SYMPOSIUM

on the occasion of the retirement of Prof. Dr. R.Th.R. Wentges

Nijmegen, The Netherlands, October 13, 1989

RHINOLOGY

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R.Th.R. Wentges, Professor of Otorhinolaryngology
Catholic University, Nijmegen, The Netherlands.

On the 15th of February 1989 Professor Dr. R.Th.R. (Bob) Wentges retired. In the field of otolaryngology he primarily gained a national and international reputation as a rhinologist, but his many friends know him also as a versatile man and an expert on many different other subjects.

During the past 15 years he was an Associate Professor at the Department of Otorhinolaryngology and as such he had a stimulating influence on all who work there. He introduced many new surgical concepts in the field of rhinology and as a scholar and scientist he stimulated research in several related areas. Last but not least he is an eminent clinician, who cares much for his patients and is greatly loved by them.

In appreciation and gratitude for the many fine years of cooperation and friendship in the Department in Nijmegen a compilation was made of the papers presented at the symposium held in his honour on October 13, 1989. The resulting collection of articles, written by some of his fellow-colleagues and good friends form the contents of this special Supplement of "Rhinology".

The Organizing Committee,
Henriëtte Beukering
Paul van den Broek
Hans Cornelisse
Frans Disch
Charles Hanrath
Eize Wielinga

Paul van den Broek, William Brinkman and Bob Wentges in front of the E.N.T. Department of the St. Radboud Hospital.

Rhinology, Suppl. 9, 7-10, 1989

Introduction

William B. Brinkman and Paul van den Broek

Haec studia adolescentiam acuunt,
senectutem oblectant .....
M. Cicero in *Pro Archia*

On the occasion of the retirement of Dr. R.Th.R. Wentges, Professor of Oto-rhinolaryngology at the University of Nijmegen, a symposium was organized on October 13th 1989 to focus on the merits of a man who has worked at this department for over 25 years. He has made numerous contributions to our specialty, especially in the field of rhinology and allergy. Those who know Bob Wentges – very noticable because of his more than average height – will agree that he is remarkable man.

Born on the 26th March 1933, he spent most of his youth in Rotterdam, a city and folk of which he is proud. His family belongs to the pioneers of the Rotterdam shipping business and he likes to proclaim all the good properties generally attributed to the hard-working, thrifty and modest Rotterdam people.
His education has been focused on making a career and as the brightest of the four sons he was pushed to exploit his capacities to a maximum. He received an important part of his school education at the most well-known Catholic boarding school "The Breul" in Zeist, where the Jezuits did everything to mold the mind of this young catholic intellectual. They only partly achieved this task because young Wentges reclined the carefully nurtured religious feelings at a later date. Nonetheless, his school education set the mark for his later life. Quite surprisingly for his surroundings and his family, he turned away from a business career and decided to study medicine to become a doctor. He chose the University of Leiden, our oldest university which has brought forth many famous doctors and, still to-day, stands out as an important centre of science. The young student joined the students' fraternity Minerva, which not only played an important social role in his student life, but was also a source of many good and lasting friendships.
After graduating from Leiden, he performed his national service as a medical

officer in the airforce based at Soesterberg. He followed a short course on psychiatry and served further as a selection psychiatrist, estimating the suitability of candidates to become pilots. After finishing these duties, he left for the United States, for a year of rotating internship at Waterbury hospital, in Connecticut, U.S.A.

Before that time, he had already decided that he wanted to specialize in Otorhinolaryngology and had assured himself of a place in the residency programme at the Catholic University of Nijmegen, under the directorship of Professor William Brinkman. Returned from the U.S.A, he started the residency programme in Nijmegen, on August 1st 1963. Between consultations, he read Churchill's memoires and other books of historical interest. In 1967 he received an appointment as a member of the medical staff in Nijmegen, with the task of further developing his expertise in rhinology and allergy. For this purpose, he spent six months in Pittsburg (PA) with the late Ken Hinderer, who was one of the most outstanding American rhinologic surgeons. In January 1983, he was appointed associate Professor of Otorhinolaryngology at Nijmegen University, the post from which he is retiring now.

His achievements have been numerous. They were always in line with his personal interests which balanced between otorhinolaryngology, art and history. Therefore, it is not surprising that a considerable number of his publications are also dedicated to the borderline subjects in our field.

Primarily, he is a good physician and clinician, with a keen and often very personal interest in his patients, who he has given all the care they need. Furthermore, he is an expert surgeon, experienced more specifically in rhinologic surgery. He introduced surgery of the sphenopalatine fossa to the Netherlands in 1972 and gave the first (and also the only) course in sphenopalatine surgery, together with its initiator Mr. P.H. Golding Wood. In the same period, he presented his thesis on the results of surgery of the sphenopalatine fossa. In his research, he tried to go to the very limit to find the truth and the real indications for this surgical technique. Nerve surgery in the fossa appears to be of only temporary benefit, if it is of any use at all. However, the clipping of the maxillary artery has held its place in the treatment of intractable nose bleeding.

Perhaps even more than research he enjoys teaching and many students and residents have benefited from his vast experience and knowledge. For many years, he has been one of the most highly estimated faculty members of the Rhinology Courses in Utrecht and Erlangen, under the direction of Bert Huizing and Professor Masing. However, more than anything else he likes the subjects related to history and art, which capture him most of all. Studying nasal polyps, he ran into the name of Woakes, an English otolaryngologist practising at the beginning of this century and subsequently devoted a study to "Woakes' disease" and how this name entered into the medical literature in the Romanic countries.

At the same time, he gained an interest in the history of famous patients with otorhinolaryngologic disorders. He studied profoundly the disease of Crown Prince Friedrich of Prussia who married the daughter of Queen Victoria and who later developed a laryngeal carcinoma. So much having been written already on this case history in international journals and books, there seemed to be little to add, however, he liked to come up with new facts and citations. The deafness of Beethoven is another subject which has attracted his keen interest and which has been carefully analysed, even down to the elements of the music he composed in which some can hear the tinnitus from which Beethoven suffered. He did away with many common beliefs about the cause of Beethoven's deafness and brought forward many arguments in favour of a metabolic bone disease, probably van Buchem's disease, although definite radiological or histological proof will be missing for ever.
Literature, both classic and modern, is also one of his favourite leisure time activities. Over the last few years, besides rereading his old favourite Greek writers, he has been studying the literature on the role played by the nose and smell. More than anybody else, he is aware that the nose is an important phallic symbol and that smell is a primitive sensory sensation which plays an extremely important role in animal life. However, it seems to have lost its significance at least as far as our survival is concerned, but perhaps not for the gourmets to which he undoubtedly belongs. His study on odour in the works of one of the most famous Dutch writers, Frederic van Eden was an important and unique contribution which was published in "De Gids", the most prestigious Dutch literature journal, in 1982.

Unfortunately, for some years now, problems with his health have prevented him from performing full blown activities and finally, have become the main cause of his retirement at the beginning of this year. It is sad to take leave of a man who has been so closely linked to the E.N.T. Department of Nijmegen and who has given his best to the department for over 25 years. The many years of working together with Van Baarle, Marres and van den Broek, under the directorship of Brinkman, mark an important episode at the Nijmegen Department. Those who know Bob Wentges well can imagine his part in this alliance. On the one hand, he likes to be considered an intellectual with a surprisingly broad knowledge of literature, music and other arts. There is hardly any subject, except for perhaps football, (however, he always used to win the department jackpot) which Bob does not know a lot about. On the other hand, seemingly contrary to this, is his strong affinity for the most simple jokes, which, if desired, can be performed at any moment for anybody who gives the slightest hint. He likes these all the more if they have some scrabous elements in them and nobody who has ever been in touch with Bob has failed to be witness of his priceless sense of humour. At the clinic his presence never went unnoticed

and during social events he could never resist an opportunity to quote one of his famous illustrated jokes, like the one about a man who bought a second hand suit.
However, this certainly does not mean that he is not serious or emotional. On the contrary, he likes to philosophize about the deeper things in life and can be very emotional and touched especially when he perceives beauty.
Bob likes to be confronted with provocative statements especially on religion and social issues, which would have offended many. He has a good number of friends all over the world. His strong ties with the Anglo-Saxon part of Europe has led to him becoming a member of the O.R.L. Club, one of the oldest English Otolaryngologic travelling clubs. He has recieved the medal of honour of the Dutch E.N.T. Society for his masterful treasureship over many years and received the William Wilde medal in 1984 after delivering the eponymous lecture in Dublin.
After many years of close cooperation resulting in mutual respect and deep personal affection, it seems strange that Bob is going to retire at this relatively young age. But looking on the bright side, it will give him more time to further cultivate his broad interest in other things. However, he will certainly not forget otorhinolaryngology and also otorhinolaryngology will not forget him. Several colleagues and personal friends have agreed to dedicate a paper to him on the occasion of his retirement. The papers have been presented at this special symposium on the 13th of October 1989, the day he is giving his last official lecture.

We, friends and colleagues, wish Bob many more years, to persue and enjoy the good things in life, together with his wife and children.

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The Dutch polymath

Martin Horowitz and Charles Diamond

"He doth bestride the narrow world like a Colossus"
Shakespeare (Julius Caesar 1.ii.134)

The Oxford English Dictionary defines a polymath as:– "A person of much and varied learning; one acquainted with various subjects of study." In the medical profession we are acquainted with persons of much learning in their chosen specialised field and we admire them for their specialised knowledge. We understand how they achieve their success. They all have an excellent brain, an intense dedication and an enormous capacity for sheer hard work. What excites our imagination is the rare individual who is extremely knowledgeable across a wide range of subjects, the person who has specialist knowledge not in one subject but in a host of different subjects.

Quite frankly the polymath puzzles us. We do not understand how he achieves his success. On the surface at least, he does not seem to be intensely dedicated or to work extremely hard. He seems to find it incredibly easy to master a great variety of complex subjects. He moves so effortlessly from subject to subject that no hard work seems to be involved. He seems to be motivated by the pleasure he derives from learning rather than by a spirit of dedication to a single goal. One therefore wonders if the polymath has a different kind of brain from the rest of us or if he simply has a bigger and better brain.

Professor Wentges is the perfect example of this phenomenen. He is an internationally famous surgeon, a gifted scholar of the ancient Greek and Latin languages, a talented historian, and outstanding modern linguist and a man of sparkling wit and humour. He also has a great appreciation of music and of the problems of the deaf in relation to it.

The O.R.L. Travelling Club is a peculiarly British Institution in which a small group of E.N.T. surgeons join together in fellowship to pursue their interest in E.N.T. surgery by making organised visits to other departments. Each takes

it in turn to be host and organise a scientific meeting enchanced by a social programme. Through the common bond of interest in E.N.T. surgery, post-graduate education is pursued and bonds of friendship are developed. Membership of the Club is limited to between 10 and 12 Consultants in active practice in order to keep the group to a manageable size.
It is not possible to apply to join the Club as membership is by invitation only. To achieve a good balance, a deliberate attempt is made to choose members of different ages and of different speciality interests within E.N.T. surgery. On retirement from clinical practice members remain in the Club and continue to travel to Club meetings where their years of accumulated experience provide a most valuable contribution.
The O.R.L. Club is second oldest British E.N.T. Travelling Club and it was the first E.N.T. Club to invite a non British surgeon to become a member. Professor Wentges was that first member from abroad and he was invited to join in 1972. Although British clubs are characteristically traditional in their outlook it was easy on this occasion to break with accepted practice and to invite the internationally renowned "Bob" Wentges to join. He is such a cosmopolitan personality that he was immediately at home and at ease in the British Club. His fluent English led some people to wonder if he had been educated in England and had mastered the language so well because he had lived in the country for a long time. In reality he had learned English and several other European languages while living in Holland. British people find great difficulty in learning a single foreign language and therefore have great admiration for a person who can speak several foreign tongues fluently and whose sense of humour coincides so aptly with their own.
Professor Wentges' command of the English language is so great that he can give lectures to various learned societies in English and respond spontaneously to questions from the audience. Indeed it often seems that he speaks better English than some of the British audience who have asked the questions.

He gave a lecture to the Royal Society of Medicine in London in 1975 entitled "The Surgical Significance of the Pterygo-Maxillary Fossa." He was invited to address the Royal Society because of his international reputation as an expert on this subject. Indeed his MD Thesis on "The Surgery of the Pterygo-Maxillary Fossa" has been universally recognised as the principal modern contribution to this previously obscure area of anatomical and surgical knowledge. In Ireland the highest honour that can be given to any E.N.T. surgeon is to be invited by the British Otolaryngological Society to give the Sir William Wilde Discourse. Sir William Wilde was the father of the literary giant Oscar Wilde and was himself a famous Dublin E.N.T. Surgeon. The post-auricular incision he devised for exploration of the infected mastoid process is known as Wilde's incision to this day. Harold Schuknecht and Professor Palva are among the select band who have given this prestigious lecture. Professor Wentges gave the Sir William Wilde Memorial Discourse in 1982 entitled "Beethoven's Deafness", and received the gold medal in appreciation.

His knowledge of the history of medicine is quite exceptional and he has given lectures to the Club on the History of Rhinplasty during a Club meeting in Nijmegen and on Wilhelm Fiss, an E.N.T. associate of Freud, during a Club visit to Israel. When the Club visited Malaysia a number of members gave lectures to the E.N.T. community in Kuala Lumpur. All the trainees in the speciality voted Professor Wentges lecture as the most instructive and enjoyable. His sucess as an international lecturer is not based solely on his expert knowledge. His lectures are built on a foundation of meticulous preparation, superb illustrations, logical development of a subject and a masterly style of delivery which audiences throughout the world have enjoyed.
Although Professor Wentges has now officially retired he has been invited to give the famous Watson Williams Memorial Lecture at the University of Bristol in 1990.

The O.R.L. Travelling Club is conscious of the debt it owes to "Bob" Wentges. He has formed a link between British and Continental E.N.T. Surgery and has given the Club a European dimension that it previously lacked. The Club visits to Nijmegen have been memorable occasions both for the academic content and for the outstanding hospitality of the host. At the Club meetings in Britain it is common practice to present particular problems in Rhinology in order to obtain "Bob" Wentges advice. His opinions on other aspects are also highly valued because his knowledge and wisdom transcends the whole of E.N.T. Surgery.
In the O.R.L. Travelling Club the term of office of the President is two years. The highest honour the Club can bestow on one of its members is to elect him as President. "Bob" Wentges was elected President of the O.R.L. Travelling Club in 1985. He is the first and, so far, only non British President. Like a true polymath he fulfilled the function of President, of what is to him a foreign club, with cosmopolitan style, with great distinction, and with apparently effortless ease.
The O.R.L. Travelling Club congratulates Professor Wentges on his many achievements and is delighted that it will have the pleasure of his membership throughout his retirement.

Martin Horowitz, President O.R.L. Club
Charles Diamond, Secretary O.R.L. Club
c/o 1, Fairville Road
Fairfield, Stockton
Cleveland
United Kingdom

Bob Wentges during one of his favourite activities.

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Unanimity and diversity in nasal surgery

Egbert Huizing (Utrecht), Wolfgang Pirsig (Ulm), Robert Wentges (Nijmegen), Sigurd Hellmich (Dortmund), Eugene Kern (Rochester), Adriaan van Olphen (Utrecht), Gerhard Rettinger (Erlangen), John de Groot (Utrecht)

The Courses in Nasal Surgery in Erlangen and Utrecht have been presented by almost the same group of teachers for many years. The Erlangen "Fortbildungskurs in Funktionell-ästhethischer Nasenchirurgie" dates back to 1967 and was founded by the late Professor Hellmuth Masing. Nowadays it is a three day course given in German which is conducted by Prof. Gerhard Rettinger. The Utrecht "Course in Functional Corrective Nasal Surgery" is a five day Course and its English counterpart. Generally speaking both courses serve the same goal i.e. the spreading of knowledge of modern advances in nasal surgery. The concepts that are presented are based on anatomical and functional principles. Restoration of function and re-creation of normality of form are the basic elements. Historically techniques date back to Roe and Joseph, with later modifications by Metzenbaum, Foman and many others. It was Cottle's great achievement to bring different surgical techniques together in a concept which has restoration of function as its main objective.

Because of the similarity in their own rhinosurgical education the teachers of the Utrecht and Erlangen Courses speak a common language. The participants usually consider this to be a great advantage because they see the same principles and methods used by different hands instead of receiving an encyclopedic and often conflicting overview of all the different methods. In spite of the unanimity in thinking and methodology, differences in opinion among the teachers may sometimes be noticed. In order to identify these a teachers' discussion was organized in the harpsichord-room in the ancient house of John de Groot on the Old Rhine.

1. MAXILLA-PREMAXILLA APPROACH: ITS INDICATIONS

In 1959 Cottle published a new surgical approach to the nasal septum which he named the maxilla-premaxilla (M–P) approach. The sequence of steps in this method is as follows: 1. hemitransfixion on the right side, 2. left anterior

superior septal tunnel, 3. undermining of the nasal base, 4. exposure of the anterior nasal spine, 5. bilateral elevation of the periosteum caudally from the piriform crest in a lateral direction (straight McKenty elevator), 6. bilateral elevation of the mucoperiosteum of the nasal floor by means of the curved McKenty elevator and creation of two inferior septal tunnels, 7. connection of the left inferior and left anterior superior tunnel, 8. connection of the right inferior tunnel with the two connected tunnels on the left (Figures 1a-d).
The technique offers a maximal access to and visualization of all parts of the nasal septum and its deformities. The technique is not easy, however, and implies greater surgical trauma. In particular the incisival nerve has to be preserved.

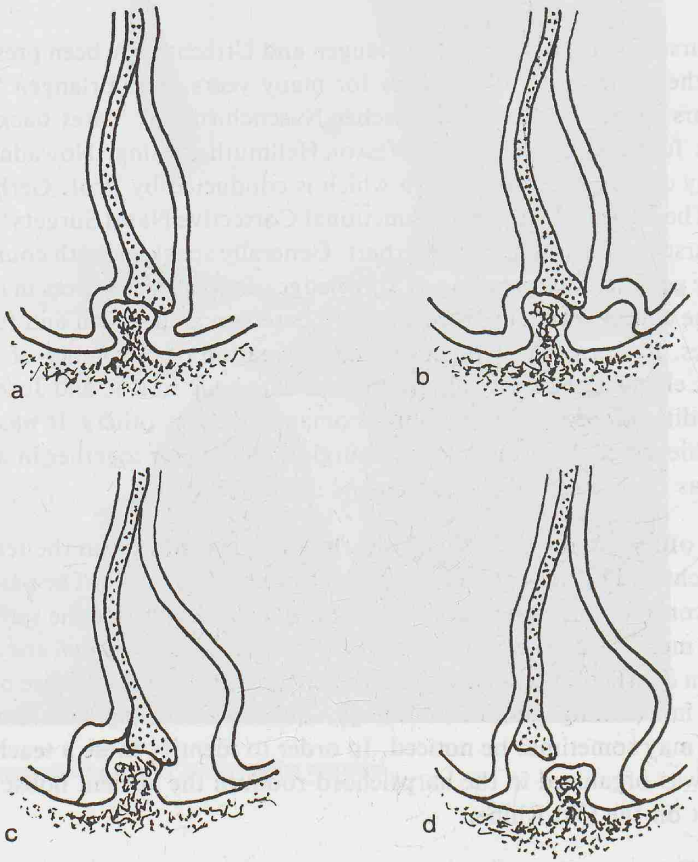

Figure 1. Maxilla-Premaxilla approach according to Cottle.
a. left anterior superior tunnel;
b. left anterior and inferior tunnel;
c. right inferior tunnel and connection on both tunnels on the left;
d. disconnection of the septum from its base leaving the right mucosa attached.

Teachers of the Utrecht Nasal Surgery Course in Unanimity and Diversity together, June 1989.
From left to right: S. Hellmich, R.Th.R. Wentges, W. Pirsig, E.B. Kern, E.H. Huizing, A.F. van Olphen, G. Rettinger, J.A.M. de Groot.

QUESTION: How often do you use the M–P approach and on which indications?
Hellmich: In our department in Dortmund the M–P approach is a routine procedure in almost all cases of septum-pyramid surgery. In my opinion all residents have to learn this technique. If we do not teach it thoroughly they will not be able to use it later in their own practice and thus will be incapable of correcting more difficult cases of septal pathology.
Wentges: I personally reserve the M–P approach for 1. revision septal surgery, in particular when the previous surgeon has used the Killian technique and 2. in severely traumatised septa. I agree that a thorough teaching of the method to the residents is very important.
Pirsig: I use about the same indications as Wentges and I also use it in cleft-palate patients. In children I do not use it as I want to be as conservative as possible. In order to avoid damage to the incisival nerve I advise to create the inferior tunnel only parallel to the maxillary crest and not on the nasal floor.
Kern: I would like to add the transseptal transsphenoidal approach to the sella and parasellar region as an other indication for the M–P approach. Otherwise I agree with Wentges and Pirsig.
van Olphen: Narrowing of the nasal cavity by submucoperiosteal implantation also requires the M–P approach. By means of this technique it is possible to implant material not only into the nasal septum but also into the nasal floor and the lateral nasal wall.
Rettinger: I agree that all beginners should be taught how to perform the M–P approach. They should have the technique at their disposal. Nevertheless I try to avoid it when possible. Since we have to take care of a large number of revision cases in Erlangen I estimate that I nowadays need it in about half of my operations. As to the special indications I would add the closure of septal perforations by means of pedicle flaps.
Huizing: Thus we all agree that the ability to perform the M–P approach is mandatory for nasal surgeons. This is the reason why we devote so much time to the method during the first days of our courses.

2. UNILATERAL OR BILATERAL SUPERIOR SEPTAL TUNNELS

The classical M–P approach according to Cottle implies a superior and an inferior tunnel on the left and only an inferior tunnel on the right. The septal cartilage is left attached to the right mucosa. The question arises whether this is either necessary or desirable. The advantage of leaving the cartilage attached to the mucosa is that it cannot rotate backwards which may produce cartilaginous sagging and a retracted columella. Leaving the right mucosa attached makes surgery more difficult, however, and according to some surgeons

certain cartilaginous concavities will not straighten out. Animal experiments (Eitschberger et al., 1980) showed that unilateral elevation of the mucosa may lead to deformities.

QUESTION: When do you prefer to make a bilateral septal tunnel and when do you make an unilateral one?
Wentges: I routinely elevate the mucoperichondrium on both sides. This is of course related to my practice of not making inferior tunnels in most cases.
van Olphen: The Utrecht Clinic follows the same principle.
Huizing: Our only two indications for a unilateral tunnel are: 1. resection of a bony spur if it is the only pathology and 2. transseptal hypophysectomy.
Pirsig: We follow the same concept in Ulm.
Hellmich: I am more conservative and, as said before, I perform the M–P approach and leave the right mucosa attached. There are of course many exceptions where this is impossible, such as: 1. a multiple fractured septum, 2. in reconstruction of the septum (''Austausch Plastik'' and transplants), 3. wedge resection and many others.
Rettinger: In Erlangen we undertunnel on both sides of the septum but we like to stress that this implies solid fixation of the cartilaginous septum to the columella and sometimes to the nasal spine as well at the end of the operations. Otherwise backward rotation of the cartilage may occur.
Kern: I also advocate bilateral septal tunnels except in the following two situations: 1. pathology restricted to the bony septum and 2. pituitary surgery.

3. SEPTAL SPLINTS

Fixation of the septum in the midline may be effected in several ways: by splinting, by packing (internal dressings), by septal columella sutures, by suturing of the septal base to the nasal spine and by transseptal sutures.

QUESTION: What are your feelings about splinting?
Kern: I apply splints in almost all my cases to prevent adhesions. Another advantage is that you can remove your internal dressings with less discomfort much earlier so that the patient can breathe through his nose after one to two days.
Hellmich: So do I. Only when the septum is reconstructed in the ''mosaic'' way I do not suture splints to the septum.
de Groot: In our department we rarely use splints. We are under the impression that S.C. sutures, transseptal sutures and fixation to the nasal spine (if required) together with careful application of an internal dressing make splints unnecessary. We leave our packing in for three to five days depending on the case.

Wentges: In Nijmegen we work along the same lines.
Pirsig: In Ulm splints are seldomly used, like in Utrecht.
Rettinger: We on the contrary, use splints quite regularly. Our single contra-indication is closure of septal perforations.
van Olphen: As John de Groot said we rarely use splints, let us say in about 5% of our operations, where we wish extra fixation of a rebuilt septum.

4. CARTILAGES OF THE EXTERNAL NOSE – NOMENCLATURE

The cartilages that make up the cartilaginous part of the pyramid and the lobule are indicated by a variety of names.

QUESTION: Which nomenclature do you use?
Kern: In the U.S.A. upper lateral cartilage (U.L.C.) and lower lateral cartilage (L.L.C.), lobular cartilage or alar cartilage are the terms commonly used.
Pirsig: In Germany we use "Seitenknorpel" (lateral cartilage) and "Flügelknorpel" (alar cartilage).
Huizing: When Sedee, Wentges and I wrote our small book on corrective nasal surgery in 1973, Bob Wentges and I took care of the chapter on terminology. We had several meetings in the Railway Station restaurant in Utrecht, Bob coming from Nijmegen, I myself from Leiden. Ultimately we decided on "triangular cartilage" (Dutch: triangulair kraakbeentje) as part of the septolateral cartilage and on "alar cartilage" (Dutch: alair or neusvleugelkraakbeentje). Now I am not so happy with the choice we made. Although the Anglo-Saxon and German speaking countries use it too I nevertheless consider alar cartilage a misnomer as it ignores the existence of the medial crus in the columella and the dome in the tip. In my present opinion the best clinical name is: lobular cartilage consisting of a medial crus, a lateral crus and a dome. I realize, however, that with this proposition I am not following the official anatomical nomenclature (Table 1).

5. LOBULAR SURGERY –. TERMINOLOGY

There is no uniformity, even at times in our group, about the names of the various procedures for lobular surgery. Nevertheless, all participants agree that the following different techniques are to be distinguished nowadays:

1. *Luxation or delivery technique*. In this procedure the dome and the ventral halves of the lateral and medial crura are dissected out through a marginal and an intercartilaginous incision. They are then pulled caudally out of position and can be modified outside the nose under direct vision.
2. *Inversion technique*. In this procedure the cranial half of the lobular cartilage is turned upside down (inverted) after retrograde undermining of the

Table 1. Different terminology of the (other) nasal cartilages.

Nomina Anatomica[1]	U.S.A.	German	Dutch[2]
Cartilagines nasi			
1. Cart. nasi lateralis	Upper Lateral Cart.(ULC)	Seiten-knorpel	Triangu-lair
2. Cart.alaris major – crus med. – crus lat.	Lower Lateral Cart.(LLC) or Alar Cart.	Flügel-knorpel	Alair
3. Cart. alares minores			
4. Cart. nasales accessoriae			

[1] Anatomisches Bild Wörterbuch der internationalen Nomenklatur. H. Feneis, 1972, Thieme Verlag.
[2] Huizing EH, Sedee GA and Wentges RThR. Correctieve Neuschirurgie, 1973, 1–147.

overlying skin through an intercartilaginous incision. The method only allows modification of the cranial part of the dome and the lateral crus.

3. *Transcartilaginous (splitting) technique.* In this technique a transcartilaginous incision is made in the vestibule through skin and lateral crus about 4 mm cranially from its lower margin. It is a quick and reliable method of narrowing the lobule and nasal tip. It was especially propagated by Anderson and has come into widespread use among plastic surgeons. In our group it is not so often used as the technique does not allow functional corrections.
4. *External approach.* This method goes back to the twenties when it was first described by Rethi and by Sercer. In the last twenty years it has become more and more popularized by the work of Goodman and others. The method is often appraised as a new rhinoplastic technique. It should be kept in mind, however, that it is a method of approach with its advantages and disadvantages. The advantages are the wide exposure of the lobular cartilage and its relation to the caudal part of the cartilaginous septum. The disadvantages are the transverse columellar incision and the soft tissue trauma that is produced when the lobular skin is dissected from the lobular cartilages and the septum. Because of these disadvantages the method is reserved by us for specific lobular deformities. The best indication is the bifid nose and severe lobular asymmetries as may be present in cleft-palate patients. In reconstruction of the septum the external approach is not superior to the hemitransfixion and M–P approach.
5. *Sutures.* All participants agreed that the hemitransfixion, the intercartilaginous incision and the marginal incisions should always be closed. Whether the vestibular incision is sutured is considered to be optional and to depend on the length of the incision and the number of incisions in the vestibule.

As material everybody prefers 4–0 Vicryl or 4–0 Catgut. For septum columella sutures (always two, sometimes three sutures) 3–0 Catgut or 3–0 Vicryl is used. It is claimed that the advantage of catgut is that the sutures do not have to be removed. It is a common experience, however, that the resorption of catgut takes longer than the time required for healing. In case of crusting and infection in the vestibule catgut sutures have therefore sometimes to be removed too.

6. PACKING – INTERNAL DRESSING

Huizing: in my opinion the word "packing" should be avoided. It ought to be replaced by "internal dressing". I use 2 cm woven gauze soaked in saline. The first double sling is placed on the nasal floor against the septal base in order to approximate the mucosal blades and to close the septal space. Before the gauze is applied, all blood is sucked out from the interseptal space as well as from the nasal cavity. The second somewhat shorter sling is placed under the nasal bones and triangular cartilages in order to support these in their new position. The third and last sling is brought in between the first two and fills up the middle part of the nasal cavity (Figure 2a). The whole dressing is rather loose. The vestibulum is left free at this stage.

The septal space is now reinspected and reconstruction of the posterior part of the skeleton is carried out if necessary. The final adjustments of the vestibule, the caudal end of the septum and the columella position are now carried out. The incisions are closed and some crushed cartilage is inserted into the nasal dorsum or tip if required. Al loose saline-soaked 2 cm gauze is then inserted into the vestibule and an external dressing of tapes and a stent is applied. After extensive lobular surgery or scarring because of previous surgery Terracortril® is applied with the vestibular dressing. Usually the internal dressings are removed on the third to fifth day.

Wentges and *Kern*: We essentially use the same method although the sequence of the steps may sometimes be a little different. Removal of the gauzes takes place between the third to sixth day depending on the case.

Pirsig: I use 2 cm gauzes with Terracortril®, but I start with an upper sling to support the nasal bones and then proceed in almost the same way (Figure 2b). The dressing is kept in place for four to six days.

Hellmich: I use four sponges soaked in Nebacetin® in a similar way as Hellmuth Masing did: two smaller ones in the upper part and two bigger ones in the lower half of the nasal cavity. The advantages are, I think, that they stay nicely in place and provide an equally soft pressure in all directions, avoid empty spaces within the packed nose, and – not being of cotton material – don't start to smell since bacterial superinfection does not occur.

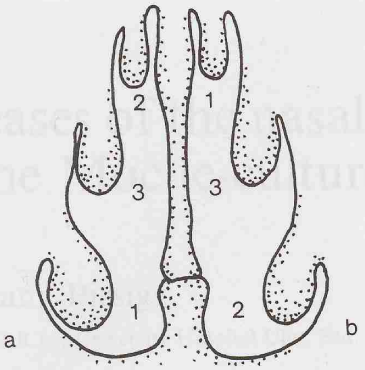

Figure 2. Internal dressings. Sequence of steps: a. Huizing, b. Pirsig.

After a septoplasty I remove all internal dressings after two days. In cases of osteotomies the upper sponges are removed after two days and the lower ones after four days, leaving the septal splints and the outer stent in place for another week.

Rettinger: I have abandoned Masing's technique with the sponges and I now use Merocele® which swells up by absorbing blood (together with splints). It was originally developed for the treatment of epistaxis. One piece is introduced into each nasal cavity and removed after two days.

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Diseases of the nasal region on ceramics of the Moche-culture in ancient Peru

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Dedicated to my rhinophilosophical friend R.Th.R. Wentges from Nijmegen

The Moche-culture is named after the river "Moche" which cuts a valley into the desert coast of northern Peru near the town Trujlo. From this period which is dated from 200–700 A.D. no written document has been discovered until now.

Instead thousands of earthernware vessels were dug up from the tombs in the desert by "desperado" robbers who destroyed the tombs in the process.

These vessels are a unique document depicting with startling realism the daily life of this population although the background of this huge cultural programme is still being discussed by the archeologists (Eisleb, 1987).

The sculptors and painters of this period captured in clay the physical states of their people including the pathology of many diseases. Many vessels show signs of congenital deformities, inflammations, and injuries of the midfacial region, and since hundred years medical science in collabaration with archeology has tried to identify the pathological entities of those ancient art products (Gantzer, 1972). In 1987, I was able to study approximately one thousand portrait vessels from the Moche period in the department "Old America" of the ethnology museum in Berlin-Dahlem (Museum für Völkerkunde) by the generous kindness of its director Dr. Dieter Eisleb.

In the following pages I will present some diseases of the nasal region depicted in these portrait vessels which were sculptured a thousand years before Columbus. These portrait jars, enabling individuals to be recognized, as a rule have faces looking upward.

As to "normal" noses there is an unexpected variety of shapes and sizes: thus we find snub noses, straight noses and hump noses. With regard to the nasal lobule we would describe many of the noses as oriental or caucasoid and a few even as negroid.

Figure 1.
Siamese twins (VA 18036; 17 cm).

Figure 2.
Achondroplasia (VA 7647; 32 cm).

Figure 3.
Saddle nose (VA 17984; 23 cm).

Figure 4.
Craniofacial anomaly (VA 17850; 19,5 cm).

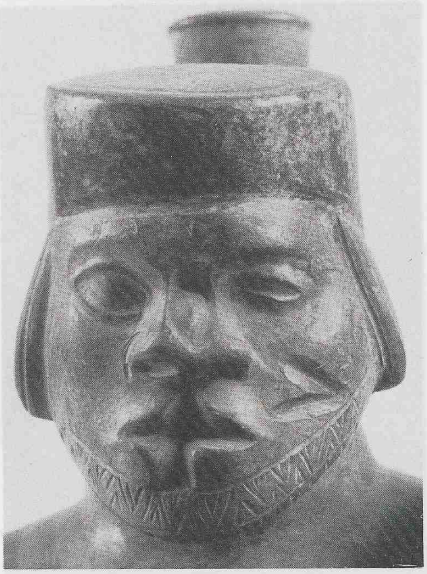

Figure 5.
Median facial cleft (VA 62211).

Figure 6.
Epistaxis (VA 48171; 38,6 cm).

CONGENITAL MALFORMATIONS

An example of caucasoid noses is depicted in Figure 1 where the sculptor shows Siamese twins with one trunk and two heads. The faces present straight noses in the frontal view with a slightly curved nasal dorsum in profile and symmetrical painting of the skin.

Figure 2 shows a dwarf with shortened arms and legs and a head of normal height. The face is characterized by its baby-like saddle nose and bulging forehead. These features are typical for achondroplastic dwarfism, a very common type of retarded growth in man.

Well proportioned dwarfism with a snub nose of normal size may be due to different reasons, both congenital and acquired, and there is no additional criterium to offer a good diagnosis for Figure 3.

The same holds true for the next example from the Berlin-Collection (Figure 4): We look into a face with a mini-nose which is part of a craniofacial anomaly: the oblique position of the mouth with underdeveloped or cut-off lips, the antimongoloid position of the eyes, retromaxilla, and malformation of the mandible, while the auricles seem to be of normal size and position. The man is holding a drinking vessel and a rattle in his hands, both considered to be therapeutic paraphernalia. This type of underdeveloped nose and anomalous face is found in four other vessels in the Berlin-Collection.

Clefts of the lip and maxilla are more often encountered in ceramics of the

Figure 7.
Hypoplastic right nose (VA 12936; 14,5 cm).

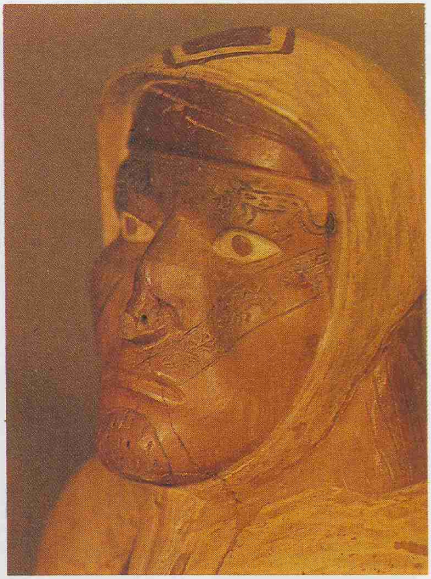

Figure 8.
Aplasia of nasal alae (VA 62148; 23 cm).

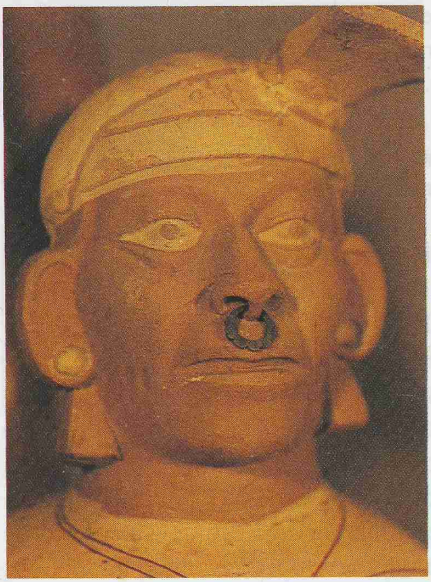

Figure 9.
Septal perforation (VA 4621; 20 cm).

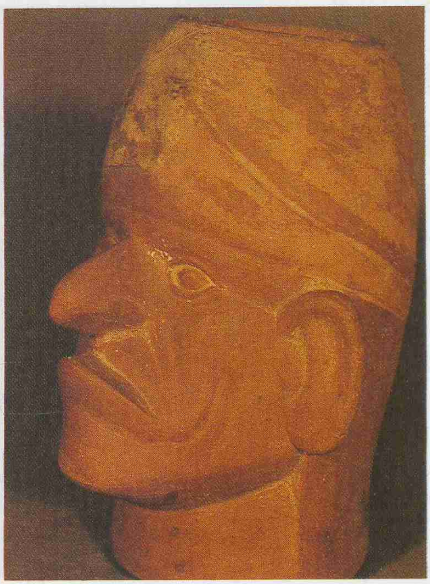

Figure 10.
Acromegaly (VA 3431; 18 cm).

Figure 11.
Leishmaniasis (VA 3198; 18 cm).

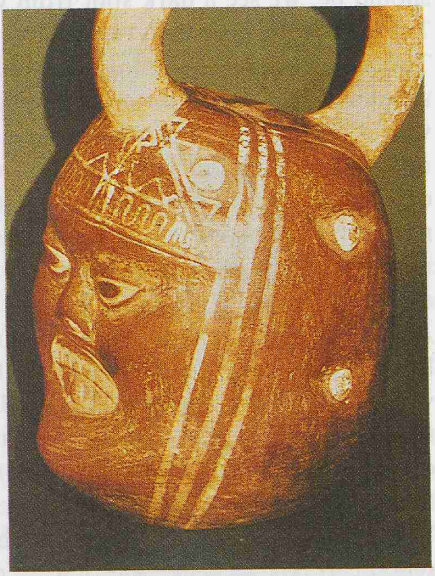

Figure 12.
Potato head (VA 48036; 28 cm).

Moche period, but a median facial cleft is rare (Figure 5). In this portrait vessel we recognize the median clefts in the lips. The nasal tip with the lower lateral cartilages appears normal, while the cartilaginous and bony nasal dorsum is characterized by a deep median cleft formation. In addition there is a left anophthalmia and an angled deficiency of the skin of the left cheek.
Figure 8 presents a rarity, too: both lower lateral cartilages are lacking while the septal cartilage with its upper lateral cartilages is in a normal position and has a small perforation, probably to carry a decorative nasal ring.
When one half of the nose is hypoplastic and combined with an underdevelopment of the face of the same side (Figure 7) we look into an asymmetric face with the nose in an oblique position. The ancient sculptor had even created a hypoplastic right nasal ala and a steeper right nasal lateral wall compared to the more shallow left nasal lateral wall. If one draws the axes through the pupils and through the angles of the mouth theses axes will cross outside the right face underlining the facial asymmetry.

NASAL ALTERATIONS BY EXTERNAL INFLUENCES

Some earthenware vessels from the Moche period show pictures of people with severed and bleeding noses due to combat injury and mutilations of the noses of prisoners of war. Figure 6 presents such a prisoner: where the tip of the nose

should be, we see a dark spot from which blood is dripping to the ground. The lack of the nose tip is remarkable in the portrait jar VA 17264 (Figure 13). The caudal edges of the bony nose flanks and the remainder of the medial nasal septum are smooth and straight, as after the planned removal of the nasal tip with a sharp object. In addition the contour of the mouth is flattened. The upper and lower front teeth are shown exposed in the elliptic, sharp-edged oral office. This shape of mouth could result from the deliberate excision of the lip mounds. It is therefore justified to assume that the symmetrical mutilation of nose and mouth of the face represented on this portrait vessel, was planned and executed by man (Pirsig and Eisleb, 1988).

An interesting interpretation of a planned mutilation of nose and lips was given by the English physician Redcliffe Nathan Salaman (1874–1955): in Figure 12 we find a portrait vessel which reminds us of a potato with three "eyes" in the frontal and left lateral surfaces. The cut-off lips and nasal tip make these facial openings resemble the "eyes" of a potato. Were these special mutilations performed to pay one's tribute to a special god or demon of the potato?

The septal perforation (Figure 9) can be considered as a planned trauma of the septal cartilage to enable decoration of the nose with a ring which we found in many examples of the vessels of the Moche period.

Among toxic substances producing defects of the nose and lip and known in ancient Peru is cocaine which is absorbed by chewing the leaves of the coca-plant or sniffing it as a pulverized substance. The face in Figure 19 attracts notice because of a nose with flaring nostrils and a cartilaginous saddle and because of a defect in the left upper lip and a tumour-like protrusion in the left cheek. This ball visible in the cheek is the sign of a coca-leaf chewer who suffered from mucosal destruction in the oral cavity. Thus the defect in the upper lip can be explained. Sniffing material containing cocaine may induce septal perforation and defects in the cartilaginous nose, thus a nose depicted in Figure 19 can result in the long run.

NASAL ALTERATIONS DUE TO INFECTIOUS DISEASES

Since the end of the 19th century archeologists and physicians have been trying to discover the underlying cause of midfacial deformities which will be discussed in the following figures. The facial alterations are characterized by coarse swellings of the lip, loss of tissue in the nasal alae and upper lip with irregular borders of the surrounding tissues, and loss of the septal cartilage and the premaxillary bone. Although some microorganisms can produce such alterations most interpreters (Gantzer, 1972) of these midfacial deformities of the Moche ceramics think that they are due to Leishmaniasis, a disease which is even now endemic in South America (Jaffé, 1955).

Leprosy can cause similar deformations, but there is no definite pre-Columbian evidence of leprosy in the New World, which supports the belief that this dis-

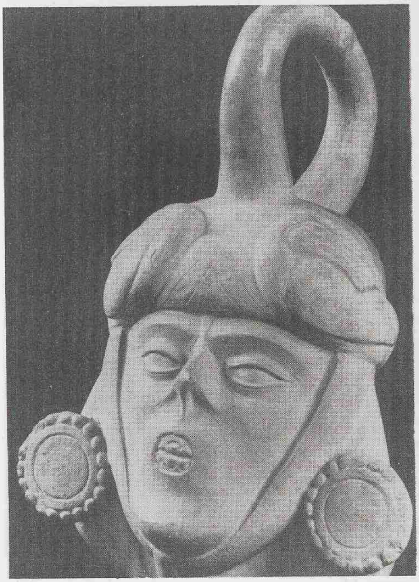

Figure 13.
Resected nasal lobule (VA 17264; 23 cm).

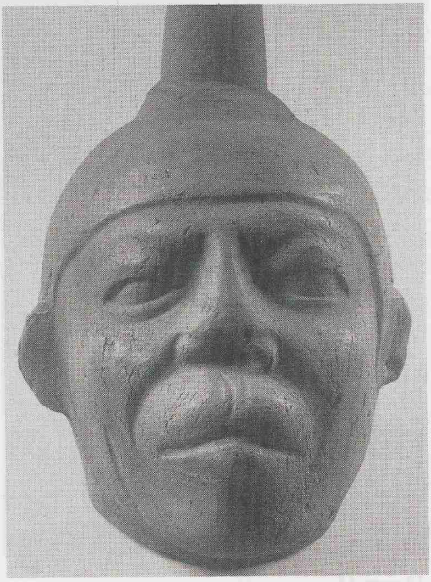

Figure 14.
Leishmaniasis (VA 2718; 17 cm).

ease was introduced by the Spaniards or African slaves (Steinbock, 1976). Figures 11, and 14 to 18 demonstrate some examples of Leishmaniasis showing different stages of midfacial destruction: in Figure 11 the disease is confined to the nasal alae and part of the septum with intact upper lip. Figures 14 and 15 depict persons with a thickened upper lip and the nose tip partially destroyed including the cartilaginous septum. The bulging remnants of the nasal alae are remarkably different from the sharp-edged contours visible in the nasal tip following planned mutilation (Figures 12 and 13). Figures 16 to 18 show both the increased destruction of the nasal structures and the enhanced defect of the upper lip while the lower lip appears normal or swollen in the faces of Figures 16 and 17.

In the Musée de l'Homme in Paris there is a vessel from the Moche period depicting a mother with her baby (Coury, 1969). The midface of the mother shows midfacial destruction similar to that seen in Figure 18, while the nose and lips of the baby are totally normal: a support for the interpretation that the sequelae of this disease are acquired after birth and not congenital.

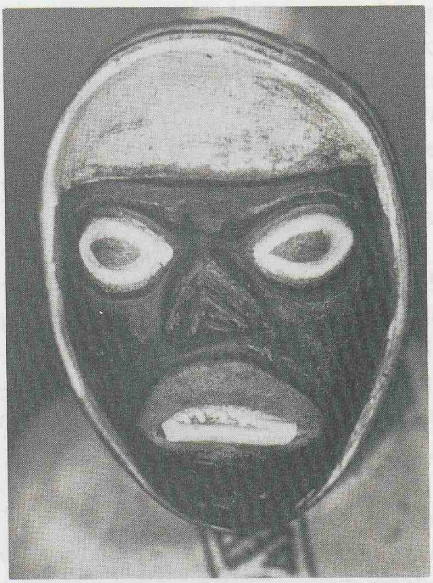

Figure 15.
Leishmaniasis (VA 17848; 22,5 cm).

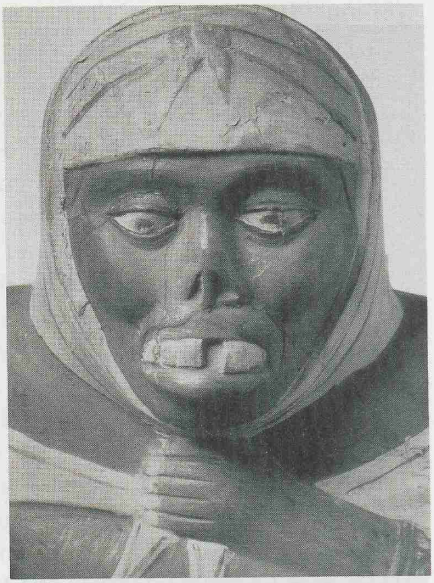

Figure 16.
Leishmaniasis (VA 48072; 28 cm).

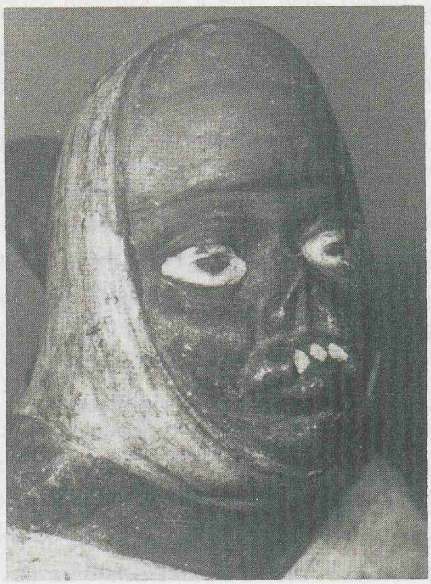

Figure 17.
Leishmaniasis (VA 48071; 22,5 cm).

Figure 18.
Leishmaniasis (VA 48064).

Figure 19.
Cocaine sequelae (Lima).

Figure 20.
Disease of nasal tip (Lima).

MISCELLANEOUS NASAL DISEASES

Figure 10 presents a portrait jar of a man with a huge nose, hyperplastic mandible, and large ears, while the maxilla appears of normal size or even underdeveloped. These coarse features of the face remind us of a patient with acromegaly.

Our last example (Figure 20) is noteworthy because this man has an altered nasal tip which is built up of three zones: a prominent center, a surrounding groove and a prominent wall with some indentations. Is this a benign or malignant tumour of the nasal tip or a scar after a burn with a hot ring, I don't know.

Comparing these twenty faces under the aspect of representing real portraits we find many differences: Figures 8, 11, 14, and 16 are very realistic in a way, while Figures 4, 10, 12 and 15 show more features to characterize a type of diseased person than a special individual. Furthermore we have to realize that the ancient artists were no physicians. But nevertheless they observed these anomalies in their people with such an accuracy that we are able to recognize the underlying disease in most of the examples. These earthenware vessels seemed designed not so much to please the eye as to deliver a message which is not yet understood. As this type of sculpture was found in graves as part of

the dead person's possessions, we don't even know its meaning in every day life. It is very astonishing that so many ceramics have been excavated depicting the population's state of health, their diseases, techniques of treatment like amputation or trephining, and even skeletons. In no other culture during the history of mankind so many artifacts have been found relating to medicine as in the Moche culture. However, it will probably remain a secret why the pre-Columbian sculptors told the medical story of their people in clay.

ACKNOWLEDGEMENT

I thank Dr. Dieter Eisleb, Director at the Museum für Völkerkunde in Berlin-Dahlem, for his friendly support in examining the vessels of the Moche period, and Frau Christine Mader for typing the manuscript.

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FIGURES

All figures "VA" are from the Berlin-Collection.
Figures 19 and 20 are from the Museo Nacional de Antropologia y Arqueologia in Lima.
Figures 5, 6, 14, 16 and 18 were photographed by Dietrich Graf (Berlin), the other pictures were taken by the author. The measurement in cm refers to the height of the whole vessel.

Rhinology, Suppl. 9, 37-44, 1989

Intranasal ipratropium: Literature abstracts and comments

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Since the journal "Rhinology" published the first paper on intranasal ipratropium bromide (ipratropium) in 1978 a series of papers has followed, and the treatment has been introduced in a number of countries. This paper contains a commented review of the abstracts of placebo-controlled trials of ipratropium in perennial non-allergic rhinitis.

IPRATROPIUM NASAL SPRAY: A NEW TREATMENT FOR PERENNIAL RHINITIS

P. Borum, N. Mygind and F.S. Larsen (1979)

Abstract

Eighty micrograms of the topically active parasympatholytic drug ipratropium were applied intranasally four times daily in 20 adults with perennial rhinitis and severe watery rhinorrhoea in a double-blind controlled cross-over trial. There was a significant reduction in nasal hypersecretion during ipratropium treatment. Fourteen patients preferred the ipratropium period, three the placebo period and three had no preference. There were no systemic or local side effects. Ipratropium was effective also in patients resistant to glucocorticoids, sodium cromoglycate and antihistamines. As the drug works immediately it can also be used before exposure to known provocating factors. It is concluded that continuous use of this new medication is of value in the management of severe rhinorrhoea in patients with perennial rhinitis, and that the occasional use is helpful in subjects with infrequent attacks of nasal hypersecretion.

Comment

This is the first demonstration of efficacy in perennial rhinitis, but although there was a striking difference in favour of ipratropium with regard to preference, the mean reduction in nasal secretion scoring was only 23%. The authors'

comment that "ipratropium was effective also in patients resistant to other therapies" is merely based on anamnestic data, and it would have been wiser to omit it. Pioneer enthusiasm may be the reason why "there were no local side effects". Although it is claimed that "the drug works immediately", the maximum effect was not reached until treatment had persisted for 1–2 weeks. This clinical experience seems to conflict with earlier data showing inhibition of methacholine-induced hypersecretion when ipratropium was given five minutes before and maximum inhibition when it was given 30 minutes before challenge.

INTRANASAL IPRATROPIUM BROMIDE FOR PAROXYSMAL RHINORRHOEA

H.E. Bok, H.A. van Wijngaarden and P.J.G. Cornelissen (1983)

Abstract

Twenty-one patients, suffering from paroxysmal watery rhinorrhoea, were treated with the topically active parasympatholytic ipratropium bromide in a double-blind, placebo controlled, cross-over trial. Forty to eighty micrograms of ipratropium bromide were applied by pressurized dosis aerosol intranasally four times a day. There was a significant reduction in the number of handkerchiefs used in the ipratropium bromide period ($p = 0.035$). Based on a subjective assessment 15 patients (71%) preferred the ipratropium period and six patients preferred the placebo period ($p = 0.05$). It is concluded that intranasal application of ipratropium bromide is a useful treatment to prevent the annoying symptom of paroxysmal rhinorrhoea. However, continuous use by the patients, suffering from infrequent attacks of nasal hypersecretion, is experienced as superfluous. It is suggested to commence intranasal application in the morning at getting up, followed by occasional use during the day.

Comment

We completely agree that a dosage in the morning, matched to the severity of the symptoms, followed by occasional usage, as required, during the rest of the day, is preferable to a standardized q.i.d. usage. The drug is very long-acting (8–12 hours), and even a moderate dose in the afternoon or evening can cause an unpleasant feeling of dryness in the nose during the night, when the secretory activity usually is low.

INTRANASAL IPRATROPIUM IN THE TREATMENT OF VASOMOTOR RHINITIS

K. Jokinen and P. Sipila (1983)

Abstract

Ipratropium administered in the form of a nasal spray was compared with placebo in 30 patients with vasomotor rhinitis in a double-blind cross-over trial. There was a significant reduction in nasal hypersecretion during ipratropium treatment, but no effect on nasal blockage, sneezing or tickling. On the whole 20 patients (66.7%) considered ipratropium worth using. Eleven patients had mild side-effects, mainly nasal irritation, during ipratropium treatment and seven with placebo. A therapeutical trial with ipratropium is appropriate in the management of severe rhinorrhoea in patients with vasomotor rhinitis.

Comment

Very much the same design and results as in the two first trials. As in all other trials it was found that the drug had no effect on itching, sneezing and blockage, and it is essential for the use of this type of therapy to inform physicians and patients that it is monosymptomatic, exclusively acting on watery rhinorrhoea. It is also our experience that spraying in a sensitive nose can result in some immediate irritation and perhaps reflex-induced sneezing and hypersecretion. This side effect is short-lasting, seldom a problem, and probably caused by the freon and the lubricant. The spray used in all the trials was primarily designed for oral inhalation and not for use in the nose. Possibly, it could be improved for intranasal usage. We also completely agree that it is difficult to predict who will respond and that a therapeutic trial is the correct attitude.

IPRATROPIUM (ATROVENT®) IN THE TREATMENT OF VASOMOTOR RHINITIS OF ELDERLY PATIENTS

H. Malmberg, B. Grahne, E. Holopainen and E. Binder (1983)

Abstract

Ipratropium is a parasympatholytic agent with high topical activity. The effect of intranasal ipratropium was studied in 34 patients who were over 60 years of age and who suffered from watery vasomotor rhinorrhoea. The study was a double-blind cross-over placebo controlled trial. Trial parameters were: daily nasal symptom and side effect scores, nasal methacholine testing before and after treatment, and clinical evaluation. The active drug clearly reduced nasal discharge. Nasal methacholine testing showed reduction of nasal secretion after the active treatment period. The majority of the patients preferred the

active drug to the placebo. Excessive drying of the nasal mucosa was the most common side effect. Ipratropium seems to have a beneficial effect on vasomotor rhinitis, which often is an irritating condition in elderly patients.

Comment

This result is interesting as it has been unknown whether "the elderly gentleman's nosedrip in the cold weather" is due to condensated water in the expiratory air, tears, or glandular hypersecretion from the nose. The study clearly shows that the last factor plays an important role. A sensation of nasal dryness was described in 15 patients during ipratropium therapy and eight during the placebo period. It seems contradictory that patients who visit their doctor for rhinorrhoea also claim to have a dry nose, but we have the same experience. The secretory activity varies considerably during the day.

DOUBLE-BLIND CROSS-OVER TRIAL OF IPRATROPIUM AND PLACEBO IN CHRONIC RHINORRHOEA

N.P. von Haacke, V. Moore-Gillon, K.H. Capel (1983)

Abstract

Ipratropium was assessed in 20 patients consecutively referred with chronic watery rhinorrhoea. The dosage was 40 μg to each side of the nose four times a day. Patients were randomly allocated to either ipratropium or placebo for two weeks and then crossed over to the other medication for two weeks. Fifteen patients preferred ipratropium and three preferred placebo ($p < 0.01$). Two had no preference. Scores for rhinorrhoea were significantly reduced during treatment with ipratropium (1.42) compared with placebo (1.98) ($p < 0.01$). There was no effect on nasal obstruction or on sneezing. This study suggests that intranasal ipratropium may give symptomatic relief in a broad spectrum of patients with chronic watery rhinorrhoea (abstract constructed fromt text).

Comment

Confirmation of the above mentioned trials.

IPRATROPIUM IN THE TREATMENT OF PATIENTS WITH PERENNIAL RHINITIS

I. Sjögren and J. Juhasz (1984)

Abstract

Rhinorrhoea is due to increased parasympathetic activity. This study was

undertaken in order to study the applicability and efficacy of ipratropium, an anticholinergic drug, in patients with perennial rhinitis seen in an allergy clinic. Thirteen patients were included in the double-blind, cross-over study following screening with methacholine test. The number of paper tissues used during the period with active drug treatment decreased significantly. Other variables did not change significantly. Eight patients preferred the active drug. The findings of this study suggest that ipratropium bromide is a valuable addition in the treatment of patients with perennial rhinitis with rhinorrhoea.

Comment

Although there was a significant reduction in the mean number of paper tissues/day from 17 in the control period to 14 during the placebo period and 11 during the ipratropium period, the difference between the latter two ($p < 0.01$) is not clinically impressive. The authors speculate that perhaps the dosage was too low. It could block methacholine-induced hypersecretion, but evidence from the bronchi indicate that a relatively higher dose is necessary to block reflex-induced hypersecretion. Another explanation is that the authors only give mean values for the entire period, including the first days with submaximal efficacy of the treatment. Finally, patient selection is also a possibility of this somewhat disappointing result.

A TRIAL OF INTRANASAL ATROVENT® VERSUS PLACEBO IN THE TREATMENT OF VASOMOTOR RHINITIS

A. Knight, F. Kazim and V.A. Salvatori (1986)

Abstract

Twenty-six patients with perennial rhinorrhoea were treated with ipratropium bromide (Atrovent®), the anticholinergic agent, or placebo in a randomized double-blind cross-over trial. The severity and duration of rhinorrhoea were significantly reduced by Atrovent®. Local side effects were more frequent with the active drug. These were reduced in a later open trial by a reduction in dosage.

Comment

In this well-conducted Canadian study there was a clear effect of ipratropium (21 preferred ipratropium, three placebo and three had no preference). The inclusion of a wash-out period did neither show a carry-over effect nor a rebound effect. A 12-hour symptom recording showed that rhinorrhoea is

worst at day-time, and as mentioned earlier a q.i.d. dosing may not be optimal. This is supported by fact that the marked anti-rhinorrhoea effect of ipratropium in this study was at the expense of significant local side effects (dry and sore nose and throat), reported by 18 patients on ipratropium and two on placebo.

CONTROL OF THE HYPERSECRETION OF VASOMOTOR RHINITIS BY TOPICAL IPRATROPIUM BROMIDE

J. Dolovich, L. Kennedy, F. Vickerson and F. Kazim (1987)

Abstract

A randomized, double-blind, placebo-controlled trial of ipratropium bromide nasal spray was performed in 25 patients with vasomotor rhinitis. Criteria for selection of patients were (1) clear watery nasal discharge more than one hour each day, (2) absent or mild nasal obstruction, (3) no known allergic cause, and (4) no satisfactory response to previous alternative medications.

Ipratropium bromide, two sprays (20 μg per spray) in each nasal cavity four times daily, for three weeks, produced a major reduction in nasal discharge severity and duration ($p < 0.00005$ for day-time reduction in both). There was a decreased daily use of nasal tissues ($p = 0.0017$). At the end of the trial, 21 patients preferred the drug, two preferred placebo, one had no preference, and one patient dropped out for a reason unrelated to the symptoms or treatment. This drug preference in favour of active medication was statistically significant at the 0.01 level. Local mild side effects were reported in 21/25 (84%) with ipratropium bromide and 8/25 (32%) with placebo ($p = 0.0004$). Pulse and blood pressure were not affected. In an ensuing one year open trial in which the frequency of use of ipratropium bromide nasal spray was selected by the subjects, the dosage chosen was considerably lower than that used in the controlled trial. There were seven drop outs caused by insufficient benefit or local side effects. Seventeen subjects continued the use of ipratropium bromide for one year and reported good results and no side effects. Topical nasal ipratropium bromide is highly effective in the control of the rhinorrhoea of vasomotor rhinitis. Drug dosage is a major determinant of local nasal side effects.

Comment

Another excellent Canadian study with a design similar to that of Knight et al. (1986). The effectiveness of treatment appears greater than the previously reported, which is considered likely to be due to careful selection of subjects. Again a frequent occurrence of mild, but unpleasant, local side effects speaks against a standard dosage of 80 μg given four times daily.

ORDINARY AND HIGH-DOSE IPRATROPIUM IN PERENNIAL NON-ALLERGIC RHINITIS

J. Kirkegaard, N. Mygind, F. Molgaard, B. Grahne, E. Holopainen, H. Malmberg, K. Brondbo and T. Ronje (1987)

Abstract

The aim of the present study was to test the efficacy of the topically active cholinergic antagonist, ipratropium, in the treatment of rhinorrhoea in perennial non-allergic rhinitis, with special reference to identification of subgroups of responders and increased efficacy from high-dose therapy. Thirty-six adults with watery rhinorrhoea as a dominant symptom completed the study, which consisted of a 2-week run-in period followed by two 3-week treatment periods with placebo and ipratropium in an ordinary dosage (80 μg four times a day) in a double-blind, cross-over design, and finally, an open 2-week period with high-dose therapy (400 μg four times a day). The number of nose blowings was 47% lower during treatment with ipratropium in the ordinary dosage than during the placebo period ($p < 0.001$). There was an additional reduction during high-dose therapy that was slight but statistically significant ($p < 0.05$). Ipratropium had no effect on the number of sneezes or on nasal blockage index. During ordinary-dose therapy, side effects were slight and confined to the nose, whereas the high-dose therapy caused unpleasant nasal dryness and, in a few cases, systemic side effects. It was not possible to separate responders from nonresponders by case history, physical examination, or nasal methacholine testing. It is concluded that intranasal ipratropium is effective in the treatment of watery rhinorrhoea in perennial non-allergic rhinitis and that 320 μg a day is sufficient in most patients.

Comment

This study showed that the maximum attainable efficacy of intranasal ipratropium is a 50% reduction of symptoms. It also showed that patients who visit their doctor due to "rhinorrhoea" blow their noses from "3.6 to 373 times daily". Very few patients needed more than 320 μg a day, but for the little lady the 373 nose blows were reduced from 139 on ordinary dose-therapy, to 39 on the high-dose regime, and it almost saved here life, socially and mentally. Most patients got very dry noses at high-dose therapy, but interestingly mucociliary transport rate was not reduced.

CONCLUSION

Ipratropium nasal spray is proven effective in patients with perennial non-allergic rhinitis and watery rhinorrhoea as a dominant symptom. It is essential for a good therapeutic result to inform the patient that it is monosymptomatic

treatment, and to select the patients carefully, e.g. using the criteria of Dolovich et al. (1987). In order to obtain the best efficacy with a minimum of local side effects the dosage must be tailored to the severity of the symptoms. The major part of the daily dose should be given early in the morning. Other studies have shown efficacy also in cold air-induced and hot curry soup-induced rhinorrhoea, as well as in the common cold.

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Neuroceptors in nasal allergy

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INTRODUCTION

Nasal hyperreactivity in allergic rhinitis may originate from an imbalance of the autonomic nerve regulation (Mygind, 1982). Systemic adrenergic abnormalities and cholinergic nasal hyperresponsiveness has been observed in allergic patients (Shelhamer et al., 1983; Devillier et al., 1988). Beta-adrenergic hyporesponsiveness, alpha-adrenergic and cholinergic hyperresponsiveness have been explained in terms of changes in characteristics of β-adrenoceptors, α-adrenoceptors and muscarinic acetylcholine receptors respectively in the lower airways of asthmatics (Barnes et al., 1986). In this study radioligand receptor binding and in vitro autoradiographic studies were performed in order to elucidate the supposed changes in characteristics and/or localization of adrenoceptors and muscarinic receptors in nasal hyperreactivity.

MATERIALS AND METHODS

Biopsies of human nasal mucosae were obtained from operations. Patients were classified into a non-allergic and an allergic group on the basis of some parameters (Mygind, 1982): nasal symptoms, family history, X-rays of the sinuses, serum IgE, blood and/or nose eosinophils, RAST and skin-tests. The heterogeneous non-allergic group was further subdivided into control individuals, chronic sinusitis and vasomotor rhinitis patients.

Nasal mucosae were washed in 0.9% NaCl and stored at $-80°C$. The tissue was homogenized in buffer with an Ultraturrax for 2×10 sec, centrifuged (1000 g, 5 min) and the resulted supernatant was centrifuged at 100,000 g for one hour. The pellet was resuspended by Potter homogenization. Protein determination was performed according to Bradford. The different incubation conditions of ^{3}H-Prazosin, ^{3}H-Rauwolscine, ^{125}I-(-)-CYP and ^{3}H-l-QNB binding to the various neuroreceptors are listed in Table 1. The procedure for the in vitro autoradiography has been described before (van Megen et al., 1988).

Table 1. Incubation conditions for the receptor assays of α-adrenoceptors (α), β-adrenoceptors (β) and muscarinic receptors (M).

Ligand	R	Buffer	Incubation	Non-specific binding
^{3}H-Prazosin	α_1	Tris/HCl	40 min, 37°C	12 μM phentolamine
^{3}H-Rauwolscine	α_2	Tris/EDTA	20 min, 25°C	12 μM phentolamine
^{125}I-(-)-CYP	β	Tyrode + 0.01% BSA	90 min, 37°C	2 μM (±)propranolol
^{3}H-l-QNB	M	HEPES/PI	90 min, 37°C	12 μM l-QNB

RESULTS

Radioligand receptor binding

Specific ^{3}H-Prazosin and ^{3}H-Rauwolscine binding to α_1- and α_2-adrenoceptors was saturable and of high affinity in non-allergic and allergic patients (Table 2). No significant differences in equilibrium dissociation constants (Kd) or densities (Bmax) could be demonstrated in allergic patients in comparison with non-allergic patients and controls. The β-adrenoceptor density, expressed per mg protein, was significantly reduced in allergic patients in comparison with controls (Table 2). The antagonist affinities in allergic patients were not different from control individuals. Inhibition of the ^{125}I-(-)-CYP binding with the subtype selective antagonist $LK_{203-030}$ demonstrated the presence of a homogeneous population of β_2-adrenoceptors in the nasal mucosa of both allergic and non-allergic patients.

The specific ^{3}H-l-QNB binding to muscarinic receptors in nasal mucosa membranes was saturable and of high affinity in all groups of patients. No significant differences could be demonstrated between subgroups of the non-allergic patients. In allergic patients, the Kd- and Bmax-values were significantly decreased in comparison with non-allergic patients and in comparison with controls (Table 2).

In vitro autoradiography

The autoradiographs of 10 μm sections of the nasal mucosa of non-allergic patients showed specific ^{125}I-(-)-CYP labelling of the nasal epithelium. No specific labelling of the glands, the blood vessels and connective tissue could be observed. The autoradiographs of the allergic patients showed similar specific ^{125}I-(-)-CYP labelling. Because of the unfavourable ratio specific/non-specific binding no in vitro autoradiography for the α-adrenoceptors could be performed. The autoradiographs of sections of the nasal mucosa of both non-allergic and allergic patients showed specific ^{3}H-l-QNB labelling of the glandular acini. The epithelium, blood vessels and connective tissue were devoid of silver grains.

Table 2. Binding parameters (mean ± SEM) of ^{3}H-Prazosin, ^{3}H-Rauwolscine and ^{125}I-(-)-CYP to α_1-, α_2- and β-adrenoceptors and of ^{3}H-l-QNB to muscarinic receptors in the nasal mucosa of non-allergic and allergic patients.

α_1-adrenoceptors	Kd (nM)	Bmax (t)	Bmax (p)	n
non-allergic	0.4 ± 0.1	0.77 ± 0.14	177 ± 33	5
control	0.4 ± 0.2	0.90 ± 0.17	195 ± 40	3
chronic sinusitis	0.5	0.35	80	1
vasomotor rhinitis	0.2	0.83	218	1
allergic	0.3 ± 0.1	0.80 ± 0.11	244 ± 50	4
α_2-adrenoceptors	Kd (nM)	Bmax (t)	Bmax (p)	n
non-allergic	2.7 ± 0.5	5.53 ± 1.04	1180 ± 127	14
control	2.7 ± 0.6	4.61 ± 0.87	1070 ± 119	8
chronic sinusitis	3.7 ± 1.4	9.65 ± 3.80	1630 ± 430	3
vasomotor rhinitis	1.6 ± 0.2	3.86 ± 0.59	1020 ± 198	3
allergic	2.3 ± 0.4	5.21 ± 0.59	1230 ± 96	9
β-adrenoceptors	Kd (pM)	Bmax (t)	Bmax (p)	n
non-allergic	2.7 ± 0.2	0.50 ± 0.06	87 ± 11	18
control	2.8 ± 0.3	0.48 ± 0.06	92 ± 10[a]	13
chronic sinusitis	2.9 ± 0.2	0.67 ± 0.20	100 ± 46	3
vasomotor rhinitis	2.7 / 1.6	0.32 / 0.45	42 / 30	2
allergic	3.1 ± 0.4	0.41 ± 0.05	63 ± 6[a]	14
muscarinic receptors	Kd (pM)	Bmax (t)	Bmax (p)	n
non-allergic	47.2 ± 4.4[a]	2.65 ± 0.30[a]	616 ± 52[a]	18
control	49.2 ± 5.5[b]	2.59 ± 0.39[b]	661 ± 68[b]	12
chronic sinusitis	39.3 ± 9.4	3.25 ± 0.58[c]	543 ± 146	3
vasomotor rhinitis	47.0 ± 15.1	2.27 ± 0.87	449 ± 51	3
allergic	35.0 ± 5.5[a,b]	1.56 ± 0.29[a,b,c]	445 ± 57[a,b]	11

Bmax (t) in pmol/g tissue, Bmax (p) in fmol/mg protein. [a], [b], [c]: $p < 0.05$.

DISCUSSION

Nasal hyperreactivity in nasal allergy may be due to changes in characteristics of adrenergic and/or muscarinic acetylcholine receptors (Mygind, 1982). No significant changes in affinities or densities of α_1- and α_2-adrenoceptors could be demonstrated in allergic patients in comparison with non-allergic patients and control individuals. As far as the α_1-adrenoceptors, these findings are in agreement with similar reactivity to α_1-agonists in allergic patients and non-allergic patients (Brooks et al., 1988).

The β-adrenoceptor density, expressed per mg protein, was not changed in allergic patients in comparison with non-allergic patients but was significantly

reduced in allergic patients in comparison with controls. These findings emphasize the importance of an accurate characterization of the patients. The decreased number of β-adrenoceptors may reflect a β-adrenergic abnormality in nasal allergy (Shelhamer et al., 1983). However, intranasal administration of terbutaline caused no changes in the nasal airway resistance in allergic patients in comparison with non-allergic patients (Svensson et al., 1980). Until now, the influence of β-adrenergic agonists on the nasal secretion in allergic patients in comparison with non-allergic patients has not been investigated. In the lower airways an infusion of terbutaline resulted in an increased mucociliary transport in asthmatic patients. The small shift in receptor density may reflect a possible β-adrenergic abnormality in nasal allergy but is probably too small to explain the complex allergic reaction.

The Kd-value and the density of muscarinic receptors were significantly decreased in allergic patients in comparison with non-allergic and control individuals. The increased sensitivity may reflect the cholinergic induced hypersecretion in nasal hyperreactivity. The decreased number of muscarinic receptors was somewhat surprising, since methacholine provocation resulted in a significant increased secretion in allergic patients. However, this decreased receptor number may reflect the hyperresponsiveness by an adaptation of the effector cells to overstimulation or by a decreased number of inhibitory presynaptic receptors. The small shifts in affinity and receptor density may reflect the cholinergic hyperreactivity in nasal allergy but are probably too small to explain the complex allergic reaction. A difference in sensitivity to methacholine of two glandular parts in the rat nasal mucosa has also been explained by small shifts in receptor density and in affinity (Klaassen et al., 1987).

A decreased number of α_1- as well as β-adrenoceptors and an increased number of muscarinic receptors have been reported in the nasal mucosa of allergic patients in comparison with chronic sinusitis patients (Ishibe et al., 1983; Konno et al., 1987). The discrepancy between both studies can possibly be explained by the use of chronic sinusitis patients as controls or by differences in the biopsy removal or in medication.

The autoradiographs demonstrated specific ^{3}H-l-QNB labelling of the glandular acini and specific ^{125}I-(-)-CYP labelling of the epithelium. From histochemical studies (Thaete et al., 1981) and the in vitro autoradiography it may be concluded that the (glyco)protein production by the acini is under parasympathetic control. It has been suggested that the β-adrenoceptors in airway epithelium play a role in the mucociliary transport, active ion transport or the production of epithelium derived factors (Welsh, 1987).

ACKNOWLEDGEMENT

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Differential diagnosis and management of cluster headache

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INTRODUCTION

Cluster headeache is a relatively uncommon headache disorder which can easily be recognized when it presents in its typical form (Wentges, 1985). The diagnosis, however, is often overlooked for which the main reason probably lies in the rarity of the disease. The prevalence has been estimated 0.4 per 1000 in a general population (Heyck, 1976). There are several distinctive qualitative and quantitative characteristics, that are quite constant from patient to patient. The quality of the pain is often described as throbbing and boring during the attack. The patient cannot lay still but usually walks about in agony, rubbing his face or even banging his head against the wall. The pain is almost always unilaterally situated around and behind the orbit. When at its maximum it is of excruciating intensity, reason why the headache is sometimes referred to as "suicide headache". In the interval between attacks there often remains a feeling of pressure and soreness on the symptomatic side. Autonomic phenomena usually accompany the pain and may consist of conjunctival injection, lacrimation, nasal congestion, rhinorrhoea, sweating, miosis and ptosis. Figure 1 shows a drawing made by a patient of an acute attack.

The main quantitative characteristic is the occurrence of a sequence of attacks within a limited period of time. Attacks usually last from 15 minutes to one hour, seldom exceeding two hours. They appear almost invariably during the night or early in the morning, often awakening the patient. A sequence of attacks is called a cluster period, during which they occur daily for a period of one week to several months. The disorder is called episodic when these periods are separated by remissions of at least two weeks, months or years and chronic when there are no attack-free intervals for one year or more. The mean age of onset is in the second or third decade but it may start at any age. Furthermore it is the only primary headache disorder with a male preponderance. The male-to-female ratios vary in different reports with a mean percentage of females of 16.5% (Sjaastad, 1986).

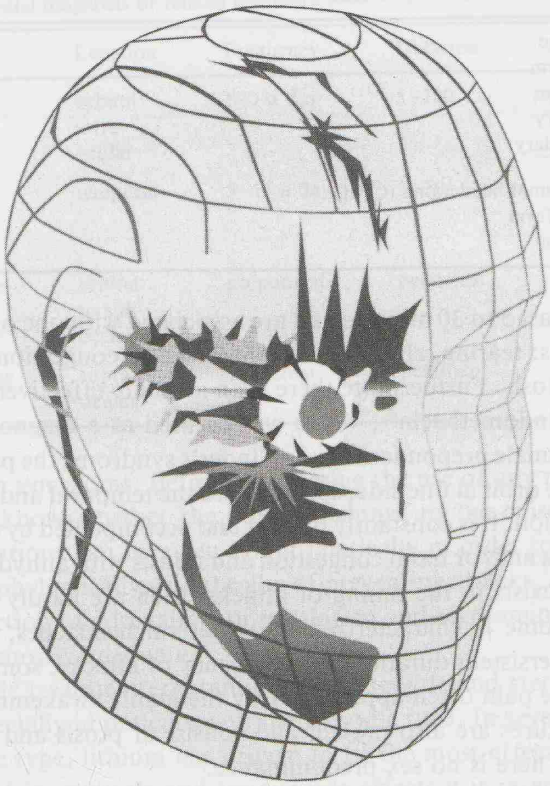

Figure 1. An acute attack. Drawing made by a patient.

CLASSIFICATION AND DIFFERENTIAL DIAGNOSIS

The typical set of symptoms has been described by several authors during the past 150 years. Before Kunkle named it cluster headache (Kunkle, 1952), numerous eponyms were attached to it, some of which retrospectively being synonyms and only of historical interest, but others representing related syndromes with a slightly different symptomatology. In the differential diagnosis of unilateral headache disorders only three conditions resemble cluster headache in a way that they can give rise to diagnostical problems. These are chronic paroxysmal hemicrania (CPH), neuralgia of the sphenopalatine ganglion (Sluder's syndrome) and Raeder's paratrigeminal syndrome. The first (CPH) is closely related to cluster headache and according to the latest diagnostic criteria for headache disorders set out by the ad hoc committee of the International Headache Society, cluster headache and CPH together from the cluster headache syndrome (Table 1).

The main features of CPH are: multiple attacks of unilateral pain, temporally

Table 1. The cluster headache syndrome.

1. Cluster headache
A. Episodic Form
B. Chronic Form
a. primary
b. secondary
2. Chronic paroxysmal hemicrania (CPH)
A. Pre-chronic form
B. Chronic form

localized, that last 5 to 30 minutes and are associated with one of the following autonomic signs: tearing, rhinorrhoea and/or nasal congestion, conjunctival injection and ptosis. Furthermore there is an absolute effectiveness of an adequate dose of Indomethacin®, which can be used as a diagnostic criterium. There exists a female preponderance. In Sluder's syndrome the pain is localized around or in the orbit at one side, spreading to the temporal and ultimately the suboccipital region. It is constantly present and accompanied by sneezing, tearing, rhinorrhoea and/or nasal congestion and miosis with anhydrosis. No consistent pattern exists in the timing of attacks. Men are hardly ever affected. Raeder's syndrome is characterized by unilateral headaches, supraocularly localized with persistent duration and frequency of attacks, sometimes lasting for months. The pain often appears during the night, awakening the patient. Autonomic features are also present and consist of ptosis and myosis at the involved side. There is no sex predominance.
The conditions described above are summarized in Table 2.

THEORIES ON PATHOGENESIS

Concerning the etiology of cluster headache there still exists controversy but it is now widely felt that dilatation of extracranial vessels is the cause of the syndrome (Kunkle and Anderson, 1961; Anthony and Lance, 1971). To a lesser degree the internal carotid artery and its branches are also involved, which could possibly be an explanation for the presence of the retro-orbital pain. The simultaneously occuring autonomic symptoms are thought to be a consequence of dysfunction of the ocular sympathetic nerves that are under pressure when the carotid artery is dilated within the relatively more rigid carotid sheath (Riley and Mayer, 1971). The vascular phenomena are according to some the result of neurogenic stimuli originating from the sphenopalatine ganglion (Meyer et al., 1970; Gardner et al., 1977), but others contribute the vasodilatation to the activity of 5-hydroxy-triptamine (= serotonine).

MANAGEMENT

Primarily the therapy is conservative but surgical procedures are also described

Table 2. Differential diagnosis of related disorders.

Name	Location	Frequency	Duration	Associated signs
Cluster headache	orbital intra-ocular	1–3 a day	5–180′	partial Horner rhinorrhoea nasal congestion
CPH	temporal	5–15 a day	5–30′	partial Horner rhinorrhoea nasal congestion
Sluder's syndrome	orbital to sub-occipital	no pattern	persistent	sneezing, tearing rhinorrhoea nasal congestion
Raeder's syndrome	supra ocular	persistent	persistent	partial Horner

to alleviate the symptoms. Before considering the use of any medications it is important to know whether the patient belongs to the episodic or chronic group. Medications can be given symptomatically in order to abort an acute attack, or prophylactically with the aim of preventing attacks. As symptomatic therapies injection of adrenaline, or inhalation and ergotamine are frequently used and are mostly adequate.

In prophylactic treatment ergotamine, methysergide and steroids are usually effective, especially in patients with the episodic type. In severe cases, mostly of the chronic type, lithium has proven to be the most effective agent so far but because of its multiple and serious side effects it is reserved for selected cases only.

A number of patients, however, either do not respond to the above described medications or are unable to tolerate them because of side effects. Constantly searching for new treatments, Professor Wentges contributed much to the care of the 160 patients with cluster headache that visit the Nijmegen E.N.T. Clinic regularly. He developed a keen interest in the various aspects of the disease and also initiated several trials in an effort to establish the best possible treatments for patients for which the current therapies were inadequate. Being an expert on the surgery of the pterygopalatine fossa, he performed a surgical procedure on six patients, that did not respond to the medications that were available. In this procedure the pterygopalatine fossa at the symptomatic side is opened and the ganglion excised.

The results after a follow-up period of 6–24 months showed that in two patients the attacks ceased, two others showed improvement of the symptoms and in the remaining two no improvement was detected. It was concluded that this procedure is worthwhile in patients in which all conservative treatment has failed (Wentges, 1973).

Table 3. Comparison of severity of symptoms of Flunarizin® versus placebo.

	Flunarizin®		placebo	
	start	16 wks	start	16 wks
absent	–	4	–	2
mild	–	–	–	2
moderate	2	2	–	1
severe	4	–	6	1

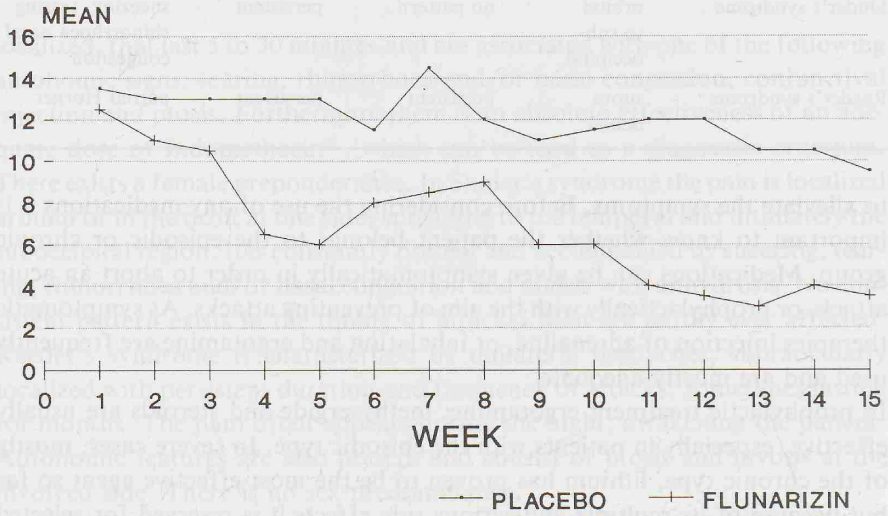

Figure 2. Number of attacks per week.

In another trial the efficacy of Flunarizin® as a prophylactic drug was investigated. This drug has anti-hypoxic properties with respect to the brain, being a selective calcium entry blocker and is successfully used in the treatment of common migraine (Manna et al., 1987). In the Nijmegen study a double-blind randomized trial was set up, in which six patients (all males) were given Flunarizin® and the other six (five males, one female) were given a placebo. All patients had more than two attacks per week and treatment with other prophylactic and/or symptomatic drugs was not interrupted. The efficacy of the treatment was established by measuring the severity of an attack and by counting the number of attacks per week. Table 3 and Figure 2 show the results. It was concluded that although the placebo response was high in all subjective parameters, the number of attacks per week decreased significantly more on Flunarizin®. Because of this promising preliminary result the use of this drug for cluster headache will be subject of further investigation.
Finally a pilot study was initiated in which a new drug was tested as a sympto-

matic treatment. The drug, GR 43175, a selective and novel 5 HT,-like agonist was shown in previous clinical trials to be very effective in acute migraine. In the Nijmegen study it was injected subcutaneously in six patients with a cluster headache attack, which was provoked by pretreatment with sublingual nitroglycerine. Clinically the results are very promising so far and further studies with this drug will be performed.

CONCLUSIONS

Although cluster headache is a disorder with a strikingly typical symptomatology, its pathogenesis is still poorly understood. During the past decades several treatments have evolved that are effective in both symptomatic and prophylactic management. Because there still remains a group of patients for which the current therapies are not adequate, the need for research concerning the etiology and alternative treatments still exists.

The retiring Professor Wentges of the Nijmegen E.N.T. Department will be greatly missed by his patients but we hope and expect he will remain active in the search for answers to the many questions posed by this intriguing headache disorder.

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Hypophysectomy: The rhinologist's vanishing art

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INTRODUCTION

Hypophysectomy utilising the external ethmoidal approach with a transseptal transsphenoidal route is a technique employed and perfected by the rhinologist. The transsphenoidal route was pioneered by the neurosurgeons before the First World War for space occupying pituitary tumours and then abandoned in the 1930's.

In the 1950's with the advent of the operating microscope, antibiotics, skilful anaesthesia and cortisone replacement therapy, the rhinologist contributed to the rediscovery of the transsphenoid route. The indications for surgery then were the ablation of a normal gland to utilise endocrine manipulation of hormone dependent malignant disease (especially breast). The ready availability of the E.N.T. surgeon and his already close association with the radiotherapist led to a resurgence of pituitary surgery. In the 1970's with the development of Tamoxifen® and aminoglutethimide together with the increasing use of cytotoxic chemotherapy and a critical appraisal of the surgical results there has been a virtual cessation of hypophysectomy for these diseases.

During this same period there has been a greater understanding of pituitary function with the ability to now measure levels of secretions of growth hormone and prolactin, and to classify by radioimmunoassay the secretory function of the pituitary cells. The discovery of so-called micro- and macroadenomata has led to a demand by endocrinologists for pituitary surgery. Although equipped and trained in this surgery, the E.N.T. surgeon appears in the main to have failed to fill the breach. The neurosurgeons rediscovered the sublabial transseptal approach and the reluctance of the rhinologist, with some exceptions, to deal with abnormal glands (some with suprasellar extension) and the growth of joint clinics between endocrinologists and neurosurgeons have paved the way for the neurosurgical development of a rhinological approach.

The neurosurgeons' transseptal route gives a more limited access and is technically more difficult with greater intranasal complications than the rhinologists' external ethmoid approach; however, the endocrinologists prefer a lack of a visible scar on the face to an invisible septal perforation or an atrophic rhinitis. The development of the drug bromocriptine and the increasing understanding of prolactinomas may lead to a further decline in pituitary surgery although space occupying lesions with suprasellar extension leading to optic involvement and/or raised intracranial pressure will always remain a neurosurgical indication.

The rhinologist's hypophysectomy may well become a vanishing art.

HISTORICAL BACKGROUND

Schloffer (1907) described the first transsphenoidal removal of a pituitary. The nose was split in the midline. Cushing (1909) described the sublabial transsphenoidal approach and between 1909 to 1935 performed 171 such operations. It was Chiari (1912) who first described the transethmoidal approach through an external ethmoid incision describing it and acknowledging it as a modification of "The Schlofferschen Operation".

A review of Cushing's cases showed a significant lower five year recurrence rate for transfrontal as compared to the transsphenoidal approach (13% versus 35%) and Cushing abandoned the approach as ineffective in dealing with suprasellar extension of tumours despite the mortality and morbidity being virtually identical. Up until 1938 the transsphenoidal approach was the method of choice for the management of pituitary tumours.

The indications for the operation during this early period of development were all for space-occupying pituitary tumours manifesting themselves by pressure effects such as headache, visual disturbance or endocrine deficiency. The tumours were large when diagnosed and were therefore referred to and treated by the neurosurgeon.

The introduction of cortisone, together with advances in and availability of antibiotics, the use of skilful anaesthesia and the introduction of the operating microscope led to a resurgence of interest in the operation during the 1950's. A Swedish neurosurgeon Olivocrona and his colleagues Luft and Sjögren, in 1952 described hypophysectomy for metastatic breast cancer utilising the transfrontal approach (Luft et al., 1952). The indications for surgery now included pituitary ablation in normal glands for the endocrine manipulation of diseases such as cancer of the breast and prostate, malignant melanoma, diabetic retinopathy, malignant hypertension and in abnormal glands for acromegaly and Cushing's disease.

Falconer (1963), a neurosurgeon stated "it is generally agreed that metastatic breast cancer remains its pre-eminent indications and it also has some possible,

although limited, value in the treatment of prostatic cancer, diabetic retinopathy, acromegaly and Cushing's syndrome''. Between 1954 to 1962 Falconer reviewed 119 cases of subfrontal hypophysectomy. There were three deaths within two weeks of operation and he was of the opinion that comparison of the transfrontal with the transnasal route showed a greater risk of chiasmal, optic nerve and tract injuries and extradural haemorrhage in the former but a lesser risk of rhinorrhoea, meningitis, polyuria and polydipsia.

In the United Kingdom, the E.N.T. surgeons under the influence of Bateman (1959), Macbeth (1961) and Angell-James (1967) pioneered the resurgence of transsphenoidal hypophysectomy. The major source of referral was the radiotherapist for ablation in palliation of metastatic breast cancer. The number of hypophysectomies performed by the E.N.T. surgeons in the United Kingdom in the 1960's and 1970's may be estimated at approximately 1000 cases per year. The development of the drugs Tamoxifen® and aminoglutethimide during the 1970's, the influence of the medical oncologist and his manipulation of the disease by cytotoxic chemotherapy, as well as a critical appraisal of the surgical results led to this source of referral declining to negligible numbers in the late 1970's and to virtually zero in the 1980's.

During the same period of 20 years of rhinological ascent and descent (1960–1980) there emerged a new era in the endocrinological understanding of the pituitary gland with radioimmunoassay permitting the measurement of minute quantities of hormone in blood and tissue. By means of immunocytologic techniques and electron microscopy, the cellular composition of an adenoma and its derivation could now be established. At the same time, the development of CT scanning (and later MRI) made the radiological assessment of the tumour far more precise without the need for invasion (angiography and air studies). Neurosurgeons throughout the world re-established themselves under the leadership of Jules Hardy (1969) who reintroduced Cushing's transseptal sublabial transsphenoidal route. It was Dott (1963) in Edinburgh during the 1920's–1950's (influenced by Cushing), later Guiot (1958) (influenced by Dott) and then Hardy (influenced by Guiot) who directly continued Cushing's original procedure.

THE PITUITARY

This minute structure possesses manifold functions; and is recognised as the Captain of the Endocrine National Team. The gland consists of two lobes, anterior and posterior. The posterior lobe (neurohypophysis) is rarely the site of primary disease and is not removed selectively. It consists of glial cells, nerve fibres and nerve endings which secrete the hormones vasopressin and oxytocin. The anterior lobe (adenohypophysis) consists of five distinct cell types producing at least six hormones.

The old classification of basophilic, acidophilic and chromophobic has been replaced by a nomenclature based on immunocytology, electron microscopy and functional correlations. Growth hormone and prolactin cells are essentially acidophilic. Corticotroph, thyrotroph and gonadotroph cells are essentially basophilic. Classifications based on staining affinities of cell cytoplasm has limited value for they fail to take into account structure-function relationships and provide no information on the biological behaviour of any tumour.
Pituitary disease manifests itself as either an overproduction of hormones, an insufficient production of hormones or by local affects of a growing mass.
Overproduction may be due to a hormone-secreting tumour or to hyperactive non-neoplastic adenohypophyseal cells. The diseases resulting may be acromegaly (overproduction of growth hormone), amenorrhoea-galactorrhoea (overproduction of prolactin) or Cushing's disease (increased ACTH). These are the three most frequently occurring; an increase of TSH, FSH and LH being very rare.
Insufficient production of hormones leads to hypopituitarism. The pituitary has a substantial reserve capacity and remarkably little adenohypophyseal tissue is required to maintain an endocrine equilibrium. The local effects by a growing mass compromises the optic nerve, tract and chiasm and/or hypothalamus leading to headaches, raised intracranial pressure and visual defects.

PITUITARY ADENOMAS (THE ABNORMAL PITUITARY)

Adenomas comprise 10% of all intracranial neoplasms. They are commonly occurring benign epithelial neoplasms arising from and consisting of adenohypophyseal cells. Increasingly sophisticated diagnostic methods (both chemical and radiological) and the development of transsphenoidal surgery permits the localisation and selective removal of adenomas with increasing frequency (adenomectomy).
The concept of micro- and macroadenomas was introduced by Hardy and is based on tumour size (less than 1 cm: microadenoma, greater than 1 cm: macroadenoma). Pituitary adenomas are generally demarcated, although not usually surrounded by a fibrous capsule. Microadenomas do not invade neighbouring tissues. If the lesion is very small a diagnosis of nodular hyperplasia is possible, the proliferative cell being intermingled with other cell types. The size of the focal lesion can only be assessed when several sections are examined. The immunoperoxidase technique of radioimmunoassay shows which hormone is stored in the adenoma cells.
The relative incidence of diagnosis of pituitary tumours has increased due to radioimmunoassay, radiological and surgical techniques. Most are in the confines of the sella turcica (only 10–20% lead to compression of the optic chiasm). The substantial majority is benign but very occasionally may be

aggressive leading to distant metastases. Grossly they are solid although soft and vary in colour from grey to red (depending on their vascularity) whereas the normal pituitary is yellow.

SURGICAL INDICATIONS FOR HYPOPHYSECTOMY

These have varied over the years. The original indications were for those symptoms produced by a growing mass and later for the hormonal manipulation of metastatic breast cancer, whereas now the major indication is in the management of pituitary adenomas when the clinical effects of pathological hypersecretion draw attention to the pituitary fossa while the tumour is relatively small. The mass effects have always been, and will always remain, a major source for neurosurgical intervention.

Therapeutic approaches vary in different clinics and in different countries. All forms of active treatment are potentially hazardous. It is often decided on the basis of the types of treatment and expertise available in any particular centre or country (Nabarro, 1980).

a. Normal pituitary

The rhinological interest in pituitary surgery developed in the late 1950's and continued through to the end of the 1970's. Major hormonal ablation, such as oophorectomy and adrenalectomy, was performed increasingly for palliation in metastatic breast cancer. Hypophysectomy was the obvious sequelae to initially impressive results. The ready availability of E.N.T. surgeons in every hospital, their expertise with the microscope and their familiarity with the anatomy made them the obvious referral source by their radiotherapy and general surgical colleagues. Lack of successful therapy for diabetic retinopathy, arterial hypertension, malignant melanoma, malignant exophthalmos stretched the indications for referral. The E.N.T. surgeon acted initially as a technician until the consensus of informed opinion and the development of other treatment modalities demonstrated that the operation was not efficacious in some of the more bizarre indications. In carefully selected patients with metastatic breast cancer – such as those postmenopausal patients with painful bone secondaries, a previous response to hormone manipulation and a long period between diagnosis and the development of metastases; hypophysectomy may still have a place. However, with the synthesis of Tamoxifen®, an anti-oestrogen, in 1966 and its evaluation in the treatment of breast cancer in the early 1970's together with aminoglutethimide, an inhibitor of oestrogen synthesis, in the late 1970's, plus the increasing role of cytotoxic chemotherapy – there has been a virtual cessation of referrals for hypophysectomy.

b. The abnormal pituitary

The experience obtained by the rhinologist in the 1960's and 1970's when

pituitary ablation was widely practiced, gave to the E.N.T. surgeon the skill and expertise to deal with endocrine disorders due to pituitary tumours. Williams (1975) in London and Richards (1979) in Cardiff have made a significant contribution to the management of pituitary disease. The neurosurgeons were experienced in the transfrontal approach to the pituitary but it was Hardy who reintroduced his colleagues to the work of Cushing and developed the neurosurgical transsphenoidal route by the sublabial transseptal approach.

In 1972, human prolactin was isolated. It was found that 20% of women investigated for secondary amenorrhoea had hyperprolactinaemia. Many were found to have a small pituitary adenomas which could be readily resected. This led to a demand for more pituitary surgery, but at the same time it was found that these small tumours were influenced by a dopamine-like drug, bromocriptine; dopamine probably being the natural hypothalamic prolactin release-inhibiting factor. Treatment with bromocriptine restored normal menstruation and enabled many women with prolactinomas to become pregnant. It is not certain and it is still debatable as to how many operations for prolactinomas are and were really necessary.

The sublabial transseptal route appealed to the endocrinologists. In simplistic terms there was no shaving of heads, or visible external scar. The transethmoidal rhinological route left a scar (although ultimately unnoticeable) and a black eye whereas the transseptal neurosurgical route resulted in nasal obstruction, crusting, septal perforation and atrophic rhinitis and was noticed only by the patient and not by the referring endocrinologist or neurosurgeon.

The E.N.T. surgeon required the neurosurgeon's co-operation for patients with suprasellar extension and for dealing with any operative or post-operative catastrophes. In certain centres co-operation exists. In some centres E.N.T. surgeons make the external ethmoidal approach, expose the pituitary bulge and the neurosurgeon performs the ablation or adenoma removal. Such co-operation has become less as the neurosurgeon has developed his transseptal technique.

RESULTS OF SURGERY

In practiced hands the mortality of the procedure can be practically zero. Nabarro (1980) reports one death from a pulmonary embolism six weeks after leaving hospital in 173 of Williams' cases. The morbidity is low (CSF leak, meningitis, diabetes insipidus) and readily treated.

In selected cases of breast cancer the remission rate for six months is in the order of 30–40% (now irrelevant with other modalities of treatment available). According to Serri (1985) in acromegalics the overall cure rate is 68% (88% for patients with microadenomas and 59% for macroadenomas) which is lower than that reported for women with prolactinomas (Serri, 1983).

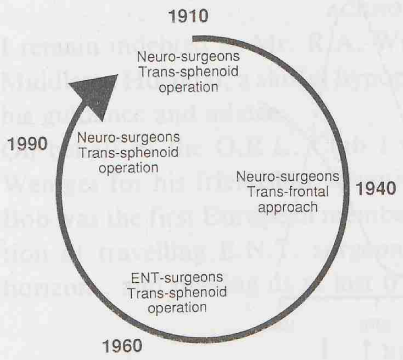

Figure 1. The evolution of pituitary surgery.

CHANGING PATTERNS

The evolution of pituitary surgery has indeed been a revolution; a turning of the full circle (Figure 1). The circle starts in 1911 with neurosurgeons performing the transsphenoid operation; this ceases in the 1930's as the transfrontal approach finds favour and in the 1960's the transsphenoidal approach is rediscovered and reappraised by the rhinologist; the indications now being entirely different. In the 1970's the neurosurgeons re-embrace the nasal approach and we approach the 1990's with the sphenoid approach dominating the craniotomy approach by a ratio of 5:1. The reasons for this full circle are due to changes in presentation of the disease, changes in the source of referral, changes in the indication for the operation, advances in immunochemistry and radiology, and a critical appraisal of the alternative forms of management.

It is obvious why the rhinologist should have been the pioneer in transnasal pituitary surgery in the 1960's (Figure 2). The discovery of cortisone and the ability to control infection with antibiotics made surgery of the pituitary safer. The rhinologist's expertise with the operating microscope (as yet not utilised by other surgical specialities) and his intimate anatomical knowledge of the ethmoids and sphenoid made his domination inevitable. These reasons, together with a referral source by the radiotherapists and general surgeons of desperate patients with breast cancer especially, led to a rapid expansive growth of this surgery. The ready availability of E.N.T. surgeons and the relative simplicity of the operation with minimal mortality and morbidity led to upward of 1000 referrals per year in the United Kingdom during the 1960's. The later introduction of Tamoxifen®, aminoglutethamide and chemotherapy led to a reappraisal and limited referrals. The development of radioimmunoassay with the increasing awareness of prolactinomas, the role of CT and MRI scanning and the rediscovery of Cushing's original transsphenoidal approach by the neurosurgeon accounts for the changing pattern of neurosurgical hypophysectomy (Figure 3). Centres specialising in pituitary disease with their histological expertise with electron microscopy and with their traditional refer-

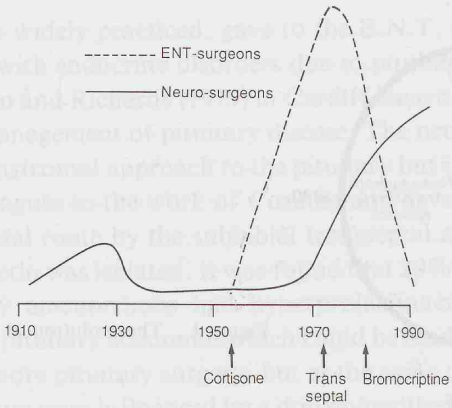

Figure 2. The increasing of the transseptal pituitary surgery.

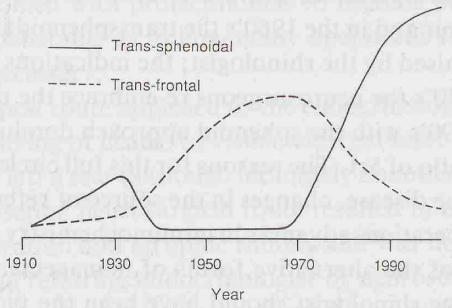

Figure 3. Changing pattern of neurosurgical hypophysectomy.

ral pattern has led to a neurosurgical resurgence and rebirth. Numerous joint publications with the neurosurgeons have in themselves generated referrals. In the United Kingdom the neurosurgeons now dominate as in the U.S.A., Canada, New Zealand and Australia. The wheel has turned a full circle.

CONCLUSIONS

The contribution by the E.N.T. surgeon to hypophysectomy must be acknowledged. The E.N.T. surgeon has made similar contributions to broncho-oesophagology now dominated by the thoracic surgeons and gastroenterologists. The transethmoid approach, not utilised by the neurosurgeons is still the best and shortest approach to the pituitary gland. The transethmoid scar is rarely visible, the nasal polyposis of acromegaly can be dealt with as part of the surgery and the intranasal complications of septal perforation, crusting and adhesions from the transseptal route do not occur.

The rhinological contribution to hypophysectomy must not pass unnoticed. This is not intended as a requiem but as a tribute to a vanishing art.

ACKNOWLEDGEMENTS

I remain indebted to Mr. R.A. Williams, Consultant E.N.T. surgeon to the Middlesex Hospital, a skilful hypophysectomist, for his teaching, his stimulus, his guidance and advice.

On behalf of the O.R.L. Club I wish to record our gratitude to Professor Wentges for his friendship, devotion, contribution, humour and hard work. Bob was the first European member of this peculiarly eccentric British institution of travelling E.N.T. surgeons; a unique achievement, broadening our horizons, and making us at last true Europeans.

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Visual loss following intranasal injection

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Total or partial visual loss following intranasal operations are disastrous incidents. It is comprehensible that in most of these cases the patient feels as a victim of malpractice and sues the surgeon. The causality between surgery and visual disturbance has to be discussed especially in those cases, where a direct injury to the orbital wall and its contents is not detected.
A medical expertise in a tragic case provides opportunity to draw attention to this rare complication. The pathomechanisms for blindness following intranasal surgery and concomitant procedures are presented and rules for prevention are to be discussed.

CASE REPORT

A 30 year old male patient, suffering from asthmatic disease, was submitted for nasal septal and inferior turbinate surgery. After an injury in childhood he was blind on his right eye. Surgery was performed under general anaesthesia with additional injection of 20 cc of local anaesthetics combined with a vasoconstrictor. The mixture consisted of 30 cc Lidocain® 0,5% and 0,5 cc (2,5 I.U.) Ornipressin (POR 8®) and was injected into the septal mucosa exclusively.
Surgery and immediate postoperative course were uneventful. But four hours later the patient complained of visual loss, he was only able to differ light from dark on his last seeing eye. Systemic steroids were applied and an ophthalmologist consulted. The diagnosis of a total occlusion of the central retinal artery with the typical findings during funduscopy was established. No clinical signs referred to a direct injury of the orbit; this was later confirmed by CT. There was no restitution of visual function after immediate thrombolytic therapy. Because of the arterial occlusion on his last seeing eye the young patient turned out to be definitely blind.

In order to judge the causality of blindness following intranasal surgery or injection, different pathways for damages have to be discussed. They can be attributed to two different pathomechanisms (Figure 1).

1. Direct or indirect traumatic injury to the optic nerve by surgical instruments, bone fragments or compression within the canal, due to increased intraorbital pressure from ruptured vessels (Berendes, 1963).

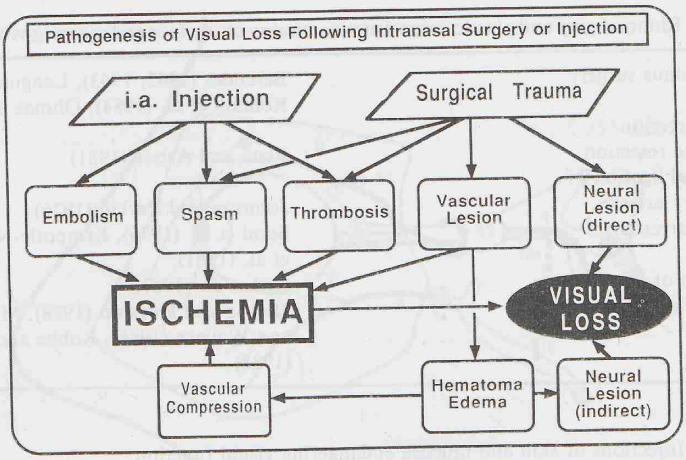

Figure 1. Pathogenesis of visual loss following intranasal surgery or injection.

2. Direct or indirect damage to the intraorbital vascular system by vessel injury or compression and occlusion of the arterial system by spasm, embolism or thrombosis (Berendes, 1963; Hommer and Bettelheim, 1978).

There is a variety of different surgical interventions that can cause visual disturbances (Table 1). Most of them are related to direct injury to the orbital content during manipulations nearby. Compared to these cases septal and turbinate surgery without intraoperative complications is not immediately endangering visual damages. In the literature there is only one report with a direct injury during fracturing the inferior turbinate. Two additional cases were referred to intra-arterial injection of local anaesthetics (Plate and Asboe, 1981).

There are many reports on visual complications following injections of different substances into the mucosa and soft tissues of the face (Table 2). Independent of the effects of the injected material the prerequisite is a connection between the side of injection and the ophthalmic artery. Three different ways can be discussed:

1. The substance reaches the ophthalmic artery via the venous system

This possibility can be neglected because a corpuscular substance is filtered by the peripheral or pulmonary capillary system. Liquid substances on the other hand will be diluted significantly and would be expected to induce a systemic damage or at least a statistical distribution. In our literature, all reports describe an ipsilateral visual loss after unilateral injection.

Table 1. Rhinosurgery and plastic reconstructive surgery of the face endangering visual function.

Ethmoid sinus surgery	Berendes (1962, 1963), Langnickel (1978), Romani et al. (1984), Ohmae et al. (1986)
Septal correction/ turbinate resection	Plate and Asboe (1981)
Transantral ligation of maxillary artery	Johnson and Parkin (1976)
Vidian neurectomy	Sood et al. (1976), Krmpotic-Nemanic et al. (1981).
Reposition of jaw fracture	Ord et al. (1981)
Blepharoplasty	Heinze and Hueston (1978), Mahaffey and Wallace (1986), Robbe and Coenen (1988)

Table 2. Injections of skin and mucosa endangering visual function.

A. SUBSTANCES	
Steroids	Bahr (1963), Hommer and Bettelheim (1978), Byers (1979), Evans et al. (1980), Kröner (1981), Mabry (1981)
Steroids and adrenalin	McGrew et al. (1978), Baker (1979)
Thrombogenic agents	Hommer and Bettelheim (1978), Breuninger (1983), Uffenorde and Georgi (1983)
Paraffine	Bahr (1963), Kröner (1981)
Thorotrast	Breuninger (1983)
Ozon	Breuninger (1983)
Local anaesthetics and adrenalin	Heermann (1980), Plate and Asboe (1981), Cheney and Blair (1987), Fischer et al. (1987)
Collagen	Personal report
Fat	Teimourian (1988)
B. SITE OF INJECTION	
Skin of the face and head	Bahr (1963), Hommer and Bettelheim (1978), Kröner (1981), Fischer et al. (1987)
Turbinate	Baker (1979), Byers (1979), Evans et al. (1980), Mabry (1981), Breuninger (1983)
Nasal septum	Breuninger (1983), Uffenorde and Georgi (1983)
Ethmoid sinus	Heermann (1980)

2. After intra-arterial injection into vessels of the external carotid artery system the internal carotid artery is reached via vessel anomalies

The ophthalmic artery can descend from the middle meningeal artery (external carotid artery system) (Figure 2). This condition is not rare and sometimes responsible for blindness following Vidian neurectomy (Krmpotic-Nemanic et al., 1981).

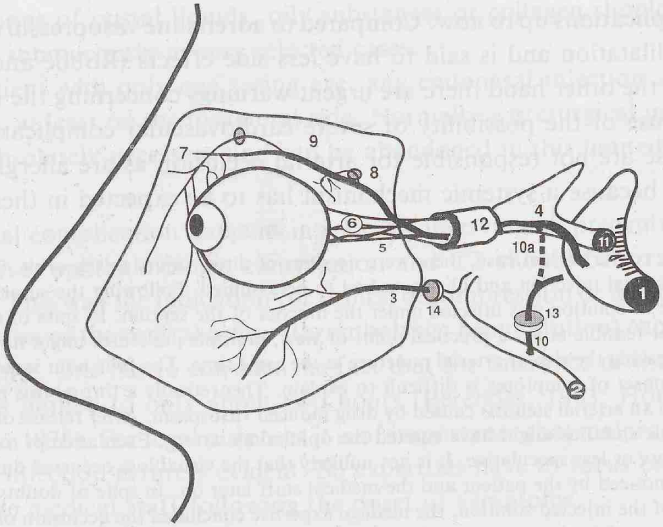

Figure 2. Arterial interconnections ("bridging arteries") between nasal septum and ophthalmic artery.

1. Internal carotid artery
2. Maxillary artery
3. Sphenopalatine artery
4. Opthalmic artery
5. Central retinal artery
6. Ciliary arteries
7. Supratrochlear artery
8. Posterior ethmoidal artery
9. Anterior ethmoidal artery
10. Middle meningeal artery
10a. Anomal descend of 4 from 10
11. Optic nerve
12. Optic canal
13. Spinous foramen
14. Sphenopalatine foramen

3. The substance reaches the ophthalmic artery via regular connections between the internal and external carotid artery system

Such "bridging arteries" are the supratrochlear, frontal and nasal dorsal arteries (within the facial skin) as well as the anterior, posterior and additional ethmoidal artery (within the nasal mucosa).

The routes presume a reversion of the flow-direction induced by the injection pressure after imperceived arterial puncture. The direction of flow depends on only small pressure gradients that are easily modified by intra-arterial injections. As the resistance is higher from the capillary system the flow is directed to the anastomoses with the "bridging arteries" even with low injection pressures and small volumes (Hommer and Bettelheim, 1978).
After invasion of the ophthalmic artery the substance can evoke thrombosis, embolism or vasospasm. Spasm of the central artery by adrenaline is proven, even through animal experiments (McGrew et al., 1978; Heerman, 1980; Plate and Asboe, 1981). There were no reports on vasopressin (POR 8®) concerning

these complications up to now. Compared to adrenaline vasopressin causes less rebound dilatation and is said to have less side effects (Robbe and Coenen, 1988). On the other hand there are urgent warnings concerning the use of this drug because of the possibility of severe cardiovascular complications. Certainly those are not responsible for arterial occlusion as are allergic or toxic reactions, because a systemic mechanism has to be expected in these cases.

Coming back to the present case, there were no signs of direct injury to the orbit. So a relation between intranasal injection and blindness had to be assumed. Following the surgical report, a total of 20 cc of solution was injected under the mucosa of the septum. In spite of the fact that this seems not feasible under a practical point of view, multiple punctures might have been performed, increasing the risk of arterial puncture at the same time. The four hour interval between surgery and onset of symptoms is difficult to explain. Theoretically a thrombosis may develop proximally to an arterial stenosis caused by drug induced vasospasm. After release of the spasm, the thrombotic embolus might have entered the ophthalmic artery. Each attempt to explain the interval is more or less speculative. It is not unlikely that the visual loss occurred during surgery and was not noticed by the patient and the medical staff later on. In spite of doubts concerning the amount of the injected solution, the medical expertise concluded the occlusion of the central retinal artery as a fate that was not influenced by the pressure and the injected substance alone. A malpractice by the surgeon was denied.

CONCLUSIONS

Blindness following intraseptal injections is extremely rare. Local anaesthetics with vasoconstrictors prior to septal surgery are routinely used even under general anaesthesia. We experienced no case of visual loss from this procedure among more than 25.000 operations during the last 10 years. Independent of the extraordinary scarcety some precautions should be considered.

GENERAL RULES FOR INTRANASAL INJECTIONS

1. The amount of 5 cc, max 10 cc of solution should not be exceeded. The injection should be restricted to regions of planned incisions, multiple punctures and infiltration of wider areas should be avoided. The dissection of the perichondrium layer from the septal cartilage by infiltration is not possible as is supposed very often. One has to be conscious that a negative blood aspiration (in the syringe) after puncture of the mucosa does not exclude an intra-arterial position of the needle tip, as the small artery may collapse (Meythaler and Naumann, 1987).
2. Because of the vascularity, injections into the turbinates should be avoided. Complications may also occur even when solutions are used that do not induce thrombosis or vasoconstriction. It is very likely that in most of these cases, small air bubbles are the only reason for occlusion (Meythaler and Naumann, 1987). During funduscopy they are invisible and therefore not described in the literature. The total freeing of the contents of the syringe from air must be stressed particularly.

3. Suspensions of cristal liquids, oily substances or collagen should only be injected submucously in very selected cases.
4. In a patient with only one seeing eye, any endonasal injection should be avoided, at least on the ipsilateral side. Normally a presurgical infiltration is not absolutely necessary and can be abandoned in this limited group.

If an orbital complication happens in spite of observing all precautions mentioned above, ophthalmologic consultation and CT should be arranged immediately. This way the indication for orbital decompression or an attempt for recanalization of the central artery (thrombolysis, hemodilution) can be established in time. One has to consider the fact that the tolerance of the retina to ischemia is limited to only about two hours (Berendes, 1963; Hommer and Bettelheim, 1978). For legal purposes it is of importance that malpractice from intranasal injection is rarely evident. So expertises have to focus on the reactions of the medical staff following the onset of symptoms.

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Mishaps in rhinoplasty

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Mishaps are, of course, to be avoided in every type of surgery. In rhinoplasty however, mishaps, although not life-threatening as a rule, could not be more obvious. A minimal nasal tip deformity is apparent – even if minimal, and almost grotesque if more gross. A nasal deformity is almost impossible to disguise or camouflage. Surgical mishaps in tympanoplasty may, in many instances, require an experienced otologist to detect: the hospital hall porter has no difficulty in detecting at a glance if a rhinoplasty has gone amiss.
Although faulty rhinoplasty technique is the most obvious cause of surgical mishap, it is the faulty application of the technique and wrong assessment of the patient that often underlies mishap.

With rhinoplasty it is extremely important to understand the patient's wishes. Many people who have undergone a technically satisfactory rhinoplasty remain completely disenchanted with the nose that they have been given, for it is not the one they had in mind. Excellent pre-operative photographs and careful discussion of the changes that are possible are therefore an essential prerequisite of rhinoplasty. Computerised studies of the face are a recent technological advance now available to all rhinoplasty surgeons. Whether in fact this is of benefit to patients and surgeons remains arguable. A basic sound technique of rhinoplasty is essential. It is, however, also essential to know the type of nose that is required for a specific patient and the application of the technique for the specific nasal deformity. It is almost impossible to carry out even the simplest rhinoplasty on "automatic pilot": every nose is different. A rhinoplasty that may appear very simple can often trap the most experienced rhinoplasty surgeon during the operation with some unexpected problem.
The correct rhinoplasty technique must also not be overdone or underdone: it is better to veer on the side of 'undergoing' the operation. These cases are easier to revise. Invariably a rhinoplasty that has been overdone, i.e. that in which an excess of tissue has been removed, requires grafts. It is well-known that grafts may give problems with subsequent change in shape or position, sometimes related to fibrosis and healing.

Figure 1. An excessive rhinoplasty in which too much nasal hump has been removed with a gross removal of the caudal angle of the septum. This small "nose" and pug appearance should not be seen today and is the result of excessive steps taken in a standard procedure.

Figure 2. With thin skin, particularly in the elderly where the skin tends to tether, great care must be taken to achieve "smooth" edges to the nasal bones and upper lateral cartilages, and gross changes should not be made in the elderly. In this patient the imperfections have been concealed with subsequent conchal cartilage grafts.

Figure 3. Skin tethering after rhinoplasty settles in the younger patient but in the older patient, particularly if a sequence of ill-advised revisions have been carried out within 9–12 months, the tethering of the skin may become permanent.

In the past, many of the surgical errors were related to excess work on the nasal bones and cartilages. The time-honoured nasal deformities of ski-lope, polly-beak and pug-nose, all relate to these. Today more refined tip techniques – particularly if wrongly applied or done to excess, give rise to more complicated and even more obvious nasal tip deformities. Twisting, asymmetry or abnormal pointing of the nose are all nasal tip deformities that may be seen today. The most important pre-operative rhinoplasty analysis of the tip involves assessment of the skin. This skin is particularly demanding for rhinoplasty technique. Any small fault or sharp edge or asymmetric removal of cartilage may well be obvious. The 'strength' or 'spring' of the cartilage is the other important factor to assess pre-operatively with tip rhinoplasty.

Some examples of the mishaps that may arise are shown in the Figures 1–3.

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Endonasal surgery

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Principles of sinus surgery have evolved over 2000 years and especially over the last century.

The origins of sinus surgery must be sought in the technique of trephination as practised by prehistoric man. Pre- and post-mortem trephination was common among the old tribes and had both a ritual and practical significance. In some cases releasing the evil spirits from the head had the therapeutic effect of draining the pus of an intracranial abscess.

An inca skull, dating back to the period of 1400 AD shows evidence of a frontal sinus trephination with subsequent new bone formation around the edges of the defect. In this case it included a curettage of the supraorbital foramen.

Until the 16th century it was believed that the mucus was secreted by the pituitary gland in the brain and excreted into the nose via the cribiform plate, collected in the sinuses and subsequently released into the nose. Later Fallopius demonstrated that the sinuses contained air rather than mucus and Schneider put an end to the idea that the nasal mucus originated in the pituitary gland: he showed that the olfactory processes were cranial nerves. In 1651 Highmore described a case of suppurative maxillary sinusitis in relation with carious teeth in the upper jaw and trephination of the antrum, either externally or through the socket of an infected tooth was apparently introduced by Zwingler and Meibomius. Antral trephination for suppuration remained the most common sinus operation during the 17th and 18th century.

In chronic suppuration the antrum was opened through the alveolar ridges; if no infected tooth was present, a healthy one was extracted, usually the first or second molar, to create a permanent oroantral fistula via which daily irrigations were done. When the anterior wall of the antrum was opened through the canine fossa, this was also kept open and irrigated daily until in 1893, Caldwell proposed curettage of the infected mucosa followed by closure of the canine fossa incision and an intranasal antrostomy – today's Caldwell-Luc operations.

At the end of the 17th century the first surgical removal of a sinus tumour was done in Paris followed by a total maxillectomy in Edinburgh in 1826.

In 1891 Frankel frose cadaver heads in a bucket with water and sectioned the resulting ice block with a carpenter's saw. This resulting atlas of cross sectional anatomy rivals modern radiologic depictions. The true foundation of modern sinus surgery was laid down during these years. Every sinus was trephined, and frontal, ethmoid and maxillary sinuses were curetted intranasally and also via external incisions.
External surgery of the frontal sinus was carried out both preserving the anterior table and sacrificing it. Where the anterior table was sacrificed, the resulting deformity was corrected by injecting wax.
Billroth's pupil Czerny was the first to propose the frontal sinus osteoplastic flap to prevent such defects. The contents of sinuses could only be visualized by transillumination until Roentgen's discovery of the X-ray.
Final phases of sinus surgery are procedures carried out through a healthy sinus to gain access to deeper structures for instance to perform a transantral decompression of the orbit or to gain a transantral approach to the pterygomaxillary spaces or to perform a transsphenoidal hypophysectomy.

The era of endoscopy probably started with the urethroscope of Desormaux in 1853.
In 1879 Nitze developed a cystoscope with distal electric illumination with a water cooled system and Hirschmann used this cystoscope in 1901 for visualisation of the middle meatus in the nose. In 1925 Maltz coined the term sinuscopy and soon this was done through the inferior meatus or the canine fossa. Although many reports of the advantages of sinuscopy continued to appear, it was not until in the seventies of this century that this technique was generally accepted and a bible about this subject was published by Messerklinger.
Messerklinger studied mucociliary clearance of the sinuses utilizing endoscopy in patients and in fresh autopsy specimens.
He described the special pathways of the mucociliary clearance to their natural ostia and showed that this remained unchanged if an artificial ostium, for example, an inferior antrostomy was made. So if an inferior antrostomy was made, the mucociliary clearance was still taking place through its natural ostium.
This inferior antrostomy functions only as drainage-window when it overflows, but normally it works as a ventilation window and that is also the explanation of its success.
Messerklinger identified a special pathway of mucociliary clearance in the frontal sinus. The medial wall of the nasofrontal duct showed a mucus flow from the frontal recess up into the frontal sinus, whereas the lateral wall of the nasal frontal duct showed the mucus flow downwards. These pathways explain the ascending infection from the ethmoid into the frontal sinus. Messerklinger

noted that wherever two mucosal layers come into contact, localised disruption of mucociliary clearance occurs, causing retention of secretions in the area of contact, with increased danger for infection even in the absence of ostial closure.
Anatomically, areas of mucosal contact are most likely to occur in the narrow mucosal-lined channels of the middle meatus and ethmoid air cell systems.
The frontal sinus drains via the frontal recess into the middle meatus and the maxillary sinus drains via the infundibulum into the middle meatus. Both the frontal recess and the infundibulum ethmoidale are called prechambers by Stammberger. They form a system of fissures and clefts in the middle meatus, all of which are part of the anterior ethmoid. So all the problems are likely to occur in this area, not in the least because of the fact that the anterior part of the ethmoid is situated near the head of the middle turbinate and these areas bear the brunt of inspiratory airflow. As we all know the anterior part of the middle turbinate is the primary site for adenocarcinoma in woodworkers and it is reasonable to believe that given the pattern of airflow in the nasal cavity this area is also the primary site for the deposition of inflammatory diseases in the nose and paranasal sinuses.

Finally surgical experience learns that during surgical intervention the anterior ethmoïd cells are diseased whereas the posterior cells are often free of disease.
In the twenties Hajeck and Zuckerkandl were already convinced about the role the middle meatus played in the pathogenesis of frontal and maxillary sinusitis and Naumann described this area therefore as the "osteomeatal unit".
Messerklinger, Wigand and Draf demonstrated that even severe mucosal disease in the maxillary and frontal sinuses, which in the past was considered irreversible, will heal when ethmoid disease is eradicated and normal ventilation and mucociliary clearance is restored.
One should make an ostium for ventilation and drainage in cases of chronic sinusitis, but the question was where one should make that ostium and what its size should be.
The formation of a window in the inferior meatus for chronic maxillary disease will be succesful in cases where very little disease in the osteomeatal complex is present. This disease will recover just by good ventilation. However, the symptoms of the maxillary sinusitis remain very often after such an inferior antrostomy or Caldwell-Luc procedure. The reason is that the pathology in the osteomeatal complex is still present and this pathology blocks the drainage of the sinus. Therefore, one should make a window in its physiological place in the middle meatus thereby ensuring ventilation and drainage.
In practice this means that an inferior antrostomy as advocated by Buiter, can be done in cases with very little disease, where there is a history of recurrent sinusitis with intervals without complaints.

When a Caldwell-Luc procedure is done, one should also make a middle meatus antrostomy. Thus a Luc de Lima operation is performed in which a transantral ethmoidectomy is carried out.
Much more comfortable for the patient is an endonasal operation via which all ostia of the sinuses can be opened and enlarged without having the disadvantages of the other operations like in the inferior antrostomy where the elevation of the inferior turbinate can block the infundibulum because of luxation of the uncinate process or hyposensibility of the teeth and in the Caldwell Luc the dental damage and the lesion of the infraorbital nerve.
The advantage of the endoscopy of the nose is the ability to diagnose even relatively small changes in the osteomeatal complex that interfere with mucociliary clearance of the frontal and maxillary sinuses.
This area of the anterior ethmoid cells is poorly visualized on the routine sinus X-rays. The sinus X-ray shows the opacification of maxillary sinus, but it is of much more interest to know the reason of this opacification.
The nasal endoscopy gives a good view of the nasal cavity and especially the middle meatus where most of the pathology causing a sinusitis can be found. Not only pathology can be seen with the endoscope, but also all kinds of anatomic variations, like an extensively pneumatized agger nasi cell, a so-called "paradoxically bent" middle turbinate, a concha bullosa, an uncinate process that turns medially and a large bulla ethmoidalis, all of which produce narrowing of the middle meatus with all the consequences.

Computed tomography is used to reveal mucosal changes deeper in the osteomeatal complex that are not visible endoscopically. At the same time the CT scan gives information about the skull-base, the orbit, and the sphenoid sinus with the carotids as well as the extension of the disease.
With the help of nasal endoscopy and the CT scan we are able to identify the etiology (pathology) in patients with minor complaints, where we could not find any disease or the reason for complaints in the past.
Functional endoscopic endonasal surgery will free the diseased area of its pathology, it will stop where healthy mucosal lining begins and in general the mucosal lining will be preserved.

In the last one and a half year, about 150 patients were operated in this University Hospital using the endoscopic endonasal technique. For an academic hospital it was a normal patients population, that means a majority of patients with recurrent diseases like extensive nasal polyposis and a minority of primary cases, patients with no history of operations before.
From our own experience but also from the experience of others the conclusion is drawn that endoscopic endonasal surgery is at least as good as the "conven-

tional'' techniques of nasal and paranasal surgery. In skilled hands it takes less time to operate, the complications are less, no incisions are made, however, the after-care takes more time. Last but not least it is more convenient for the patient and it can be done under local anaesthesia on an out-patient basis.
Indications for this type of surgery are chronic and recurrent sinusitis, acute frontal sinusitis, mucoceles of the frontal or ethmoid cell system, CSF leakage, nasal lacrimal duct problems and nasal polyps. The results of nasal polyp surgery are not as good as in the other indications.
The technique is less suitable in patients with a very narrow nose or severe deformities. In these cases the postoperative care can also be very difficult. Also children, patients who have had many operations and patients with hypertension may not be suitable.

The rhinologic surgeon should be aware of the fact that he is operating just below the skull-base, between the eyes, the optic nerves and carotid arteries, and the optic as well as the carotid arteries are not necessarily covered with bone! Of course this is the same for the endoscopic way of surgery as for other surgical interventions but the approach of the nasal sinuses by endoscopy is from a different angle and therefore sometimes more troublesome.
My conclusion is that endoscopic endonasal surgery will have a main role in the future of sinus surgery.

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Relationship between nasal and middle ear pathology in children

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There has always been some controversy about the role of nasal pathology in the etiopathology of middle ear diseases. Especially about the role of adenoids in secretory otitis media (SOM) a considerable number of papers and theories are published. But there is controversy also about the role of, e.g., chronic sinusitis and allergic rhinitis in the onset and maintenance of chronic otitis media in adults and their influence on the outcome of reconstructive middle ear surgery. In addition, the question is not fully answered yet how important the role is of the Eustachian tube and the nasal cavity and rhinopharynx in the etiopathology of cholesteatoma.

In this paper we will focus on the relationship between nasal pathology and acute and secretory otitis media in young children. We will give a brief survey of the literature and present our own data on this matter.

SURVEY OF THE LITERATURE

In various clinico-epidemiological studies it has been demonstrated that acute otitis media (AOM) is usually a consequence of a viral upper respiratory tract infection (Reed and Brody, 1966; Pukander et al., 1985; Visscher et al., 1984; in children younger than one year; Pestalozza et al., 1984 in neonates). In clinico-bacteriological studies (Tos et al., 1979; De Maria et al., 1984; Freyd et al., 1984) it has been demonstrated that a pathological bacterial flora in the nasopharynx (especially H. influenzae) plays a role in episodes of AOM, and also in SOM.

Upper respiratory tract infections play also a very important role in the onset and maintenance of SOM. This has been demonstrated by Suehs, already in 1952. He was the first to study in detail the role of various predisposing factors in SOM; he found that 45% of the children with SOM had a concurrent upper respiratory tract infection (15% had sinusitis).

In a study of two year old children Tos et al. (1979) found an important and very significant correlation between the frequency and severity of "catar-

rhalia'' on the one hand and the finding of pathological tympanometrical curves on the other hand. Grote and Kuijpers (1980) and Otten (1986) found that the majority of children with SOM had an additional infection elsewhere in the respiratory tract. Grote and Kuijpers reported that in 85% of these children the middle ear effusions disappeared after sinusal irrigation, while Otten could not demonstrate a clear beneficial effect of the anti-sinusitis treatment.

The correlation between respiratory tract infections and SOM is a universal finding: it was also demonstrated in the U.S.A. (Casselbrant et al., 1984), in New-Zealand (Stewart et al., 1984) and in Japan (Kaneko et al., 1984).

OWN STUDIES

Methods and material

In a large prospective clinical epidemiological study we examined 2069 children aged between 2.5 and 6 years. The children were examined at school, so only apparently healthy children were included. The clinical examination consisted of a general physical examination, a clinical E.N.T.-examination, tympanometry (1722 Middle Ear Analyser of Grason Stadler), passive anterior rhinomanometry and pure tone audiometry (where possible). To evaluate predisposing factors in the personal and family history, a questionnaire was completed by the parents. Statistical analysis was performed with the χ^2 test, the analysis of variance (ANOVA) and the multiple linear regression analysis. The latter was performed between the dependent variable and most of the independent variables, to exclude indirect correlations.

RESULTS

a. Acute otitis media

We found an, expected, close correlation between the annual frequency of episodes of common cold and of AOM ($p < 0.0001$ with MLRA and χ^2). 90% of the children without common cold during the last year were also free of AOM, while only 55% of the children with more than three common colds during the last year were free of AOM. The mean annual frequency of AOM was: 0.16 for children without common cold during the last year, 0.29 for those with 1, 0.53 for those with 2 to 3, and 1.05 for those with more than 3 (Figure 1). This finding was not a surprise, but also the ''negative'' findings were important: 10% of the children contracting an otitis had no common cold and 55% of children with more than three common colds a year did not contract AOM. This suggests that both infections are not connected to each other but not in an absolute way.

From the comparison of the appearance of the last episode of common cold

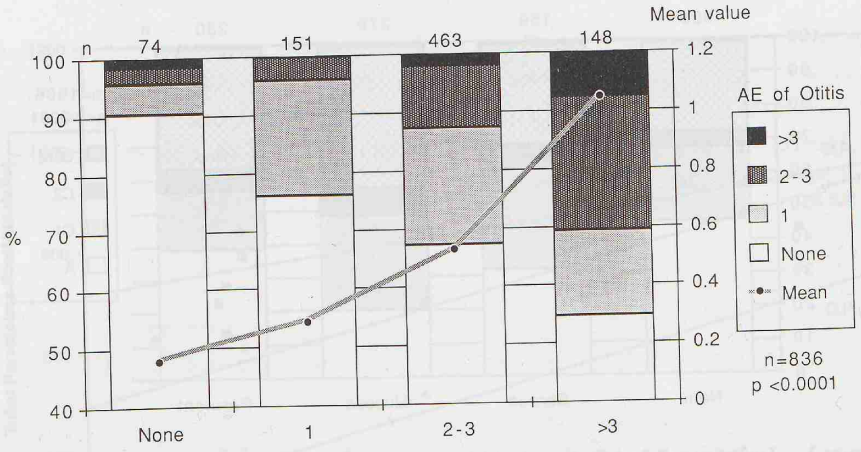

Figure 1. Relationship between the annual frequency of common colds and of acute otitis media; n = number of children, AE = annual episodes, p = according to χ^2 test for the groups and according to ANOVA for the mean values.

with that of AOM we learned that 8% of the children contracted AOM during the last episode of common cold.

We could not find a correlation between the nasal edema and AOM, and only a marginal correlation ($p = 0.5$, χ^2) between the presence of pathological nasal secretions and the annual frequency of AOM, mucoid secretion being associated with a higher mean annual frequency of AOM.

Extreme hypertrophy of the adenoids (adenoids visible by simple throat inspection) was shown to be associated with a higher mean annual frequency of AOM (1.31 vs. 0.62 without this extreme hypertrophy; $p = 0.03$, ANOVA).

There was no correlation between the morphology of the septum and the annual frequency of AOM ($p = 0.9$, ANOVA).

b. Secretory otitis media

When plotting the annual frequency of common colds with the tympanometrical findings we found a statistical significant correlation with the χ^2 test ($n = 1976$, $p = 0.02$), a higher annual frequency of common cold being associated with a higher prevalence of SOM and C1 and C2 curves. Children with normal tympanometrical curves have a mean value of 2.28 common colds a year, children with a C1 curve: 2.49, children with a C2 curve: 2.40 and children with SOM: 2.60 ($p = 0.0004$, ANOVA). From our findings we could also calculate that children with more than three common colds a year had a 1.8 higher risk to have SOM than children without SOM.

When plotting the tympanometrical findings against the time lapse between the last episode of common cold and our examination, we noted that children who had their last episode of common cold five to eight weeks before we performed

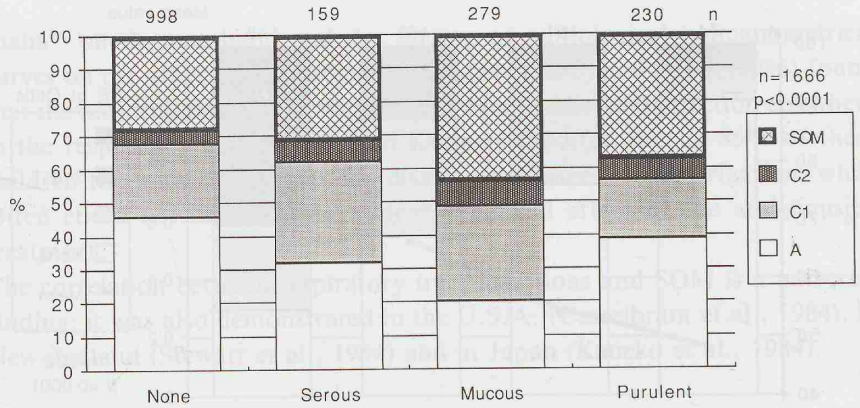

Figure 2. Tympanometrical findings in various forms of rhinitis; n = number of ears, p = according to χ^2 test.

tympanometry had the highest prevalence of SOM, even somewhat higher than children who had their last episode of common cold within the preceding month.

However, although we found, with the χ^2 test, this close correlation between the annual frequency of common cold (and the last episode of common cold) and the tympanometrical findings, this was not the case when we used the MLRA test, where a whole series of additional parameters was tested. This means that the relationship between common cold and the middle ear status is an indirect one, probably due to the close correlation between common cold and acute otitis (Van Cauwenberge, 1988).

We found a close correlation between the presence of edema of the nasal mucosa and abnormal tympanometrical findings: children with nasal edema had more frequently C1, C2 and flat curves ($p = 0.002$, χ^2 test).

The presence of an infectious rhinitis with pathological nasal secretions was even more clearly correlated with pathological tympanometrical findings ($p = 0.003$, MLRA and $p < 0.0001$, χ^2 test). Mucoid and purulent secretions were more often associated with an abnormal tympanogram, including SOM, than serous secretions and no secretions (Figure 2).

If we only consider children with SOM persisting during at least two months, we found the percentage of these children with rhinitis being twice as high as children with a normal tympanogram ($p = 0.00001$, χ^2).

We could not demonstrate a correlation between septal abnormalities and the tympanometrical findings ($p = 0.2$, χ^2).

ADDITIONAL DATA

In an experimental set-up where we performed nasal challenges with histamine

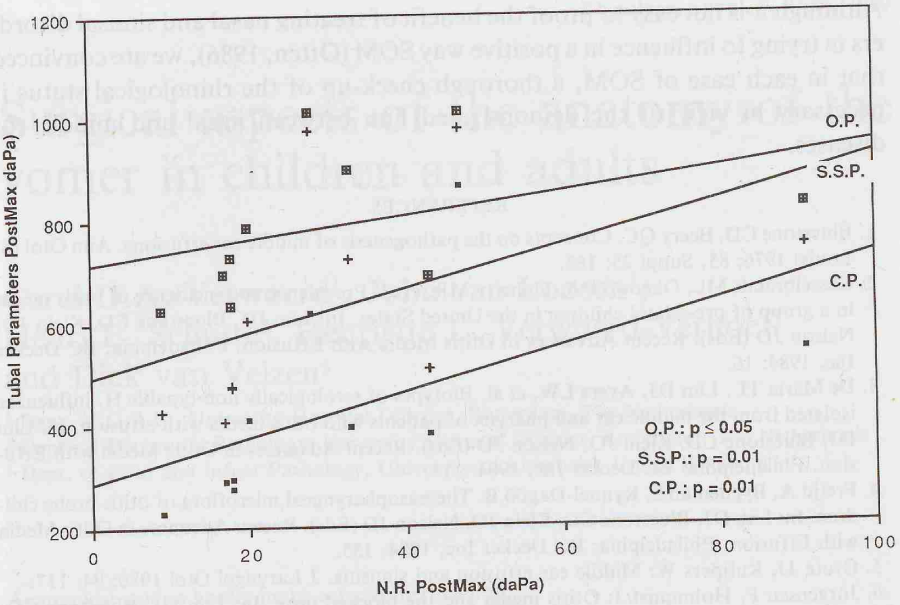

Figure 3. Scatter diagram plotting the maximum changes of the nasal resistance (N.R.) against those of the tubal parameters (O.P. = opening pressure; S.S.P. = steady state pressure; C.P. = closing pressure) after nasal provocation with histamine and/or Substance P (ten experiments in four rhesus monkeys). The lines represent a simple curve fit (simple linear regression-analysis); the p-value is based on the Spearman Rank Coefficient test.

and Substance P in rhesus monkeys, we found that an increase of the nasal resistance influenced some parameters of Eustachian tube function (Van Cauwenberge, 1988). Especially the steady state pressure and the closing pressure of the Eustachian tube increased with increasing nasal resistance (Figure 3). We concluded that these experiments illustrate the correlation between edema of the nasal mucosa and the function of the Eustachian tube.

DISCUSSION

From our results, and from data of other authors, it is obvious that nasal pathology is a very important factor in the etiopathology of acute and secretory otitis media. Endonasal abnormalities can have an unfavourable influence on the middle ear in different ways. Hypertrophic adenoids and an edematous nasal mucosa may cause an extrinsic obstruction of the Eustachian tube, but also to a functional obstruction (Toynbee phenomenon) (Bluestone and Beery, 1976). The underlying pathology causing edema of the nasal mucosa may also cause edema of the Eustachian tube. Finally, infected nasal secretions may ascend to the Eustachian tube and middle ear; this mechanism is facilitated by the negative pressure in the middle ear in cases of tubal dysfunction (Jörgensen and Holmquist, 1988).

Although it is not easy to proof the benefit of treating nasal and sinusal disorders in trying to influence in a positive way SOM (Otten, 1986), we are convinced that in each case of SOM, a thorough check-up of the rhinological status is necessary in view of the demonstrated link between nasal and middle ear diseases.

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Surgical aspects of the anatomy of the vomer in children and adults

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Anatomical studies hardly make entertaining reading, for anatomy deals with spatial relations and their verbal description is an almost impossible undertaking. Hence, the text is not much more than advice on how to study the figures.

G. von Bonin and *P. Bailey* (1947):
The neocortex of Macaca mulatta,
The University of Illinois Press.

INTRODUCTION

In most publications on septal surgery hardly any attention is paid to the exact anatomy of the vomer and certainly not to the developmental changes during childhood. Recently, Takahashi (1988) reviewed his anatomical studies of the (isolated) vomer of dry skulls together with many other aspects of the septal development in various animal species.

The nasal septum is cartilaginous up to the 8th month of intra-uterine life. Peter (1913), Hillenbrandt (1933) and Schultz (1976) described the development of the perpendicular plate by enchondral ossification. The first "Anlage" of the vomer is a bilateral centre of desmal ossification just lateral to the basal rim of the septal cartilage (Fawcett, 1911). Both centres fuse on the inferior side to form a bony gutter. The inferior part of the vomer is the result of desmal ossification located between the mucous membranes lining both nasal fossae. The perpendicular plate reaches the vomer between the 4th and 7th year after birth (Hillenbrandt, 1933), and according to Schultz (1976), this may even occur after the age of 10 years. Thus, the most postero-inferior part of the car-

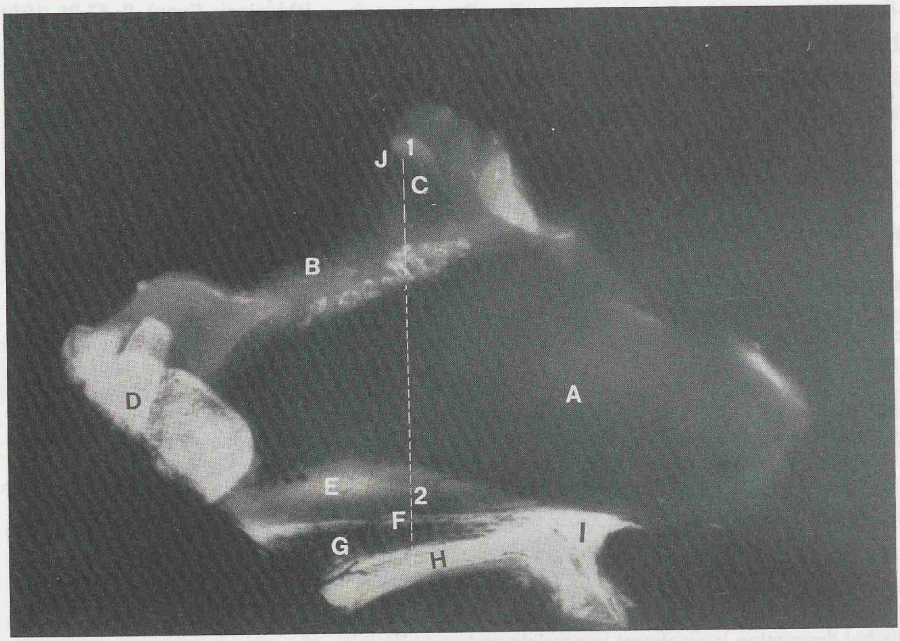

Figure 1. Lateral X-ray picture of nasal septum, neonate.
A. cartilaginous nasal septum
B. anterior skull base with overprojection of bony lateral ethmoid region
C. crista galli
D. sphenoid bone
E. ala vomeris
F. fusion line of both alae vomeri
G. inferior part of vomer
H. palate
I. anterior nasal spine
J. level of frontal CT (1–2) represented in CT picture (Figure 2).

tilaginous septum (''sphenoid tail'') is enclosed in a bony tunnel (vomerine tunnel) and will ultimately ossify in most individuals (Scott, 1953; Melsen, 1977).

Developmental variations at the junction of vomer and perpendicular plate are very common. A symmetrical development of the vomer is exception rather than rule. In case only one vomeral ala is formed, the cartilaginous sphenoid tail can be found during surgery extending along side the ''incomplete'' vomeral bone. Often this situation is combined with a spina vomeris.

To our knowledge reports describing the development of the nasal septum radiographically have not been published. In this paper a radiographic evaluation of the development of the vomer from birth to the age of 30 is presented. Additionally, a short comment will be given on the anatomical features of the vomer in skulls with facial clefts.

Figure 2. CT-scan frontal plane (line A-B Figure 1) of nasal septum.
A. cartilaginous nasal septum
E. ala vomeris
F. fusion of both alae vomeris
G. inferior part of vomer

MATERIAL AND METHODS

Post-mortem specimens of the nasal septum of 22 Caucasian patients, with apparently normal facial structures, were examined radiographically. The ages ranged from birth to 30 years.

The specimens were obtained by block dissection and included the nasal septum, part of the hard palate, the cribriform plate and the sphenoid bone (van Loosen, 1988). Lateral radiographs were obtained on a mammography unit (Senograph 500t, film screen, 22 keV, 0.3 mm focus and magnification). Frontal CT-scans were made of a few specimens.

The skulls presented here are part of the collection of the Museum Vrolik, Anatomical Institute, University of Amsterdam.

OBSERVATIONS IN NASAL SEPTA

0–1 year of age; N = 6 (Figures 1 and 2):

In radiographs the cartilaginous septum shows no signs of ossification: a perpendicular plate has not yet been formed. The ala vomeris is well demonstrated. The zone of fusion of both alae, inferior to the basal rim of the car-

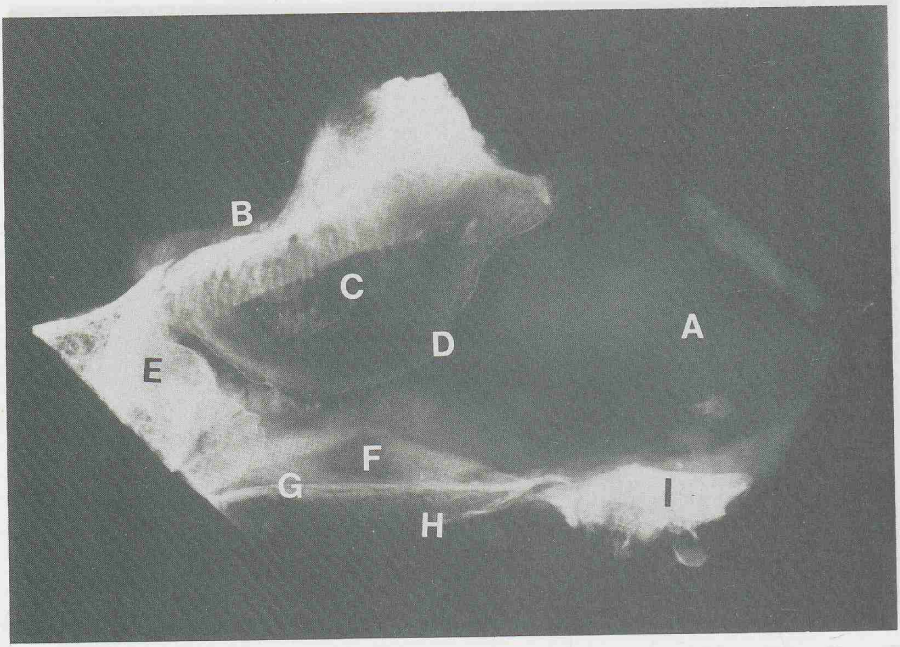

Figure 3. Lateral X-ray picture of nasal septum, age 10 years.
A. cartilaginous nasal septum
B. anterior skull base
C. perpendicular plate, ventral thin area
D. thickened rim of perpendicular plate
E. sphenoid bone
F. ala vomeris
G. fusion line of both alae vomeris
H. palate
I. maxilla with anterior nasal spine

tilaginous septum, is demonstrated as a contrasting line. The inferior part of the vomer has a triangular shape and extends between the line of the fused vomerine alae and the palate; posteriorly it has a free edge at the level of the choana. The lower part of the vomer consists of a very thin bony plate between the mucosa on both sides.

1–10 years of age; N = 12 (Figure 3):
The earliest centre of enchondral ossification is seen annex the anterior skull base. This primordium of the perpendicular plate enlarges gradually in antero-inferior direction as a result of replacement of cartilage by bone. This rim of the perpendicular plate always shows more contrast, because of a greater thickness compared to the central area.

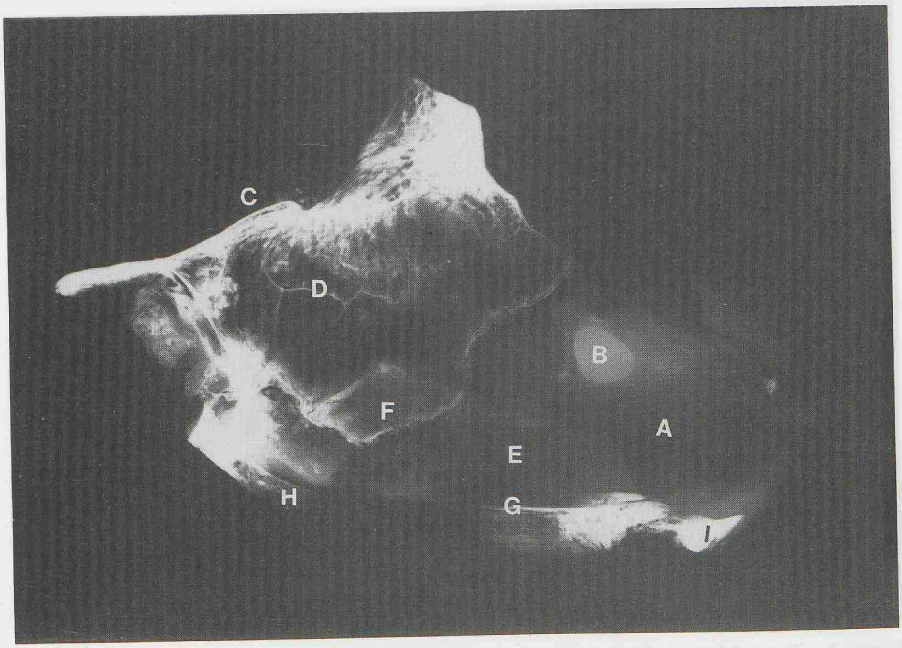

Figure 4. Lateral X-ray picture of nasal septum, age 17 years.
A. cartilaginous nasal septum
B. artefact
C. anterior skull base
D. perpendicular plate
E. ala vomeris
F. overlapping perpendicular plate and alae vomeris
G. line of fusion of alae vomeris
H. inferior part of vomer
I. anterior nasal spine

The age at which the perpendicular plate reaches the vomerine alae was found to be highly variable: in our material between 3 and 10 years after birth.

10–17 years of age; N = 2 (Figure 4):
The progressive expansion of the median perpendicular plate and the extension in cranial direction of the bilateral vomeral ala results in an overlap.

17–30 years of age; N = 2 (Figure 5):
Even in this age-group the enlargement of the perpendicular plate continues, whereas at the same time the cartilaginous nasal septum becomes proportionally smaller. The overlap between vomer and perpendicular plate can no longer be demonstrated, probably because of a bony integration of both structures. Between the thickened rim of the perpendicular plate and the line of fusion of

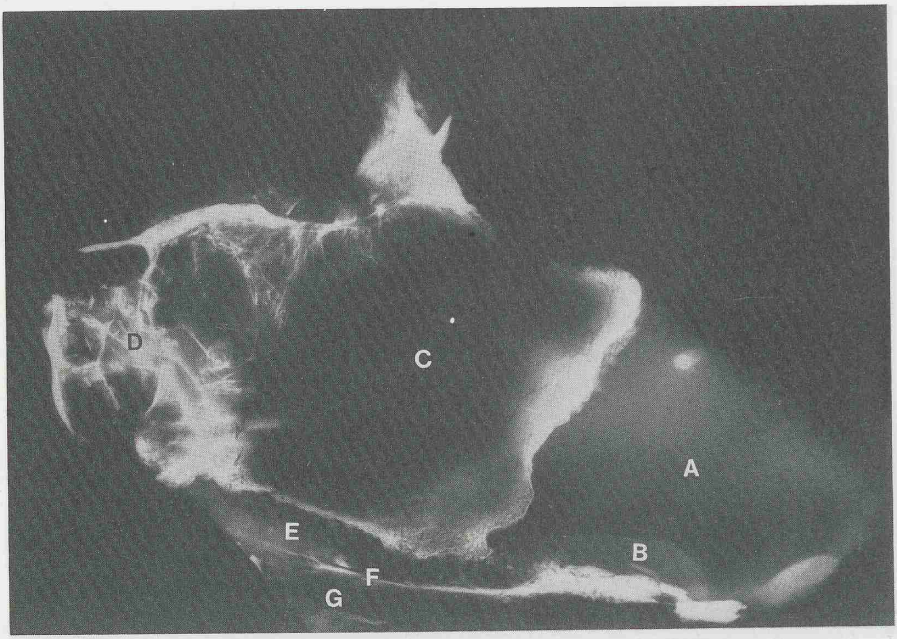

Figure 5. Lateral X-ray picture of nasal septum, age 30 years.
A. cartilaginous nasal septum
B. artefact
C. perpendicular plate
D. sphenoid bone
E. vomerine tunnel with sphenoid tail (?)
F. line of fusion of alae vomeris
G. inferior thin part of the vomer

both alae vomeris a remnant of the septal cartilage – the sphenoid tail – was often present in a vomerine tunnel as in the previous age-group.

DISCUSSION

With respect to the morphological development the vomer can be divided into two parts. First, the superior part, composed of the partly fused alae vomeris and secondly the inferior part extending as far as the palate.

In animal experiments it was demonstrated (Poublon, 1987) that the position of the superior part of the vomerine gutter is determined by the cartilaginous septum, i.e. cartilage dominates bone (Verwoerd, 1989). Furthermore, the morphology of the inferior part is probably determined by the line of fusion of the palatal halves. This hypothesis could be tested by studying skulls with facial clefts. In these anomalies the relation between the basal rim of the septum is abnormal as a result of underdevelopment of one or both palatal halves.

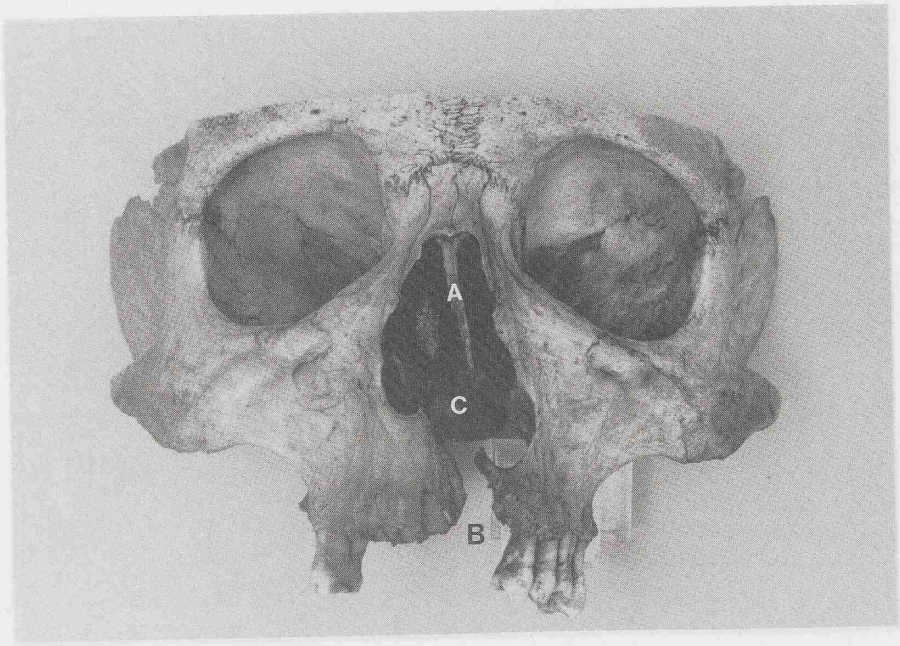

Figure 6. Adult skull with left-sided cleft of alveolus and palate. Frontal view.
A. perpendicular plate, deviated to the affected side.
B. cleft in alveolus and palate
C. vomer: "horizontal" position, broadening nasal floor

Van Limborgh (1964) described the development of the maxilla in a series of human skulls with facial clefts. It was possible to reinvestigate part of his material which today is still present in the museum Vrolik, but now with special interest in the nasal skeleton.

Observations in skulls with unilateral cleft of alveolus and palate (Figures 6, 7 and 8):

All the four adult skulls with this type of cleft showed identical features. The perpendicular plate is deviated to the cleft side and its basal rim is sharply bended in lateral direction. The ala vomeris on the cleft side has not been developed. The imprint of a sphenoid tail in the remaining ala, is evident, extending as far as the vomeral spine. Instead of vertical, the position of the inferior part of the vomer, deviated to the cleft side is almost horizontal. The transverse diameter of the floor of the nasal fossa looks extraordinary broad.

This, however, is not the result of a broadening of the palatal part, but caused by addition to the nasal floor of the inferior part of the vomer.

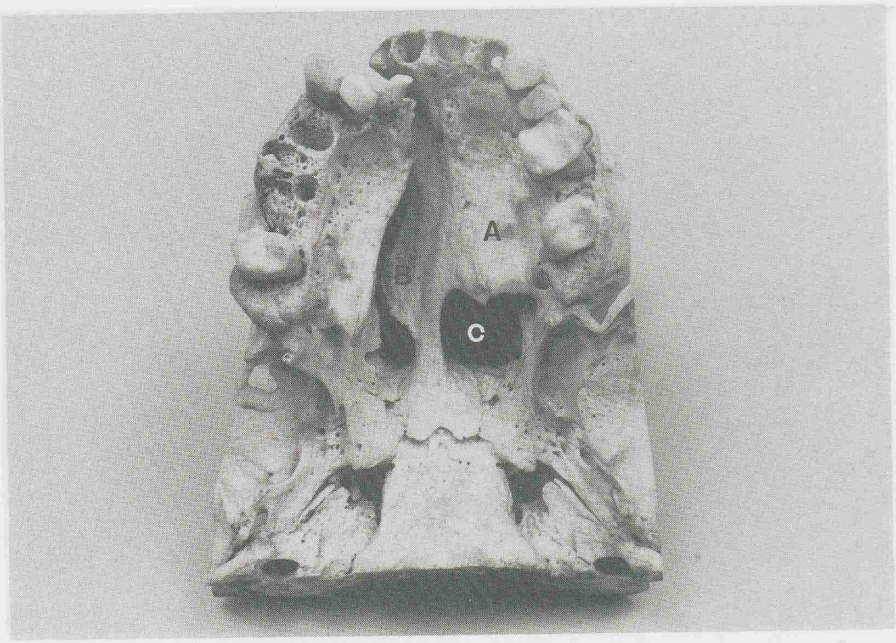

Figure 7. Adult skull with right-sided cleft of alveolus and palate. Palatal view.
A. cleft of alveolus and palate
B. vomer, connected to palatal half
C. choana

CONCLUSIONS

1. At birth the inferior part of the vomer is composed of an extremely thin plate of bone. It may not be considered to support the cartilaginous nasal septum. It seems that resection of this part of the vomer will not interfere with later nasal development. Evaluating acquired or congenital deviations of the nose in infants, one should realise that the nasal septum is not firmly connected to the secondary palate.

2. In skulls with unilateral clefts of alveolus and palate the vomer is malformed. The inferior part assumes an almost horizontal position and contributes to the broadening of the nasal floor on the non-clefted side. Thus, planning a septal correction the anatomy of the nasal floor has also to be considered.

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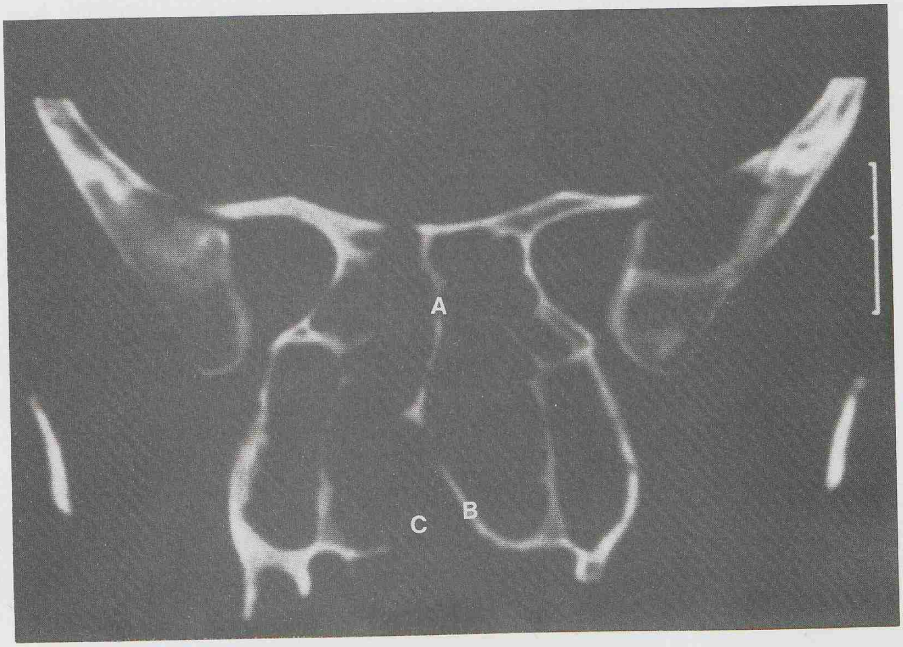

Figure 8. Adult skull with unilateral right-sided cleft of alveolus and palate. CT-scan, frontal plane.
A. perpendicular plate
B. vomer "horizontal" position, broadening nasal floor
C. cleft

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