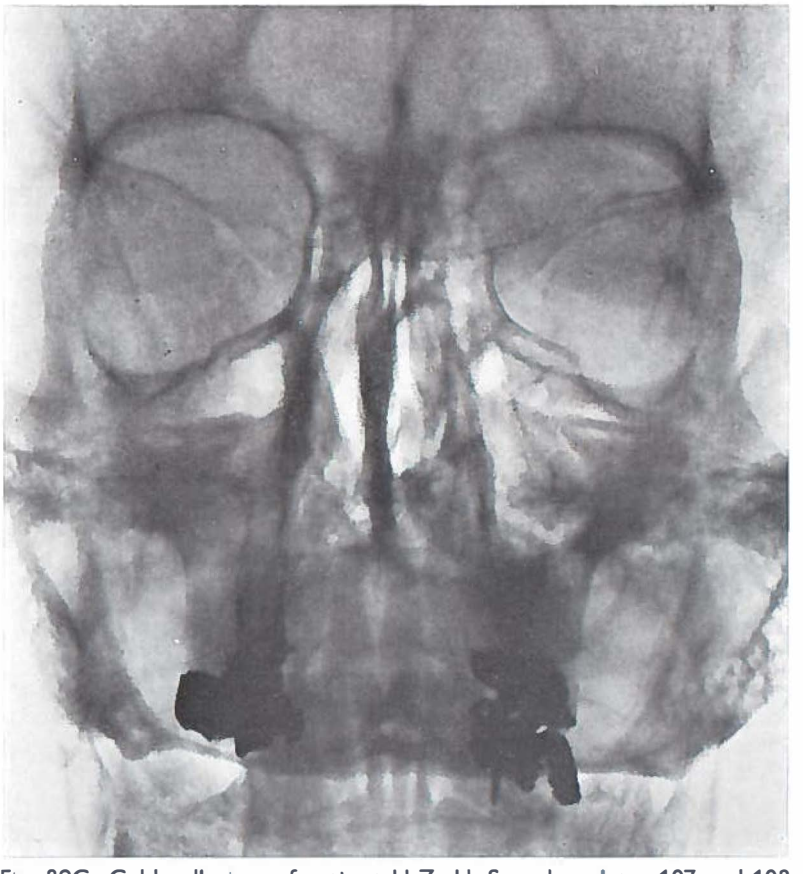


Fig. 39C. Caldwell view of patient H.Z.-H. See also plates 107 and 108.

3. The base or basal view – submentovertical projection (fig. 40)

The patient sits with his back to the case and has his head stretched backwards 90°, with the vertex of the skull against the case. The central ray (CR) which is directed at right angles to the case, makes an angle of about 95° to the orbitomeata line (OM). The centering point (CP) is the angle of the mandible.

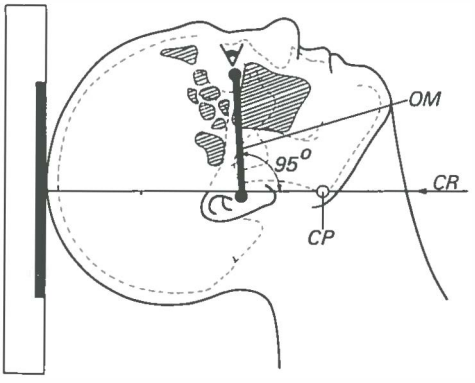


Fig. 40A.

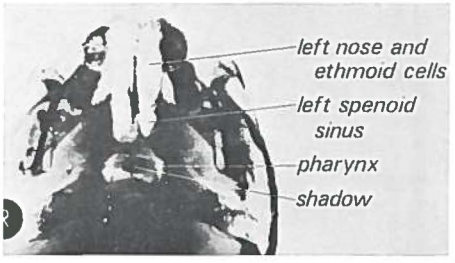


Fig. 40B. Key to fig. 40C.

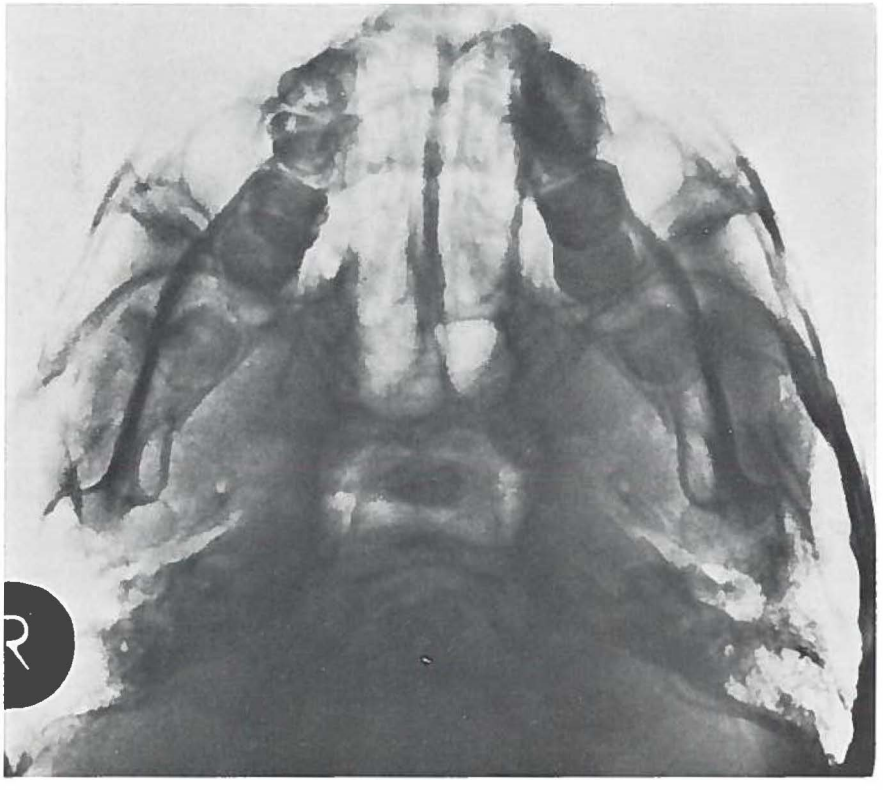


Fig. 40C. Submentovertical view of patient E.F. See also plate 24.

4. The lateral view (fig. 41)

The patient holds his head truly lateral to the case (Young[186]; Meschan[104]; Yanagisawa et al.[182]), or with his nose turned to the case at an angle of 5° (MacMillan[97]). The central ray (CR) is at right angles to the case. The centering point (CP) is the middle of the orbitomeatal line (MacMillan), or the external cantus of the eye (Young).

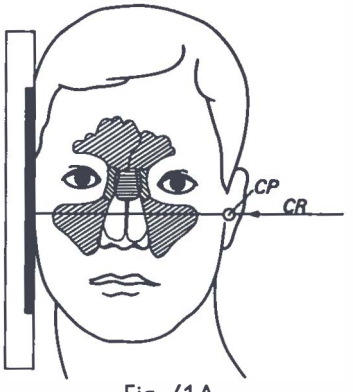


Fig. 41A.

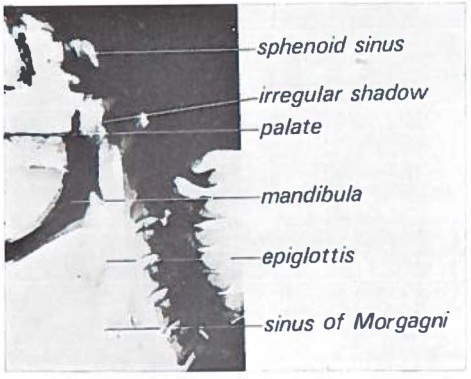


Fig. 41B. Key to fig. 41C.

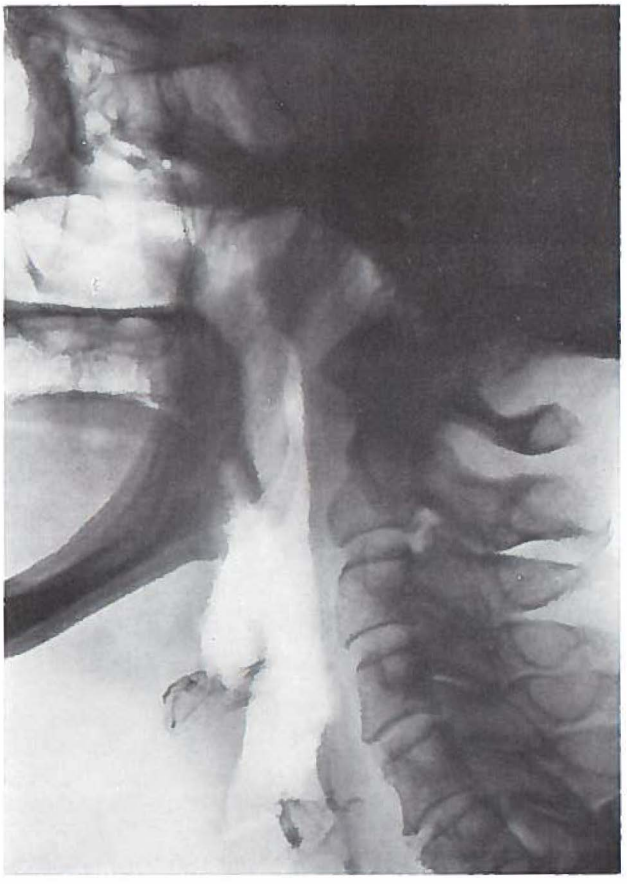


Fig. 41C. Lateral view of patient A.E.-S. See also plate 28.

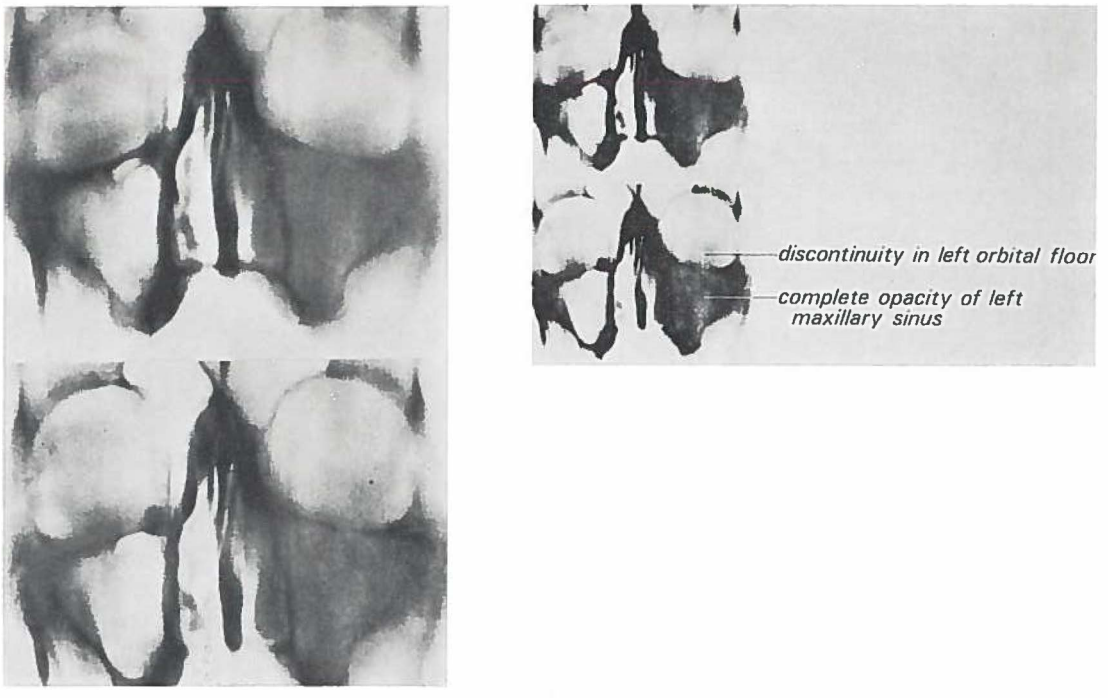


Fig. 42. Anterior-posterior tomographic sections of patient A.J.-K.

anterior–posterior view of the upper jaws of patient A.J.-K. Especially on the lower picture a discontinuity in the left orbital floor is clearly visible, with complete opacification of the left maxillary sinus (see also plates 121 and 122).

CHAPTER 5

The development of the endoscopy of the upper airways

The oldest instrument known to have been used to inspect the inside of body-cavities, and which had a light unit of its own (viz. a candle of bees-wax), is probably the Lichtleiter of Bozzini[23]. This endoscope had been designed to examine the female bladder.

The term endoscope originated with Désormaux, who in 1853 demonstrated a urethroscope at the Académie de médicine, the use of which he described in his book: 'De l'endoscope et de ses applications au diagnostic et au traitement des affections de l'urèthre et de la vessie', which appeared in 1865. In a survey article, 'Zur Geschichte der Oesophago- und Gastroskopie' Killian stated in 1901 that this instrument, for which Désormaux received the Argenteuil prize, surpassed all previous instruments as to its practical use. Hence Killian regarded Désormaux's endoscope as the true beginning of endoscopy[82].

The endoscope of Désormaux (fig. 43) consists of a lamp, which burns a mixture of four parts of 96% alcohol and one part of turpentine, and of a rotatably mounted tube. The lamp has a high funnel that can be drawn out. The light of the flame is concentrated by a concave mirror and a lens, and is subsequently cast into the actual endoscope by a mirror placed at an angle of 45°. In the centre of this mirror there is a hole, through which the examiner looks. The endoscopic tube is rotatably mounted on the lamp-socket on a level with the condenser-lens (L), so that the lamp can always remain in a vertical position, independent of the position of the endoscope.

Désormaux considered the endoscope suitable for more body cavities than just the urethra. For this reason he called the instrument 'endoscope', and constructed it in such a way as to allow various tube-like specula to be attached to it.

In 1879 Nitze, in collaboration with the instrument-maker Leiter, developed a cytoscope with distal electric illumination (distal illumination means that the source of light is fixed to that end of the endoscope which is introduced into the patient). It was further provided with optics, enlarging the field of vision, made by Bénèche

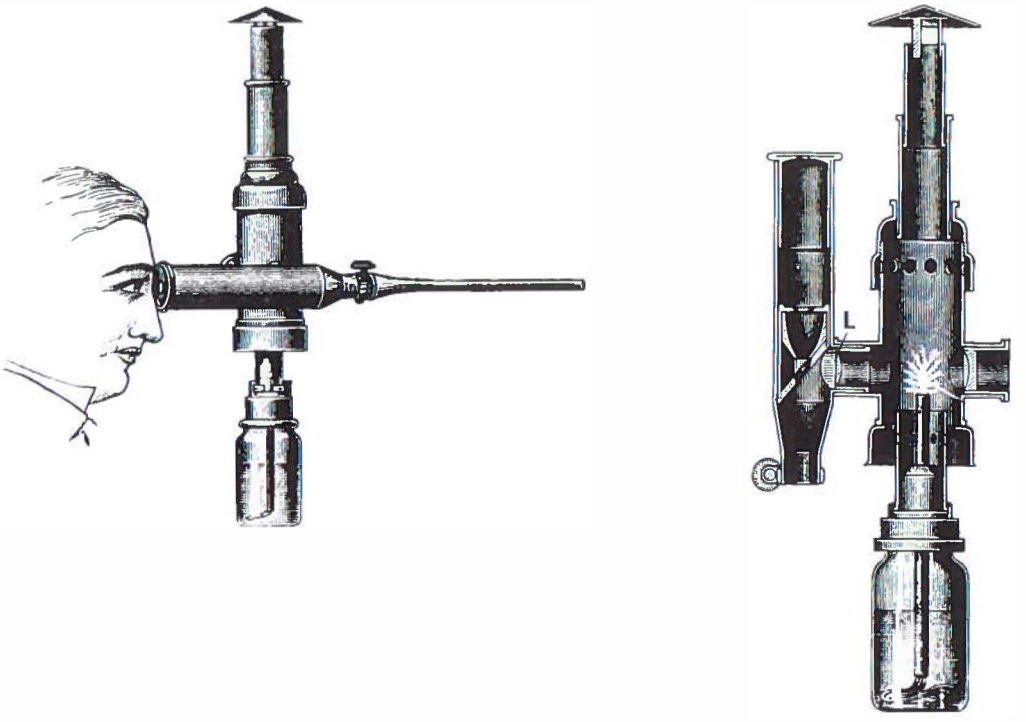


Fig. 43. Endoscope after Désormaux.

at Berlin. The electric lamp contained an incandescent filament of platinum, which produced considerable heat, so that an elaborate system of water cooling had to be built in. Although the electric lamp and the optics have been greatly improved in the course of time, this principle of electric distal illumination and enlarging of the field of vision by means of a system of single lenses for a long time formed the basic concept of every endoscope.

Nitze and Leiter also thought that this instrument could be applied in more fields than cytoscopy alone, as witnessed by the title of the monograph written by Leiter in 1880: 'Beschreibung und Instruktion zur Handhabung der von Dr. Nitze und J. Leiter konstruierten Instrumente und Apparate zur direkten Beleuchtung menschlicher Körperhöhlen'[92].

During the last two decades further developments in endoscopic optics have led to great improvements. The desire for photographic documentation has greatly accelerated these developments. Besides the natural desire for a sharp picture demands concerning the brightness of the entire endoscopic system and the angle of vision of the optics also played a part.

For the smaller optics in particular the maximum size of the distal lamp was a limitation. In 1951 Hopkins introduced an essential improvement by making the illumination proximal again. Just like Bozzini and Désormaux he placed the source of light outside the endoscope, on account of which the lamp was no longer restrict-

ed in size. For the transmission of the light to the (distal) tip of the endoscope he made use of glass fibres. This light conducted by means of glass fibres is called 'cold light', as there is hardly any heat where the light leaves the endoscope.

For a long time the improvement of endoscopic optics seemed to be faced with an insurpassable barrier. In order to improve the optical results more and more lens-elements were added to the optics. The reflections occurring at each air-glass-boundary limited the number of possible elements, so that further improvements did not seem possible. This difficulty has been overcome in two ways.

In 1956 it was again the English physicist Hopkins, who indicated the first way when he demonstrated a new solid rod lens system to the British Association of Urological Surgeons in Glasgow. This lens system uses solid rods of glass with small spaces between them to act as lenses. It enabled a wider angle of vision and in addition to that it was sufficiently powerful to take good pictures (fig. 44B).

The second way was the coating of the lenses, which solved the problem of reflection, and the use of new strongly refracting kinds of glass, which made less concave lenses possible. The latter improvement allowed reducing the spherical aberrations, more powerful optics and a wider angle of vision. This second way of improving on conventional optics is used in the Lumina* endoscopes after Lent. The optical results of the Lumina endoscopes come very close to those of the Hopkins endoscopes, and may in some cases even be considered slightly superior (fig. 44C).

Both the Hopkins and Lumina endoscopes are provided with cold light by means of glass fibres. These glass fibres can either continue in a fibre light transmitting cable directly connected to the optics (integral fibre optic bundle), or they may end in an attachment for a fibre light transmitting cable. In both cases the light transmitting cable is connected to a cold light fountain, usually fitted with a 150 Watts halogen lamp. Photography is possible either by fitting an electronic flash

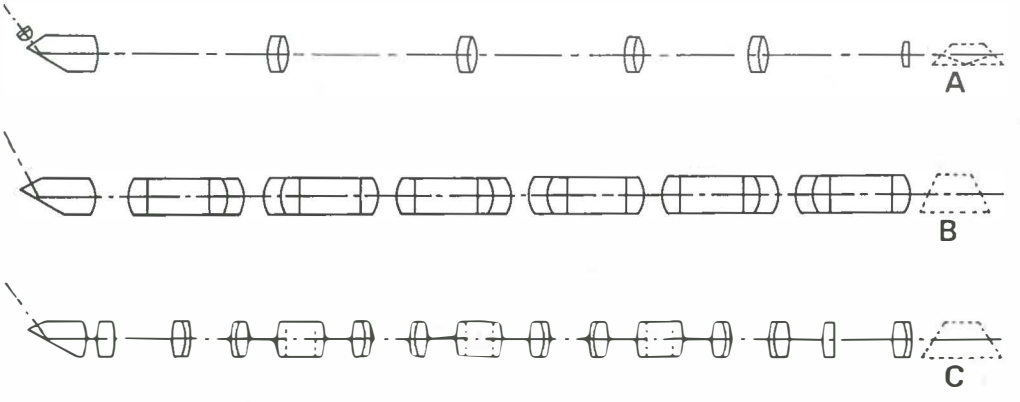


Fig. 44. A, principle of conventional endoscope. B, principle of Hopkins endoscope. C, principle of Lumina endoscope (taken from H. Lindner[93]).

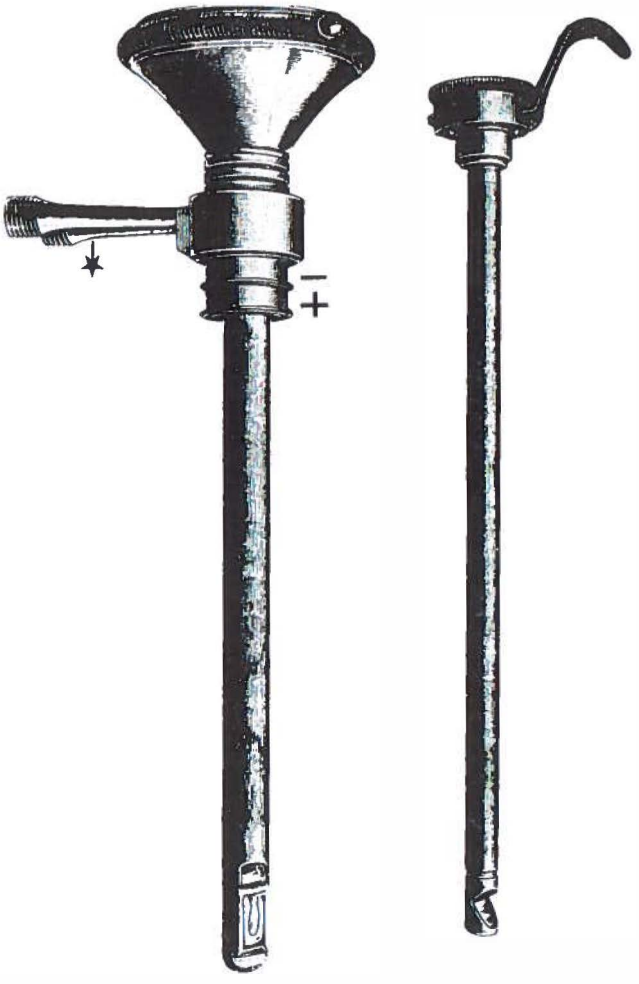


Fig. 45. Endoscope after Zaufal. Left, the jacket with connections for the cooling water (*) and electricity (—, +). Right, the corresponding optics. (Full size pictures.)

tube to the attachment for the light transmitting cable, or by means of a cold light fountain with a built-in electronic flash unit (see ch. 6).

Although many of the endoscopic developments were first applied in urology, endoscopic examination certainly did not remain restricted to that area.

The first to carry out endoscopic examination of the upper airways was E. Zaufal, who – inspired by Nitze's success – had a modified cytoscope made for that purpose by Leiter as early as 1880 (fig. 45). Zaufal mainly studied the orifice of the auditory tube into the nasopharynx with it. The endoscope, which just like Nitze's instrument had a water cooling system was 6 mm wide, and was introduced through the nose.

Zaufal's announcement in the Prager medizinischen Wochenschrift apparently fell into oblivion however. For when Valentin[170] described his entirely analogous

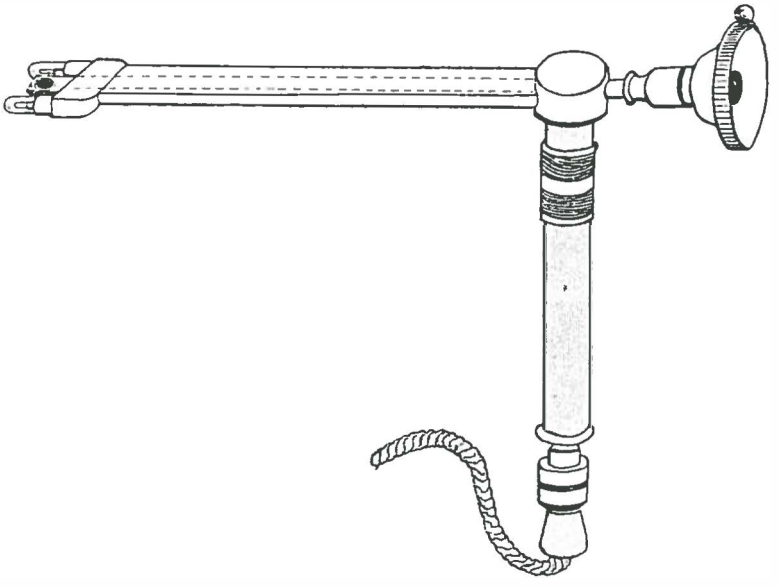


Fig. 46. Pharyngoscope after Hays[62].

investigations carried out with a more modern and more slender (Ø = 4.5 mm) endoscope, he was surprised to find that it had not been until 1902 that Reichert employed Nitze's invention for the first time in oto-rhino-laryngology. Valentin called the endoscopic examination of the torus tubarius 'salpingoscopy'. For a number of years salpingoscopy roused a fair amount of interest, which caused Zaufal[189], in 1909, to point out in a more or less indignant article that he had been the first to employ this method.

In 1909 Hays was the first to describe endoscopic examination of the nasopharynx through the mouth. He thought that salpingoscopy had only limited advantages and mentioned the following drawbacks: the poor view of the nasopharynx, and the fact that the lens is often 'covered with mucous'. Hays' 'pharyngoscope' (fig. 46) was composed of a horizontal and a vertical shaft. The horizontal shaft is at the same time used as a tongue depressor. Hays did not use any extra aids. After introducing the instrument almost as far as the posterior pharyngeal wall he had the patient close his mouth and breathe through his nose. The space between the palate and the posterior wall of the pharynx, which is obtained by relaxation of the muscles of the soft palate, was sufficient, according to Hays, to be well able to inspect the nasopharynx. Moreover, local anaesthesia was required, according to him, in only 8 cases out of a series of 50. Evidently the visual angle of his scope was not wide, for he had to turn it to be able to see the different parts of the nasopharynx. He did not mention at all the occurrence of burns in the patient caused by the heat of the lamps.

Garel[59] was greatly impressed by this 'révolution dans la rhinoscopie postérieure', and predicted that it would have a great future, although he did see burns in the patient's throat. Like Hays he also used the instrument – turned 180° – for examining

Fig. 47. Nasendoscope after Hirschmann[67].

the larynx. After the endoscope after Hays had at first also been used by others (e.g. Fridenberg[58]), it fell into oblivion.

Fourestier et al.[55] employed this method of nasopharyngoscopy anew in 1964; the quality of the optics and the illumination were far better, however, and photographic documentation was considered. Fourestier et al. made use of local anaesthesia and pulled the soft palate forward with 'reins', which they kept under tension with the aid of an artery forceps.

In 1967 Clark and Berci[13, 36], too, again drew attention to oral nasopharyngoscopy. Superficially their endoscope was a replica of the instrument by Hays. This endoscope, however, enabled good photographic documentation, be it that the angle of vision was not wide enough to record the entire nasopharynx on one picture. In spite of the fact that this way of photography was rather exacting, they considered this way of documentation of sufficient importance (follow-up, instruction) to propagate it.

In spite of the fact that nasendoscopy had been described as early as 1903 by Hirschmann, the endoscopic examination of the nose was developed at a very late stage, probably due to the misconception that the nose can be examined sufficiently accurately with the aid of anterior rhinoscopy (with nasal speculum and head mirror). Originally Hirschmann used an endoscope with a diameter of 5 mm, which he considered too thick, however, to be used generally. He justly regarded his later 4 mm scope as highly superior, therefore. The slightly bent tip clearly shows that the instrument is a modification of a cytoscope (fig. 47).

Hirschmann generally introduced the endoscope into the middle meatus, since as a nasendoscopist he took a special interest in the ostia of the paranasal sinuses, unlike Valentin, who passed the instrument through the inferior meatus. Valentin did not actually perform true nasendoscopy, but used the nose as an approach for his salpingoscopy. Hirschmann was very enthusiastic about the new possibilities. He claimed to have exenterated, under endoscopic control, some ethmoidal cells on account of empyema.

After Hirschmann a silence fell round nasendoscopy. Should some have conceived the idea of taking up this method of examination again, they would have been deterred by slighting remarks like those of Zarniko's[188]:

'Ich habe von ihr mehr den Eindruck einer interessanter Spielerei, als einer notwendigen Untersuchungsmethode. Ich wüsste keines der durch sie erreichten Ergebnisse zu nennen, das nicht auf andere Weise einfacher zu erreichen gewesen wäre.'

It was to lie dormant until 1970, when Messerklinger resumed it and made nasendoscopy a full-grown method of examination. Previously ([105, 106, 107]) Messerklinger had studied the transport of secretions in the nose and paranasal cavities on fresh corpses (the ciliary movement continues for another 24–48 hours after clinical death). He developed the natural desire to make a detailed study of the transport of secretions in living people as well. With the aid of Hopkins optics with a diameter of 4 mm he soon raised the technique of nasendoscopy to a high level. He published an impressive number of articles on this subject[108, 109, 110, 111, 112], in which he dwells on the endoscopic aspects of the anatomy of the nose in particular. He considered nasendoscopy of extreme importance for every day practice, because it offered the following possibilities: finding the cause of therapy-resistant sinusitises (e.g. the ostia being closed off by benign or malignant soft tissue swellings) being able to determine the spread of malignant growths more accurately, and being able to perform minor operations under optical control. Besides, Messerklinger was struck by his discovery of unknown or forgotten anatomical details, such as the variability in size of the maxillary ostium and the fontanelles, the bulging of especially the posterior fontanelle in case of maxillary sinusitis, the occurrence of mucosal 'ridges' parallel to the conchae in the middle meatus in case of rhinitis vasomotoria, and by the relative ease with which the ostium of the sphenoid sinus can be brought into view. He also succeeded in locating cerebrospinal rhinorrhoea endoscopically in which case traces appear of Fluorescin–Natrium, of which 1 cc of a 5% solution has been injected suboccipitally into the cerebrospinal fluid 1 hour previously.

Since Messerklinger's publications nasendoscopy has been deservedly recognised and propagated (Schwarz[147]; Birnmeyer[16]; Semczuk[149]; etc.). It is undoubtedly the possibility of recording the endoscopic picture photographically that has contributed to this recognition.

The type of nasendoscopy as described by Pigott et al. is essentially independent of this development. Like Valentin they also used the nose as an approach to study the closure mechanism of the soft palate in cleft palate patients, before and after surgical correction, with the aid of an optics that has its field of vision directed downwards. Their endoscopic findings agree with Calnan's theory that Passavant's ridge plays a major part only in swallowing and retching, and not in speech.

The question as to who was the first to examine the maxillary sinus endoscopically can be disputed. Hirschmann must probably be given credit for this, for he wrote that he had made his first attempts in 1901. The first publication on antroscopy (synonyms: sinoscopy, Highmoroscopy), however, by Reichert, saw the light

Fig. 48. Antroscope after Reichert[139].

in 1902. Reichert's instrument was an endoscope, 10 cm long and oval in section, the greatest diameter of which was 7 mm. Hirschmann used a 4 mm optics. They both performed antroscopy through the alveolar process, for which they extracted a molar and amply bored out the hole, thus obtained, into the maxillary sinus.

The coloured plates drawn after the endoscopic pictures, which Hirschmann included with his publications, prove that he had a quite usable optics already, although the image was reversed in the sense that left and right were interchanged.

After some initial hesitation, the first communications on antroscopy – quite unlike those of nasopharyngoscopy and nasendoscopy – were followed by a long series of publications, among which those of Spielberg[154]; Maltz[99]; Slobodnik[152]; Lüdecke[96]; Christensen[34]; Agazzi[3]; Bethmann[14]; Adam[2]; Bollobás[21]; Jiménez-Quesda[78]; Von Riccabona[141]; Nehls[120]; Timm[164, 165, 166]; Bauer and Wodak[11, 12]; Wodak[180]; Rosemann[142]; Pihrt[135]; Papurov[130]; Hütten[73]; Grünberg[60]; Illum and Jeppesen[74]; Hellmich and Herberhold[63]; Prott[137]; Herberhold[64]; Draf[46, 47]; Zielinski[190].

Christensen claimed to have made colour photographs with the aid of the antroscope as early as 1946, but Timm was the first to publish colour photographs in 1965. The quality of photographic documentation was clearly improved when Hopkins optics also came to be available for antroscopy.

The approach through the alveolar process has not been selected by anyone since Hirschmann and Reichert. The great majority of authors carry out antroscopy via the inferior meatus. Mostly this choice is not motivated any further. Von Riccabona does motivate it, he preferred insertion through the inferior meatus because he enlarged the perforation to a much wider opening for drainage, if this was indicated by the endoscopic picture. Illum and Jeppesen also used the perforation-opening in the inferior meatus for draining; through the canula they inserted a polyethylene tube into the sinus, as described by Schobel[146] and Knudstrup[84] among others.

Only few authors introduced the antroscope through the canine fossa. Draf[46] preferred this approach for taking a biopsy under vision, with the aid of an optical biopsy forceps. He justly thought that the development of this forceps makes that 'bimeatal sinoscopy' can be avoided in most cases as it is unduly complicated. Jiménez-Quesda[78] carried out a modified Caldwell–Luc operation through the canine fossa under endoscopic control.

In bimeatal sinoscopy (Hellmich and Herberhold[63]) a canula is inserted both through the canine fossa and through the inferior meatus. Through one canula a biopsy forceps is introduced, through the other an optics. By means of this combination they take biopsies from the maxillary sinus under visual control.

Zielinski[190] used a 6.3 mm antroscope, with which biopsies can be taken under vision with the aid of a forceps that can be manoeuvred to a certain extent at a fixed angle.

Recent authors more or less unanimously mention the following indications for antroscopy: 1) If X-ray photographs are inconclusive; 2) clinical suspicion of disease

without abnormal X-ray findings; 3) disease established in the neighbourhood of the maxillary sinus (especially in the case of malignant processes); 4) Follow-up (after surgery, radiotherapy, cytostatic treatment).

All authors appear to be impressed by the information provided by antroscopy. Illum et al.[75] and Herberhold[64] compared their endoscopic findings with the information provided by X-ray photographs of the maxillary sinuses. They find that 38 respectively 36% of the X-ray findings are 'wrong or inconclusive'. This reliability of only slightly more than 60% is sharply contrasted by the percentage of 80 or more, previously ascribed to X-ray findings (Ballantyne[6]; Hinde[66]; Vuorinen et al.[173]; McNeill[98]; Axelsson et al.[5]; etc.).

Illum et al. even go so far as to wonder whether X-rays (Waters and Caldwell view) are necessary at all, since they have proved to be so unreliable and since endoscopic examination of the maxillary sinus is available. The very high degree of reliability of the information provided by tomography is not contested by any author. Prott[137], therefore, uses tomography to check his endoscopic findings. Thus he could confirm the endoscopic finding, that in only a quarter of the cases there exists a genuine maxillary ostium (a direct connection between the sinus and the nose), and that the drainage of the maxillary sinus takes place much more frequently via an ethmoidal cell by means of a maxillo-ethmoido-nasal canal.

There is no unanimity as to the correlation between the appearance of the mucosa during antroscopy in the case of sinusitis and the microscopic findings in the biopsies. Bauer and Wodak found a good correlation, Moesner et al.[115] could only establish little agreement between the macroscopical and microscopical appearance. This also corresponds with Timm's experience[167]. This relative unreliability is probably due to the fact that in the case of sinusitis several histological pictures are found in one maxillary sinus. Besides, the biopsy is usually small and it is slightly compressed when taking it, moreover, which may lead to a fibrosis-like artefact (Moesner).

CHAPTER 6

The author's method of endoscopy

Nasopharyngoscopy[28, 30]

In order to obtain a good overall picture of the nasopharynx with posterior rhinoscopy we make use of 'reins' as described by Hopmann (see fig. 30). The metal plate, the 'rein bridge' to which the reins are attached, was modified by Koopman[85], who propagated this method anew (see pictures 2 and 12).

The reins are inserted after local anaesthesia of the mucosa of the nose, the nasopharynx and the oropharynx. Anaesthesia is produced by spraying with a surface anaesthetic. For this purpose we mostly use oxibuprocaine HCl 1% w/v or lidocaine HCl 4% w/v. Xylocaine 10% (Xylocaine base 100 mg/ml) takes effect sooner, but is far more disagreeable to the patient. The reins can be more easily inserted when a decongestant is also sprayed into the nose. We use xylometazoline HCl 0,1% for this purpose. When nasendoscopy is also planned, or when it is probable that a minor operation will be carried out in the nasopharynx, it is advisable to apply the anaesthetic and the decongestant by inserting strips of cotton wool soaked in these solutions into the nose instead of using the spray. These strips must be long enough to reach from the nasal vestibule into the nasopharynx. We leave them for about 10 min to take effect.

After the space between the soft palate and the posterior pharyngeal wall has been enlarged with the aid of the reins, and the reflexes have been suppressed by the local anaesthesia, a fairly good survey of the nasopharynx is obtained with a large mirror (Ø = 2.5 cm). This procedure requires the use of a tongue depressor (see picture 13). Operations in the nasopharynx thus carried out require the aid of a third person to keep the tongue down (see picture 15).

For the endoscopic examination of the nasopharynx we use 8 mm Lumina*

* N.B. By the manufacturer, Wolf company, Knittlingen, Germany, straight forward is called 180°.

optics, provided with cold light by means of glass fibres: one optics with an angle of vision of 90° for a general survey of the nasopharynx and one optics with an angle of vision of 70° for examining the choanae* (see fig. 49 D, E and picture 2). Thanks to these optics the ideal of surveying the whole of the nasopharynx in one picture has been realized. Moreover, these optics have been constructed in such a way that they are solid enough to be used as tongue depressors. Thus one of the examiner's hands becomes disengaged and with it he can carry out operations under view, so that he is no longer dependent on the assistance of a nurse (picture 16).

Nasopharyngoscopy can be best carried out with the patient in a sitting posture, since in this position the uvula remains furthest removed from the posterior pharyngeal wall.

Generally the local anaesthesia mentioned above is sufficient and can take place in the outpatients' department. Nervous patients can still be examined in this way after praemedication with 0.25 mg atropin and diazepam (depending on age and weight from 5 to 15 mg) administered intramuscularly (Wesseling et al.[176]). Atropin especially serves to check the production of saliva and mucus, thus preventing aspiration.

The administration of diazepam makes it advisable to carry out the examination with the patient in a semi-recumbent posture, in view of the possibility of a collapse. For the same reason the patient ought to remain under observation for at least one hour after the examination, and can only be allowed to leave the clinic under escort.

With hypersensitive patients and small children general anaesthesia is indicated, preferably with a Woodbridge tube. In that case the mouth of the patient is kept open with a Whitehead mouth gag with fixed tongue plate. When general anaesthesia is used it is preferable to examine the patient clinically.

The most frequent operation in nasopharyngoscopy is the biopsy under view. The oral approach is the best also for taking biopsies. To gain good access to all places in the nasopharynx and the posterior part of the nasal cavities a biopsy forceps was developed consisting of one handle with interchangeable shafts, differently curved (picture 3).

Nasendoscopy[29, 30]

As in nasopharyngoscopy we generally carry out nasendoscopy after local anaesthesia and decongestion of the nasal mucosa. The solutions that are used and the way of application are the same. When cotton wool is used, two parallel strips are generally inserted above each other. One of them is inserted along the nasal floor, the other along the edge of the middle concha. When spray is used, three administrations, allowing each of them one or two minutes to take effect, have proved to provide sufficient anaesthesia. The administration by means of spray is to be preferred when there is a suspicion of a malignant process, as these processes tend to bleed when

touched. Such bleeding is a serious obstacle for carrying out nasendoscopy, because the blood soils the front lens of the endoscope.

As the anterior parts of the nasal passages have a downward course, it is advisable first to point the scope somewhat cranially to prevent it from being soiled right with the introduction. Only when the nasal vestibule has been passed can it be brought parallel to the nasal floor (see picture 18). Another method is to lift the tip of the nose. This can be done both externally and with the aid of a nasal speculum.

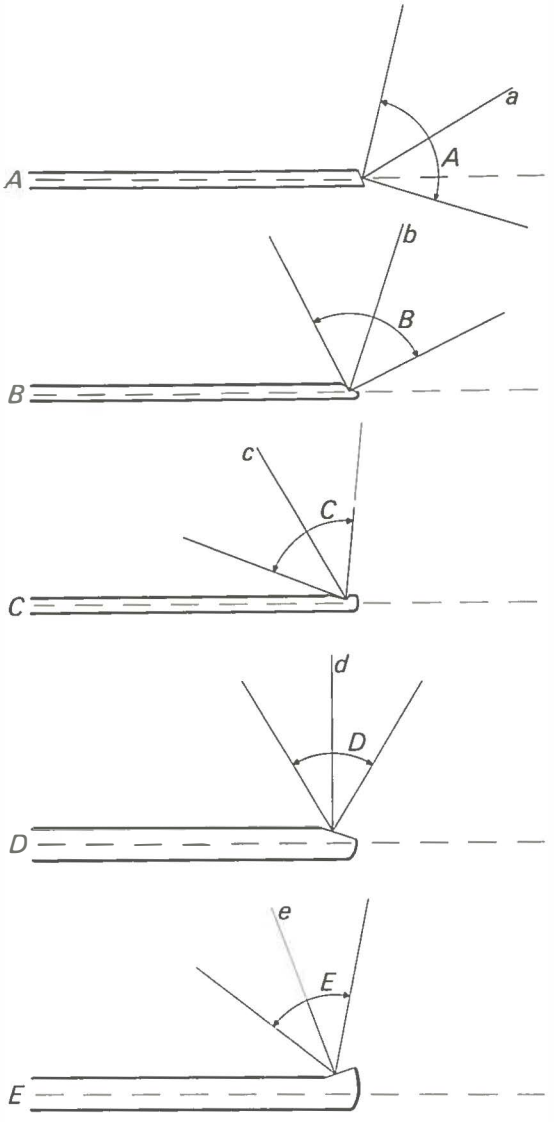


Fig. 49. A, viewing field of 30° Hopkins optics, Ø 4 mm. B, viewing field of 70° Hopkins optics, Ø 4 mm. C, viewing field of 120° Hopkins optics, Ø 4 mm. D, viewing field of 90° Lumina optics, Ø 8 mm. E, viewing field of 70° Lumina optics, Ø 8 mm.

When the endoscope is brought further into the nose, the edge of the medial concha is one of the major points of orientation. Immediately below the edge of the medial concha the nose is often at its widest. It is mostly possible, therefore, to push the scope along, below the medial concha, right into the nasopharynx. This may be rendered impossible by a septal deviation. A septal spur, for instance, with an otherwise straight septum can obstruct this way, since such a spur often protrudes into the middle meatus. In such a case there usually is a possibility of inserting the scope along the nasal floor underneath this spur.

When the nose is wide, examination can already take place while the optics is being inserted. When the nose is narrow – and in proportion to the endoscope this will often be the case – it is better first to push the optics as far as the nasopharynx, taking care that the front lens is not soiled. Subsequently endoscopic examination takes place from back to front, the nasendoscope being slowly pulled forward again. In this way each meatus can be examined in the narrow nose. The chance of the front lens being soiled is considerably reduced in this way.

For nasendoscopy we generally use Hopkins optics with a diameter of 4 mm, and with angles of vision of 30° and 70°*. The viewing field of these optics is over 90°, so that with the 30° optics the area situated in a direct line of the endoscope is well within the viewing field (see fig. 49A). Thus with a 30° optics the examiner can survey the course along which he plans to introduce the endoscope. With the 70° optics this is not possible. This is no obstacle for the trained endoscopist, however. The choice between the two optics seems to be a subjective one, therefore. And yet in the case of a narrow nose the 70° optics would seem preferable, namely for two reasons. Firstly the 70° optics is oval in section, with a greatest diameter of 4 mm indeed, but with a smallest diameter of only 3.4 mm. This makes the optics functionally as thick as the 30° optics only when it is used looking in a truly lateral or medial direction. In all other positions the 70° optics is more slender, and hence easier to introduce. Secondly the 70° optics is rounded at the tip, whereas the 30° optics has a somewhat sharp edge. Lesions of the nasal mucosa are therefore less likely when a 70° optics is used, with all apparent advantages.

Together with the nasendoscopes it is quite well possible to introduce another instrument into the nose, enabling minor operations under view at every level. Taking biopsies and removing small polyps are the most frequent procedures performed in this way.

Antroscopy[29, 30]

The endoscopy of the maxillary sinus, called antroscopy or sinoscopy, is performed via a cannula, which is introduced into the maxillary sinus with the aid of a trocar.

* N.B. By the manufacturer, Storz company, Tutlingen, Germany, straight forward is called 0°.

There are two ways of approach: a) through the anterior wall, via the canine fossa; b) through the medial wall, via the inferior meatus.

Besides, in the case of an oroantral fistula, the cannula can be introduced into the sinus through this opening, provided this fistula is sufficiently wide. At the E.N.T.-Department of Groningen University Hospital antroscopy is almost exclusively carried out through the inferior meatus. The local anaesthesia used with antroscopy is similar to that of the antral puncture. It is produced by applying a strip of cotton wool soaked in an anaesthestic (lidocaine or oxibuprocaine) and a decongestant (xylometazoline) under the inferior concha.

It is to be recommended to apply a similar strip of cotton wool in the middle meatus to make it easier for the irrigating fluid to flow away through the natural ostium.

In puncturing the medial antral wall it is often necessary to luxate the inferior concha slightly upward, so that the puncture can be made sufficiently high. Afterwards the inferior concha returns to its original position. A rotating movement of the trocar makes the puncture of the bony antral wall considerably easier. As the point of the trocar has a sharp triangular shape a kind of boring effect is produced by this movement. This enables insertion of the antroscope even in those cases in which a thick bony wall prevents puncturing with a needle.

After the cannula has been inserted well into the antrum, the trocar is taken out and the actual antroscopy can begin. First the inside of the cannula must be cleansed of secretions and/or blood, which come in when the trocar is withdrawn. If a sterile swab is used for this it can provide the material for a culture. The maximum freedom of movement is obtained by pulling back the cannula under view of the optics so far, that the antral mucosa of the punctured wall just comes into view at the end of the cannula. Care must be taken only to move the cannula along and round the axis. Any other movement will cause extra lesions of the mucosa, which produces inconvenient bleeding in the sinus.

When there are secretions in the sinus, they can easily be rinsed out by means of a tube, which is introduced through the cannula. For this purpose we use a disposable suction catheter no. 10. These catheters, which are 3.3 mm wide, fit exactly on an aural syringe. With this combination the maxillary sinus is rinsed clean, if necessary, with a 1:10,000 solution of chlorohexedine digluconate, heated to 37°C (see picture 21).

Rinsing with a fluid of 20°C, e.g., causes pain to the patient.

For the endoscopy of the maxillary sinus we make use of the same Hopkins optics that are used in nasendoscopy (Ø 4 mm, angles of vision of 30° and 70°) with an additional 120° optics. By turning the optics round the axis the whole sinus can be inspected. The area of the medial wall immediately round the cannula remains the only 'blind spot'. The maxillary ostium often appears to be present in the margin of the field of vision of the 70° optics. With the aid of the 120° optics the ostium can always be brought into view. Because the fields of vision of the three optics

overlap, orientation is always possible. When there is a large cyst in the maxillary sinus it may obstruct a major part of the view. In connection with this we developed a so-called 'cyst-knife', with which a cutting movement can be made in the sinus (by pressing the two sides of the handle the blade of the knife is moved from straight to an angle of 90°), after it has been inserted in a straight position. With this knife the cyst can usually be cleft successfully. The fluid flows away and the cyst collapses, after which the sinus can be surveyed far better.

With a straight biopsy forceps the possibilities of taking biopsies are greatly limited. As the cannula has a practically fixed position, a biopsy can only be taken from a small area of the posterior wall, i.e. in a direct line with the cannula, when a straight, stiff biopsy forceps is used. The development of a manoeuvrable biopsy forceps (see picture 8) has made far more places in the maxillary sinus accessible. Like the cyst-knife this manoeuvrable biopsy forceps is introduced in a straight

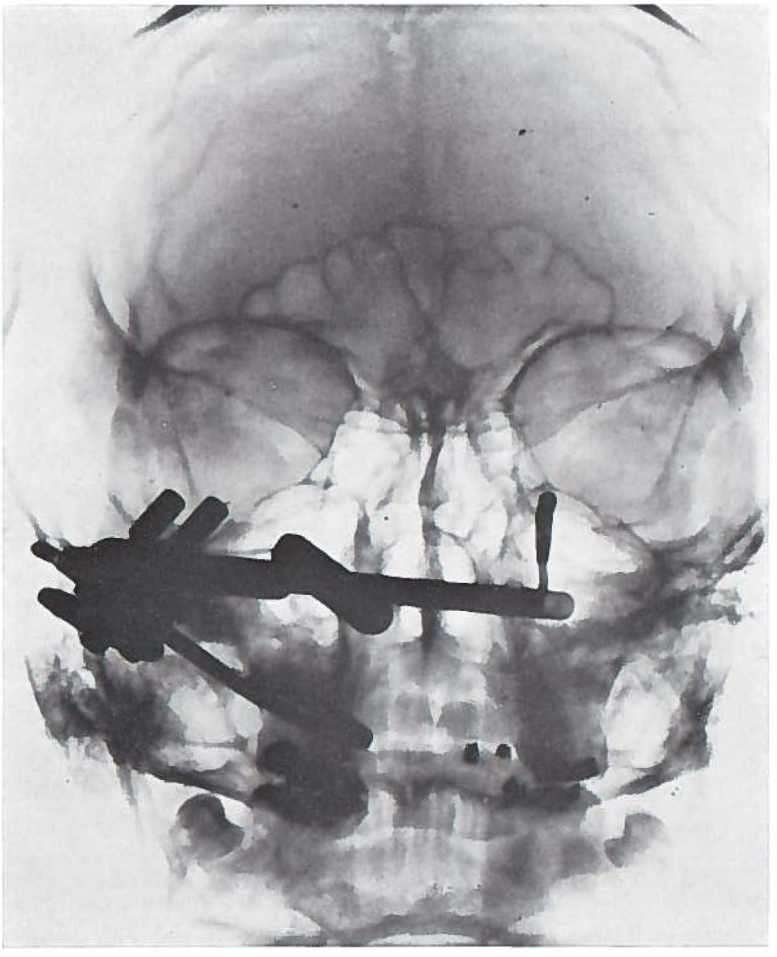


Fig. 50. Manoeuvrable biopsy forceps in the maxillary sinus.

position. A graduated dial attached to the shaft of the forceps corresponds to the position in which the manoeuvrable part can be brought. This instrument is shown in picture 8, second from the top, with its manoeuvrable part in a 90° position. The angle under which the biopsy is to be taken is determined by the position in the field of vision of the optics used, taken up by the point to be biopted. This 'blind manoeuvring' naturally involves some degree of inaccuracy. In spite of this disadvantage the manoeuvrable biopsy forceps has proved practicable several times already. Recently an optic manoeuvrable forceps has been developed, which is 5 mm wide, however. The diameter of the corresponding cannula is almost 6 mm. The use of this optic manoeuvrable biopsy forceps via the relatively narrow inferior meatus will not be possible, therefore, in a great number of cases. When antroscopy is carried out via the canine fossa, however, this instrument can be a welcome addition to those already known. Fig. 50 shows an X-ray photograph of the manoeuvrable biopsy forceps in action in a left maxillary sinus.

When daily rinsing of the maxillary sinus is indicated, a polyethylene tube can be inserted into the sinus through the cannula. To this purpose a no. 12 suction catheter is modified in such a way that it has two 'wings' at the tip, which tend to stand outwards. After insertion the tube is cut off at such a length that the other end can stay in the nasal vestibule, unseen from outside.

Endo-photography

All endoscopes mentioned in this chapter can be coupled to a single-lens reflex camera with the aid of an intermediate optics. For all the reproduced colour photographs included here a RiWo intermediate optics* has been used, with a focal distance of 95 mm, which has a somewhat enlarging effect. Although the brightness of the whole optic system is much greater now than it used to be, the amount of light is still not sufficient to enable focusing on a matte focusing screen. For this reason the camera is equipped with a clear focusing screen. Owing to the very great depth-of-field of the Lumina* and Hopkins* optics the absence of a matte focusing screen is no drawback.

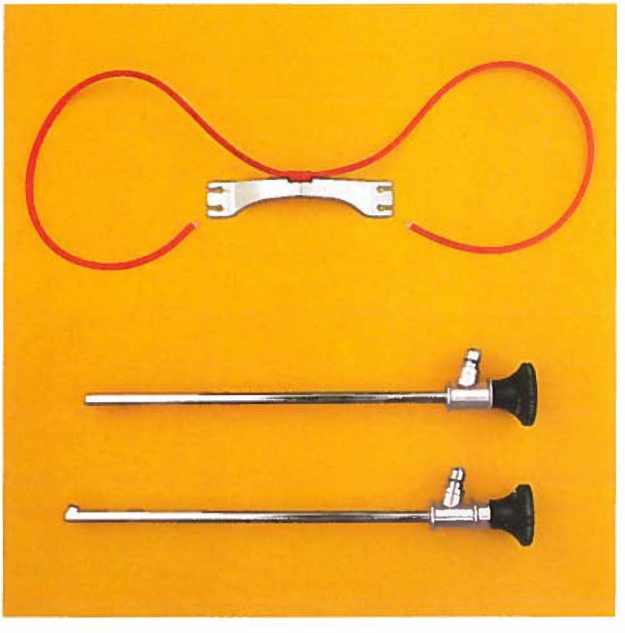
At first the Wolf 5004 and later on the Wolf 5005 light projector were used as a source of light (see picture 9). They both have the advantage that one and the same exit emits both continuous light for diagnosing and electronic flash light for photography. For photography it is not necessary, therefore, to mount a separate flash unit on the endoscope, which greatly benefits the managability. The major difference between the 5004 and the 5005 type is that the capacitors of the flash light installation of the Wolf 5005 needs far less time to be charged. For this reason photographs can be taken in a much more rapid succession with the latter type.

* Wolf company.

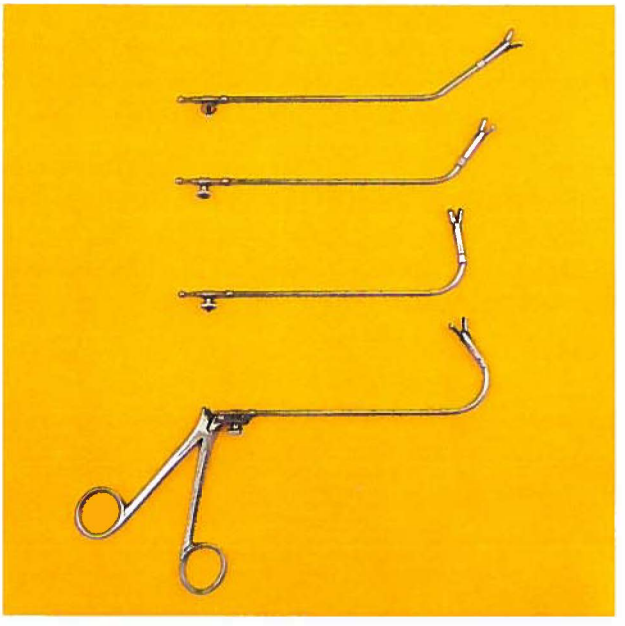
The endoscopic pictures are recorded on Kodak Ektachrome 23° Din H.S. colour reversal film. This film has proved superior in representing shades of colour. The choice of films is limited, however, as the light-sensitivity of the film must be at least 22° Din.

The pictures 1–24 have been made by the Department of Medical Photography of the State University, Groningen.

Picture 1. Instruments used for routine examination. Top, nasal speculum (cf. pict. 17). Middle, post nasal mirror. Bottom, tongue depressor (cf. pict. 10).

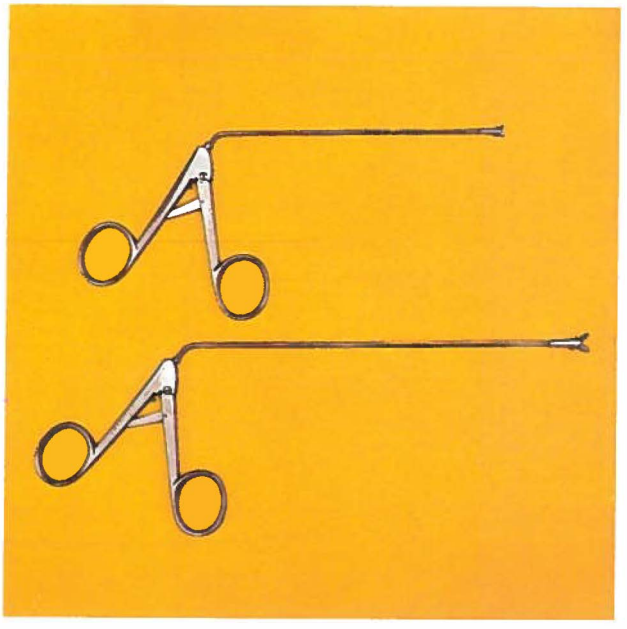


Picture 2. Above, the 'reins' attached to the rein bridge. Below, Lumina nasopharynx-endoscopes (90° and 70°).

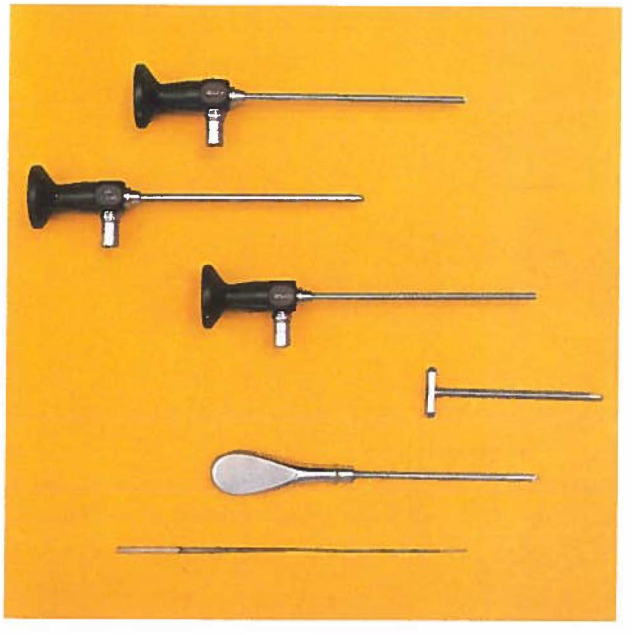


Picture 3. Biopsy forceps for the naso-pharynx. One handle with differently bent interchangeable shafts.

Picture 4. Optics for nasendoscopy. Above, 160° and 100° (photo) Lumina optics, Ø 4 mm (Wolf nomenclature). Below, 30° and 70° Hopkins optics, Ø 4 mm (Storz nomenclature).



Picture 5. Biopsy forceps (small and large) used in nasendoscopy.

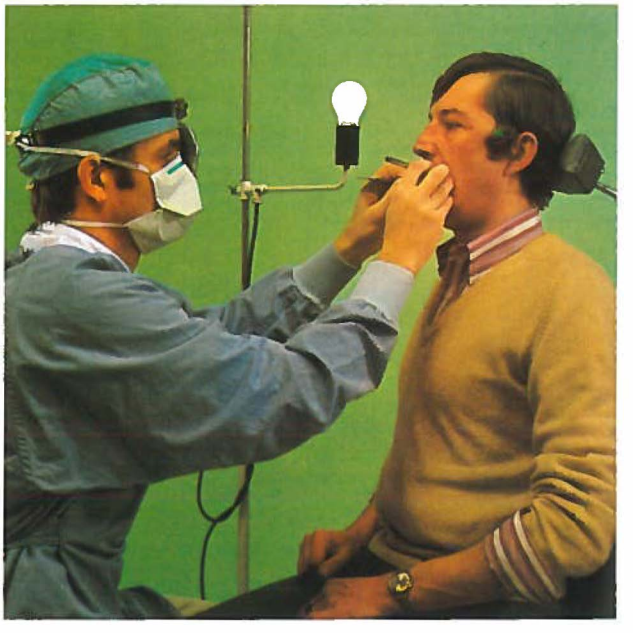


Picture 6. Storz instruments for antroscopy. 30°, 70° and 120° Hopkins optics, Ø 4 mm, cannula, trocar, cotton-wool carrier.

Picture 7. Wolf instruments for antroscopy. 100° (photo) and 160° Lumina optics, Ø 4 mm, trocar, cannula, cotton-wool carrier.

Picture 8. Other instruments used in antroscopy, from top to bottom: cyst-knife, manoeuvrable biopsy forceps, straight biopsy forceps, straight optic biopsy forceps.

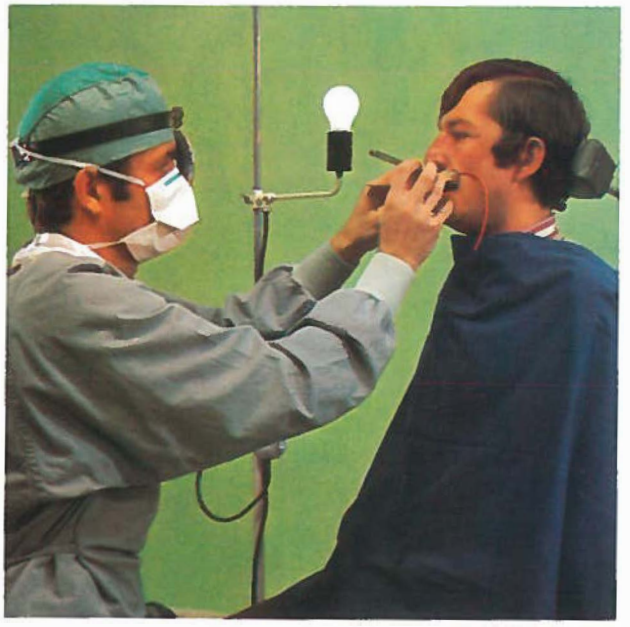
Picture 9. Wolf 5005 light projector, Nikon-F camera, RiWo 95 mm intermediate optics, nasopharyngoscope (cf. pict. 2).



Picture 10. Routine posterior rhinoscopy, in which the nasopharynx is examined with a small mirror.

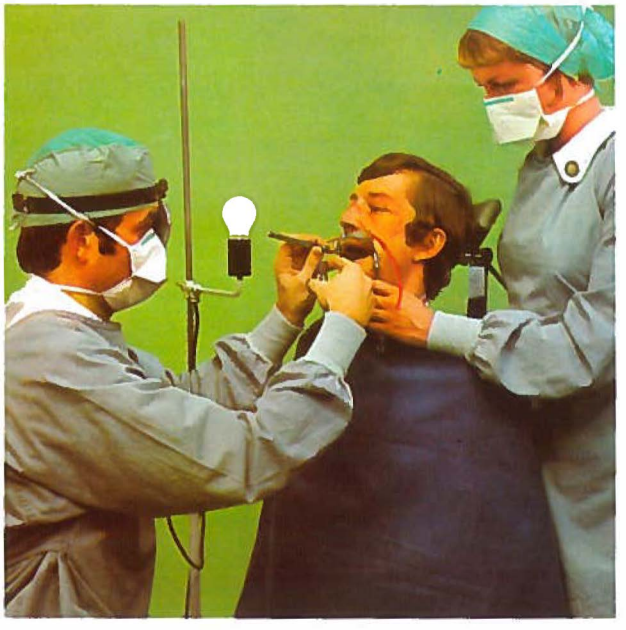
Picture 11. Examination of the naso-pharynx by means of reins, kept taut by the nurse.

Picture 12. Patient with the reins in situ, fixed to the rein bridge.



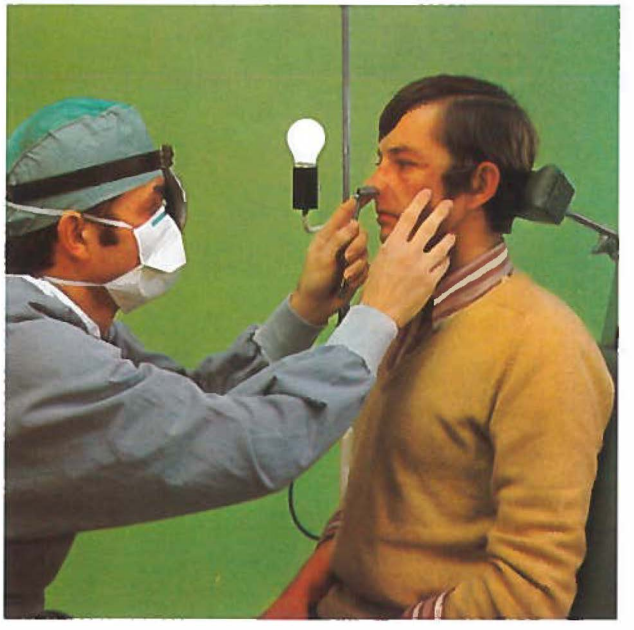
Picture 13. Examination of the nasopharynx by means of a large mirror (Ø 2.5 cm), using the reins and rein bridge.

Picture 14. Nasopharyngoscopy. The optics replaces both the mirror and the tongue depressor.

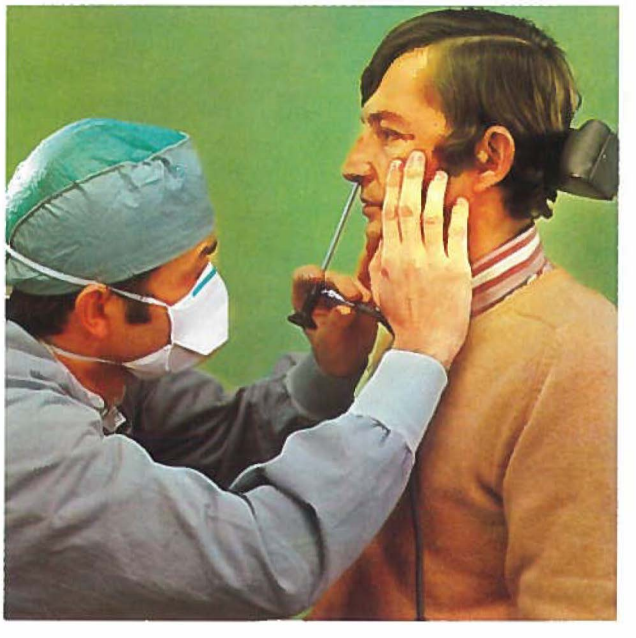


Picture 15. Biopsy under view from the nasopharynx, using the large mirror and the reins with rein bridge. The nurse keeps the patient's tongue down.

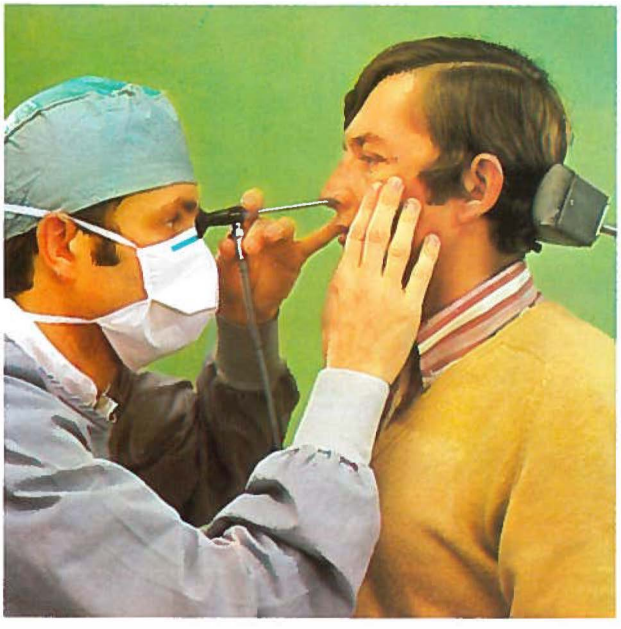
Picture 16. Biopsy under view from the nasopharynx, using the nasopharyngoscope (and the reins with rein bridge). The assistance of a third person is superfluous.



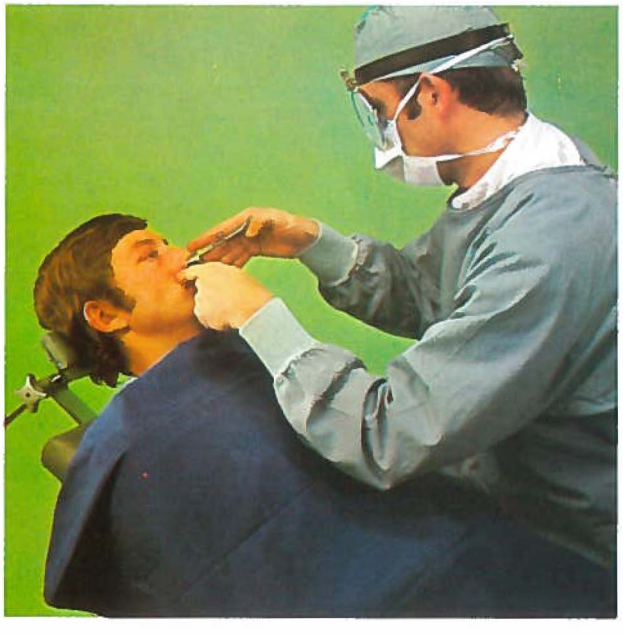
Picture 17. Routine anterior rhinoscopy by means of a nasal speculum (the hand normally resting on the patient's head, here rests on his cheek, so that a good picture could be taken).



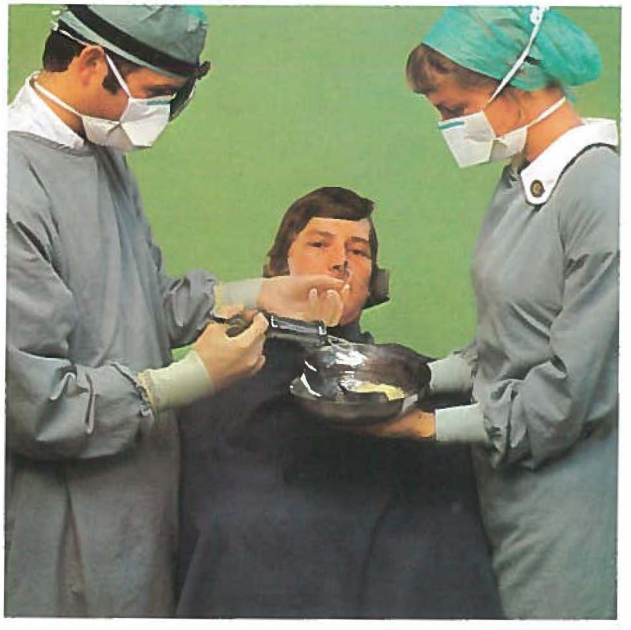
Picture 18. The best position for the nasendoscopy when it is introduced. In this way there is the least chance of soiling the front lens.



Picture 19. During nasendoscopy unwanted movements of the endoscope can be prevented by resting the examiner's hand, holding the endoscope, on the patient's face.



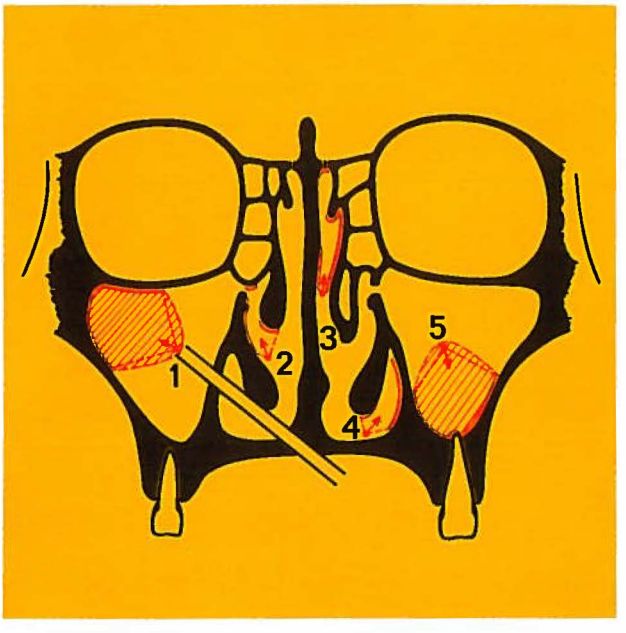
Picture 20. Insertion of the cannula with the aid of a trocar.



Picture 21. Rinsing of the maxillary sinus, with an aural syringe and a suction catheter.

Picture 22. During antroscopy both the cannula and the endoscope must be prevented from unwanted movements by resting the examiner's hand on the patient's face.

Picture 23. A biopsy is taken from the zygomatic recess of the maxillary sinus, by means of the manoeuvrable biopsy forceps.



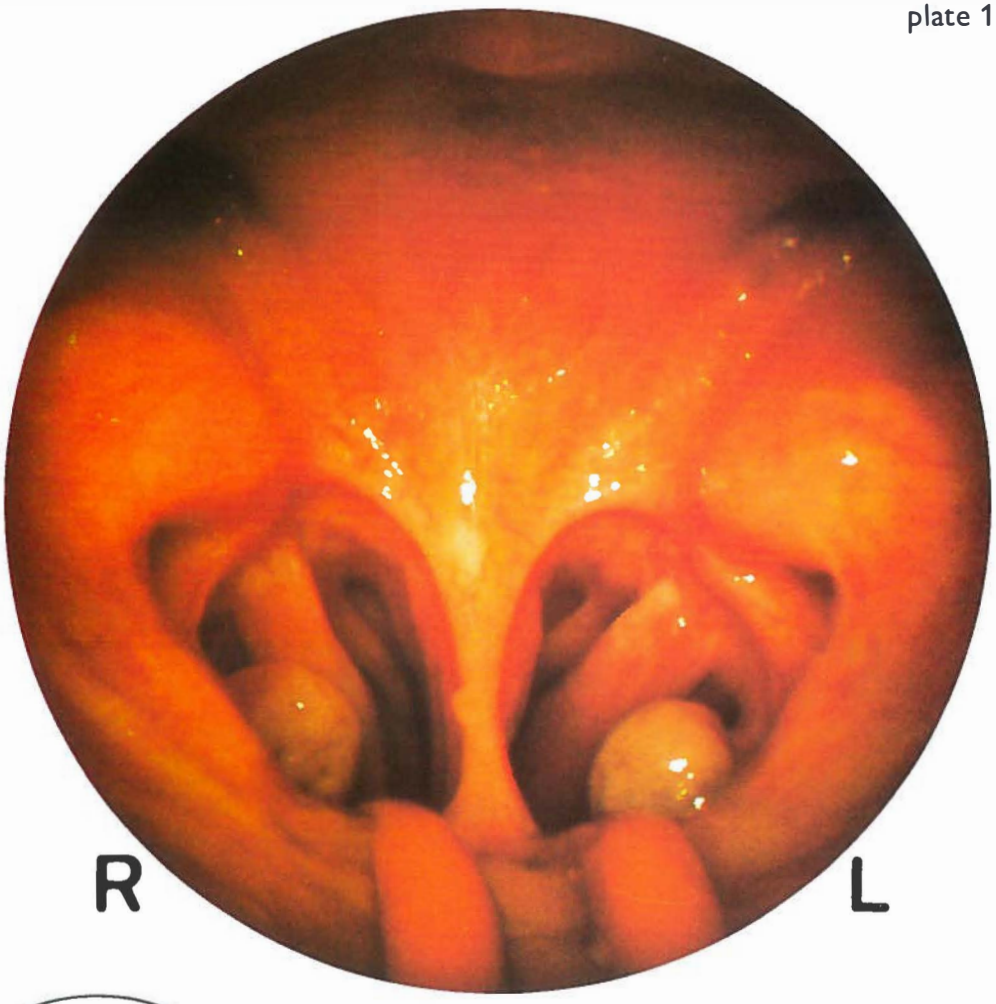
Picture 24. Frontal section with some visual fields. 1, right antroscopy, zygomatic recess (cf. plate 91). 2, right nasendoscopy, middle meatus (cf. plate 45). 3, left nasendoscopy, superior meatus. 4, left nasendoscopy, inferior meatus (cf. plates 43 and 44). 5, left antroscopy, bottom (cf. plate 83).

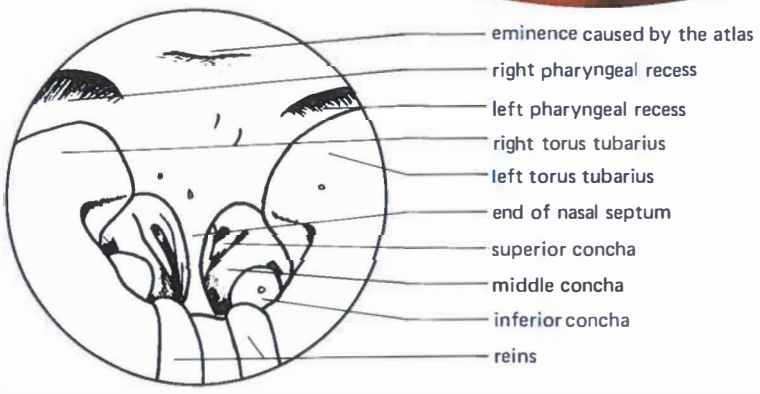
CHAPTER 7

Nasopharyngoscopic plates

All nasopharyngoscopic plates are printed with the soft palate below, that is to say as the nasopharynx is seen, in parts, in the mirror and as it is generally represented in drawings in textbooks. The endoscopic picture of the nasopharynx, however, is upside-down i.e. with the palate at the top. This feature becomes familiar quite soon, in practice.

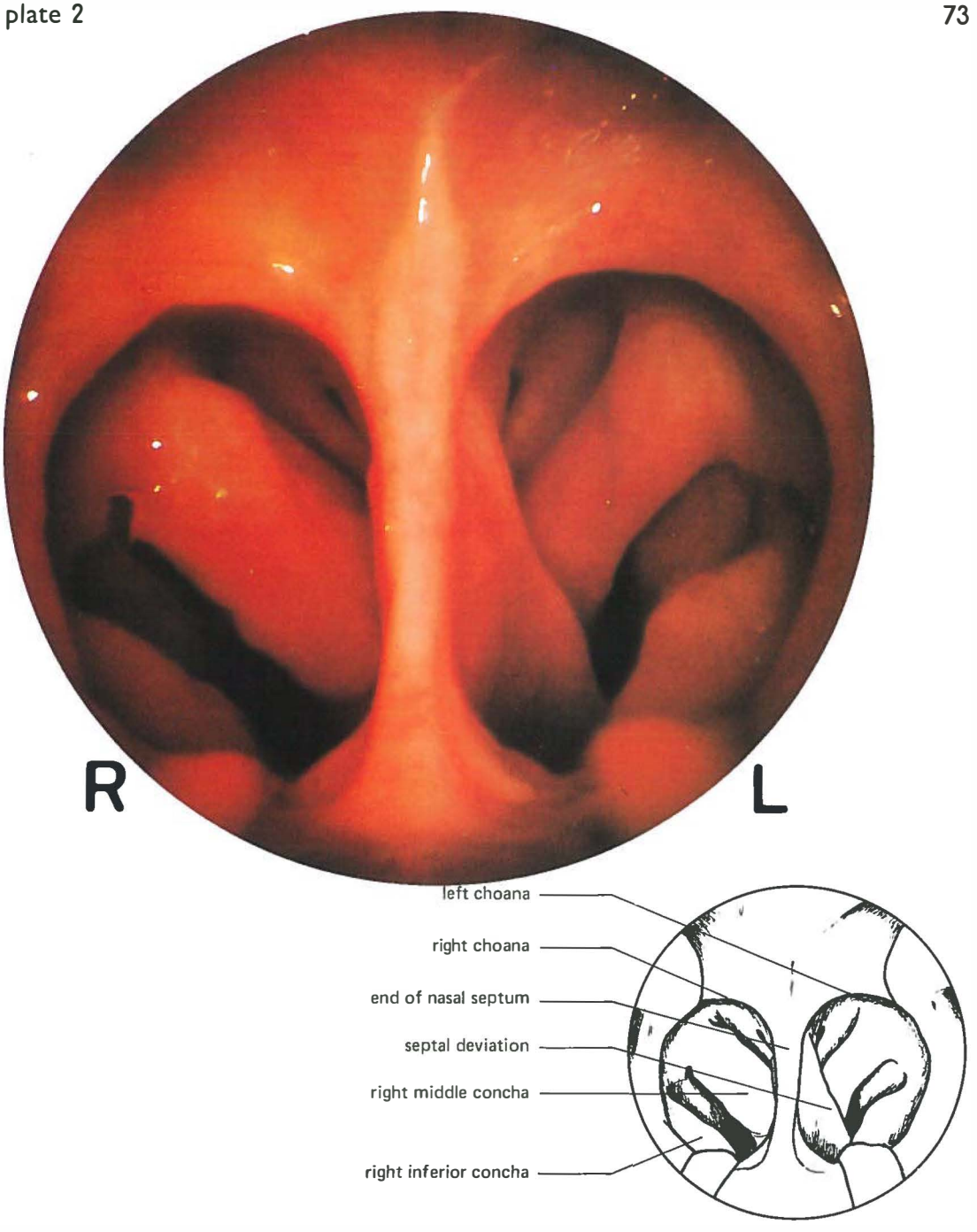
The 'R' and 'L' on either side of the plates represent the right and left side of the patient, respectively.





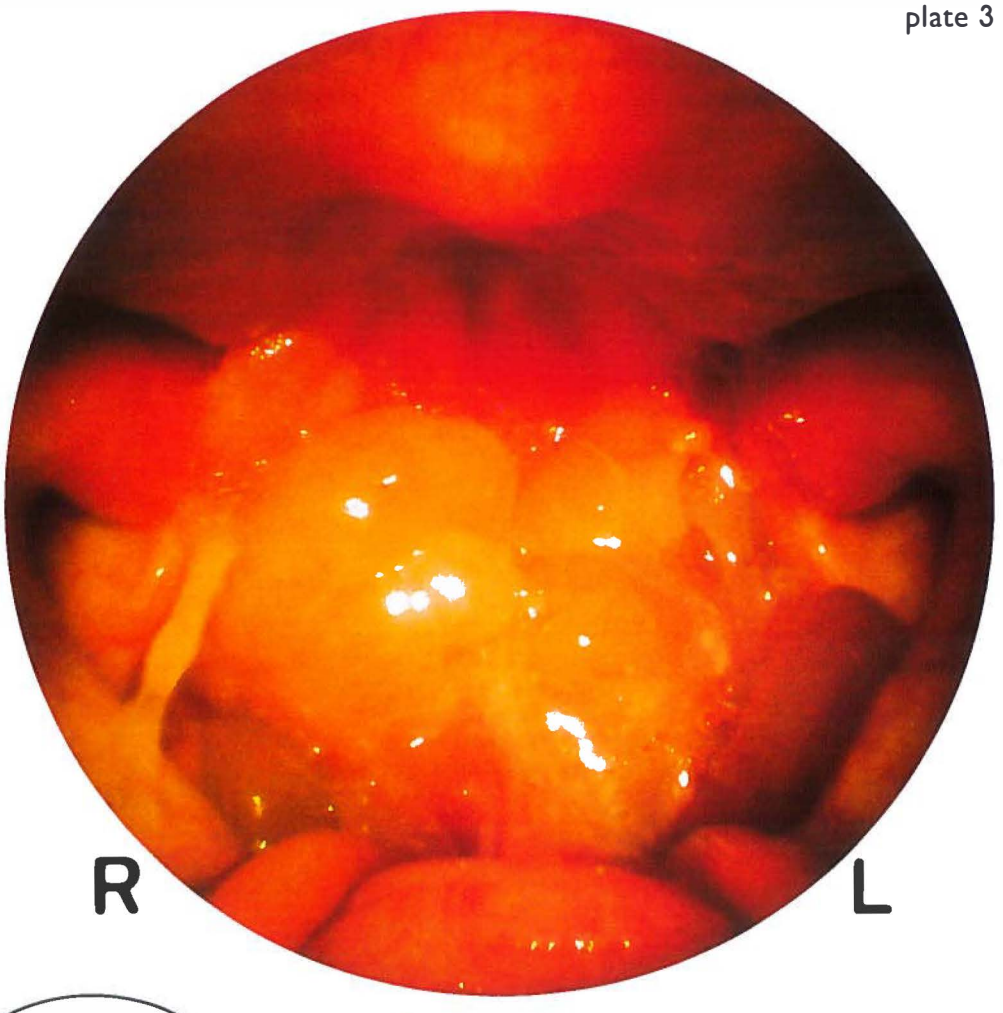
Nasopharyngoscopy: normal anatomy

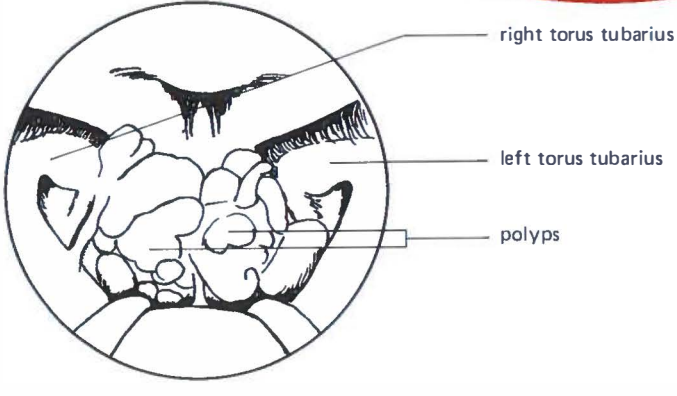
Patient H.D.-K., female, aged 62, complaining of a stuffed-up nose for the last 6 weeks, had an epistaxis several times when blowing her nose. An allergic rhinopathy was suggested by the anamnesis. In the nose no cause for the epistaxis could be found. There were no signs of disease in the nasopharynx either. There was no recurrence of nose bleeding.



Nasopharyngoscopy: septal deviation to the left

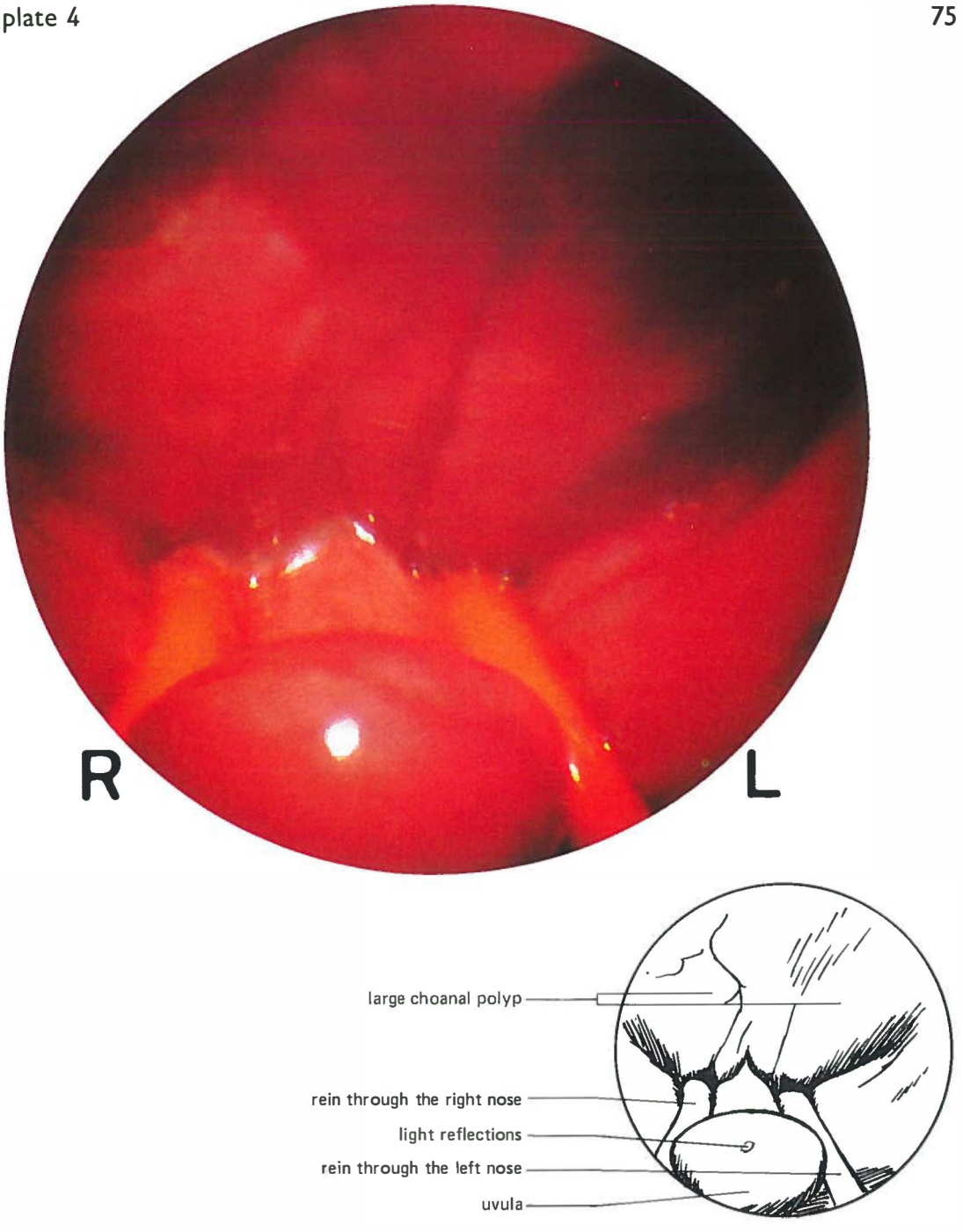
Patient J.K., male, aged 51, was admitted into the clinic for internal diseases in connection with periods of fever of unknown origin for the last two years. There were no signs of disease in the nasopharynx, although in the left nasal cavity a septal deviation to the left – already known – could be seen. A seronegative rheumatoid arthritis was established later.





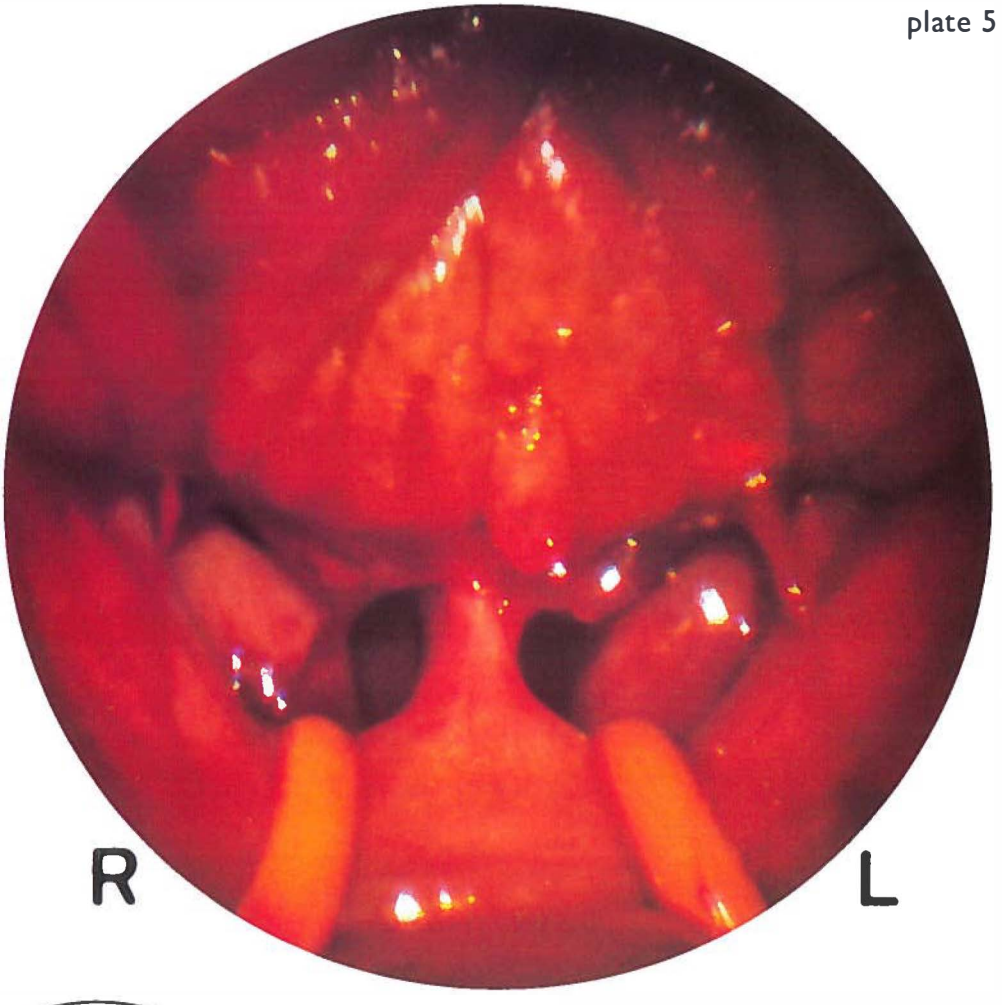
Nasopharyngoscopy: bilateral choanal polyps

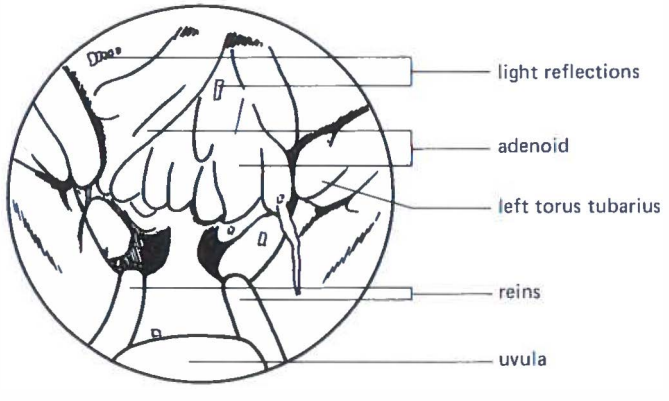
Patient A.G.-K., female, aged 67, complaining of complete nasal obstruction. In the past she had had nasal polyps removed many times already. This time the polyps appeared to extend as far as the nasopharynx. Histological examination showed a marked eosinophilia in the stroma of the polyps.



Nasopharyngoscopy: large choanal polyp

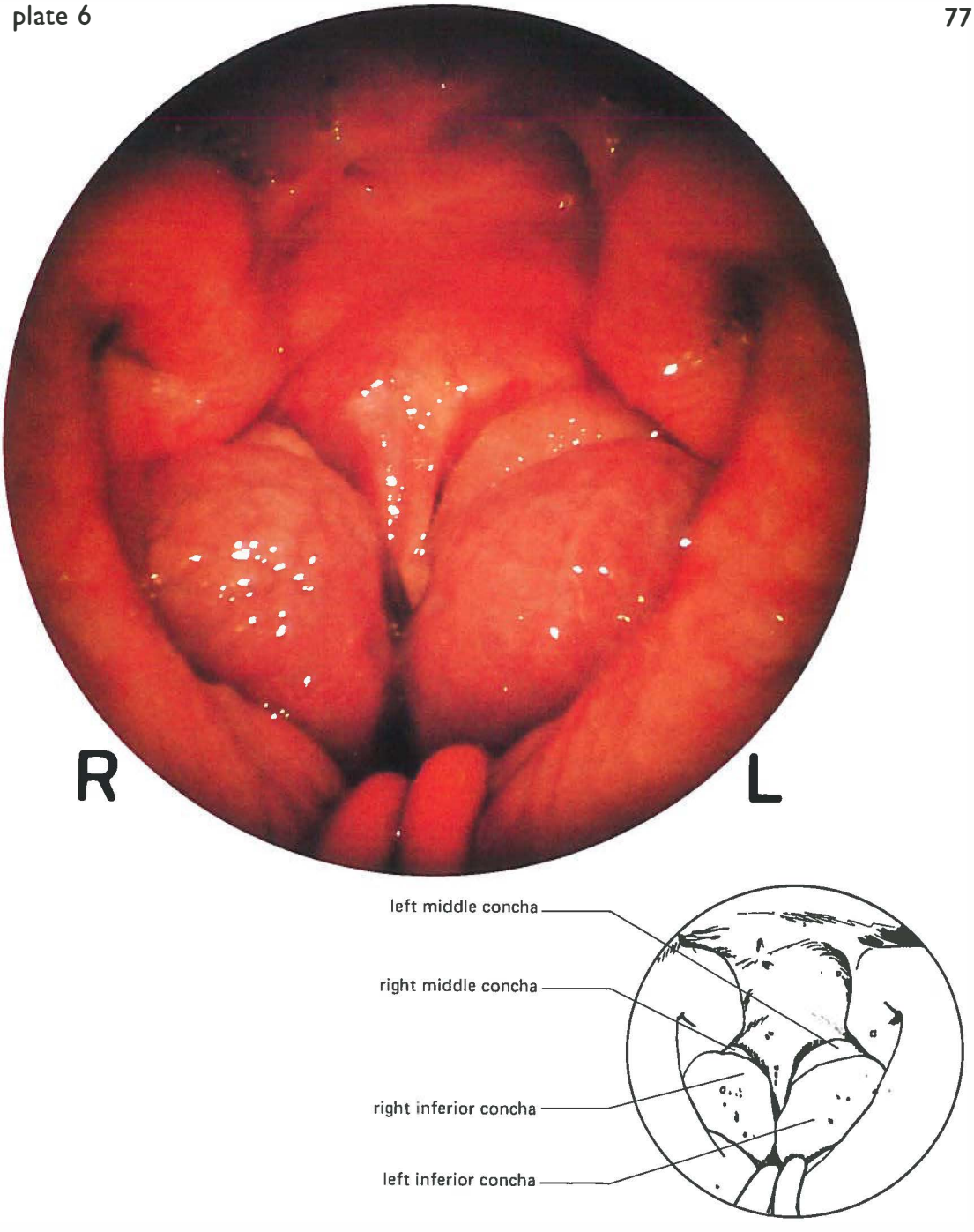
Patient H.M., boy, aged 8. At school his nasal speech had been noticed. Breathing through the nose was impossible. In this case the reins are also an aid to orientation. Here the choanal polyp lies against the roof and the posterial wall of the nasopharynx. The uvula is distorted – i.e. too large – because of the short distance to the endoscope.





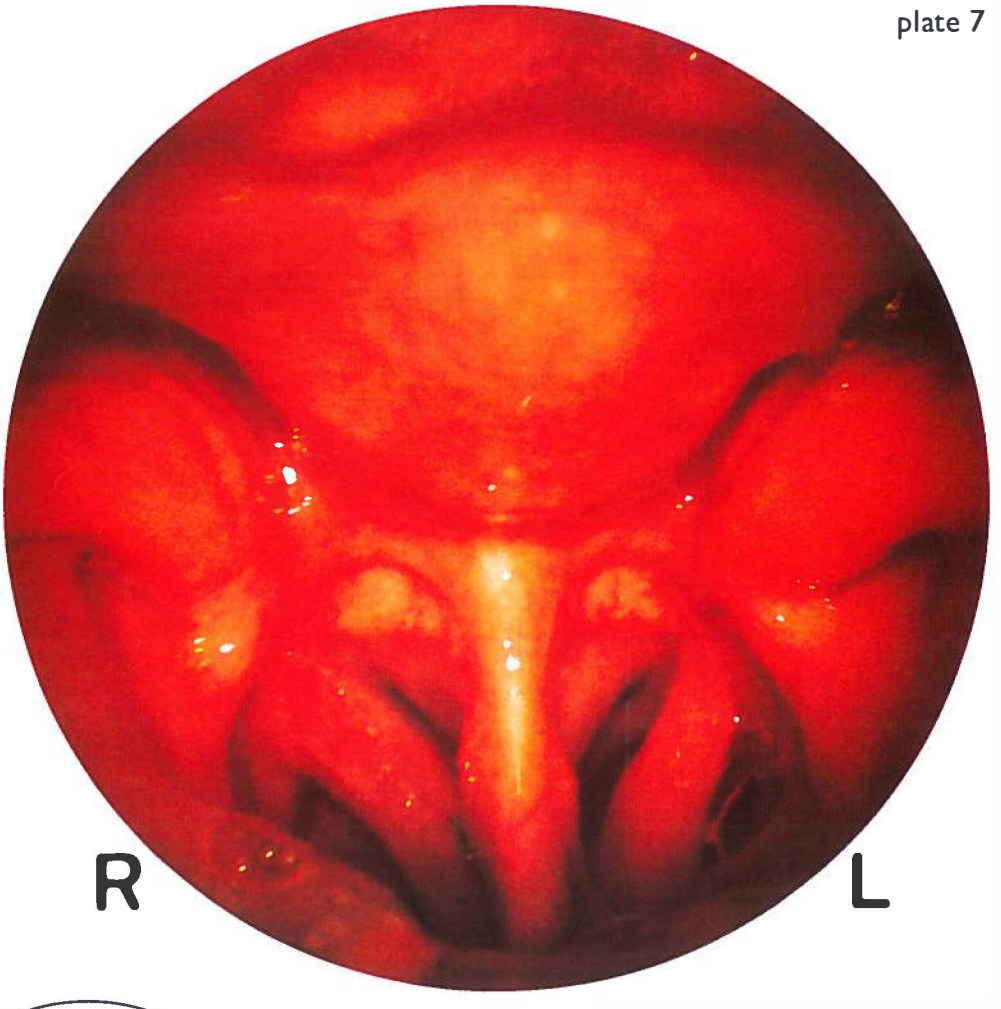
Nasopharyngoscopy: adenoid hypertrophy

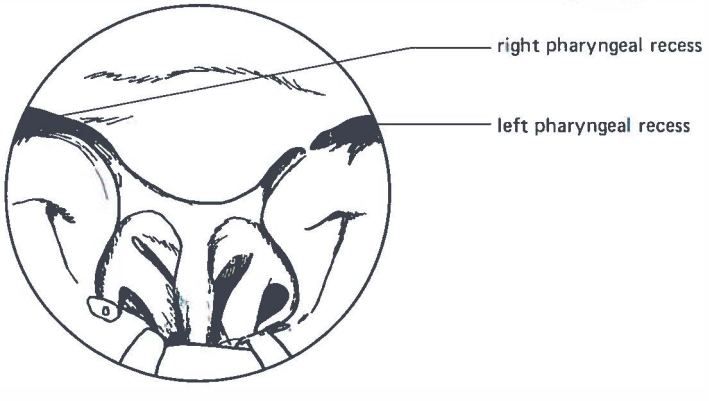
Patient H.M., boy, aged 8, same patient as on plate 4. After the removal of the choanal polyp, there appeared to be an enlarged adenoid. Only after adenotomy had been carried out a permanent good nose-breathing was obtained.



Nasopharyngoscopy: marked hypertrophy of the conchae

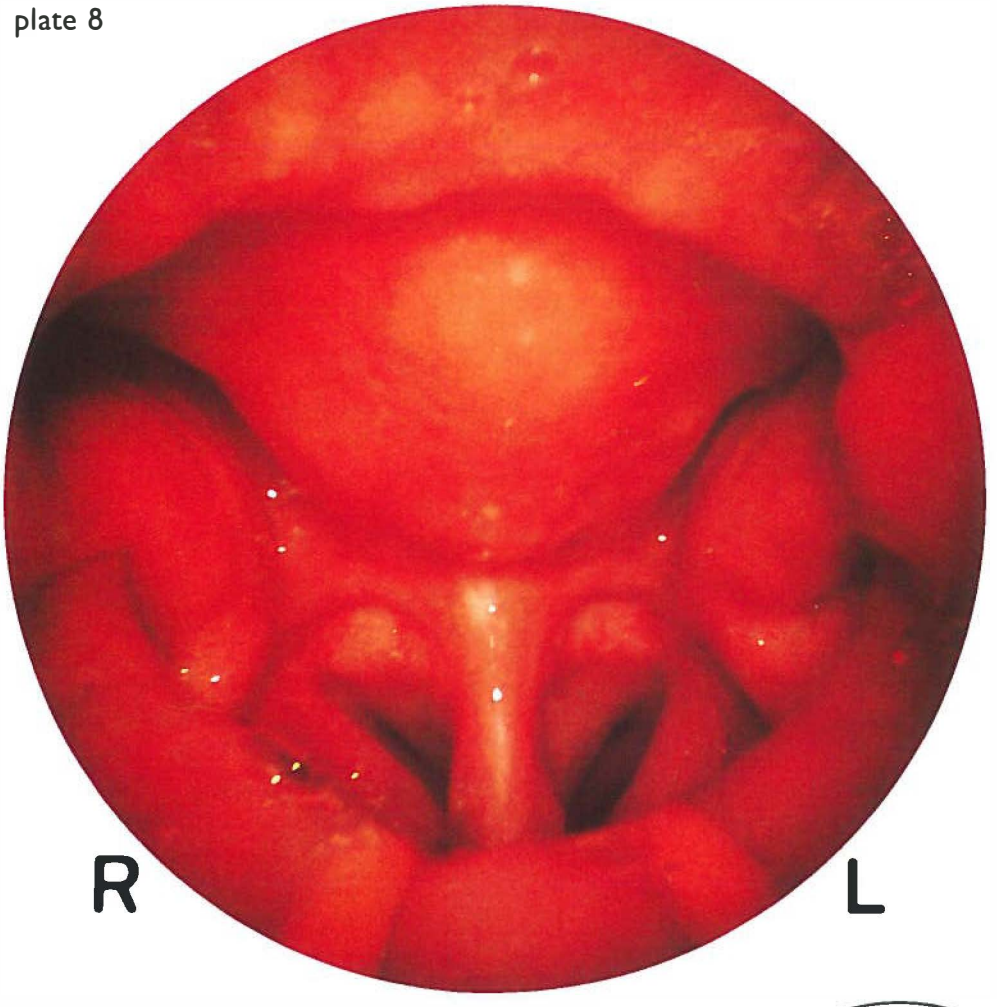
Patient H.L., male, aged 26. It was known that he had a distinct hypersensitivity to house dust, hairs and feathers, and moulds, and a chronic bilateral otitis media. No explanation for the nasal obstruction could be found with anterior rhinoscopy. The choanae appeared to be almost completely blocked by strongly hypertrophic posterior extremities of the conchae.

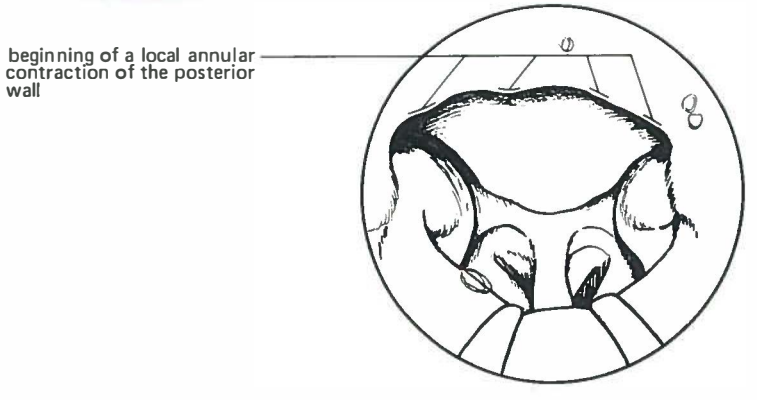




Nasopharyngoscopy (I): normal anatomy

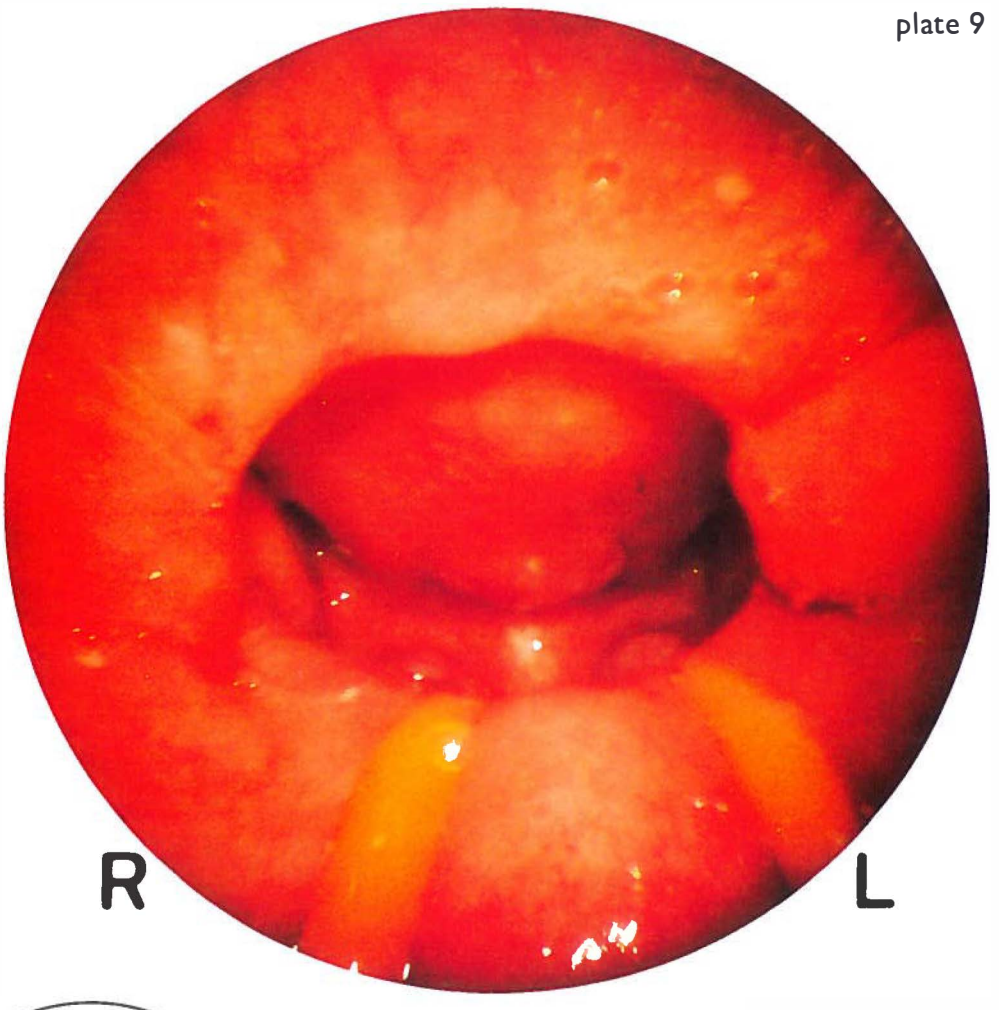
Patient M.K.P.-R., female, aged 34, complaining of impaired hearing and a full feeling in the left ear. Examination showed a conductive hearing loss and a malfunction of the left auditory tube. Nasopharyngoscopy did not explain why the complaints were unilateral. With a single puncture of the eardrum the complaints were suppressed permanently.

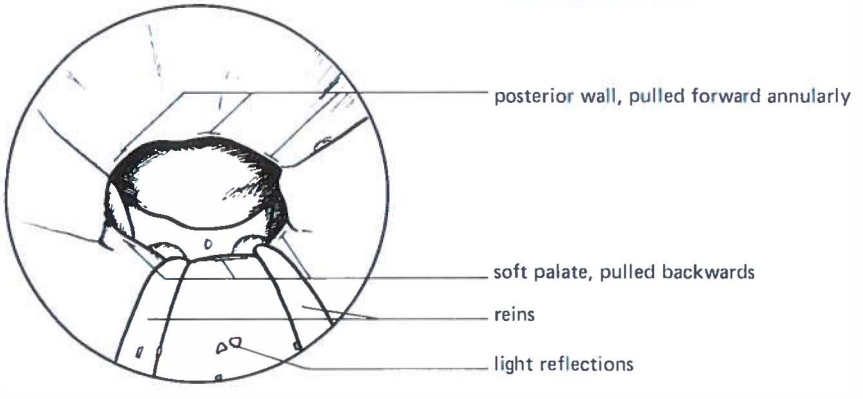




Nasopharyngoscopy (II): beginning of a retching reflex

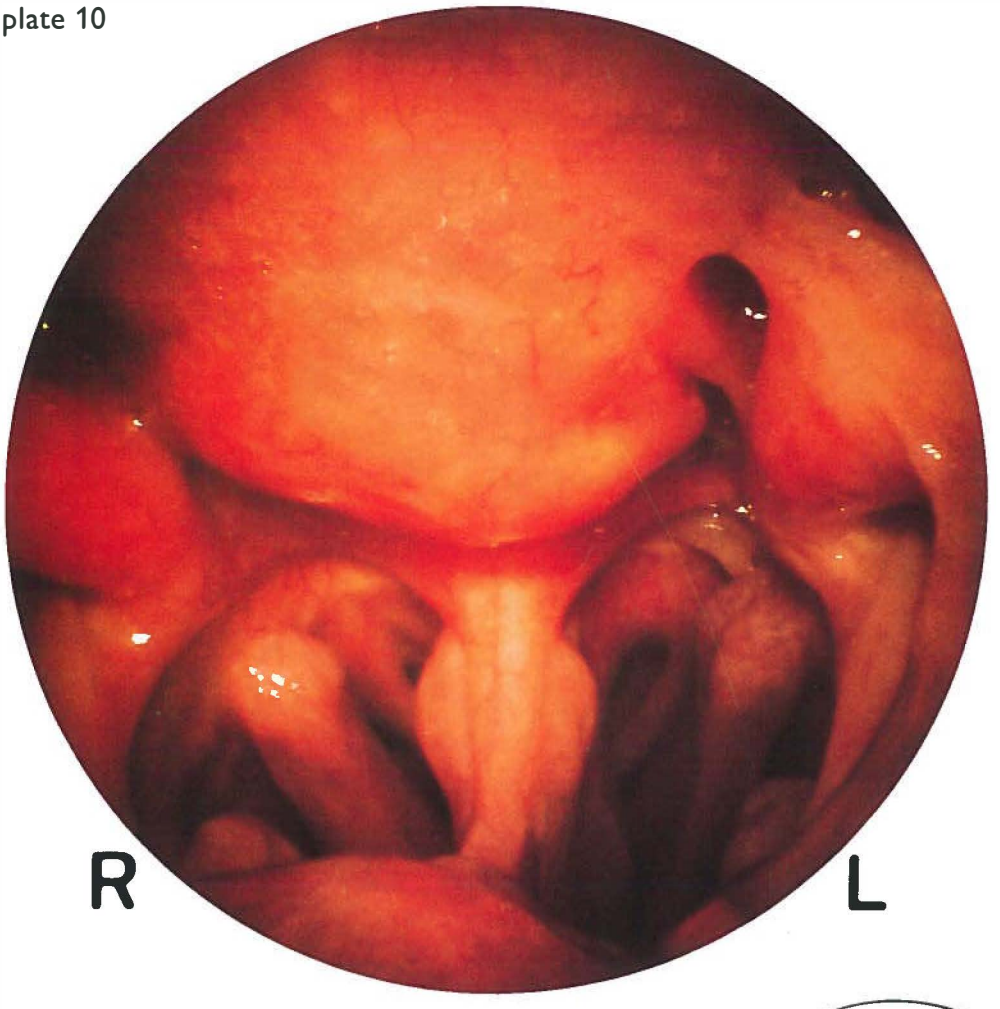
Patient M.K.P.-R., female, aged 34, same patient as on plate 7. After the local anaesthesia had partly disappeared, a retching reflex could be evoked again: the posterior wall (and the sides) of the nasopharynx are brought forward locally by the contraction of the superior constrictor pharyngis muscle. The movements of the soft palate are inhibited by the elastic rubber reins.

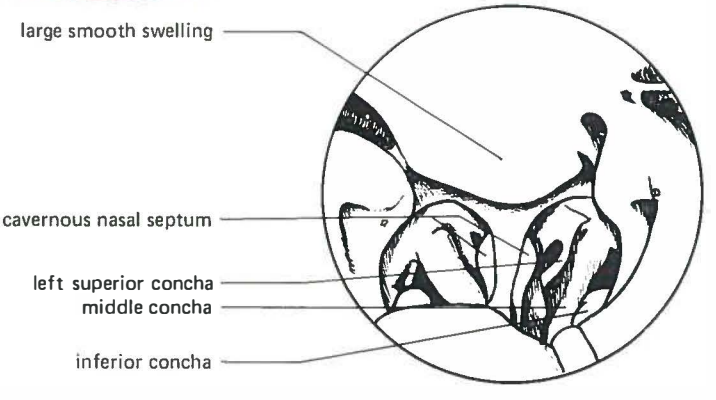




Nasopharyngoscopy (III): Passavont's ridge completed

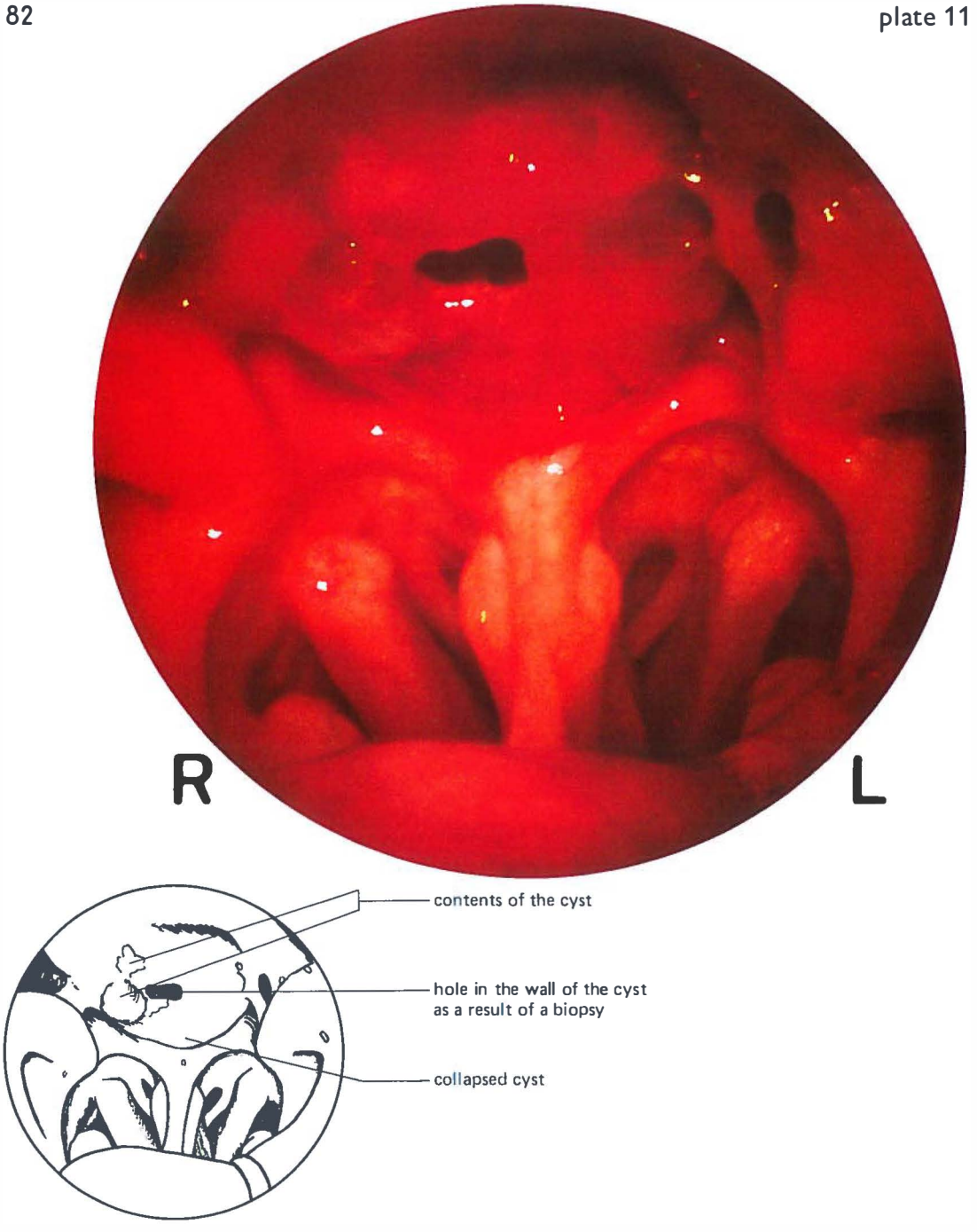
Patient M.K.P.-R., female, aged 34, same patient as on plates 7 and 8. Here the retching reflex is at its height. If the tensor and levator veli palatini muscles had not been inhibited by the reins, the soft palate would have been pulled against the annular ridge on the posterior pharyngeal wall. Without the reins the nasopharynx would have been cut off from the oropharynx completely.





Nasopharyngoscopy (I): swelling against the roof

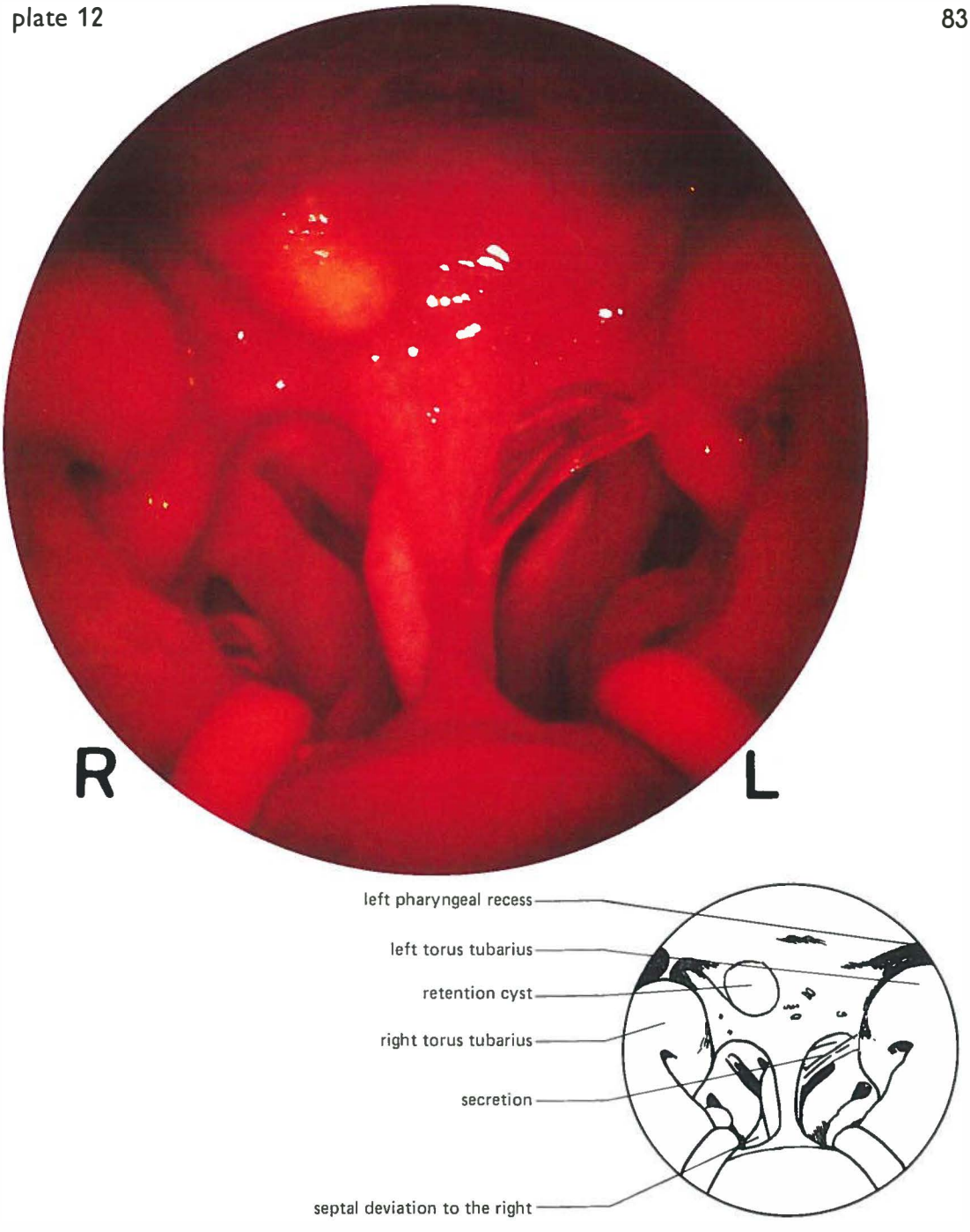
Patient S.d.J., male, aged 46, known to have undergone surgical treatment for a basal cell carcinoma in the left nasal vestibule, complained of a slight feeling of having a lump in his throat. No signs of disease were found in the oro- and hypopharynx. Against the roof of the nasopharynx there was a large smooth swelling.



Nasopharyngoscopy (II): opened cyst

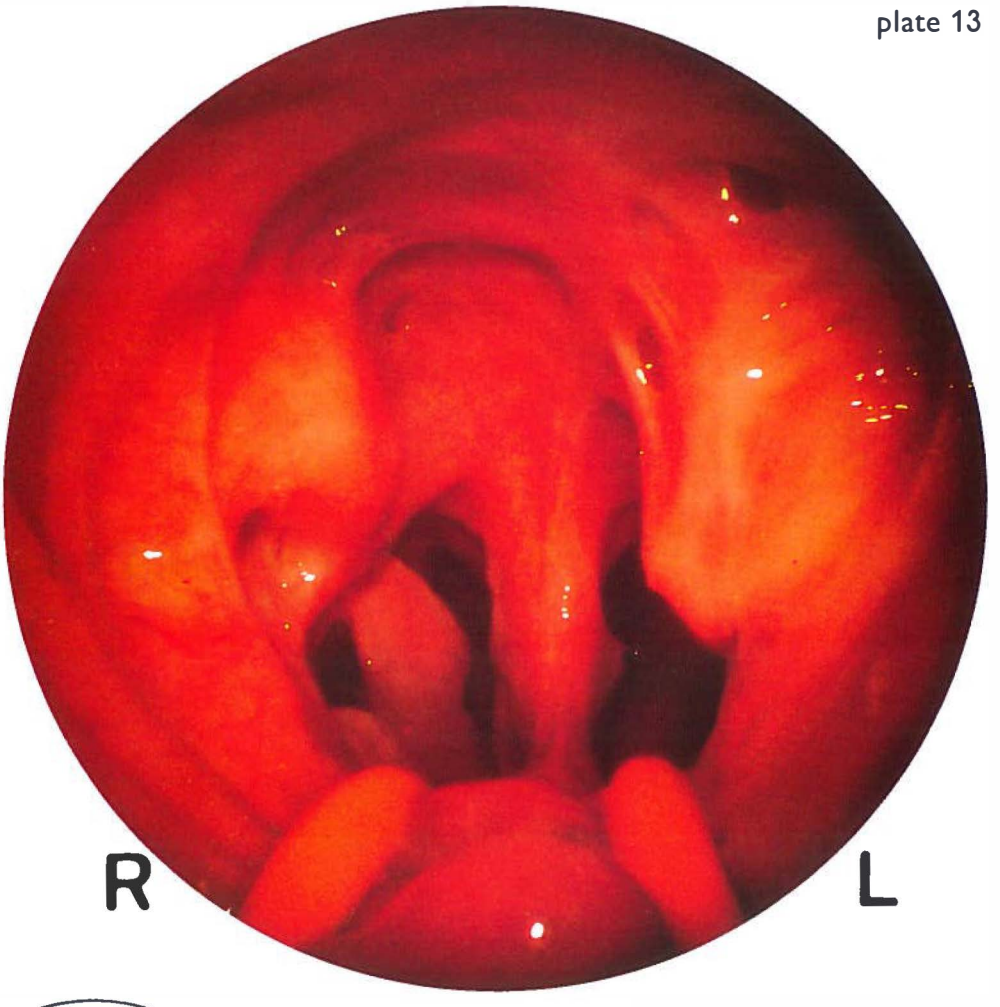
Patient S.d.J., male, aged 46, same patient as on plate 10. After taking a biopsy from the smooth swelling against the roof of the nasopharynx, it turned out to be a cyst.

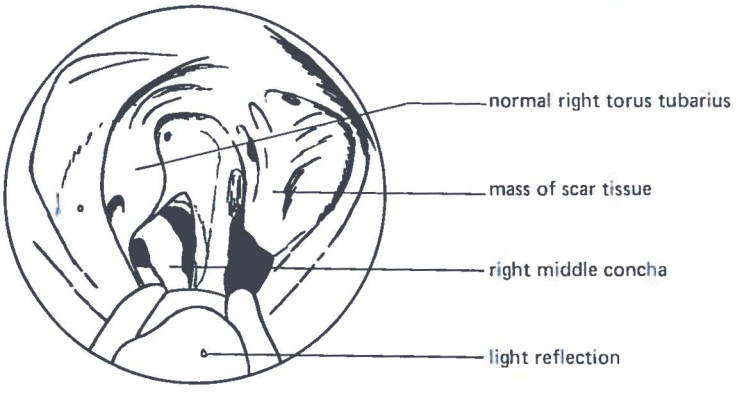
The contents of the cyst flowed away and the cyst collapsed. By way of therapy a major part of the wall of the cyst was taken away. There was no recurrence of the cyst, the feeling of having a lump in the throat disappeared.



Nasopharyngoscopy: retention cyst

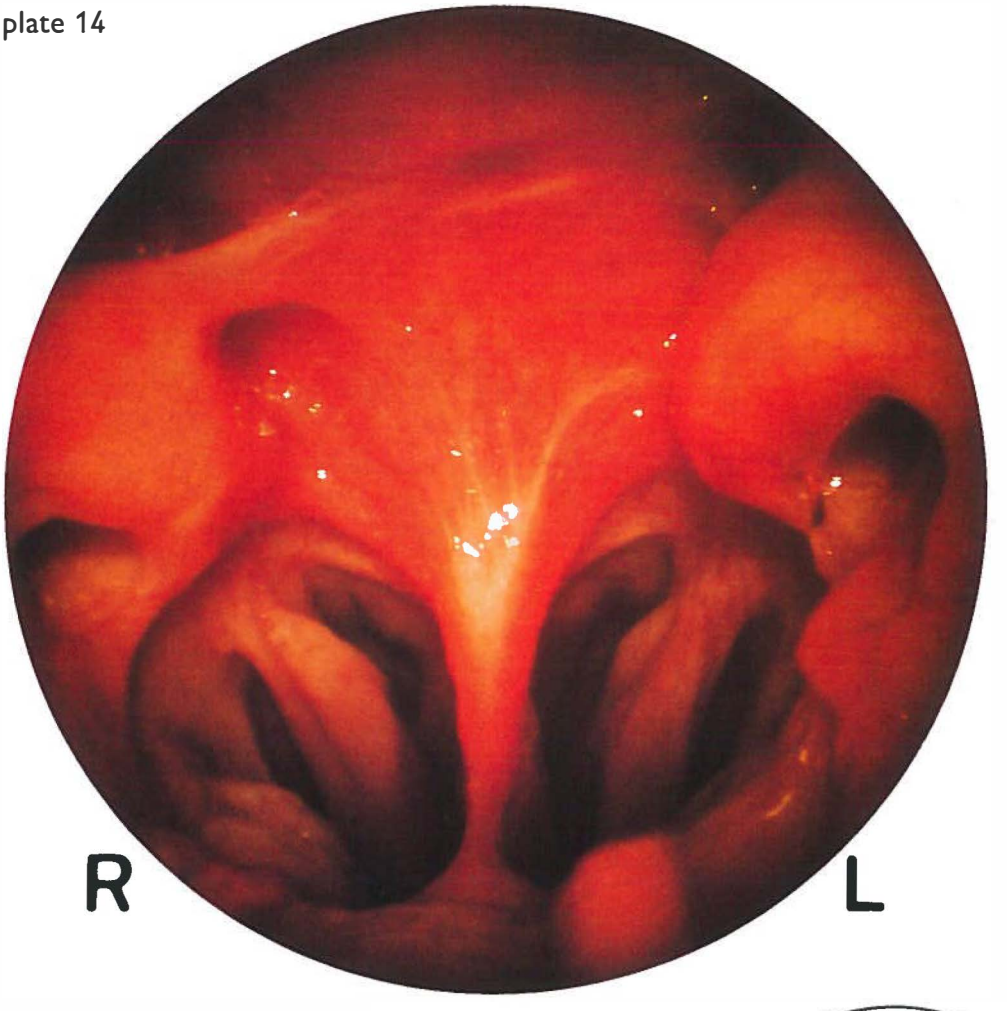
Patient C.A.W.-D., female, aged 60, came to the outpatients' department in connection with a frontal sinusitis on the right side, which was cured by conservative therapy. A small retention cyst against the roof of the nasopharynx, which did not require therapy, was accidentally found.

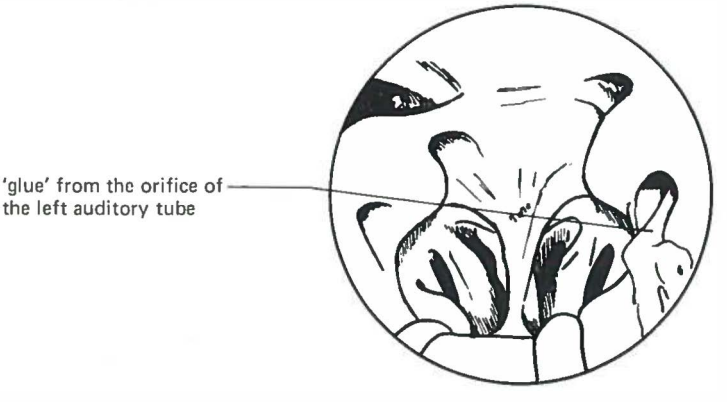




Nasopharyngoscopy: scarred tubal area

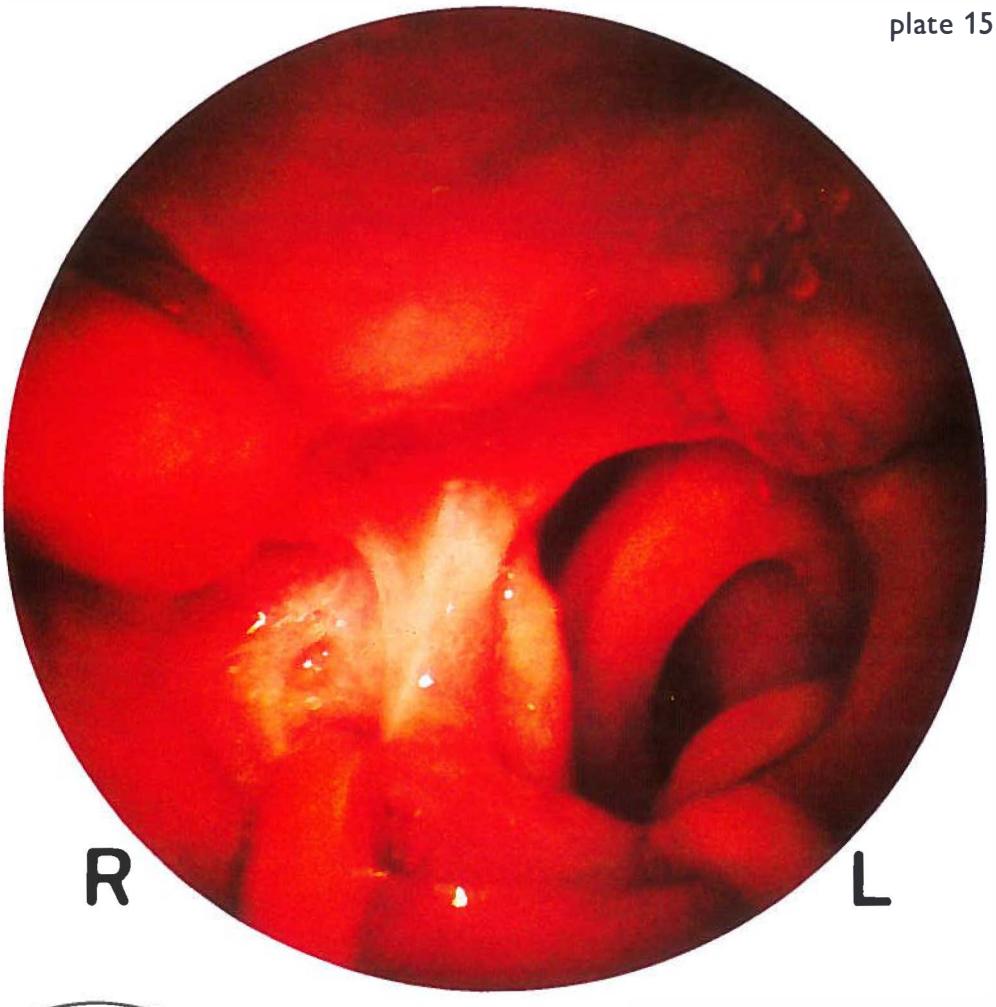
Patient J.S., male, aged 27, consulted the out-patients' department in connection with a chronic suppurative otitis media on the left side, for which he had undergone an operation twice (last time a modified radical). There was a conductive hearing loss of 60 dB. in the left ear, hearing was normal on the right side. Where the left torus tubarius is normally situated, there was a mass of scarry tissue. The left auditory tube was obstructed. At the age of 14 the patient had had an abscess in the left side of his throat.

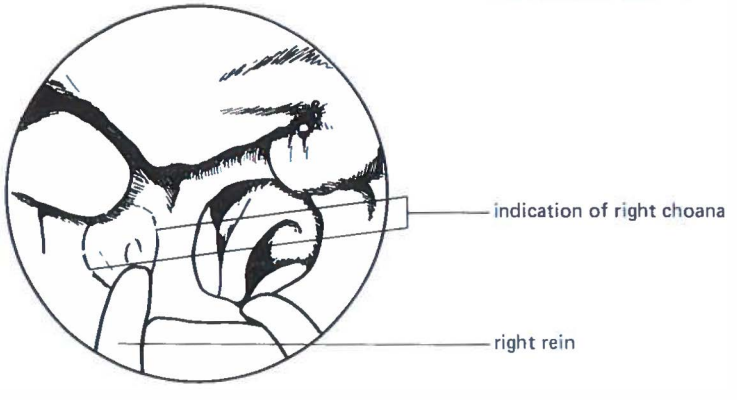




Nasopharyngoscopy: thick secretion from the left auditory tube

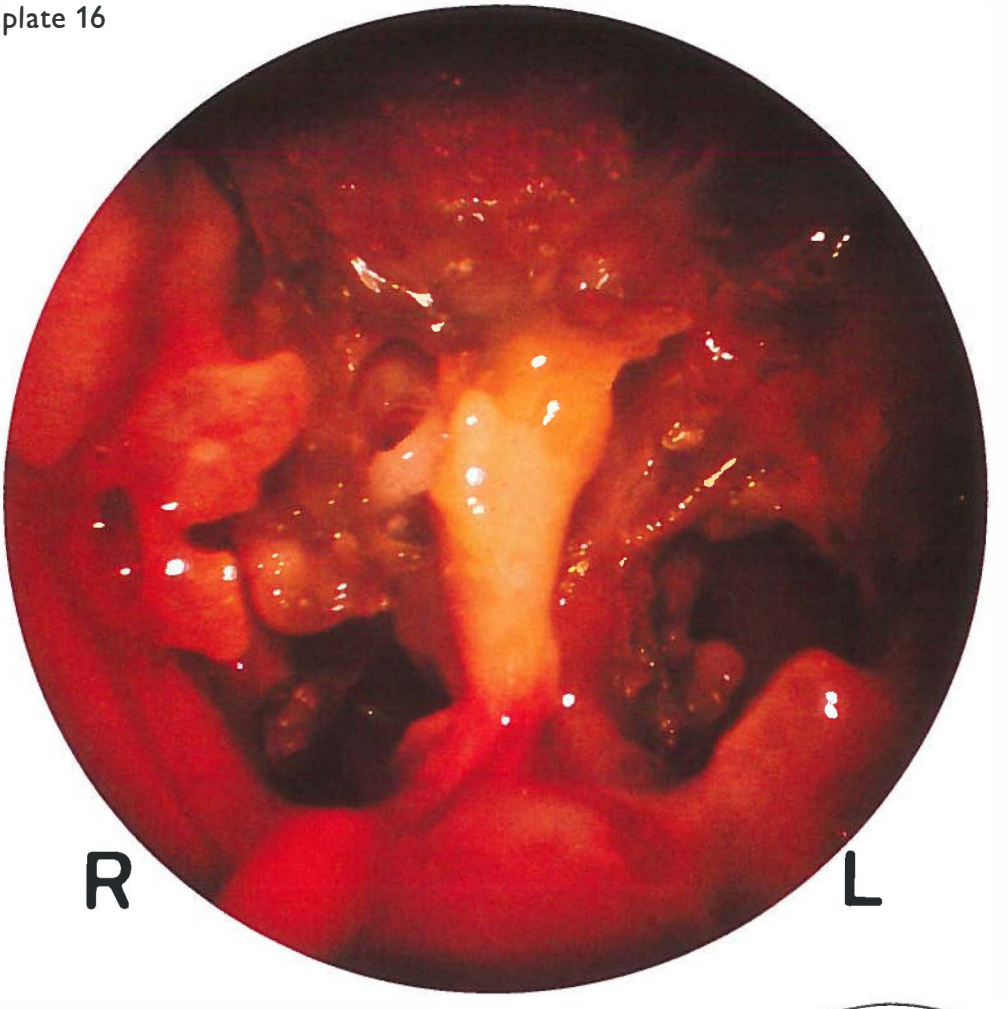
Patient E.K., female, aged 26, had a dry perforation in the right eardrum. On both sides there was a conductive hearing loss. Tubometry demonstrated a malfunction of the right auditory tube. Thick seromucoid secretion ('glue') was emitted by the left tubal orifice: serous otitis.

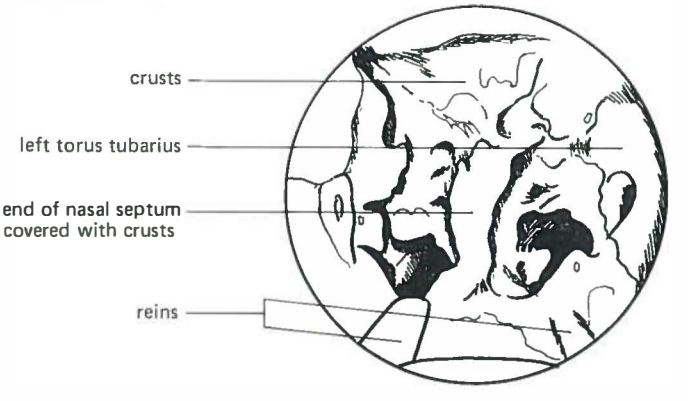




Nasopharyngoscopy: subtotal choanal atresia

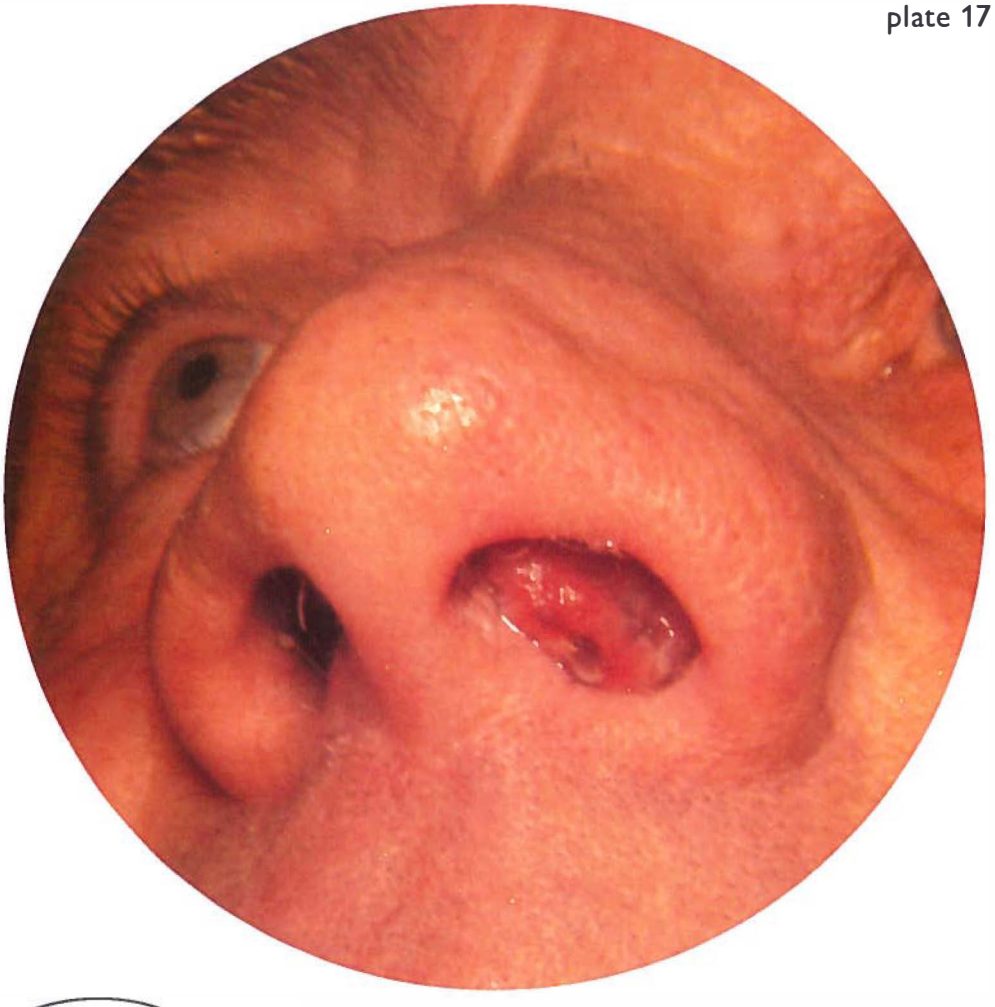
Patient H.B., female, aged 19, had from birth an almost incessant purulent rhinitis and a strongly impaired nose-breathing on the right side. This was caused by a subtotal unilateral choanal atresia: the rein could only just pass through. The left choana is extra wide.





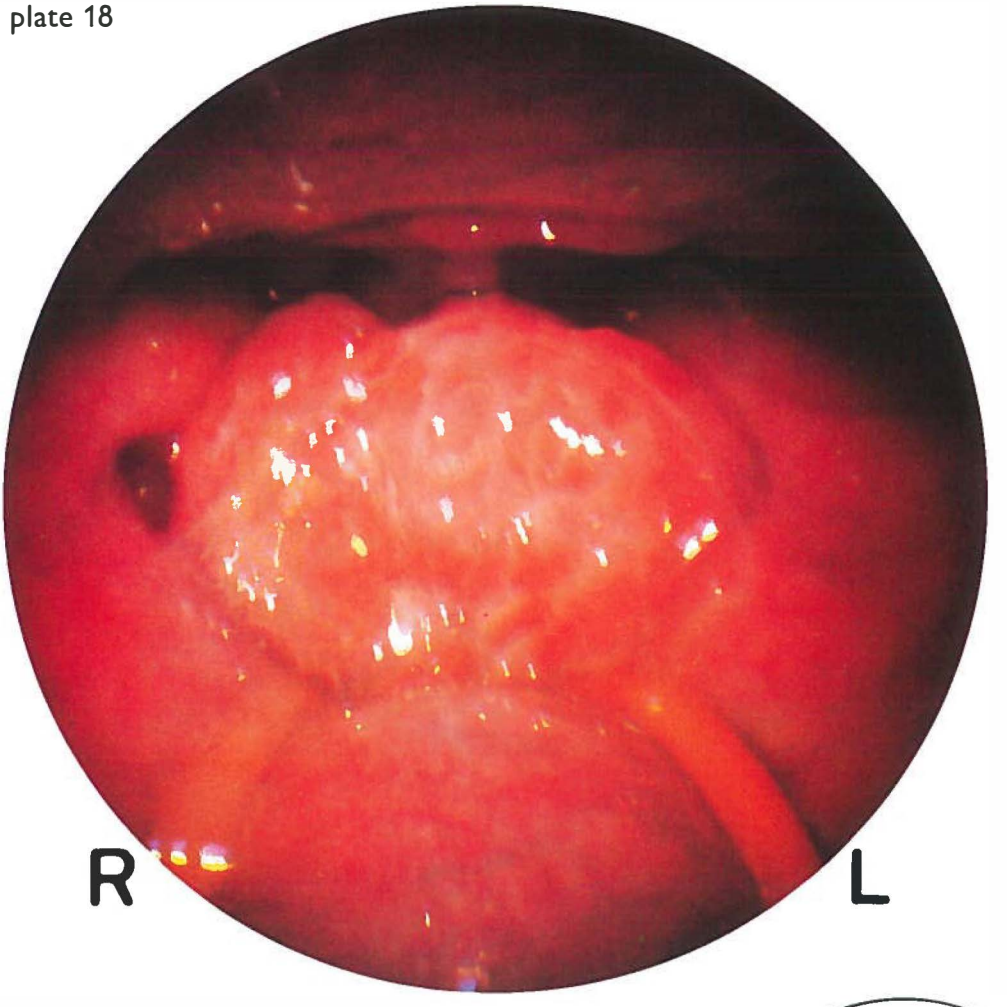
Nasopharyngoscopy: ozena

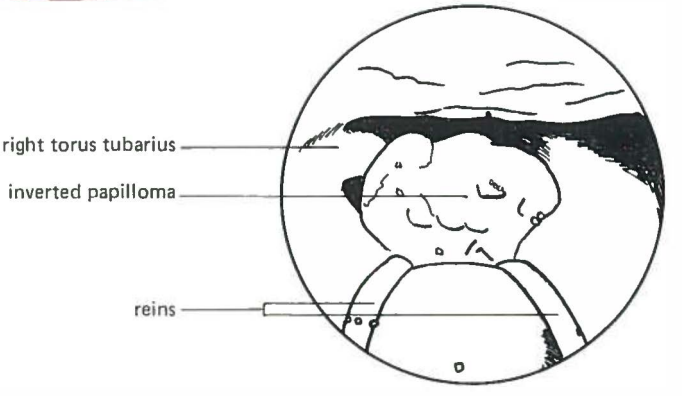
Patient H.V.-R., female, aged 57, with a foul smell from the nose. The nasopharynx is almost completely covered with crusts (dried-up secretions). The atrophic nasal mucosa is highly vulnerable. The complaints of the foul smell arose after a bilateral Caldwell–Luc operation.



inverted papilloma

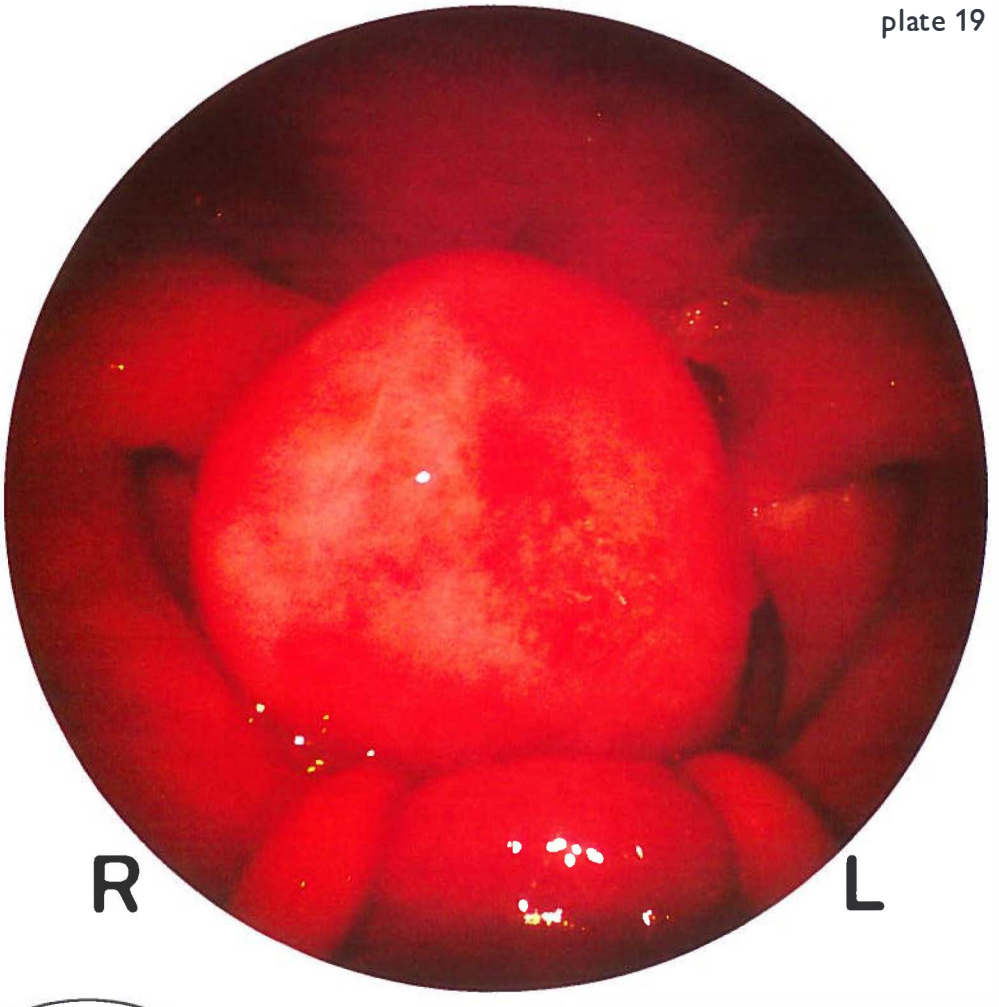
Patient A.d.B., male, aged 60, could not breathe through the left side of his nose during the last few months. The last few weeks the nose appeared to become thicker on the left side. A biopsy was taken from the irregular mass of soft tissue in the left nasal vestibule: inverted papilloma.

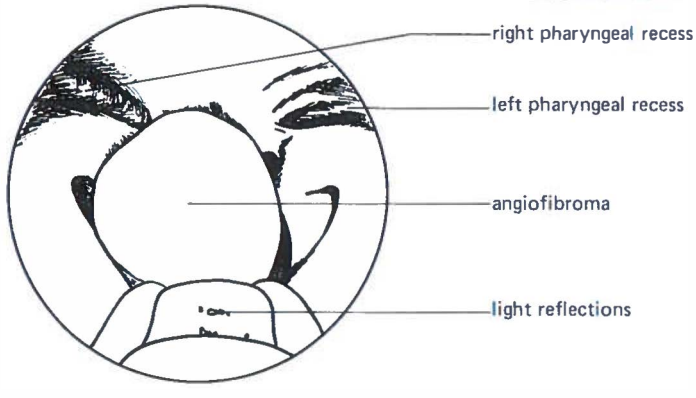




Nasopharyngoscopy: inverted papilloma

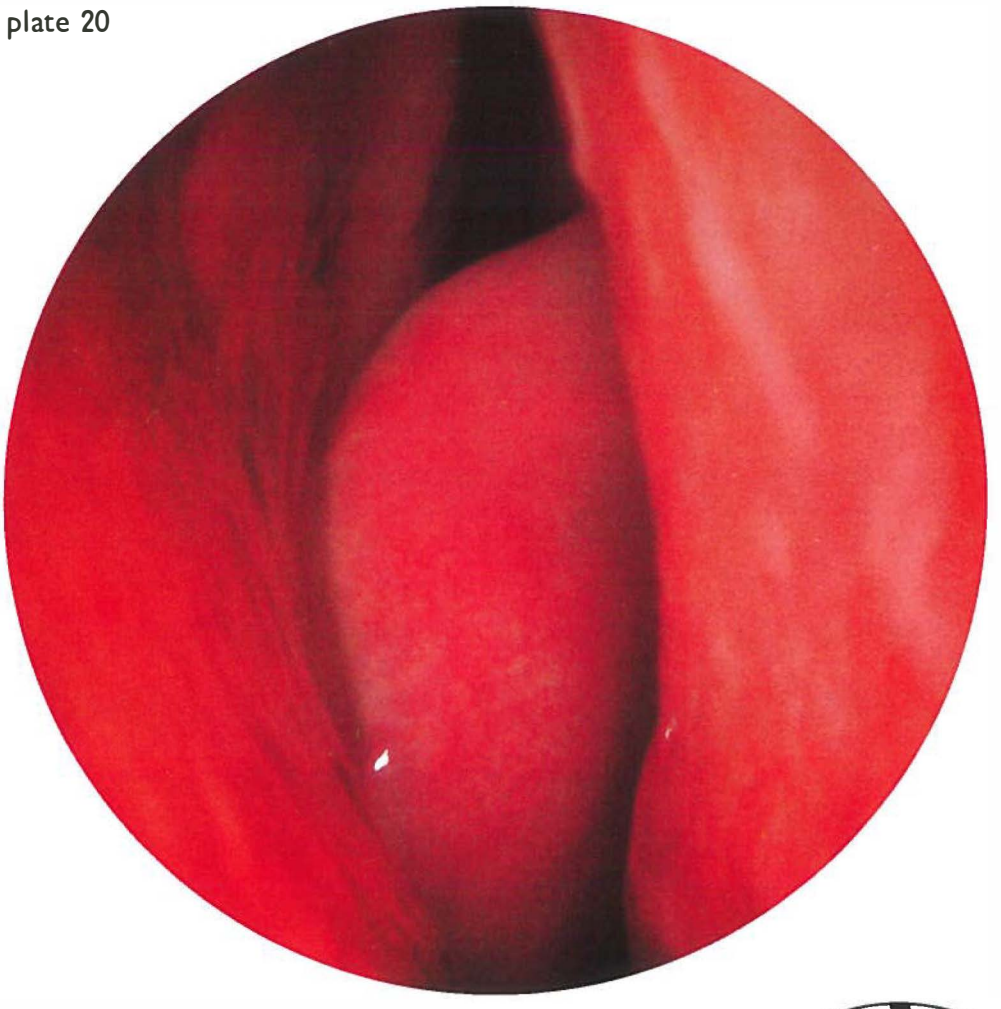
Patient A.d.B., male, aged 60, same patient as on plate 17. Nasopharyngoscopy showed that the inverted papilloma had extended into the nasopharynx. This extension proved pedicled, when the tumor was removed surgically.

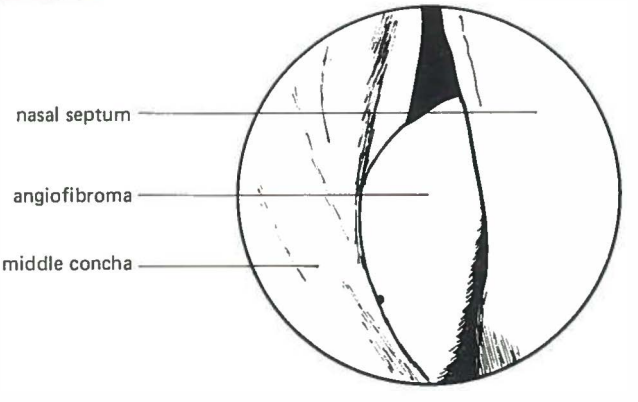




Nasopharyngoscopy: angiofibroma

Patient W.B., male, aged 20, had complained for more than two years of nasal obstruction, mainly on the right side. In the nasopharynx there was a smooth, round tumor. As an angiofibroma was suspected, no biopsy was taken. Carotis angiography showed that the tumor was very rich in blood vessels. After ligation of the right external carotid artery the tumor was removed transpalatinally. Histological examination: angiofibroma nasopharyngis.

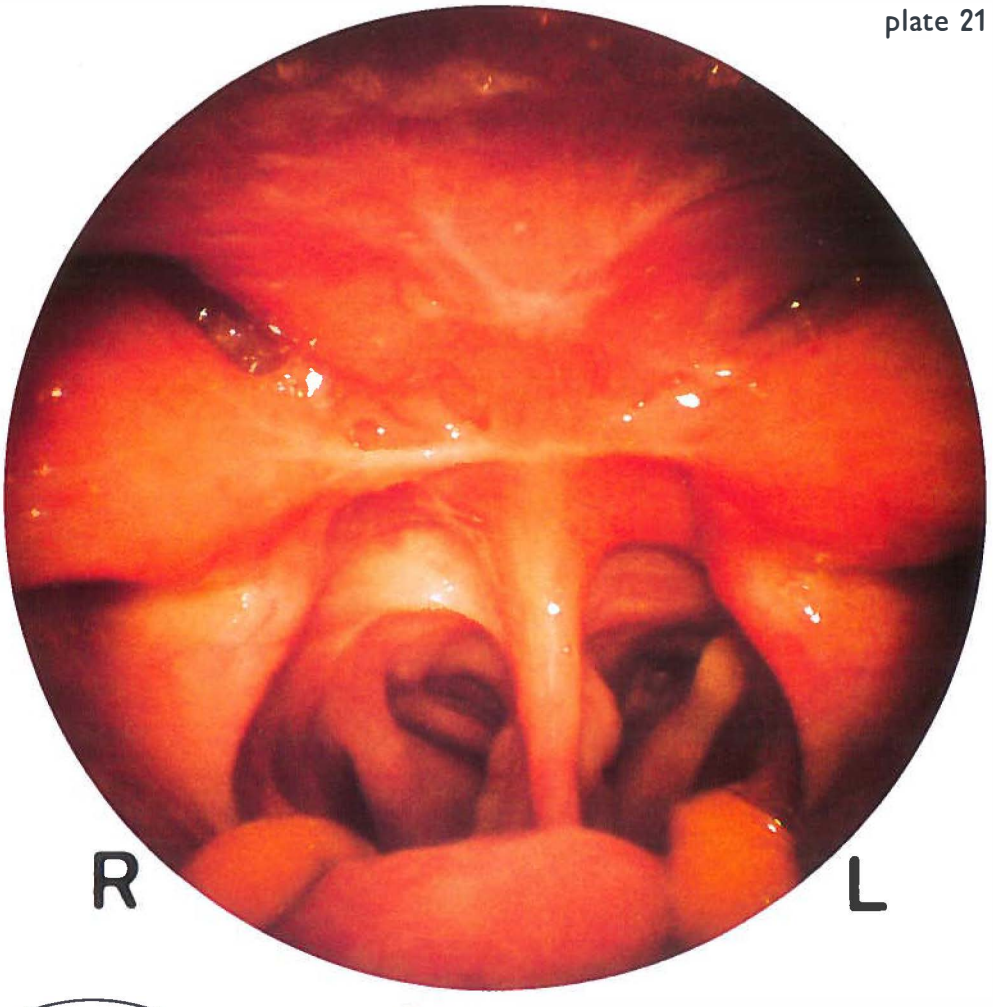


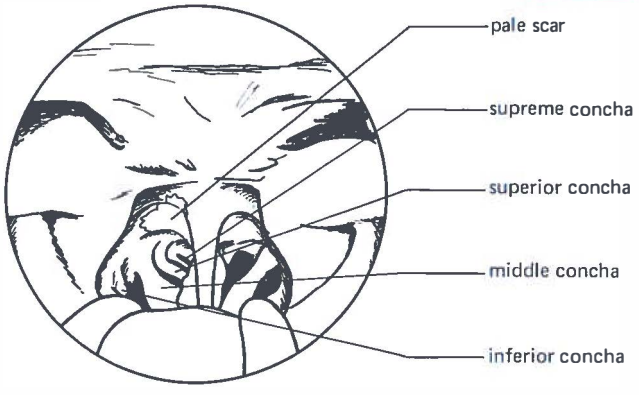


Right nasendoscopy: angiofibroma

Patient W.B., male, aged 19, same patient as on plate 19.

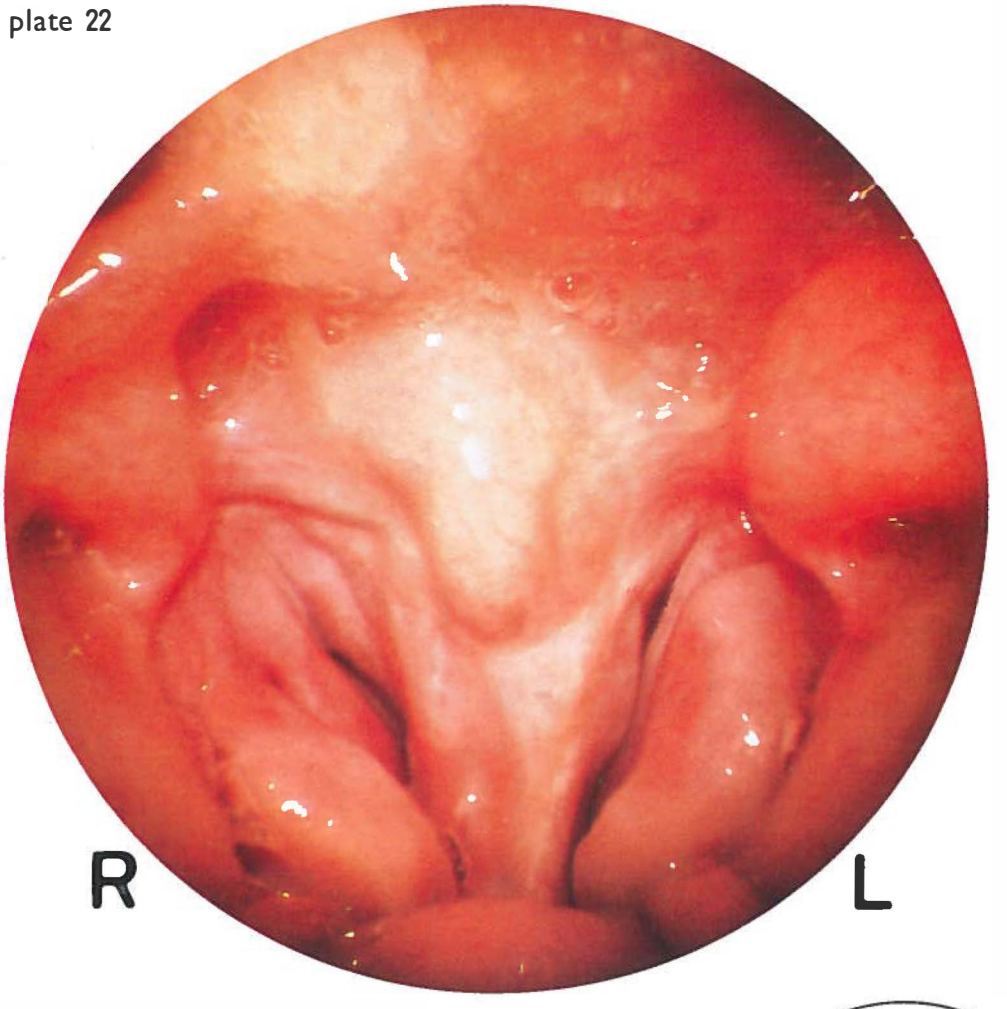
Nasendoscopy showed a pedicled extension of the angiofibroma into the right middle meatus.

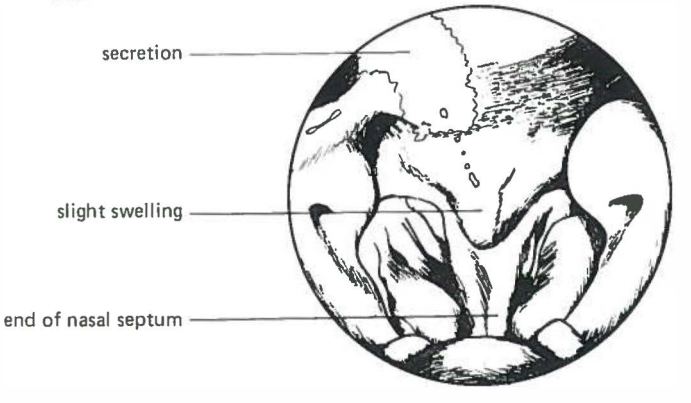




Nasopharyngoscopy: no recurrence of angiofibroma

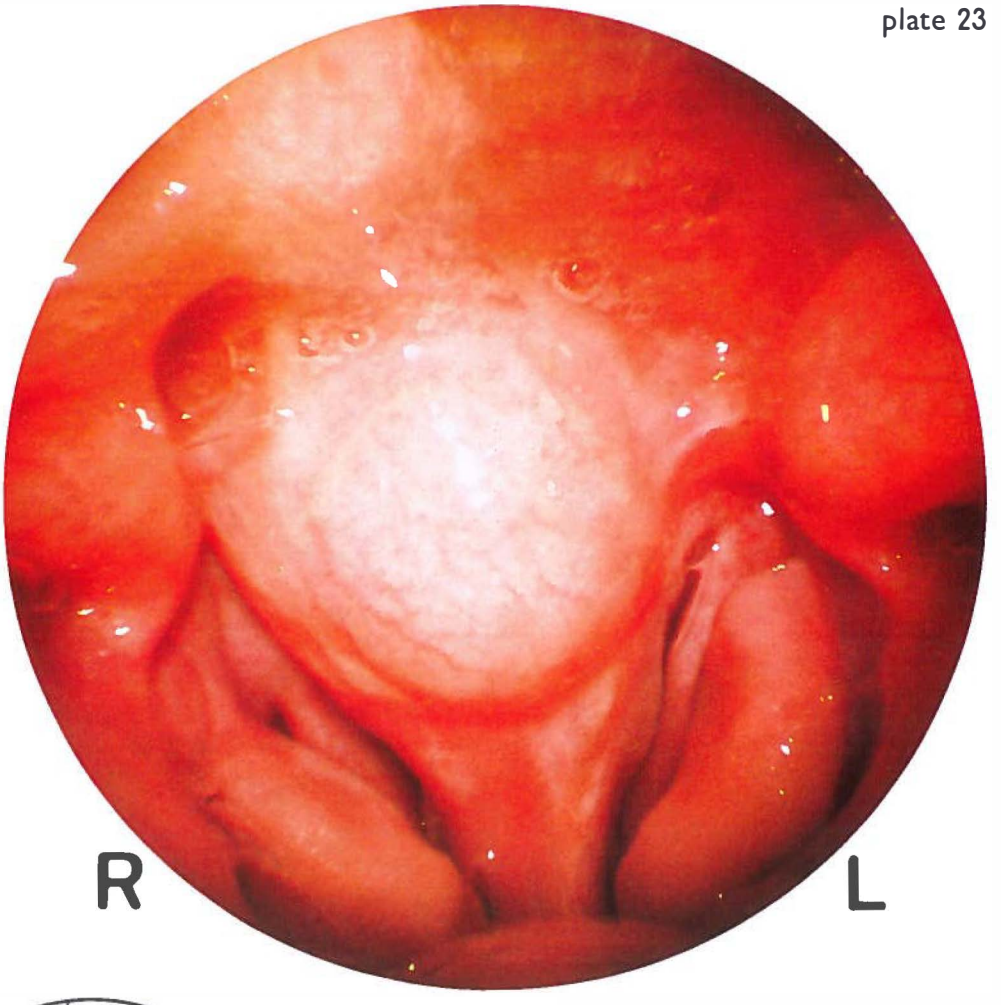
Patient W.B., male, now aged 22 (cf. plates 19 and 20). During a check-up, 20 months after the removal of the angiofibroma, no signs could be seen of a recurrence. On the place where the tumor had been attached there was now a pale scar. The patient appeared to have four conchae on the right side.

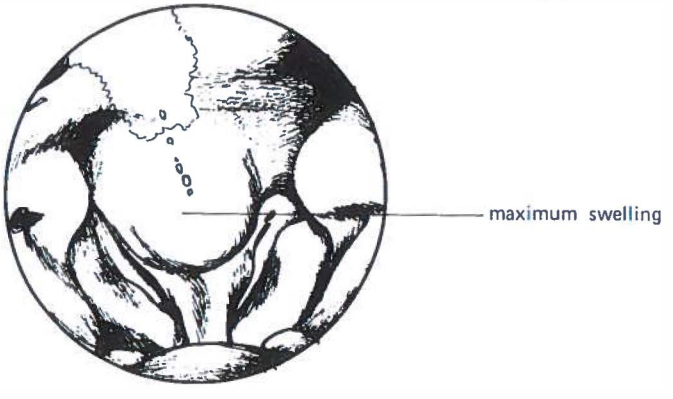




Nasopharyngoscopy: encephalocele (I)

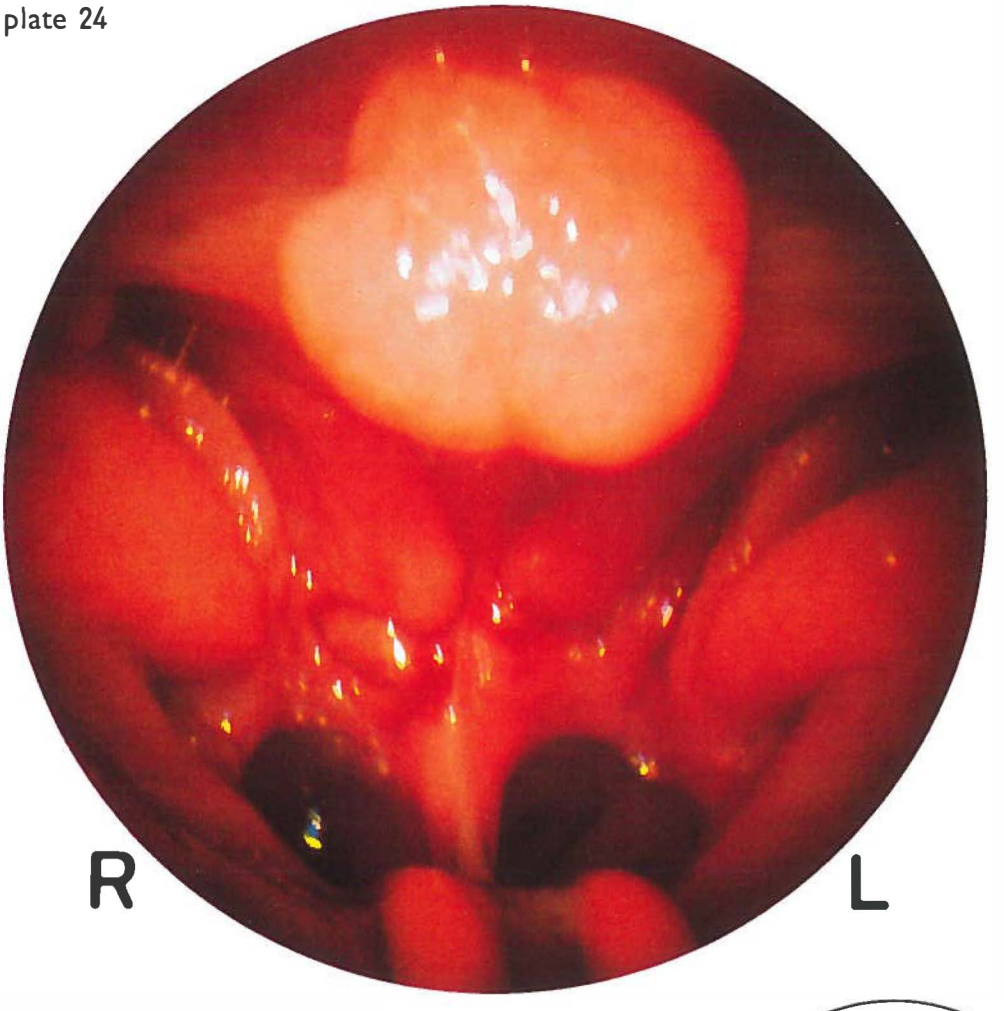
Patient A.T.R.H., female, aged 26, had been known already for a long time at the endocrinology department in connection with primary amenorrhea with Turner's syndrome (sex chromosomes XO), for which she was given a cyclic substitution in the form of diethylstilbestrol. An X-ray photograph of the skull (lateral view) demonstrated a soft tissue radiopacity against the roof of the nasopharynx. This appeared to be due to a pulsating swelling on the transition of the nasal septum to the roof of the nasopharynx. In Valsalva's test the swelling became clearly enlarged.

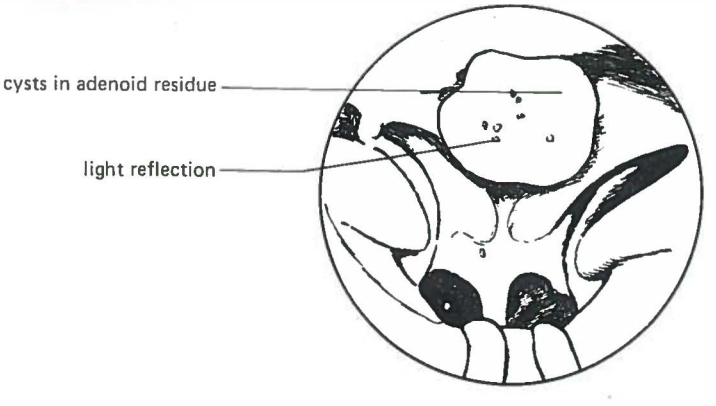




Nasopharyngoscopy: encephalocele (II)

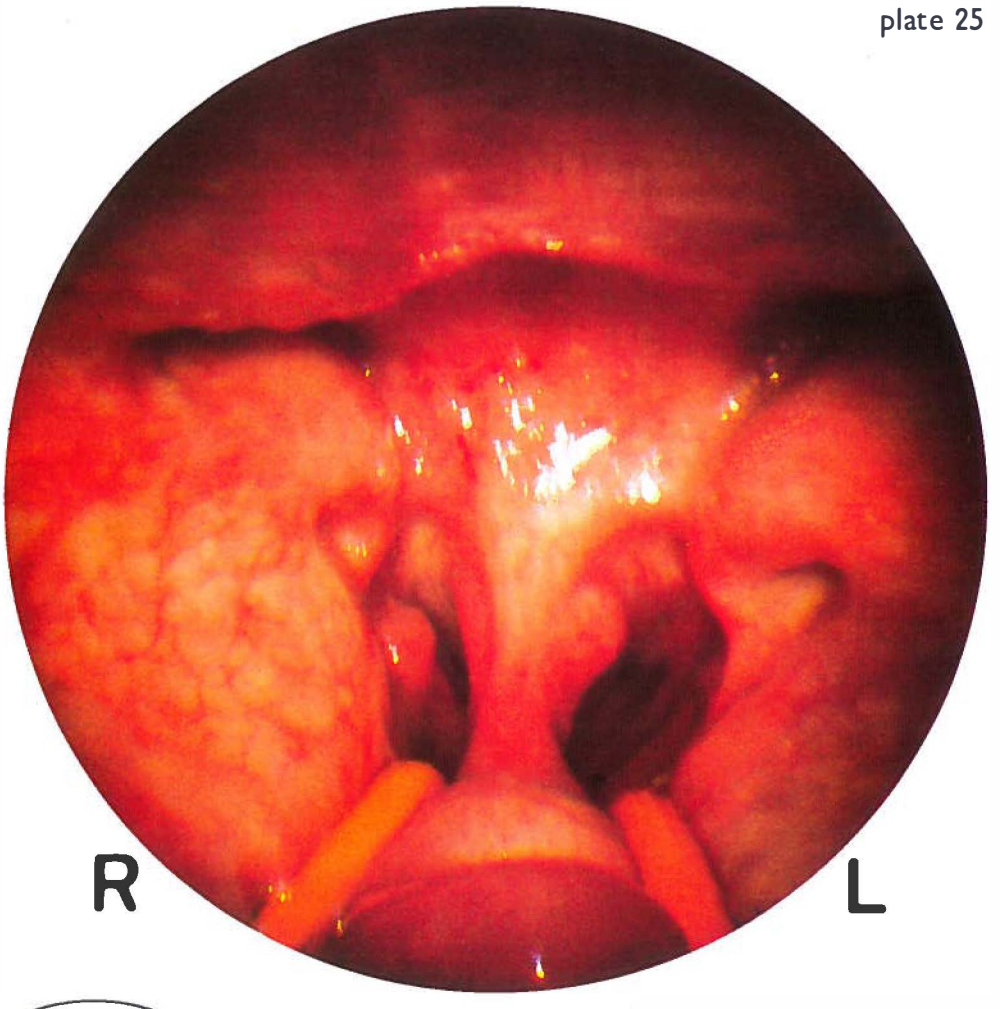
Patient A.T.R.H., female, aged 26, same patient as on plate 22. Tomography clearly demonstrated a defect in the base of the skull at the point where the soft tissue swelling was situated. In the area of the sphenoid sinus there further was a gap in the floor of the sella turcica. Extensive neuroradiological examination led to the diagnosis: 'encephalocele recessus chiasmatis' part of a defective closure of the skull.

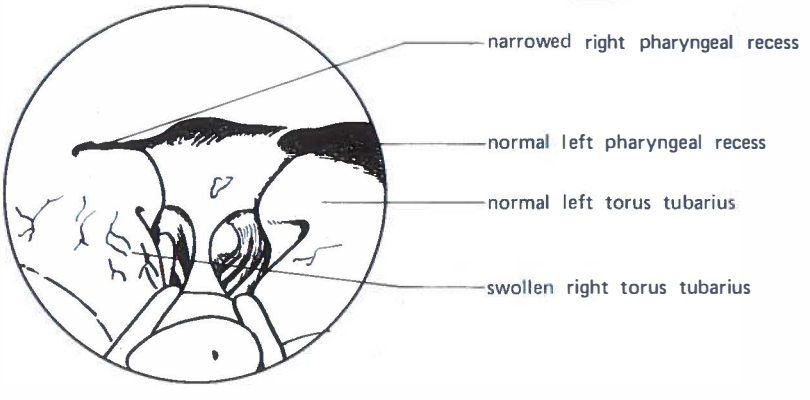




Nasopharyngoscopy: cysts in adenoid residue

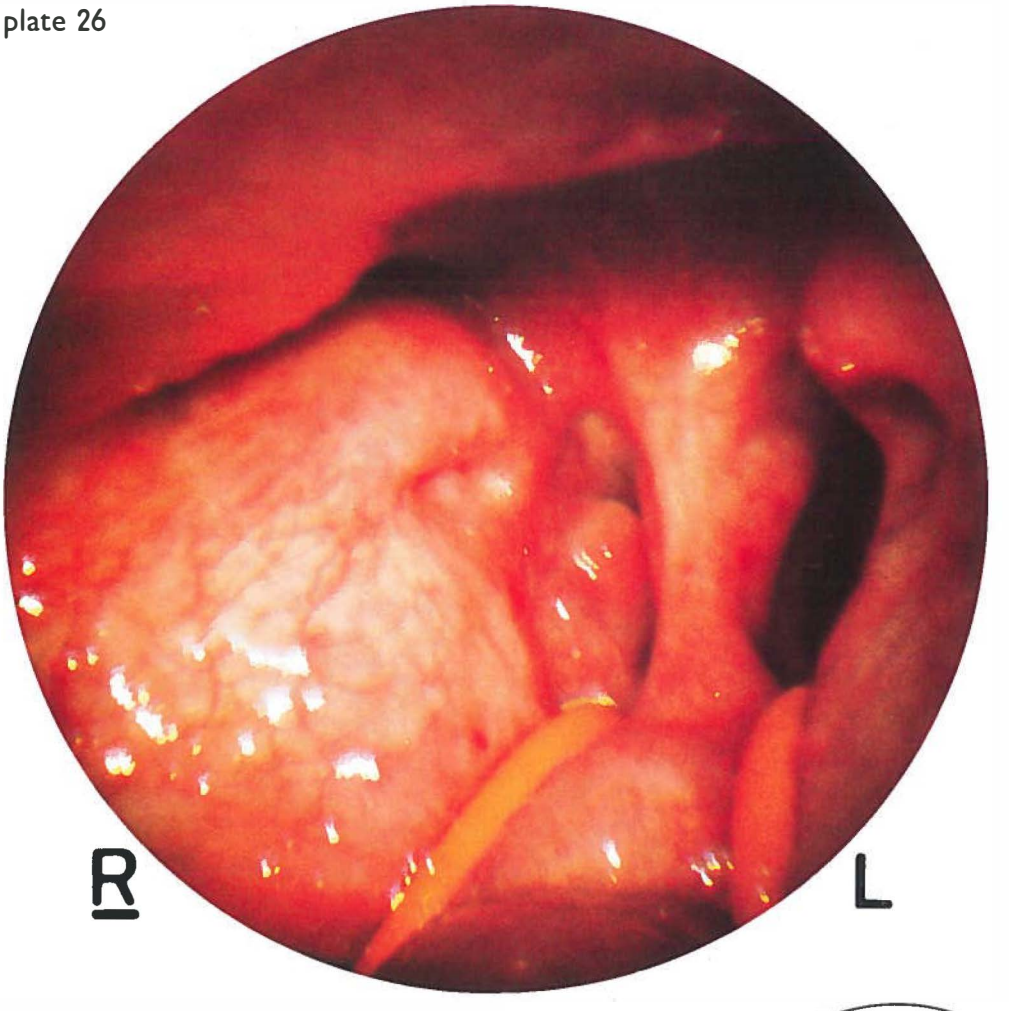
Patient E.F., boy, aged 6, was referred to our clinic in connection with a possible angiofibroma. Two years before the patient had undergone an adenotonsillectomy. There was hardly any bleeding at the removal of the tumor, which was attached to the uppermost part of the posterior wall with a slender stem. During the operation a Bellocq tampon was attached to one of the reins by way of precaution. Histological examination: normal adenoid tissue, with a number of cysts.

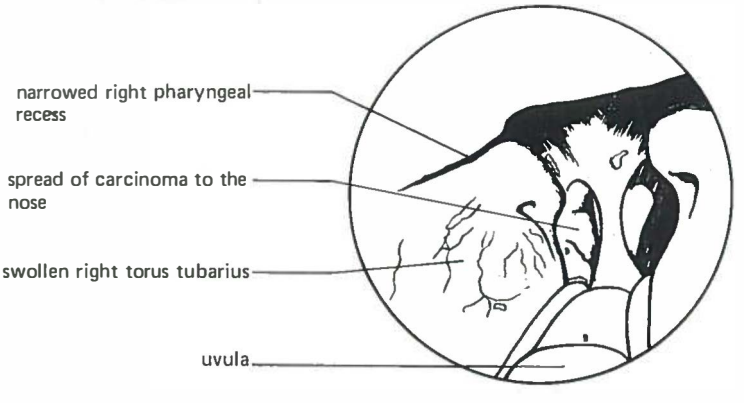




Nasopharyngoscopy: spread of maxillary sinus carcinoma

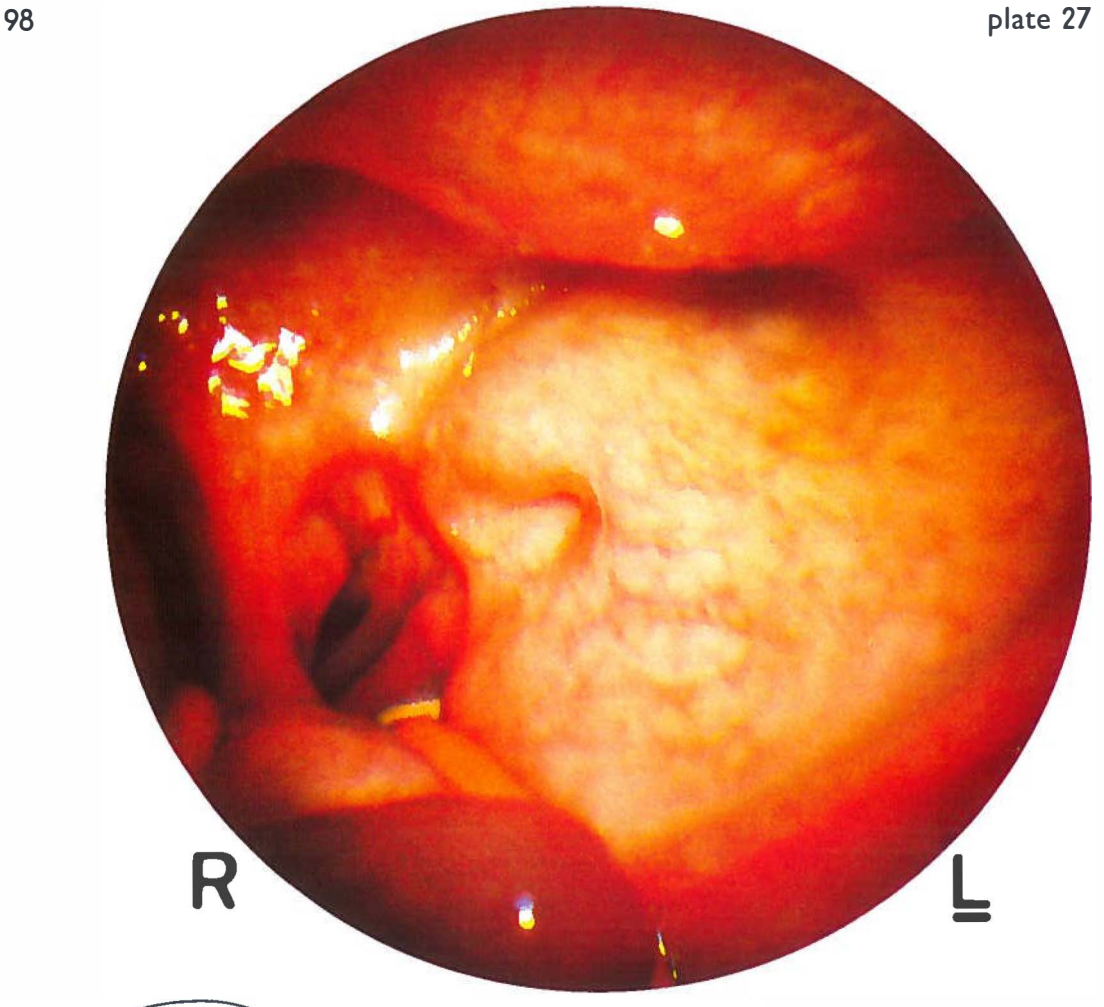
Patient H.W.M., male, aged 64, had had an increasing swelling of the right upper jaw for 6 weeks, succeeding a period of toothache in that region. There were no complaints of nasal obstruction. Antroscopy showed the right maxillary sinus completely filled with crumbly tissue. Biopsy: squamous cell carcinoma. The nasopharynx was asymmetrical: the area of the right torus tubarius was swollen and showed increased vascular injection.





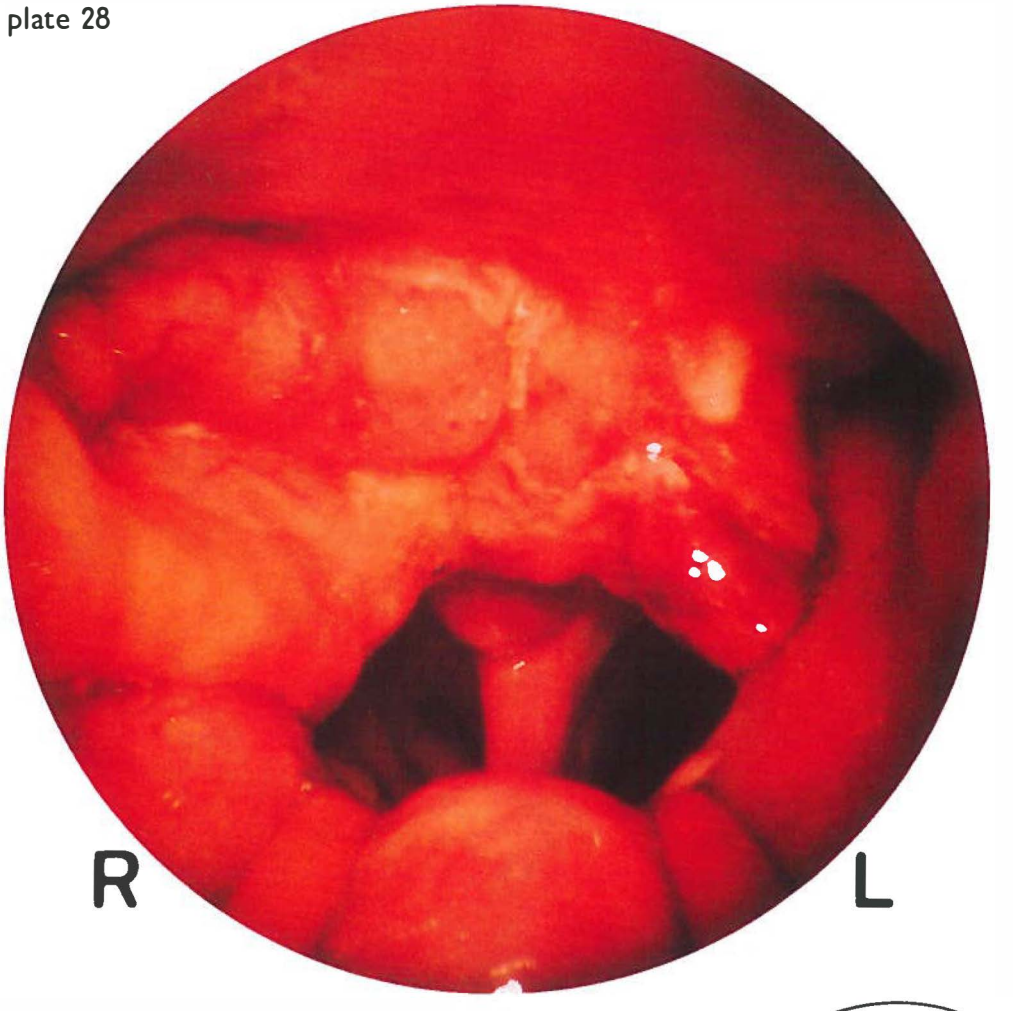
Nasopharyngoscopy: spread of maxillary sinus carcinoma

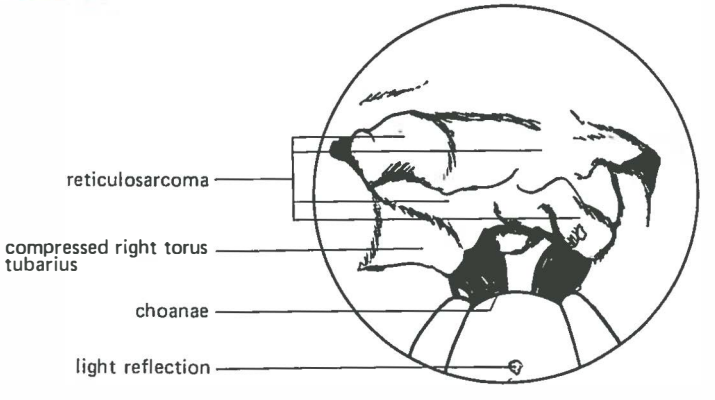
Patient H.W.M., male, aged 64, same patient as on plate 25. This photograph, directed more towards the right, shows the swelling and the consequent narrowing of the right pharyngeal recess even more clearly. Spread of the maxillary sinus carcinoma towards the nose is also visible now.



Nasopharyngoscopy (III): no pathology on the left side

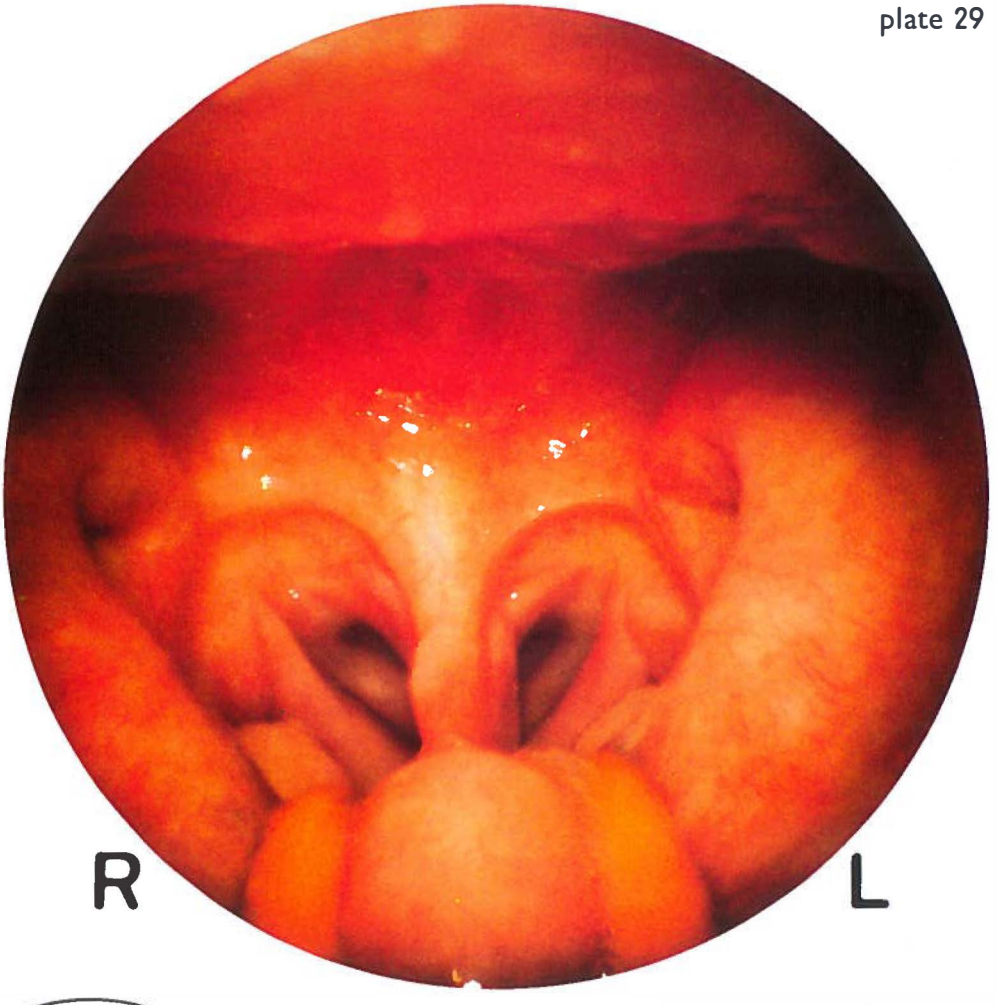
Patient H.W.M., male, aged 64, same patient as on plates 25 and 26. On the left the nasopharynx is without pathology. The left nasal cavity shows normal conchae. Tomography demonstrated destruction of the medial, the anterior and the posterior wall of the right maxillary sinus. The patient was given cytostatic treatment (methotrexate) and radiotherapy, but died one year after.

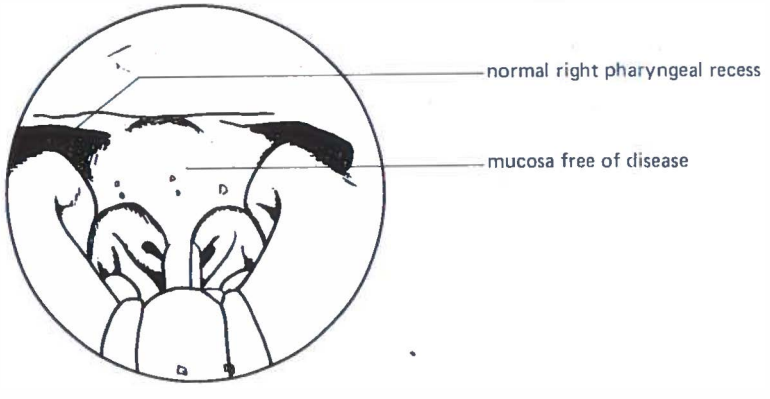




Nasopharyngoscopy: reticulosarcoma

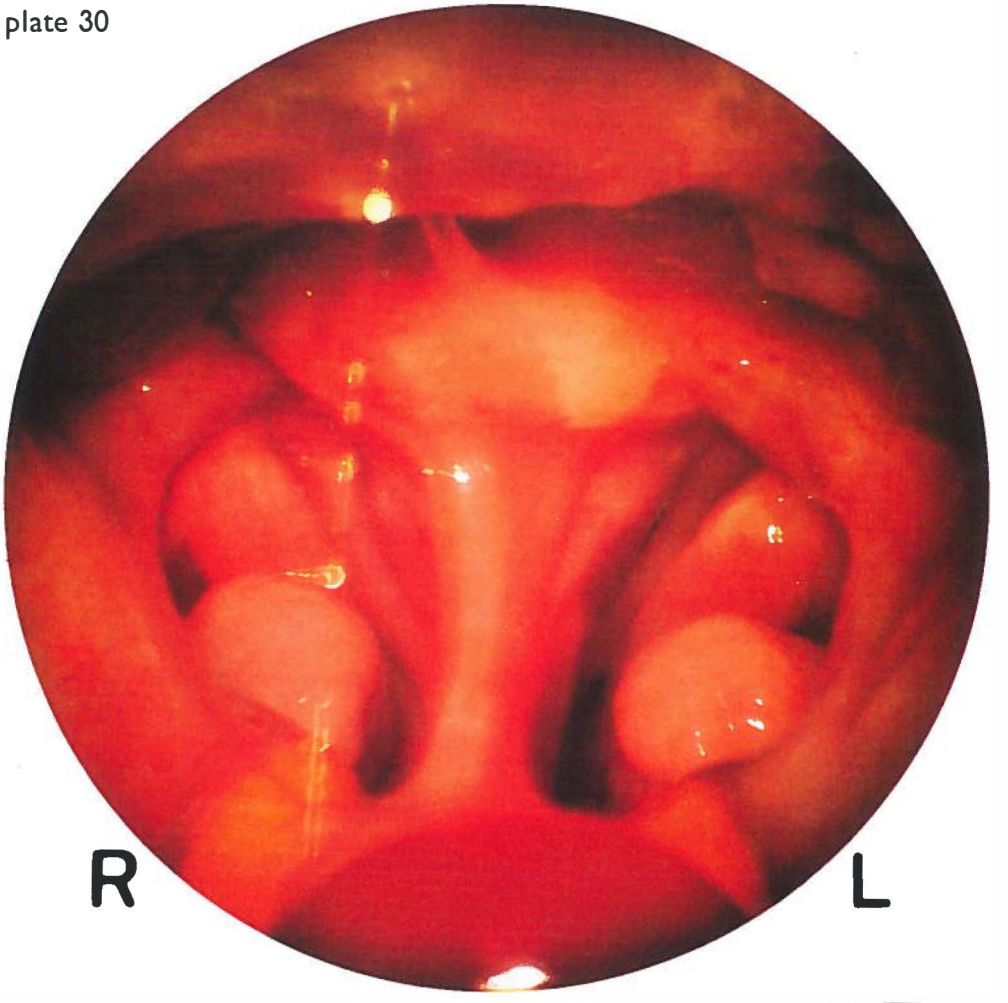
Patient A.E.-S., female, aged 66, had had complaints of nasal obstruction and impaired hearing on the right side one year previously already. At first these complaints temporarily improved after the use of nose drops. On examination the patient had a serous otitis on the right side. In the nasopharynx there was a large mass of irregular soft tissue. Biopsy: reticulosarcoma. On both sides of the neck lymph nodes could be palpated. Further examination as to dissemination proved negative.

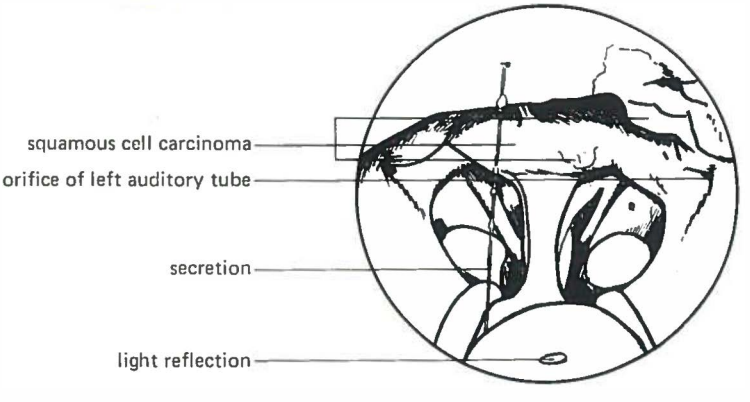




Nasopharyngascopy: free of disease

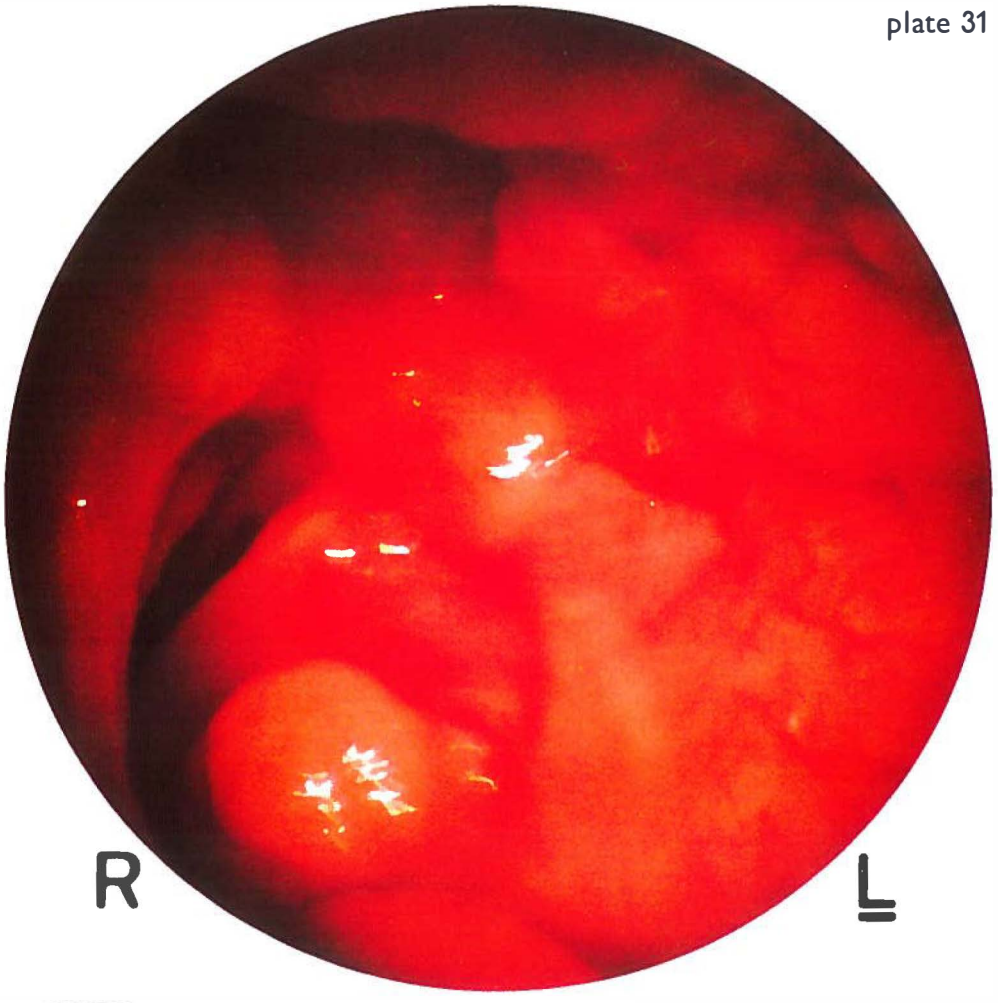
Patient A.E.-S., female, aged 66, same patient as on plate 28. Check-up 9 months after radiotherapy (4000 Rad. tumor dose): no signs of recurrence of reticulosarcoma.

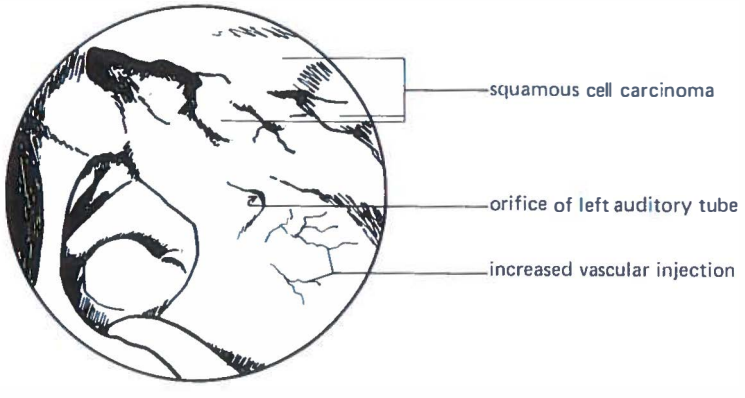




Nasopharyngoscopy: squamous cell carcinoma

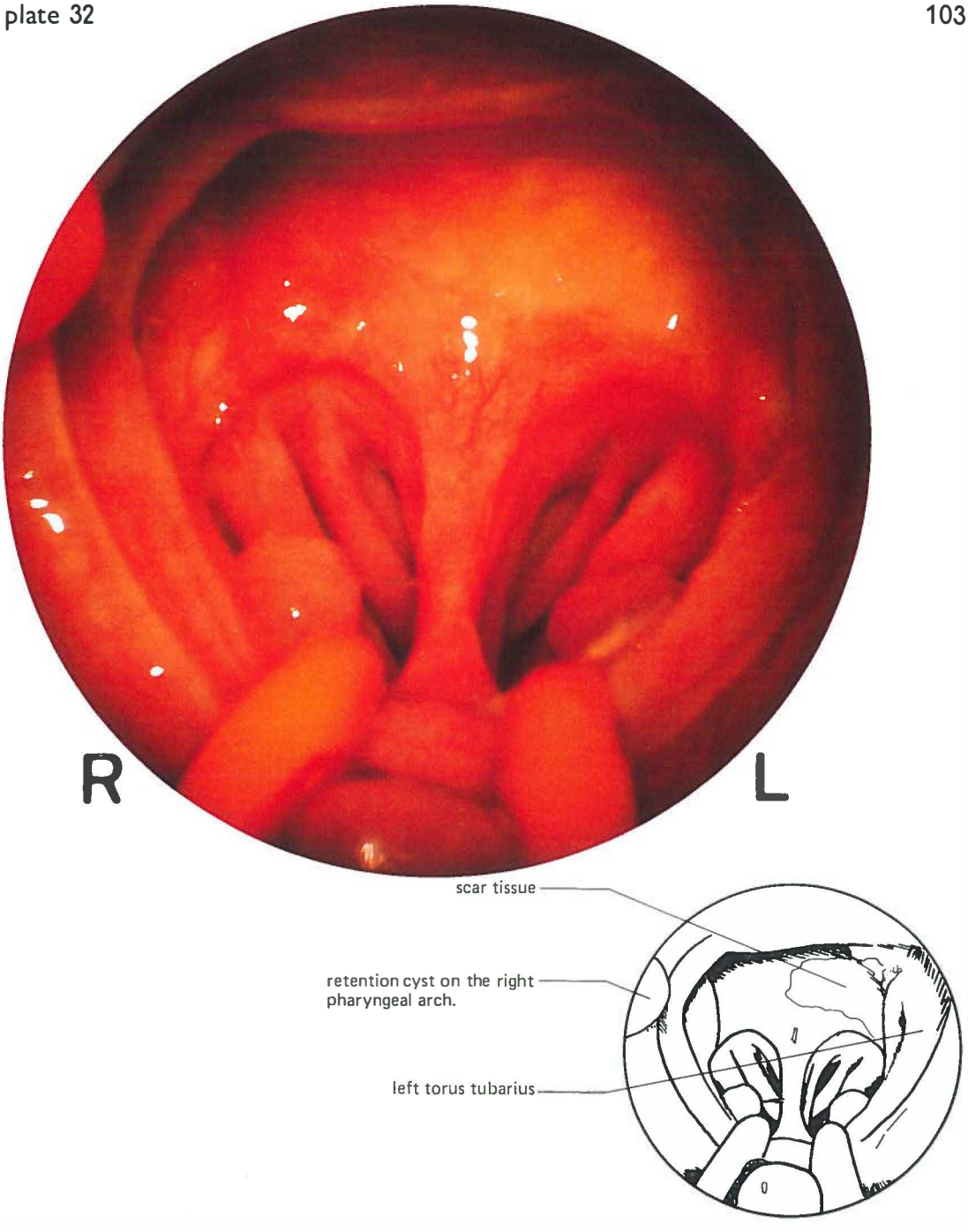
Patient M.K.-J., female, aged 57, had had paresthesies and pain on the left side of the face for five months, which could not be explained at first. The patient consulted the E.N.T.-specialist again when she developed a peripheral facial palsy on the left side. On examination the left pharyngeal recess was filled up with irregular soft tissue. Biopsy: squamous cell carcinoma. There were positive lymph nodes on both sides of the neck. It seemed that the peripheral facial palsy could be explained by pressure from large lymph nodes.





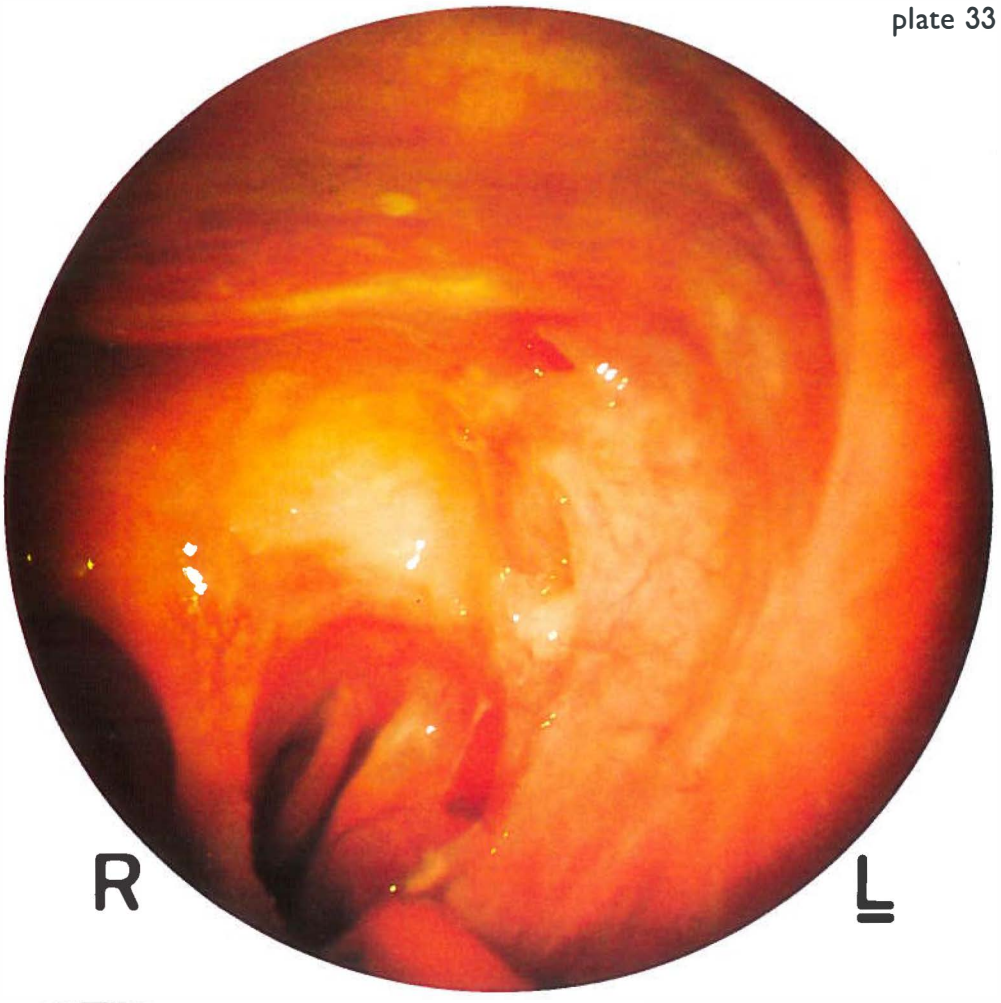
Nasopharyngoscopy: squamous cell carcinoma

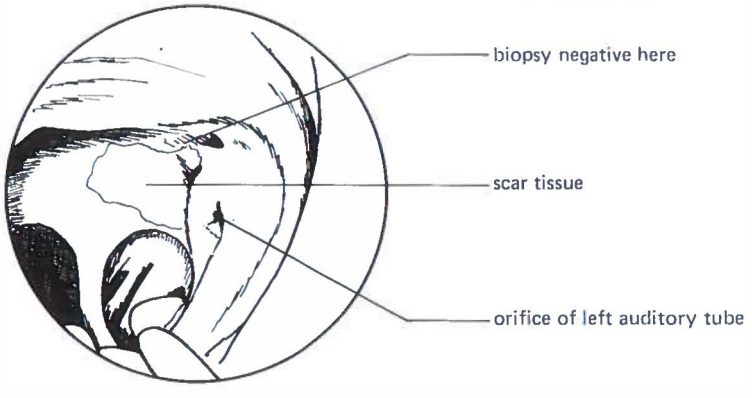
Patient M.K.-J., female, aged 57, same patient as on plate 30. Detailed photograph of the left torus tubarius and pharyngeal recess. There are no signs of disease to be seen in the left nasal cavity.



Nasapharyngoscopy: check-up after radiotherapy

Patient M.K.-J., female, aged 57, same patient as on plates 30 and 31. Four weeks after treatment (methotrexate and radiotherapy, 6120 Rads) only scar tissue was found on the place where the carcinoma had been. The lymph nodes could no longer be palpated. The function of the left facial nerve was restored.

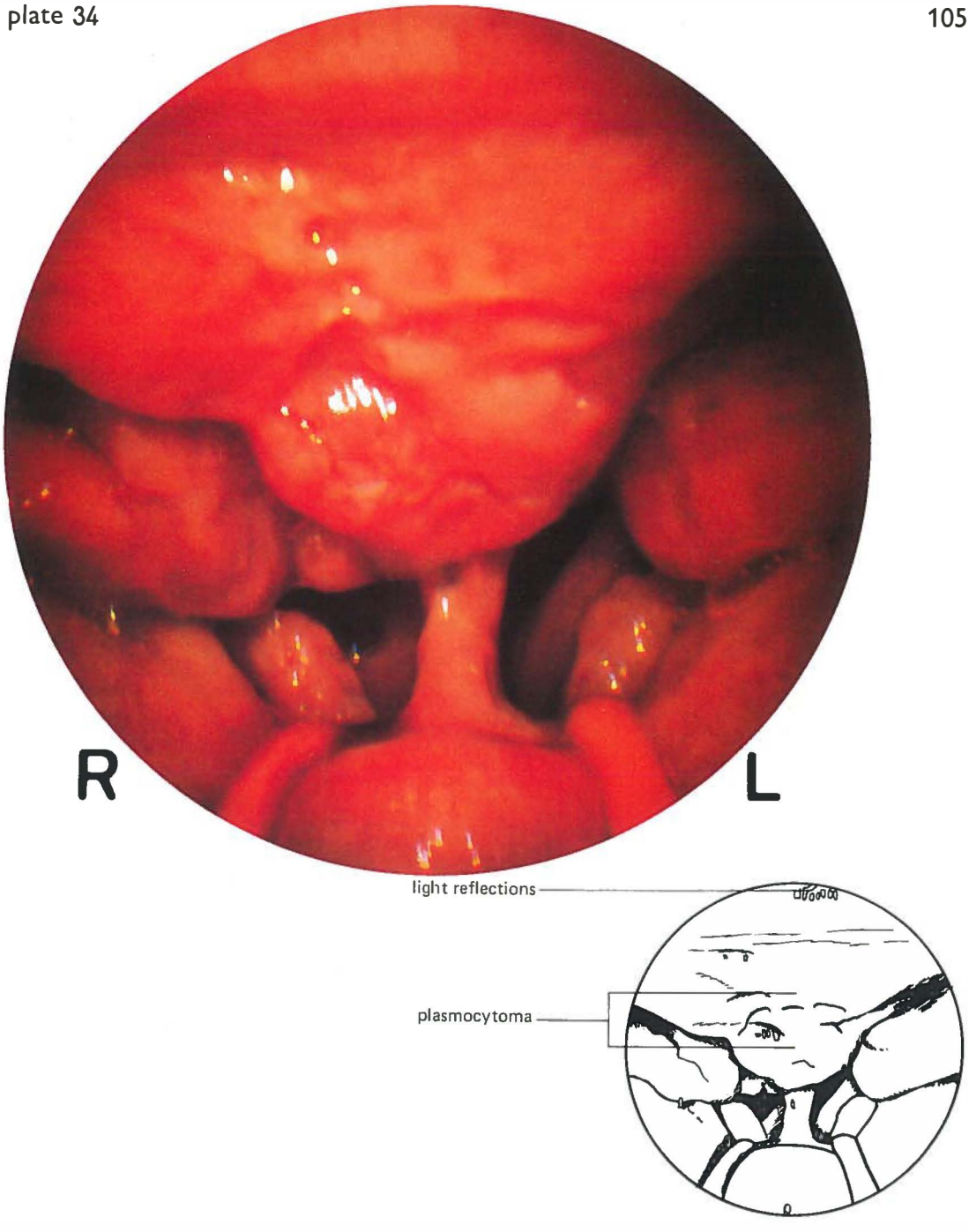




Nasopharyngoscopy: check-up after radiotherapy (detail)

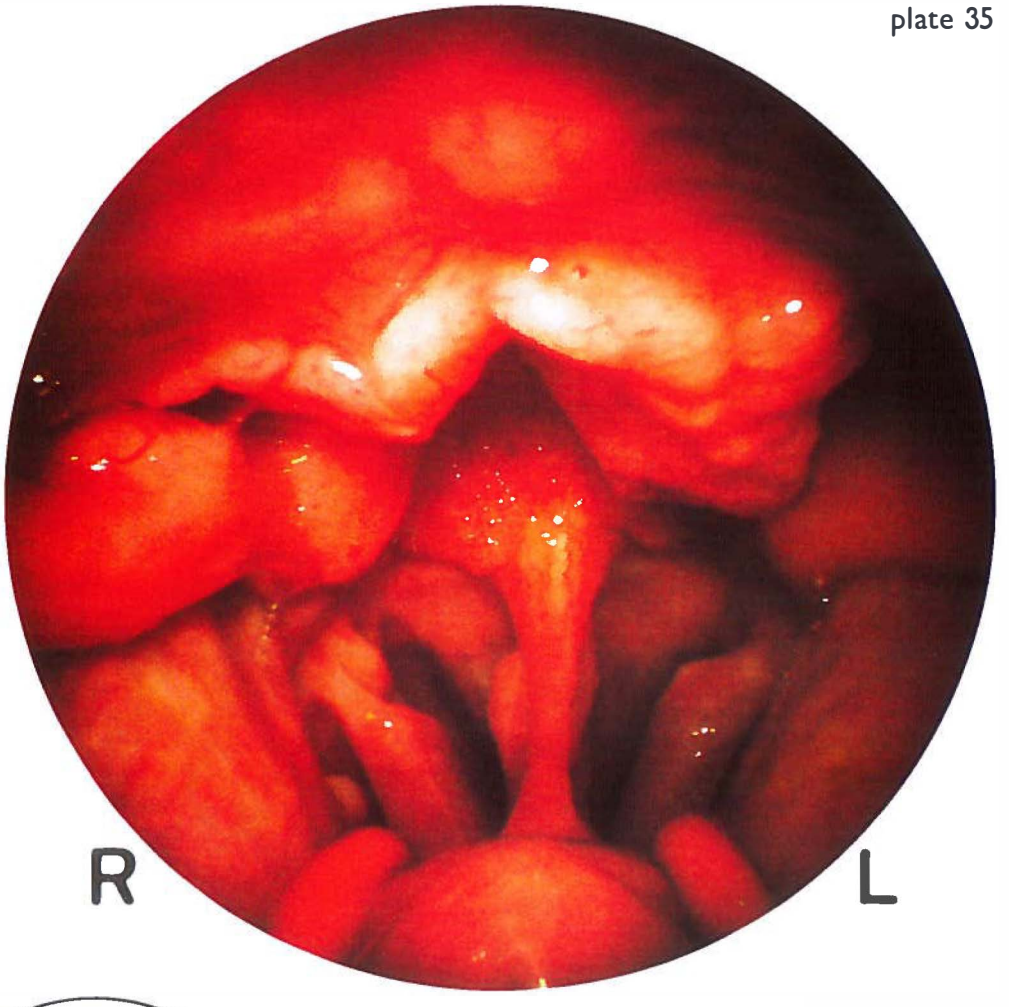
Patient M.K.-J., female, aged 57, same patient as on plates 30, 31 and 32. Detailed photograph of the area where the squamous cell carcinoma had been situated.

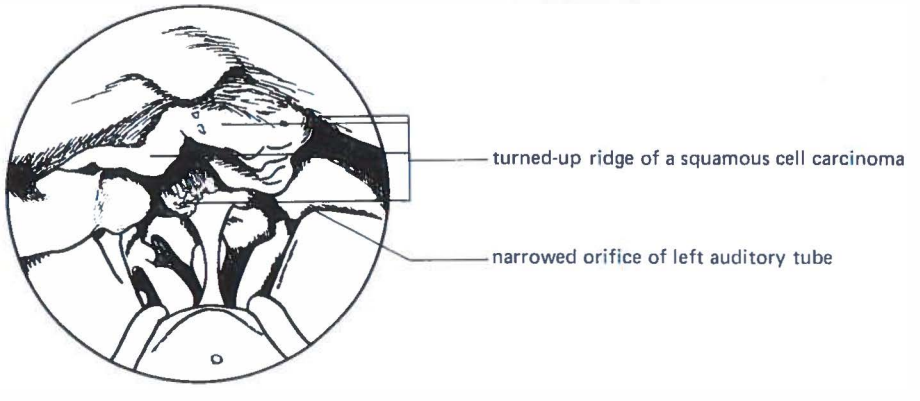
Three months after the diagnosis had been made metastases in the lower neck nodes manifested themselves, just outside the field of irradiation. The patient died five months later.



Nasopharyngoscopy: plasmocytoma

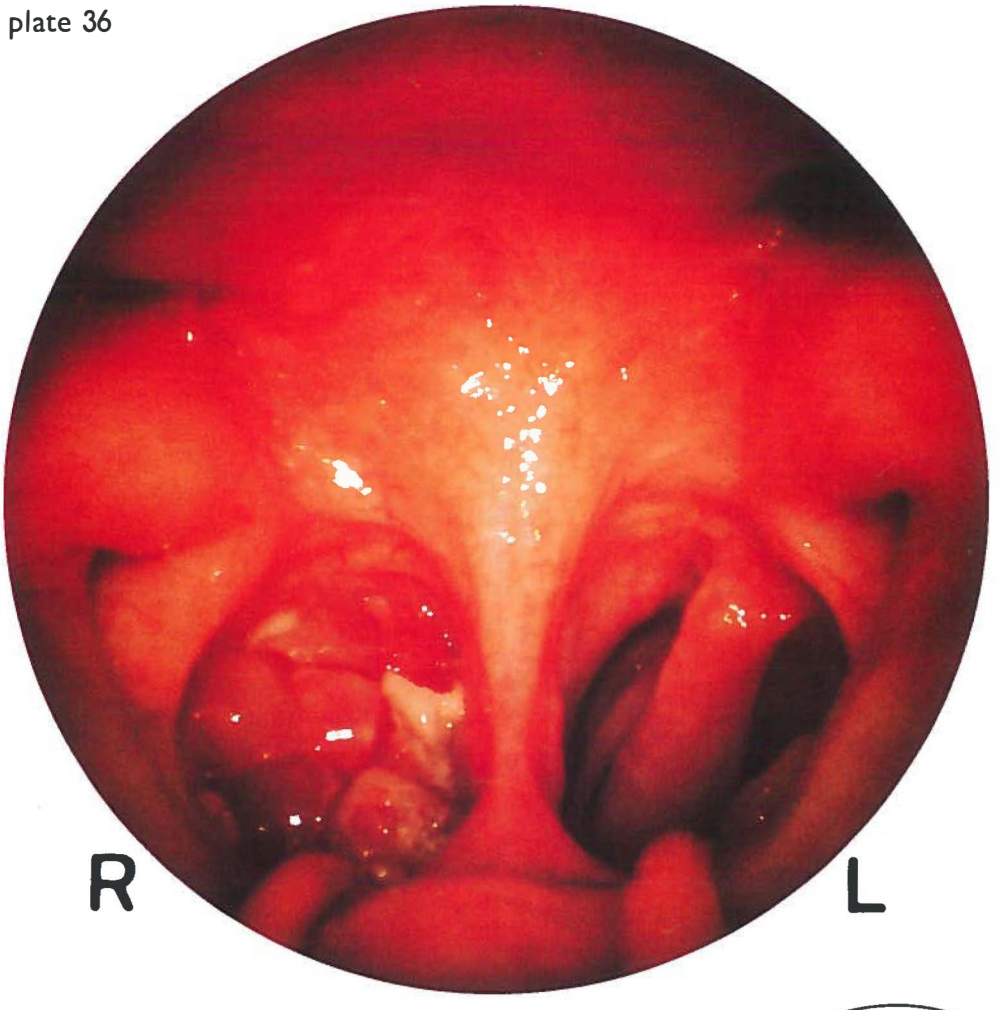
Patient F.H., male, aged 27, complained of impaired hearing on both sides for the last three months, and of nasal speech. On examination there was a serous otitis and a conductive hearing loss on both sides. Against the roof of the nasopharynx there was a large smooth tumor. Biopsy: extramedullar plasmocytoma. There were no signs of dissemination. The patient was given local treatment with radiotherapy (4000 Rads.).

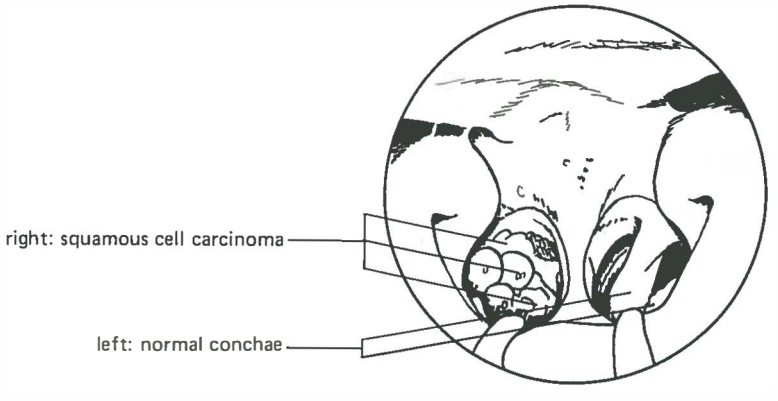




Nasopharyngascapy: squamous cell carcinoma

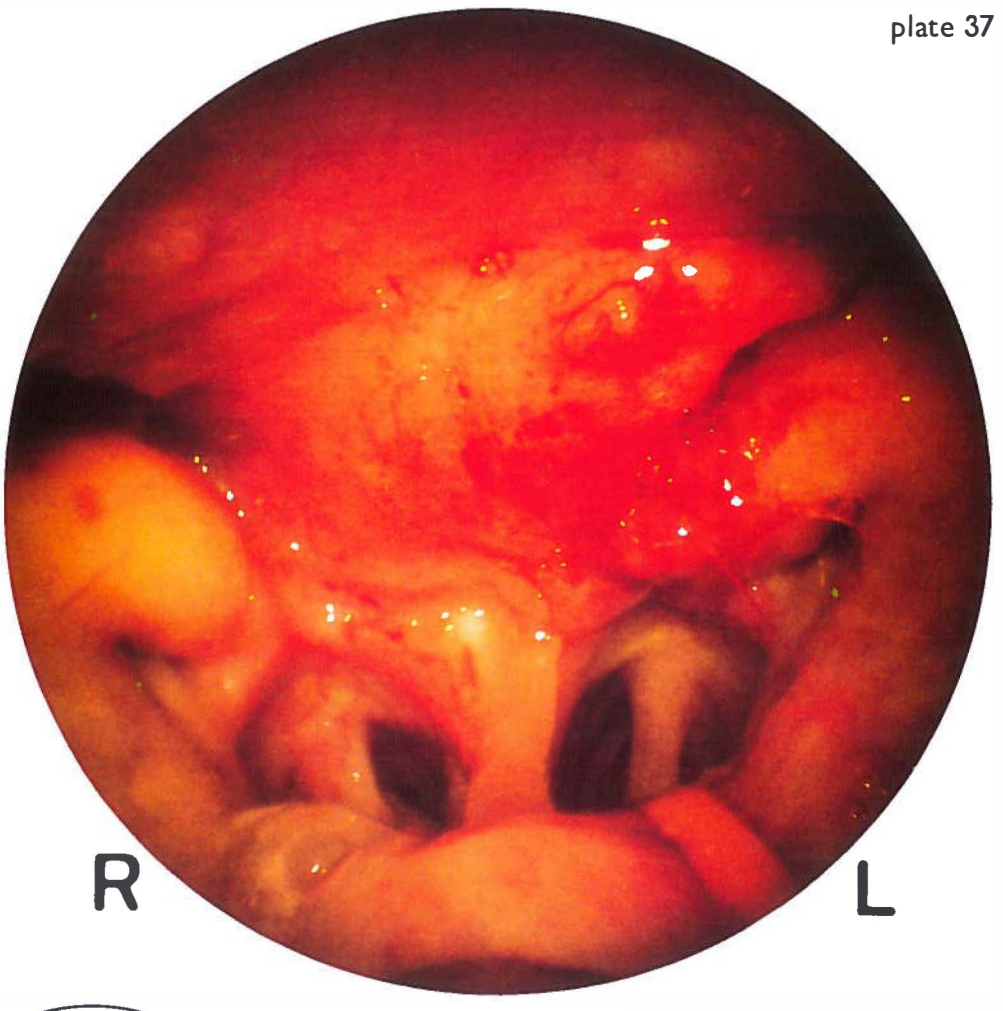
Patient G.S., male, aged 59, had a submandibular swelling on the left side. The patient explained that for some time breathing through the nose had been a little more difficult and hearing less sharp on the left side. There appeared to be a mixed hearing loss on both sides. Against the roof of the nasopharynx there was a large granulating swelling. Biopsy: squamous cell carcinoma. The sunmandibular swelling appeared to be a mass of lymph nodes.

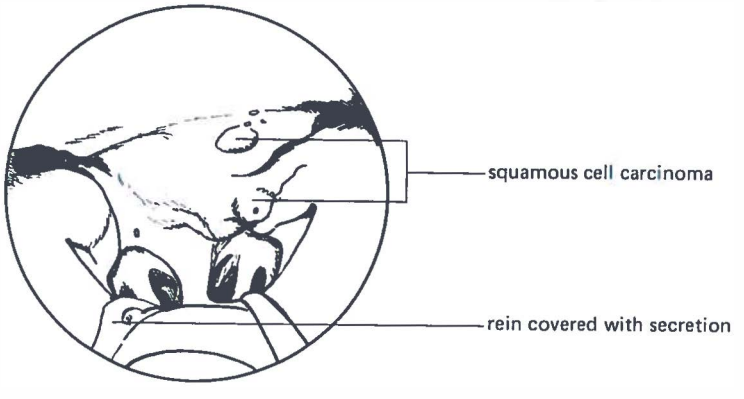




Nasopharyngoscopy: spread of maxillary sinus carcinoma into the nose

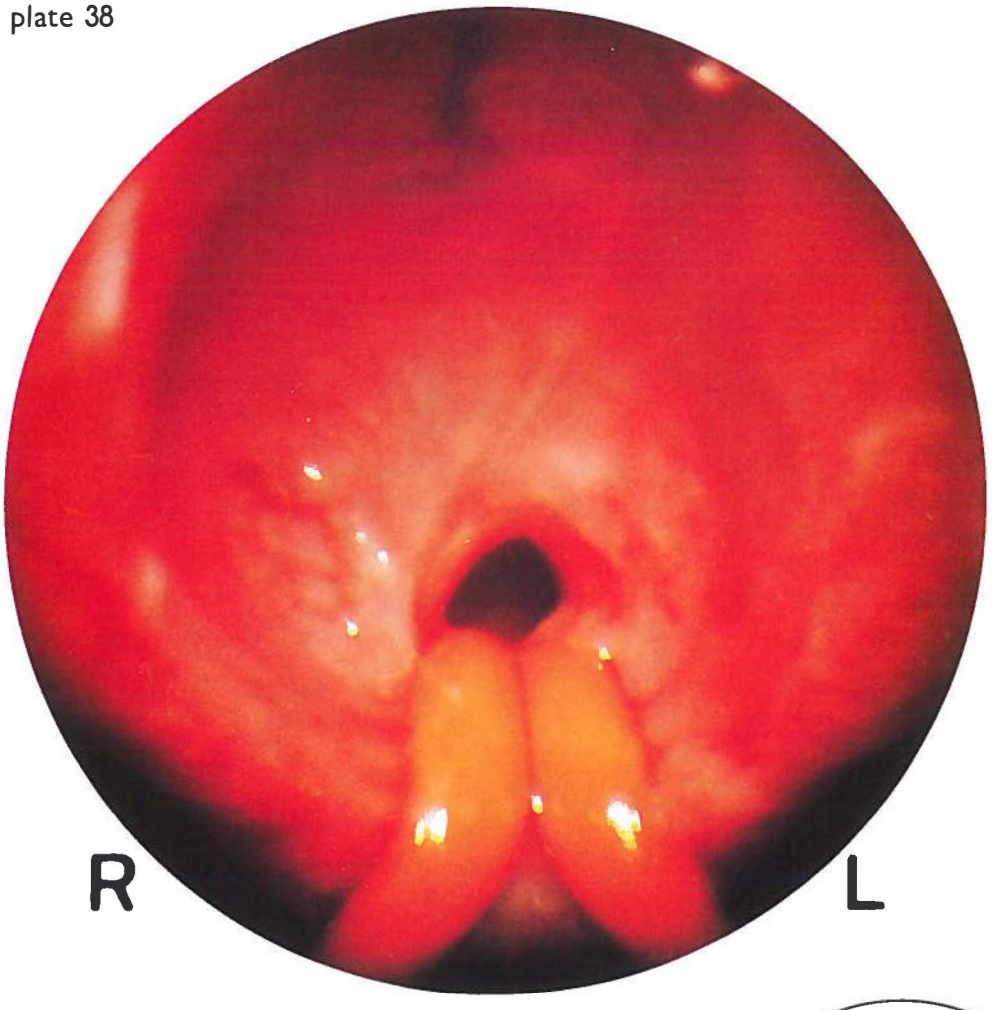
Patient S.B., male, aged 69, had a squamous cell carcinoma of the right maxillary sinus. There was nasal obstruction on the right side. Tomography showed defects in the orbital floor and the anterior and posterior maxillary wall, and an opacity of the right ethmoid complex. Nasopharyngoscopy demonstrated growth into the nose. Only palliative radiotherapy (6600 Rads.) was given on account of dementia. The patient died one year later with symptoms of growth into the anterior cranial fossa.

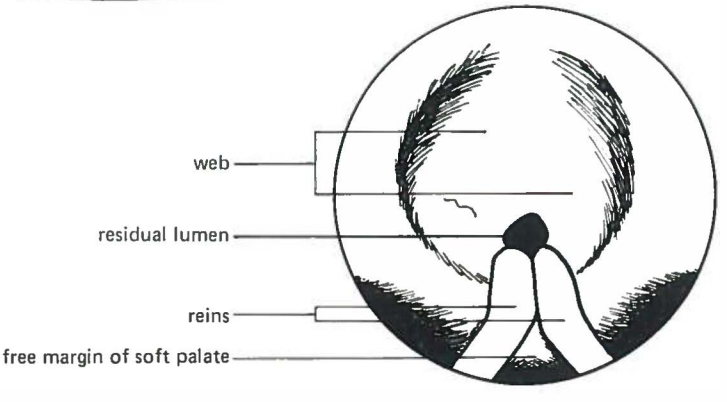




Nasopharyngoscopy: squamous cell carcinoma

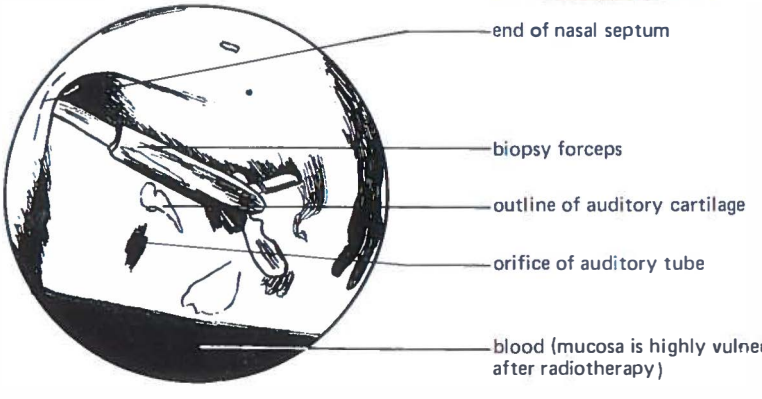
Patient N.T., male, aged 53, was admitted into the clinic for internal diseases on account of a suspected M. Hodgkin. A biopsy was taken from the large mass of lymph nodes on the right side of the neck: metastasis of a squamous cell carcinoma. Nasopharyngoscopy showed the primary tumor, which caused no complaints.





Nasopharyngoscopy: web after radiotherapy

Patient R.S., female, aged 52, was given radiotherapy on account of an nasopharyngeal carcinoma one year previously. Some time after radiotherapy the patient complained of serious nasal obstruction. These appeared to be caused by a circular web-like stenosis between the soft palate and the posterior pharyngeal wall. Inspection of the nasopharynx through the mouth was not possible (see also plate 39).



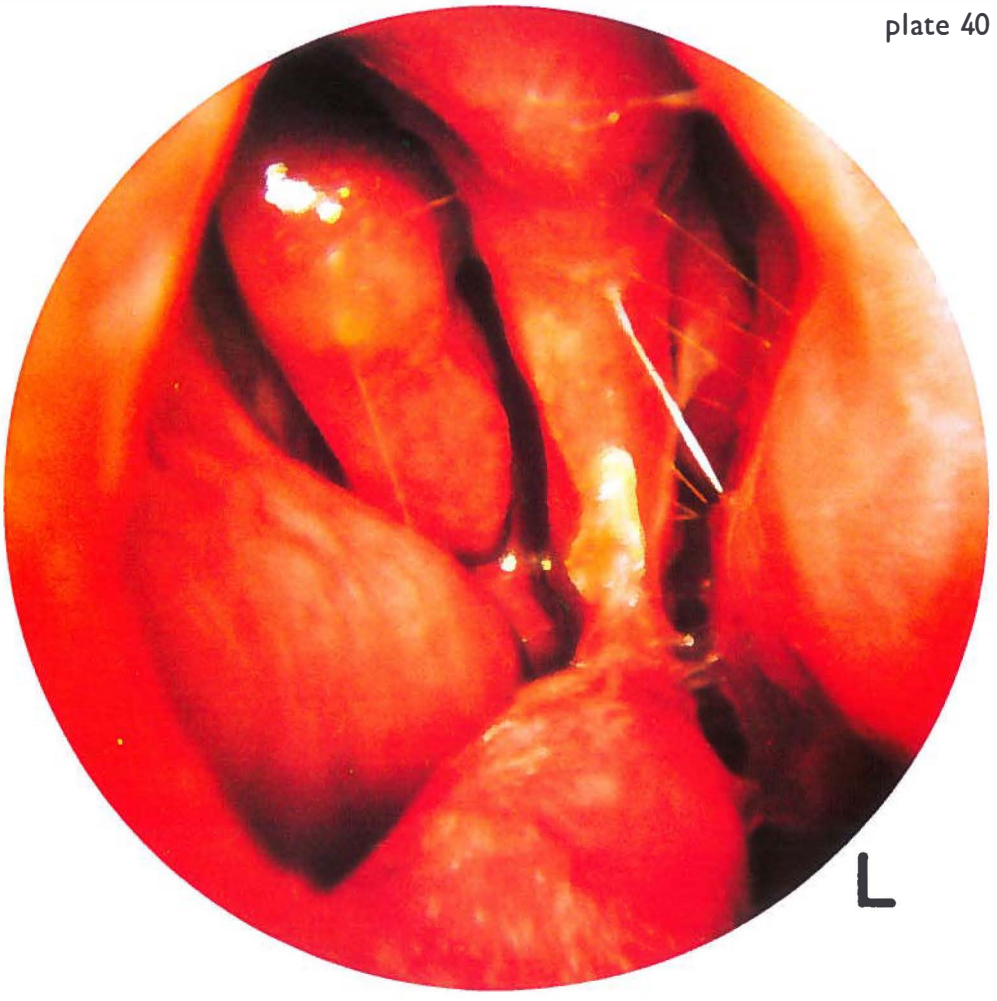
Transnasal nasopharyngoscopy: no recurrence of carcinoma

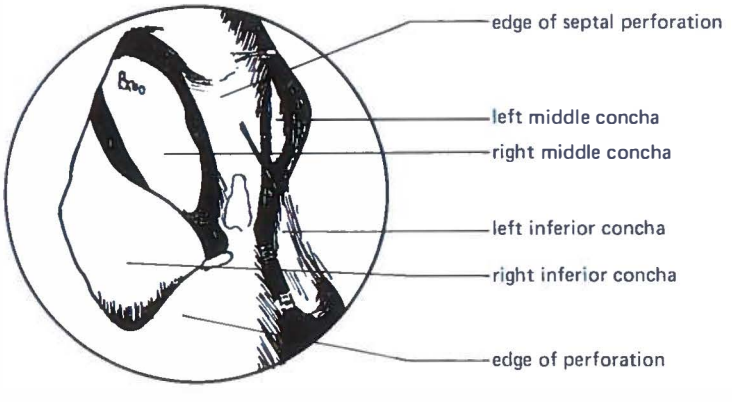
Patient R.S., female, aged 52, same patient as on plate 38. Because oral nasopharyngoscopy was not possible, the nasopharynx was inspected by means of a nasendoscope (70° Hopkins) inserted deep through the left nasal cavity. A suspected area was biopted via the right nasal cavity: no recurrence.

CHAPTER 8

Nasendoscopic plates

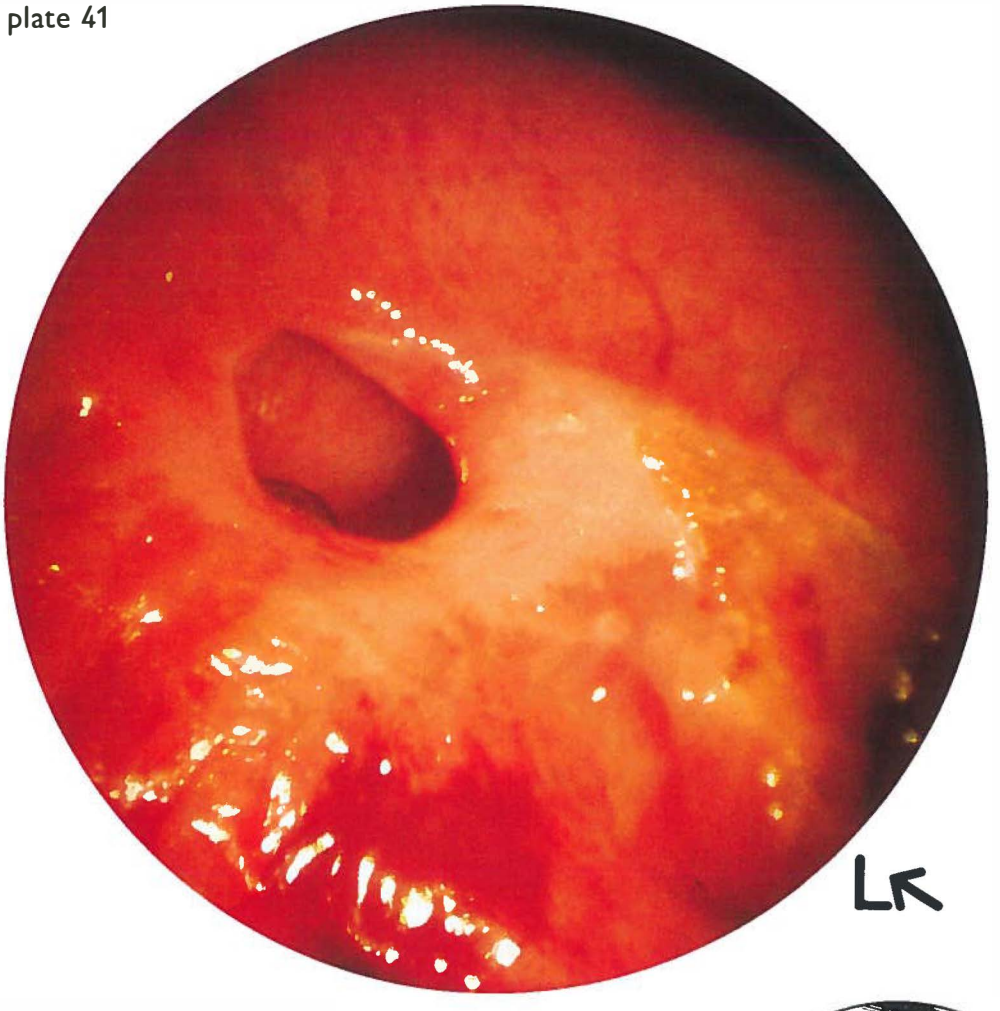
In this chapter the 'R' or 'L' indicate that endoscopy has been carried out in the right or left nasal cavity, respectively. The arrows printed by the side of these letters represent the direction in which the 30° or 70° optics have been applied. A few plates have been made with the aid of a straight forward optics. This is indicated by a dot.

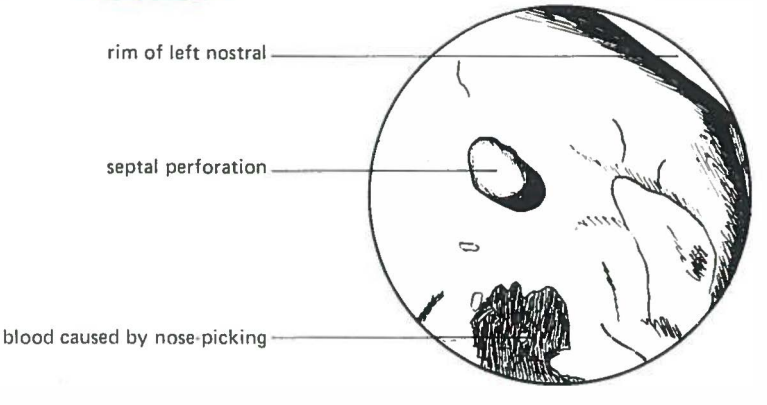




Nasendoscopy: large septal perforation

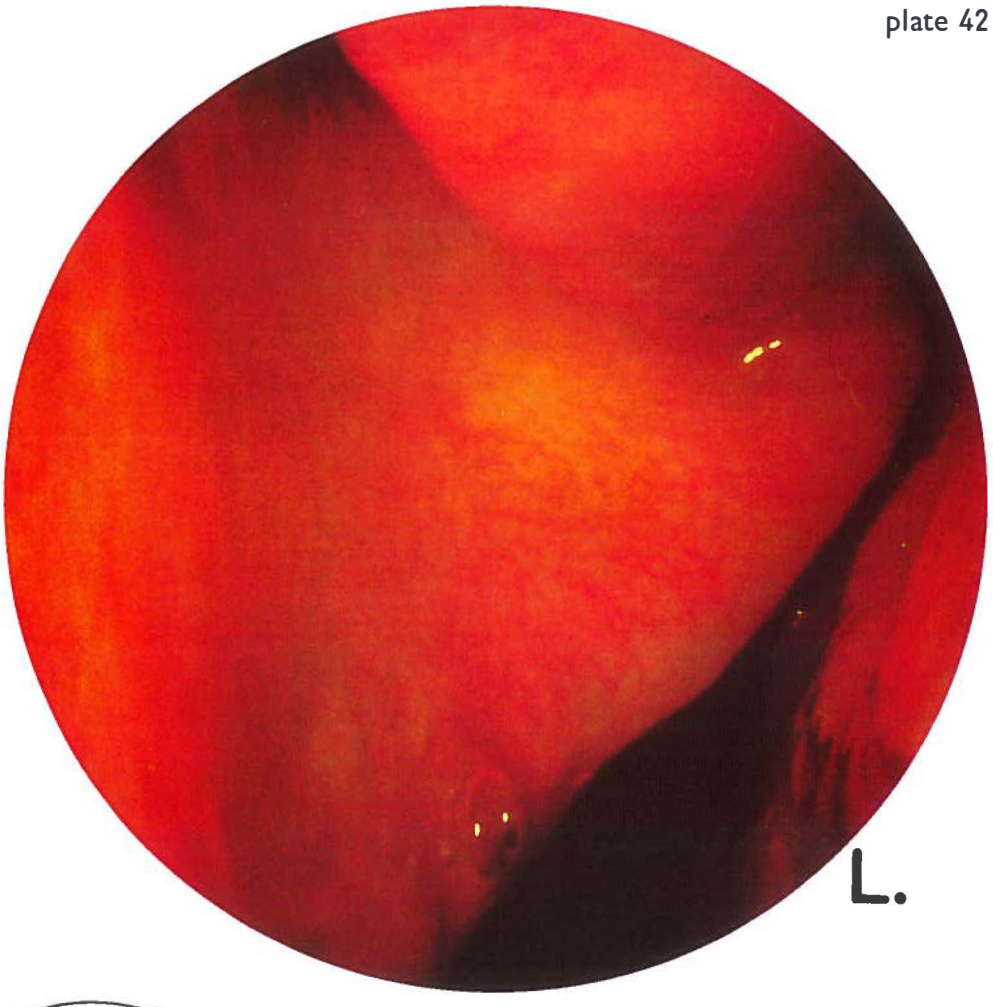
Patient A.G., male, aged 48. As a result of a large septal perforation a good survey is possible of both nasal cavities. On the edge of the perforation there are some crusts of dried-up secretion. The patient had undergone a submucous resection of the nasal septum 22 years ago.

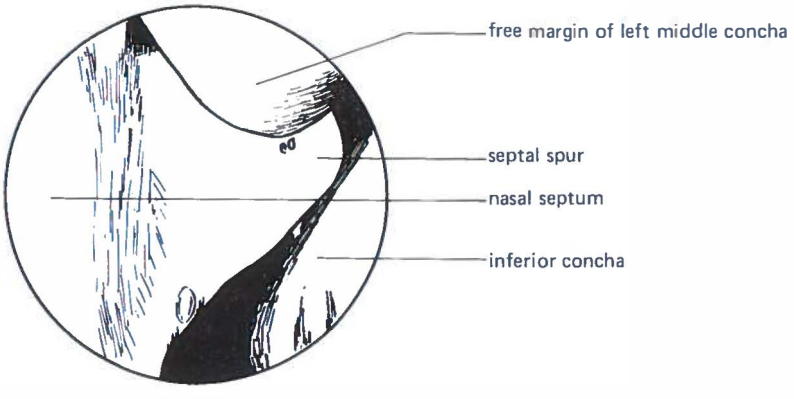




Left nasendoscopy: small septal perforation

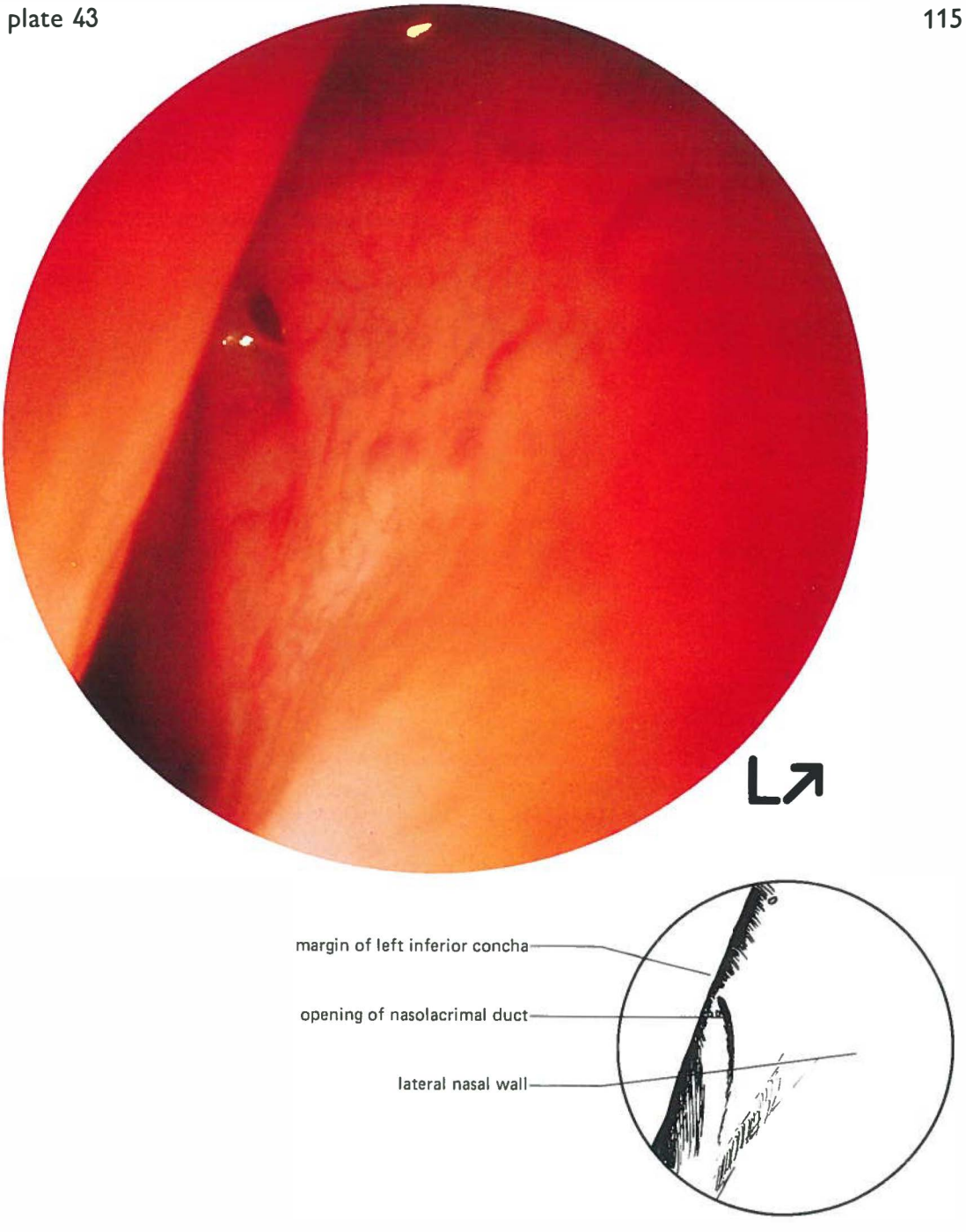
Patient M.J.H., female, aged 23, underwent a septal correction four years ago. On examination there appeared to be a small septal perforation, possibly as a result of frequent nose-picking, to which she admitted. A small septal perforation sometimes causes an annoying whistling sound in nose-breathing.





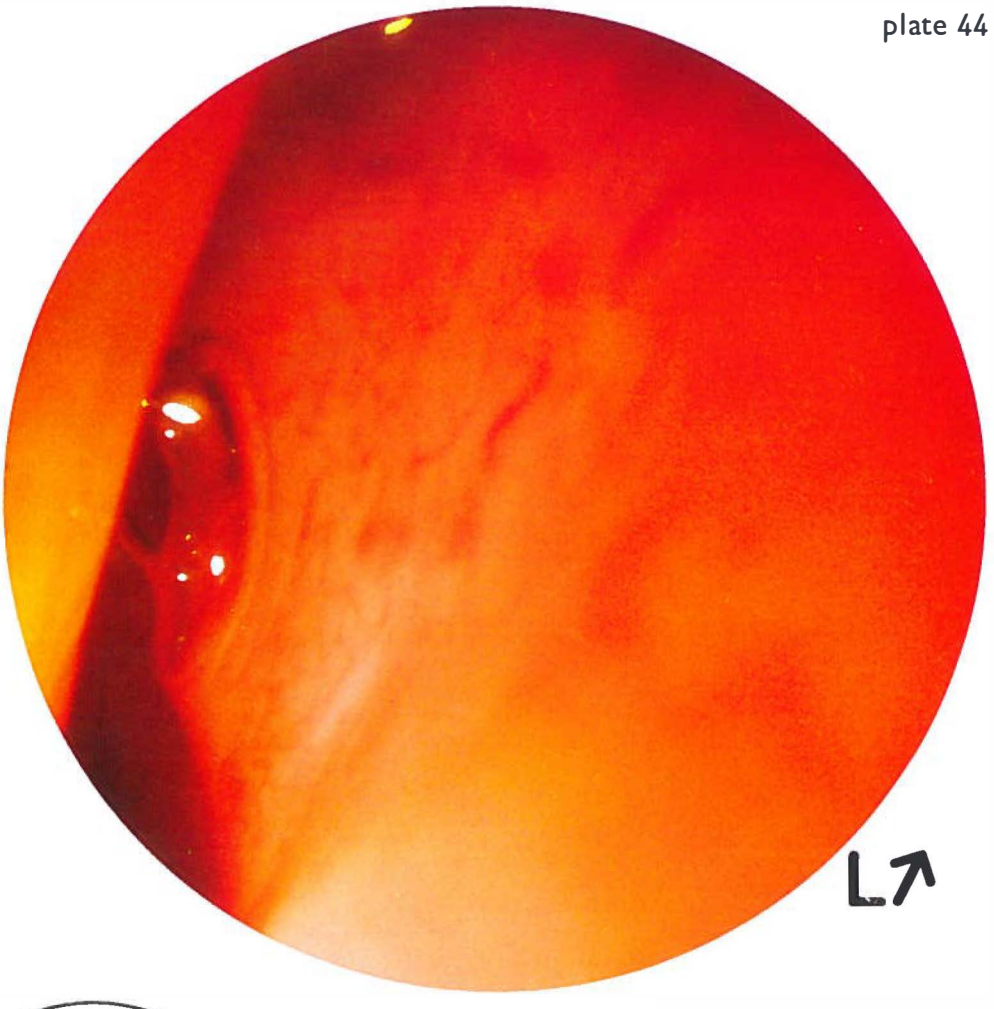
Left nasendoscopy: septal spur

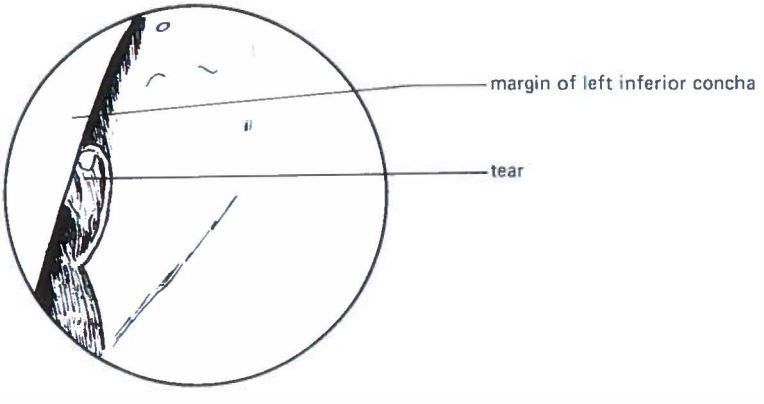
Patient F.M.B.-P., female, aged 26, had complaints of serious headaches. She had had a left maxillary sinusitis several times. There appeared to be a large septal spur on the left side. After removal of the spur the headaches ceased to exist.



Left nasendoscopy: opening of nasolacrimal duct (1)

Patient K.L., male, aged 56. During a check-up after removal of an inverted papilloma in the left nasal cavity nasendoscopy was carried out. In the inferior meatus the slit-like opening of the nasolacrimal duct can be seen. No signs of disease.

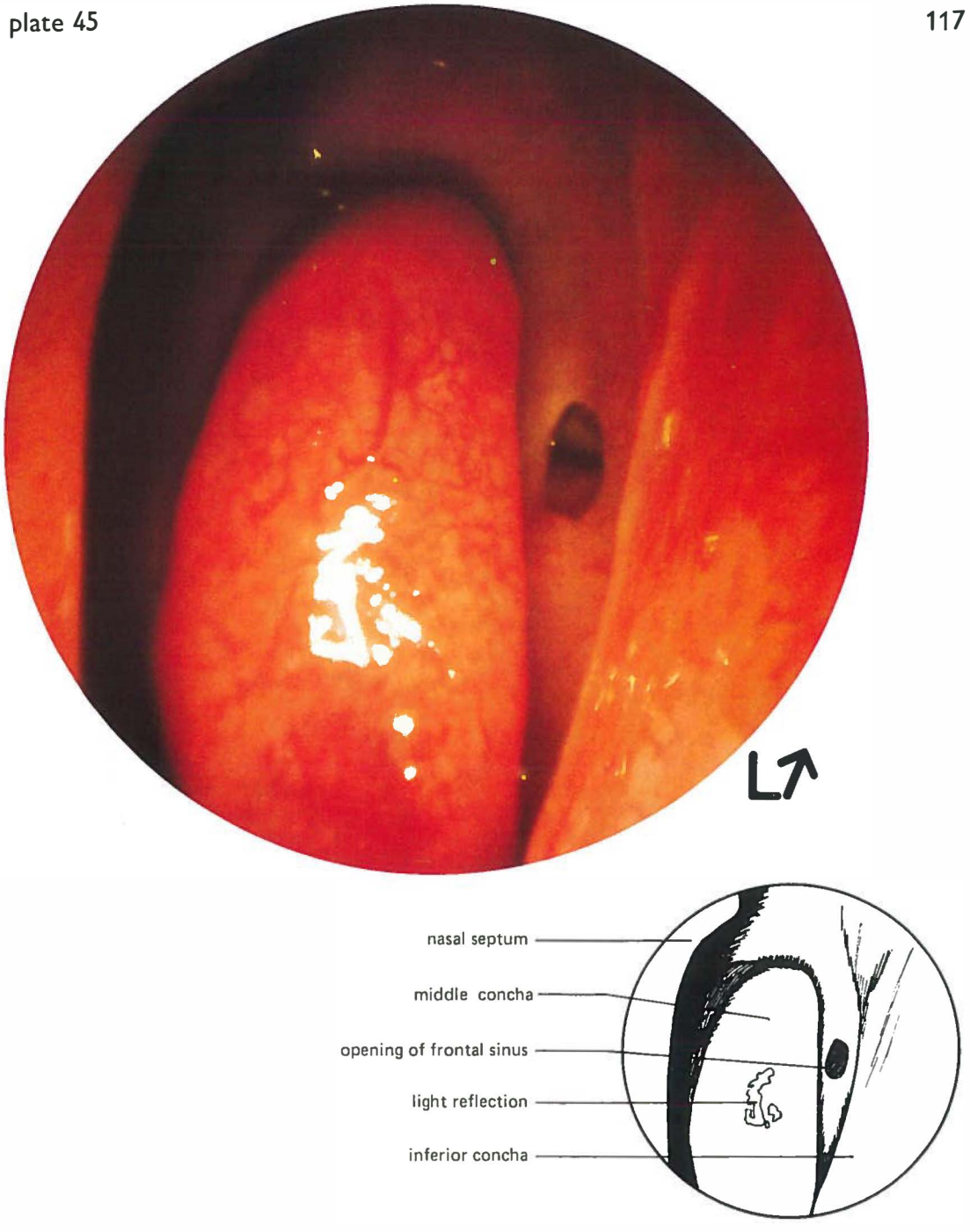




Left nasendoscopy: opening of nosolacrimal duct (II)

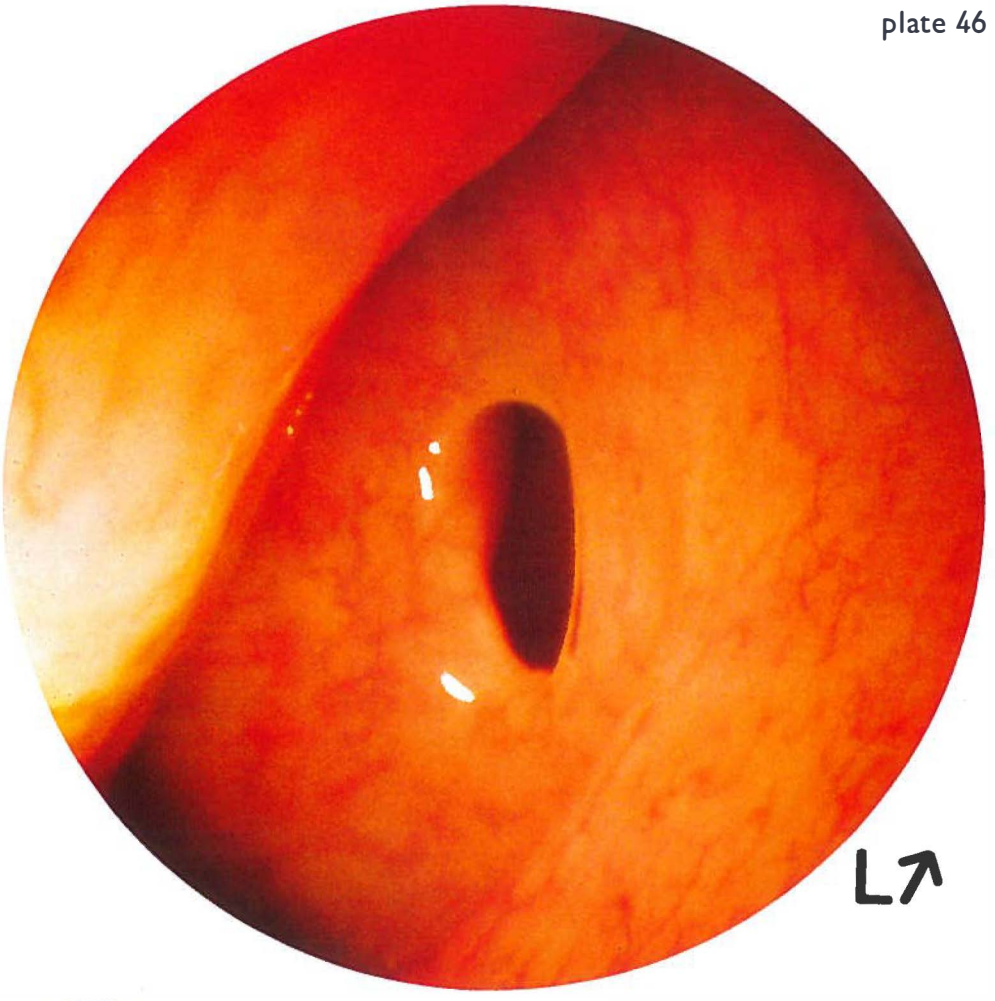
Patient K.L., aged 56, same patient as on plate 43.

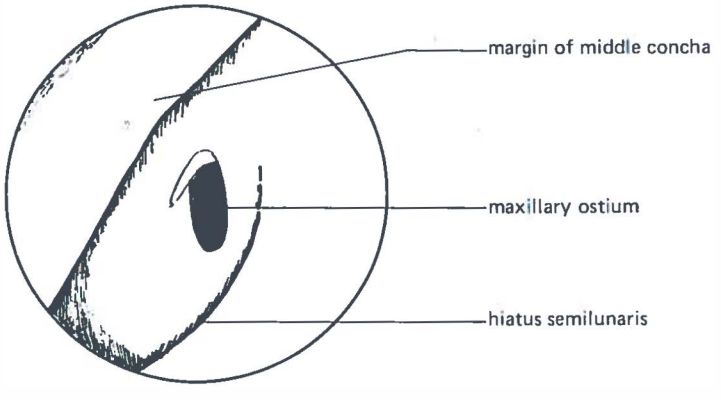
By massaging the medial corner of the eye lacrimal fluid is pressed from the lacrimal sac via the naso-lacrimal duct into the nose.



Left nasendoscopy: opening of frontal sinus

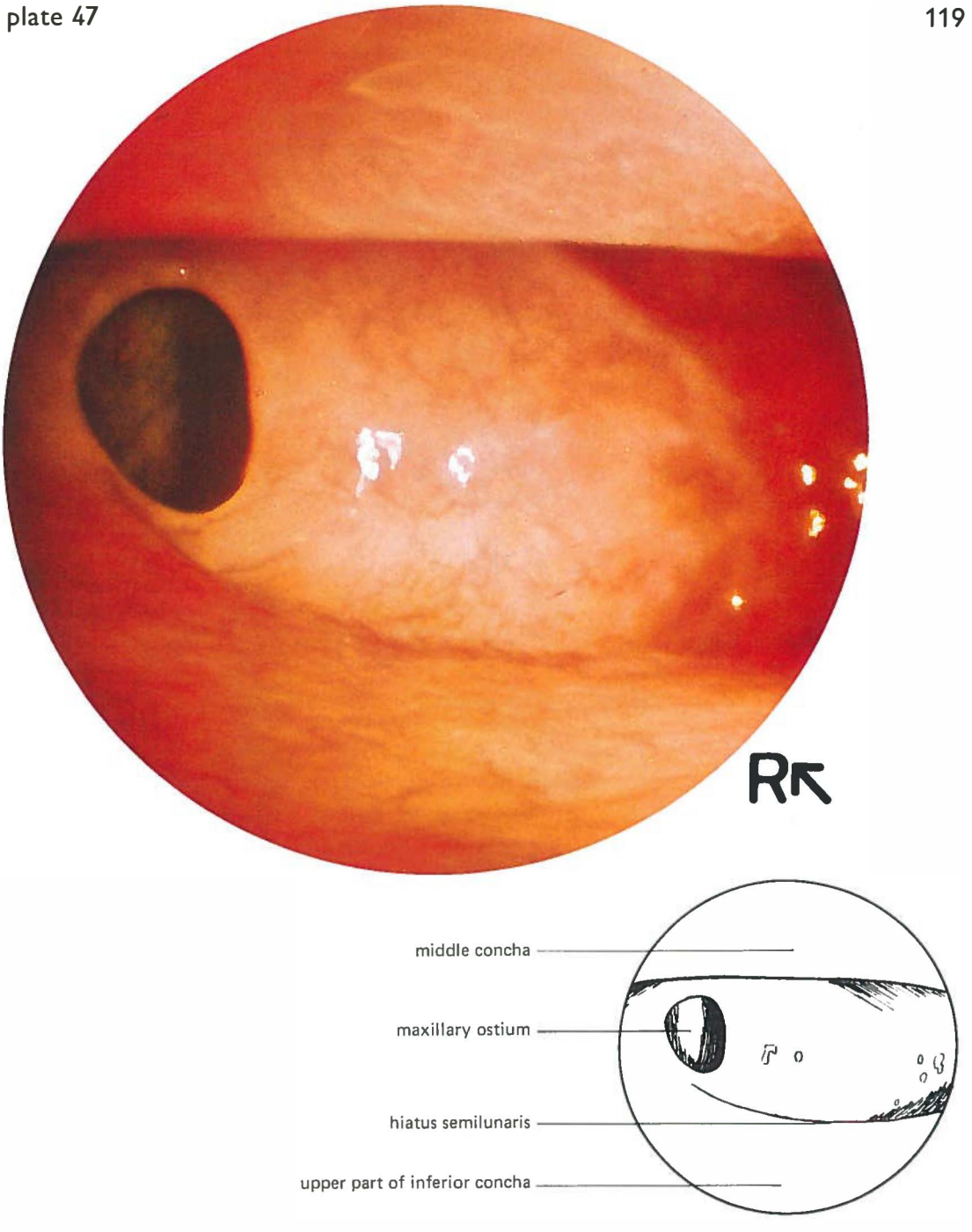
Patient J.D., male, aged 70. During left nasendoscopy a good view could be obtained of the opening of the frontal sinus to the nose, high up underneath the anterior part of the middle concha. Normal anatomy.





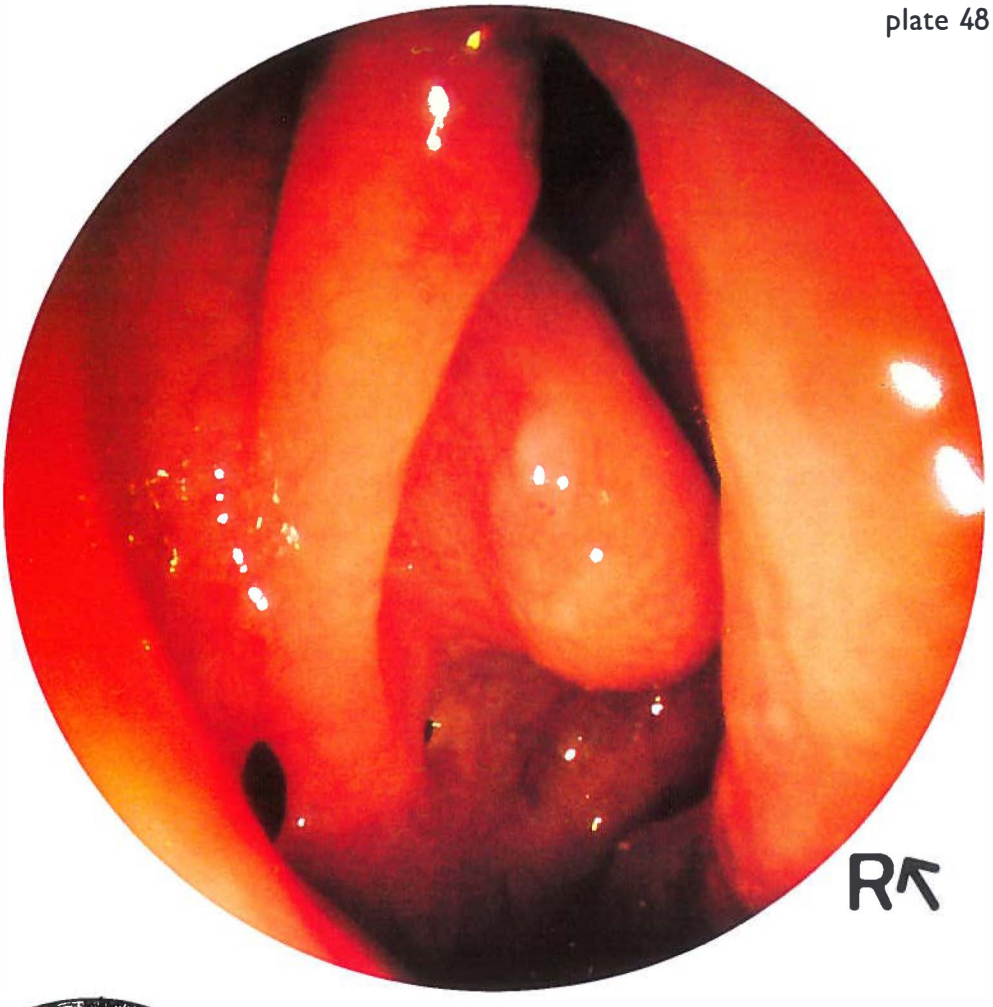
Left nasendoscopy: maxillary ostium

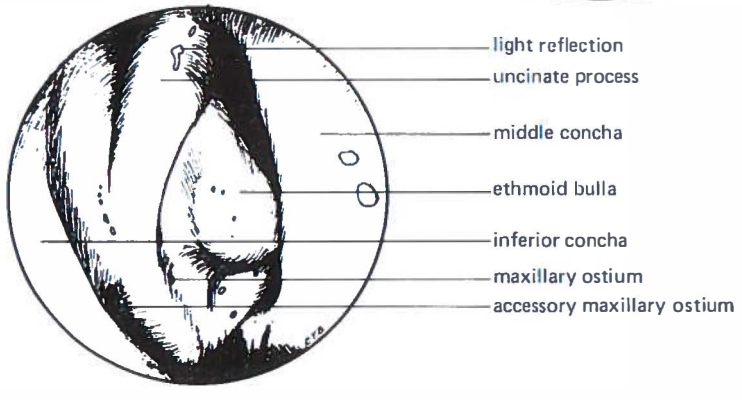
Same patient J.D., aged 70 (see plate 45). More backwards, underneath the middle concha the maxillary ostium is situated. Normal anatomy.



Right nasendoscopy: maxillary ostium

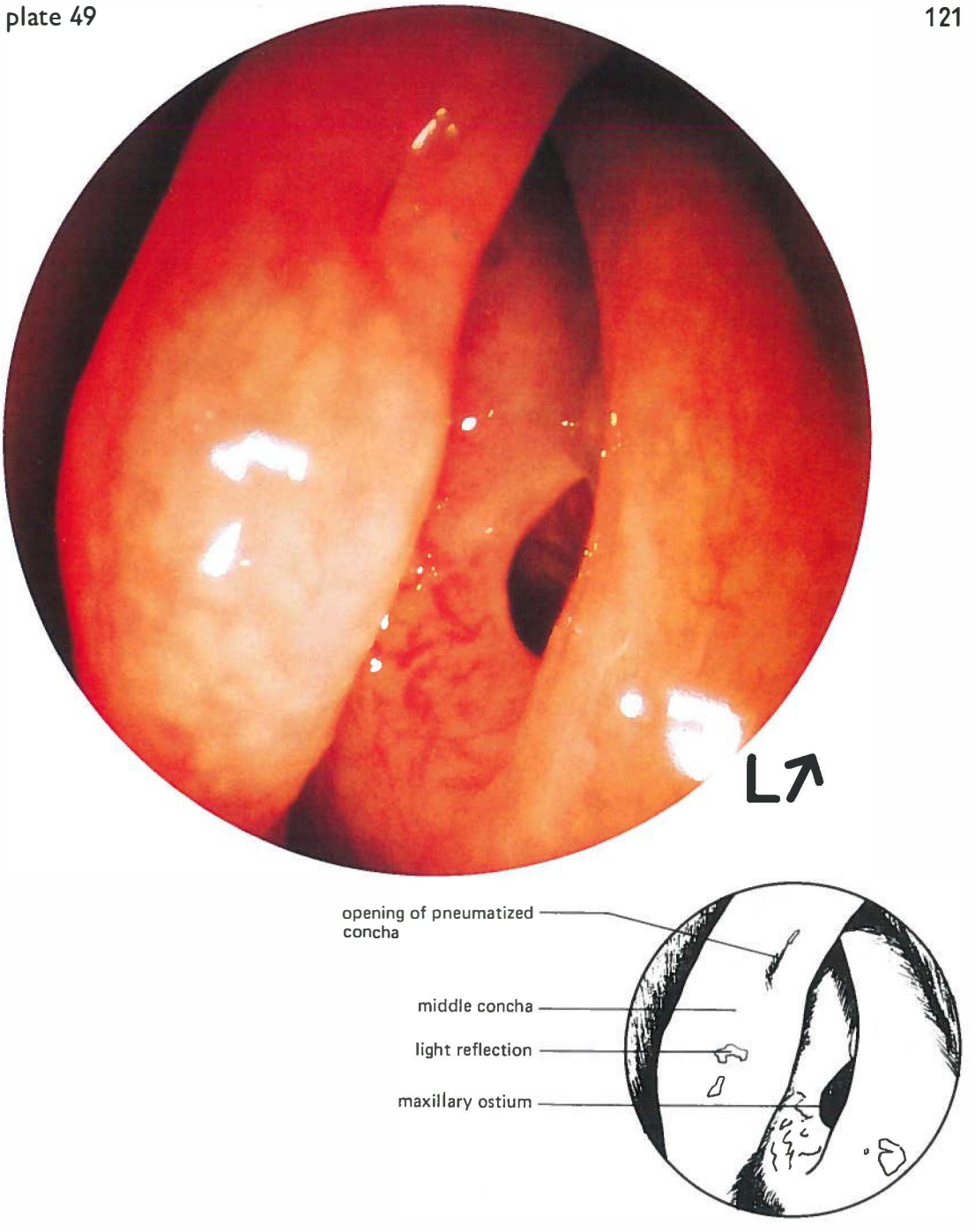
Patient A.d.G., female, aged 59. On this photograph a small part of the maxillary sinus can be seen through the maxillary ostium. Normal anatomy.





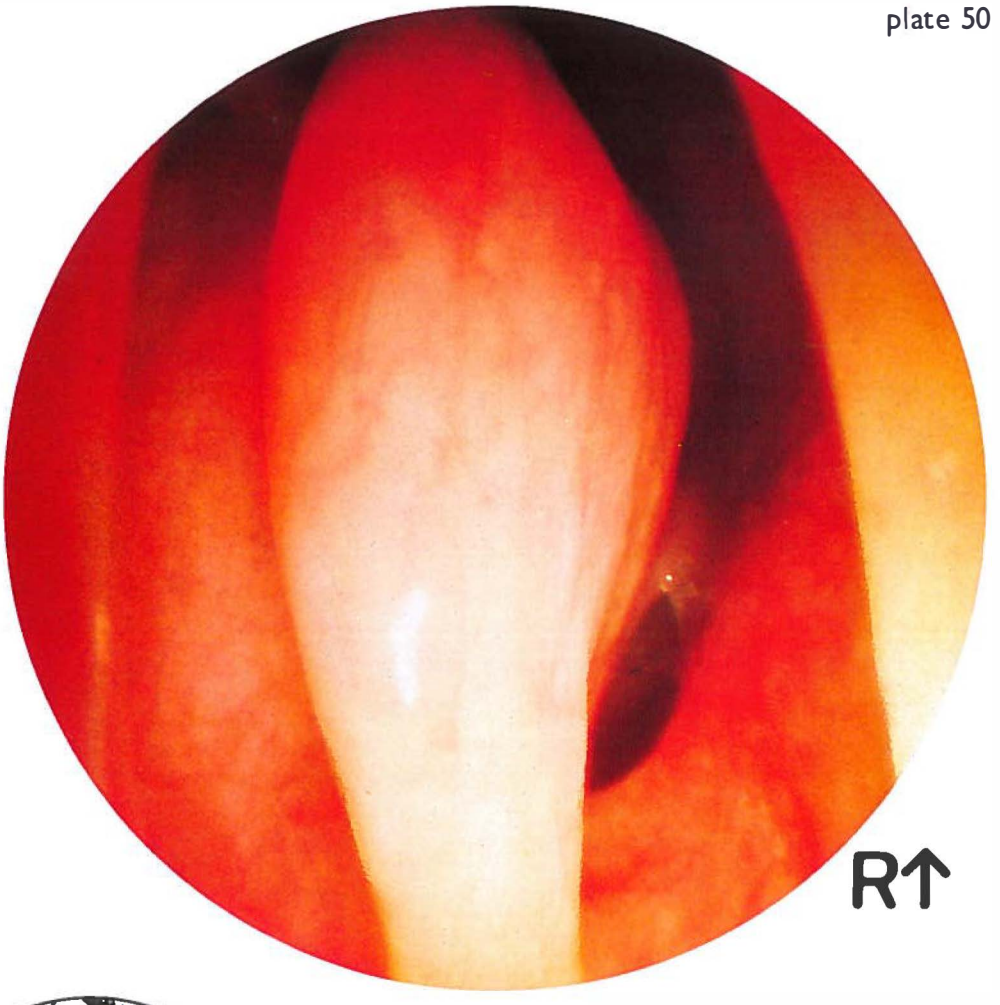
Right nasendoscopy: normal anatomy

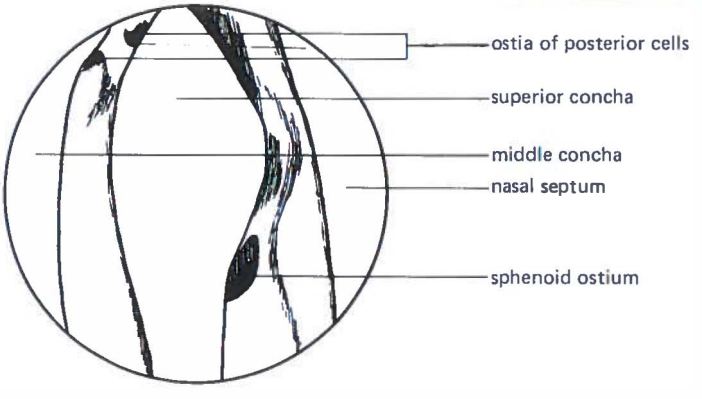
Patient B.K., male, aged 53, had had complaints resulting from chronic bronchitis and increasing emphysema for a long time. He was referred to the E.N.T.-department in connection with a possible infection of the upper airways. This was not the case. Nasendoscopy provided a good survey of the middle meatus.



Left nasendoscopy: opening of pneumatized middle concha

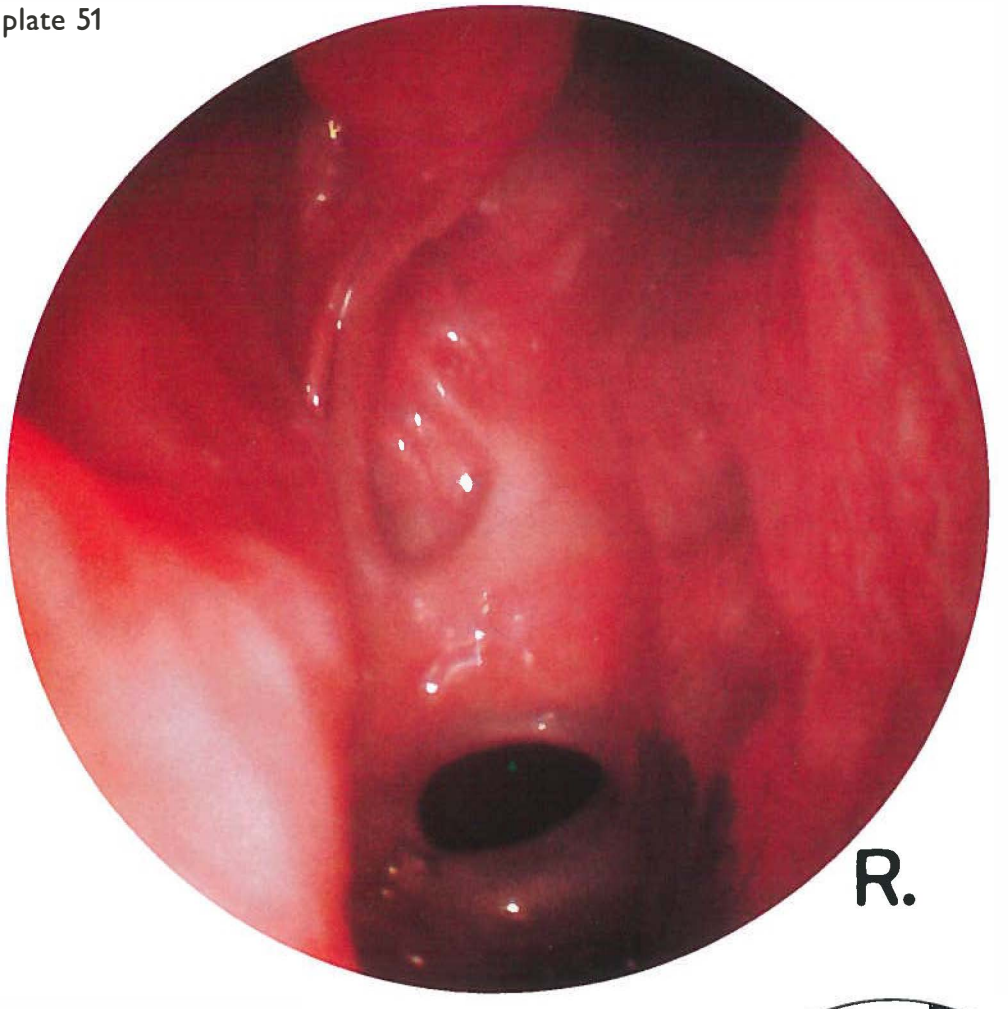
Patient K.D.-d.J., female, aged 58, had had complaints suggesting a chronic left sinusitis for many years. Nasendoscopy showed how secretion was transported through the maxillary ostium to the nose. Accidental finding: opening of pneumatized middle concha.

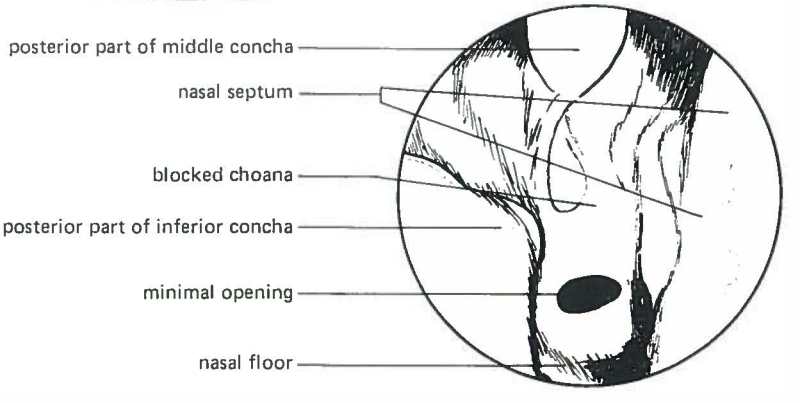




Right nasendoscopy: ostia of posterior ethmoidal cells and sphenoidal sinus

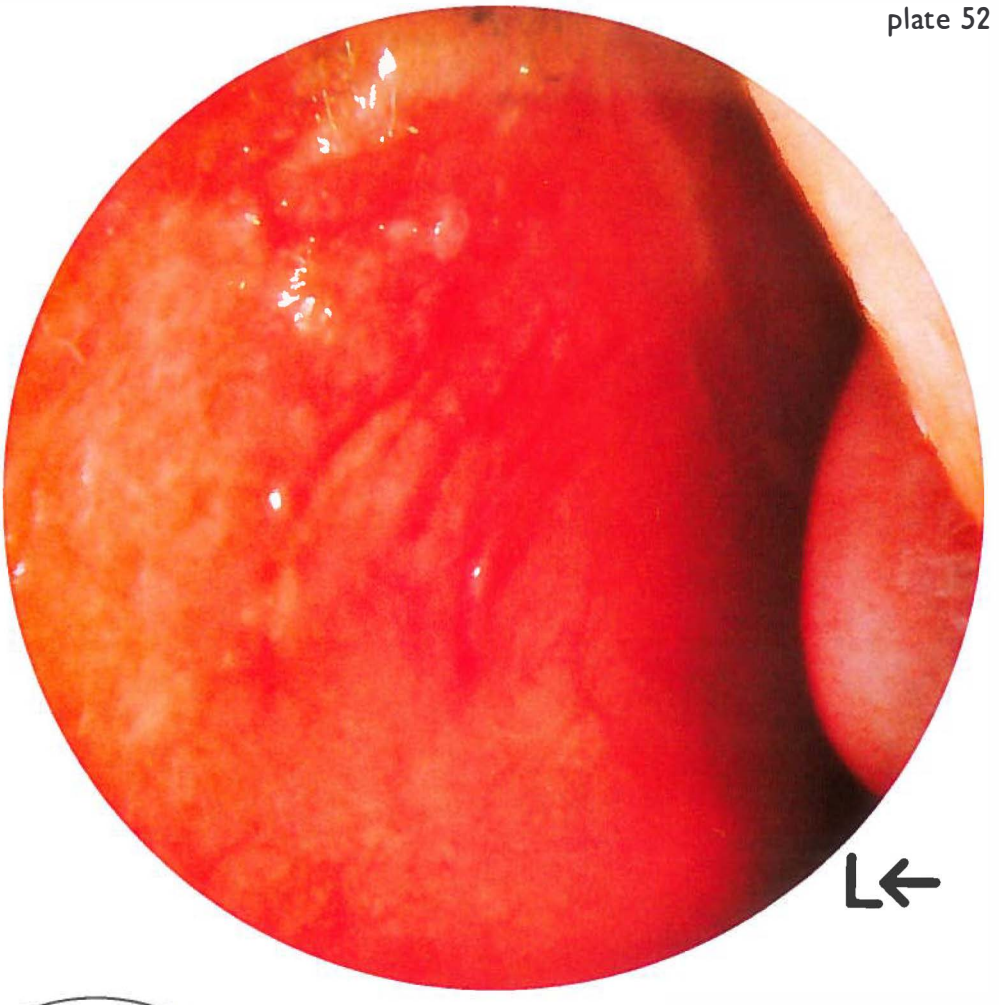
Patient A.d.G., female, aged 59 (same patient as on plate 47). Normal anatomy of the right superior meatus, posterior part. Medial to the middle concha the ostia of the posterior ethmoidal cells are situated, more dorsally, medial to the superior concha, the sphenoidal ostium.

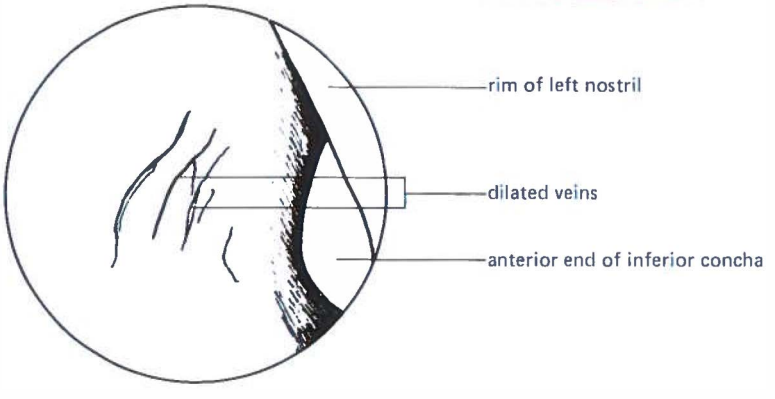




Right nasendoscopy: subtotal choanal atresia

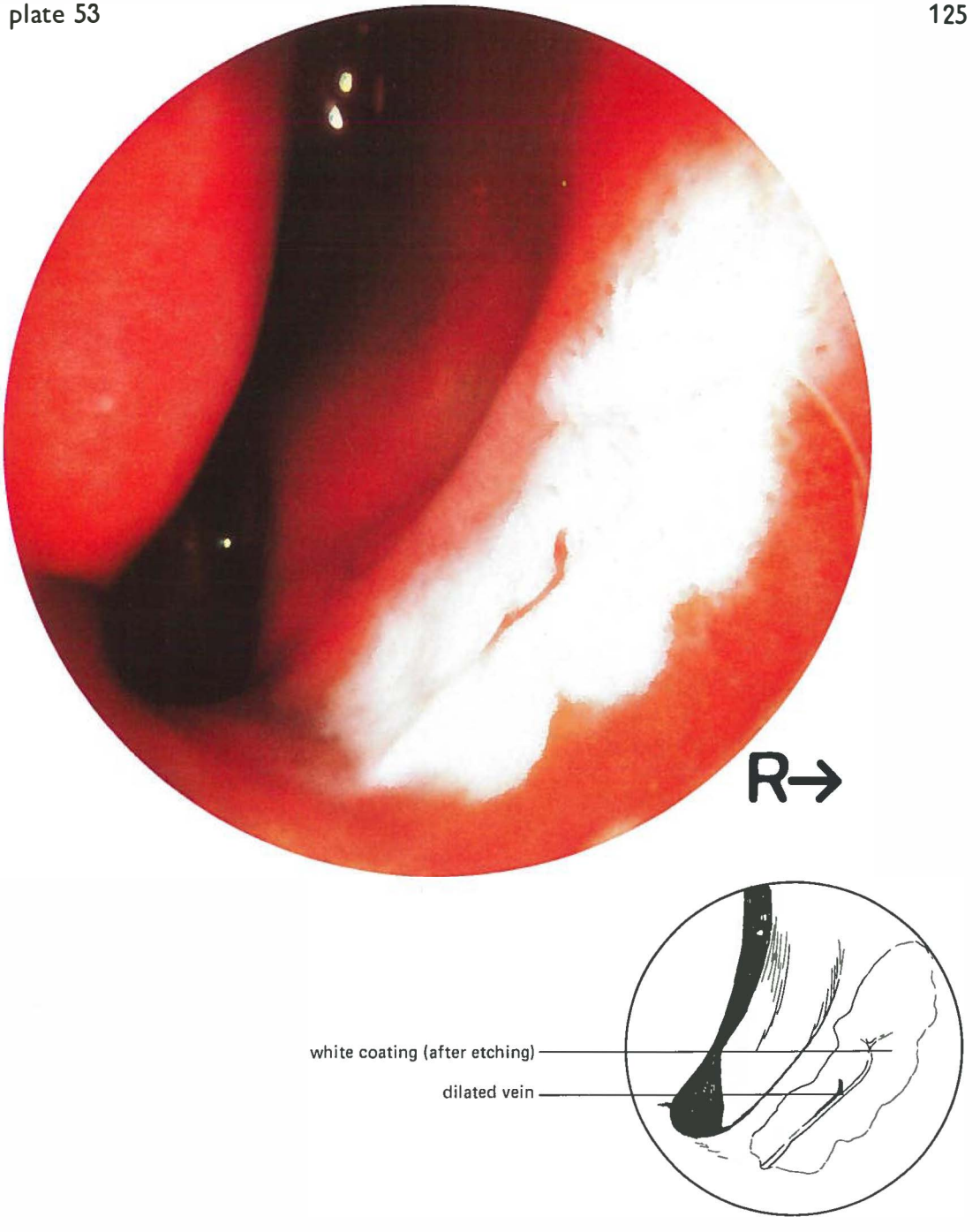
Patient H.B., female, aged 19 (same patient as on plate 15). A good view of the subtotal choanal atresia is also obtained by nasendoscopy. The secretion of the concomitant chronic rhinitis had been removed by suction.





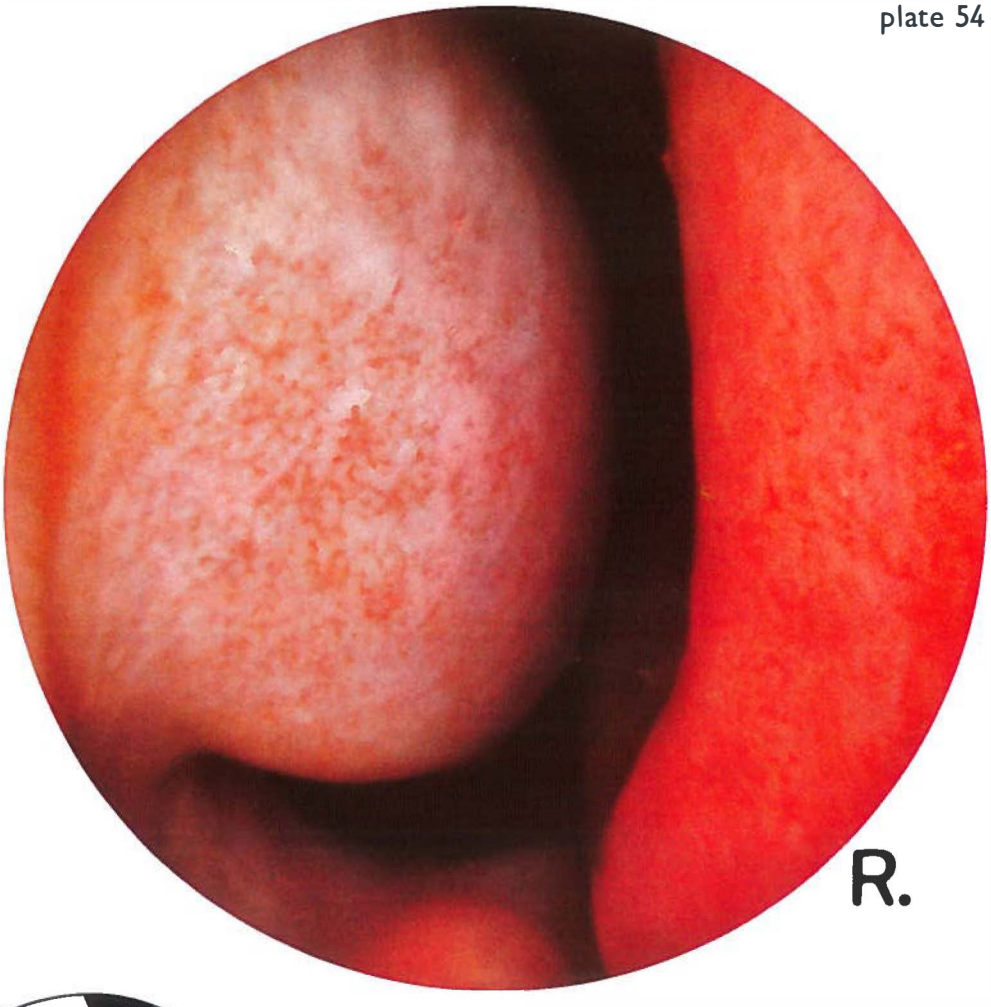
Left nasendoscopy: Kiesselbach's area

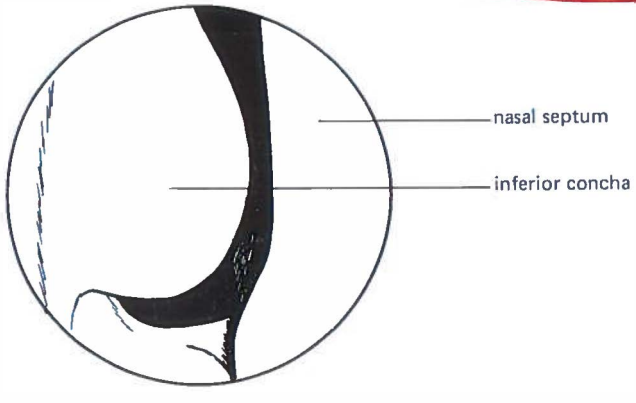
Patient H.H.T.d.H., boy, aged 6, had had three severe nose bleedings on the right side in the course of 2 weeks. In the left Kiesselbach's area there were a few dilated vessels, which did not require therapy.



Right nasendoscopy: etched Kiesselbach's area

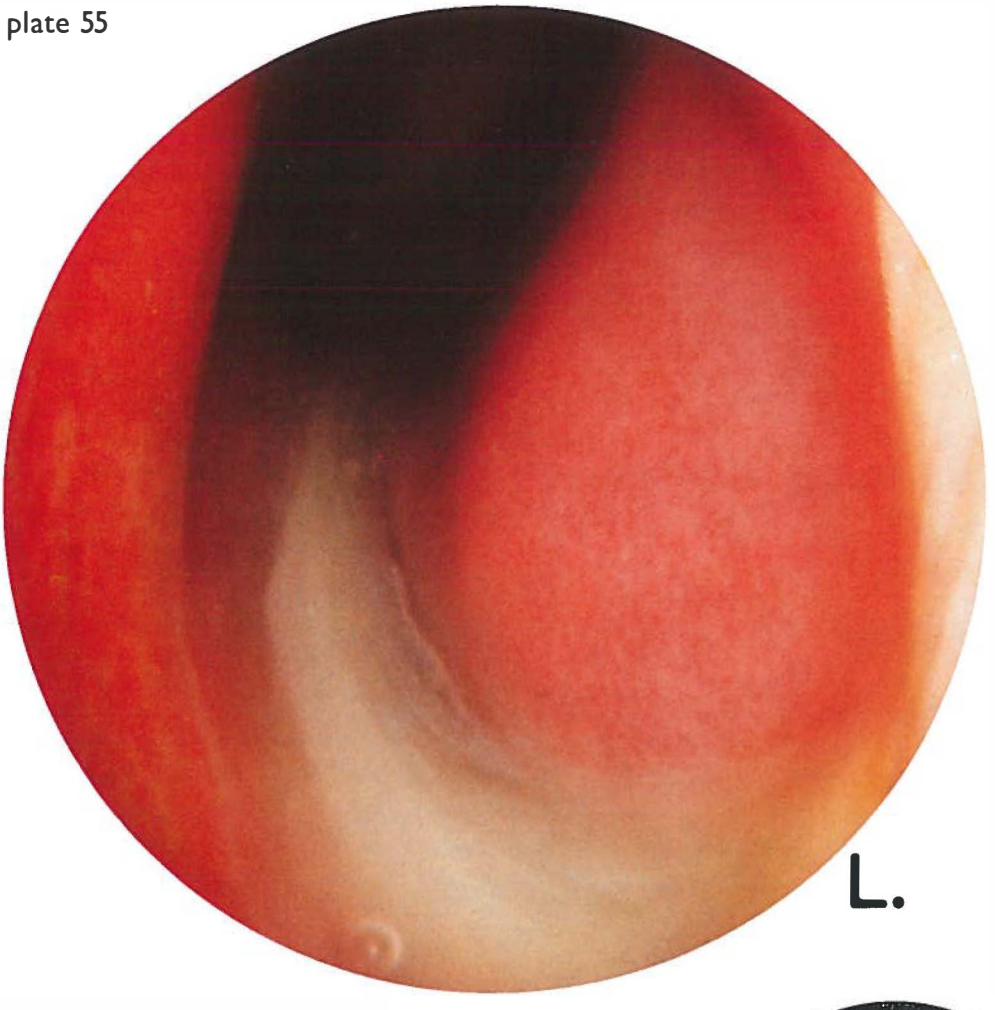
Same patient H.H.T.d.H., boy aged 6 (see plate 52). In the right Kiesselbach's area there was a clearly dilated, vulnerable vessel, which had caused the bleedings. This vessel was etched with trichloroacetic acid, after which there were no more nose bleedings.

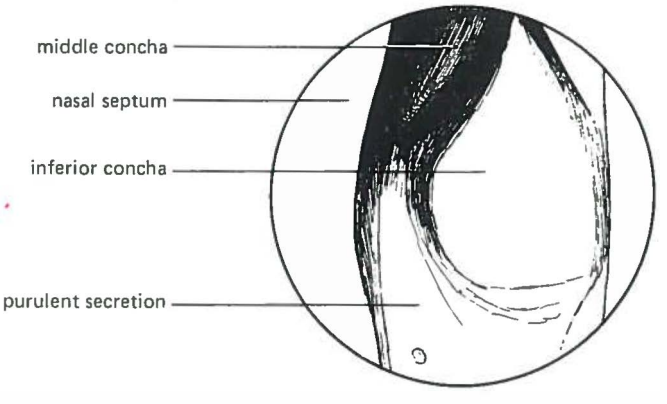




Right nosendoscopy: congestive inferior concha

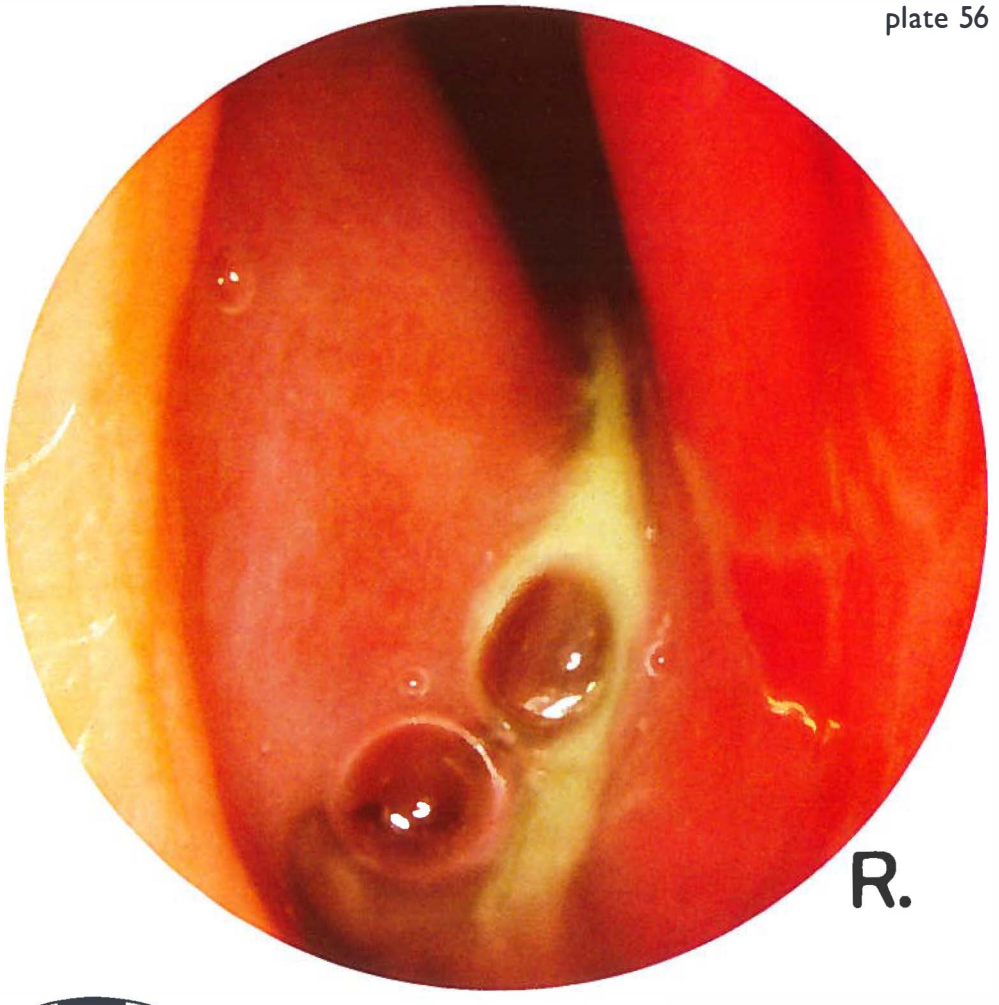
Patient L.B. B., female, aged 22, had an allergic rhinitis, caused by hypersensitivity to house dust, moulds and hay dust. Nasendoscopy showed the characteristic picture of a livid and swollen inferior concha. The patient underwent desensitization and was free of complaints after 3 years.

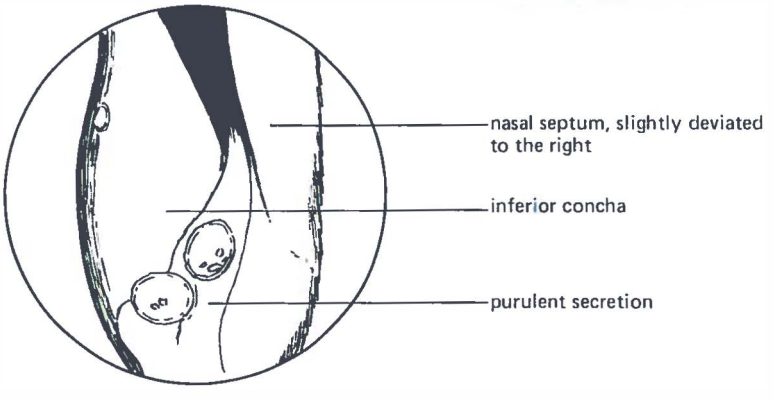




Left nasendoscopy: purulent rhinitis

Patient H.v.d.M., boy, aged 7, had a chronic purulent rhinitis. In sleep he continuously breathed through his mouth. He had frequently had a tonsillitis. After adenotonsillectomy there were no more complaints.

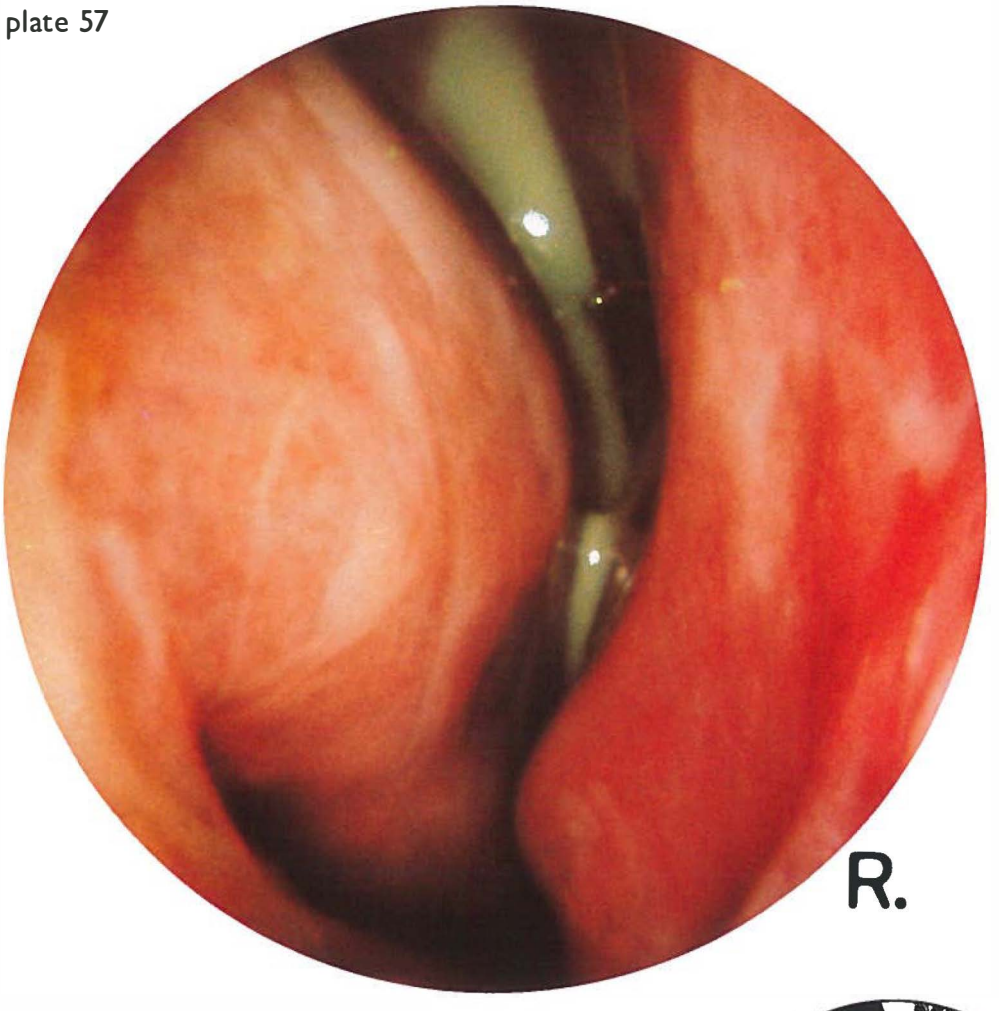


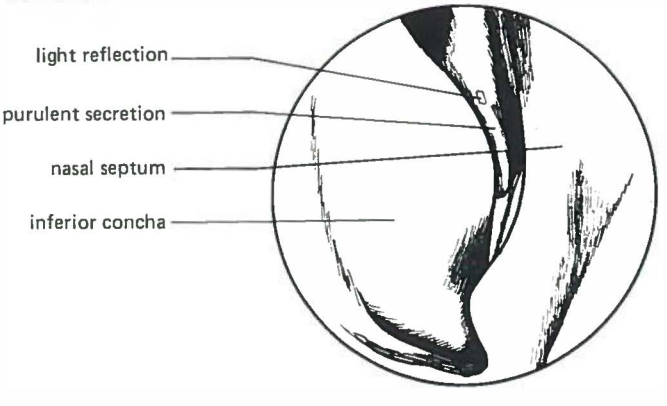


Right nasendoscopy: purulent rhinitis

Same patient H.v.d.M., boy, aged 7 (see plate 55).

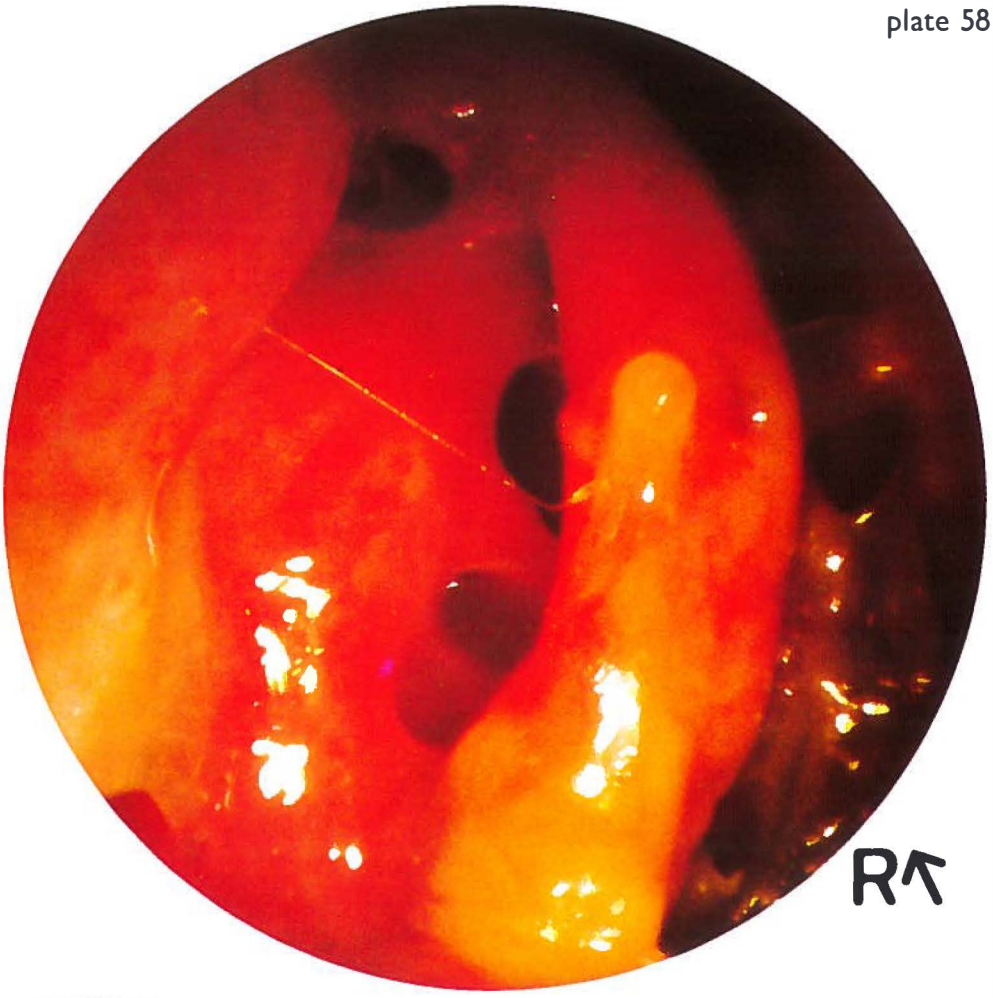
In the right inferior meatus there was also purulent secretion. Also compare plate 57.

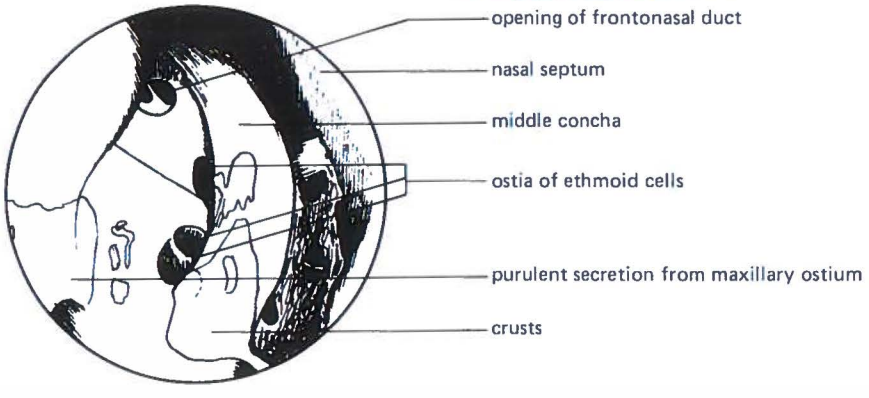




Right nosendoscopy: purulent secretion in the middle meotus

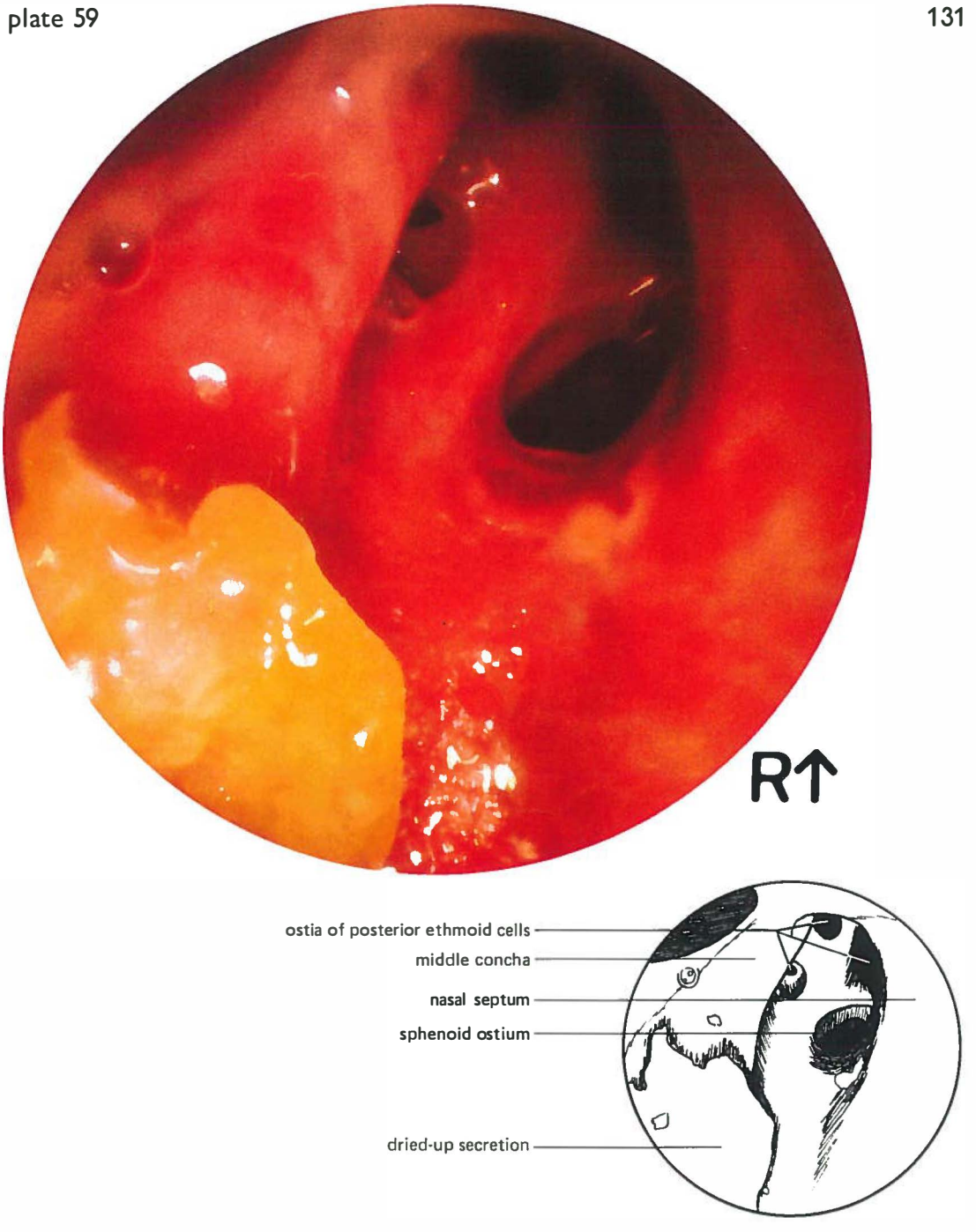
Patient N.N., female, aged 30, suffering from a maxillary sinusitis. Unlike rhinitis, sinusitis gives rise to secretion in the middle meatus. The inferior meatus is clean.





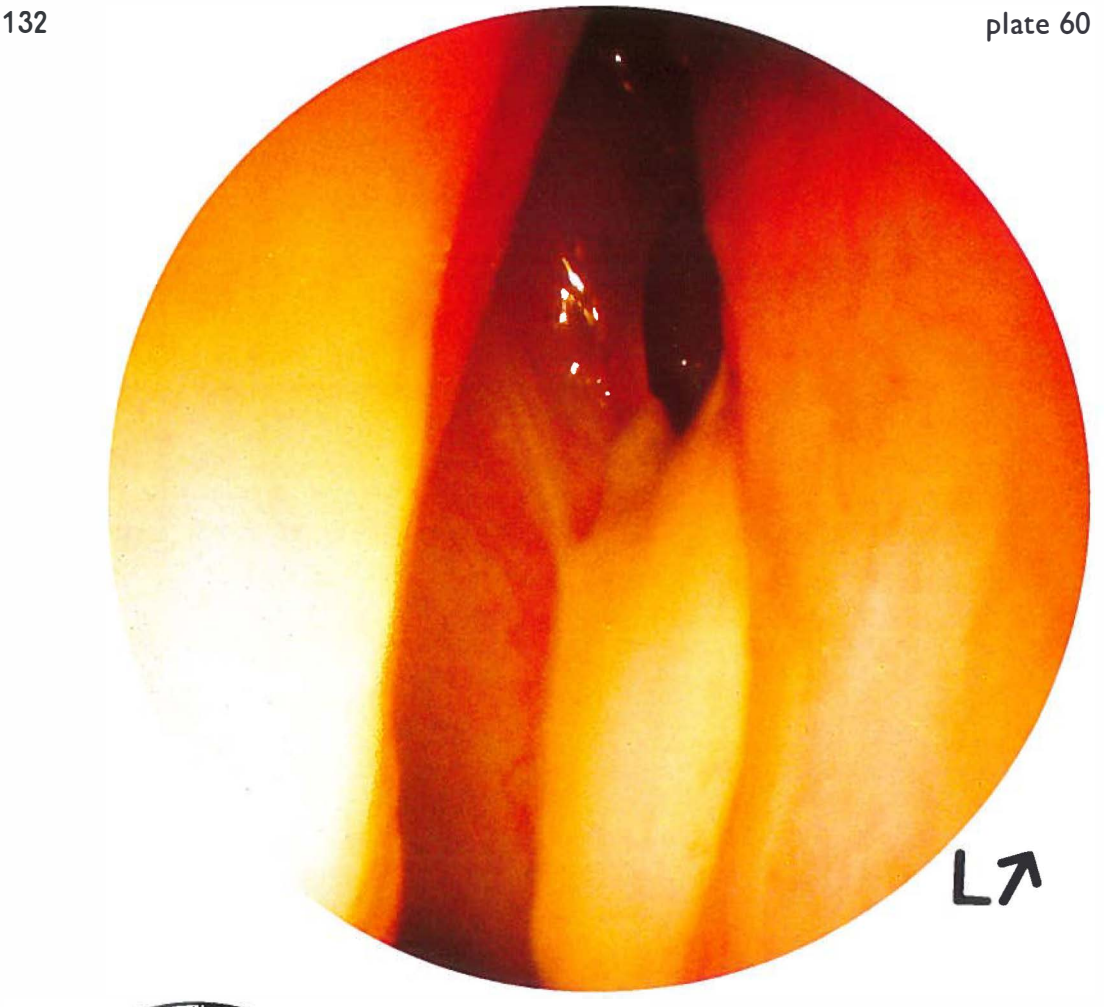
Right nasendascapy: atraphic rhinitis

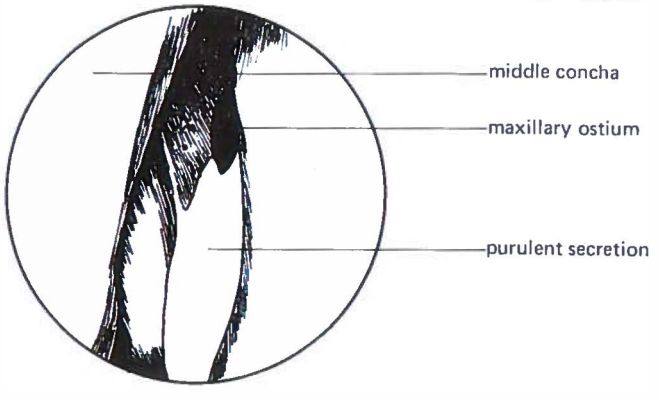
Patient G.T., male, aged 62, had been complaining for many years of crusts of dried-up secretion in the nose, and of giving out a foul smell when breathing through the nose. When nasendoscopy is carried out on patients suffering from (fetid) atrophic rhinitis (ozena) a good view is usually obtained owing to the wide nasal cavities.



Right nasendascopy: atrophic rhinitis

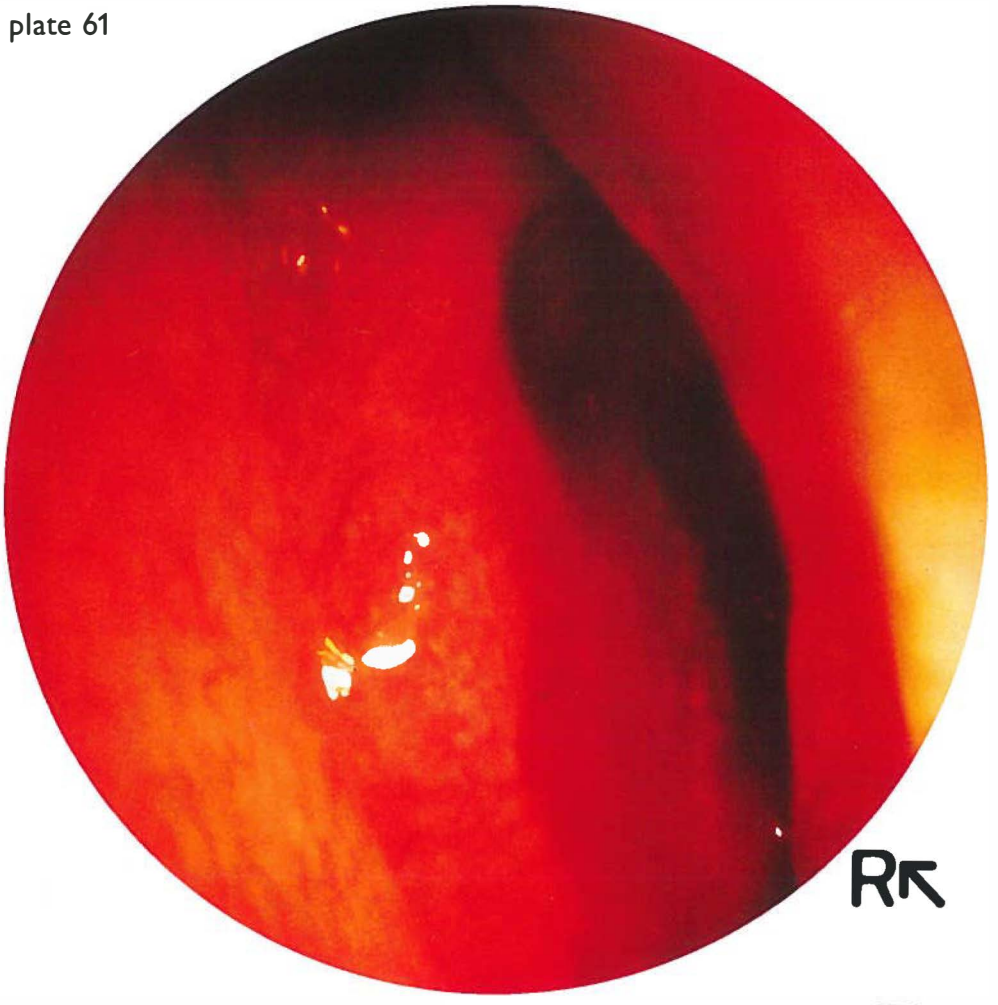
Same patient G.T., male, aged 62 (see plate 58). More backward in the nose the atrophy of the nasal mucosa facilitates a good survey too. There is no superior concha to be seen.





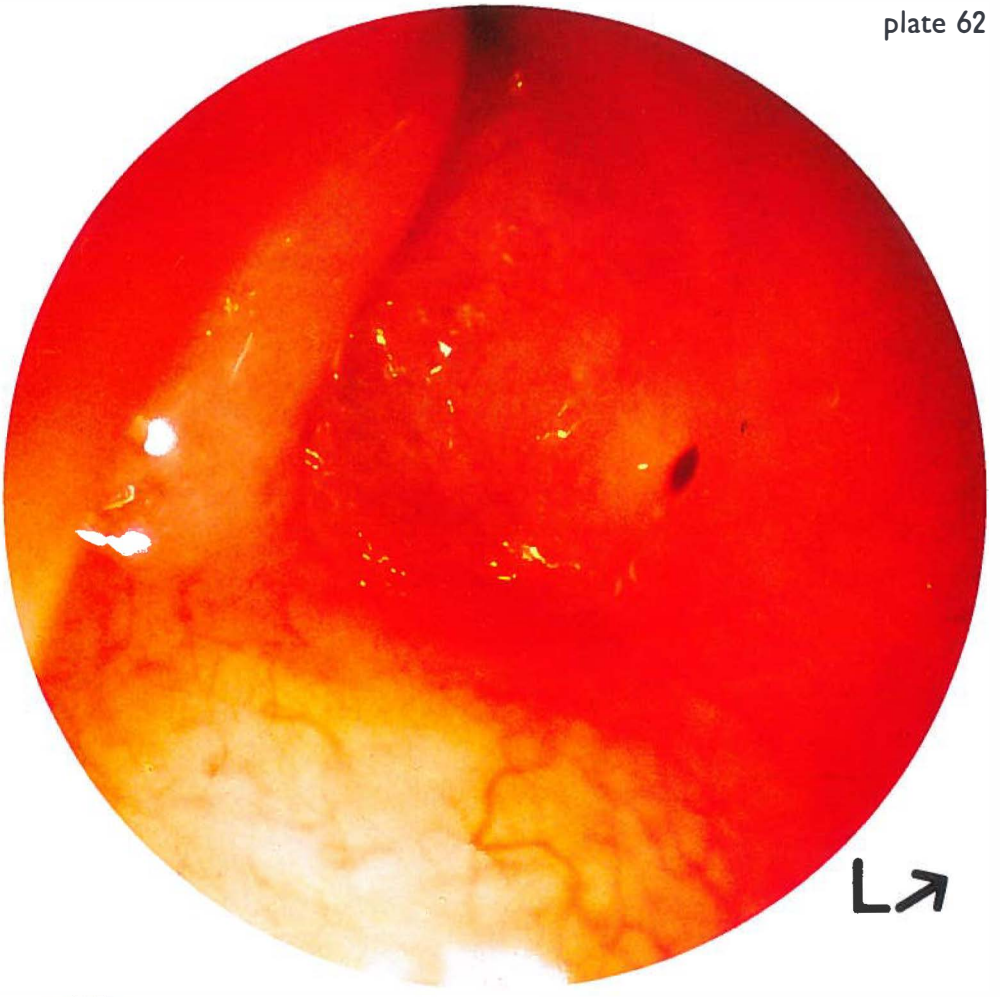
Left nasendascopy: purulent secretion from the maxillary ostium

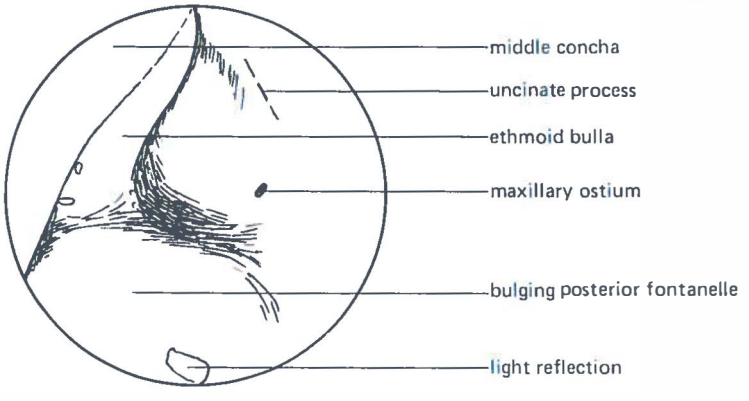
Patient A.B., female, aged 64, had a chronic maxillary sinusitis on the left side. When nasendoscopy was carried out it was possible to see the maxillary ostium emitting purulent secretion (see also plate 101).



Right nasendoscopy: blood from the maxillary ostium

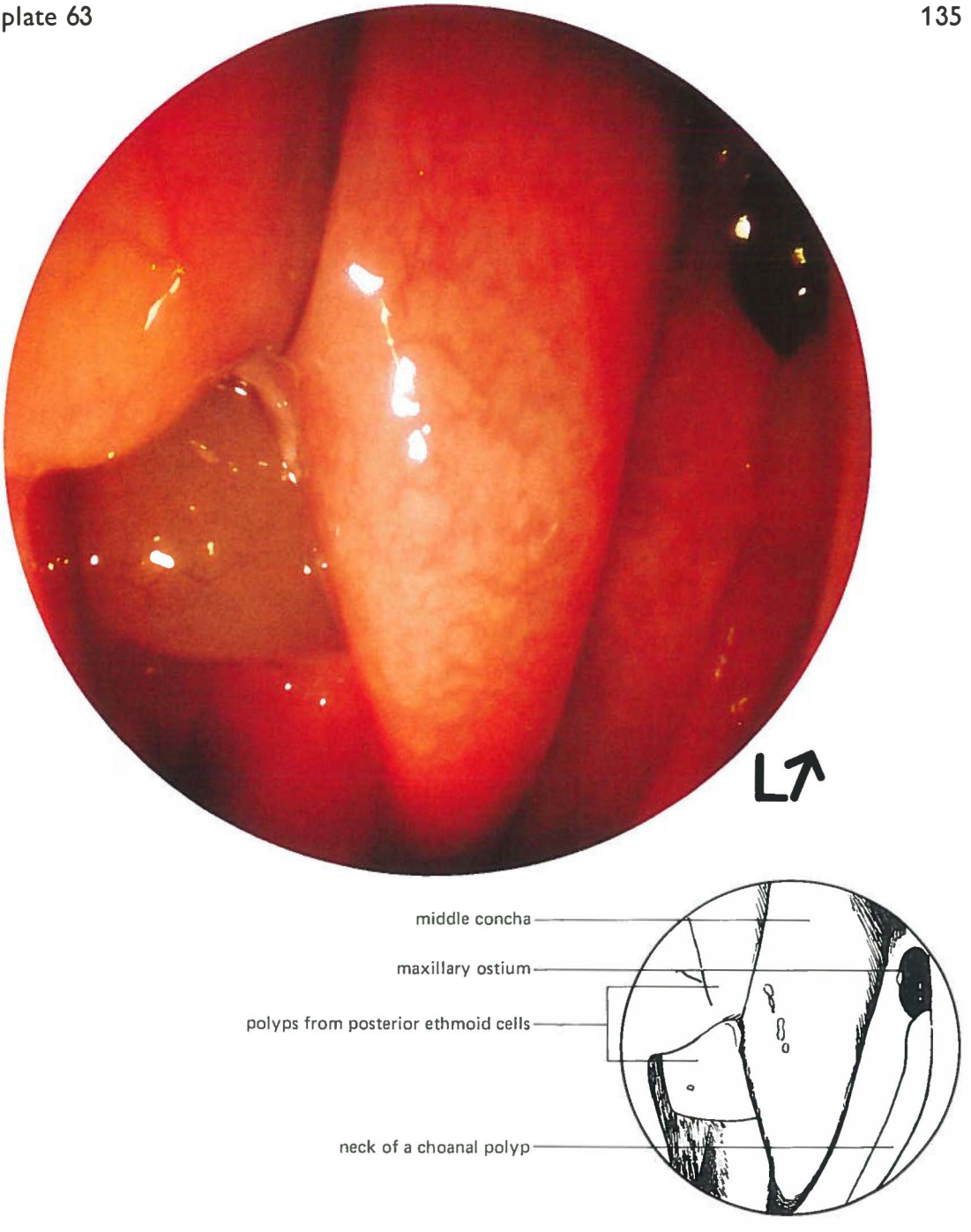
Patient C.P., male, aged 59, underwent antroscopy on account of a shadow, caudally in the right maxillary sinus on the X-ray photograph. Antroscopy showed no disease in the right maxillary sinus. Nasendoscopy subsequently carried out gave a good picture of blood (caused by the puncture) being transported out of the maxillary sinus.





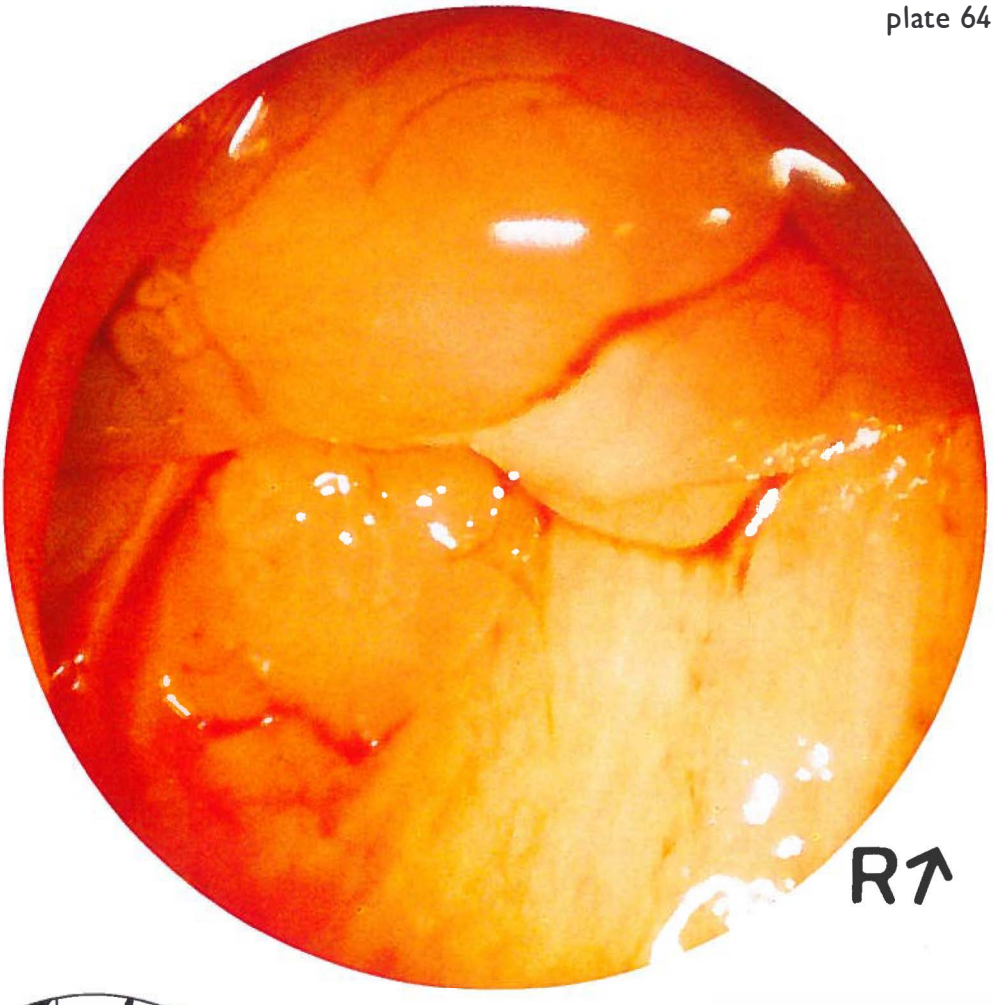
Left nasendoscopy: narrowed maxillary ostium

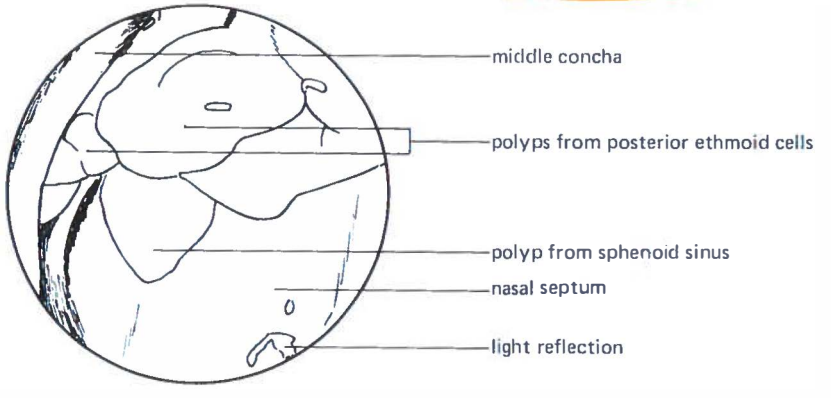
Patient J.R.S., male, aged 19, was suffering from a chronic left maxillary sinusitis. Nasendoscopy showed corresponding symptoms: hyperaemia of the nasal mucosa, a strongly narrowed maxillary ostium, and a bulging posterior fontanelle. The sinusitis responded favourably to conservative therapy.



Left nasendoscopy: nasal polypi

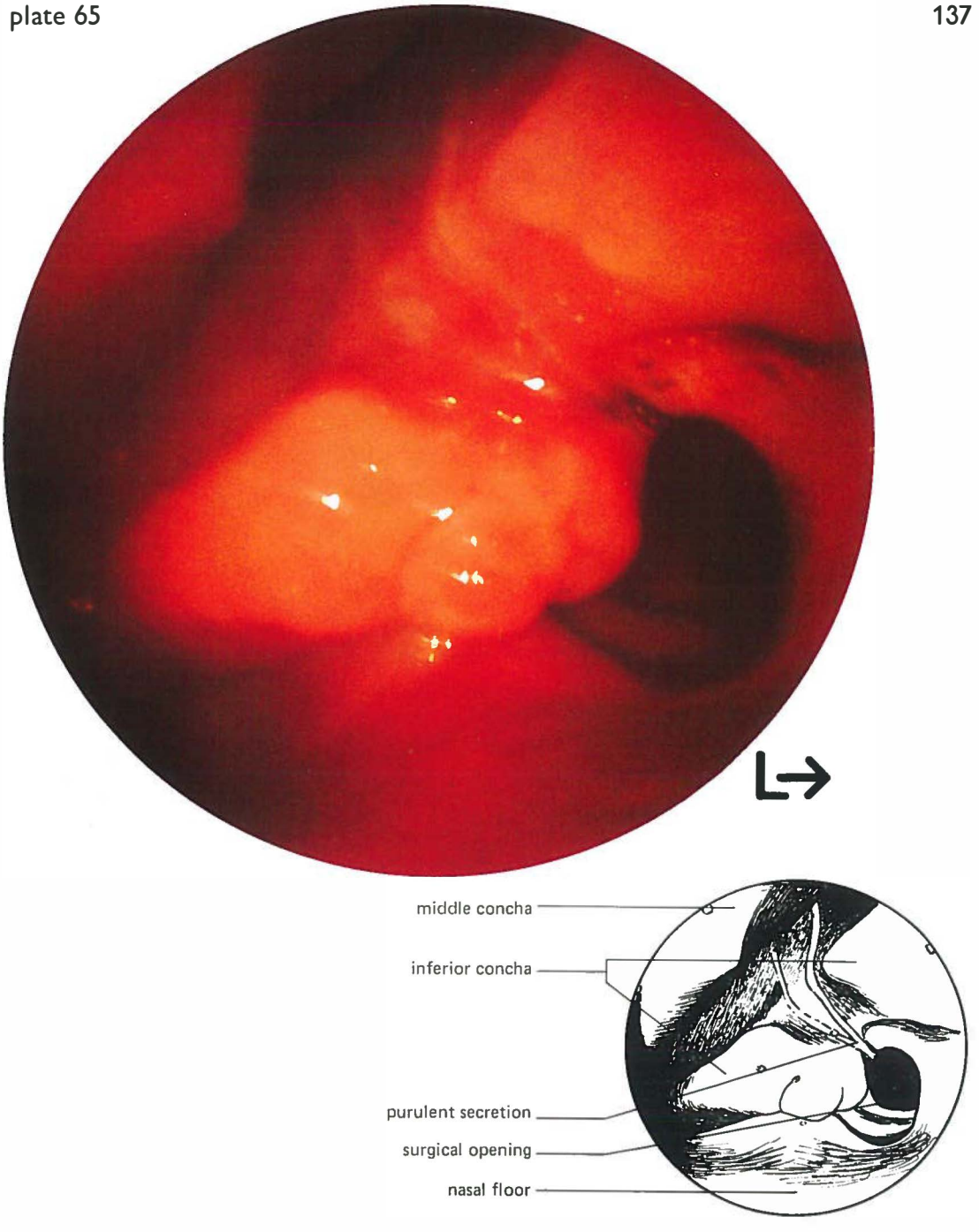
Patient P.d.V., male, aged 43, complained of nasal obstruction on the left side. Nasendoscopy showed nasal polypi at the back of the left nasal cavity. There also turned out to be a nasal polyp whose neck appeared from the maxillary ostium. After the polyps had been removed the patient was free of complaints. A histological examination of the polyps showed no signs of malignancy.





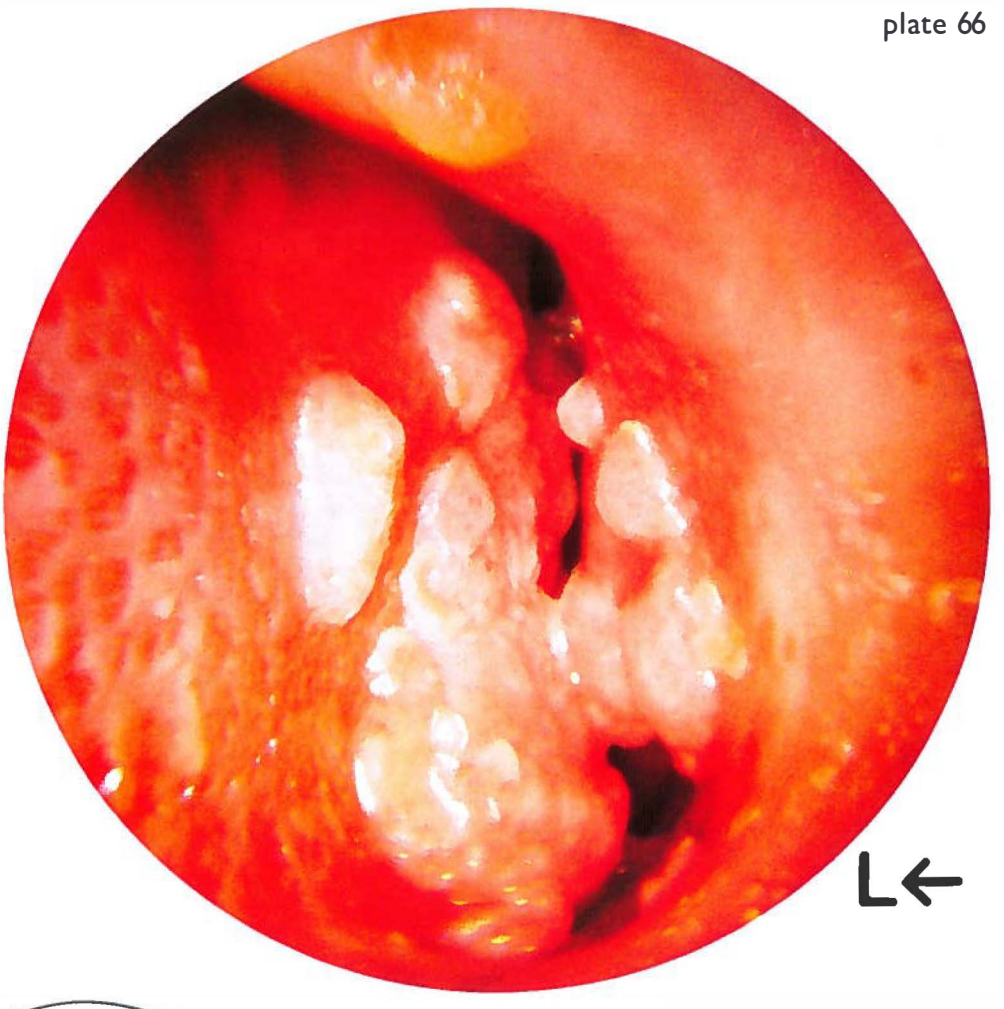
Right nasendoscopy: nasal polypi

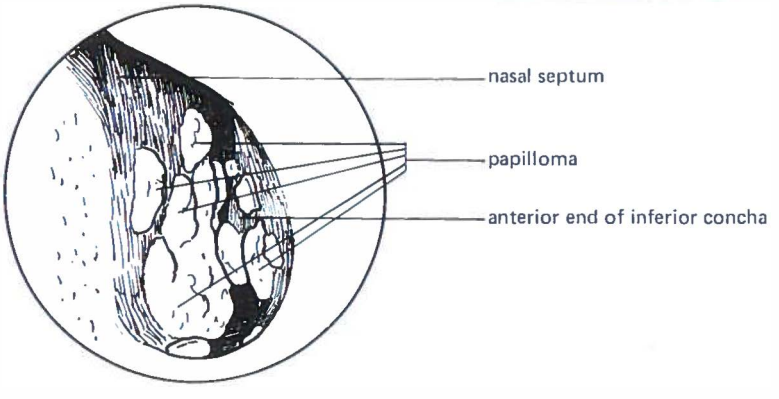
Patient J.B., male, aged 38, had for years been suffering from headaches, prolonged nasal secretions, and chronic bronchitis. The X-ray photographs showed an opacity of the right ethmoid region and the right maxillary sinus. Right antroscopy demonstrated polypoid mucosa and many cysts. Right nasendoscopy revealed polyps at the back of the nose.



Left nasendoscopy: Caldwell–Luc antrostomy

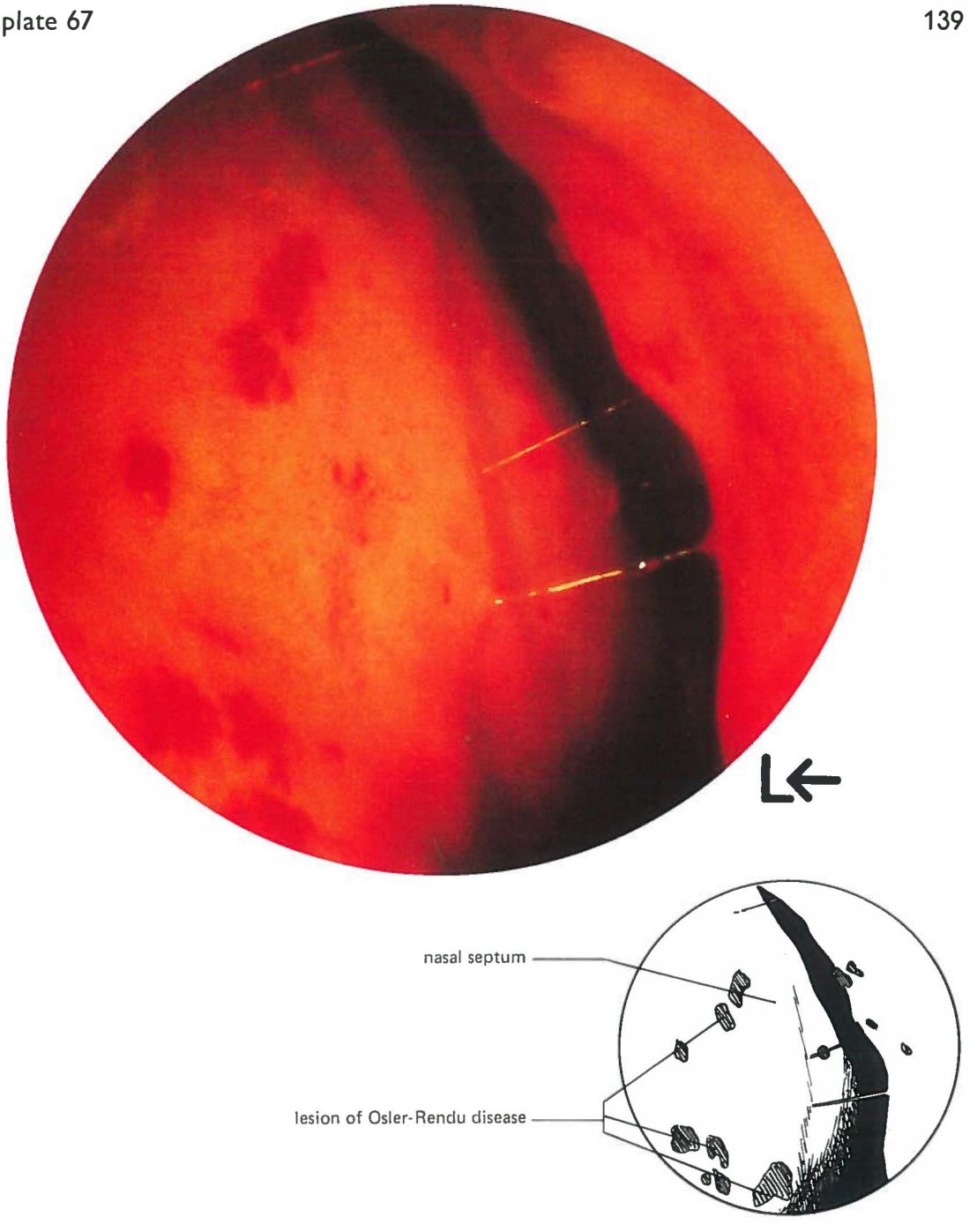
Patient J.d.V., female, aged 69, underwent an operation after Caldwell–Luc 28 years previously. She consulted the E.N.T.-department again on account of ear-ache on the left side, which proved to be caused by under-pressure in the left middle ear. Nasendoscopy revealed purulent secretion emerging from the old antrostomy. The complaints disappeared after she had used anti-biotics and nosedrops.





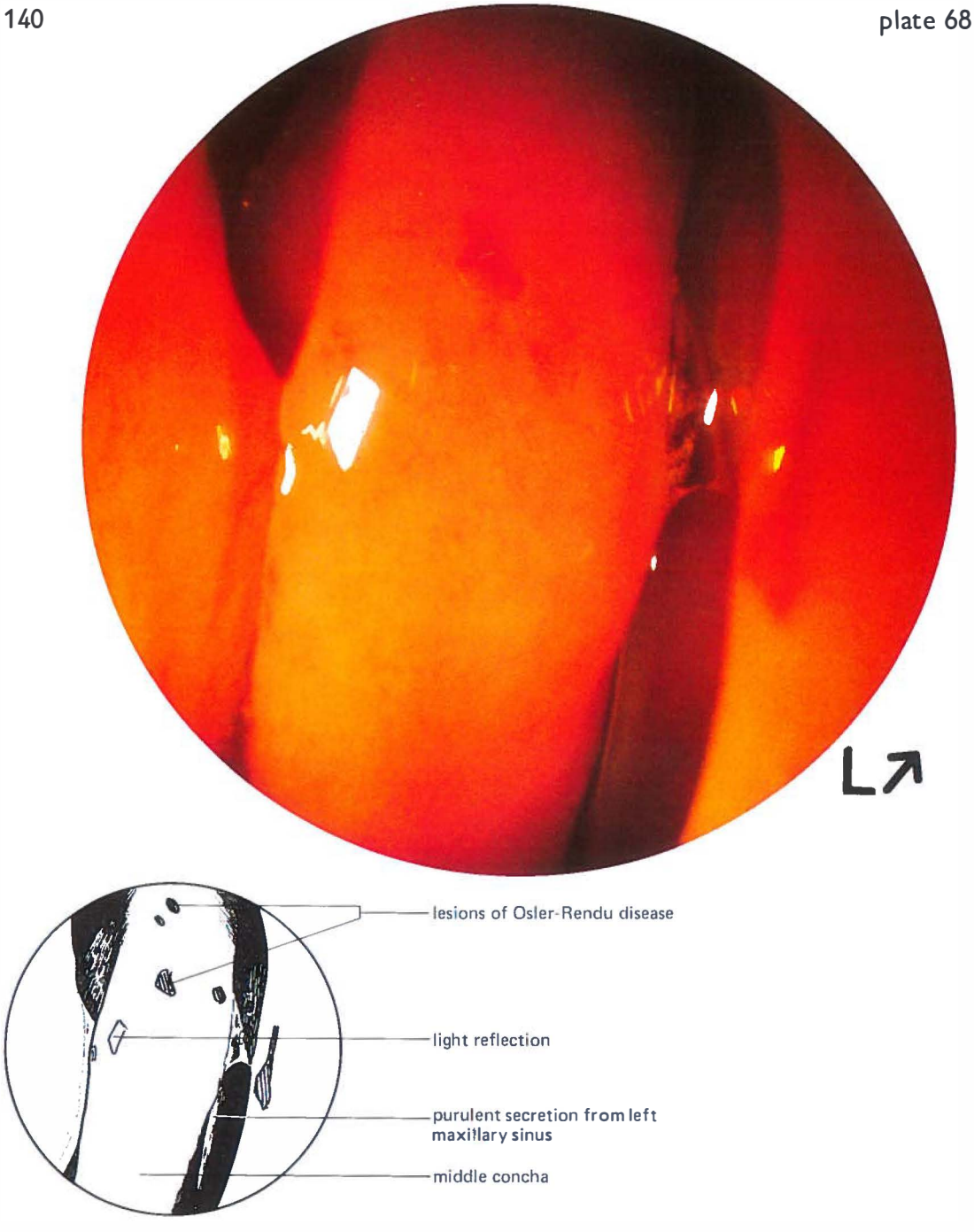
Left nasendoscopy: papillomatosis

Patient J.A.K., male, aged 50, had been increasingly suffering from nose bleedings on the left side for the last eighteen months. Anteriorly in the left nasal cavity there were soft tissue swellings, both on the anterior part of the inferior concha and on the nasal septum. Biopsy: inverted papilloma. Two years after surgical removal there were no signs of recurrence.



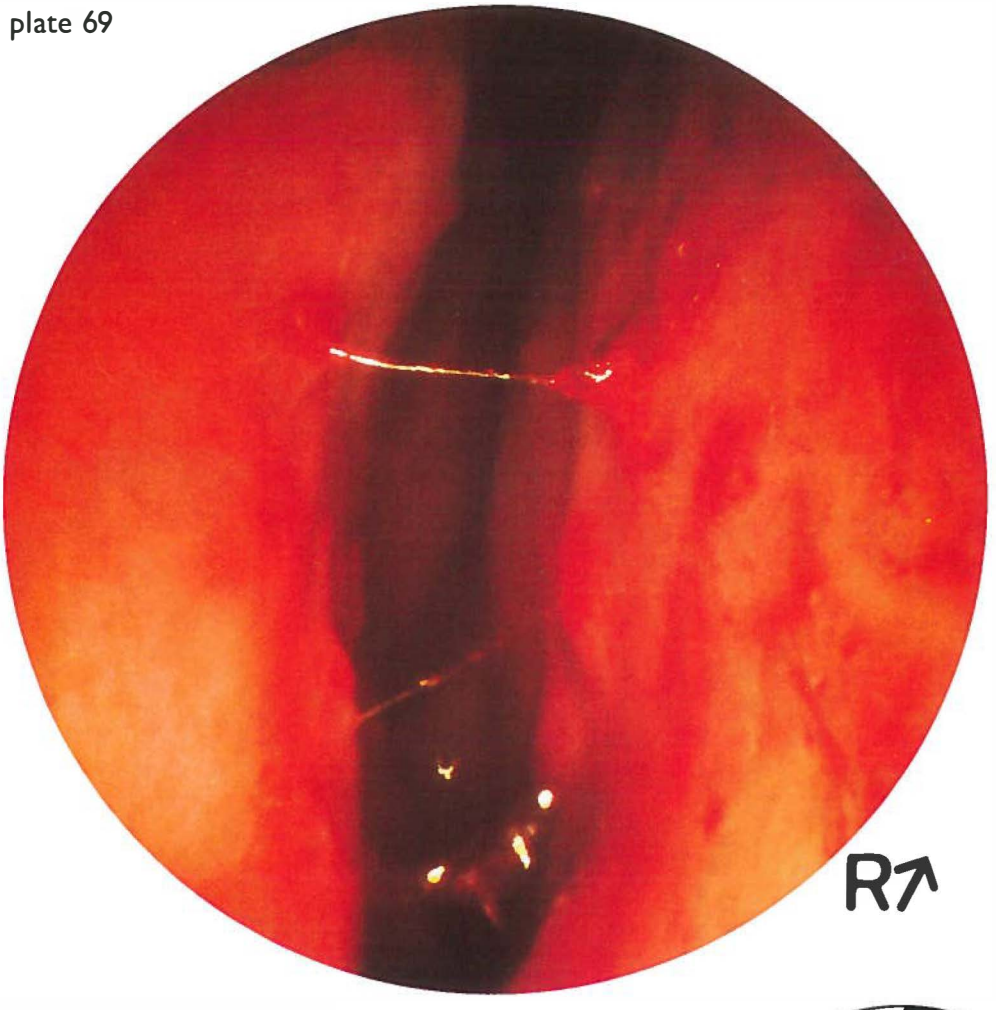
Left nasendoscopy. Osler–Rendu–Parkes–Weber disease (hereditary hemorrhagic telangiectasis)

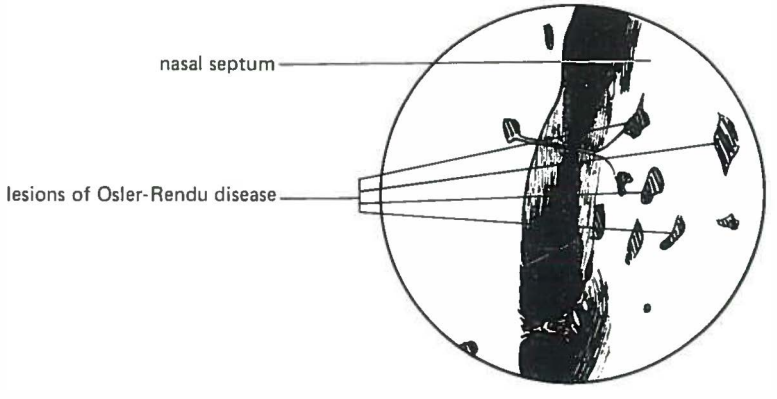
Patient J.H.d.J.-O., female, aged 26, had from early childhood suffered from frequent nose bleedings, which had become more serious during the last four years. There were cases of Osler–Rendu disease in the family (father, brother). In the left nasal cavity characteristic lesions of the Osler–Rendu disease were present both on the nasal septum and on the inferior concha. See also plates 68, 69 and 70.



Left nasendoscopy: Osler–Rendu disease, maxillary sinusitis

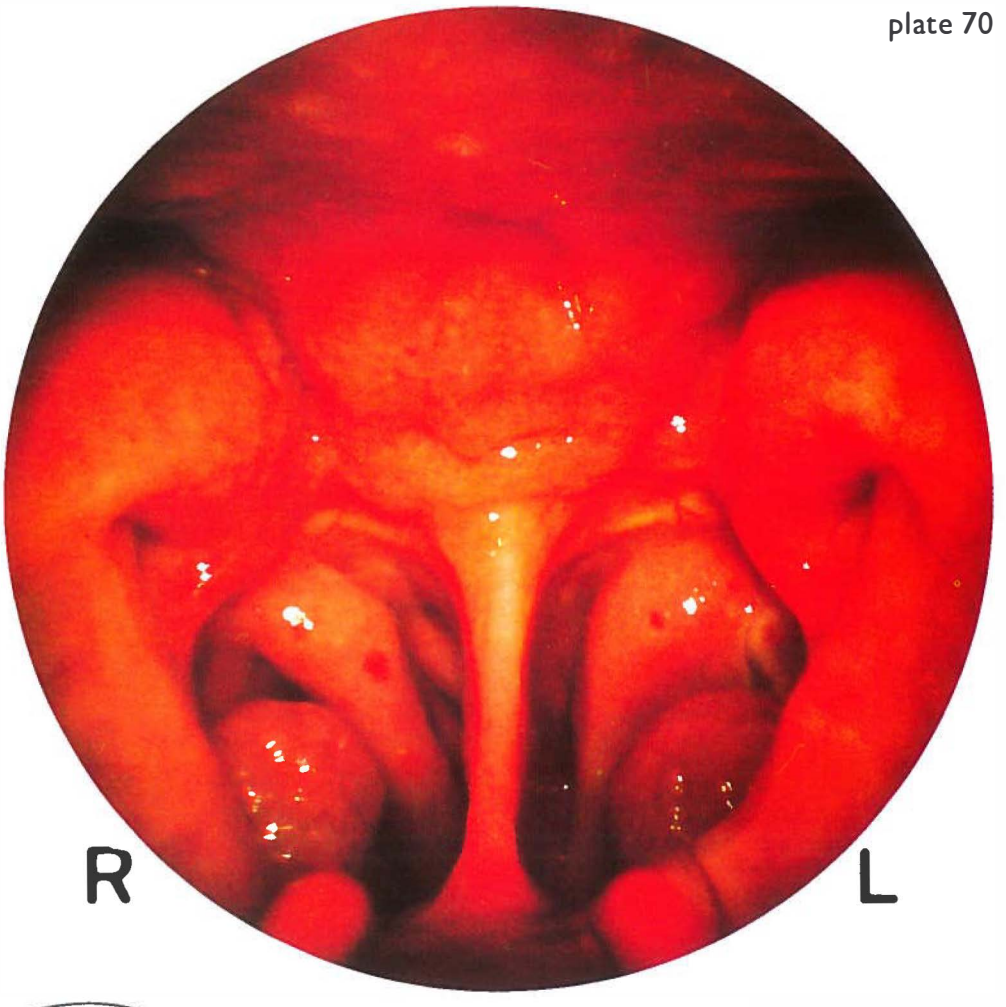
Same patient J.H.d.J.-O., female, aged 26 (see plate 67). Besides, the patient had had frequent periods of nasal secretion, headaches and nasal obstruction during the last four years. These latter complaints appeared to be due to a chronic maxillary sinusitis on the left side, which was cured with conservative treatment. Nasendoscopy demonstrated purulent secretion emerging from the left maxillary ostium.

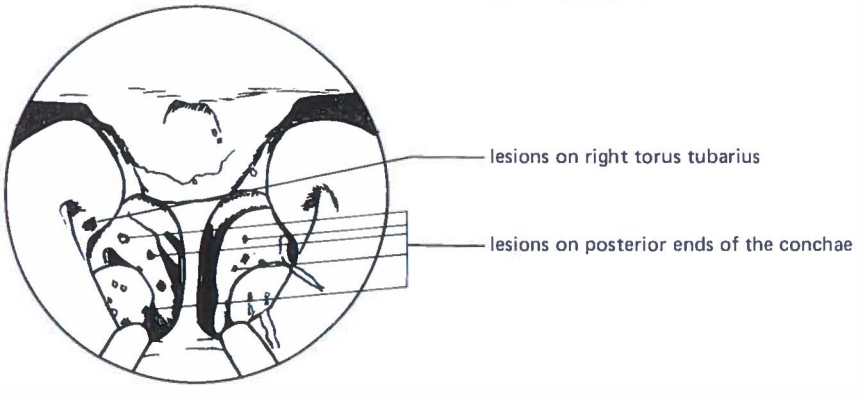




Right nasendoscopy: Osler–Rendu disease

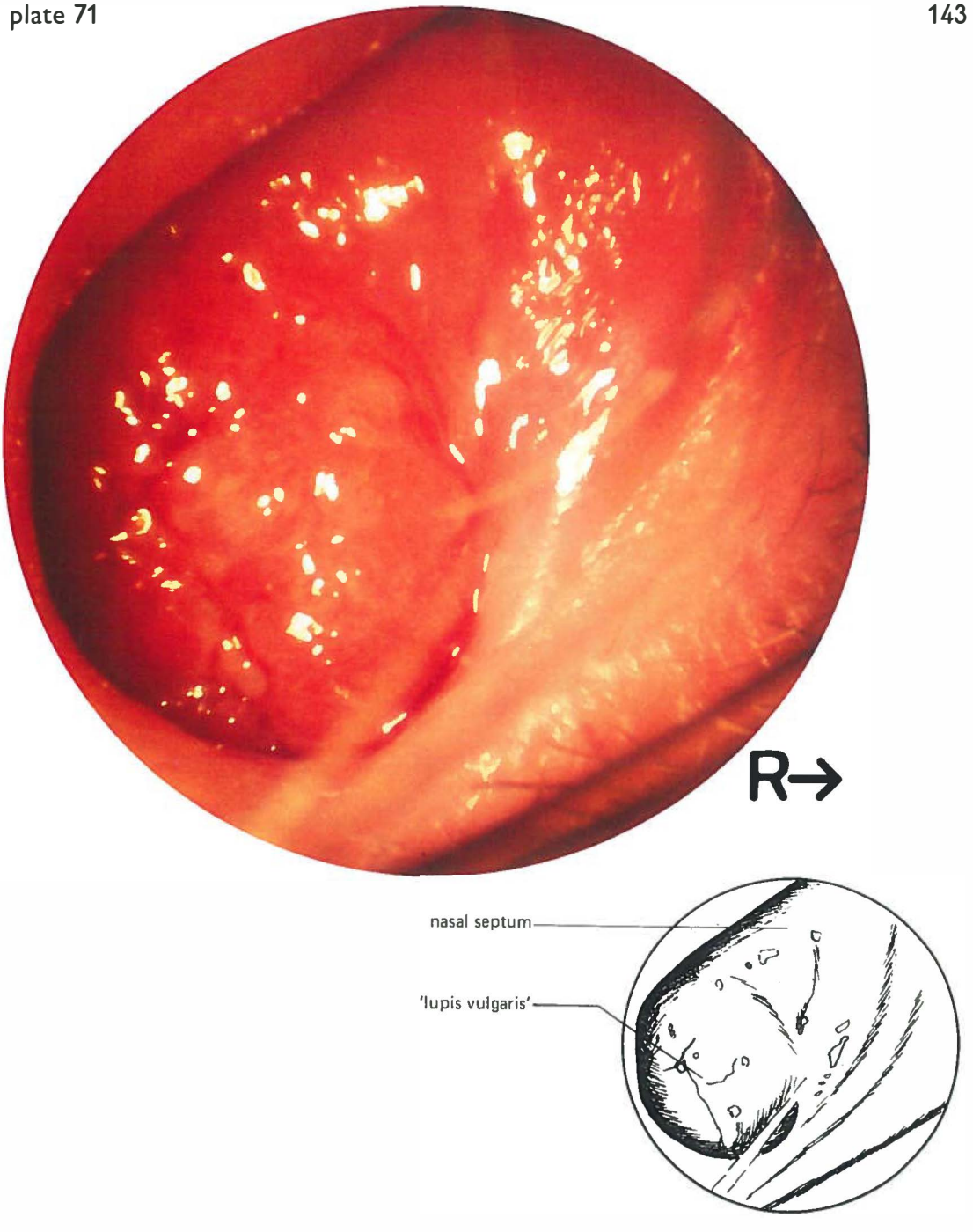
Same patient J.H.d.J.-O., female, aged 26 (see plates 67 and 68). In the right nasal cavity, too, there were many telangiectatic spots. On both sides the lesions on the nasal septum seemed the most active.





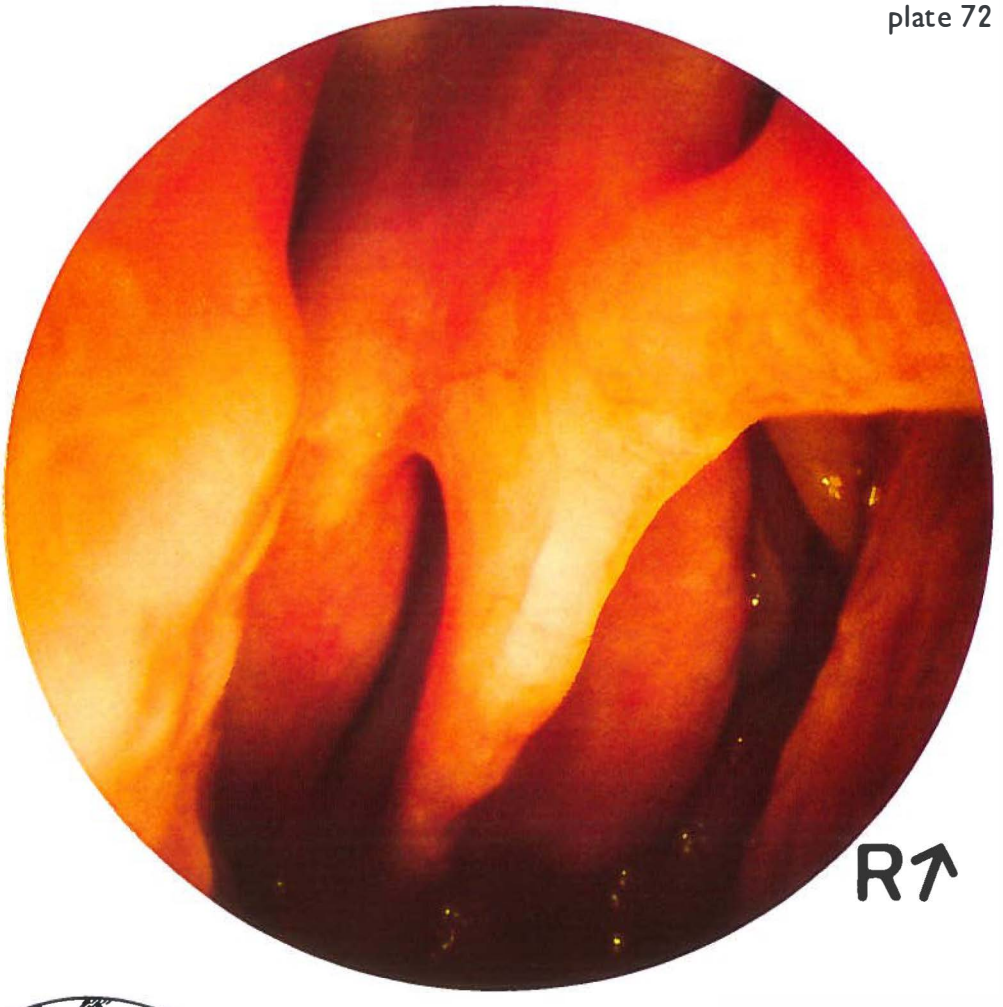
Nasophoryngoscopy: Osler–Rendu disease

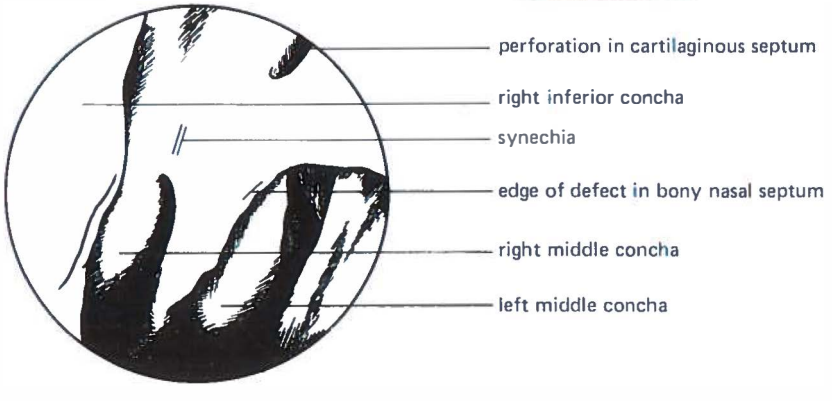
Same patient J.H.d.J.-O., female, aged 26 (see also plates 67, 68 and 69). Nasopharyngoscopy showed that there were lesions as far as the back of the nose, and even on the right torus tubarius. Here, too, purulent secretions, coming from the left middle meatus, could be seen (cf. plate 68). Only a moderate success was obtained by a free skin graft on the nasal septum (after Saunders) on both sides.



Right nasendoscopy: 'lupis vulgaris'

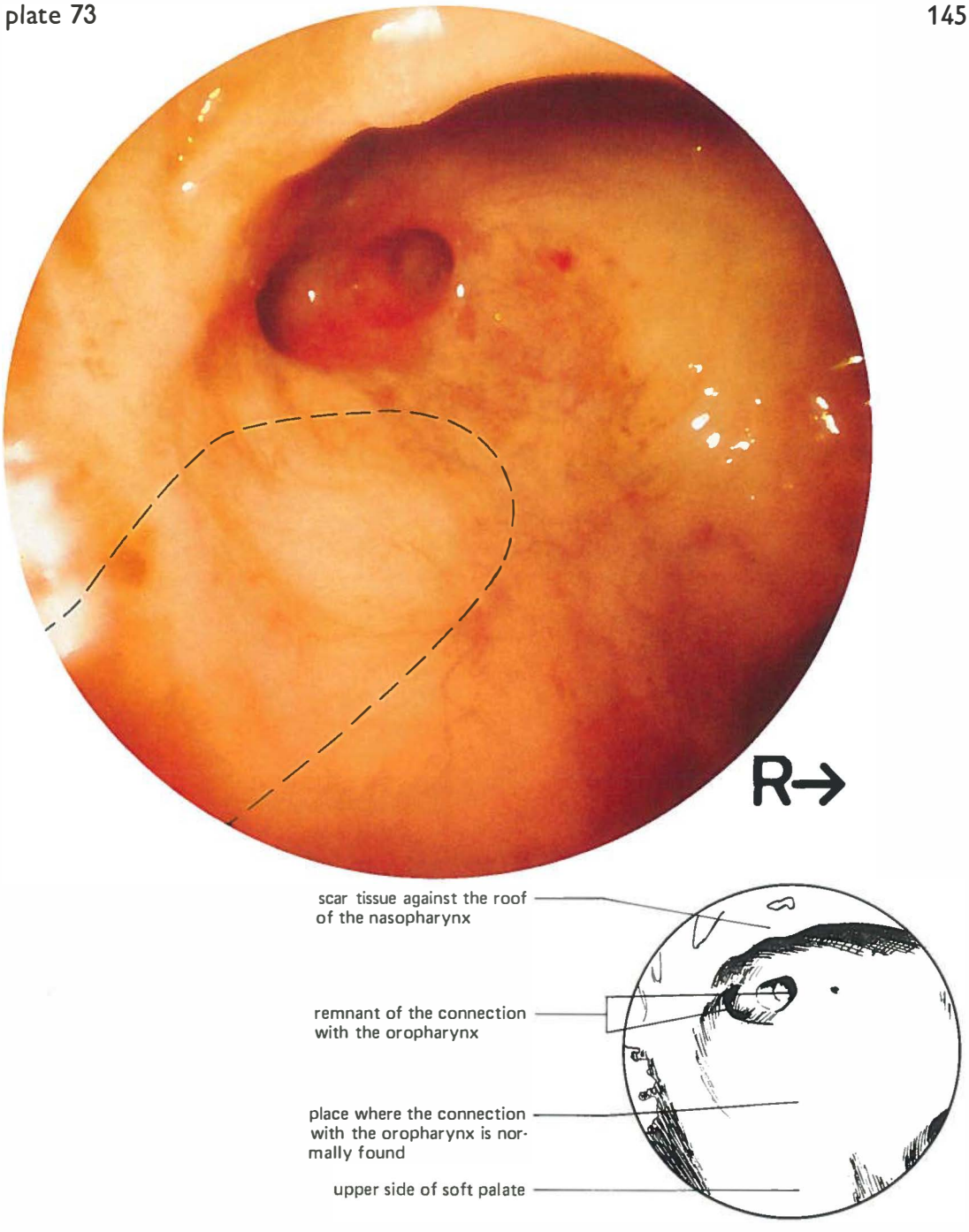
Patient I.H.-B., female, aged 49, had had complaints of nasal obstruction on the right side for six months, which appeared to be due to an irregular swelling of the right anterior nasal septum. Skin tests were negative as to PPD of mycobacterium tuberculosis, but positive as to PPD of m. avium and m. fortuitum. Histological findings agreed with the latter result. The patient was successfully treated with tuberculostatics.





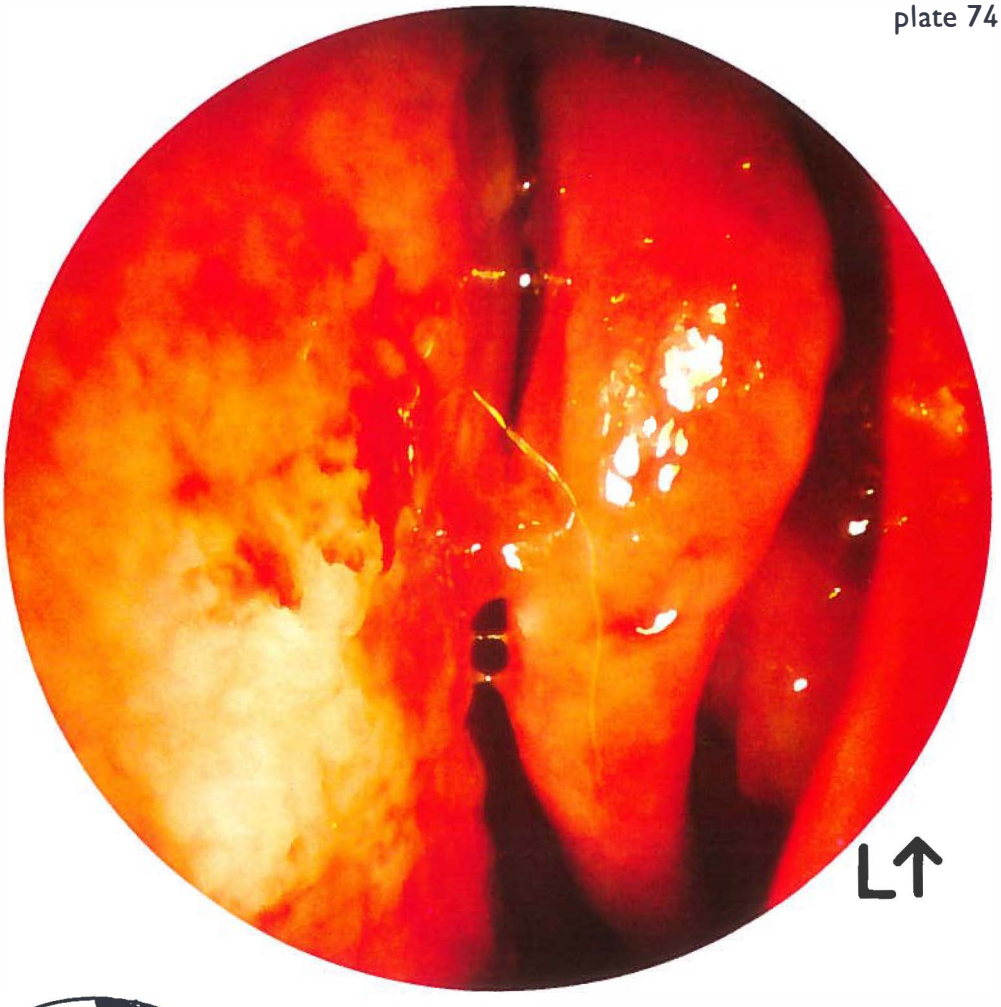
Right nasendoscopy: Lues III

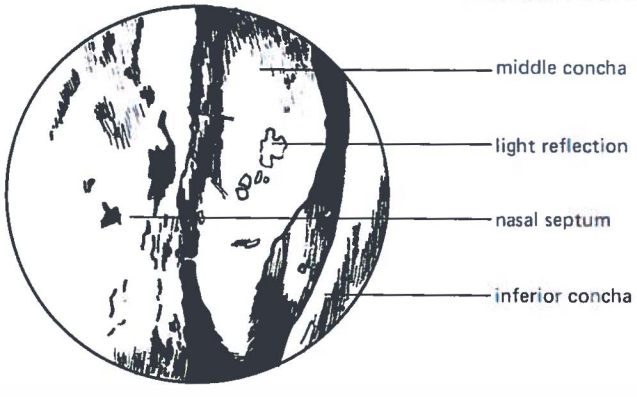
Patient M.N.-S., female, aged 67, had suffered from total nasal obstruction for six years. Whenever she bent forward secretion poured out of her nose. The patient had the typical 'Bulldog face'. The soft palate appeared to be completely grown together with the posterior pharyngeal wall. Nasendoscopy showed extensive destruction of the nasal septum, the vomer part was entirely lacking. There were also many synechiae, in particular between the two middle conchae and the nasal septum (see also plate 73).



Right nasendoscopy: Lues III

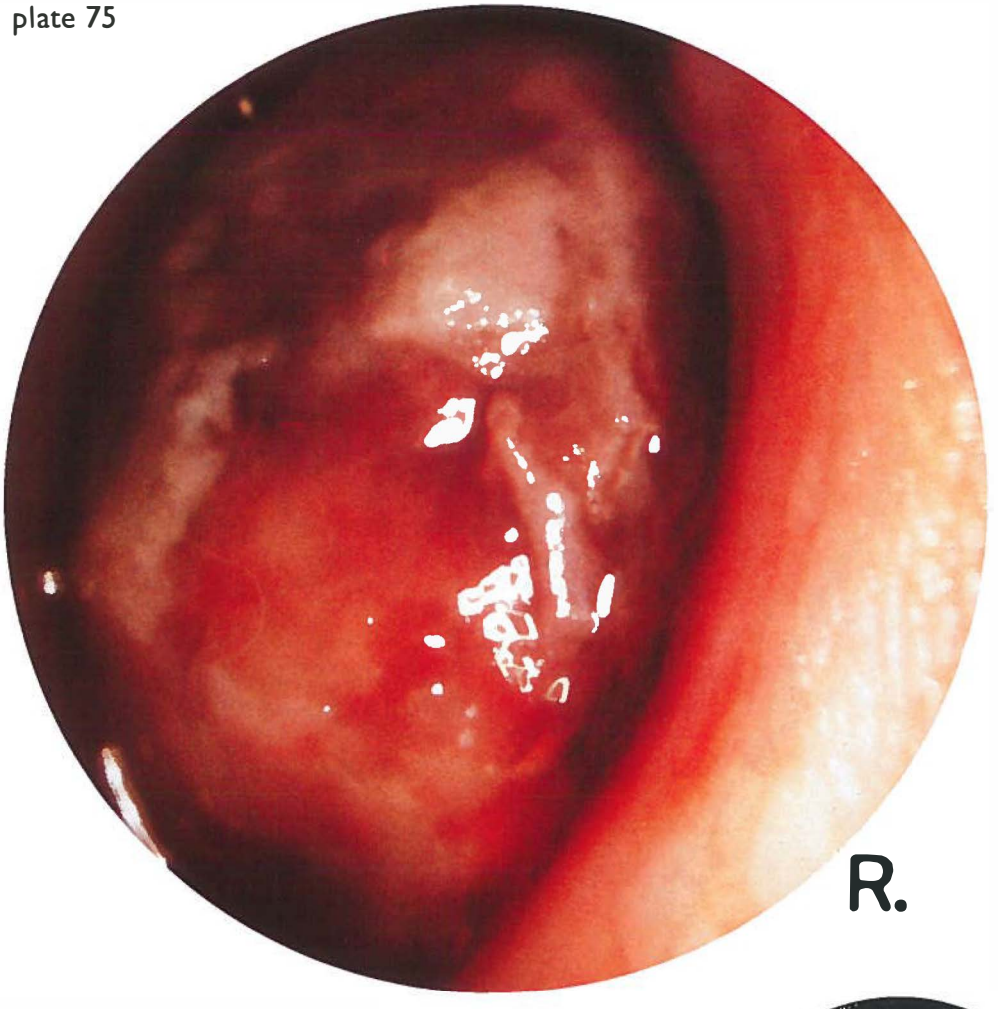
Same patient M.N.-S., female, aged 67 (see plate 72). Nasopharyngoscopy, here carried out with the nasendoscope deeply inserted through the right nasal cavity, showed how the soft palate was almost entirely grown together with the posterior pharyngeal wall, preventing nose breathing almost completely. In histological examination no specific inflammation could be found, but serologic tests proved positive. Diagnosis: Lues stage III, or congenital. The patient withdrew from further examination and treatment.

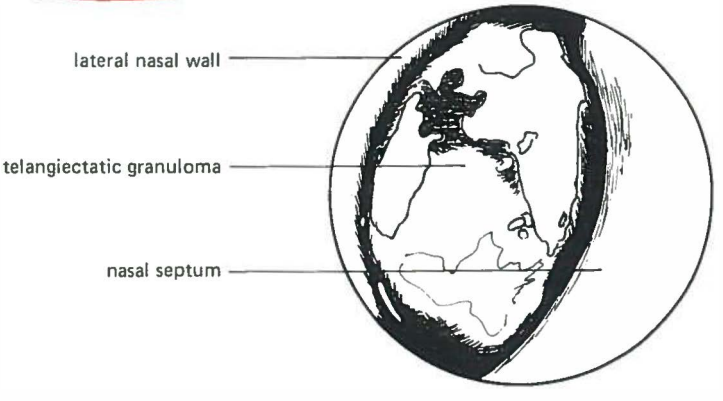




Left nasendoscopy: Wegener's granulomatosis

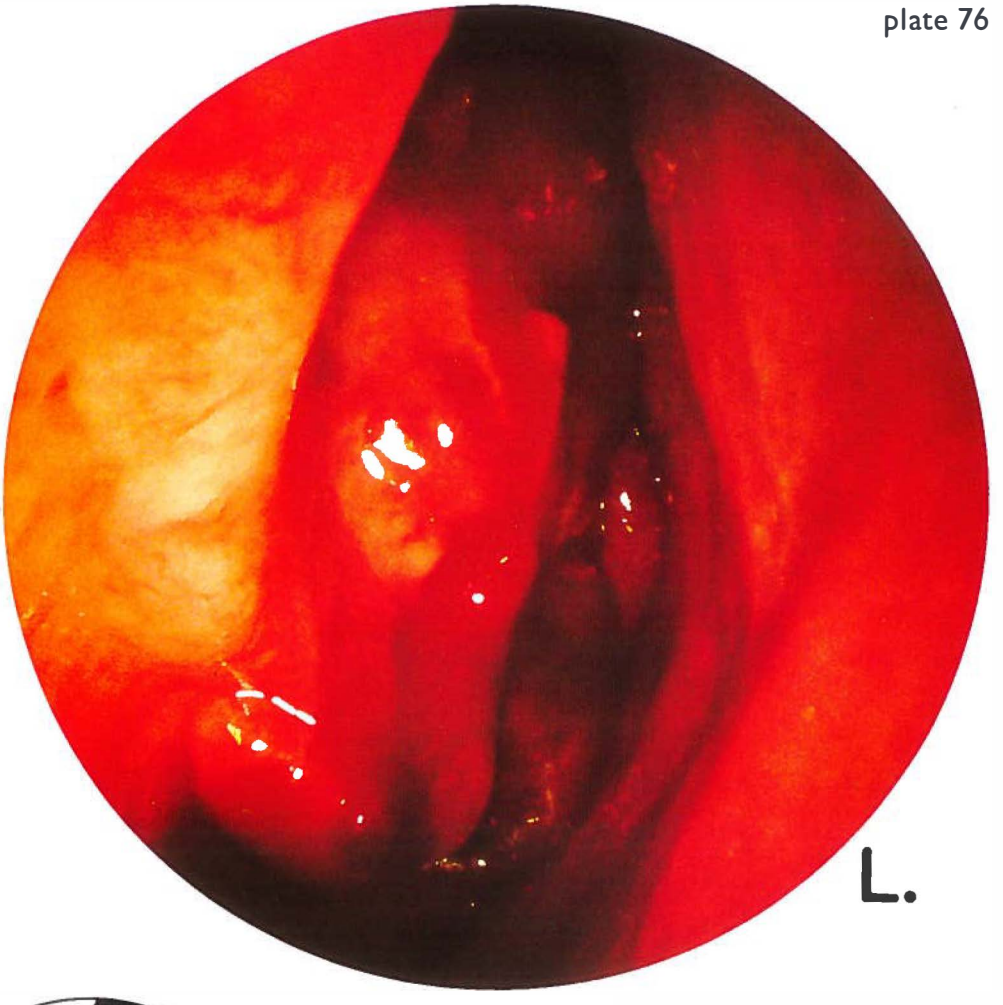
Patient A.C., male, aged 65. It was known that he had Wegener's granulomatosis (proved by biopsies from the kidneys, pleura and lungs). He had also been suffering from viscous secretion and sometimes from bloody crusts in the nose during the last year. Nasendoscopy showed marked hyperaemia of the nasal mucosa without congestion. Besides, there were ulcerations, mainly on the nasal septum. Histological examination of the nasal mucosa showed a picture, which fitted Wegener's granulomatosis. The patient was successfully treated with high doses of steroids.

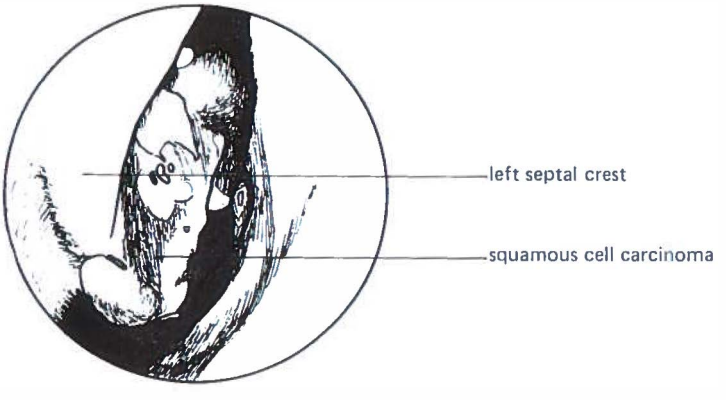




Right nasendoscapy: telangiectatic granulama

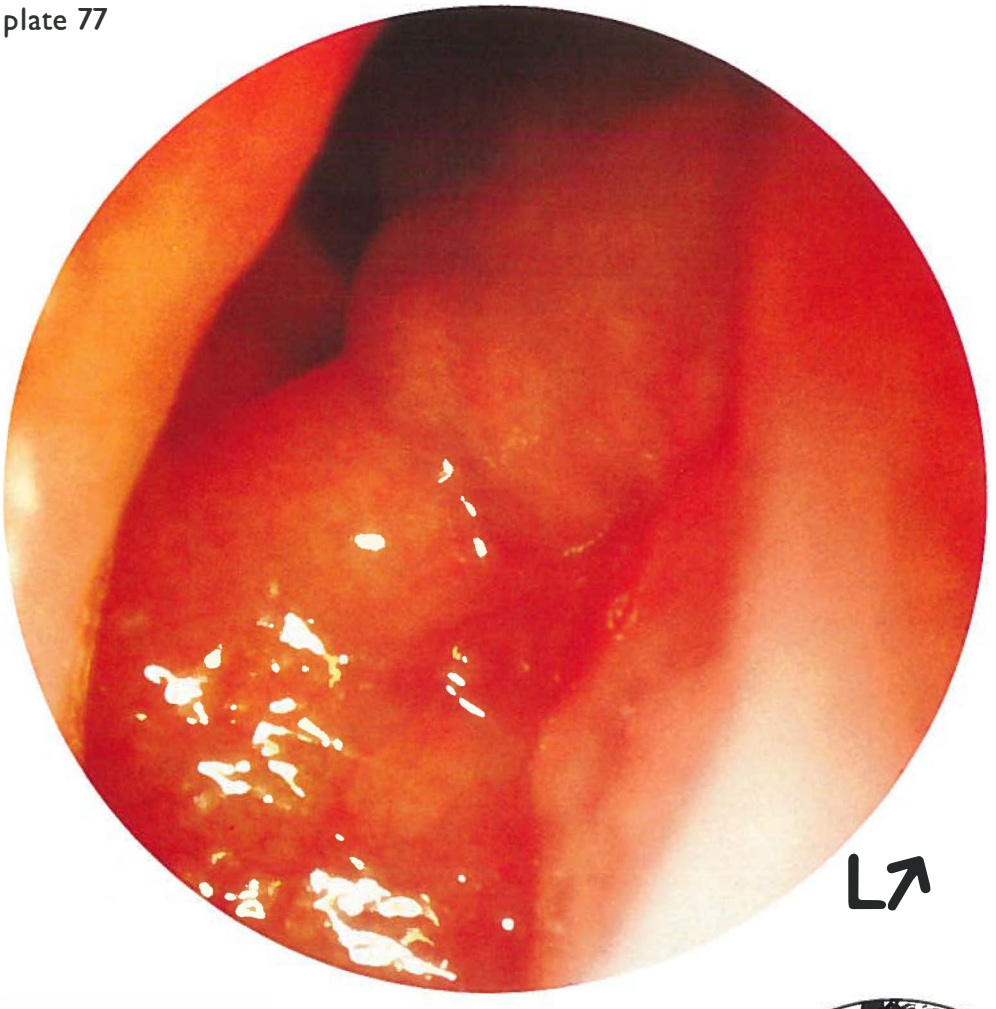
Patient H.W.-M., female, aged 28, had had complaints of nasal obstruction and purulent secretion on the right side for 8 months. There were no symptoms of a sinusitis. In the right nasal cavity a somewhat irregular but smooth purple swelling was found. Biopsy: telangiectatic granuloma. One year after surgical removal there were no signs of recurrence.

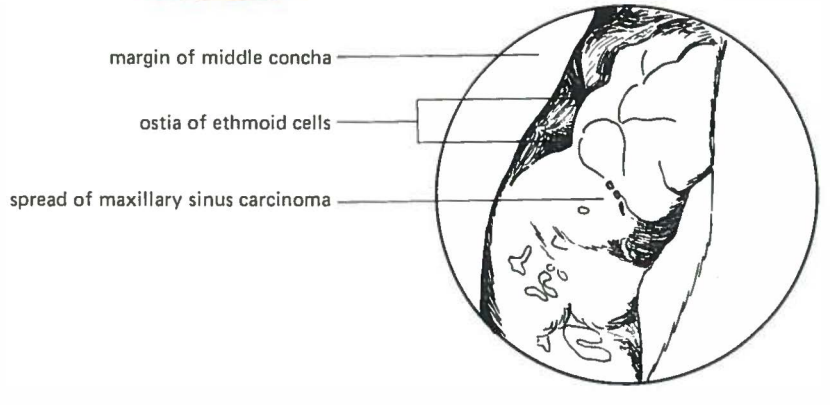




Left nasendoscopy: squamous cell carcinoma of the nasal septum

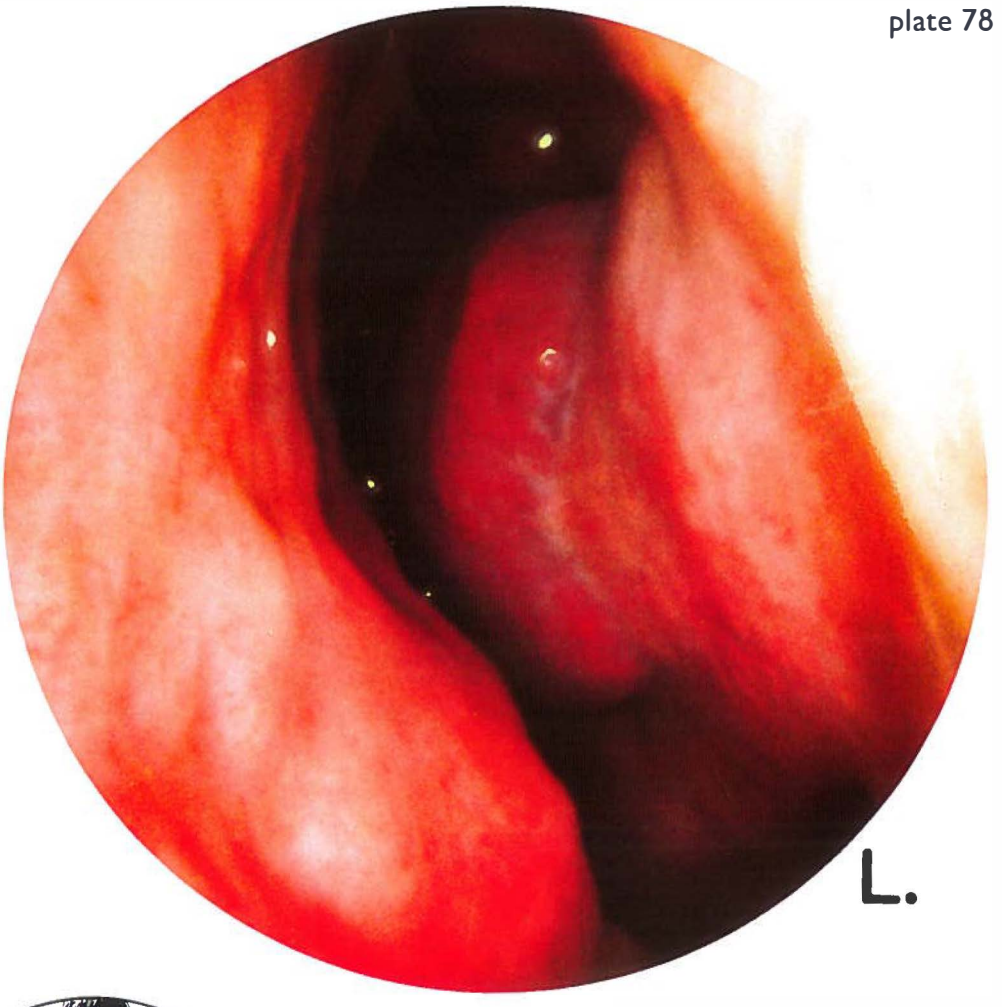
Patient R.K., male, aged 52, had had complaints of nasal obstruction on the left side during the last three weeks. Left nasendoscopy showed granulating tissue on a septal crest, which turned out to be a squamous cell carcinoma on histological examination. On the right side nasendoscopy revealed a spread through the septum high up in the nose. An opacity of the right maxillary sinus on the X-ray photographs appeared to be due to a benign cyst (Antroscopy). One year after surgery nasendoscopy showed no signs of recurrence.

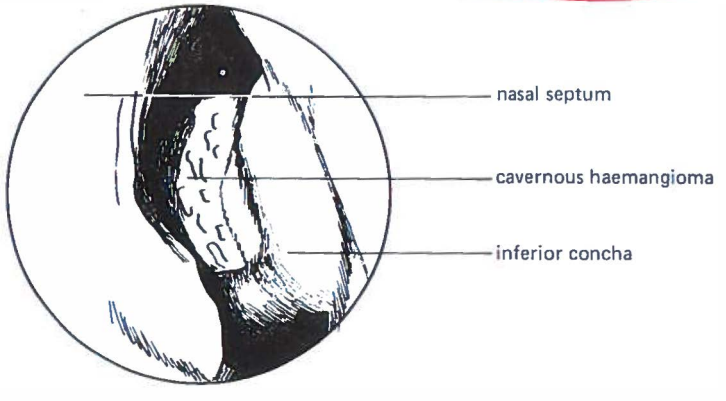




Left nasendoscopy: spread of maxillary sinus carcinoma

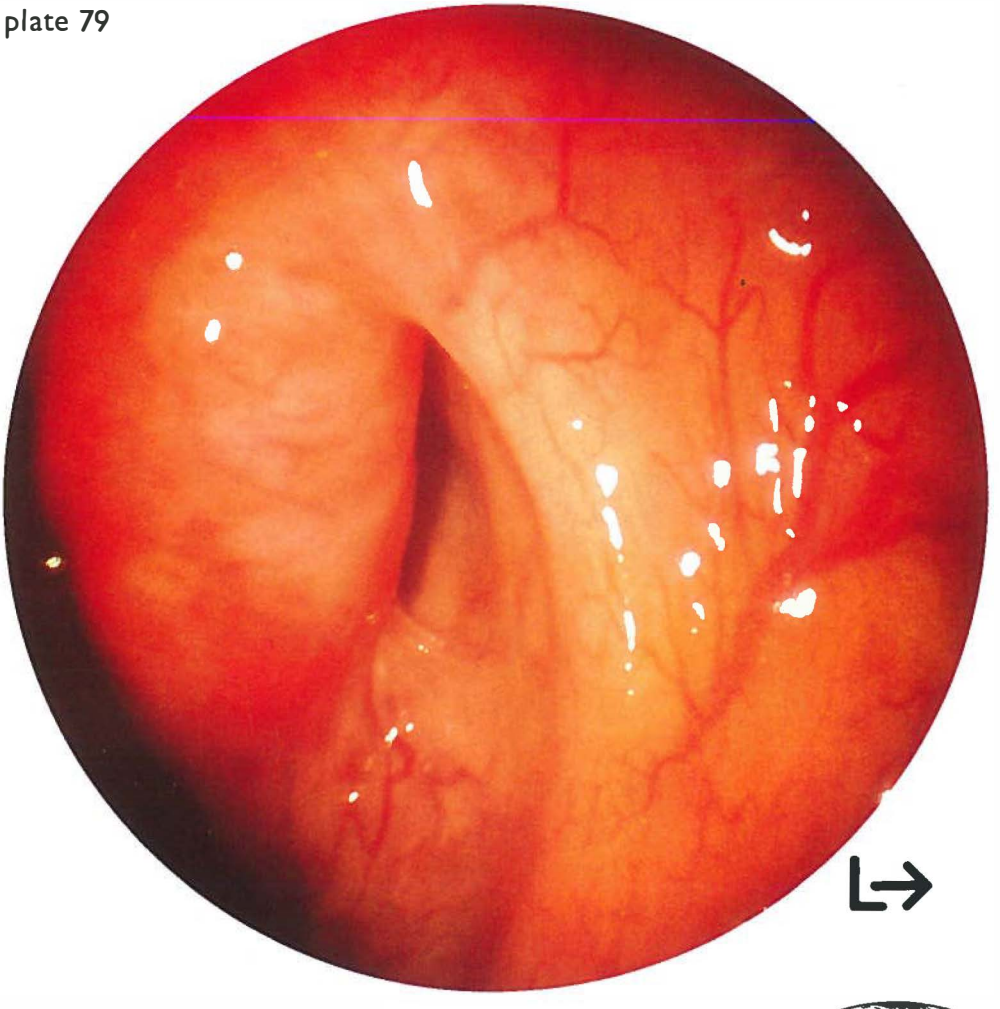
Patient Y.H., male, aged 74, had had a pain in the left upper jaw, nasal obstruction and purulent secretion on the left side for eight weeks. There appeared to be an oroantral fistula there. A biopsy, taken through this fistula, produced the diagnosis: moderately differentiated squamous cell carcinoma. Nasendoscopy demonstrated a spread into the left middle meatus. Tomography showed signs of destruction of all the bony walls of the left maxillary sinus. The patient was given palliative radiotherapy.

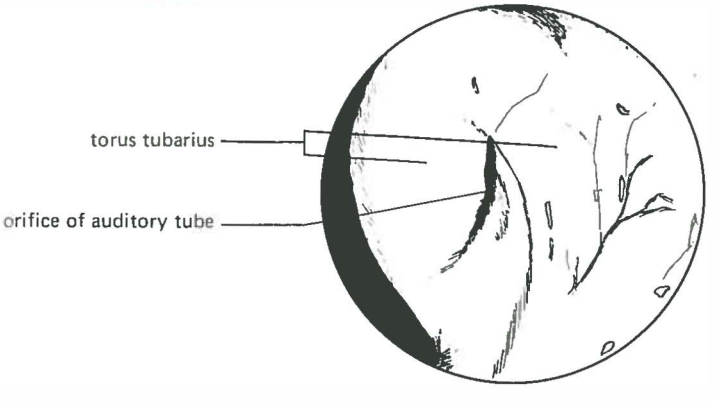




Left nasendoscopy: cavernous haemangioma on the inferior concha

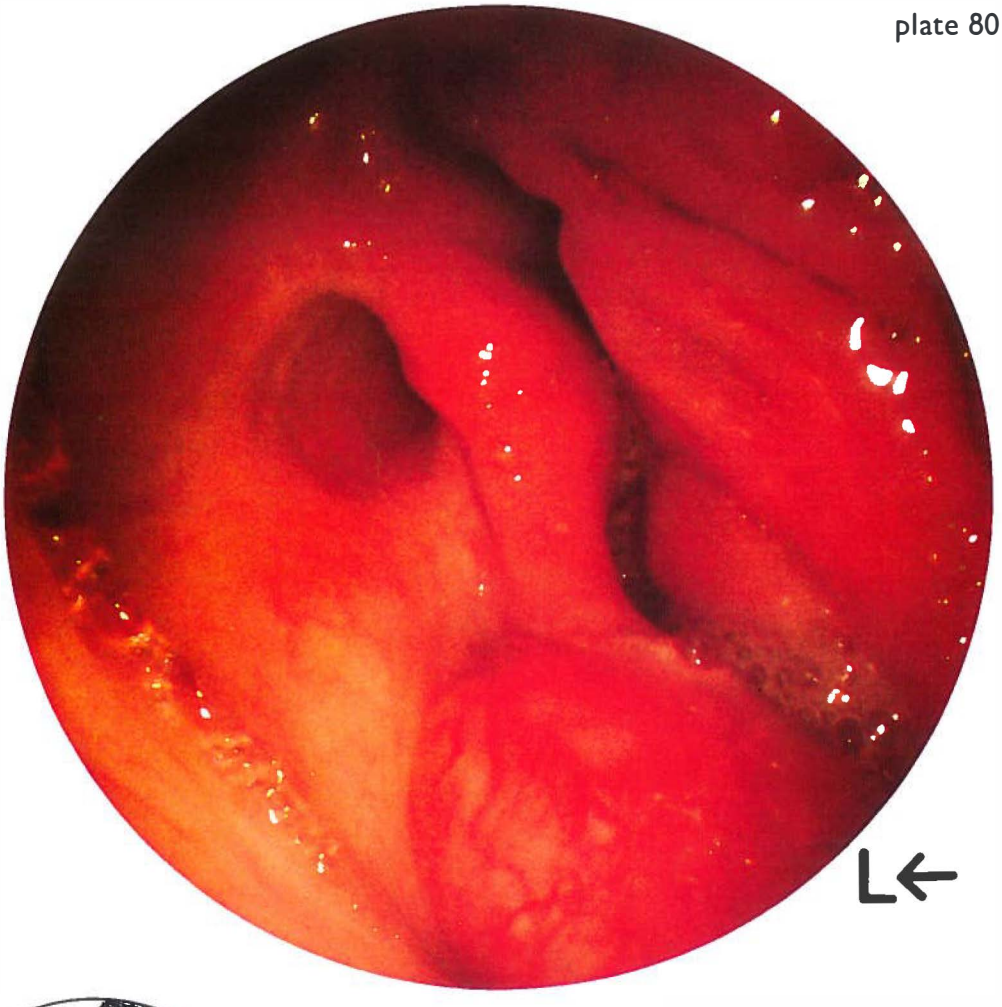
Patient J.D.-T., female, aged 66, consulted the E.N.T.-department in connection with complaints resulting from a right external otitis. In the nose there appeared to be a purple hyperaemic swelling on the left inferior concha. Biopsy: cavernous haemangioma. As the patient had no nasal complaints there was no indication for therapy (no malignancy).

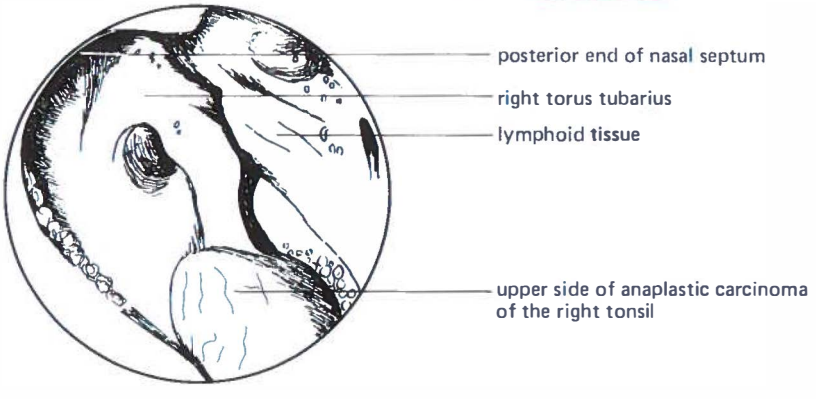




Left nasendoscopy: torus tubarius

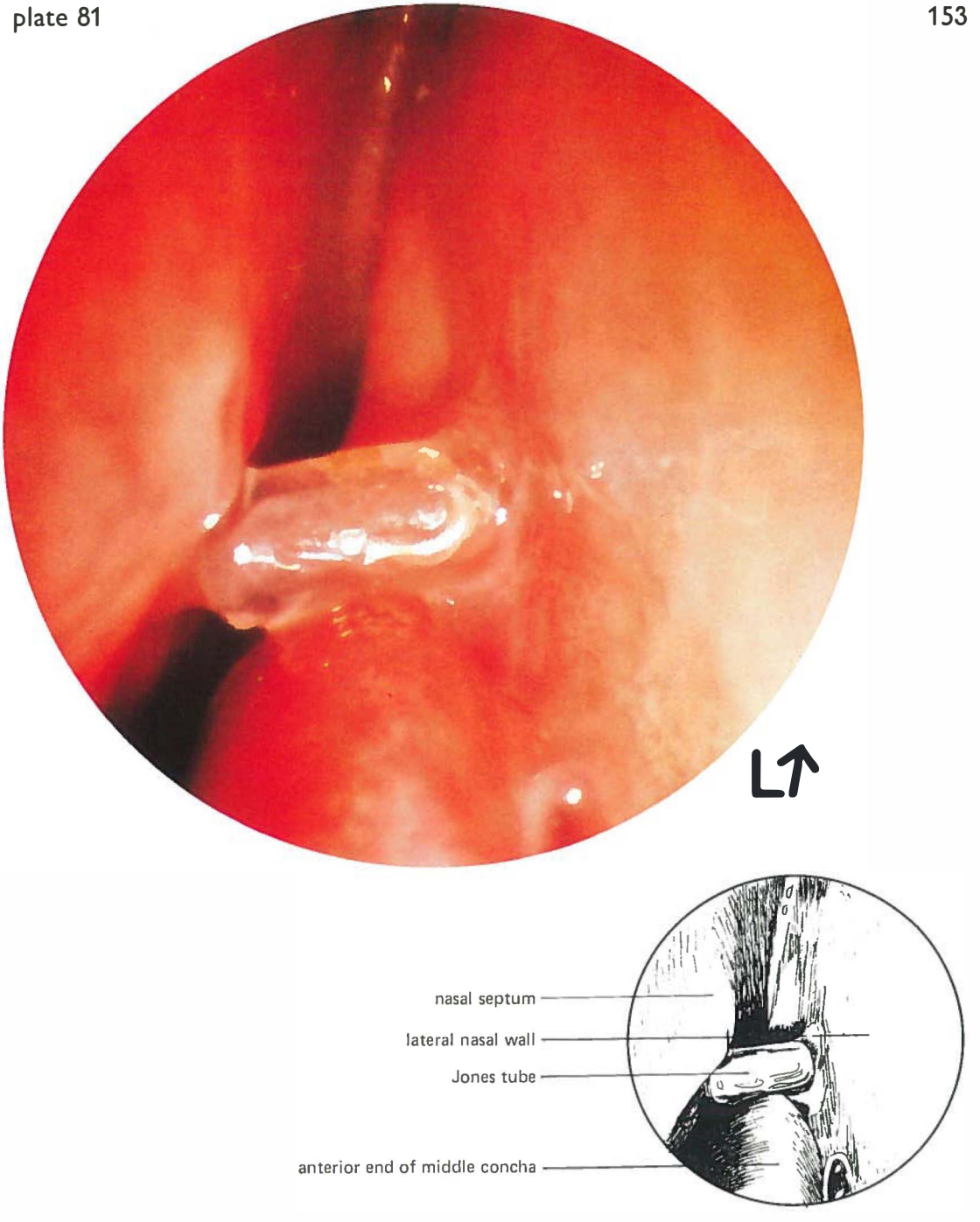
Patient K.L., male, aged 56 (same patient as on plates 43 and 44). The left torus tubarius fills the viewing field almost completely when it is inspected with a nasendoscope inserted through the left nasal cavity. Normal anatomy. When the right torus tubarius is inspected by means of left nasendoscopy it occupies only a small part of the viewing field (cf. plate 80).





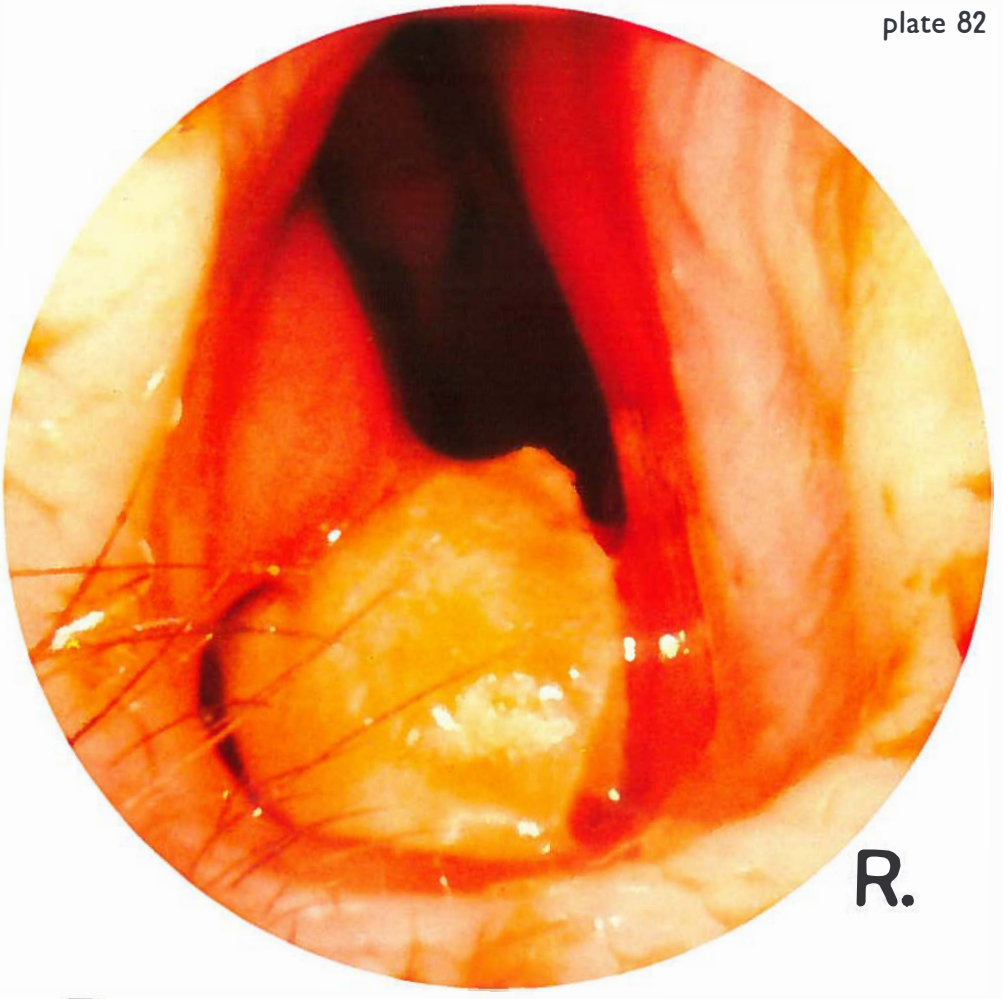
Transnasal nasapharyngoscopy: right torus tubarius

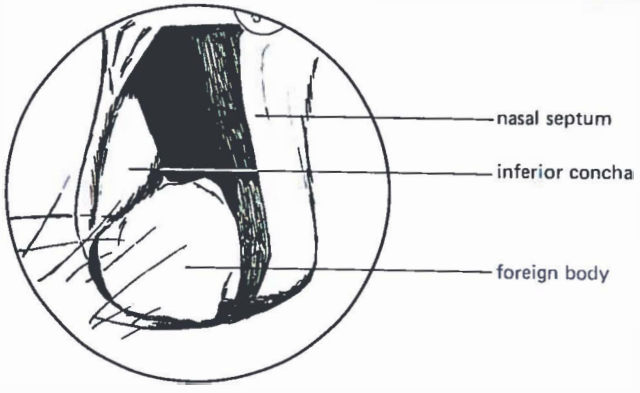
Patient A.J.-W., female, aged 26, had been complaining of her throat for three months. She had been given antibiotics three times already, which had each time cured the complaints temporarily. There appeared to be an anaplastic carcinoma of the right tonsil, with suspect lymph nodes on the right side of the neck. Endoscopic examination was carried out to determine the upper limit of the tumor. The right torus tubarius occupies only a minor part of the viewing field (cf. plate 79). The patient died 9 months later as a result of an undifferentiated carcinoma of both ovaries with extensive dissemination.



Left nasendoscopy: Jones tube

Patient H.H.-B., female, aged 74, had had a Jones tube installed by the oculist three years previously on account of an obstruction in the left nasolacrimal duct. The complaints of watering eyes did not improve, however, after this operation. Nasendoscopy showed that the Jones tube was blocked because it touched the nasal septum.





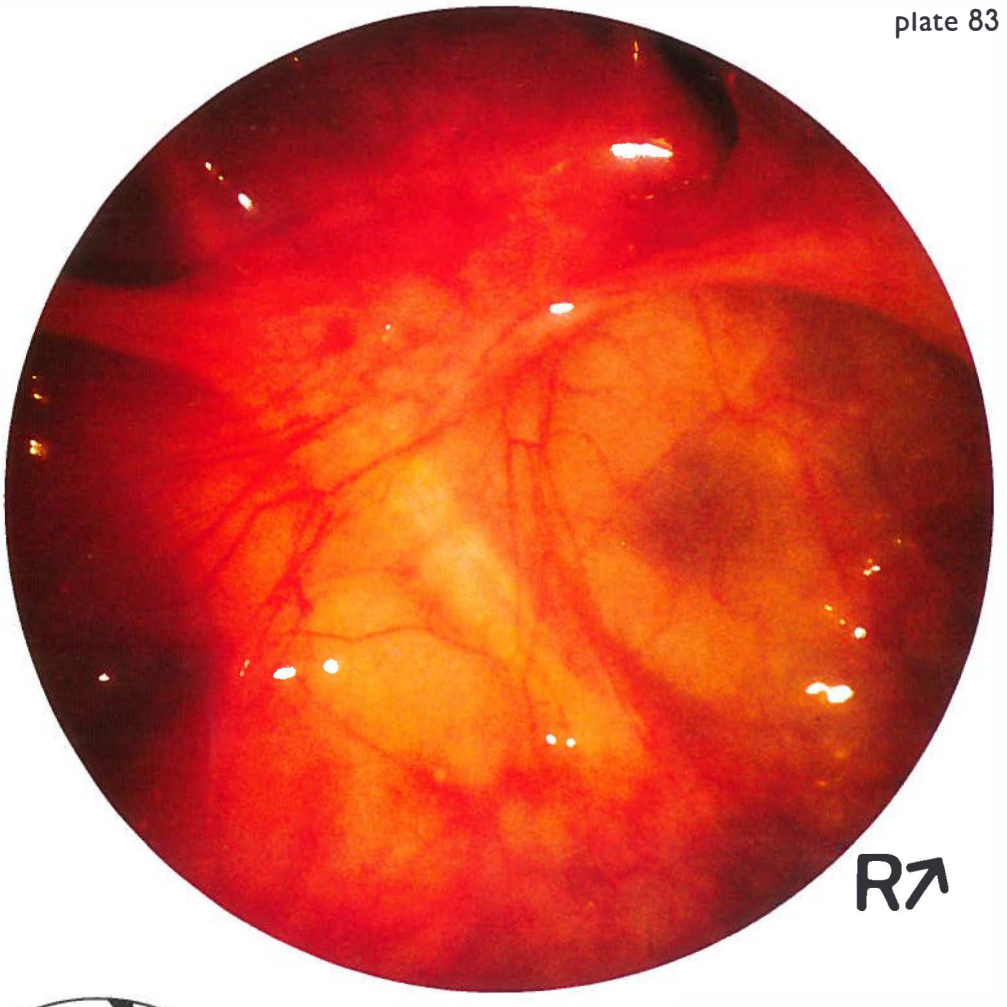
Right nosendoscopy: foreign body (peanut)

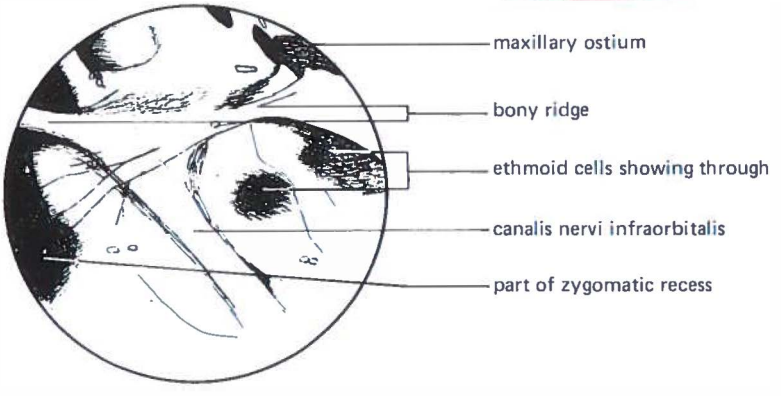
Patient G.C., boy, aged 4, had put a peanut into his right nose.

CHAPTER 9

Antroscopic plates

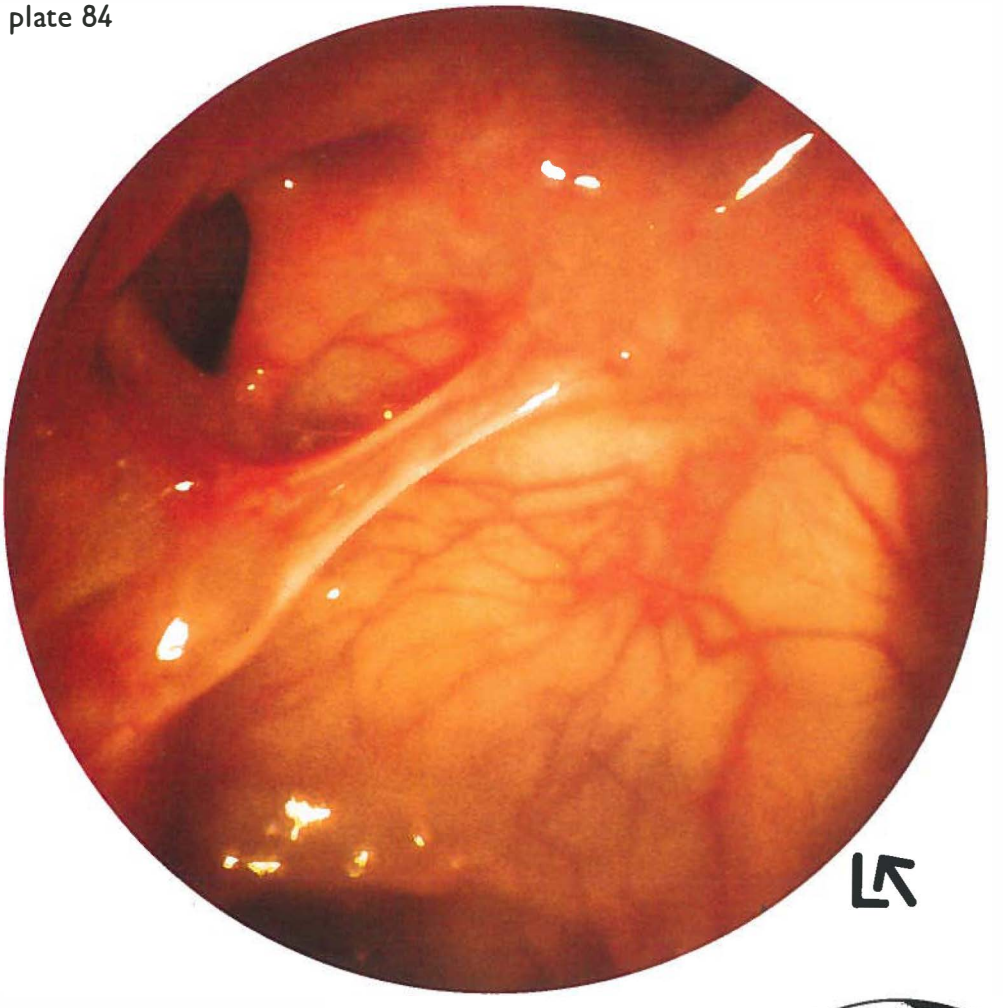
In this chapter the 'R' or 'L' indicate that endoscopy has been carried out in the right or left maxillary sinus, respectively. The arrows printed by the side of the letters represent the direction in which the 30°, 70° or 120° optics have been used.

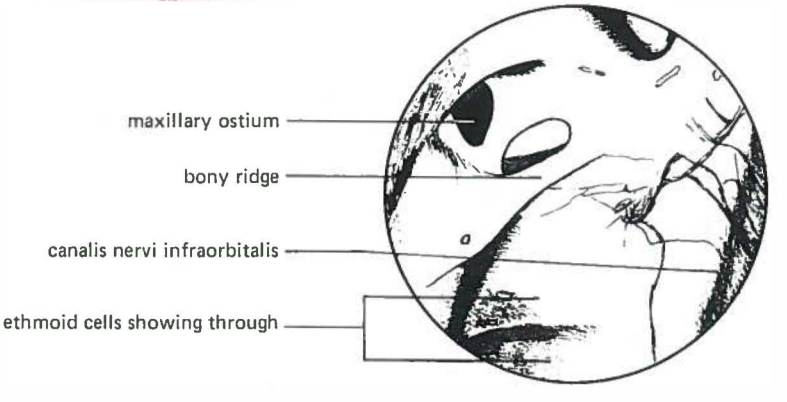




Right antroscopy: normal anatomy

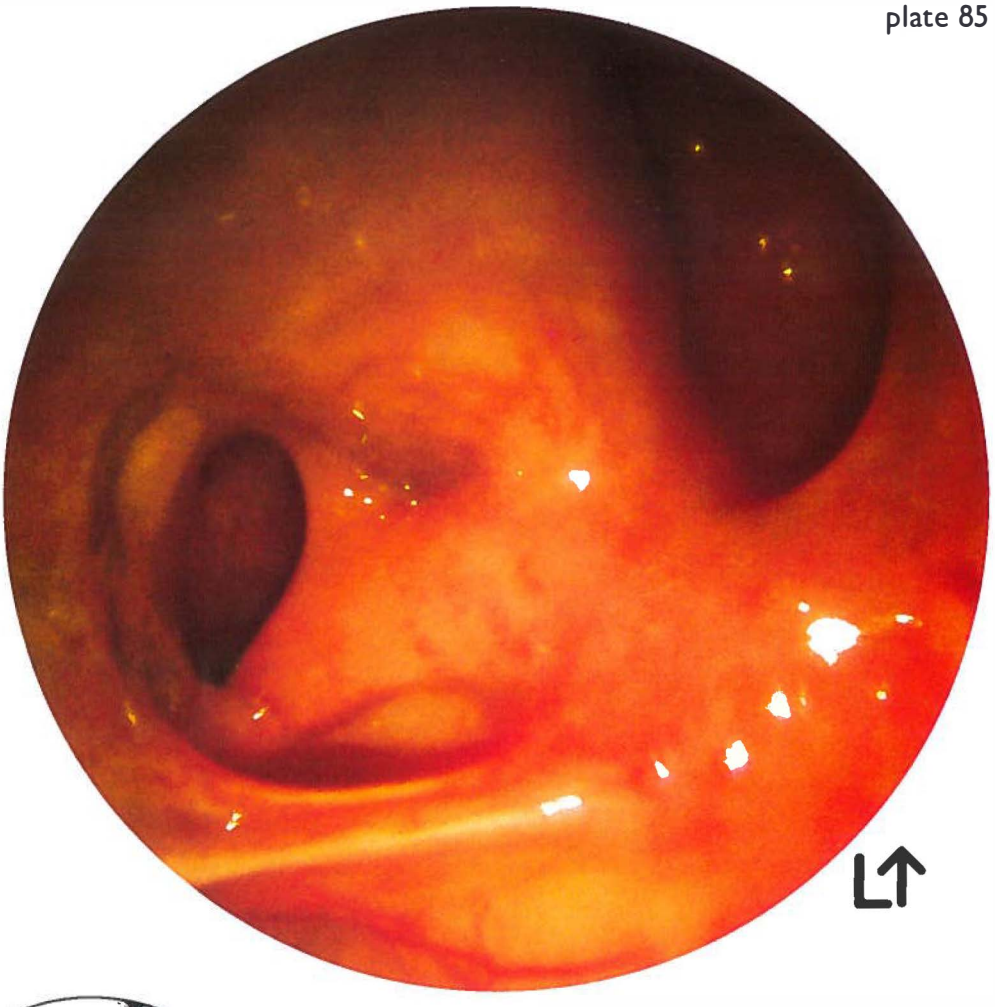
Patient J.G., male, aged 27, came to the E.N.T.-department in connection with nasal obstruction, no cause of which could be found, and which disappeared spontaneously. Antroscopy was carried out on account of a shadow on the X-ray photographs, caudally in the right maxillary sinus. This shadow appeared to be due to a cyst on the floor of the sinus, which was incised with the cyst-knife (see picture 8, top). For the rest the sinus was free of disease.

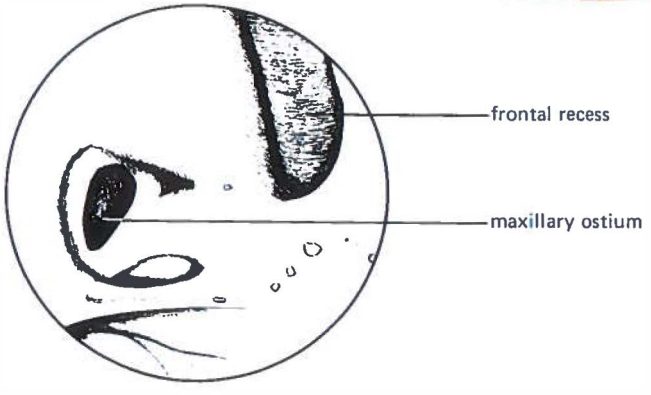




Left antrascopy: normal anatomy

Patient J.A.K., male, aged 31, had been suffering from a pain in the left upper jaw for three months, after a left upper molar had been filled. Antroscopy did not reveal any disease round the maxillary ostium. This photograph was taken with the 70° Hopkins optics. See also plates 85 and 86.

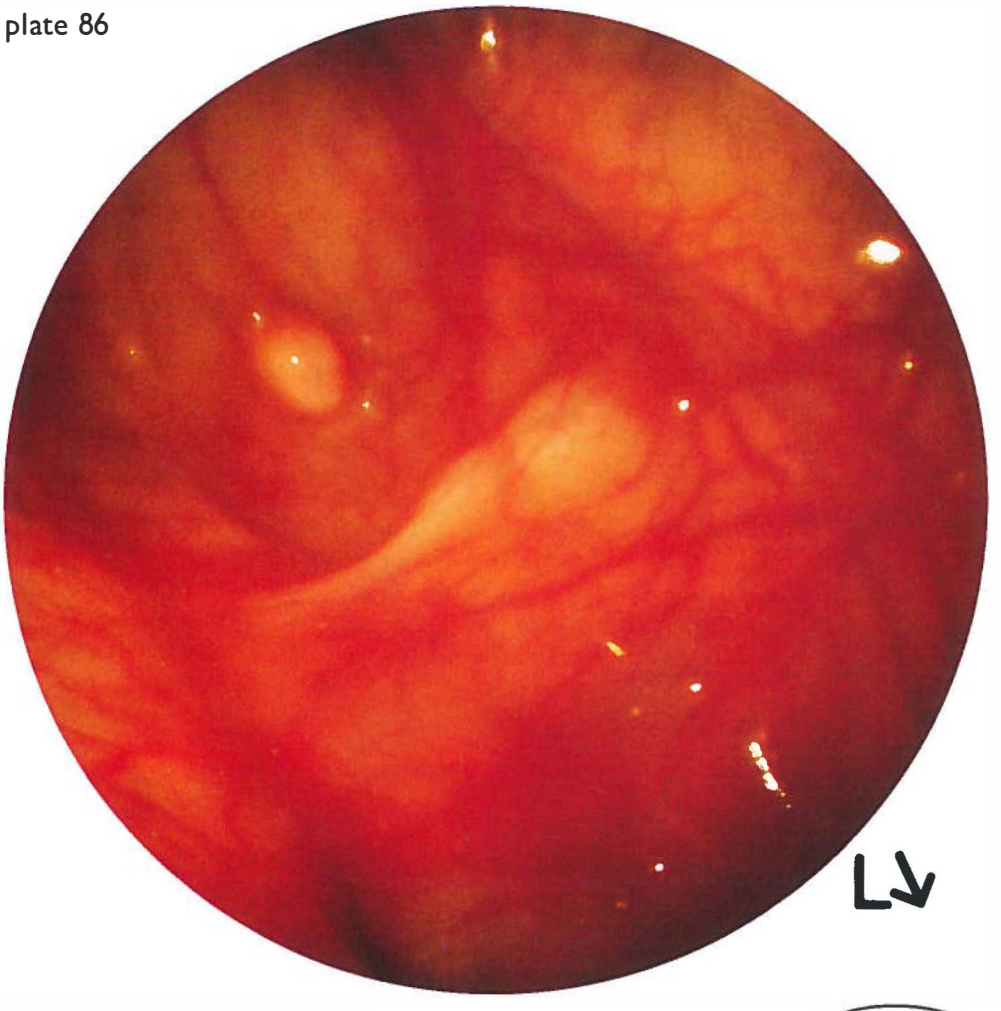


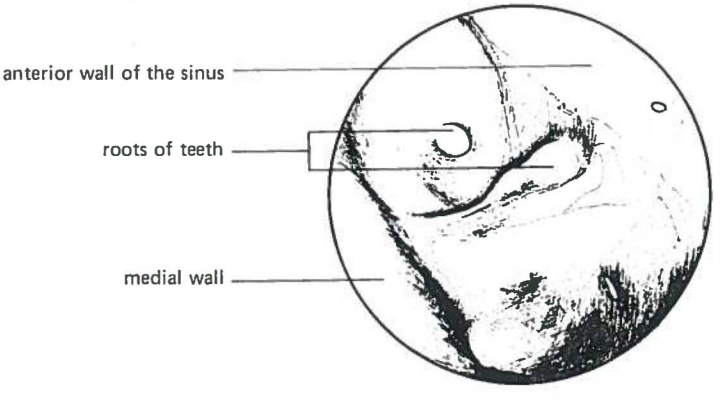


Left antroscopy: normal anatomy

Same patient J.A.K., male, aged 31 (see plate 84).

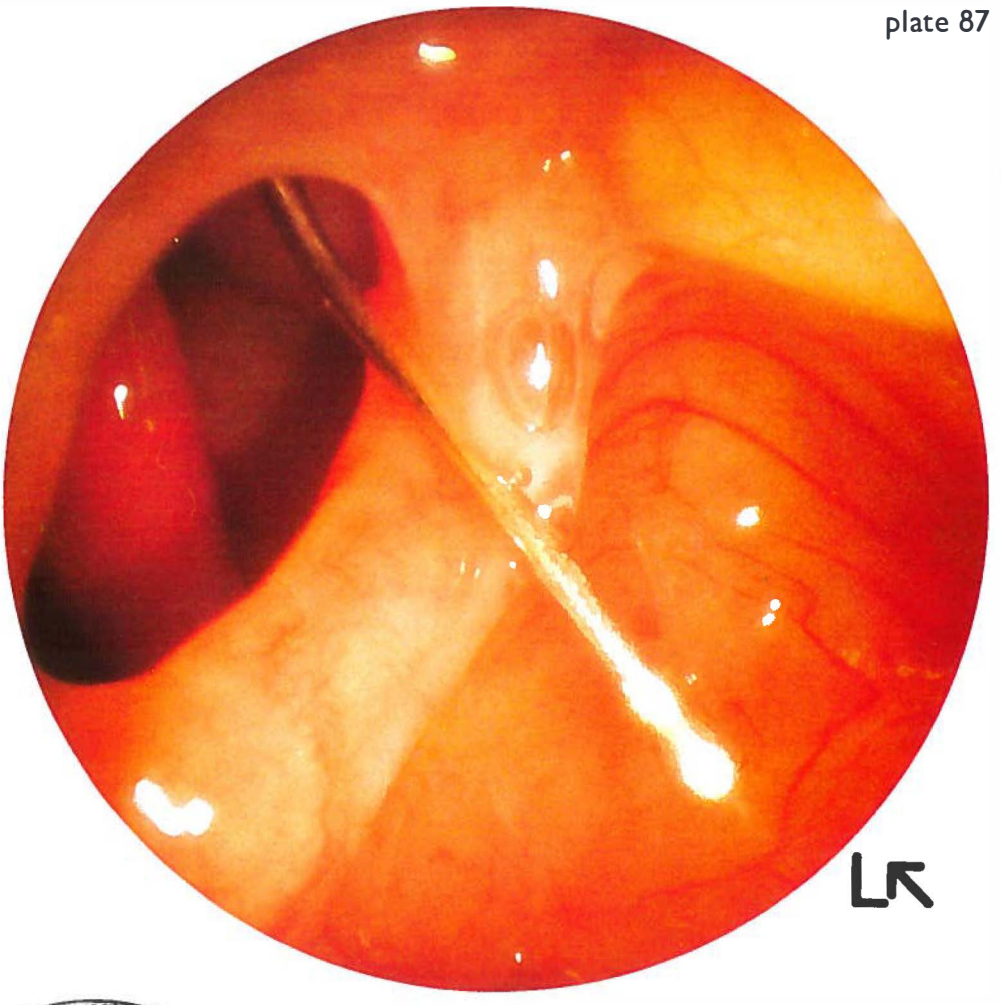
The maxillary ostium and its surroundings inspected with the 120° Hopkins optics.

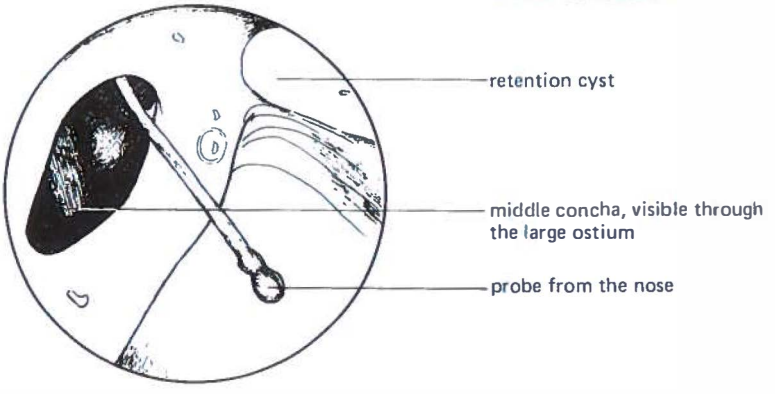




Left antroscopy: roots of teeth visible in the floor

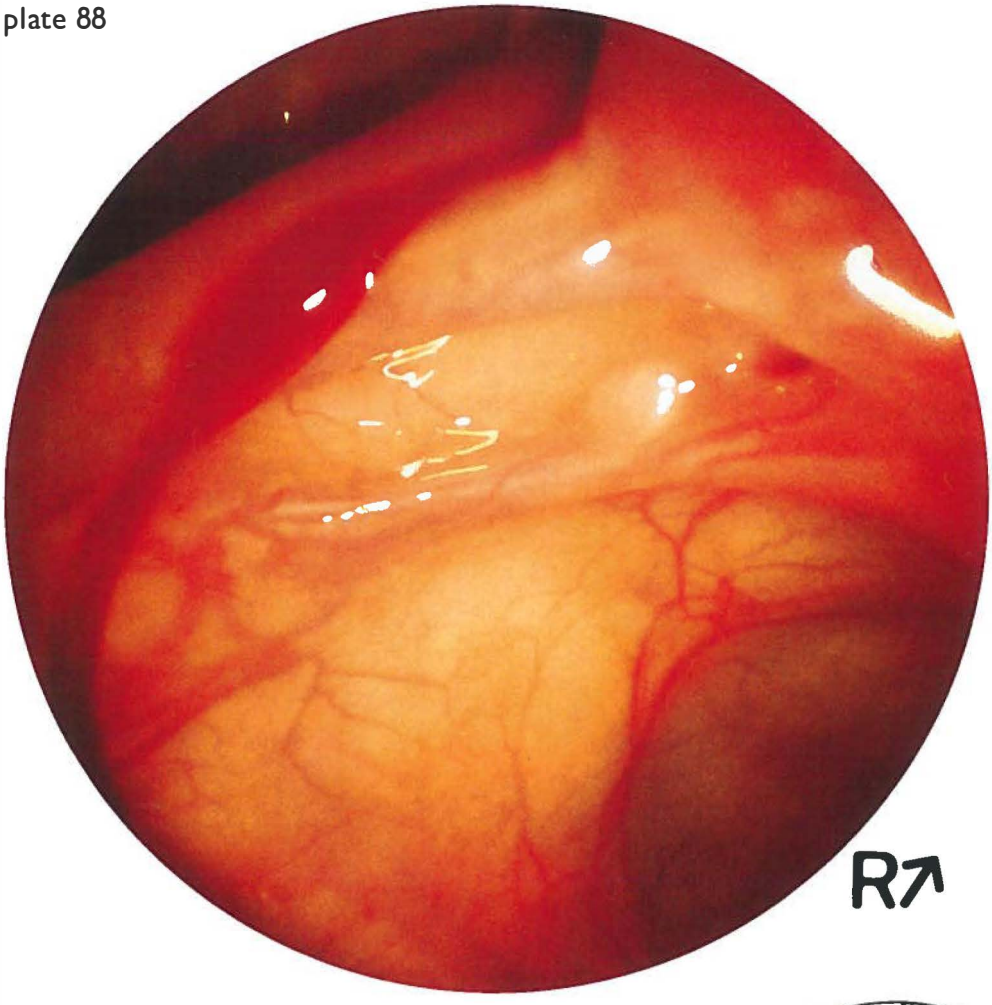
Same patient J.A.K., male, aged 31 (see plates 84 and 85). In the floor of the left maxillary sinus no signs of disease were to be seen either. Roots are not frequently seen in antroscopy. No explanation for the patient's complaints were found, therefore.

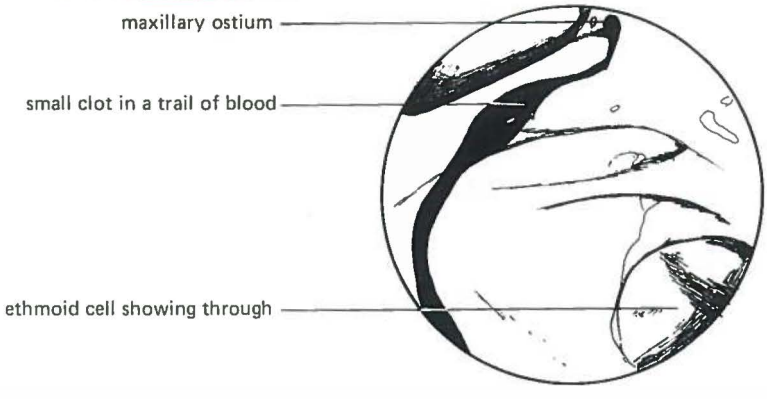




Left antroscopy: large maxillary ostium

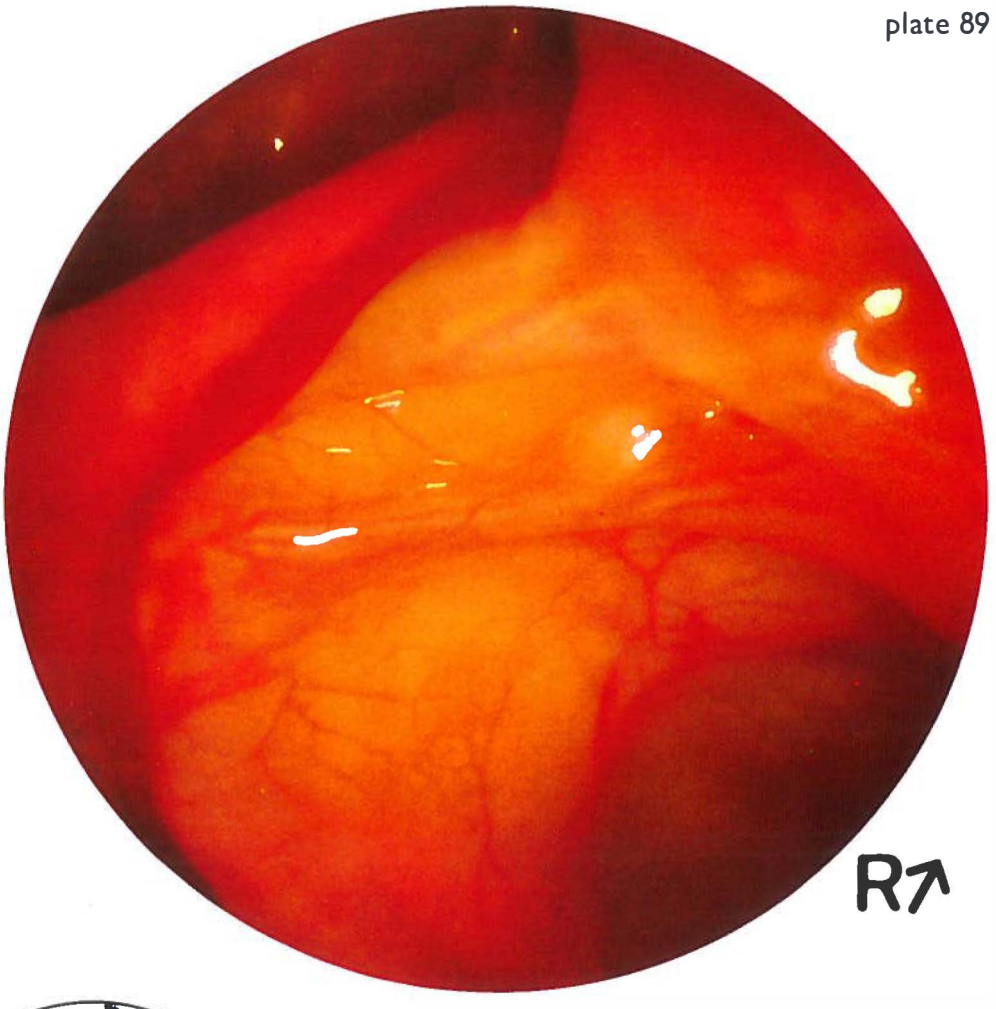
Patient R.L.-T., female, aged 58, had been suffering from a pain in the left upper jaw and temporal region as long as a year, which could not be explained. Antroscopy did not give an explanation either. There appeared to be a large maxillary ostium, through which it was possible to look into the nose. The complaints disappeared spontaneously.





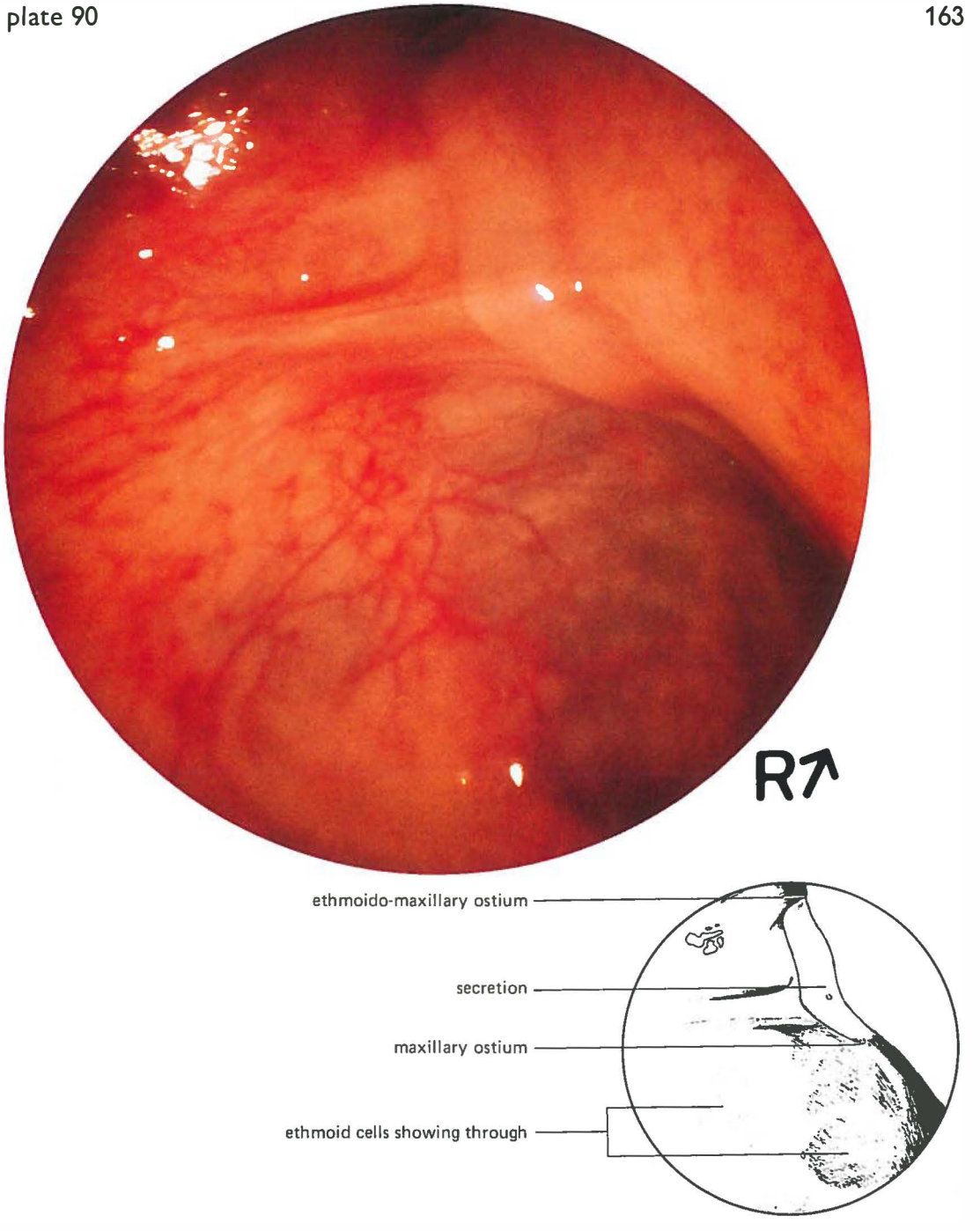
Right antroscopy: transport by ciliary movement (I)

Patient B.M., male, aged 23, was treated in the out-patients' department for sinusitis. Antroscopy was carried out to verify the result; the sinusitis appeared to be cured. By means of the small amount of blood that is always produced by the puncture in antroscopy, the transport by the respiratory epithelium can be judged (see also plate 89).



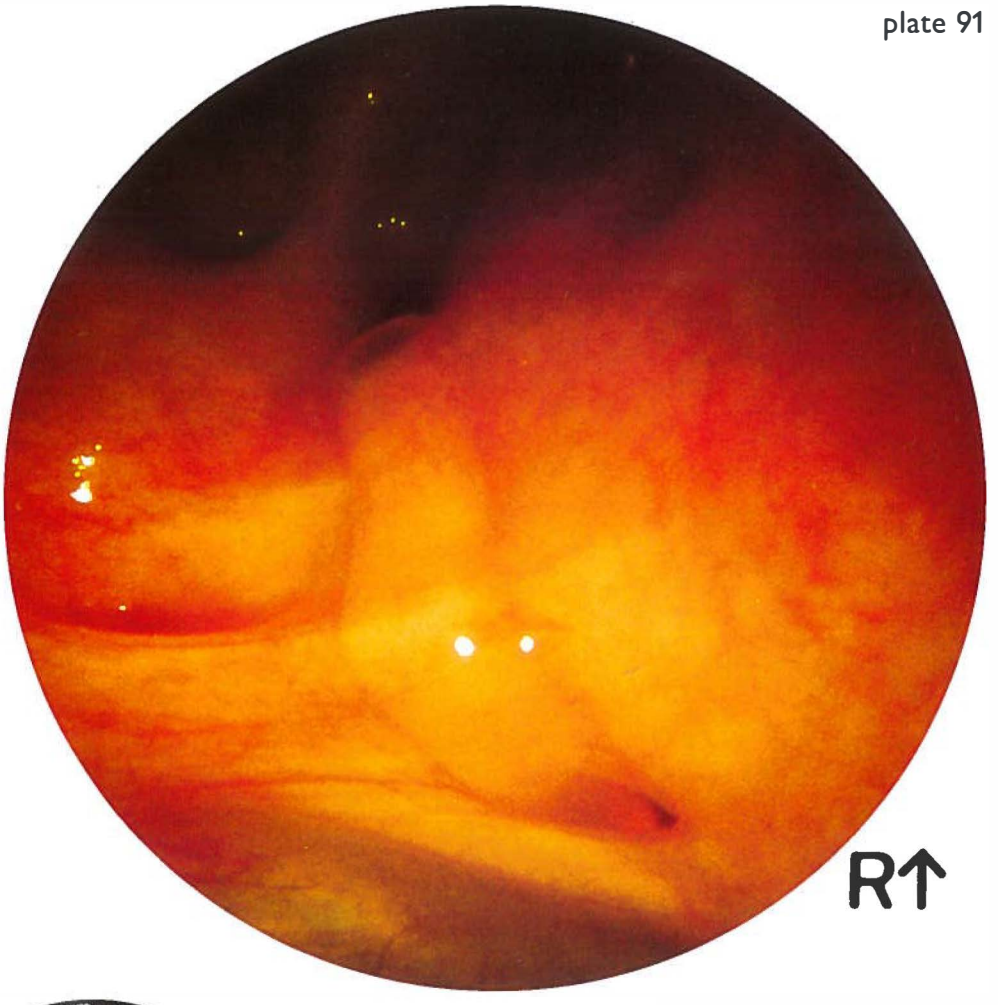
Right antroscopy: transport by ciliary movement (II)

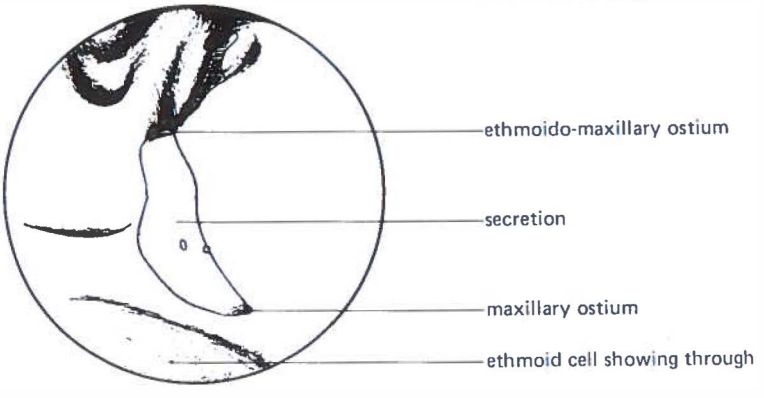
Same patient B.M., male, aged 23. This photograph was taken three minutes after that of plate 88. The small clot in the trail of blood has already been removed from the sinus. Conclusion: good transport function.



Right antroscopy: atypical mucus transport

Patient N.N., female, aged 41, underwent an antroscopy in a check-up after conservative treatment of maxillary sinusitis. The mucous membrane of the right maxillary sinus looked quite normal again. An ethmoidal cell appeared to drain via the maxillary sinus. This photograph was taken with the 70° Hopkins optics.

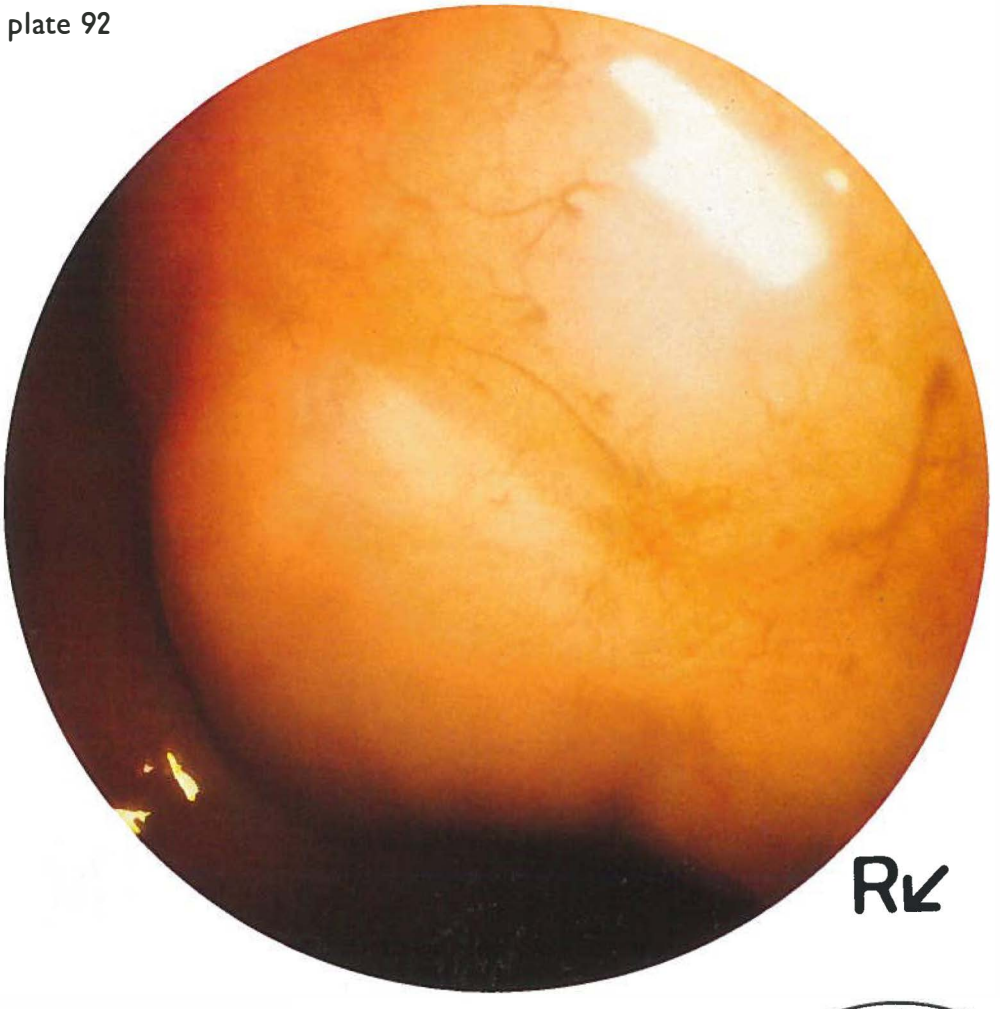


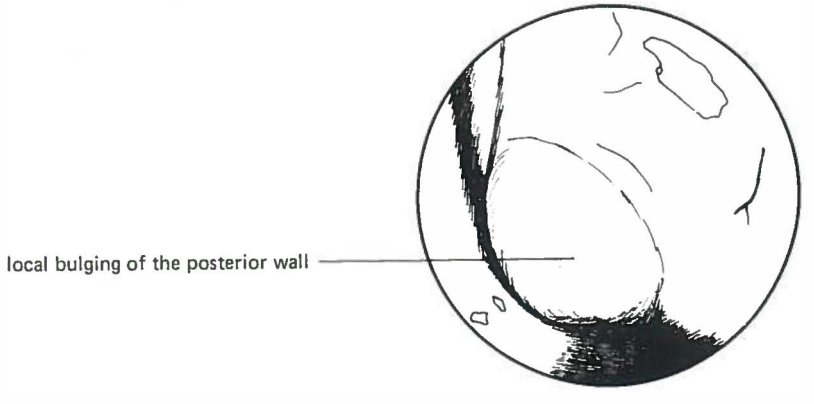


Right antrascopy: atypical mucus transport

Same patient N.N., female, aged 41 (see plate 90).

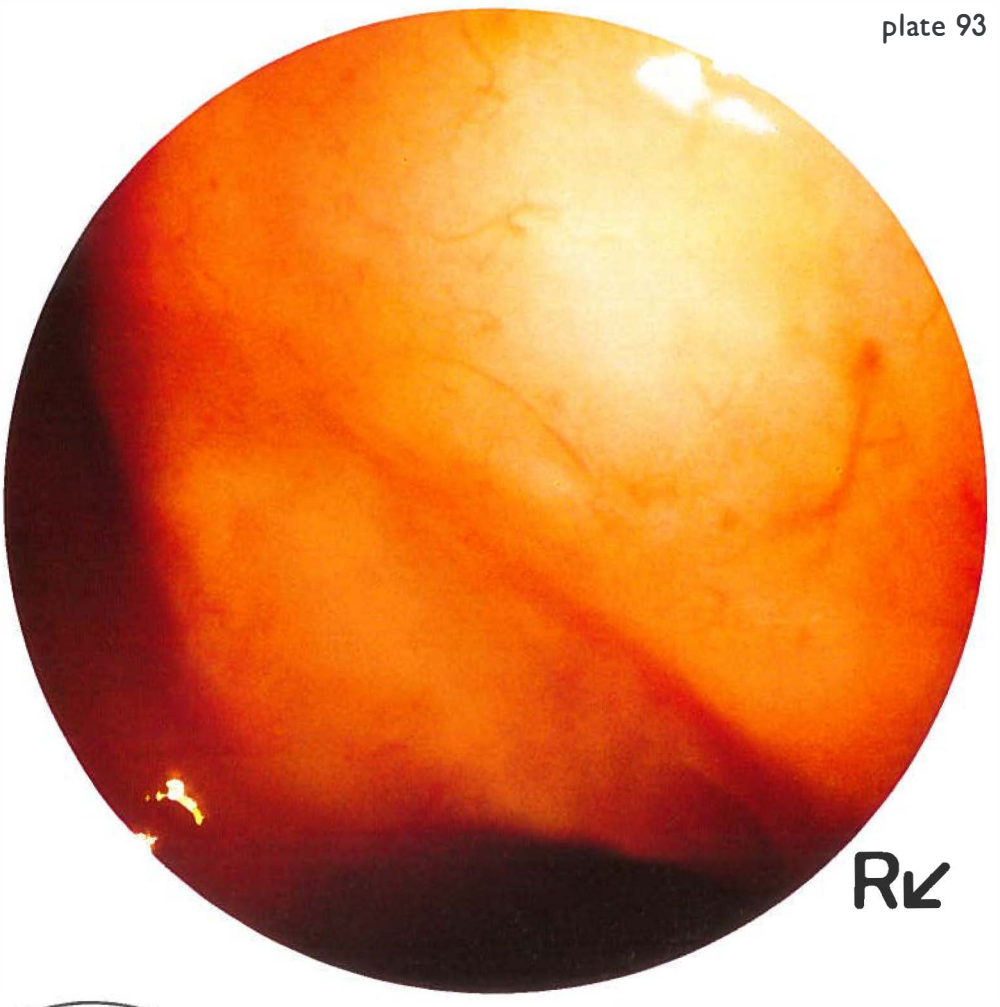
The same ostia in the right maxillary sinus, now inspected with the 120° Hopkins optics.

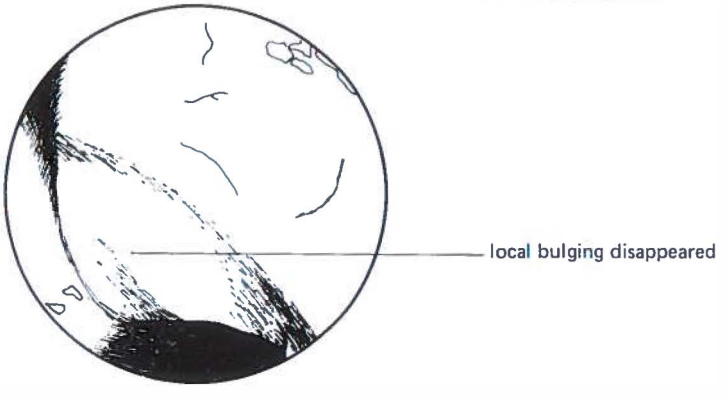




Right antroscopy: partial defect in the posterior wall (I)

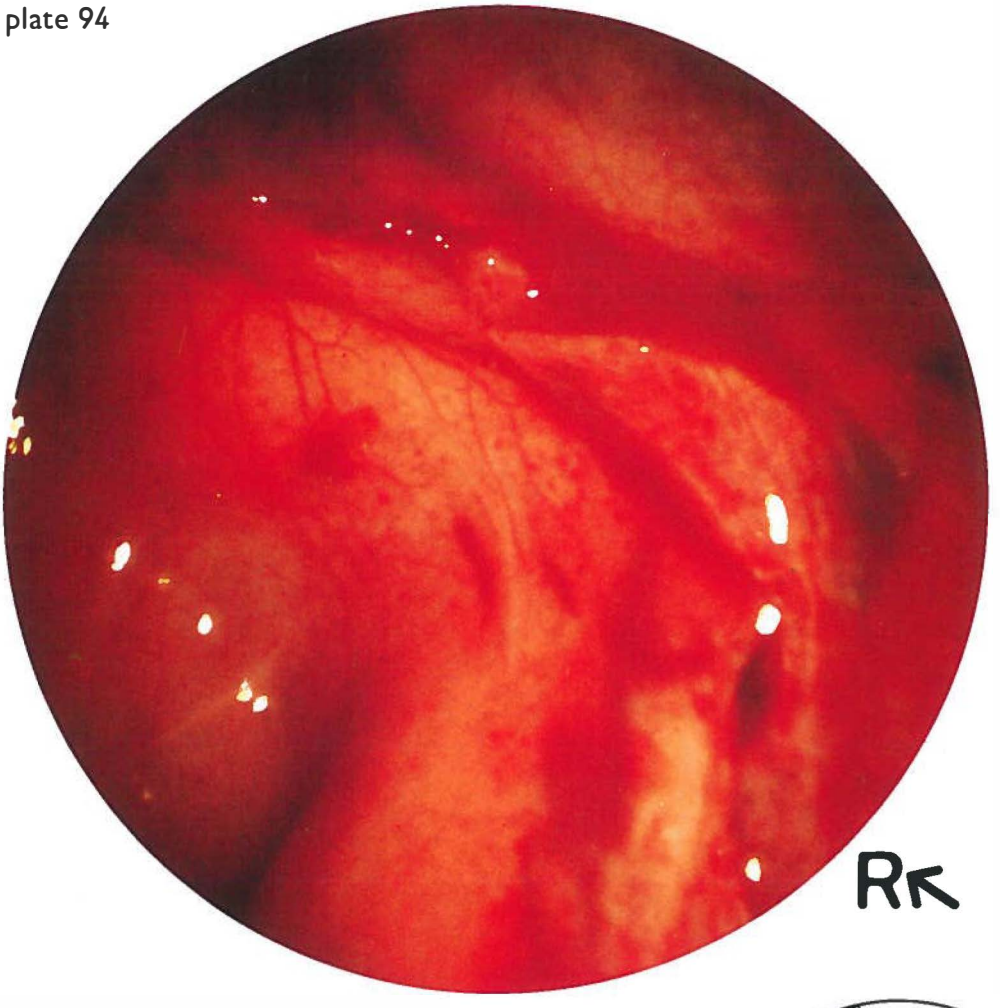
Patient J.v.d.R., male, aged 64, had been suffering from a gnawing pain in the right upper jaw for seven weeks. On the X-ray photographs the right maxillary sinus showed a diffuse opacity. Antroscopy of the right maxillary sinus showed a healthy mucous membrane. Caudally the posterior wall bulged locally when the patient closed his mouth. See also plate 93.

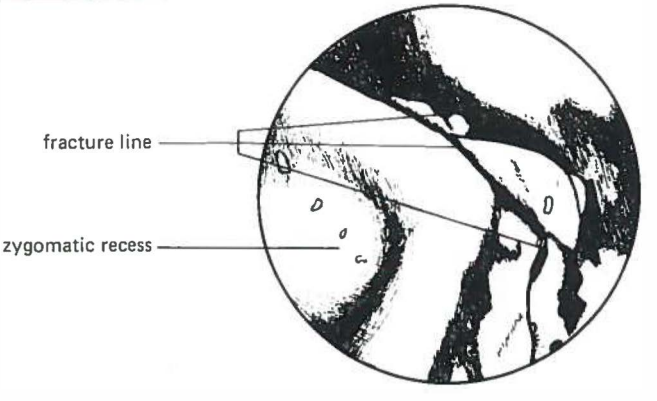




Right antroscopy: partial defect in the posterior wall (II)

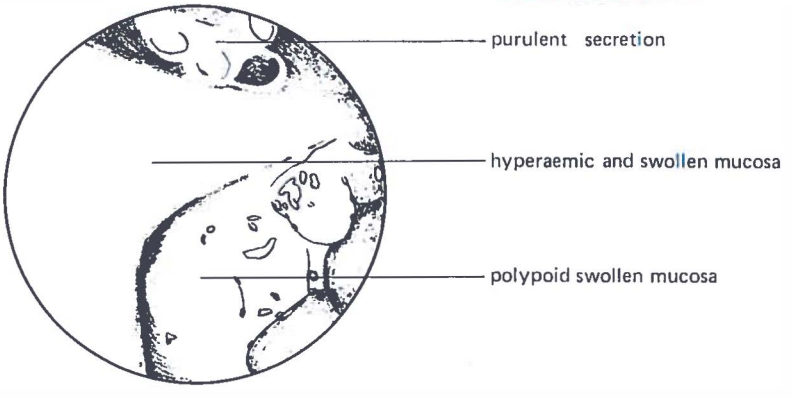
Same patient J.v.d.R., male, aged 64, as on plate 92. When the patient opened his mouth the local bulging of the posterior wall disappeared. There was a local defect in the bony posterior wall (anatomical variant). By pressure of the chewing muscles the posterior wall is pushed forward here. When the mouth is opened this pressure falls out, and the bulging disappears. The complaints disappeared spontaneously.





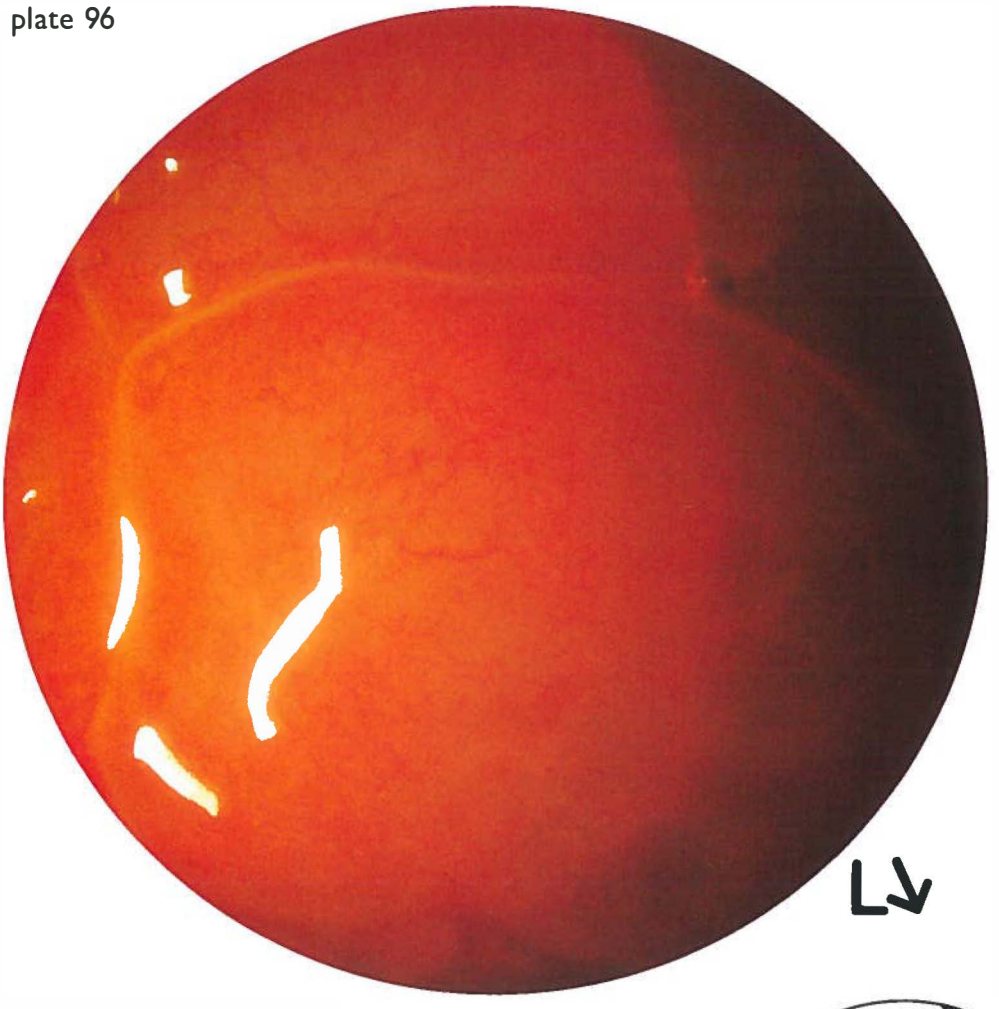
Right antroscopy: fracture of the upper jaw

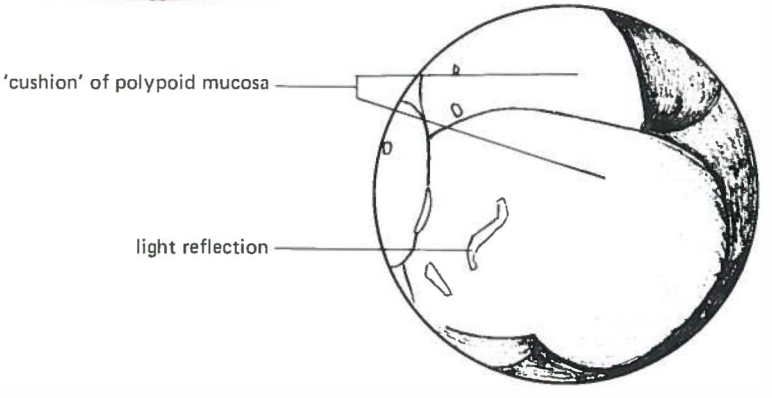
Patient G.N.-G., female, aged 44, had had a road-accident. On palpation there was a fracture of the rim of the right orbital floor. Apart from the orbital floor fracture, a fracture of the right zygomatic arch showed up on the X-ray photographs. No further fractures were to be seen. Antroscopy showed that the orbital floor fracture continued into the posterior wall, the anterior wall and the floor of the maxillary sinus.



Left ontroscopy: chronic sinusitis

Patient Sj.v.d.W., male, aged 37, had recurring sinusitis and nasal polyps. On the X-ray photographs there was an opacity indicating a mucosal thickening in both maxillary sinuses. Antroscopy showed the signs of chronic sinusitis on both sides.

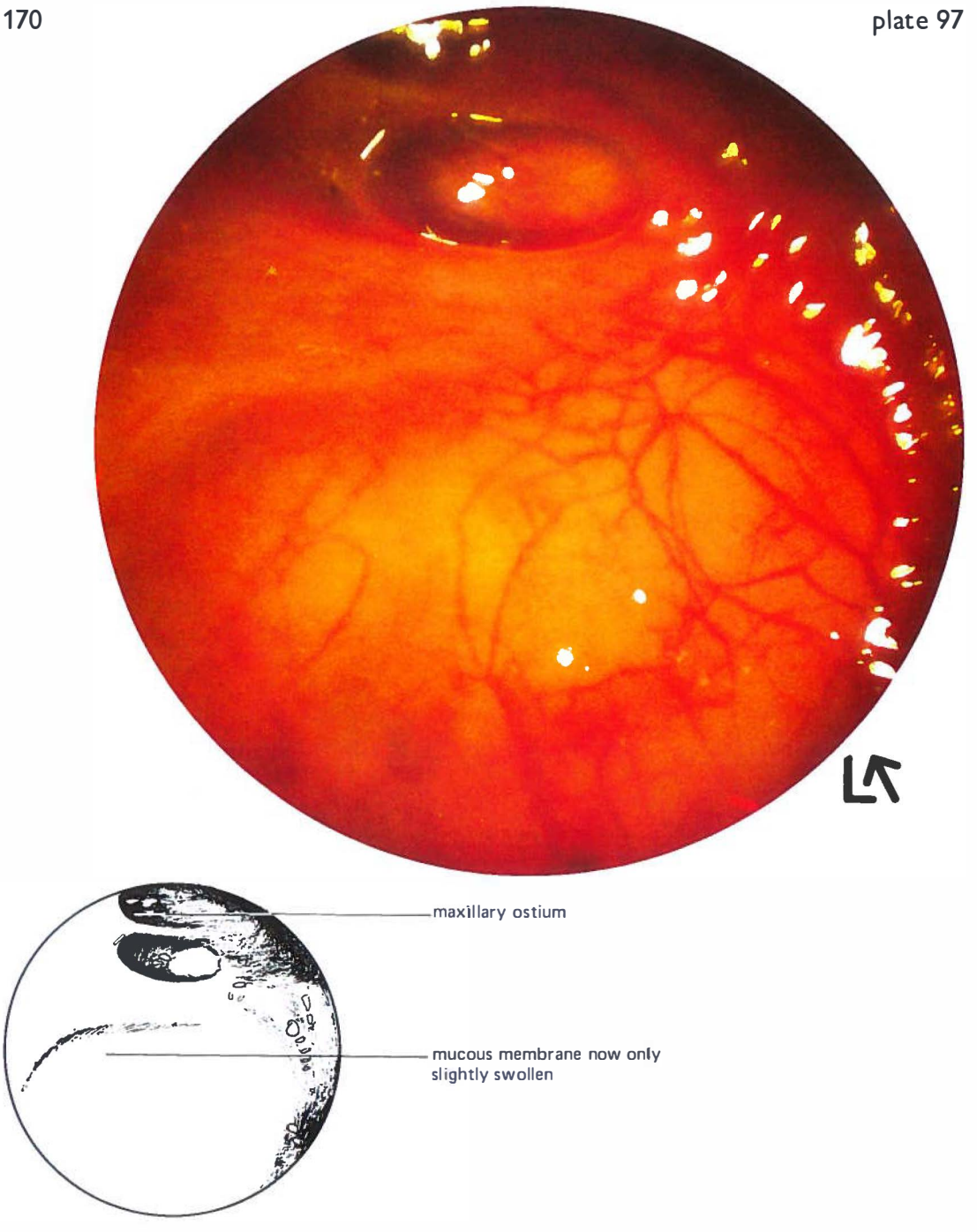




Left antroscopy: chronic sinusitis (detail)

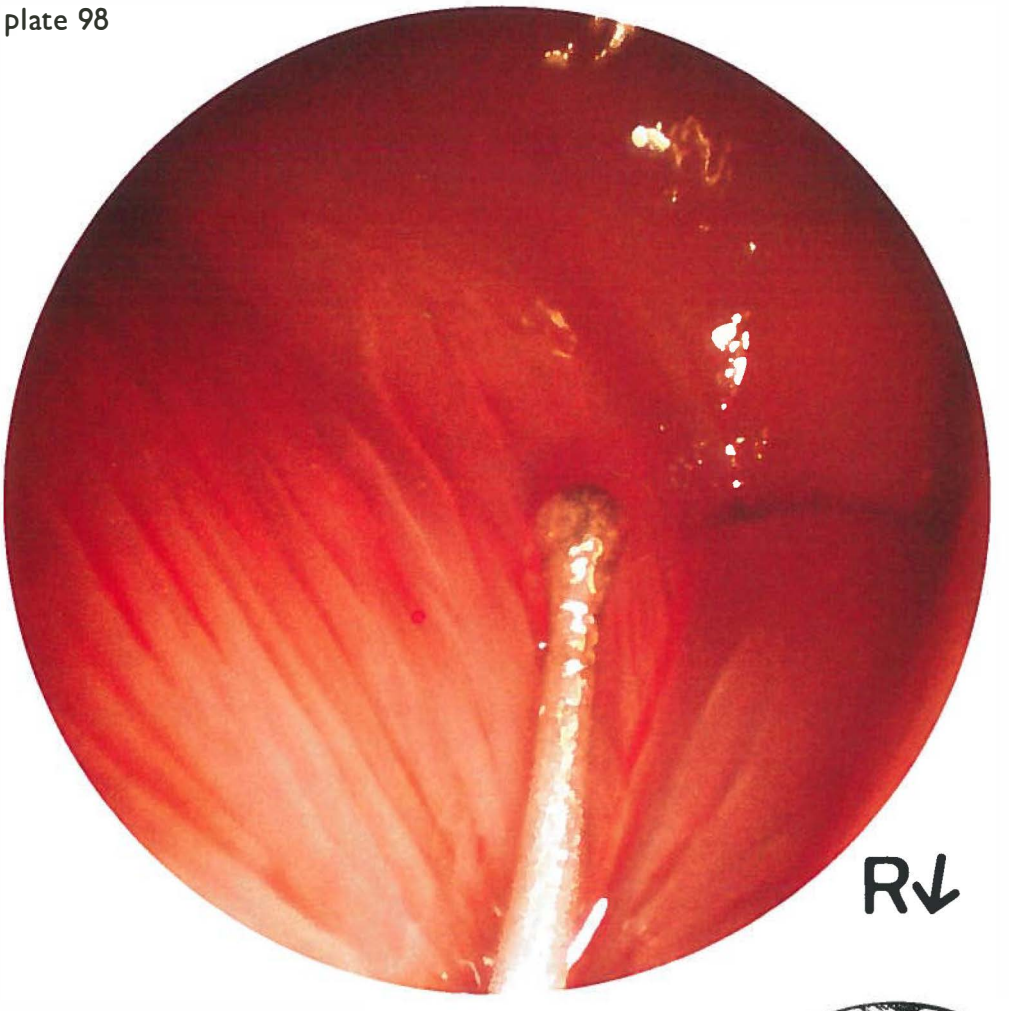
Same patient Sj.v.d.W., male, aged 37, as on plate 95.

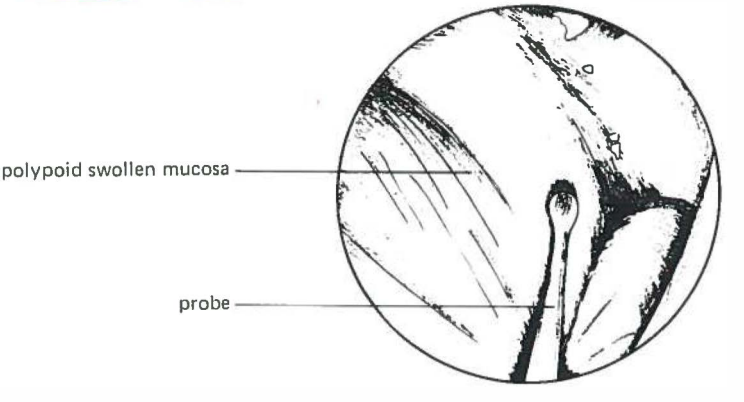
Especially on the floors of both maxillary sinuses there was a marked polypoid swelling of the mucosa.



Left antroscopy: check-up after therapy

Same patient Sj.v.d.W., male, aged 37, as on plates 95 and 96. In both maxillary sinuses 1 cc of Otricorten® (Xylometazolin 0,5% + dexamethason 0,1%) was left behind. Nose drops and antibiotics were prescribed besides. Antroscopy carried out 14 days afterwards proved that both maxillary sinuses were almost cured already, and contained no secretion. (This photograph is of the same area as that of plate 95.) The patient remained free of complaints.

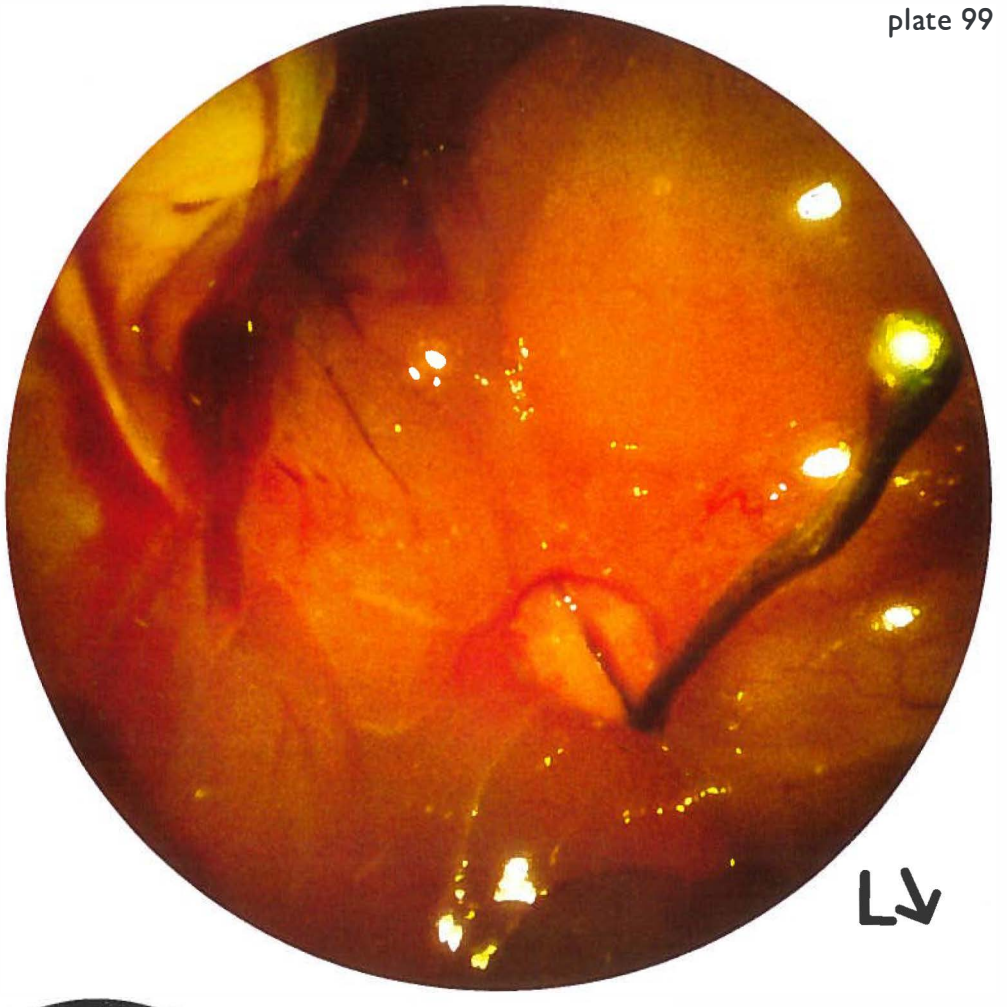


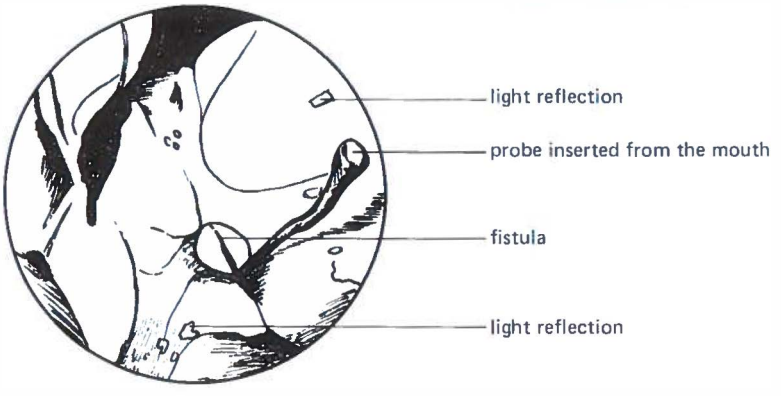


Right antroscopy: sinusitis caused by oroantral fistula

Patient H.S., male, aged 59, had symptoms of a chronic sinusitis on the right side after extraction of his teeth.

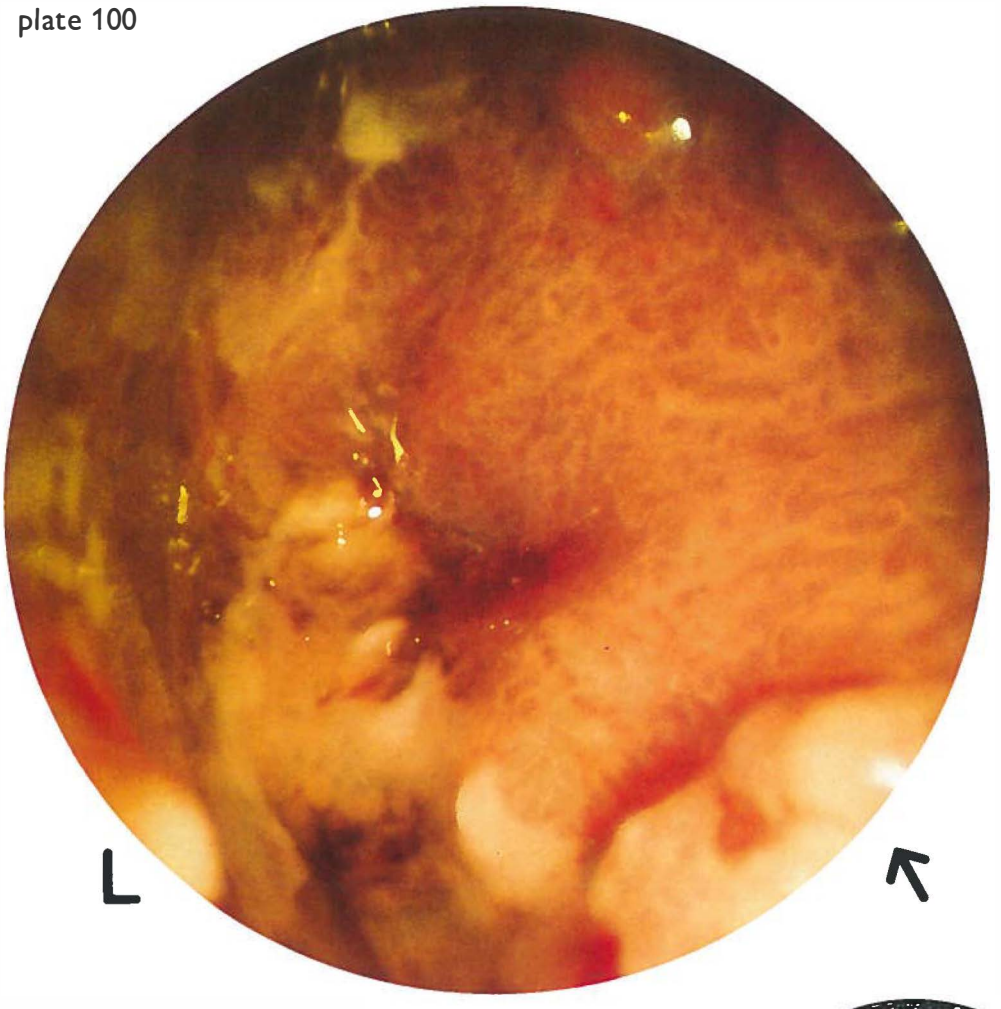
The probe seen on this photograph was introduced through the oroantral fistula. The fistula was closed surgically, after which the complaints disappeared.

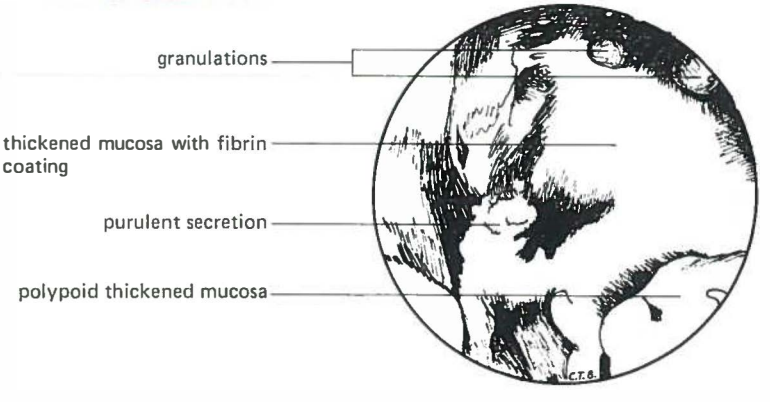




Left antroscopy: sinusitis caused by oroantral fistula

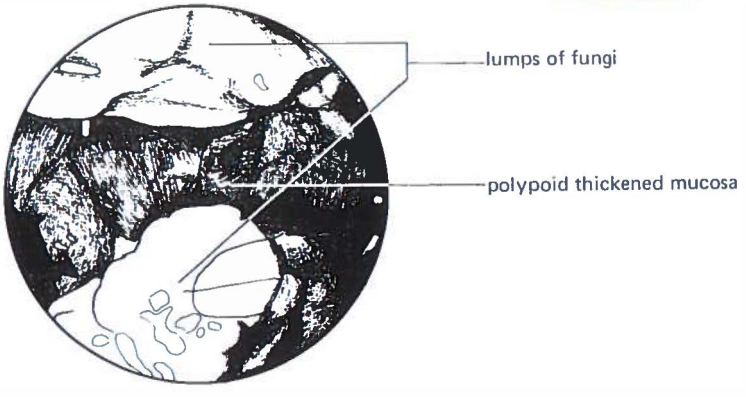
Patient R.K.B., male, aged 30, had had a large oroantral fistula on the left side for as long as 10 years, with recurrent sinusitises. Antroscopy showed that the maxillary ostium was blocked as a result of polypoid swollen mucosa. In this case surgical closure of the fistula was successful only after it was combined with a Caldwell–Luc operation.





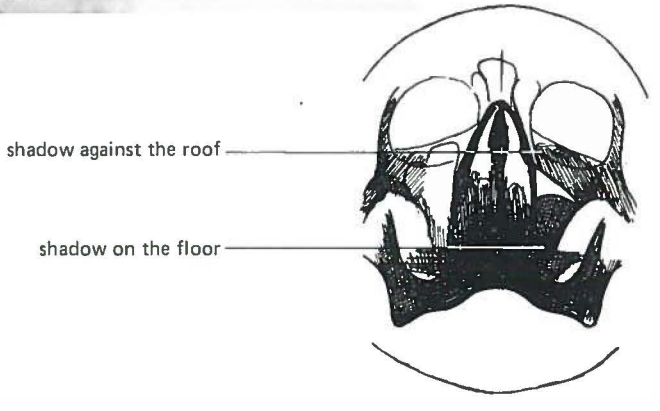
Left antroscopy: sinusitis with osteomyelitis

Patient P.E.H., female, aged 75, was admitted to the E.N.T.-department on account of a suspected malignancy in the left maxillary sinus. She had had nasal obstruction for the last six months. On examination there was a granulating oroantral fistula and a fistula in the left cheek. On the tomographs there was a defect in the floor of the left maxillary sinus. Antroscopy revealed an atypical chronic sinusitis. This was confirmed by histological examination. It was probably caused by an osteomyelitis which had started after extraction of the teeth.



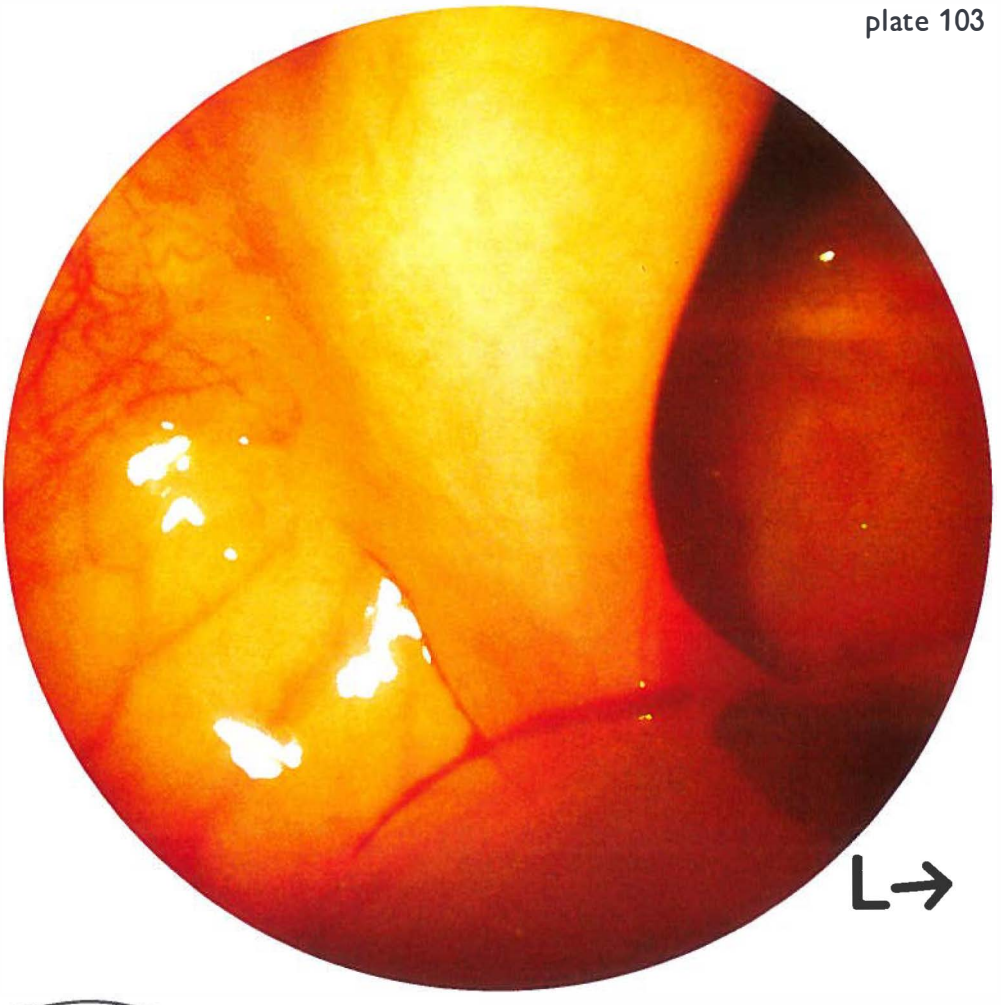
Left antroscopy: fungus infection

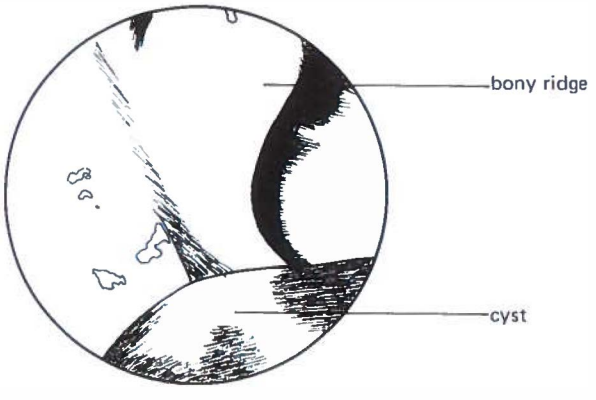
Patient A.B., female, aged 64, had been treated for a long time with cytostatics on account of a disseminated cystadenocarcinoma papilliferum ovarii, and with various antibiotics on account of chronic bronchitis. On the X-ray photographs there was a dense opacity of both maxillary sinuses. When antroscopy was carried out it looked as if the maxillary sinus was filled with necrotic material in addition to purulent secretion. Histologic examination of this material provided the diagnosis: fungus infection. Determination was not possible on account of fixation.



X-ray photographs: left maxillary sinusitis?

Patient J.P.Z., female, aged 50, had been suffering from nasal obstruction and fits of sneezing in the morning for a few months. On the X-ray photographs two shadows showed in the left maxillary sinus, one against the roof, one on the floor. With antral puncture no secretion could be rinsed out.

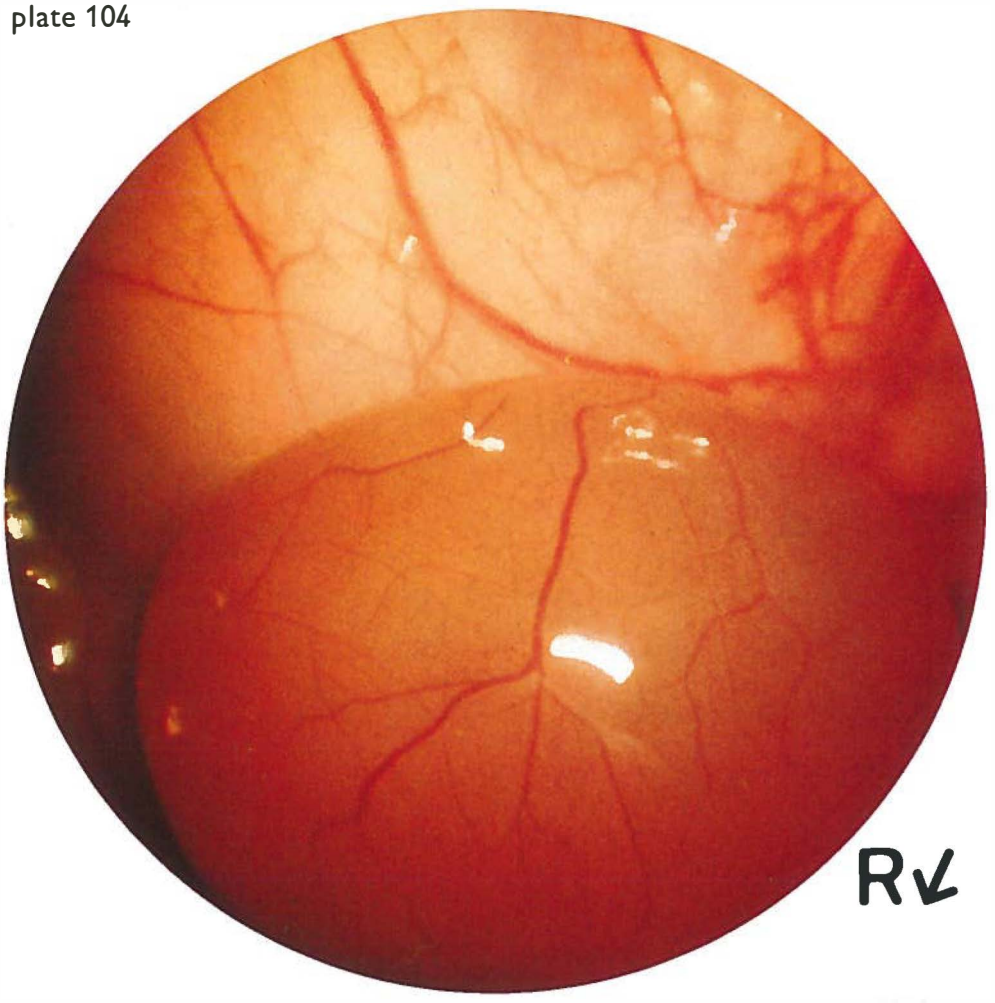


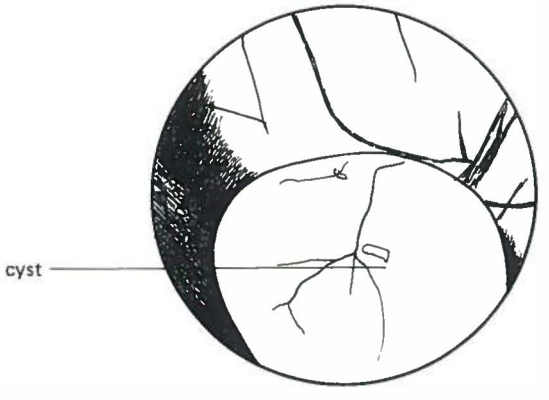


Left antroscopy: bony ridge and cyst

Same patient J.P.Z., female, aged 50, as on plate 102.

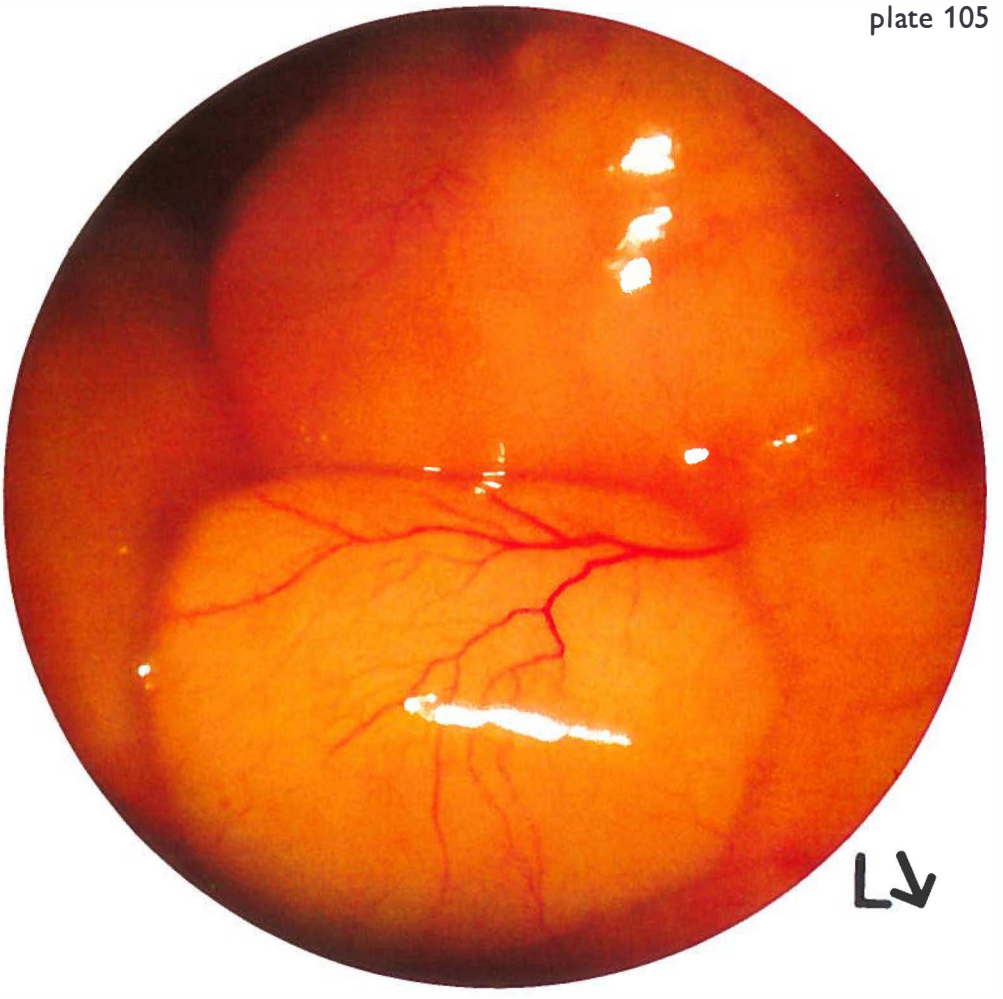
Antroscopy showed that there was no sinusitis. The shadow against the roof resulted from a large bony ridge; the shadow on the floor from a benign cyst.

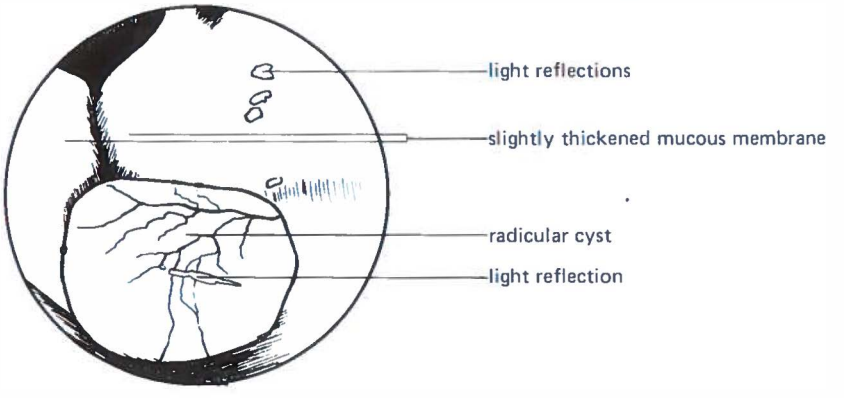




Right antroscopy: cyst on the floor

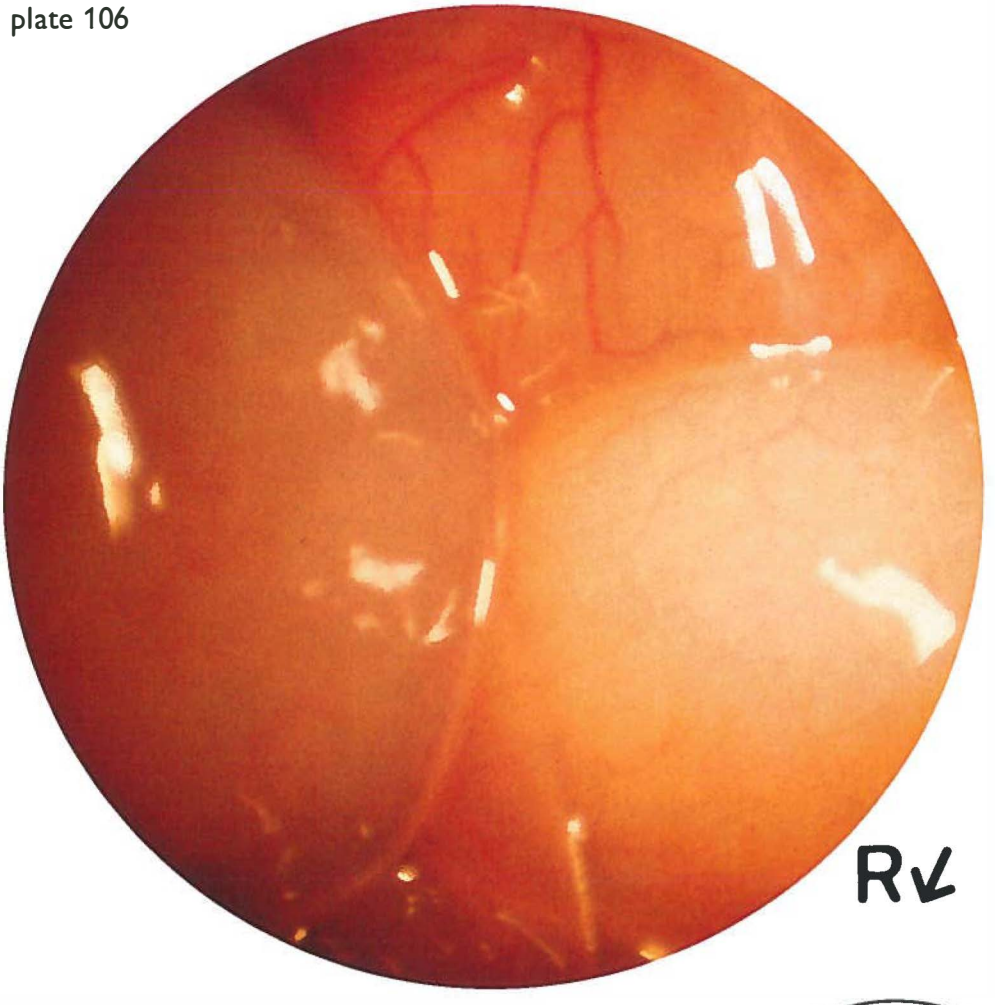
Patient R.B., male, aged 23, was seen on account of a pain in the right upper jaw, which appeared to be caused by caries of the third upper right molar. A shadow on the floor of the right maxillary sinus on the X-ray photograph (see fig. 38) turned out to be an innocent cyst in the mucous membrane (cf. plate 105).

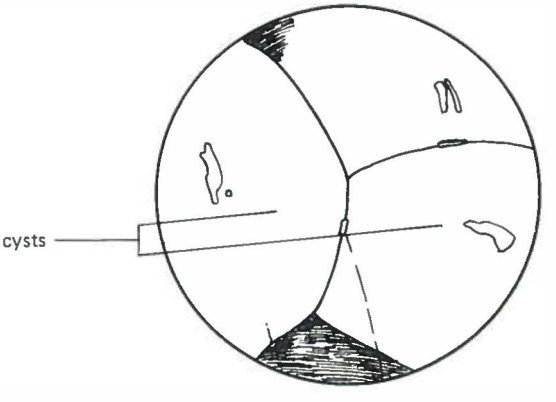




Left antroscopy: radicular cyst

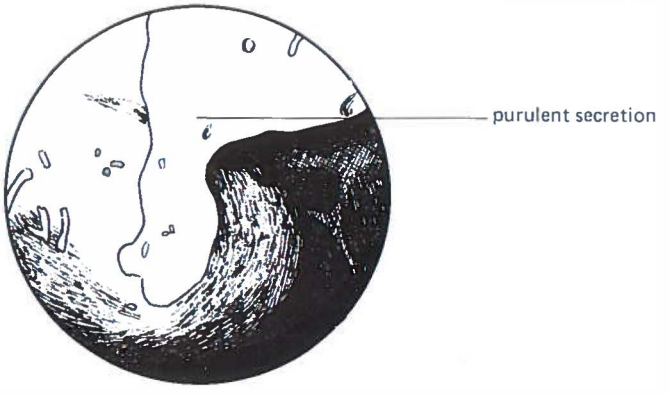
Patient J.K., male, aged 43, had very bad teeth. On the X-ray photographs a shadow on the floor of the left maxillary sinus showed up. This appeared to be caused by a radicular cyst. When such a cyst is small, the wall is often still bony, covered with a normal mucous membrane. The thin bony wall causes the difference in colour, compared with the cyst of the mucous membrane.





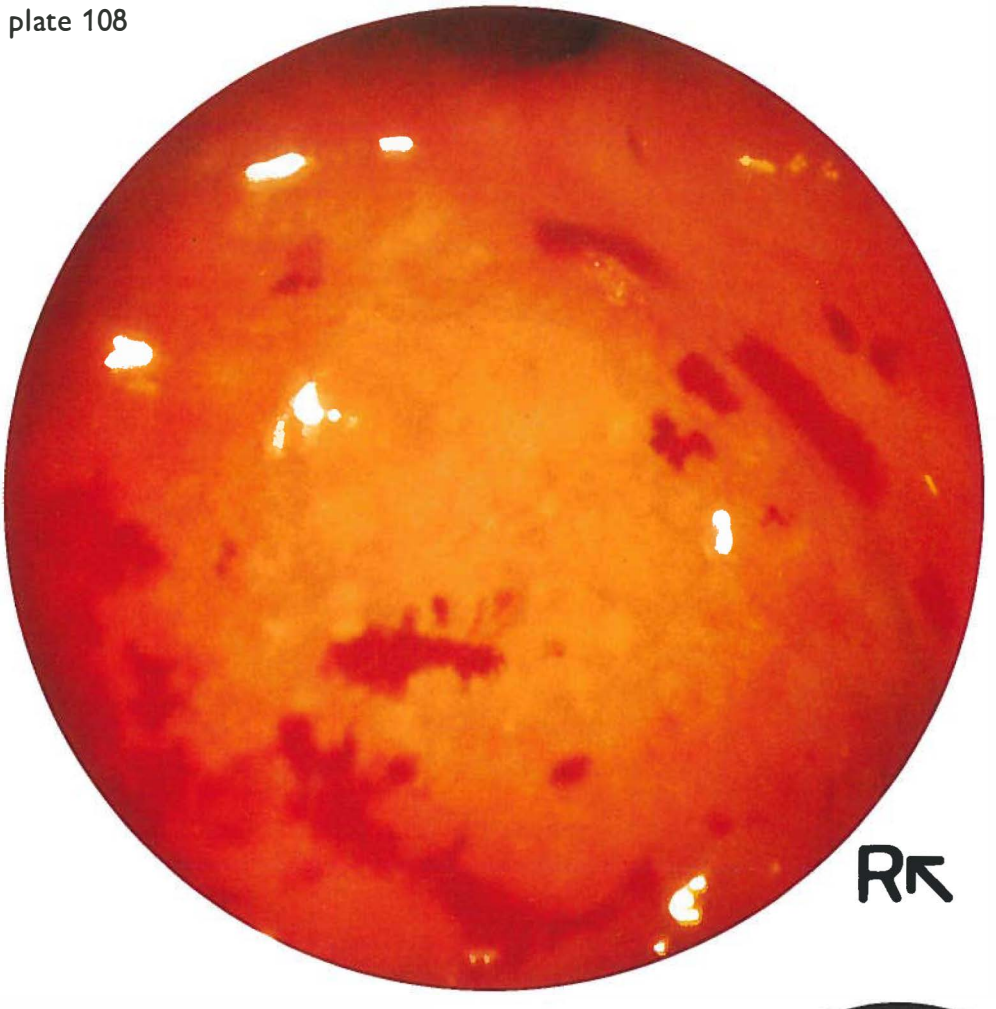
Right antroscopy: multiple cysts on the floor

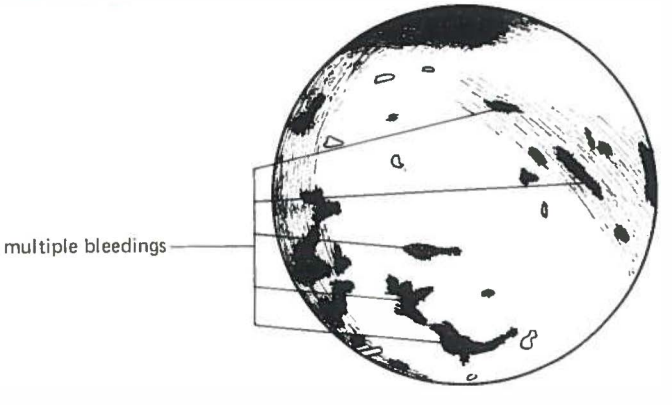
Patient J.B., male, aged 66, was treated successfully in the outpatients' department in connection with a pansinusitis. On the X-ray photographs there remained a caudal opacity of the right maxillary sinus, however. The opacity turned out to be caused by multiple cysts.



Left antroscopy: chronic sinusitis with viscous secretion

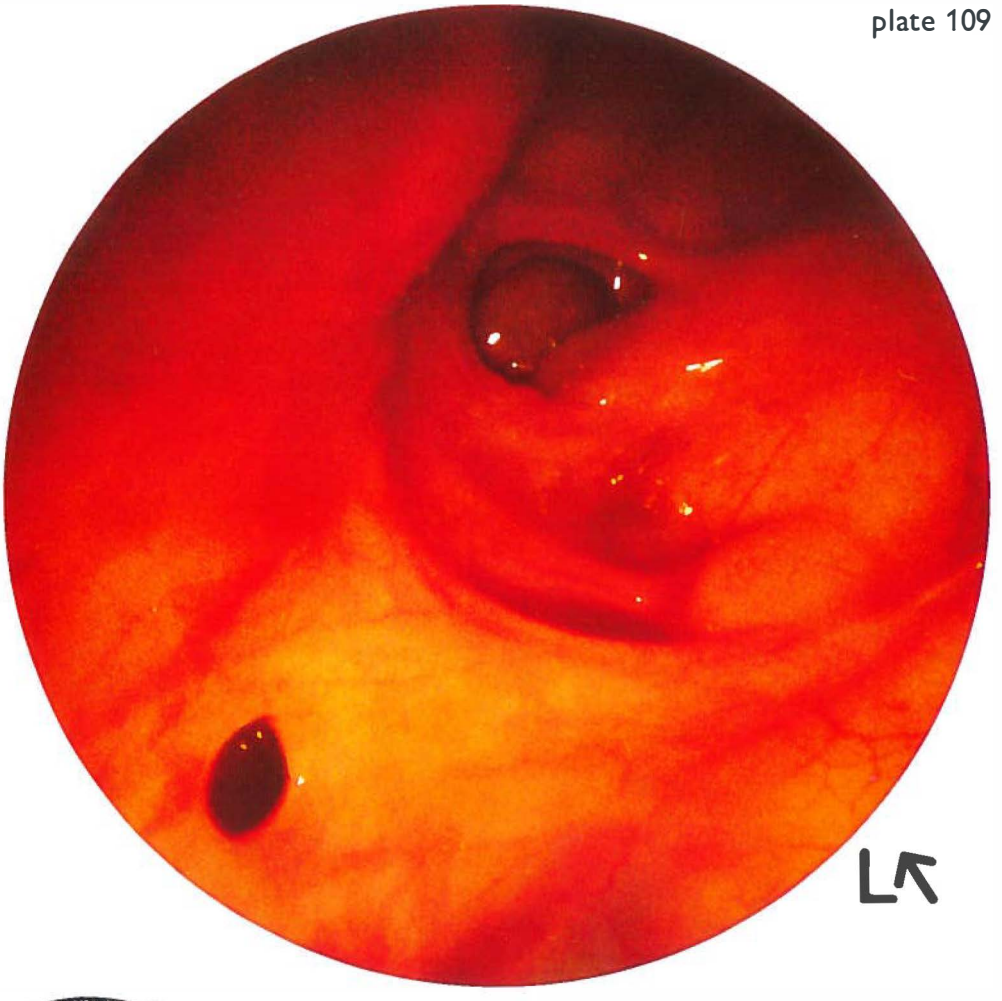
Patient H.Z.-H., female, aged 59, had frequent exacerbations of a chronic rhinosinusitis. On the X-ray photographs there was an opacity of both maxillary sinuses, more dense on the left side. After rinsing the left maxillary sinus, the picture of a chronic sinusitus emerged. A large clot of tough purulent secretion could not possibly be rinsed out, which might give the false impression of a clean sinus at a subsequent rinsing.

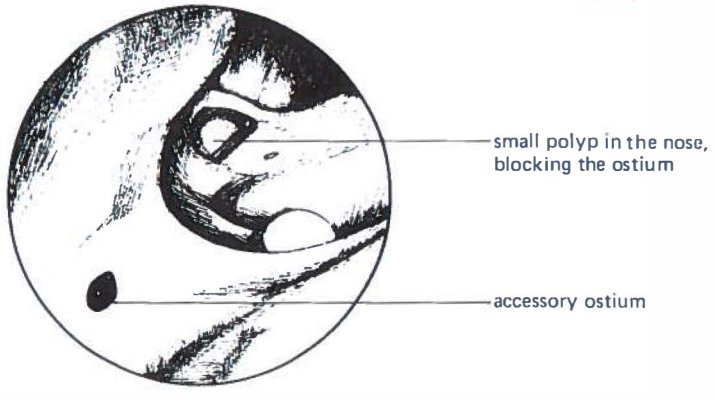




Right antroscopy: minor bleedings caused by vacuum

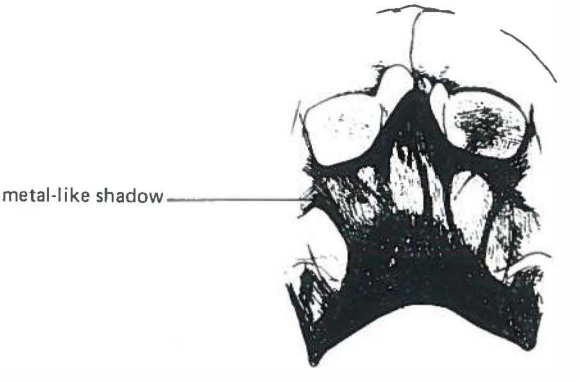
Same patient H.Z.-H., female, aged 59, as on plate 107. Antroscopy showed that the right maxillary sinus also contained pus. The maxillary ostium was blocked by a swelling of the mucous membrane. For this reason suction gave rise to a vacuum, which caused a great number of minor bleedings in the vulnerable swollen mucosa. It would seem unwise, therefore, to try to remove secretion by strong suction in antral puncture when the ostium is blocked.





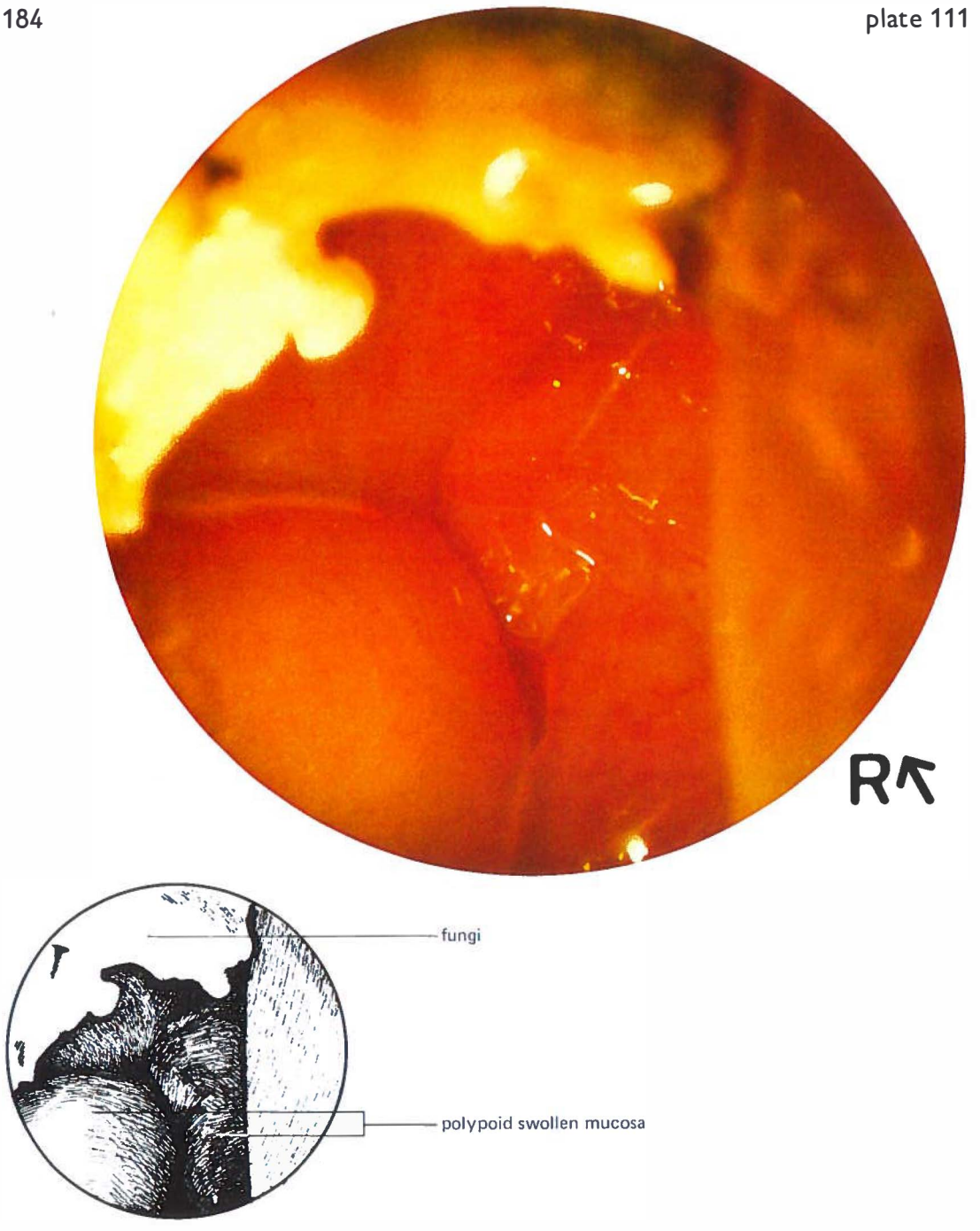
Left antroscopy: a small polyp blocking the maxillary ostium

Patient J.B., male, aged 38, had recurrent symptoms indicating sinusitis. The X-ray photographs showed an opacity of the left maxillary sinus suggesting a thickened mucosa. With antroscopy the mucous membrane of the left maxillary sinus turned out to be thickened on the floor only. The maxillary ostium, however, appeared to be blocked by a small polyp (from an ethmoidal cell) on the nasal side. This seems to explain the recurrent sinusitises. It has appeared that an accessory ostium seldom functions with regard to the transport of mucus.



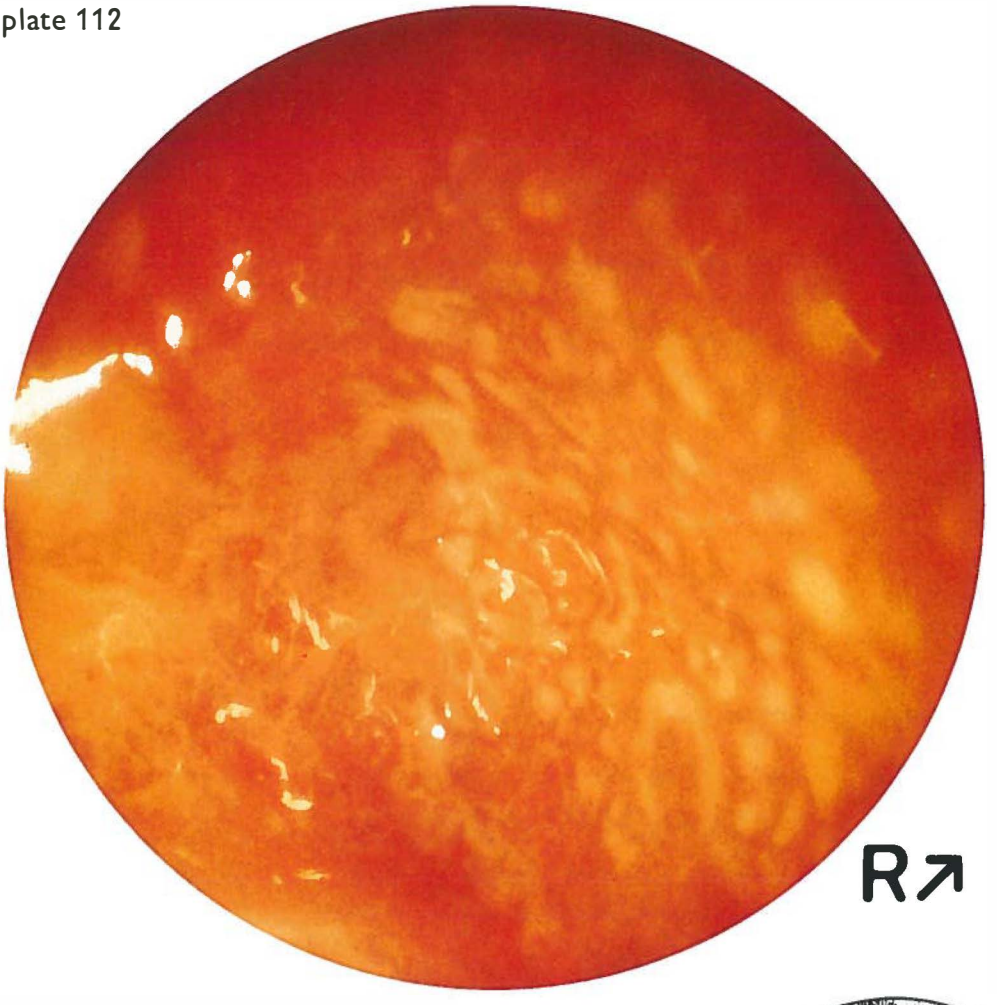
X-ray photograph: foreign body in the right maxillary sinus?

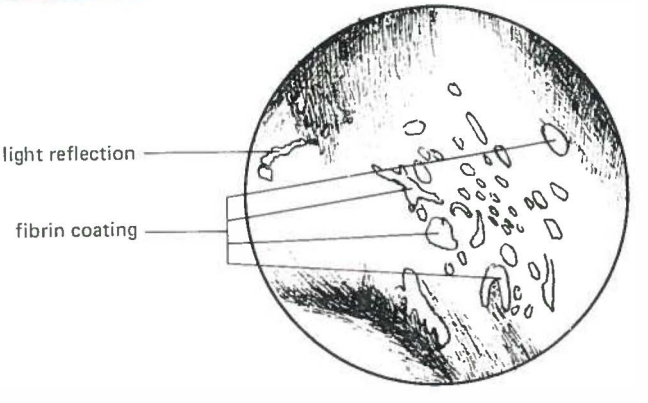
Patient A.v.O.-K., female, aged 25, pregnant, consulted the E.N.T.-specialist about symptoms suggesting a right maxillary sinusitis. On account of the pregnancy no X-ray examination was carried out. On the strength of the clinical evidence an antral puncture was made on the right side, and purulent secretion could be rinsed out. After six months the patient returned with identical complaints. She had had her baby, and X-ray photographs were made, showing a metal-like shadow in the right maxillary sinus. The patient was referred to the E.N.T.-department for antroscopy.



Right antroscopy: aspergillus infection

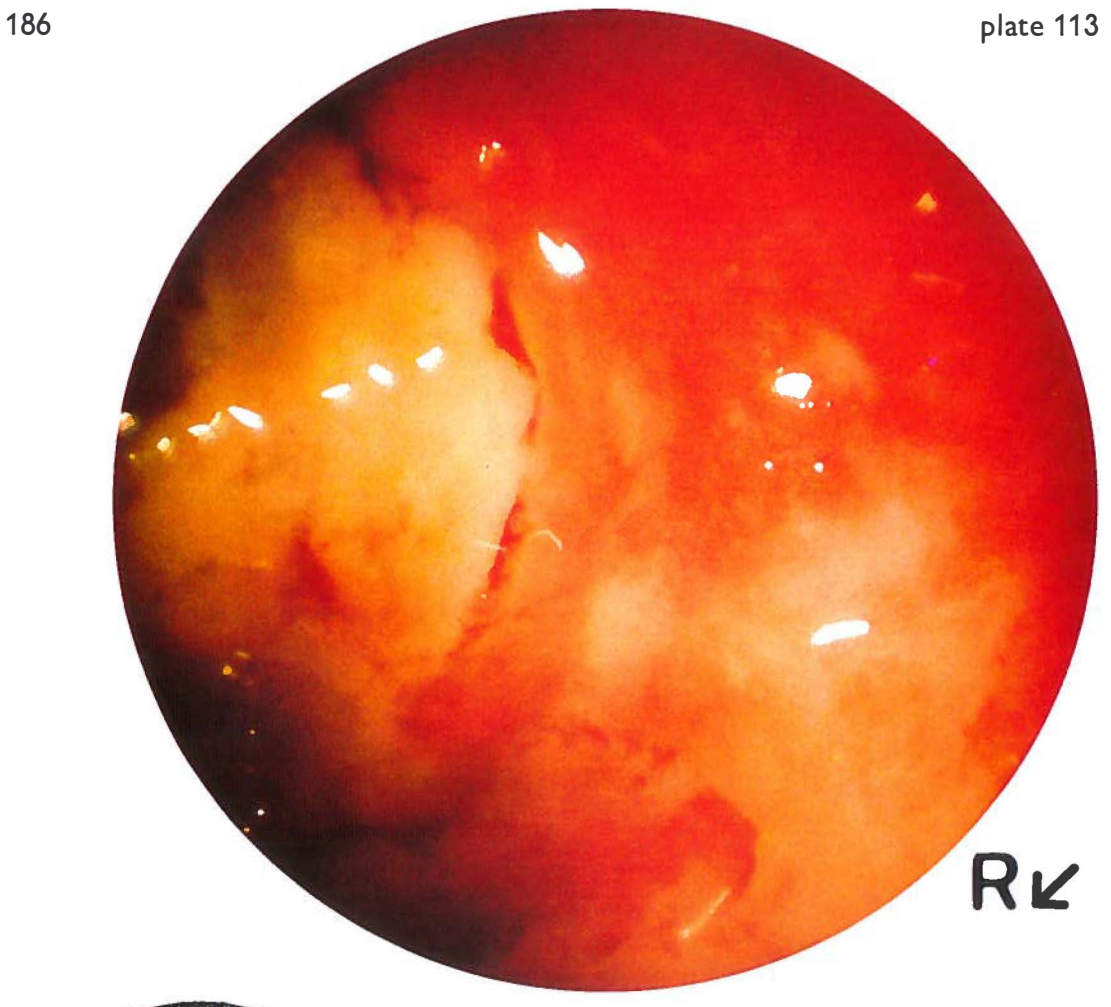
Patient A.v.O.-K., female, aged 25 (same patient as on plate 110), underwent antroscopy, which revealed a fungous infection of the right maxillary sinus. Culture: aspergillus fumigatus. After a Caldwell–Luc operation the patient remained free of complaints. The metal-like shadow on the X-ray photograph appeared to be caused by certain salts containing calcium produced by the fungi. We have come across several similar cases of a pseudo foreign body in the maxillary sinus since, caused by aspergillus.

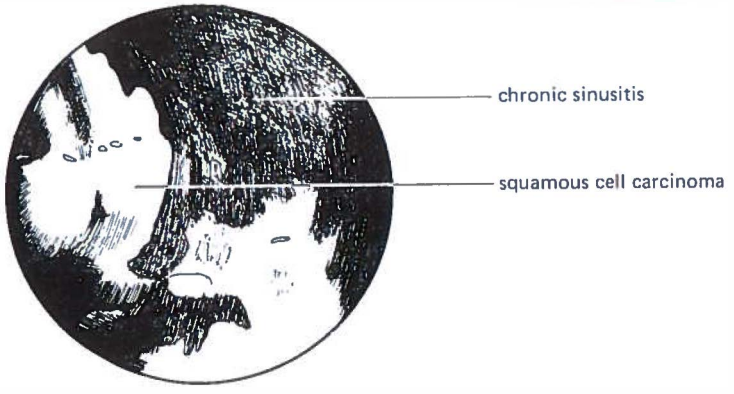




Right antroscopy: chronic ulcerating sinusitis

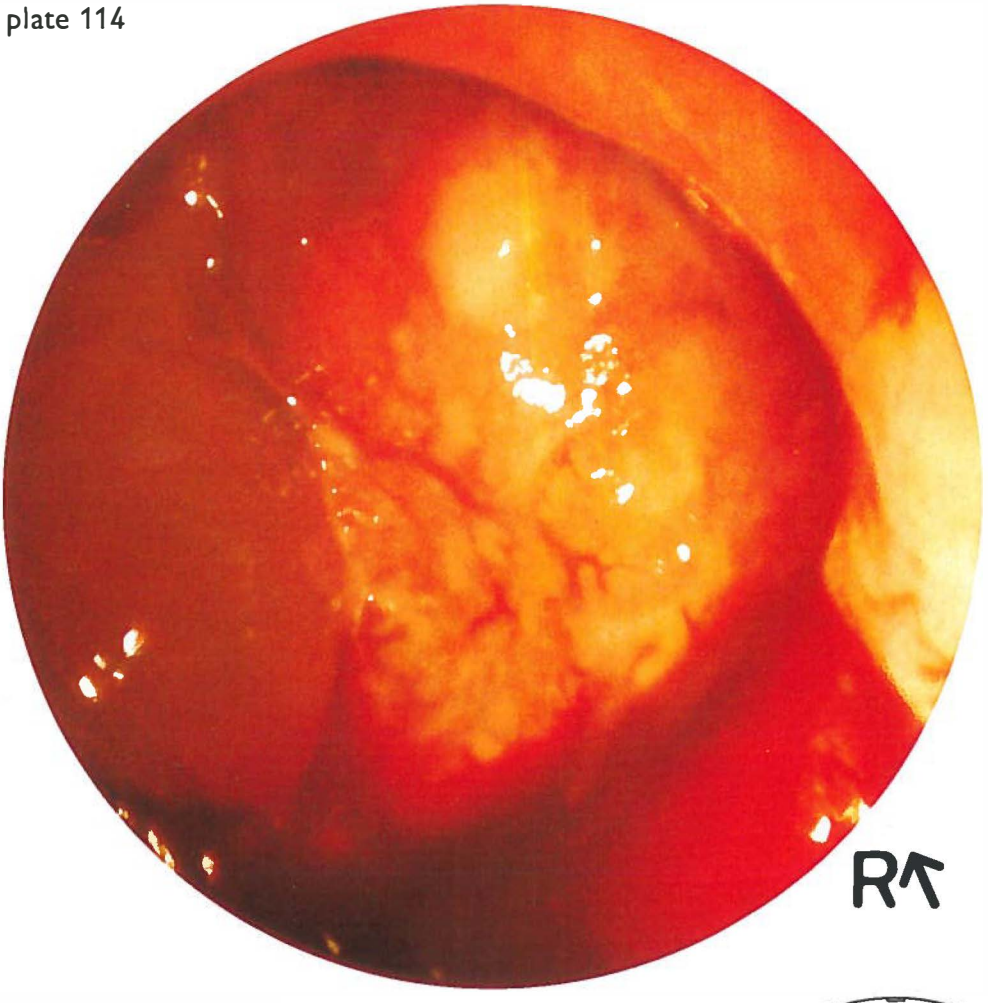
Patient H.W., male, aged 75, had had a pain in the right upper jaw for four months, accompanied by a progressive swelling of the right cheek, without any further complaints. A biopsy from the right buccogingival fold revealed a squamous cell carcinoma. The X-ray photographs showed an opacity of the right maxillary sinus and a possible defect in the anterior wall. Antroscopy: a chronic ulcerating sinusitis (biopsy) occupying the major part of the maxillary sinus. See however plate 113.

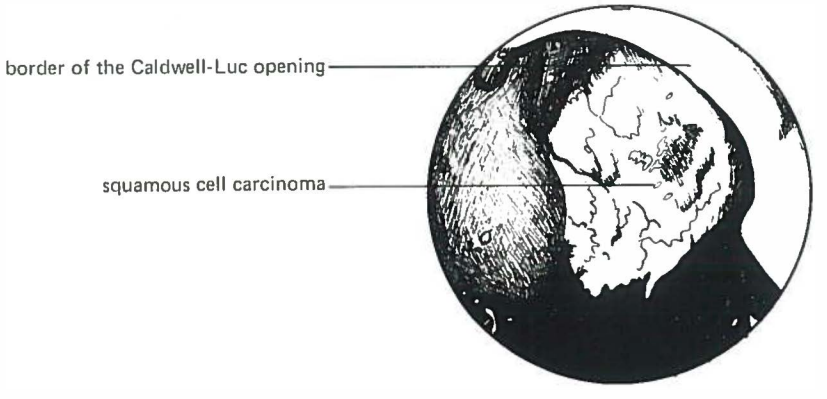




Right antroscopy: squamous cell carcinoma

Same patient H.W., male, aged 75, as on plate 112. Latero-caudally in the maxillary sinus there appeared to be a spread of the squamous cell carcinoma. The patient was treated with surgery after preoperative radiotherapy. Unfortunately, however, there appeared to be a recurrence after two months, of which the patient died.





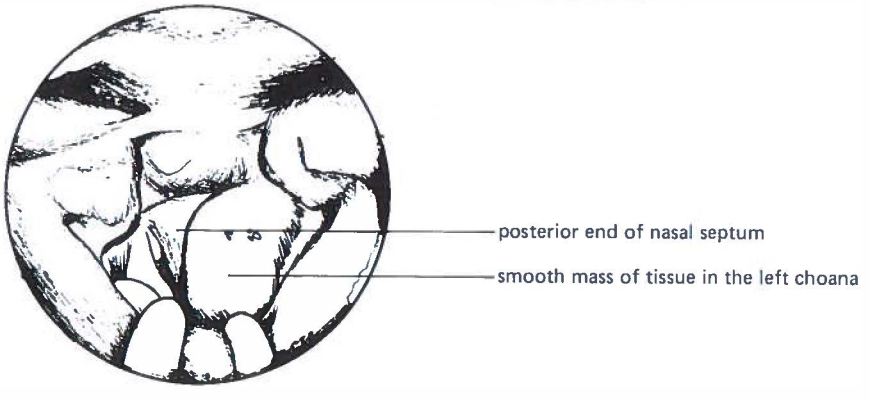
Right antroscopy: squamous cell carcinoma

Patient H.B., male, aged 79, had undergone a Caldwell–Luc operation ten years previously, after which he was, for a long time, free of complaints. Since a few months, however, he had a pain in the right upper jaw. Cytologic examination of the rinsing liquid of the right maxillary sinus showed suspect cells. Antroscopy carried out through the old antrostomy showed a granulating soft tissue swelling. Biopsy: squamous cell carcinoma. In view of his age the patient was treated with radiotherapy only (6000 Rads.). One year afterwards there were no signs of recurrence.

CHAPTER 10

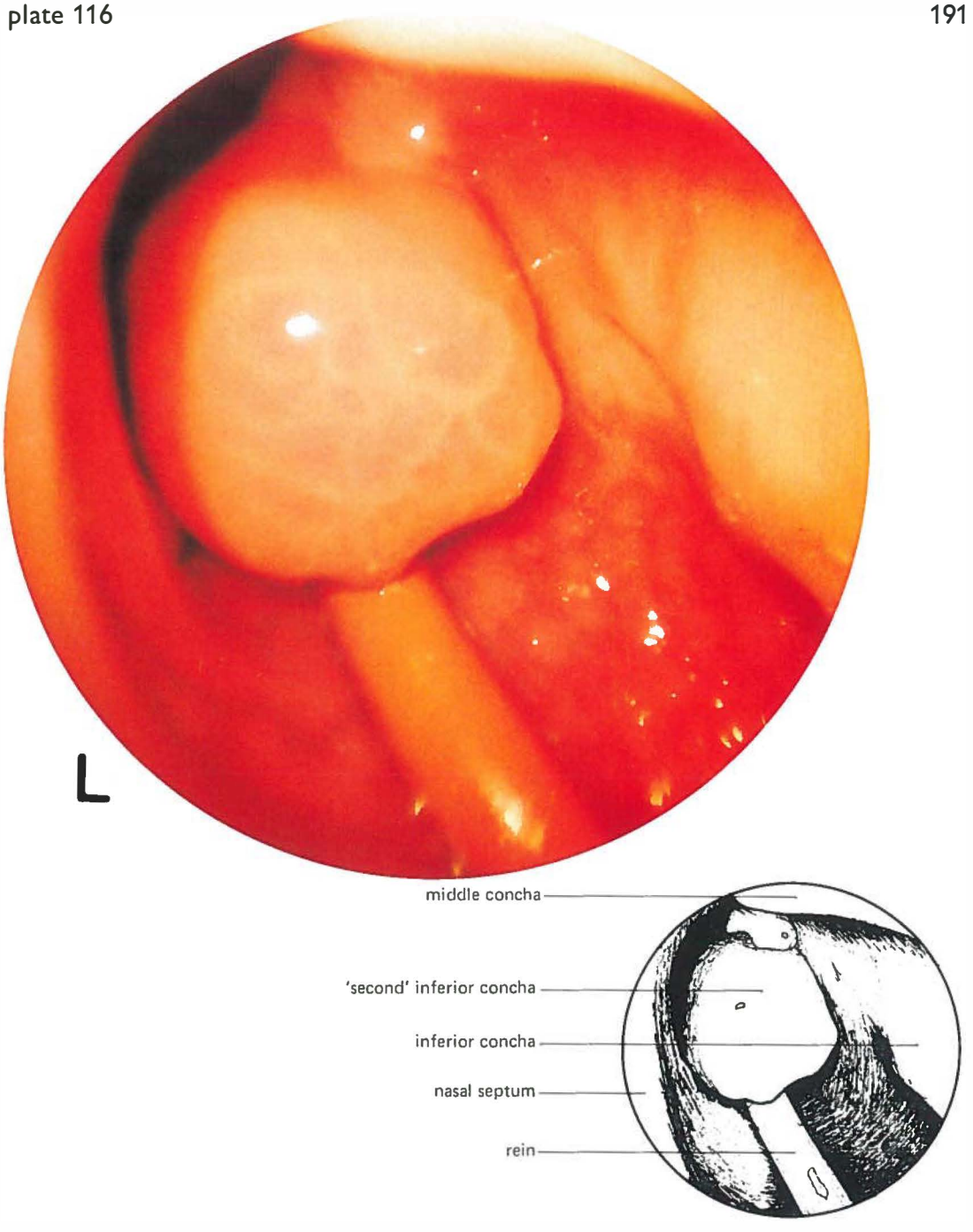
Combination of the endoscopic techniques

In this chapter it is demonstrated how combinations of the endoscopic techniques *(integral endoscopy)* result in a conclusive diagnosis of the diseases concerned. The letters and arrows by the side of the plates have been used in the same way as in the three preceding chapters.



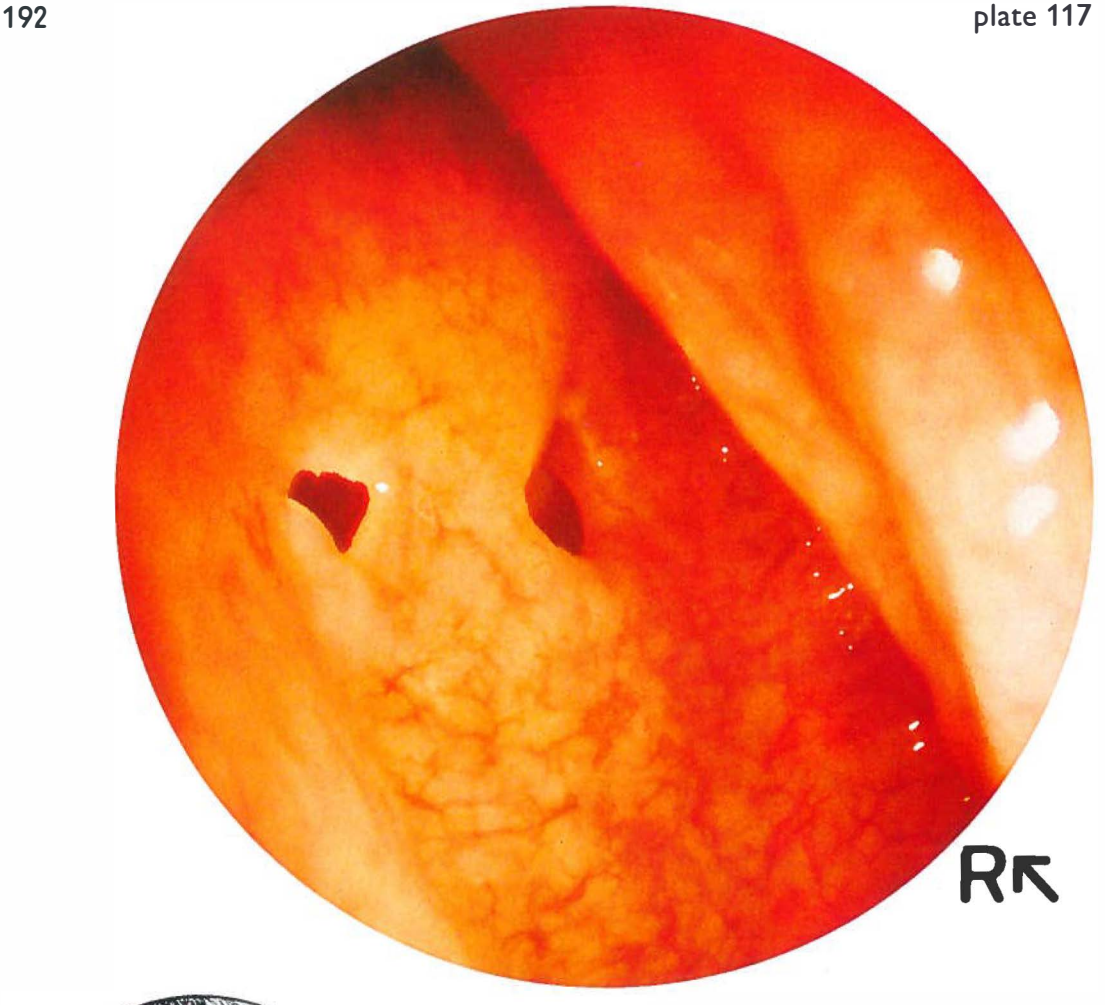
Nasopharyngoscopy: blocked left choana

Patient Sj.B., boy, aged 8, had chronic nasal obstruction on the left side. Nasopharyngoscopy revealed that the left choana was completely blocked by a smooth oval mass of tissue. See also plate 116.



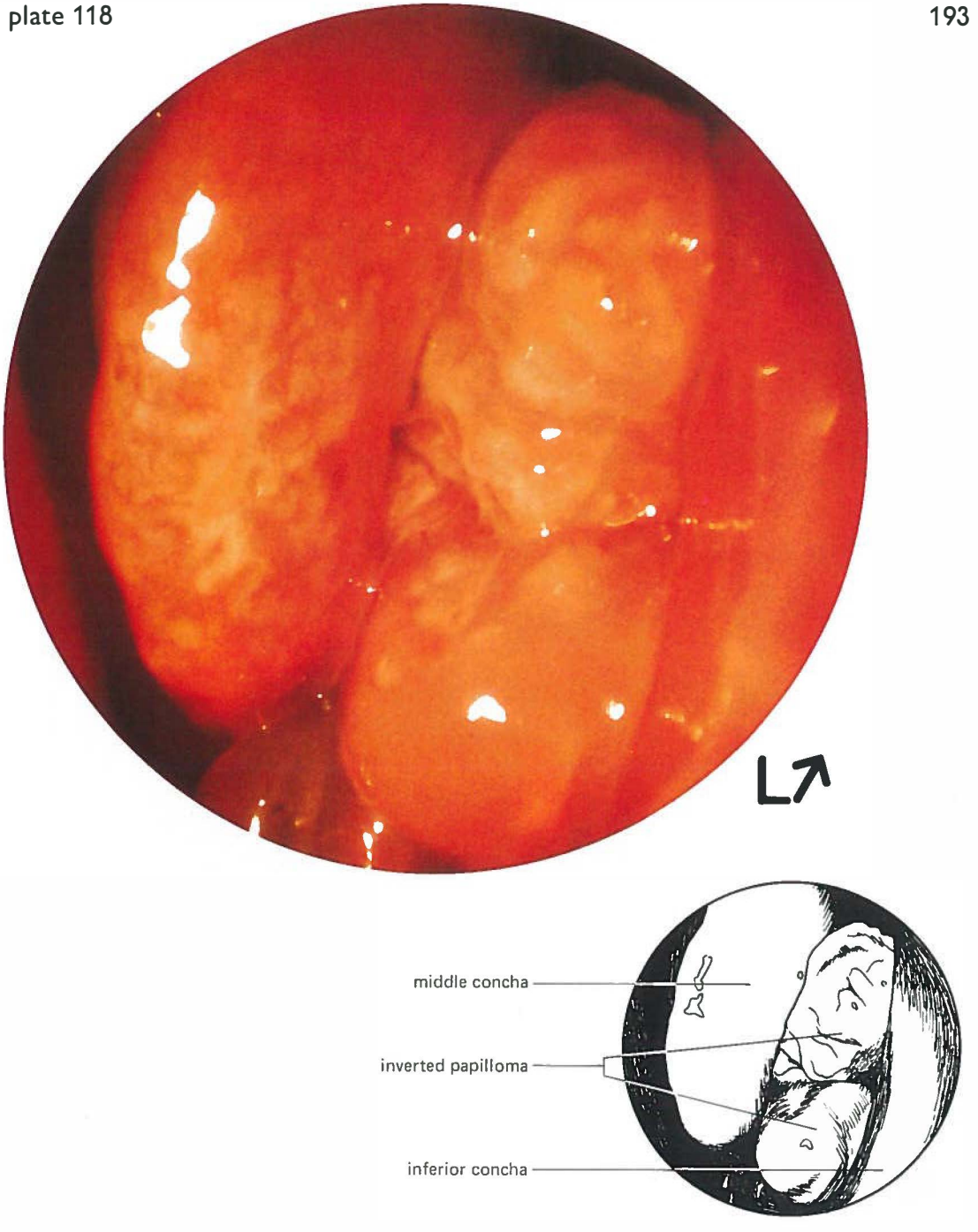
Left nasendoscopy: two inferior conchae?

Same patient Sj.B., boy, aged 8, as on plate 115. The tumor in the left choana appeared to be smooth and round on the anterior side also, and to be attached to the lateral wall. The inferior concha was much shorter than normally. After carefully questioning the mother it appeared that the boy had undergone a conchotomy several years previously.



Right nasendoscopy: accessory maxillary ostium

Patient S.K., male, aged 52, had been suffering from nasal obstruction and watery secretion on the left side for eight weeks. Right nasendoscopy showed normal anatomy, with the exception of an accessory maxillary ostium. See plates 118, 119, 120.



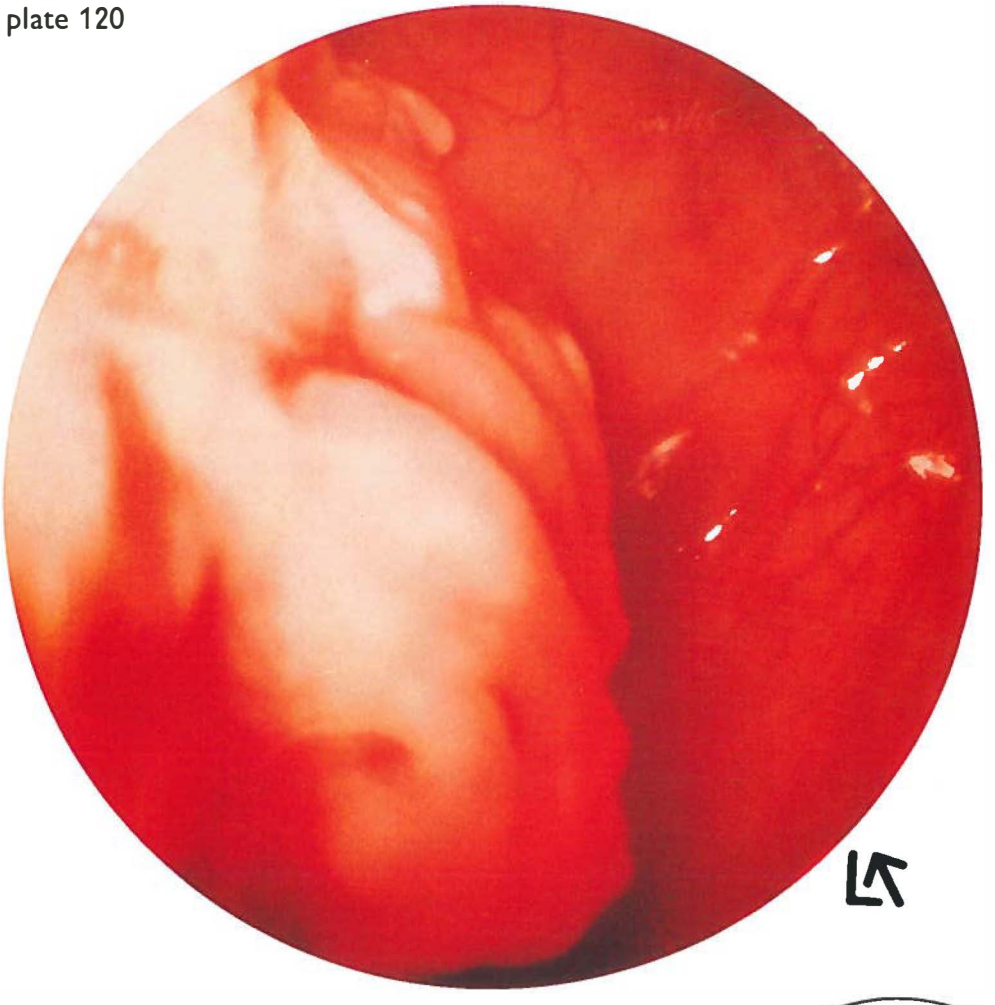
Left nasendoscopy: inverted papilloma

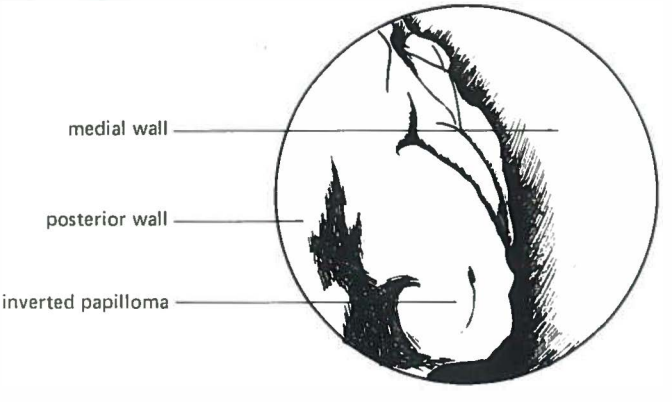
Same patient S.K., male, aged 52, as on plate 117.

In the left middle meatus atypical polyps were found, which on histological examination turned out to be an inverted papilloma.

X-ray photograph: opacity of left maxillary sinus

Same patient S.K., male, aged 52, as on plates 117 and 118, with an inverted papilloma in the left middle meatus. There was a dense opacity of the left maxillary sinus on the X-ray photographs. This was interpreted as a maxillary sinusitis caused by obstruction of the maxillary ostium by the inverted papilloma. See, however, plate 120.

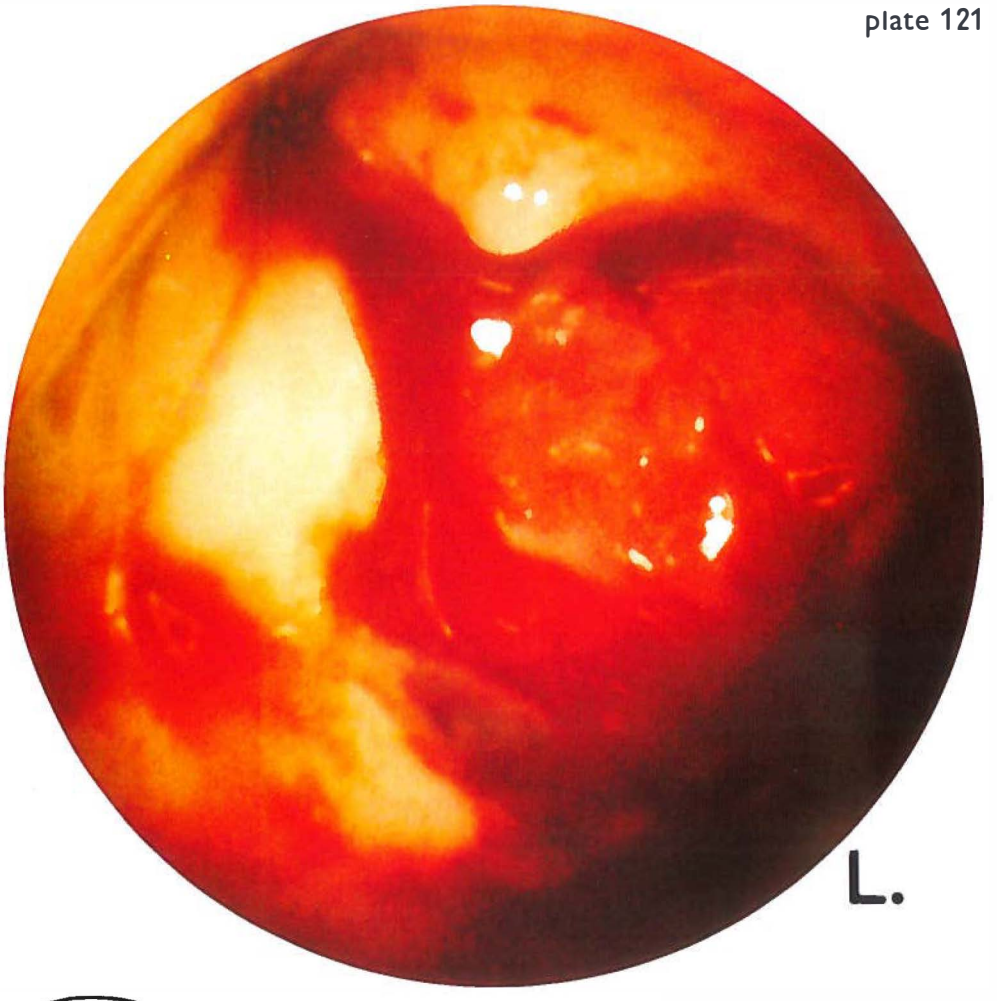


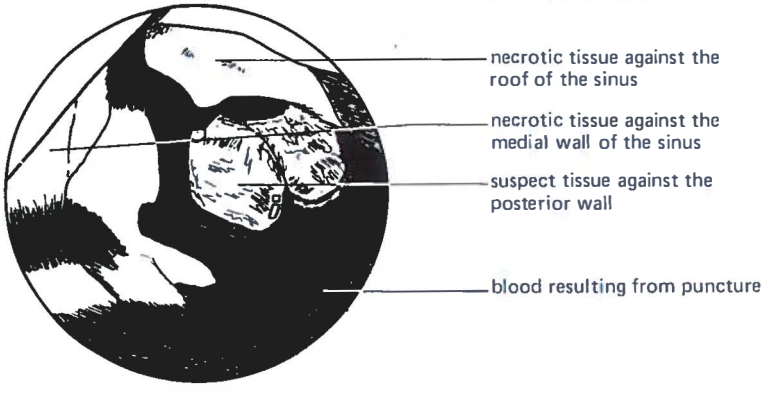


Left antroscopy: inverted papilloma

Same patient S.K., male, aged 52, as on plates 117, 118 and 119. In antroscopy the left maxillary sinus appeared to contain a clear fluid, probably the result of retention.

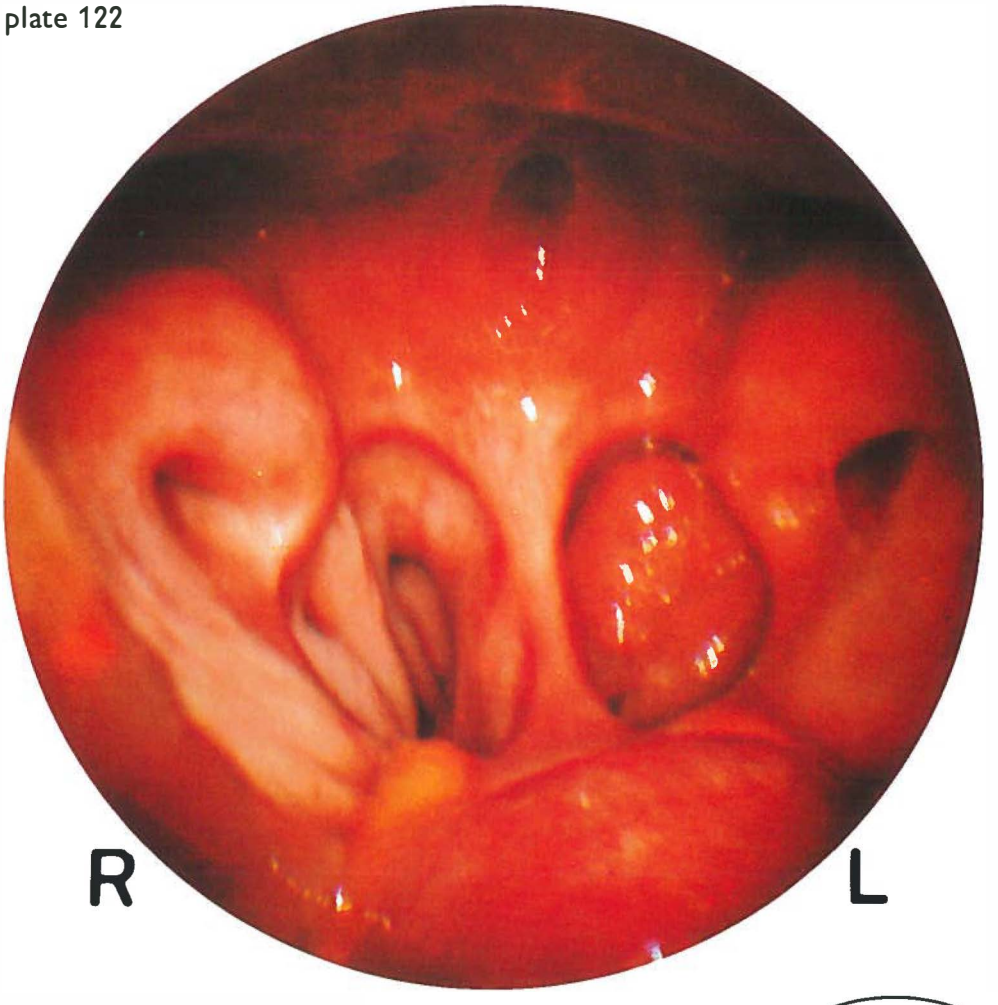
From the medial wall an irregular tumor protruded into the sinus. Biopsy: inverted papilloma. The patient was treated by a surgical removal of the complete lateral wall of the nose.

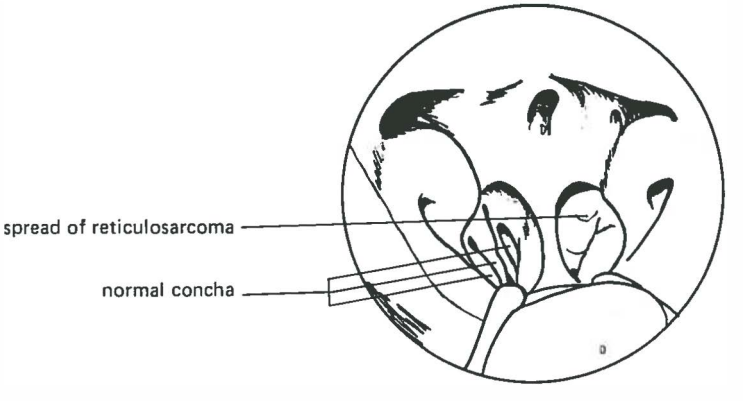




Left antroscopy: reticulasarcoma

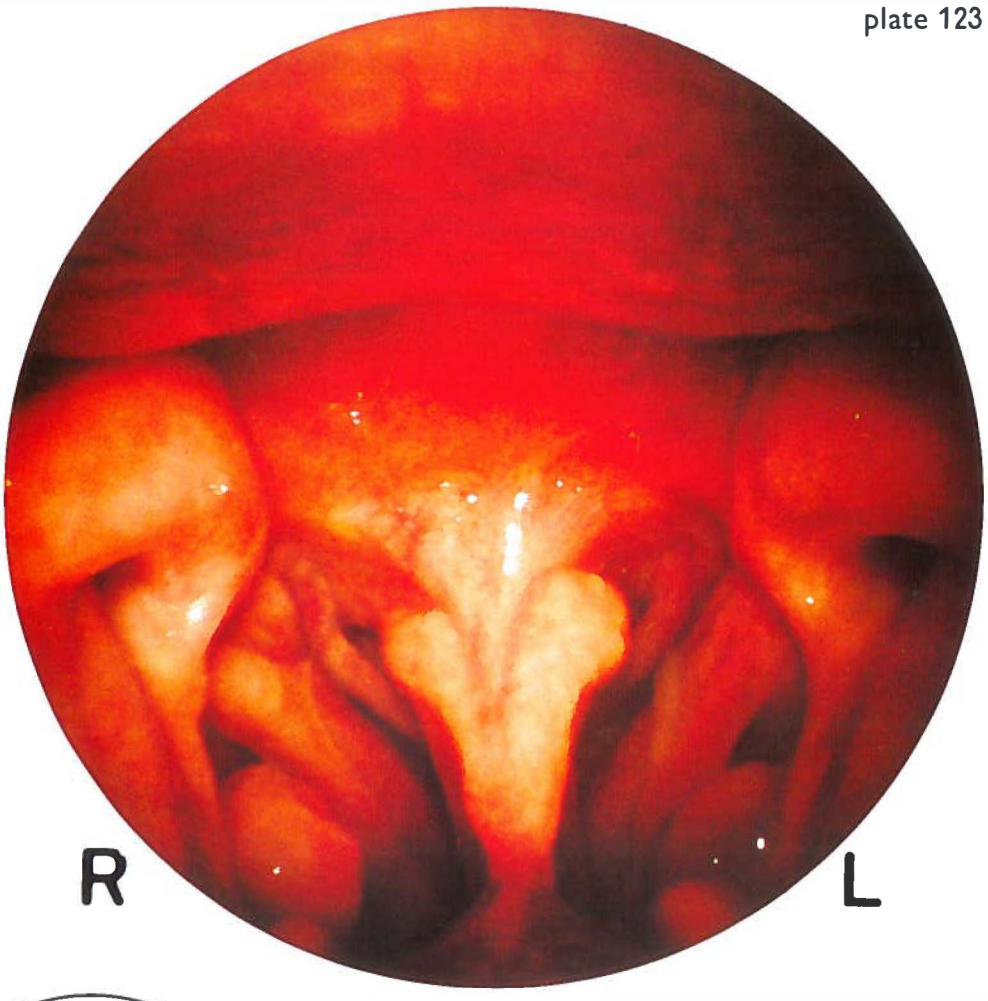
Patient A.J.-K., female, aged 52, had had a swelling on the left side of the neck for four months and a protrusion of the left eye during the last three weeks. The right eyesight was bad due to cateract. Apart from suspect lymph nodes on the left side of the neck no further signs of disease were found on examination. On the X-ray photographs there was a dense opacity of the left maxillary sinus and the left orbital floor was not clearly outlined. The cytologic examination of the rinsing fluid of the left maxillary sinus was repeatedly negative. Biopsy by means of antroscopy revealed a reticulosarcoma covered by sound mucosa. See also plate 122.

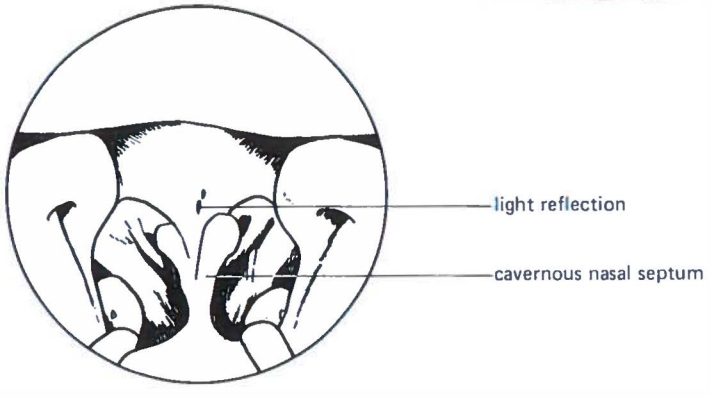




Nasopharyngoscopy: spread of reticulosarcoma into the nose

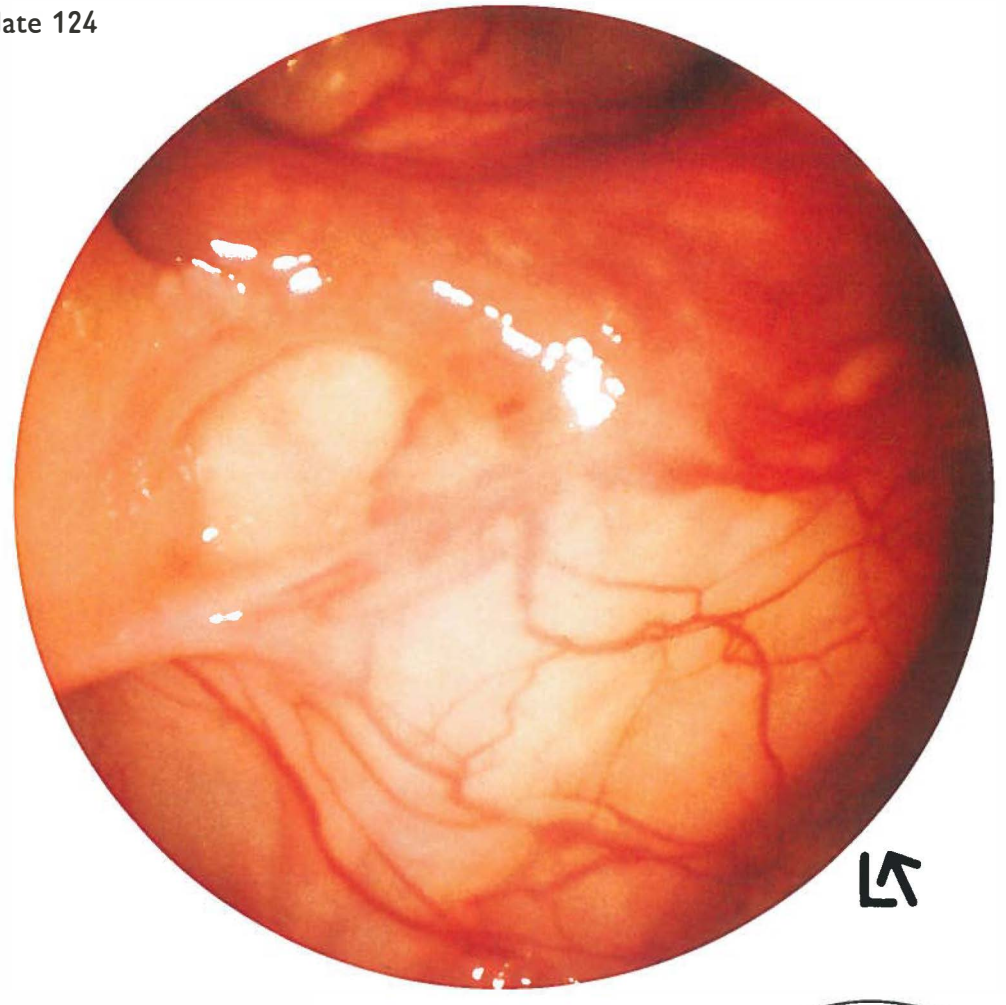
Same patient A.J.-K., female, aged 52, as on plate 121. There appeared to be a spread of the reticulosarcoma into the back of the left nasal cavity. Scans of the liver and spleen gave indications of dissemination of the reticulosarcoma. For this reason only palliative radiotherapy was given. One year later metastases in the lung became manifest. The patient died shortly afterwards of cachexia.

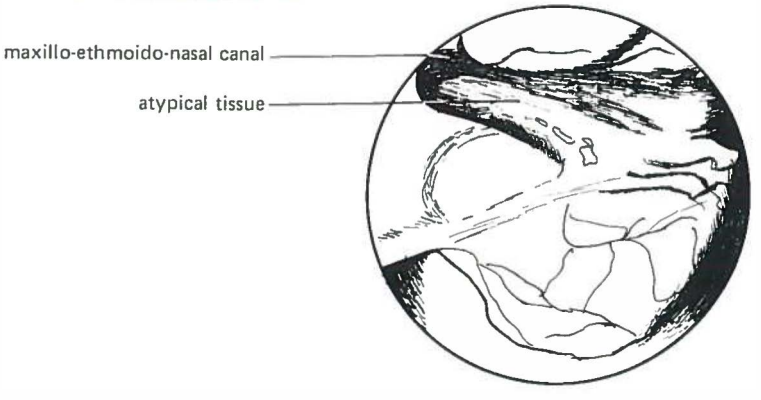




Nasopharyngoscopy: no signs of spread of ethmoid carcinoma

Patient J.D., male, aged 51, had been suffering from nasal obstruction for two years before consulting the E.N.T. specialist. There appeared to be an anaplastic carcinoma in the anterior ethmoidal region. A suspect lymph node was palpated on the left side submandibularly. Tomography showed only an opacity in the left ethmoid region and cranially in the left nasal cavity, without signs of destruction of the bony walls. Nasopharyngoscopy produced no indications of spread of the carcinoma.

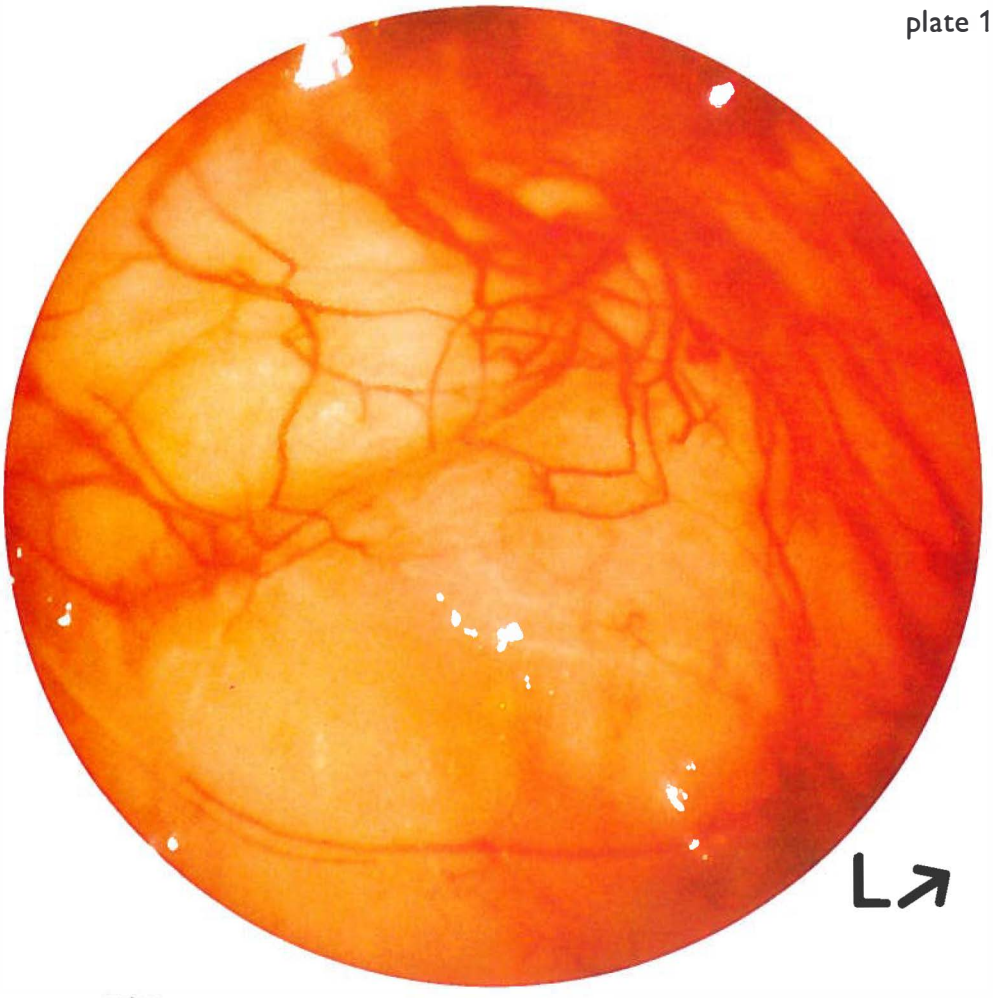


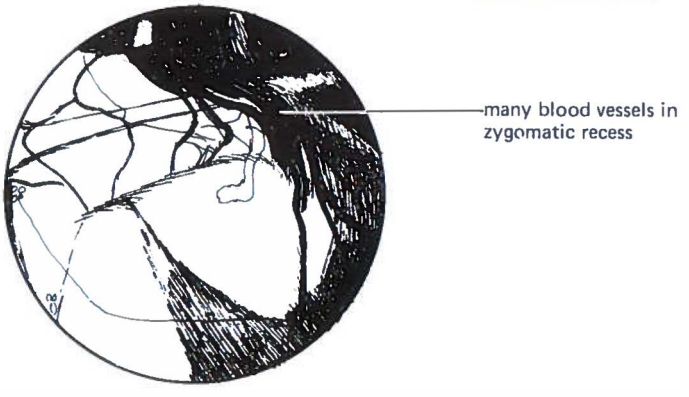


Left antroscopy (I): atypical tissue in the maxillary sinus

Same patient J.D., male, aged 51, as on plate 123.

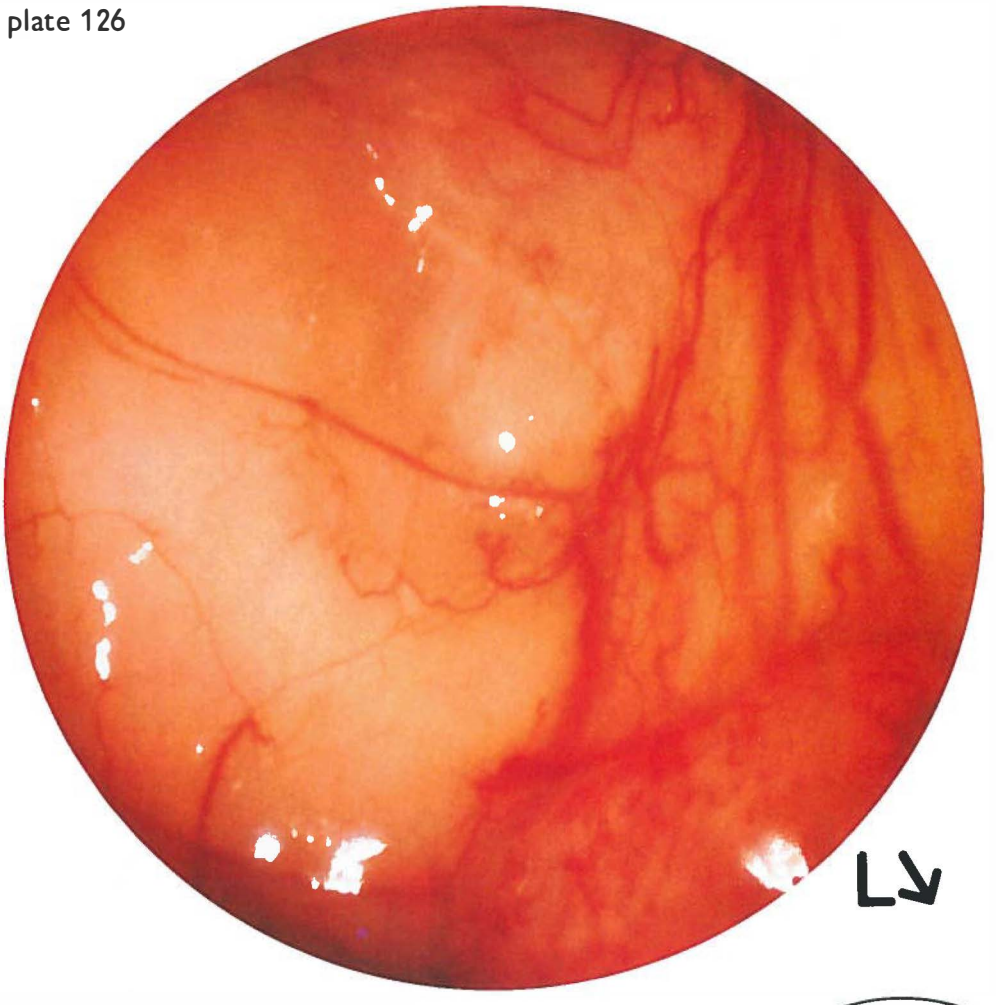
Antroscopy revealed suspect tissue medio-cranially in the left maxillary sinus. Biopsy: no signs of spread of the ethmoid carcinoma. See however plates 125 and 126.

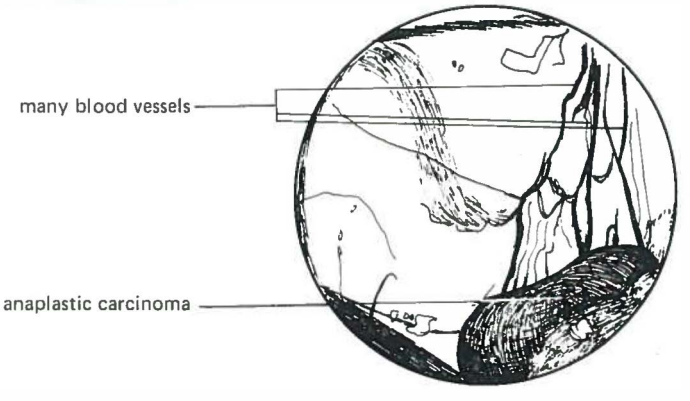




Left antroscopy (II): many blood vessels in zygomatic recess

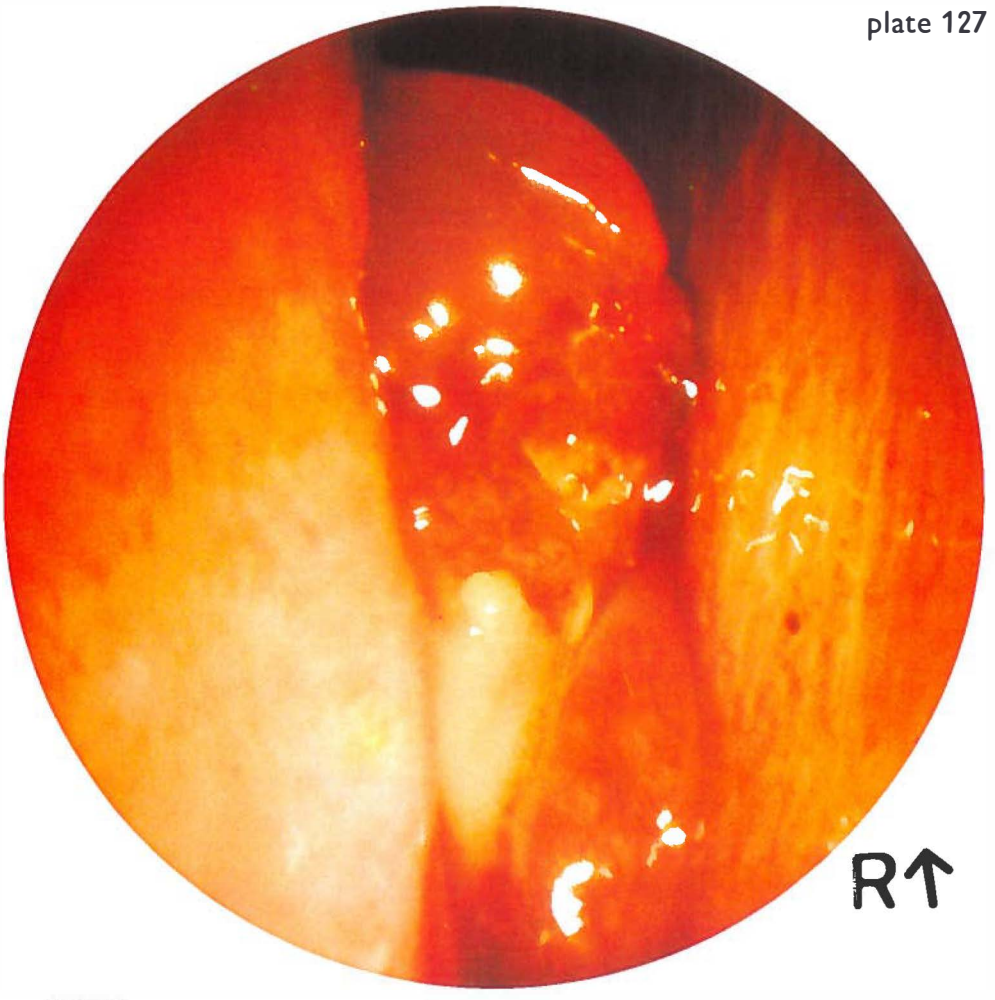
Same patient J.D., male, aged 51, as on plates 123 and 124. From the suspect tissue in the medio-cranial corner many blood vessels ran via the zygomatic recess to the floor of the maxillary sinus. See plate 126.

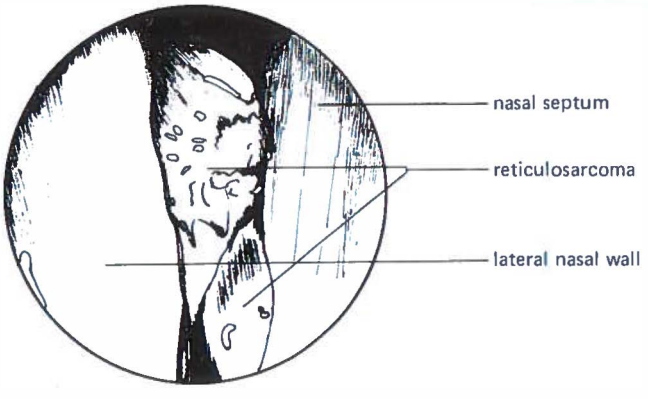




Left antroscopy: anaplastic carcinoma

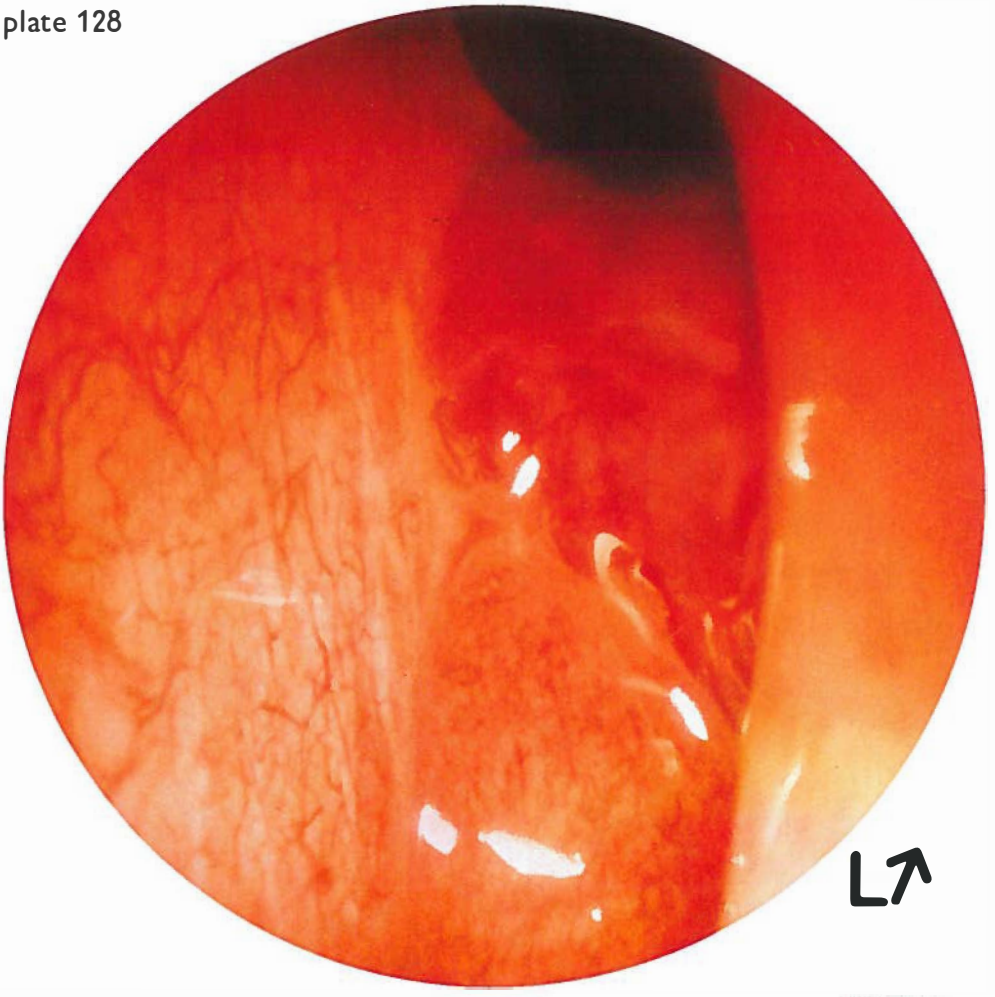
Same patient J.D., male, aged 51, as on plates 123, 124 and 125. On the floor of the left maxillary sinus suspect tissue was again found. Biopsy: anaplastic carcinoma. This may be a case of local haematogenous dissemination. The patient was treated by resection of the complete left upper jaw, ethmoid complex and nasal septum, together with the left eye, after two months followed by a radical neck dissection on the left side. Six months later, however, metastases in the skin appeared all over the body.

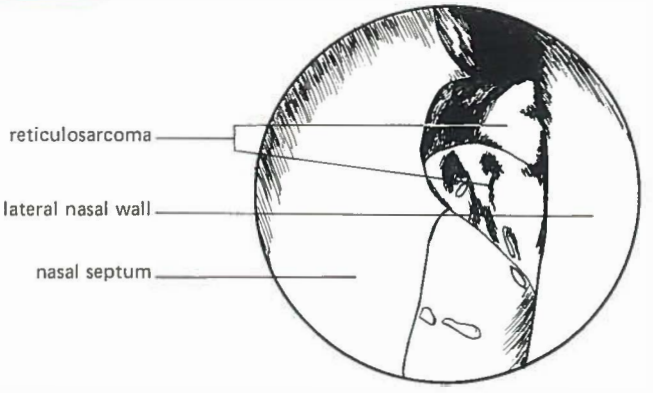




Right nasendoscopy: reticulosarcoma

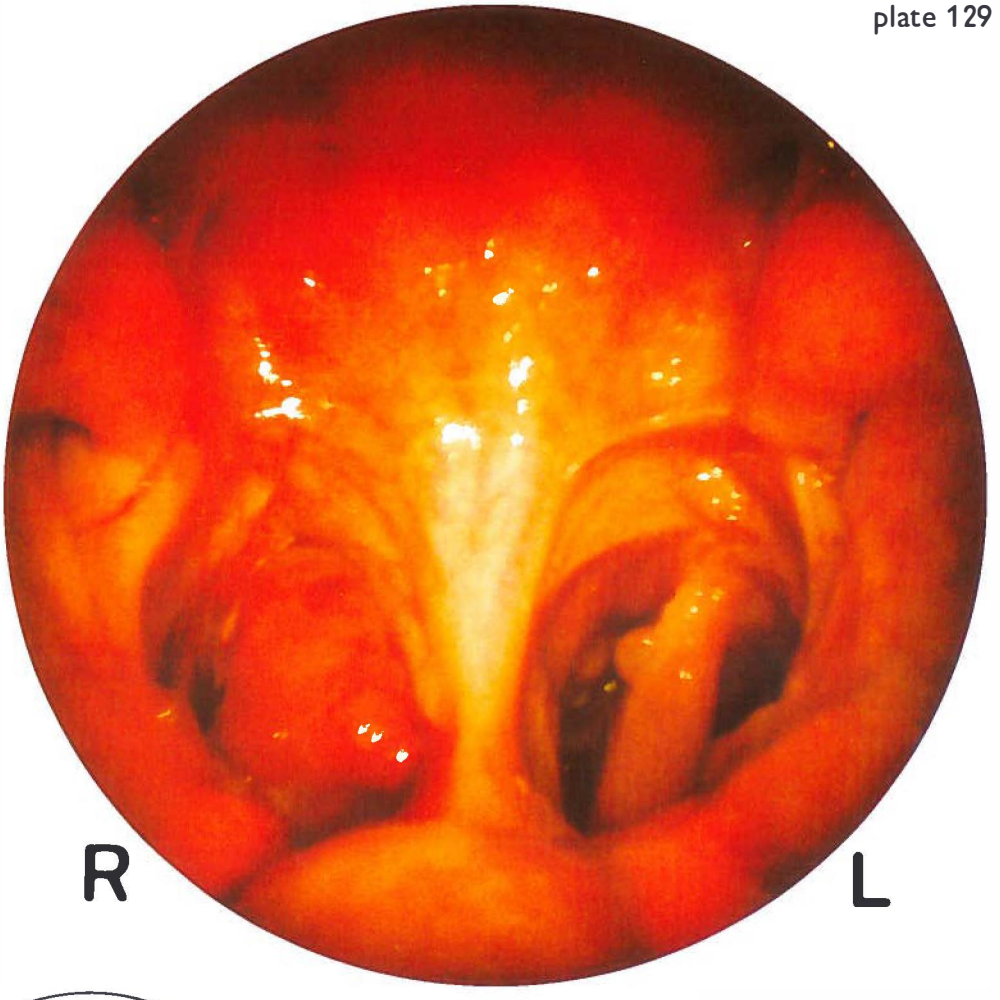
Patient A.V., male, aged 78, had been troubled with watering eyes for seven weeks. Two weeks before examination a swelling had become visible mediocranially in the right orbit, and diplopia had developed. Besides, the patient began to suffer from nasal obstruction, mainly on the right side. On examination a suspect mass was found in the right nasal cavity. Biopsy: reticulosarcoma. There were no palpable lymph nodes in the neck.

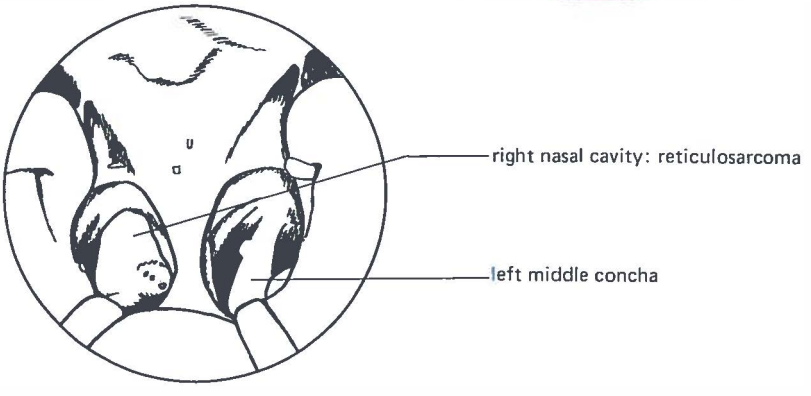




Left nasendoscopy: reticulosarcoma

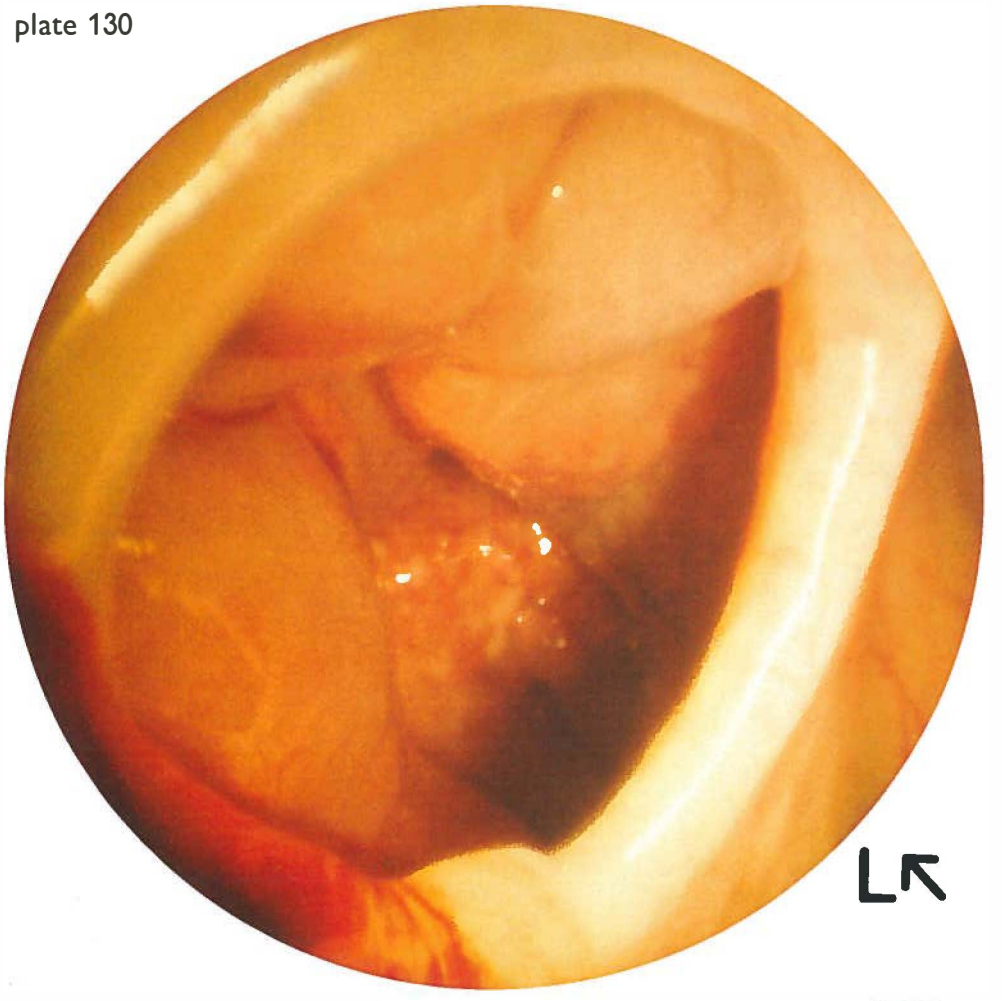
Same patient A.V., male, aged 78, as on plate 127, with reticulosarcoma in the right nasal cavity. Nasendoscopy revealed reticulosarcoma in the left nasal cavity as well.

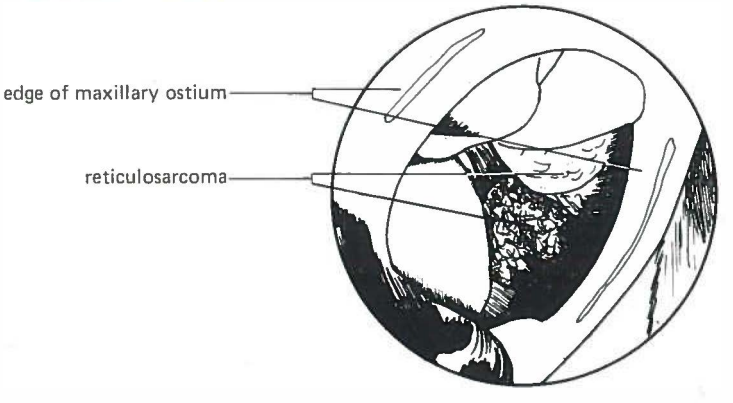




Nasopharyngoscopy: reticulosarcoma as far as the right choana

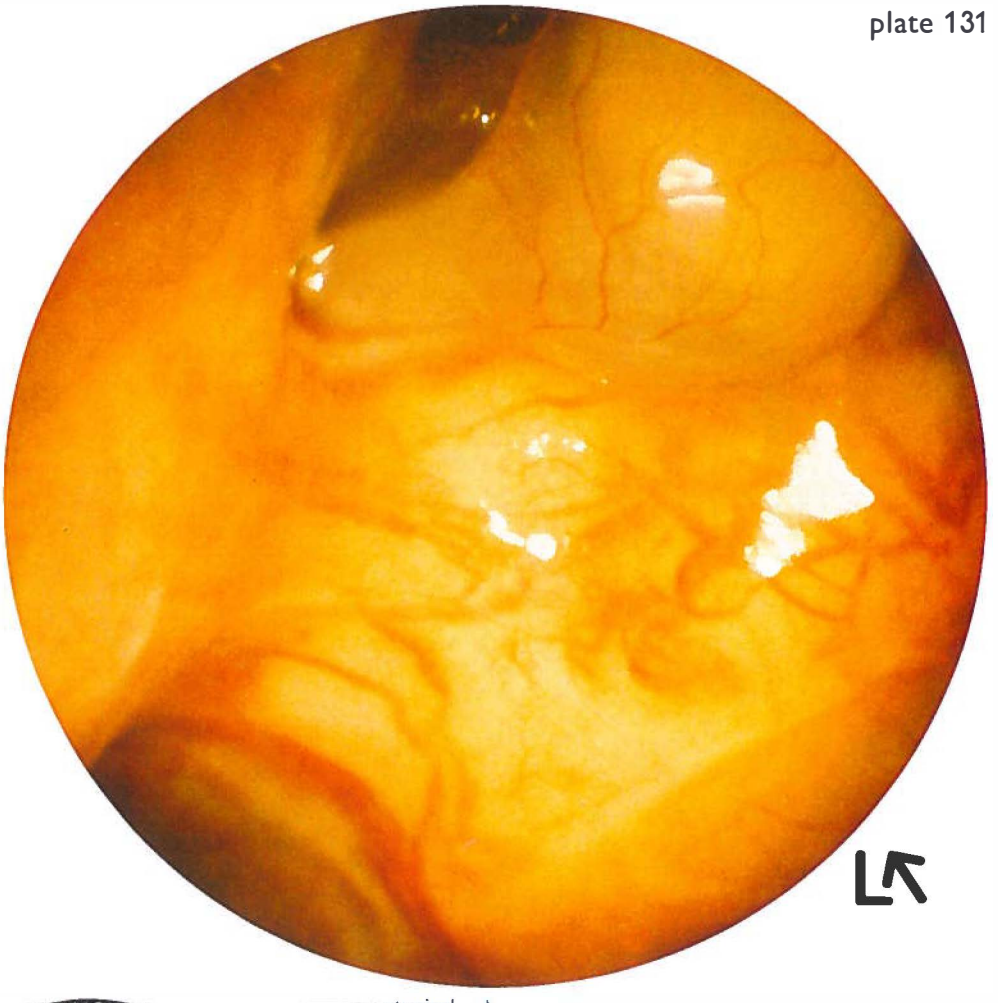
Same patient A.V., male, aged 78. In nasopharyngoscopy no suspect tissue was to be seen through the left choana, but on the right side the reticulosarcoma reached to the choanal level. The nasopharynx itself was free of disease.

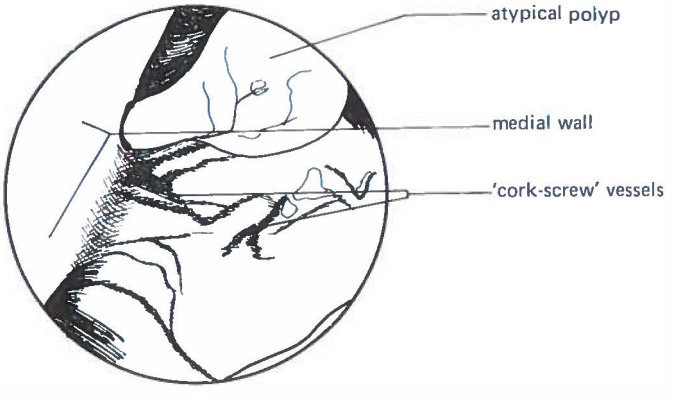




Left antroscopy (I): large maxillary ostium

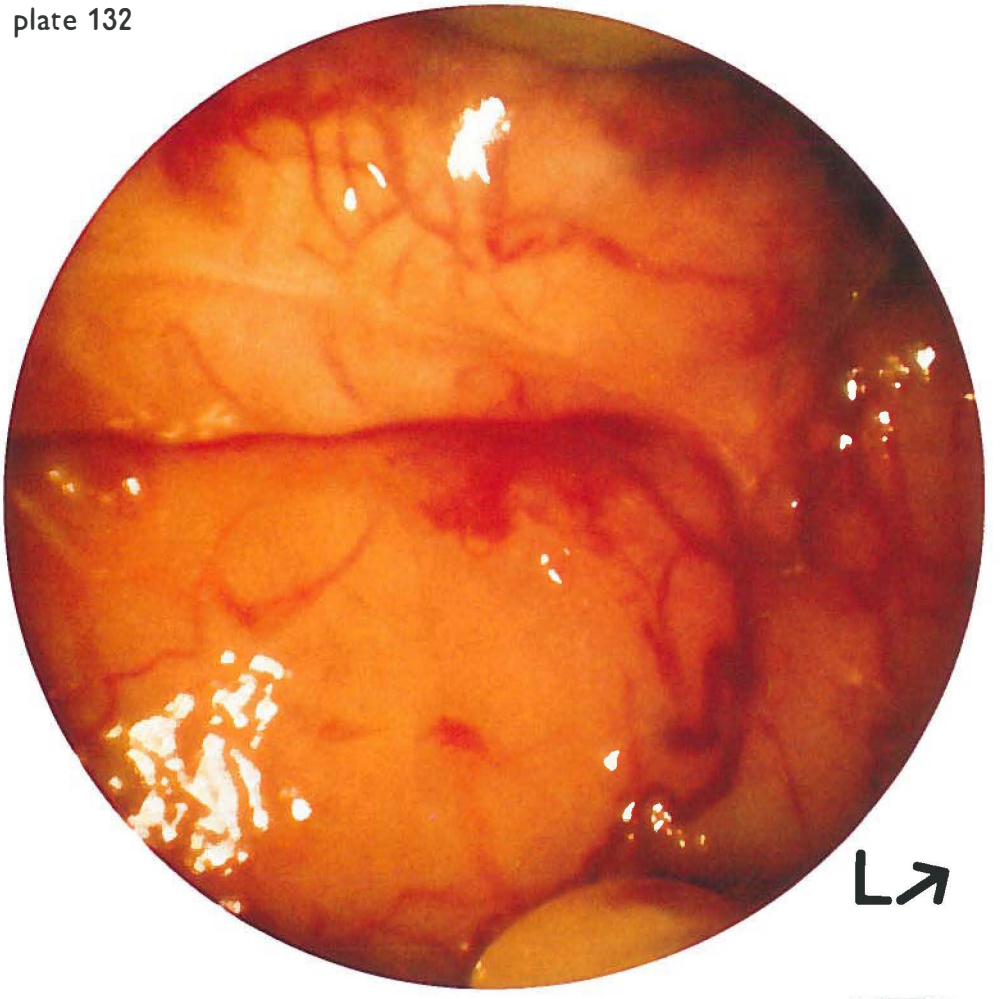
Same patient A.V., male, aged 78. Right antroscopy showed suspect tissue, which also turned out to be reticulosarcoma. No signs of disease in the left maxillary sinus were found on the X-ray photographs. In antroscopy the left maxillary ostium appeared to be very large; through the ostium the reticulosarcoma in the nose could be seen again. See also plates 131, 132 and 133.





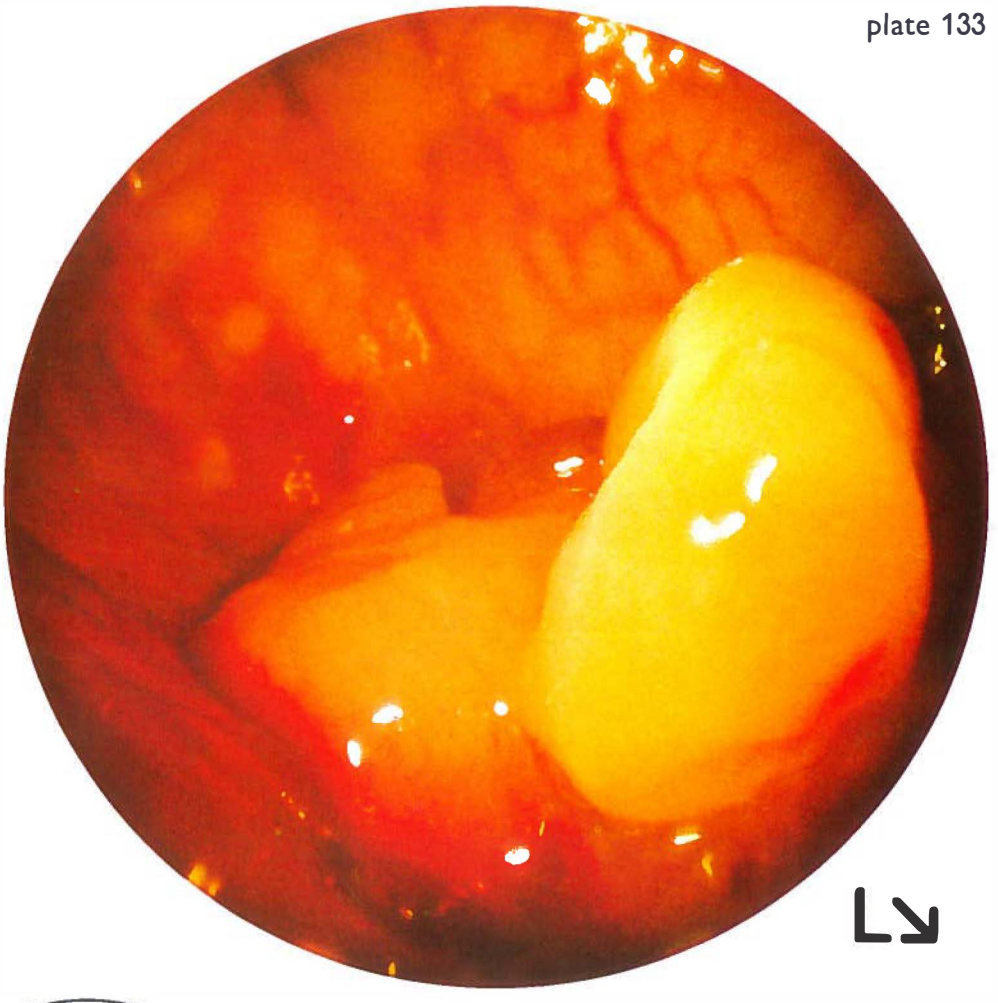
Left antroscopy (II): atypical polyp

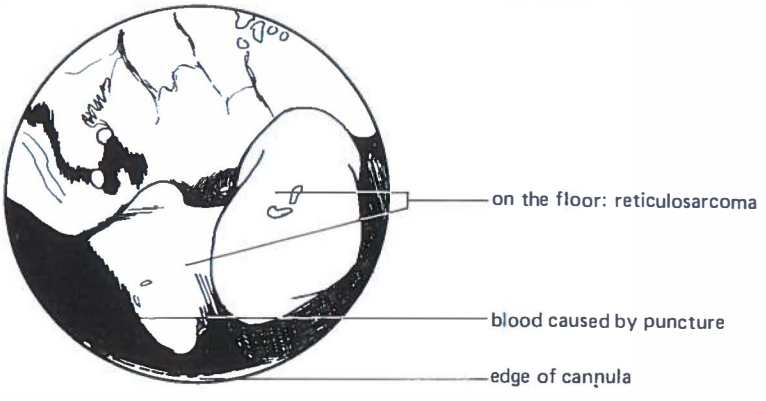
Same patient A.V., male, aged 78. Anteriorly in the maxillo-ethmoidal corner of the maxillary sinus an atypical polyp emerged through an ethmoido-maxillary canal. In this area 'cork-screw' vessels were also seen (strongly winding vessels).



Left antroscopy (III): blood vessels in zygomatic recess

Same patient A.V., male, aged 78. From the maxillo-ethmoidal corner many blood vessels ran towards the floor of the sinus via the orbital floor and the zygomatic recess. (NB cf. plate 125).





Left antroscopy (IV): reticulosarcoma

Same patient A.V., male, aged 78. The blood vessels running caudally via the zygomatic recess terminated in suspect tissue, which again turned out to be reticulosarcoma. The patient was treated with radiotherapy. For one year the patient seemed free of recurrence and dissemination; shortly afterwards, however, he died with symptoms indicating a spread into the brain. Autopsy was not permitted.

CHAPTER 11

Discussion

In discussing a 'new' method of examination an understandable enthusiasm may easily lead to an overestimation of the profits that can be obtained from it. The concluding sentence of the article by Illum, Jeppesen and Langebaek[75] is a good example of this: 'Thus it is worth considering whether or not sinoscopy could replace X-ray examination in many cases as the normal method for maxillary sinus examination, especially when an adequate routine in this procedure has been attained'.

The rapidity with which and the degree to which a certain method of examination is spread could be taken as a criterion to judge the usefulness of this method. During the last two decades the number of publications on the endoscopy of the nose, the nasopharynx and the maxillary sinuses has increased to such a degree that it is hard to speak of a mere 'interessante Spielerei'. The far-reaching technical improvements (cold light, Hopkins and Lumina optics, continuous light for diagnosing and electron flash light for photography via the same glass fibre cable, the single-lens reflex camera) which have been brought about since 1954 have certainly had a great effect upon this development.

The most stimulating of these developments may be considered the opportunity to obtain photographic documentation (cf. Olbrich[125]), of which the major advantages are:

a) An objective picture replaces the subjective description.

b) On the basis of objective pictures better team-discussions and decisions are made possible.

c) By means of repeated documentation the course of a disease and the results of a therapy can be recorded.

d) A better transfer of the knowledge concerning the anatomy and pathology of the upper airways can be realized.

Ad a) However accurate the description of a certain picture may be, it is virtually impossible to avoid inaccurate descriptions of gradations such as 'slightly hyper-

aemic', 'much swollen'. These descriptions do not only vary from examiner to examiner, but with one and the same examiner the description of, for instance, the aspect of the mucous membrane can also depend on his mood, the aspect of the relevant area in preceding patients, etc. At a later stage, therefore, a different interpretation of the same disorder on the basis of photographic documentation may result. Moreover, details that have at first been overlooked may be discovered later. Without photographic documentation this would require a second examination.

Ad b) With the aid of photographic documentation others can repeat the examination as it were, and the various interpretations can be discussed. When certain patients are to be treated by a team of specialists it can be demonstrated to the members of the team why a certain therapy is not or, on the other hand, highly appropriate, the spread of a malignant process can be shown exactly, etc.

Ad c) Especially cases requiring a lengthy follow-up demand photographic documentation. This applies both to malignant processes and to benign diseases which have a strong tendency to recur (such as the angiofibroma and the inverted papilloma). Thus we could establish a recurrence of an angiofibroma in an eight-year old boy by comparing slides made during subsequent post-operative check-ups: a soft tissue mass, which was at first interpreted as scar tissue, clearly appeared to be increasing in size. Subsequent angiography demonstrated a recurrence of a highly vascular soft tissue mass in the area concerned. When at a given moment a recurrence of e.g. a nasopharyngeal carcinoma is established, one can look for signs of this recurrence on endoscopic photographs taken previously, which may contribute towards a further refinement of the technique of examination.

Ad d) Most students of medicine consider the upper airways a difficult part of their studies. With the aid of endophotography, anatomy and pathology can be far better explained. When the student can actually see that the mucus transport in the nose indeed takes place in such a way that purulent secretion from the maxillary sinus is transported over the torus tubarius, it will be far easier for him to comprehend that a sinusitis may lead to an otitis media. For the same reason he will later, as a general practitioner, be sooner inclined to refer a patient with a suspect lymph node in the neck to the E.N.T.-specialist for further examination. The same argumentation applies to specialists: now that the endoscopic findings can be documented photographically, the value of endoscopic examination can be far better demonstrated. It is also far easier to explain new clinical views with the aid of photographic documentation.

With regard to photographic documentation, a comparison with radiological examination would seem obvious: no sensible radiologist will X-ray a patient without taking an X-ray photograph of the chest. The expectation seems justified that endoscopic findings, too, will be more and more frequently recorded photographically.

Although the opportunity of obtaining photographic documentation is a great

asset, the justification of endoscopic examination of the nasopharynx, the nose and the maxillary sinuses should mainly result from the degree to which the examination of these areas is improved by it. It is not always easy to determine what this improvement consists in. Measuring it appears to be impossible. An objective improvement of the examination can only be established when a certain area or phenomenon can be examined by means of endoscopy, which would otherwise be inaccessible. When, however, a certain area can also be examined to some extent without endoscopy, the degree of improvement becomes hard to establish. This disadvantage of not being able to 'prove' the improvement obtained by endoscopy will have to be taken for granted.

Nasopharyngoscopy

In the routine examination of the nasopharynx, as described in chapter 4, minor abnormalities will often not be revealed. Since there is only a small space between the soft palate and the posterior pharyngeal wall, only a minor part of the nasopharynx can be seen at the same time. The view is often further restricted by the uvula. Moreover, when the small mirror is used, the illumination of the nasopharynx is poor. Also many patients cannot be inspected at all because of retching reflexes.

In chapter 6 it has been described how with the aid of local anaesthesia and reins a much better examination is possible when a large mirror is used. The angle of vision, however, is still not sufficient to see the whole of the nasopharynx at the same time. Both hands of the examiner are engaged in this technique.

The nasopharyngoscope meets all these disadvantages: a) the enlarging effect enables a better view of details; b) because of the wide field of vision, an overall picture of the nasopharynx can be obtained, which is imperative for the discovery of minor unilateral abnormalities (see plates 25 and 37); c) as the optics places the examiner's eye at the back of the oropharynx, as it were, the uvula is excluded from the field of vision and can no longer obstruct the examination; d) the optics replaces both the mirror and the tongue depressor, so that minor operations in the nasopharynx can be carried out under view.

This improved method of examining the nasopharynx is of the utmost importance for discovering malignant processes in the nasopharynx and its direct surroundings at an early stage (cf. van den Broek[25]). Bohndorf[20] gives two reasons why nasopharyngeal carcinoma is generally discovered so late: 1) the late occurrence of symptoms, which besides are often atypical; 2) the difficult survey of the nasopharynx.

The first reason is responsible for the late consultation of the E.N.T.-specialist by the patient. When the patient has found his way to the E.N.T.-specialist, eventually, Bloom's remark[19]: 'the missed diagnosis is the tragic hallmark of this disease' need not apply any longer, for the possibility to examine the nasopharynx

endoscopically has put an end to 'the inability of the physician to make an early diagnosis' (Pang[129]).

Naturally, the advantages of improved diagnosing are equally valid for benign diseases, the discovery of which is less urgent, however.

The use of the biopsy forceps with differently bent shafts (see picture 3) has proved that with the aid of the middle two shafts all places of the nasopharynx are easily accessible. It would seem more practical, therefore, to have at one's disposal two fixed biopsy forceps in future, with shafts indentical to the interchangeable shafts depicted in picture 3.

Nasendoscopy

The improvement of the examination of the nose brought about by nasendoscopy is comparable with that of the nasopharynx brought about by nasopharyngoscopy. For certain areas in the nose the improvement can even be called 'objective'. Thus the opening of the nasolacrimal duct and the ostia of the paranasal sinuses cannot be seen as a rule in anterior rhinoscopy.

Especially the ease with which the sphenoidal ostium is revealed by nasendoscopy is striking in that it can nearly always be seen. As such nasendoscopy is a welcome addition to the X-ray photographs of the paranasal sinuses, on which the sphenoidal sinuses are usually the most difficult to judge. The ostia of the posterior ethmoidal cells are generally also clearly visible. The ostia of the maxillary sinuses, the anterior ethmoidal cells and the frontal sinuses are to be seen far less frequently.

Prott's findings[137], that only about a quarter of nasendoscopies reveal the existence of a real maxillary ostium (i.e. in the dorsal part of the hiatus semilunaris), was confirmed by us. Only after over 600 nasendoscopies did we first notice ostia of the middle ethmoidal cells. Initially this may have been due to an insufficient knowledge of nasendoscopic anatomy: these ostia appeared to be situated even higher than we had expected.

The openings in the lateral nasal wall show great variations in size. This is most evident with the orifice of the nasolacrimal duct, which appeared to vary from a small slit in the lateral wall of the inferior meatus, which could easily be overlooked, to a straight passage with a diameter of 4 mm, through which a direct view was possible into the lacrimal sac. The so-called Hasner's valve appeared to be relatively rare.

A striking phenomenon almost invariably found in cases of maxillary sinusitis is the bulging of the posterior fontanelle, which may be so strong that the middle meatus is completely filled with it. This bulging seems to be more or less irreversible. A bulging posterior fontanelle was frequently found in cases where antroscopy showed no trace of sinusitis (anymore). In those cases the nasal mucosa covering the fontanelle was not hyperaemic, but pigmentated, which has also been described by Messerklinger.

Zuckerkandl[191], Onodi[126], Kubo[89], Hajek[61] and Wilkerson Jr.[178], i.a., describe the possibility of making an opening in the middle meatus for draining the maxillary sinus, by way of therapy, in cases of chronic maxillary sinusitis. They had found that these openings are far less inclined to become stenosed than the antrostomy towards the inferior meatus as made in the Caldwell–Luc operation. It seems worthwhile to investigate the possibilities of making such an opening in the posterior fontanelle, as an endoscopic operation. Nasendoscopy has shown that the Caldwell–Luc and Claoué antrostomies indeed have a great tendency to become obliterated.

The use of nasendoscopy can also play a part in producing a precise diagnosis of patients with head injuries (cf. Strupler[160]). When there is a trail of blood in the nose this may help to find out which paranasal sinus is involved in the fracture. This transport of blood from one of the paranasal sinuses can often still be seen 14 days after the accident, in the form of a thin trail of reddish brown secretion ('old blood'). Antroscopy can demonstrate accurately the course of a fracture line in the wall of the maxillary sinus (see plate 94).

Nasendoscopy has led to a closer contact with the oculist. In a great number of cases it appeared possible to explain the success of the dacryocystorhinostomy or its absence by means of nasendoscopy (see plate 81). This has also been reported by Schwartz et al.[147]. Nasendoscopic examination of the post-operative progress will be able to provide good information as to whether certain modifications of the operation technique may lead to an improvement of results.

What has been said about nasopharyngoscopy also applies to nasendoscopy: it is unlikely that a general diagnosing of malignant processes at an early stage will ever be realized, because the patients consult the specialist at such a late stage due to the prolonged absence of characteristic symptoms. A 'missed diagnosis' in the case of a suspect anamnesis can certainly be prevented by means of endoscopic examination.

For this reason, *a careful endoscopic examination is imperative in cases of unilateral nasal complaints* (bleeding, secretion, obstruction), *for which no cause can be directly indicated.* This becomes all the more urgent the older the patient is. It is advisable in such cases also to carry out nasopharyngoscopy as well as antroscopy on the side of the complaints *(integral endoscopic examination of the upper airways)*. Nasendoscopy is also of great value for determining the spread of a malignant process already known to exist.

The approach through the nose seems less appropriate for endoscopy of the nasopharynx, although some, including Semczuk[147], suggest the contrary. Especially minor asymmetries can be easily overlooked when the nasopharynx is not examined from the median plane, and consequently cannot be inspected as a whole. A comparison between plates 79 and 80 gives a good impression how difficult in size the torus tubarius may seem, for instance, dependent on the distance from the optics.

On the other hand, the nasendoscope introduced into the nasopharynx can be successfully used to judge the upper limit of the spread of tumors of the palate and

the oropharynx. Plate 80 shows the upper limit of a carcinoma of the right tonsil, seen through the nasendoscope.

Observing the movements of the soft palate in speech, swallowing etc, we could neither confirm nor deny the findings of Pigott[134] and Calnan[32]. In speech Passavant's ridge does indeed appear, but it proved hard to determine whether Passavant's ridge played a part in the closing mechanism.

Antroscopy

As compared with nasendoscopy and nasopharyngoscopy the improvement in the examination of the upper airways is the most evident in antroscopy. Without antroscopy the maxillary sinus can only be inspected by means of an operation, i.e. by making an opening in the canine fossa. One of the reasons why publications on antroscopy outnumber those on nasendoscopy and nasopharyngoscopy by far undoubtedly results from the sensation of seeing what has never been seen before.

The approach through the inferior meatus has been deliberately selected by us, because:

1) Puncturing the maxillary sinus through the inferior meatus is part of the routine of every E.N.T.-specialist, so that a skill is utilized that is already mastered.

2) Subcutaneous emphysema resulting from blowing the nose shortly after the antroscopy does not arise. It may occur, on the other hand, when the approach through the canine fossa is used.

3) There is no danger of phlegmon of the cheek after antroscopy in sinusitis, as there is when the approach through the canine fossa is used.

4) With children there is less danger of injuring the permanent teeth that have not come through yet.

5) In the case of sinusitis a polyethylene tube can be inserted through the cannula into the sinus, if necessary. With the aid of this tube the sinus can be rinsed daily without new antral punctures being necessary. This is especially important in patients with coagulation disorders and a reduced resistance to infections. Also with children and nervous patients it is an asset to have to puncture once only.

6) When antroscopy is carried out in a sinus in which there is a malignant process, an implantation metastasis may develop in the puncture tract. The puncture tract in the lateral inferior meatal wall can be kept well within the margins of dissection far more simply than the tract situated in the canine fossa.

It has to be admitted that in antroscopy carried out through the inferior meatus the possibilities of taking biopsies are clearly limited in comparison with the approach through the canine fossa. This drawback is not completely met by the manoeuvrable biopsy forceps, although with this biopsy forceps a major part of the maxillary sinus can be reached. When a certain point appears to be inaccessible when antroscopy is carried out through the inferior meatus, and there is an urgent need of a biopsy from that specific point, the approach through the canine fossa is

chosen in the second instance. The only case in which the approach through the canine fossa is selected primarily is when there is a tumor of the nose thus situated that the trocar would pass through or come close to this tumor, if the approach through the inferior meatus were to be used. In all other cases the first choice is the approach through the inferior meatus for the reasons mentioned before, in particular those under numbers 5 and 6.

In 14 cases out of a series of 585 antroscopies Illum et al.[74] could not puncture the bony wall of the inferior meatus, as it was too hard. We were confronted with this problem only once in a series of 700. One patient refused to undergo antroscopy at the sight of the trocar. In two cases antroscopy through the nose was impossible on account of a septal deviation. In five cases only, the sinus could not be inspected as a result of bleeding. In ten cases this problem arose initially, but it could be remedied by means of rinsing (in two of these cases this required the use of diluted xylometazolin). Secretion, too, could every time be so well rinsed out of the sinus as not to obstruct the view. When a sinus was filled with polyps, cysts or tumor tissue to such an extent that hardly or no lumen was left, it was not considered an 'incomplete antroscopy' by us. It was considered incomplete, however, when we had the impression that there must be a fair lumen, but that local polyposis of the mucous membrane obstructed the view. This was the case 20 times. (Since this distinction was not always checked by means of an operation the number of 20 is somewhat arbitrary.) When a large cyst obstructed the view it was dealt with by incising the cyst with the 'cyst knife'. Once a perforation towards the parapharyngeal fossa was made, when a biopsy was taken from the posterior wall. Table 1 gives a survey of these data.

The mucous membrane of a healthy maxillary sinus is so thin that its colour seems yellow because the bony wall shows through. In the healthy maxillary sinus many details can often be seen (see plate 83). On the transition of the orbital floor to the medial wall the ethmoidal cells show through a bluish grey. This is because in these places the bony wall is extremely thin or even absent. In the rare event of an

Table 1

Antroscopy successful and without complications in 95% out of a series of 700 (July 1972–November 1974).

Causes of failure (9)						
Patient refused	Septal deviation	Osseous wall too hard	Bleeding	Incomplete (due to tissue in sinus)	Complication (perfor. to parapharyng. fossa)	Successful without complications
1	2	1	5	20	1	670

isolated ethmoiditis these places are yellowish as a result of purulent secretion in the ethmoidal cells showing through. Ethmoiditis, however, nearly always occurs in combination with maxillary sinusitis. Because the mucous membrane of the maxillary sinus is hyperaemic and swollen in sinusitis, the phenomenon mentioned does not occur. In a healthy maxillary sinus the infraorbital canal can also generally be seen in the orbital floor. The frontal recess may be quite deep at times (see plate 85). In the floor of the maxillary sinus protruding roots can be observed sometimes (see plate 86). Small cysts can show up quite nicely in photography (see plate 104). A small dentogenous cyst often still has a bony wall, which makes that its aspect clearly differs from that of a cyst in the mucous membrane (compare plate 105 with plate 104).

When the maxillary ostium is very narrow, or narrowed by sinusitis, the posterior fontanelle can sometimes be seen to move to and fro, simultaneously with ex- and inspiration, respectively.

When there is a defect of the bony posterior wall, it moves to and fro in that place, when the mouth is closed and opened, respectively (see plates 92 and 93).

Instead of being a handicap, the small amount of blood that inevitably enters the sinus as a result of the puncture can be regarded as a welcome aid. With the help of the transport of this blood a good impression can be obtained as to how the ciliary epithelium in the sinus functions (see plates 88 and 89). In experiments in which the mucus transport in the maxillary sinus was examined endoscopically (by means of granules of Dowex Ionenaustausch-Harz, Ø 200–400 μ, coloured with haematoxilin, or by means of acridin orange powder) it appeared that the pattern of the mucus transport in the area round the ostium often differs from that described by Messerklinger. The course of the transport towards the ostium is not star-like, as a rule, but spiral-like. In these cases the ostium is the centre of a whirlpool, as it were. In two patients with frequently recurring sinusitises this whirlpool did not appear to end in the ostium, but to have its centre about two cm lower. Shortly after antibiotic treatment the sinus was free from secretion with the exception of the centre of that whirlpool, where a small amount of purulent secretion turned round at a high speed, without leaving its place. This secretion may well have been the cause of each new sinusitis. Although this phenomenon was observed only twice, it does not seem far-fetched to suppose that in a sinus with an intricate pattern of mucus transport a sinusitis is more apt to occur than in a sinus with the straightforward type of transport as described by Messerklinger.

During the period of recovery the mucous membrane of the maxillary sinus can be seen to pass through several stages; from red and swollen, via pale and slightly thickened it regains its normal aspect. Sometimes confusion may arise between the pale, slightly thickened mucosa of a recovering sinusitis and a chronic hyperplastic sinusitis, the colour of which is often also a pale yellow. The mucous membrane of the recovering sinusitis is no longer strongly thickened and follows more or less accurately the outlines of the bony wall of the sinus, the lumen being hardly reduced

in size. The mucous membrane in the chronic hyperplastic sinusitis, on the other hand, is evidently thickened, which may be derived from a comparison between the size of the lumen as seen in antroscopy and the size of the maxillary sinus on the X-ray photographs.

Antroscopy has shown distinctly that in antral puncture a clear rinsing liquid does not mean to say that there is no secretion in the sinus (see plate 107).

In order to try to widen the maxillary ostium prior to the puncture it is helpful to apply a decongestant in the middle meatus. When the maxillary ostium remains closed all the same (for instance because it is blocked by polypoid antral mucosa), a considerable underpressure may arise when an attempt is made to suck secretion out of the sinus. The effect of such a vacuum-trauma can be seen on plate 108, namely multiple minor bleedings in the antral mucosa.

The patient also gives signs of pain when aspiration is attempted in the case of a blocked ostium. It would seem wise, therefore, only to rinse in those cases. An overpressure also causes some pain, but in antroscopy no lesions have been found on account of it.

At times an X-ray photograph can be very misleading. Our most surprising experience in this connection was the phenomenon that fungous colonies may give metal-like opacities on the X-ray photograph. These may be due to salts containing calcium, produced by the fungi. We have encountered this phenomenon several times already (cf. plates 110 and 111).

The advantages of antroscopy in malignant processes are wholly comparable with those of nasendoscopy and nasopharyngoscopy.

Illum et al.[75] and Herberhold[64] compared X-ray photographs of the paranasal sinuses with findings from antroscopy. They mention a large percentage (38% and 36% resp.) of false information, given by the X-ray photographs. Illum et al. give a quite detailed description of these 'errors'. A striking feature of table 2 in their article is that their conclusions are based on rather highly differentiated X-ray diagnoses. When diseases of the mucous membrane are diagnosed on the basis of X-ray pictures one need not be surprised to find that inspection by means of antroscopy demonstrates the validity of the old saying: 'Never diagnose on the strength of X-ray photographs alone'. Table 3 in their article – which gives 212 cases where no discharge was visible on X-ray examination, whereas antroscopy did demonstrate such discharge – is subject to similar failings. Only when the lumen of the maxillary sinus is filled partly by air and partly by secretion, will a fluid level be visible. When the whole lumen is filled with secretion, such an air-liquid boundary is naturally impossible. The amount of secretion can also be so small as to 'disappear' completely in the folds of polypoidally thickened mucosa. It is hardly a revealing finding that a method of examination does not conform to a certain requirement, when it has been established previously that this will be possible in part of the cases only.

X-ray examination of the maxillary sinuses may be expected, however, to answer

Table 2

Verification of the reliability of X-ray photographs by means of antroscopy in 350 cases.

Findings on the X-ray photographs		Findings in antroscopy			
		No disease	Cysts only	Sinus not quite healthy	Sinusitis evident
No disease	120	92	6	9	13
Sinusitis likely	230	18	30	21	161

the question whether there is any disease or not. Or, more specifically: sinusitis or no sinusitis?

In a series of 350 antroscopies we have verified in how far routine X-ray photographs of the paranasal sinuses (Waters, Caldwell) can give information as to whether maxillary sinusitis is likely or not. The outcomes of this investigation are summarized in table 2.

'Cysts only' means that there was no secretion in the maxillary sinus and that no other abnormalities of the mucous membrane could be seen. With 'sinus not quite healthy' we refer to a sinus that could be neither classed among 'no disease' nor among 'sinusitis evident'. In such a case the mucous membrane was evidently thickened, locally, or strongly hyperaemic, but the sinus contained no secretion and had a good mucus transport (trail of blood). The term 'sinusitis evident' includes any type of sinusitis, both the acute and the chronic type, with and without secretion.

When the X-ray photographs showed no signs of disease in the maxillary sinus, the reliability of this information appeared to be $(92/120) \times 100 = 77\%$.

When the X-ray photographs clearly indicated maxillary sinusitis (shadow suggesting a thickened mucous membrane, diffuse opacity, fluid level) the reliability appeared to be $(161/230) \times 100 = 70\%$.

It should be noted that the interval between the time that the X-ray photographs were taken and the time antroscopy was carried out was from one to two weeks, generally.

In view of the different degrees of reliability of the X-ray photographs, classed as 'sinusitis likely' and 'no disease' it seems wise to apply these percentages separately, instead of taking the average ($= 73\%$).

Our investigation also indicates a lower degree of reliability of the X-ray photographs than has generally been taken for granted. The outcomes are less pessimistic for X-ray examination, however, than the figures found by Illum et al. and Herberhold.

The indication for an antral puncture in the case of sinusitis is the presence of

secretion in the affected maxillary sinus, as rinsing the sinus clean is the only treatment possible by means of a routine antral puncture.

In 14 cases of our series the X-ray photographs suggested a fluid level in the maxillary sinus. In 4 of these 14 cases antroscopy showed that there was only a cyst on the floor. This erroneous interpretation of the X-ray photograph could have been prevented by also applying a modified Water's view, e.g. the modified Water's view after Axelsson et al.[5].

Axelsson et al. indicated how, in a simple way, the reliability of radiographic examination can be raised to 88% with regard to demonstrating the presence of secretion in the maxillary sinus with 'thickened mucosa' (namely by means of an X-ray photograph in the Water's view with the patient recumbent on the side of the affected sinus). In rinsing, the completely opaque maxillary sinuses (X-ray photograph) appear to contain secretion in 86% of the cases (Ballantyne and Rowe[6, 7]; Vuorinen et al.[173]; Axelsson et al.[5]).

In the beginning of this chapter we already quoted Illum et al.[75]: 'Thus it is worth considering whether or not sinoscopy could replace X-ray examination in many cases, as the normal method for maxillary sinus examination, especially when an adequate routine in this procedure has been attained'.

Once X-ray examination has established the presence of a disease that is restricted to the maxillary sinuses, it may well be that, after therapy, a check-up by means of antroscopy is to be preferred to new X-ray photographs. The first endoscopy of a maxillary sinus should always be preceded by X-ray examination, however, if only to anticipate surprises (for instance a very thick bony wall or destruction of it).

Like Moesner et al.[115] and Timm[167] we could establish no significant correlation between the macroscopic aspect of the antral mucosa and the microscopic picture of it. The various types of maxillary sinusitis appeared to have no characteristic histological picture.

The frontal sinus, too, is accessible for endoscopy. As this sinus is not often affected, we have carried out endoscopy here a few times only. Access is gained by drilling a hole into the frontal sinus, just wide enough to allow introduction of the cannula, after a small incision has been made just below and parallel to the inner end of the eyebrow. If necessary a tube can be left in the same hole for drainage. This operation is performed under general anaesthesia.

Although so far nasopharyngoscopy, nasendoscopy and antroscopy have been discussed more or less separately in this chapter, we should like to emphasize that *the upper airways ought to be regarded as a single endoscopic area*. Especially when a malignant process is suspected (for instance in case of a suspect lymph node), the diagnostic possibilities which have been so much improved by endoscopy oblige the examiner to make full use of these possibilities. Plates 123–126 and 127–133 clearly demonstrate how unpredictable the spread of a malignant process can be on the one hand, and how this spread can be discovered by means of integral endoscopy of the upper airways on the other hand. For this reason, the spread of a

malignant process in the upper airways ought to be established as accurately as possible, that is to say by means of tomography as well as endoscopy. An adequate therapy is possible only, when it is based on data obtained by careful examination. Only if this condition is fulfilled there is a possibility of improving the prognosis in these malignant diseases. Considering this, integral endoscopic examination of the upper airways may be regarded as a move in the right direction.

CHAPTER 12

Summary

After having explained in the introduction what area is covered by the term 'upper airways', the anatomy and the functions of the nasopharynx, the nose and the paranasal sinuses are discussed in chapters 2 and 3, respectively.

The upper airways form an area difficult to reach for examination, even for the trained specialist. In this examination a predominant place is occupied by inspection.

In chapter 4 a number of the many aids and appliances have been shown, developed in the course of time to improve the possibilities of inspecting the upper airways. Only a small number of these instruments have remained in use: the electric lamp and the head mirror for the illumination of the naturally dark cavities, the nasal speculum for anterior rhinoscopy, the tongue depressor and the mirror for posterior rhinoscopy. For a long time the only techniques available for the examination of the paranasal cavities were the unreliable method of transillumination by means of electric light and the diagnostic puncture.

Especially for the examination of the paranasal sinuses radiographic investigation was a great improvement.

In chapter 5 the endoscopic examination of the upper airways has been discussed. Thanks to current methods of endoscopy there are hardly any limits to the inspection of the nasopharynx *(nasopharyngoscopy)*, the nose *(nasendoscopy)* and the maxillary sinuses *(antroscopy)*.

The optics for endoscopy of the Hopkins and Lumina types, provided with cold light by means of glass fibres, make that photographic documentation of the endoscopic findings can be easily carried out. The advantages of this photographic documentation are:

1) An objective picture replaces the subjective description.

2) On the basis of objective pictures better team-discussions and decisions are made possible.

3) By means of repeated documentation the course of a disease and the result of a therapy can be recorded.

4) A better transfer of the knowledge concerning the anatomy and pathology of the upper airways can be realized.

In chapter 6 the methods of endoscopy of the upper airways have been reported as they are carried out by us. They are as follows:

A) *Nasopharyngoscopy:* with the aid of 8 mm Lumina optics, introduced through the mouth into the oropharynx, after the soft palate has been pulled forward with reins, after local anaesthesia of the nose, nasopharynx and oropharynx.

B) *Nasendoscopy:* with the aid of 4 mm Hopkins optics, after local anaesthesia and decongestion of the nasal mucosa.

C) *Antroscopy:* with the aid of the same 4 mm Hopkins optics, which are introduced into the maxillary sinuses through a cannula which is inserted through the inferior meatus with the aid of a trocar, after local anaesthesia and decongestion of the nasal mucosa.

For this local anaesthesia oxibuprocaine HCl 1% w/v is mostly used, for decongestion xylometazolini HCl 0.1% w/v.

In the nose and the nasopharynx it is possible to take biopsies under view. For use in antroscopy a manoeuvrable 'blind' biopsy forceps has been developed.

In chapters 7, 8 and 9 the superiority of the endoscopic examination of the upper airways has been demonstrated by means of nasopharyngoscopic, nasendoscopic and antroscopic colour photographs, respectively.

In chapter 10, also on the basis of endoscopic pictures, five examples have been given of patients, where the three methods of endoscopic examination were combined, resulting in a complete picture of the extent of the diseases in these patients.

In chapter 11 it has been indicated how nasopharyngoscopy, nasendoscopy and antroscopy together form a method of examination, which has found a permanent place in oto-rhino-laryngology. It enables a better insight into the anatomy, the physiology and the pathology of the upper airways.

In future it should also be possible to perform minor operations in the nose under view, with the aid of endoscopy.

Using antroscopy we verified the reliability of X-ray photographs of the maxillary sinuses. This appears to be smaller than is generally supposed: 73% instead of 86–88%. This does not alter the fact that antroscopy ought to be preceded by radiographic examination.

When a patient shows symptoms suggesting a malignant process in the head and neck region, endoscopic examination ought to take place as soon as possible to establish or exclude the existence of such a growth. Antroscopy through the canine fossa is contraindicated here. Especially in these cases it is essential to regard the endoscopy of the upper airways as a whole *(Integral endoscopic examination)*.

Since malignant processes in the upper airways often cause characteristic symptoms at a late stage it is not likely, unfortunately, that the endoscopy of this region will indeed lead to an early diagnosis, putting aside an accidental finding.

These improved methods of examination shall, however, lead to a more adequate treatment of these diseases, which should result in a reduction of the number of recurrencies (secundary prevention).

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