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Tooth Brush Bristle as a nucleus for calculus formation in the hilum of the Submaxillary gland

BY

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The submaxillary gland is a compound acinous or racemose gland of the serous type surrounded by a connective tissue capsule.

The submaxillary gland is smaller than the parotid. The submaxillary gland is partly lodged in the angle between the inner surface of the mandible and the muscular floor of the mouth.

It projects downwards into the digastric triangle of the neck.

The main duct of the submaxillary gland (Whartons duct) is a fibrous tube of considerable length. The calibre of the duct is larger than the orifice.

For this reason the duct may be considered a reservoir for saliva as well as a duct for its conveyance.

The main duct after division becomes the interlobar ducts which then divides into the interlobular ducts. The interlobular ducts in turn become the intralobular ducts, which are connected with the terminal alveoli.

This fine branching duct system can be appreciated in the normal sialogram.

Salivary gland and duct calculi are not uncommon. They are found in the following order of frequency Submaxillary duct, gland, parotid gland, duct, Sublingual gland.

Stones are never found in the sublingual ducts because of their multiplicity and consequent ability to secrete the saliva even though the main duct (Bartholins) may become obstructed.

Gland calculi are usually larger. The great majority occur singly. The size of the calculi varies. The salivary calculus is laminated and indicates its pattern of growth. Concentric shells of chalky substance between layers of organic, brownish yellow material. Usually the nucleus appears completely structureless and without recognisable features.

Several factors may account for the higher incidence of concretions in the submaxillary gland and duct.

Anatomically the orifice of the duct is situated beneath the tongue and is exposed to a considerable amount of trauma in the process of mastication.

Tartar is frequently formed about the neck of the lower incisor teeth on their lingual surface.

Small pieces of tartar may get freed into the duct laying the nucleus of a subsequent calculus.

The flow of saliva through the Whartons duct is slower than that of saliva coming from the parotid gland for several reasons.

(1) The submaxillary duct is wider and longer than the parotid.

(2) The gland is situated below its duct and the secretion must travel uphill.

(3) The parotid secretion is much less viscid since it contains no mucin.

Although Stensen's duct possesses a sharp bend at the edge of the masseter, where it pierces a fat pad and the Buccinator muscle to enter the oral cavity, this does not compare with the irregularities, diverticula and constriction (for example the passage of the lingual nerve under the duct) encountered in the route of the submaxillary duct.

These irregularities may serve as site for stasis and subsequent growth of microscopic organisms with eventual stone formation.

Several theories of stone formation deal with a precipitation of calcium salts about some nucleus.

The nucleus may be epithelial debris or foreign body. It is said that escaping carbon dioxide from solution in the mouth causes a precipitation of calcium salts in the presence of colloid mucin. Eventually a calcific concretion forms.

Chemical composition is calcium phosphate, organic matter, calcium carbonate, traces of iron and magnesium. Incidence is greater in men.

CASE REPORT

A Hindu male, Age 45 gave the classic history of periodic swelling at meal time due to ball valve type of action of the stone.

Later on the swelling became persistent. He gave history which pointed to a cellulitis of the neck which was treated with antibiotics. Occlusal roentgenogram did not reveal a calculus.

Pressure upon the swelling in the submaxillary region caused frank pus to exude from the orifice of Whartons duct at the frenum of the tongue. Sialography was not done.

From the history and the presence of the persistent swelling it was diagnosed as a case of chronic sialadenitis and it was decided that the gland should be removed in toto.

The incision was a curved one. It began in the midline between the symphysis menti and hyoid. From there it extended downwards to the level of the hyoid. It was carried laterally across the neck, ascending along the anterior border of the sternomastoid to end opposite the angle of the jaw. A flap of skin and platysma was reflected. The external maxillary artery and anterior facial vein secured as they crossed the mandible at the anterior border of the masseter. The vein passes over the gland and leaves the digastric triangle by crossing superficial to the posterior belly of the digastric at which point it should be ligated. The gland was separated from the triangle (Mylohyoid, Hyoglossus and superior constrictor) by passing a finger up on the deep surface. The external maxillary artery should be identified as it passes deep to the digastric. It runs upwards on the deep aspect of the gland then turns forwards and downwards between the submaxillary gland medially and the internal pterygoid and the mandible laterally. It should be ligated as it passes deep to the gland in order that the blood supply of the gland is completely controlled. As the gland is separated off the Hyoglossus the hypoglossal nerve lying on that muscle must be avoided.

Traction on the gland brings into view the portion of glandular tissue which passes with the duct beneath the posterior edge of the Mylohyoid. The duct was clamped and divided. The mass removed.

On slitting the duct, near the hilum of the gland a calculus was found of the shape shown in the figure with a tooth bristle sticking out.

This case is being reported because of the following reasons:—

(1) A preoperative diagnosis was not made.

(2) A tooth bristle finding its way into the Whartons duct and forming a nucleus for stone formation.

My thanks to Drs. H. K. Jain and Kailash Chand Rai for helping me in writing this article and to the superintendent of S. M. S. Hospital, Jaipur for allowing me the use of the hospital records.

Exostoses of the External Auditory Meatus

BY

Dr. A. SINHA.

Mr. Chairman, Ladies & Gentlemen,

The Subject of this discussion 'Exostoses of the External Auditory Meatus' is not a common condition. But what has impelled me to choose this subject for this discussion is the fact that as with many other diseases the features of a disease as met with in our country is not quite the same as mentioned in most text-books and in foreign literature. Neglect of diseased parts is an important factor. This adds new features to the disease which it will be beneficial to keep in mind when making diagnosis and in treatment. Later in this discussion I will present to you *two* cases of exostoses of the e.a.m. with some interesting features. And, as I have already said, this disease is rare, and I feel it may be worthwhile to refresh your memory about some of its features in general as we understand them.

Exostoses are a variety of osteomas *arising from the surface* of the bone. When they arise in the centre of the bone they are known as enostomas. The skull bones form not an unusual site of exostoses and one which interests the otologist are the exostoses of the external auditory meatus. They may be single or multiple, uni-lateral or bilateral.

This condition was discussed at the Section of Otolaryngology, Royal Society of Medicine in U.K. in February, 1922 and again in December, 1948. Reference was also made to this condition by G. P. Field, who was Aural Surgeon, St. Mary's Hospital, London, in his manual of 'Diseases of the Ear' 4th edition, 1893.

PATHOGENESIS

The whole of the bony portion of the external auditory meatus is developed from the bone which embryologically is ossified in membrane. Hence osteoma arising from its walls are

ivory in nature. This, as a group, has to be distinguished from the type of Hereditary multiple exostoses also called Diaphyseal acalasia. This latter condition appears as a disturbance of growth of cartilage and bone in the region of the metaphyses. It results in multiple lesions—similar in structure to benign tumour of bone and cartilage. This disease ceases when skeletal development is complete. But in cases of exostoses of the external auditory meatus, the disease takes an uncertain course as the exact pathogenesis is obscure. References are available in literature associating the condition to sea bathing and diving, most of which are bilateral. It is particularly said to be common in cold water swimmers. In 1937, at Venice, these tumours were reviewed and it was said that exostoses of the external auditory meatus was relatively uncommon in Italians, probably due to their bathing in the warm water of the Adriatic. The Dutch who swim in the cold water of the North Sea show a much higher incidence in meatal exostoses.

Professor VanGilse in Acta-otolaryngologica, 1938 also expressed the opinion that swimming may have relationship to the occurrence of exostoses of the external auditory meatus. He, however, did not feel that there was much difference in the effects of the sea and fresh water swimming. Fowler and Osmun (1942) suggested that cold water bathing might produce vaso-constriction of the vessels of the external bony canal, and this reduction in blood supply in potentially osteogenic tissues could precipitate new bone formation. Later studies, however, both experimental and clinical observations, according to Harrison (1951), it is suggested that it was the prolonged vasodilatation that follows presence of cold water in the deep meatus which was responsible for the changes noted and not the relatively short period of vaso-constriction which occurs while the water is actually in the canal. Experimental observations were done by Fowler using water at 90 centigrade to irrigate the external canal of the guineapig. Harrison has also gone into a consideration of the comparative anatomy of the external auditory meatus of various aquatic vertebrates. He had suggested that the meatal stenosis is commonly found in such animals

whose habitat is sea or river, *e.g.*, the crocodile (a reptile whose tympanic membrane is at the bottom of a deep fissure); the eared seals, (a mammalia); and the capybara (an acqutic rodent). Each of these animals have contracted bony meatus. It has been suggested that perhaps this narrowing of the meatus has developed as a protective mechanism for the drumhead from the effect of variation in the temperature of the water in which the animals live.

Stirk Adams (1948) in his extensive review before the Royal Society of Medicine, Section of Otology, stated that susceptible individuals develop exostoses from the repeated stimulus from the presence of fresh water in the external auditory canal. If this was so we should have expected to see more cases in our country where fresh water swimming is not so rare in rivers and ponds. But the disease is rare. It would appear that what is true of Venice and the warm waters of Adriatic is perhaps also true for our country and the condition appears to be rather uncommon.

Other factors with which incidence of exostoses have been associated are gouty diathesis, long continued middle ear suppuration, etc.

CLINICAL PICTURE

Exostoses in the deep meatus are not discovered until adolescence or adult life and their discovery is usually incidental. The condition is commonly bilateral and it has been said to have a familial tendency. It cannot be said with certainty whether the solitary type is more common or those in which there are more than one bony growth. Accordingly they present various pictures. The solitary type is said to be more commonly situated in the inferior aspect of the floor of the deep meatus called the 'anterior segment', according to Harrison. Others mention the posterior wall and its junction with the floor as a common site of origin for the exostoses ('the posterior segment') (Fig. 1).

The exostoses, on examination, present as smooth non-tender, hard masses covered with normal skin and attached by broad base. Occasionally the single exostoses may be so big as to completely fill the external meatus and obscure a view of the tympanic membrane. In such cases the skin is shinny as it is tightly stretched over the swelling. Occasionally it may be red and give rise to a mistaken diagnosis of polypus. For this reason probe palpation in all such cases is a very valuable test.

The patients of unilateral exostoses, as has already been said, are not aware of their presence but they may have knowledge of its presence if the swelling is situated in the outer part of the meatus. More often, however, they present for deafness in the same ear. This follows accumulation of cerumen and epithelial debris behind the bony growth. Occasionally these patients will present for external otitis. When this condition is associated with pre-existing chronic suppurative infection in the middle ear then the exostoses interferes with the drainage of the discharge from the middle ear. Such cases may present with grave complications of the middle ear disease *e.g.*, meningitis, extradural abscess, brain abscess, etc.

DIAGNOSIS

As a rule the diagnosis, is obvious on inspection, but if there is any doubt it may be cleared up by touching the growth with probe when its bony consistence will at once become apparent. It is to be differentiated from *a polypus* filling the external meatus, or a soft tissue swelling such as *furuncle* or stenosed meatus following on recurring external otitis. A careful history and clinical examination will exclude most of these conditions. *X-ray diagnosis*—Eric Samuel (1954) observed that radiologically, in the routine veins of the mastoid process exostoses of the external auditory meatus may be easily overlooked, but tomography in a sagittal plane will readily demonstrate the size and shape of the exostoses. Tomography is specially valuable in determining the inner limits of the exostoses.

TREATMENT (Historical)

Before going into the details of the treatment of this condition I would like to take this opportunity to draw attention to the historical fact that it was the pioneering spirit of Julius Lempert (New York), who for the first time thought of the endaural approach for surgical treatment of the middle ear diseases. This he did when he was faced with a case of exostoses of the external auditory meatus. Previously these tumours were operated upon by the post-aural route which necessarily involved extensive bone work before the offending exostoses in the external canal was reached. Use of the chisel and gauge often resulted in facial paralysis. Lempert was dissatisfied with this state of affairs. He thought and found a direct approach to the tumour through the incision which later on came to be called 'the endaural incision'. He also decried and gave up the use of gauge or the chisel in this type of case; instead he adopted the electrically driven dental drill. The combined use of these two: the dental drill and the endaural approach has, as you all know, revolutionized the surgical treatment of the ear diseases.

NON-OPERATIVE TREATMENT

If exostoses are small, unilateral, discovered incidentally and causing no symptoms they should be left alone. However, if the patient is a regular swimmer he should be warned not to indulge in his hobby. In other cases if the condition is causing accumulation of wax or repeated external otitis this should be treated conservatively. If, however, response to treatment is unsatisfactory and recurrence is frequent and if there is deafness out of proportion, making one suspicious of some hidden disease in the middle ear cavity, operative treatment should be advised.

In the multiple variety operation should be avoided unless it becomes necessary as in this form it is stated that complete obliteration of the meatus rarely occurs.

OPERATIVE TREATMENT

The present day operative treatment is to approach the tumour by antauricular endaural route. After exposure of the

tumour it is slowly and carefully levelled down by bone drill. The removal is aided by small bites of bone forceps. No chiseling or gauge cut is advisable. As the tumour is removed more and more of the deep meatus are seen and the state of tympanic membrane can be verified. Depending on what one finds in the rest of the middle ear cavity, the further steps of the operation are modified. In older text books of E. N. T. local anaesthesia induced by Naumann's method are advocated for removal of single exostoses of the meatus but today such a procedure is to be regarded as completely unsatisfactory and a general anaesthesia should invariably be used in surgical treatment of this condition. Watkyn Thomas has expressed the view that it is quoting disaster to attempt removal of exostoses in the presence of active suppuration and he has preferred that in such cases only the most prominent mass of bone need be removed to enable suppurative condition to be controlled. In such cases the rest of the tumour may be dealt with at a later date after the suppuration has been reasonably controlled.

COMPLICATIONS

(1) *External otitis* tends to occur in ear with exostoses more frequently than otherwise. This may be repeated and the resolution is delayed causing much inconvenience to the patient.

(2) Pent-up *otitis media*—By this we mean that otitis media possibly following on nasopharyngeal infection, even if associated with perforation of the tympanic membrane, is hampered in its drainage by the presence of the exostoses in the external auditory meatus. The infection may resolve under suitable treatment but in extreme cases it may lead to complications such as mastoiditis, labrynthitis, facial paralysis and intra-cranial complications.

(3) *Facial paralysis* is generally believed to follow surgical intervention when accidentally the Fallopion canal is involved in fracture.

CASE REPORT

Case No. 1.— Mrs. S. aged 25 years, a Hindu House-wife, presented at the Patna Medical College Hospital on 5th November, 1958—She was complaining of a firm swelling filling the right ear for about two years. For the past 20 days she complained of pain in the right ear followed by weakness of the right side of her face. There was no history of swimming or any other past ear disease.

On clinical examination the patient had right sided facial paralysis of the infra-nuclear type (Fig. 2). Nose, sinuses and throat— revealed no significant change.

Ears.—Left—No significant abnormality.

Right—Globular swelling was seen in the external auditory meatus nearly filling up the whole meatus, leaving narrow chink at the superior and anterior part. The swelling was situated about 5 m.m. from the bottom of the concha. It arose from the floor and the posterior wall of the meatus. The skin over the swelling was shinny, tightly stretched and red. At first thought it appeared as a case of aural polyp with facial paralysis. But on probe palpation there was no tenderness and a bony and immobile swelling was followed to be present. No view of the tympanic membrane could be obtained.

HEARING

Left ear whispered voice heard at 10 feet. Right ear low conversational voice heard at one foot. Tuning fork tests revealed obstructive deafness of the right ear.

X-RAY OF THE MASTOIDS (Lateral views)

Showed some cloudiness of the mastoid air cells on the right side but no definite shadow was seen in the external auditory meatus suggestive of exostoses.

MANAGEMENT

The patient was admitted as an in-patient. Right side of the face was given facial support and galvanic stimulation of the face muscles was started.

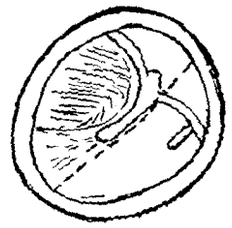
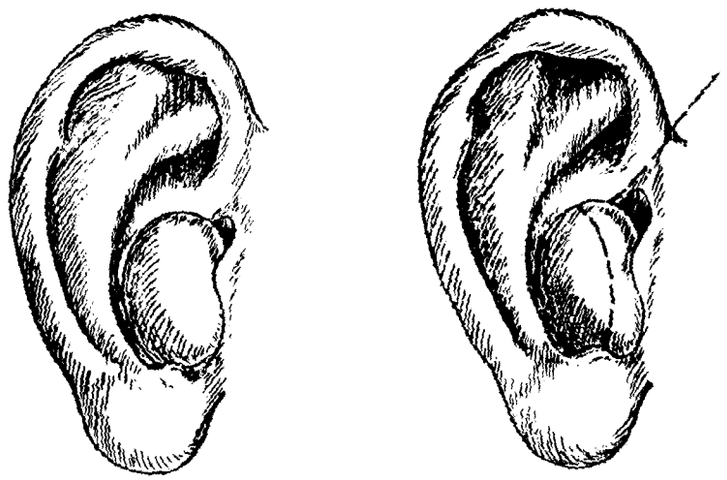
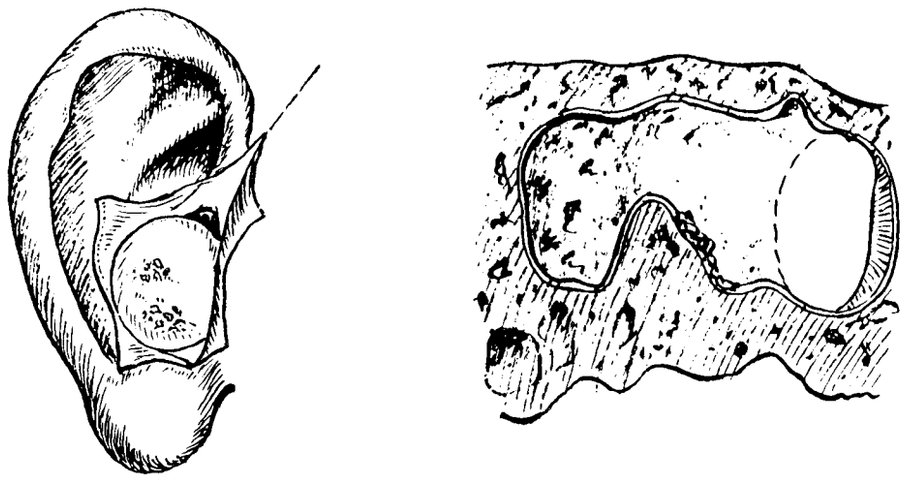


Fig. 1

Fig. 2



A Fig. 3 B



A Fig. 4 B

Fig. 5

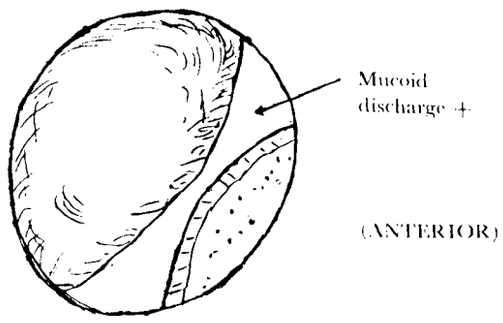


Fig. 6

OPERATION

This was performed on 14th of November, 1958 under general anaesthesia. An endaural incision (anterior auricular only at the beginning) was given, which brought exostoses more fully into view (Fig. 3B). The skin over the exostoses was then incised in its superior part and reflected backward (Fig. 4A).

This exposed a large part of the exostoses. The surface of the tumour was found smooth at its upper part but lobulated and rough near the base. The exostoses was gradually taken down using electrically driven bone drill and occasional bites with bone forceps. Gradually this enabled the deep meatus to be explored where a large amount of cholesteotomatous debris were visualised. The posterior bony meatal wall was found excavated in its deep part. The area was mostly covered with granulation tissue with pus escaping through it. At this stage the ear was cleaned by syringing. This brought into view a narrow crescentic part of the remains of the tympanic membrane in its anterior and inferior segment. The entire middle ear cavity and the part of the tympanic membrane were seen to be covered with granulation and pus escaped from the area. Most of it was cleaned by careful scraping (Fig. 4B).

The endaural incision was thereafter enlarged to expose the mastoid cortex and the supra-meatal spine identified. The antrum and the surrounding diseased cells were exentrated by gauge cuts. The aditus was identified and was found to be enlarged. No remains of the incus or the malleus was found. The facial bridge was taken down lowering it to the level of floor of the aditus. Most of the granulation from this area were removed (Fig. 4B). The cavity was swabbed clear and loosely packed with B.I.P. pack and dressings were applied.

POST-OPERATIVELY

The patient had crystalline penicillin I. M. injection 2 lac units every six hours. The first dressing was done a week later and packing was removed. The cavity appeared satisfactory. B.I.P. pack was reinserted.

Further dressings were done on alternate days. On 26th of November *i.e.* 12 days after the operation, the right side facial paralysis were showing signs of the recovery. The eyes could be partly closed and the deviation of the angle of the mouth was minimised. At this stage active exercises of the right facial muscle, while restraining the left side of the face by the palm of the hand, was advised.

The patient continued to make improvement. She was last examined on 17th of December, 1958, *i.e.*, 3 weeks ago when only very slight weakness of the right angle of the mouth was noticed, as will appear from the photograph taken on that day (Fig. 5).

Case No. 2.—Shri A. T. aged 40 yrs. a Hindu male, presented at the P. M. C. Hospital on 10—9—58. He was complaining of *discharge* from the Right ear, off and on for about 1½ year. For the past 2 months he was subject to *pain* and had a discharging wound behind the ear. The latter appeared a week after the pain started and was preceded by a swelling (≡an abscess) which burst spontaneously.

On clinical examination the patient was well built. Nose, Sinuses and Throat—revealed no significant abnormality.

Ears.—Left: no significant change. Right: Ext. auditory meatus was filled by multiple tender swellings. The skin was red and some mucopurulent discharges was present. No view of T.M. obtained. A post-aural fistula and little surrounding swelling was present. The fistula was opening just above the lobule. Mucopurulent discharge was escaping from the fistula.

Diagnosis.—A tentative outpatient diagnosis of multiple furuncle was made. It was thought that one of the furuncles had probably burst in the retro-auricular region.

MANAGEMENT

The patient was hospitalized and treated conservatively (using systemic penicillin injection, Local formulation, toilet and dressing of the post-aural wound).

On 25—9—58 the wound was explored under G.A. The fistulous tract was incised and scraped. The bony character of the endaural swelling now became apparent, and it was clear that we were dealing with a case of exostoses of the external auditory meatus.

Post-operatively.—The retro-auricular wound healed rapidly and the discharge from the external meatus stopped. The patient was discharged from the ward on 6—10—58 (*i.e.* on 11th post-op. day) with advice to attend o.p.d.

Follow up.—He was well and dry in the ear for a fortnight only when the ear stated discharging again. He was temporarily lost sight of, till he appeared again on 5—1—59, *i.e.* 5 days ago. As he is, he has 2 bony swellings (*Diagram*) with meatal stenosis, which will barley admit a 3 mm. probe (Fig. 6). External otitis and Mucoid discharge is present. No clear view of the case be obtained.

He has been advised—(1) To undergo operation (≡removal of exostoses and underlying disease) which he has preferred to put off for another 2 months to suit his personal convenience.

COMMENTS

Case No. 1.

1. **Presentation.**—The case had unilateral, large, solitary exostoses with facial paralysis which is rather a rare form of presentation of disease itself.

2. **Diagnosis.**—At first *mistaken* to be an ear polyp rectified by *probe* palpation. The value of probe-palpation in clinical examination of all types of swellings in the external auditory meatus is *desired* to be *emphasized*.

3. **Treatment.**—Rapid recovery of the facial paralysis occurred following the surgical removal of the exostoses and the infected middle ear and mastoid air-cells—It is to be *emphasized* that operation in such cases should be performed as early as possible.

Case No. 2.

1. **Presentation.**—The case presented with *post-aural fistula*, which is again a rare form of presentation.

2. **Diagnosis**—was at first *mistaken* as a case of Multiple furuncles in its acute phase. Diagnosis was rectified by exploration at operation.

3. **Treatment.**—Fistula healed on treatment with general measures. (*Locally*—Incision, scraping, toilet and dressing; systemically—antibiotic therapy). But repeated infection persists. A more thorough surgical exploration is indicated with removal of the exostoses.

4. **General Comment.**—It is to be considered whether in view of :—

(*i*) what we have met in within these cases,

(*ii*) the presence of exostoses as a constant source of trouble to the patient such as recurrent external otitis, accumulation of wax and debris persistent otitis media (as in case) and tendency to mastoiditis ;

(*iii*) and also that the surgical removal of the exostoses by modern technique is not so dangerous as it used to be, shall we not consider the surgical removal of all exostoses of external auditory meatus which are of a size that threatens to occlude the meatus even if that be symptomless at the time they are diagnosed.

5. In view of less facility of swimming in our country to those living inland it would appear unlikely that exostoses in these areas have any definite relation to swimming. Both our cases had only unilateral disease.

6. The posterior segment (Harrison) of the bony meatal wall would appear to be a common site, for exostoses.

To Summarize.—A historical review of the present interest of otologists in exostoses of the external auditory meatus is presented. A consideration of the pathogenesis, clinical features, diagnosis and treatment has been discussed. A case of exostoses of right external auditory meatus with facial paralysis treated successfully by operation is reported.

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Treatment of Chronic Maxillary Sinusitis with an Indwelling Polythelene tube

BY

Dr. J. T. SHAH, M.S., D.O.R.L.

This new method of treating chronic maxillary sinusitis was proposed as it was found that very few patients liked to undergo a puncture more than once or twice. The very idea of a puncture was enough to make a patient to go to another doctor who would treat him in a more conservative manner or who would advice a more radical operation. In this new method, a polythelene tube was introduced into the maxillary antrum through a Lipwitz cannula, so that a patient had to undergo a puncture only once, the remaining washes being carried out through the tube. This was found to be a satisfactory method, as even nervous patients were found to tolerate the procedure without any discomfort or pain. The results were extremely good as even chronic maxillary sinusitis of long standing duration were found to respond to this method. The patients were ambulant and could go about their usual work without any discomfort at all. The tube was tucked inside the vestibule so that it could not be seen thus avoiding any embarrassment to the patient. Local as well as parenteral antibiotics were used as also hyalse and alevaire, the local instillations being introduced into the sinus through the tube.

15 cases were selected from the Lokmanya Tilak Municipal General Hospital, Bombay-22, and subjected to this treatment. Only cases having a definite sinusitis as confirmed by the antrum puncture were selected.

PROCEDURE

Local Anaesthesia was used:

(1) The antrum puncture was done in all cases with a straight Lipwitz cannula of a slightly larger bore through which a polythelene tube could be introduced.

Fig. 1

Fig. 2

Fig. 3

Fig. 4

Fig. 5

Fig. 6

Fig. 7

(2) A special long No. 22 needle was then introduced through the cannula and 10 cc. of sterile distilled water was injected into the sinus. Material aspirated out through the cannula was collected in a sterile test tube and sent for smear and culture (Photo No. 1).

(3) A wash was then given with Higginson's Syringe and the character of the discharge noted.

(4) A polythelene tube was next introduced (length 3"— bore 1 mm.) after the distal end was softened in hot water. (Photo No. 2 and 3).

(5) The full tube was introduced and the cannula was then removed over the tube (Photo No. 4).

(6) The tube was cut at the top or the nose. (Photo No. 5).

(7) Finally it was tucked inside the vestibule out of sight (Photo No. 6).

(8) The patient was called every alternate day and a wash given with a 10 cc. syringe and a No. 23 needle, introduced through the tube. Atleast 30 ccs. of water was used. (Photo No. 7).

(9) 20 cc. Air was injected into the sinus after the wash, to remove the water.

(10) The antibiotics and hyalase or alevaire were then injected into the sinus through the tube.

(11) The wash was continued every alternate day until the return flow became clear.

(12) An interval of 7 days was then allowed to pass and after this period the wash was repeated.

(13) If found clear now, the tube was removed. The selection of the antibiotic was done from the smear and culture report, Penicillin being used for Gram positive Cocci and

Streptomycin for the Gram Negative bacilli. In cases where the infection was mixed, both the antibiotics were used. The concentrations used locally were 1 lac units of Crystalline Penicillin dissolved in 1 cc. and ½ gm. of Streptomycin in 2·5 cc. In severe cases (Case Nos. 1, 5, 7 and 8), hyalase (1000 units—1 cc.) was also used in conjunction with the antibiotics. In cases where the secretions were viscid and thick (Case Nos. 1, 9, 10, 14 and 15) alevaire (4-5 cc.) was used with good results.

In one case (Case No. 4), the tubes were kept on both the sides as he had a bilateral maxillary sinusitis. He responded very well but his obstruction still persisted, due to a deviated septum. A submucous resection of the septum was done for him and so far he has had no further trouble.

RESULTS

The number of washes given varied from 3 to 14, the average being 5 washes. The tube was kept in the sinus for a period varying from 14 days to 2 months without any ill effects at all. The results of the series have been very gratifying, as so far only two patients have had relapses (Case Nos. 1 and 5).

COMPLICATIONS

In one case (Case No. 8) it was found that even though the puncture had been purulent, the wash through the tube on the 3rd day was clear. On closer examination, it was found that the tube had come out through the natural osteum and its inner end was lying in the middle meatus. The tube was removed and reinserted, and the washes were found to be purulent. This may happen rarely, but should be borne in mind.

Another patient (Case No. 1), developed tenderness and slight swelling over the tip of the nose due to irritation by the tip of the tube which was tucked in the vestibule. The patient was asked to keep the tube projecting slightly out without tucking it in the vestibule. The swelling and tenderness disappeared in a few days.

TREATMENT OF CHRONIC MAXILLARY SINUSITIS WITH AN INDWELLING POLYTHELENE TUBE.

Case No.	Age Yrs.	Sex.	Occupation.	Locality.	Symptoms.				No. of washes.	Treatment.
					Cold duration.	Headache.	Nasal obstruction.			
							Rt.	Lt.		
1	40	F	Housewife	Mahim	Mths. 4	+	−	+	13	Locally Penicillin, Hyalase and Alevaire + parenteral antibiotics.
2	28	F	,,	Thana	1	+	+	−	3	,, Penicillin.
3	30	M	Millhand	Sion	2	+	−	+	3	,, ,,
4	20	M	,,	Mahim	Since childhood	+	+	+	3	,, ,, + parenteral antibiotics.
5	27	F	Housewife	Goregaon	3	−	+	−	7	,, Streptomycin, Hyalase + parenteral antibiotics.
6	35	F	,,	Sion	3	−	−	+	3	,, Penicillin + parenteral antibiotics.
7	30	M	Service	Wadala	8 yrs.	−	+	+	4	,, ,, Streptomycin and Hyalase + parenteral antibiotics.
8	20	M	Student	Ghatkopar	3	−	+	−	9	,, Penicillin, Streptomycin, Hyalase + parenteral antibiotics.
9	20	F	Housewife	Sion	Since childhood	+	−	+	8	,, Penicillin, Streptomycin and Alevaire.
10	60	M	,,	Kalyan	4	−	+	+	7	,, Penicillin, Streptomycin, Alevaire + parenteral antibiotics.
11	55	M	Millhand	Kurla	4	−	+	+	3	Parenteral antibiotics.
12	50	F	Housewife	Sion	1	+	+	−	3	do
13	30	F	,,	Matunga	4	+	−	−	5	Locally Streptomycin and Penicillin.
14	30	F	,,	Sion	1	+	+	+	4	,, do and Alevaire.
15	30	M	Millhand	Kandivali	1	+	−	−	3	,, Alevaire.

SUMMARY

15 cases of maxillary sinusitis treated with an indwelling polythelene tube have been presented along with the procedure, complications and results.

No toxic effects due to the local antibiotics occurred.

CONCLUSIONS

This method which has been used for the first time in India is a little more time consuming, but in the long run is better, for the patient, who would like to avoid the pricks of repeated punctures as well as radical procedures like the Cald-Well Luc operation.

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REFERENCE

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Innervation of the Human Larynx*

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The innervation of larynx as described by various authors lacks unanimity with regard to the mode of branching and patterns of distribution of the superior and recurrent laryngeal nerves. The reader, at times, finds himself confused on account of certain terminological differences in the various descriptions on the subject.

The present study was therefore started with the following aims and objects :—

(1) To find out a detailed pattern of distribution of the internal laryngeal nerve, specially in its intra-laryngeal part.

(2) Whether the internal laryngeal is a purely sensory or a mixed nerve ? If mixed, does it supply motor branches to the transverse—arytenoid muscle of the larynx ?

(3) The recurrent laryngeal nerve—its level and mode of terminal division and the detailed intra-laryngeal distribution.

MATERIAL AND METHODS

Twenty five specimens from the dissection room were dissected (each side of larynx being considered as one part) by the naked-eye as well as under the stereoscopic dissection microscope. Attempt was made to trace each terminal branch to its ultimate destination and dissect out its finest ramifications in the mucosa or the muscle under the higher magnifications of the stereoscopic dissection microscope.

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In two autopsy room materials the muscular branch from the inferior division of the internal laryngeal was dissected out upto its finer terminal branches in the transverse arytenoid muscle. A small piece of muscle-nerve tissue was then taken and stained with Carey's (1941) gold chloride method to demonstrate the motor end-plates of internal laryngeal in that muscle.

OBSERVATIONS

Internal Laryngeal Nerve. The internal laryngeal nerve in all the dissections was found to enter the larynx through the postero-inferior part of the thyro-hyoid membrane under cover of the thyro-hyoid muscle. In its extra-laryngeal part, a little before its entry into the larynx, certain laryngeal branches were noticed (Table 1).

TABLE No. 1

Branches to the larynx from the extra-laryngeal part of the internal laryngeal nerve

Branches	No. of Dissections
1. Twigs to inferior constrictor ...	2 (8%)
2. Sensory twigs (one in each specimen) to the mucosa on the inner aspect of inferior constrictor of pharynx.	4 (16%)
3. Two sensory twigs, each supplying the mucosa over the inner surfaces of the inferior and middle constrictors of pharynx respectively.	1 (4%)
4. No laryngeal branches ...	18 (72%)

The internal laryngeal nerve, as it pierced the thyro-hyoid membrane, lay in the mucosa of the pyriform fossa and was seen to get flattened up. It then divided into three main divisions, Superior, Middle and Inferior, the last named being always the stoutest (Fig. 1).

(a) *Superior Division.* It coursed medially and upwards in the mucosa of the ary-epiglottic fold and then divided into a number of twigs to supply the mucosa of regions shown in Table 2.

TABLE No. 2

Distribution of Superior division of the internal Laryngeal nerve

Regions Supplied (Mucous Membrane)	No. of Dissections
1. Vallecula only ...	15 (60%)
2. Vallecula + Epiglottis ...	7 (28%)
3. Vallecula + Epiglottis + Pyriform fossa ...	3 (12%)

(b) *Middle Division.*—It ran obliquely downwards and was seen to divide into three main branches in 20 out of 25 dissections (80%). In 5 of these dissections, two of the branches united together to form a ganglion-like confluence and it was from this confluence that the terminal twigs arose (Fig. 2). In one dissection this confluence was replaced by a loop (Fig. 3). Among the many fine terminal twigs, the branch to the mucosa of vocal folds ran a fairly constant course in all the dissections. It could be easily recognised under the dissection-microscope by virtue of its relatively deeper position in the mucosa. This twig coursed obliquely downwards deep to the ary-epiglotticus, thyro-epiglotticus and the thyro-arytenoid muscles and ultimately ramified in the mucosa of the homolateral vocal cord (Fig. 2 & 3). The detailed distribution of the middle division has been summarized in Table 3.

TABLE No. 3

Distribution of middle division of the internal Laryngeal nerve

Regions Supplied (Mucous Membrane)	No. of Dissections
1. Epiglottis + Ary-epiglottic fold + Vestibule and side wall + Saccule and Vocal cord.	8 (32%)
2. Ary-epiglottic fold + Vestibule and side wall + Vocal cord.	4 (16%)
3. Epiglottis + Ary-epiglottic fold + Vestibule and side wall + Vocal cord.	7 (28%)
4. Epiglottis + Vestibule and side wall + Saccule.	1 (4%)
5. Ary-epiglottic fold + Vestibule and side wall + Saccule + Vocal cord + Pyriform fossa.	1 (4%)
6. Epiglottis + Vestibule and Side wall + Vocal cord + pyriform fossa + posterior wall.	2 (8%)
7. Epiglottis + Vestibule and Side wall + Vocal cord.	1 (4%)
8. Epiglottis + Vallecula + Ary-epiglottic fold + Vestibule and side wall + Vocal cord.	1 (4%)

(c) *Inferior Division.* It was the stoutest of the three divisions and contained both, sensory and motor fibres in all the dissections. After its origin, it descended in the mucosa subjacent to the ala of the thyroid cartilage, sloping posteriorly, getting deeper into the mucosa of the side wall of the larynx till near the lower end of the thyroid cartilage, it came to lie in the angle between the posterior and the side walls of the larynx when it ended by communicating with an ascending branch from the recurrent laryngeal nerve to form the Loop of Galen (Fig. 2, 3 & 4). On its downward journey, the division was seen to give a variable number of twigs to the mucosa of the larynx chiefly the posterior wall, and one or two muscular twigs to transverse arytenoid as tabulated below (Table 4).

TABLE No. 4

Distribution of inferior division of the internal laryngeal nerve

Type of Branches	No. of Dissections
Sensory :	
1. Posterior wall + mucosa over posterior crico-arytenoid muscle + Pyriform fossa.	5 (20%)
2. Posterior wall + Pyriform fossa	16 (64%)
4. Pyriform fossa alone ...	2 (8%)
3. Pyriform fossa + vocal cords ...	1 (4%)
5. Posterior wall + Pyriform fossa + mucosa over arytenoid cartilage.	1 (4%)
Motor :	
To transverse arytenoid muscle One branch = 22 dissections Two branches = 3 dissections (for details see text below) ...	25 (100%)

The motor supply from the inferior division of the internal laryngeal nerve consists of one to two branches to the transverse arytenoid muscle (Fig. 2, 3 & 4). These muscular branches were usually given off about the level of the apex of the arytenoid cartilage or a little above it. The branch ran medially and

Showing Three Divisions of Internal Laryngeal

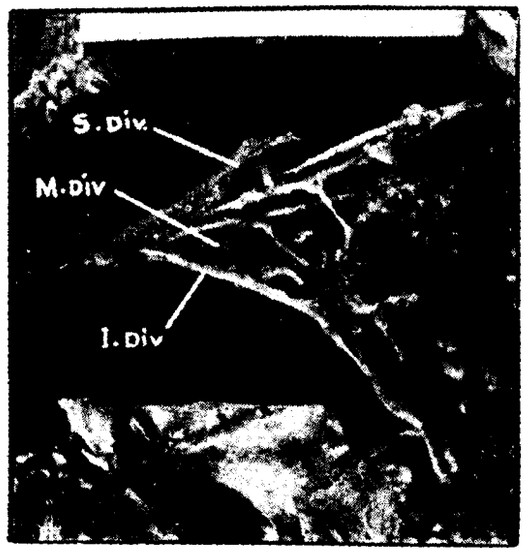

Fig. 1

I. Div. = Inferior division of Internal laryngeal.

M. Div. = Middle division of Internal laryngeal.

S. Div. = Superior division of Internal laryngeal.

Showing Nerve Supply of Larynx

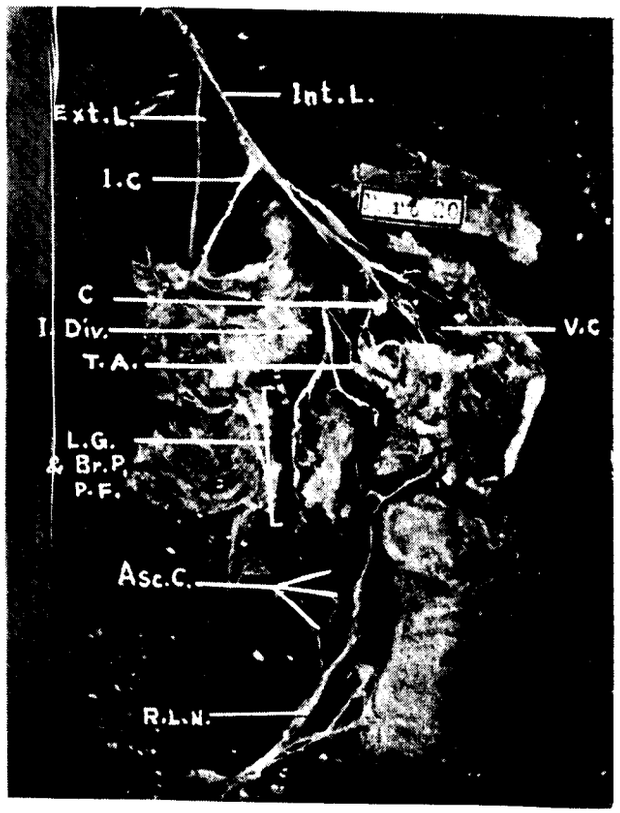

Fig. 2

Asc. C.	=	Ascending communicating branch of recurrent laryngeal nerve.
C.	=	Confluence.
Ext. L.	=	External Laryngeal nerve.
I. C.	=	Muscular twig to inferior constrictor muscle from the internal laryngeal nerve.
I. Div.	=	Inferior division of internal laryngeal nerve.
Int. L.	=	Internal laryngeal nerve.
L.G. & Br. P.,P.F.	=	Loop of Galen, Branches to posterior wall and to pyriform fossa.
R. L. N.	=	Recurrent laryngeal nerve.
T. A.	=	Muscular branch to Transverse arytenoid muscle.
V. C.	=	Branch to mucosa of vocal cord.

Showing Nerve Supply of Larynx

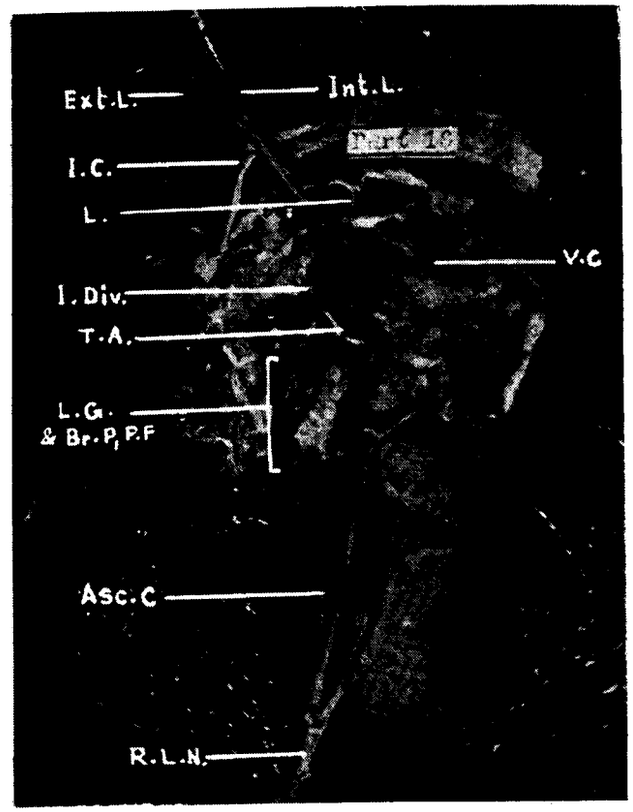

Fig. 3

Asc. C.	=	Ascending communicating branch of Recurrent Laryngeal nerve.
Ext. L.	=	External Laryngeal nerve.
I. C.	=	Muscular twig to inferior constrictor muscle from the Internal laryngeal nerve.
I. Div.	=	Inferior division of Internal laryngeal nerve.
Int. L.	=	Internal laryngeal nerve.
L.	=	Loop.
L.G. & Br. P.,P.F.	=	Loop of Galen, Branches to posterior wall and to pyriform fossa.
R. L. N.	=	Recurrent laryngeal nerve.
T. A.	=	Muscular branch to transverse arytenoid muscle.
V. C.	=	Branch to mucosa of vocal cords.

Showing Nerve Supply of Larynx

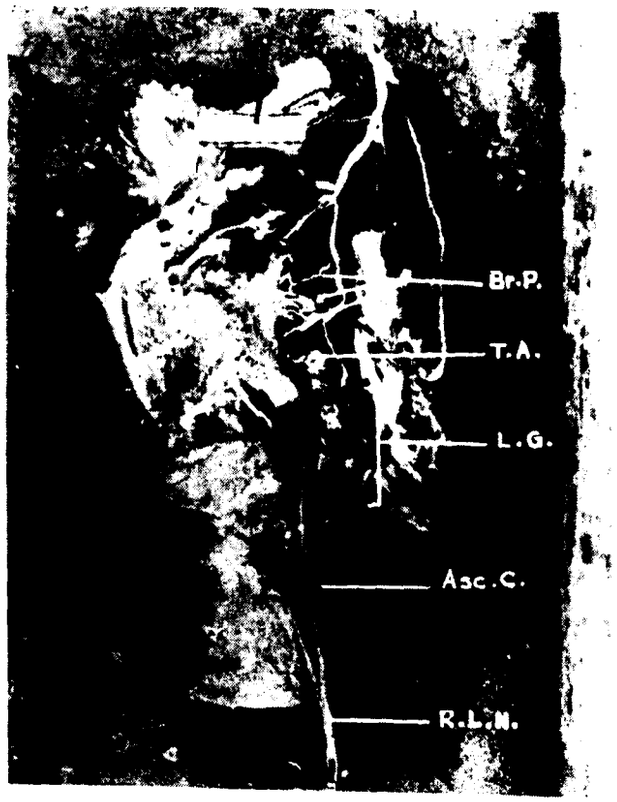

Fig. 4

Asc. C. = Ascending communicating branch of recurrent laryngeal nerve.

Br. P. = Branches to posterior wall of larynx.

L. G. = Loop of Galen.

R. L. N. = Recurrent laryngeal nerve.

T. A. = Muscular branch to Transverse arytenoid muscle.

Showing Motor End-Plates on Internal Laryngeal in the Transverse Arytenoid Muscle

Fig. 5

Me = Motor end-plate.

Showing Motor End-Plates on Internal Laryngeal in the Transverse Arytenoid Muscle

Fig. 6

Mc = Motor end-plates.

downwards to gain the posterior aspect of the arytenoid cartilage by winding round its muscular process. On the posterior surface, the branch was seen to end in the transverse arytenoid muscle by splitting into numerous terminal twigs. The fact that these branches were actually motor to the transverse arytenoid muscle was further confirmed by demonstrating motor end-plates in two fresh autopsy room materials (Fig. 5 & 6).

Recurrent Laryngeal Nerve.—The recurrent laryngeal nerve in all the dissections had a course closely resembling the text book descriptions. It divided into two terminal divisions at the level of the crico-thyroid joint in all the specimens (Fig. 7). The anterior division ran anteriorly on the lateral surface of the cricoid cartilage to gain the anterior surface of the lateral crico-arytenoid muscle which it supplied through a variable number of twigs and ultimately ended in the thyro-arytenoid muscle as it traversed farther. The posterior division was always very thin and short as compared to the anterior division. It ran posteriorly in close contact (almost adherant) with the cricoid cartilage under cover of the posterior crico-arytenoid muscle which it supplied by one or two short twigs and then ended in the transverse arytenoid muscle by winding round the muscular process of the arytenoid cartilage. In one specimen, the posterior division was not supplying the transverse arytenoid muscle and was found to end in the posterior crico-arytenoid muscle. In this specimen, an independent branch was seen to arise from the fork between the anterior and posterior divisions to supply the transverse arytenoid muscle.

In some of the dissections, the posterior division was found to give out certain sensory twigs also, *viz.*, to the mucosa around the arytenoid cartilage and the ascending sensory communicating branch (*vide infra*).

Other branches observed in the intra-laryngeal part of the nerve in some of the dissections, (branches to the inferior constrictor, to posterior crico-arytenoid and to crico-thyroid

joint) were found to arise as the nerve lay on the cricoid cartilage before its terminal division which occurred a little higher at the level of the crico-thyroid joint.

The recurrent laryngeal nerve in its extra-laryngeal part, as it lay in the tracheo-oesophageal groove was seen to give, besides numerous tracheal and oesophageal branches, an important laryngeal branch which was present in 22 out of 25 dissections. The number and the level of this branch varied —the former being one to three (Fig. 2 & 8) and the latter, 1st to 4th tracheal rings. Only in three subjects the branch was arising intra-laryngeally (Fig. 9). This branch has conventionally been described as the ascending communicating branch of the recurrent laryngeal nerve (Fig. 2, 3, 4 & 7). It ran upwards, inclining posteriorly to reach the lower border of the inferior constrictor muscle. After its entry into the larynx, it sank into the mucosa covering the posterior part of that muscle and ascended within it to communicate with the descending, inferior division of the internal laryngeal nerve, thus forming the Loop of Galen. The table below summarises the other details about the branch:

TABLE No. 5

The ascending sensory communicating branch of the recurrent laryngeal nerve

Origin	Number			Total
	1	2	3	
(A) Extra-Laryngeal origin ...	20	1	1	22 (88%)
(B) Intra-Laryngeal origin ...	3	—	—	3 (12%)

DISCUSSION

Internal Laryngeal Nerve.—It will be evident from Table 1, that the internal laryngeal nerve before piercing the thyro-hyoid membrane, besides giving certain sensory twigs to the mucosa covering the middle and the inferior constrictors, also gave muscular twigs to the inferior constrictor in two specimens (Fig. 2 & 3).

This observa tion, although made only in a very small percentage of subjects, is important because it suggests that the nerve is not purely sensory.

Authors have differed regarding the number of sub-divisions of the nerve as it lies embedded in the mucosa of the pyriform fossa. Thus (Gray 1954) states that it divides into two main sub-divisions, while Pan (1932), Ziegelman (1933), and Cunningham (1937) are of the opinion that it breaks up into three sub-divisions. Others like Schafer and Symmington (1898), Wood Jones (1946) and Hollinshead (1954) do not mention any specific number of sub-divisions. Our findings in the present work regarding the sub-divisions of the internal laryngeal are in agreement with those of Pan (1932), Ziegelman (1933) and Cunningham (1937), that is to say, the nerve divides into three sub-divisions (Fig. 1).

Regarding the distribution of the superior division, Pan (1932) holds that it supplies the mucosa of the epiglottis and its folds. Cunningham (1937) thinks that it also supplies the back of the tongue near the mid line. Both agree that the middle division innervates the mucosa of the side wall of the larynx. Hollinshead (1954) who does not mention any definite number of divisions, states that the internal laryngeal nerve breaks up into a number of twigs supplying the mucous membrane of larynx, laryngeal surface of epiglottis, an area around the root of the tongue, possibly the pharyngeal mucosa on the posterior surface of larynx, but not the pyriform sinus which according to Dandy (Quoted by Hollinshead) is supplied by the IX crainal nerve.

As would be evident from tables 2 and 3, our findings regarding the distribution of the superior and middle divisions are that both are purely sensory and that the superior division supplies the mucosa of the vallecula, or vallecula + epiglottis in a majority (22 out of 25) of dissections. In a small number of dissections (3 specimens) the superior division also furnished twigs to the pyriform fossa: The middle division in the shape of

various patterns of distribution (*vide* table 3), supplied the mucosa of epiglottis, ary-epiglottic folds, vestibule and side wall and saccule and vocal cords. In fewer specimens (3 out of 25) however, the mucosa of the pyriform sinus also derived innervation from the middle division. Certain facts stand out on considering these observations. The most important of them all is that the pyriform fossa may receive its supply from the internal laryngeal nerve through its superior and middle divisions and even the inferior division (*vide* table 4, Fig. 9). This finding is not in agreement with the descriptions of Dandy (Quoted by Hollinshead 1954). Another notable fact is that the superior and middle divisions are purely sensory and that they overlap in as far as their supply to the mucosa of the epiglottis and vallecula is concerned. Further, the details of the splitting of the middle division usually into three branches, the formation of a ganglion—like confluence or a loop by the union of two of these branches in some of the specimens and the constancy of the branch to the mucous membrane of the vocal cords (Fig. 2 & 3) are rather fascinating, being not described in the available earlier literature.

The inferior division of the internal laryngeal nerve was found to be mixed in all the dissections. The sensory supply from this division was limited to the mucosa of the posterior wall of the larynx, pyriform fossa, mucous membrane over arytenoid cartilage and the posterior crico-arytenoid muscle (*vide* table 4, and Fig. 2, 3 & 4). Only in one subject did the inferior division supply a twig to the mucosa of the vocal cords (Fig. 10) and in this specimen there was no such twig furnished by the middle division as was observed in the rest of the dissections. The sensory branches of the inferior division arose either from the division directly or from the Loop of Galen. The Loop of Galen as mentioned earlier, was present in all our dissections (100%) as against Williams (1951, 1954) who reports absence of this loop in one fourth of his 60 dissections. Lemere (1932) has studied this nervous anastomosis in great detail and his finding that the anastomosis forms various patterns, ranging from a simple Loop (Fig. 3 & 7), to a complicated network

Showing Nerve Supply of Larynx

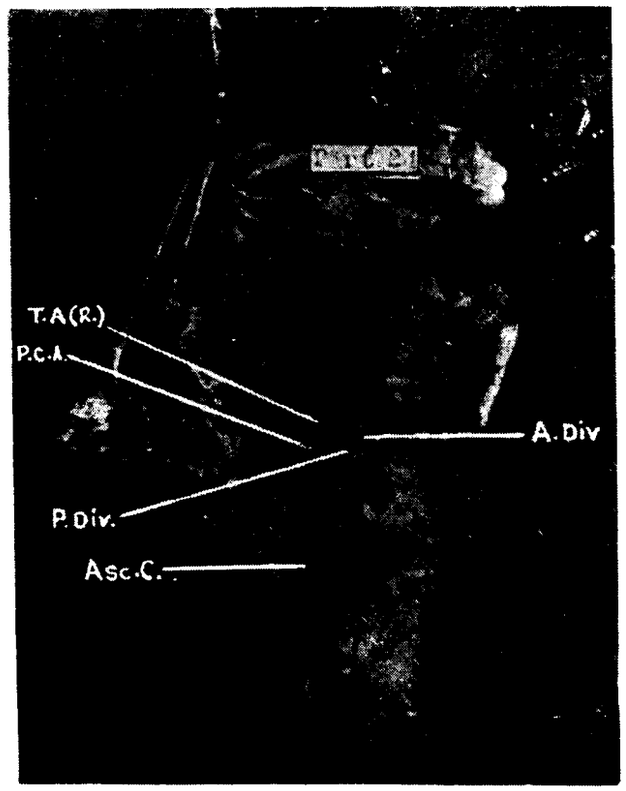

Fig. 7

A. Div. = Anterior division of Recurrent laryngeal nerve.

Asc. C. = Ascending communicating branch of recurrent laryngeal nerve.

P. C. A. = Muscular twig to posterior crico-arytenoid muscle from posterior division of recurrent laryngeal nerve.

P. Div. = Posterior division of recurrent laryngeal nerve.

T. A. (R) = Branch to transverse arytenoid muscle from posterior division of recurrent laryngeal nerve.

Showing Nerve Supply of Larynx

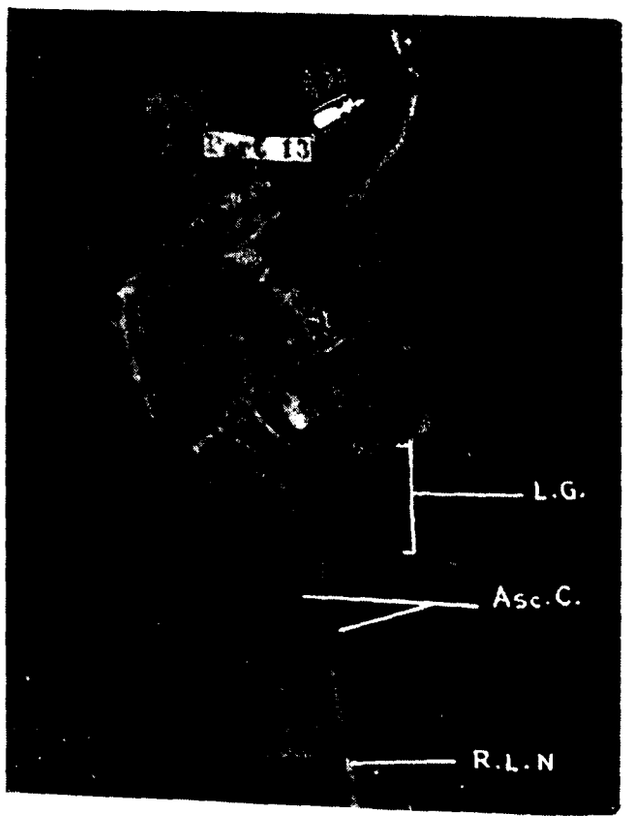

Fig. 8

Asc. C. = Ascending communicating branch of recurrent laryngeal nerve.

L. G. = Loop of Galen.

R. L. N. = Recurrent laryngeal nerve.

Showing Nerve Supply of Larynx

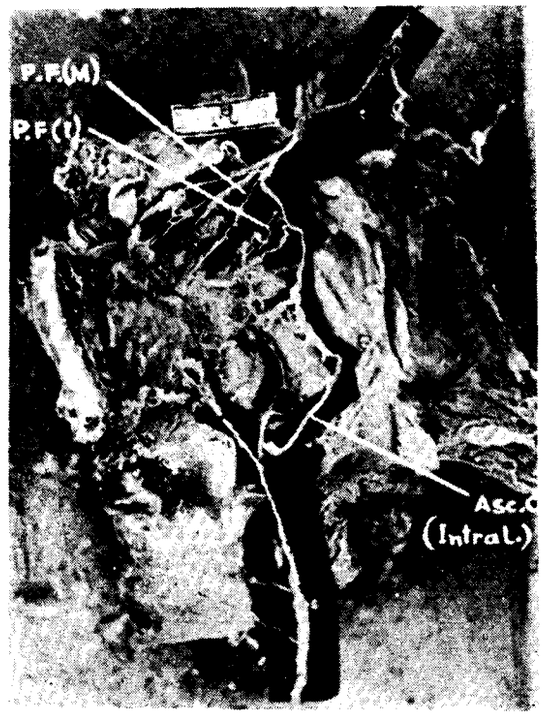

Fig. 9

Asc. C. (Intra L.) = Ascending communicating branch of recurrent laryngeal nerve arising intra-laryngeally.

P. F. (I) = Branches to pyriform fossa from Inferior division of internal laryngeal nerve.

P. F. (M) = Branches to pyriform fossa from middle division of internal laryngeal nerve.

Showing Nerve Supply of Larynx

Fig. 10

I. Div. = Inferior division of Internal laryngeal.

L. G. = Loop of Galen.

M. Div. = Middle division of Internal laryngeal.

V. C. = Branch to mucosa of vocal cord arising from Inferior division of Internal laryngeal.

(Fig. 2 & 8), has been confirmed by us during the present work. It appears that it supplies chiefly the mucosa of the posterior wall and the pyriform fossa. In no dissection could we rtace any branches from it to the upper oesophageal mucosa as suggested by Lemere (1932).

The motor innervation of the laryngeal muscles by the internal laryngeal nerve has been the main point of dispute among the various authors. Thus Exner (1884), Hyrtl (1885), Dilworth (1921), New (1923), Greene (1924), Berlin and Lahey (1929) Pan (1932), Ziegelman (1933), Todd (1938), Vogel (1952), Mitchell (1953), Gray (1954) and Tomasch and Britton (1955) are among those who believe that the internal laryngeal also supplies motor branches to the transverse arytenoid muscle. Berlin and Lahey (1929) dissected 12 human larynges and demonstrated in all of them, motor twigs from internal laryngeal to the transverse arytenoid muscle, while Ziegelman (1933) performed dissections on 7 larynges and noted similar twigs in 6 out of 7 subjects. Todd (1938) and Vogel (1952) histologically demonstrated motor end-plates on the internal laryngeal nerve in the transverse arytenoid muscle. The views and findings of all of them strongly suggest the possibility of the nerve having a motor component. The opponents of this view are Blalock and Growe (1926), Cunningham (1937), Hofer and Jascheck (1940), Murtagh (1955), Jones (1946), King and Gregg (1948), Grant (1952), Hollinshead (1954), Thomson and Negus (1954) and Last (1956). Among these, the remarks of Hofer and Jascheck (1940) and Hollinshead (1954) are worth special reference. They hold that certain branches from internal laryngeal nerve do pierce the transverse arytenoid muscle, but do not end there to supply it. They only pass through the muscle to end in the neighbouring mucosa. Williams (1951, 1954), who studied 6 blocks of muscle—nerve tissue, could not demonstrate any motor end-plates on the internal laryngeal in the transverse arytenoid muscle and so he held the view that while branches from the internal laryngeal do end in the muscle, they are probably sensory (proprioceptive). He has further corroborated

his view by reporting electrical stimulation studies in two patients for block dissection of the neck, where no movements of the vocal cords could be elicited by the stimulation of the internal laryngeal nerve.

In the present work, it was noted in all the dissections that the inferior division of the internal laryngeal nerve was the carrier of the motor fibres for the transverse arytenoid muscle. That these branches going to the muscle were actually motor was finally confirmed by demonstrating motor end-plates on the internal laryngeal in the transverse arytenoid muscle (Fig. 5 & 6).

Recurrent Laryngeal Nerve.—The main controversy about this nerve is in its nature and level of terminal division. A study of the literature reveals that there are some who do not commit any thing about the terminal divisions or branches of the nerve and are satisfied by saying that the nerve supplies all the intrinsic muscles of the larynx except the crico-thyroid. Amongst these are Schafer and Symington (1898), Onodi (1902), de Beule (1902, 1903), Lemere (1932, 1933, 1934), Pan (1932), Grant (1952), Mitchell (1953), Gray (1954), Thomson and Negus (1955) and Last (1956). Those who describe a definite terminal division of the nerve into two motor components are Semon (1881), Lahey (1938, 1944), Weeks and Hinton (1942), Jones (1946), King and Gregg (1948), Armstrong and Hinton (1951), Hollinshead (1954) and Bowden (1955). According to them the nerve terminally divides into an anterior adductor and a posterior abductor division. They are however, not of the same opinion regarding the level of this division. Thus Jones (1946) believes that the division takes place intra-laryngeally about the level of the crico-thyroid joint. Lahey (1938, 1944), Weeks and Hinton (1942) and Armstrong and Hinton (1951) state that the nerve divides into adductor and abductor or more divisions extra-laryngeally. The figures quoted by Weeks and Hinton (1942) in their own dissections are 78% specimens having extra-laryngeal division about the level of the lower pole of thyroid gland. Armstrong and Hinton (1951) report the figure to be 73%.

Williams (1951, 1954), Sunderland and Swaney (1952 and) Ramaswamy (1959) are among those who believe that the nerve does divide extra-laryngeally, but not into two motor components. According to them, the posterior division is invariably sensory and the anterior division or the main trunk of the nerve contains all the adductor as well as abductor fibres within it, only to be branched out intra-laryngeally at the level of the crico-thyroid joint. Here, they state, that the anterior division (main trunk of the nerve) gives off a short branch which runs posteriorly and supplies the posterior crico-arytenoid muscle and another to the transverse arytenoid muscle. The remaining anterior division goes and supplies the lateral crico-arytenoid and the thyro-arytenoid muscles.

Our findings in the present work are more or less in agreement with those of Williams (1951, 1954), Sunderland and Swaney (1952) and Ramaswamy (1959) except for a minor difference of nomenclature which in our opinion is less confusing and more conventional. We like to call the sensory 'Posterior division' as the ascending communicating 'Branch' of the recurrent and not a separate 'Division' because it arises as an off shoot like any other branches in that region such as the tracheal and oesophageal branches. The component labelled as the 'anterior division' by them has been considered as the main trunk of the recurrent laryngeal nerve by us being the continuation of the parent trunk. In the intra-laryngeal part, they describe a 'Branch' which runs posteriorly to supply the posterior crico-arytenoid muscle. We have preferred to call it the 'Posterior division' of the recurrent laryngeal nerve because it is here at this point that the nerve seems to split up terminally. Of course, in all our dissections except one, where there was a separate branch for the transverse arytenoid muscle, the same 'Posterior division' after supplying twigs to the posterior crico-arytenoid muscle, goes on to end in the transverse arytenoid muscle (Fig. 7). The part of the nerve called by them the 'Remaining anterior division' after the issue of the 'Branches' to the posterior crico-arytenoid and the transverse arytenoid muscles, has been labelled as the 'Anterior division' by us and

has the same supply in all our dissections as described by them *viz.* the lateral crico-arytenoid and the thyro-arytenoid muscles. This nomenclature has been used by most authors like Schafer and Symington (1898), Berlin and Lahey (1929), Lemere (1932, 1933, 1934), Jones (1946), King and Gregg (1948) and Gray (1954) and we feel no need to alter it as it only creates more confusion without any additional advantage.

In the present work, we have noted a sensory ascending communicating branch arising extra-laryngeally from the recurrent in 22 out of 25 dissections (88%). The branch was not necessarily single in all these subjects and the level of origin varied from the 1st to 4th tracheal rings. The actual divisioning of the nerve into an anterior (adductor) and a posterior (abductor + adductor + sensory) division took place inside the larynx about the level of the crico-thyroid joint. Only in one specimen as already pointed out, the posterior division did not supply the transverse arytenoid muscle and ended in the posterior crico-arytenoid muscle. In this dissection, an independent branch arose from the fork between the anterior and posterior divisions to supply the transverse arytenoid muscle. This type of arrangement, though reported in all their dissections by Williams (1951, 1954), Sunderland and Swaney (1952), and Ramaswamy (1959) was found only in 1 out of 25 of our dissections.

SUMMARY

Dissections on 25 specimens of the human larynx by the unaided eye and the stereoscopic dissection microscope have been done to elucidate its innervation. In two fresh autopsy room materials, histological studies by Carey's gold chloride staining method has been done to demonstrate the motor end-plates on the internal laryngeal nerve in the transverse arytenoid muscle. Following are the notable features:-

(1) The internal laryngeal nerve has been seen to divide into 3 main divisions—the superior, middle and inferior, as it lay in the pyriform fossa.

(2) The detailed patterns of sensory distribution by the three divisions including the formation of Loop of Galen have been described.

(3) The constant nature of the branch to the mucous membrane of the vocal cords has been noted.

(4) The inferior division of the internal laryngeal nerve has been discussed with particular note of its muscular branches to the transverse arytenoid muscle.

(5) The ascending communicating branch of the recurrent laryngeal nerve and also the terminal divisioning of the nerve have been discussed, explaining certain terminological differences in that connection.

ACKNOWLEDGEMENTS

Our thanks are due to Dr. M. L. Bhatia, M.S., D.L.O., Lecturer, Department of Otolaryngology, K. G.'s Medical College, Lucknow, for his help in the work. We are also thankful to Dr. B. N. S. Bhatnagar, M.S., Lecturer, Department of Anatomy, K. G.'s Medical College, Lucknow, for his valuable suggestions.

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The Nose in Relation to Head and Face- An Anthropometric Study

BY

INDRA BHARGAVA & J. C. SHARMA,

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The nose is a distinctive feature of human physiognomy. Its shape, form and contour have stimulated the anatomist and the anthropologists alike. The variations in the form of the nose are greater than those found in the cranium and much greater than the body variations as a whole (Proetz 1941).

The importance of the nasal index in anthropological determination has been recognised for a long time (Broca and Topinard 1878). This index distinctively differs from other anthropological indices, in being based upon both bony and cartilaginous landmarks. Thomson and Buxton have shown that average nasal index of a group shows a direct relationship with the temperature and the relative humidity of the area.

The growth of the neurocranium takes place mainly in the early years of childhood and is dependent upon the growth of cerebral hemispheres. Hartz (1909) has shown that the facial growth has two major periods, one upto 8 years of age and the other from puberty to maturity. Upto first five years, the growth takes place chiefly in breadth, being more pronounced in lower than upper part of face (Young 1937), and from fifth to eighth year the growth occurs mainly in length. Proetz 1941 has further shown that growth of the face begins round about the nasal cavity. Despite this differential growth, these three structures reach some equilibrium in adults.

With these facts in view, the present study was conducted as an attempt to establish a correlation, if any, between the nose, face and the head.

MATERIAL AND METHODS

One hundred adult males, belonging to the Barela tribe were subjected to anthropometric measurements of head, face, and nose. The measurements recorded include head length and breadth, total facial and physiognomic facial heights, bizygomatic and bigonial diameters, nasal height, breadth and prominence. All these measurements were done according to Martin's Lehrbruch de Anthropologie 1957.

OBSERVATIONS AND COMMENTS

Some correlation exists between the proportions and diameters of face and nose, for instance a long narrow face is associated with a long nose and a short broad face with a short broad nose. Similarly a broad head goes with a broad face and a narrow head with a narrow face. The huge nose of the Iranian plateau type is in harmony with the general size and the massive bony - structure of an elongated face. Similarly the characteristic nasal form of the long headed oval faced - brunette of Mediterranean subrace is leptorrhine.

A mathematical expression has been sought to explain the harmony of head, face and the nose, by correlating the various measurements of these parts, and the respective indices derived from them. The coefficients of corelation-r, were calculated by the scattered diagram method. Correlations based on the transverse and vertical diameters and on the indices have been separated out for a more systematic study.

The four transverse diameters giving the four coefficients of variations on table I are, the maximum breadth of the skull, facial breadth (bizygomatic), nasal breadth and bigonial diameter.

CORRELATION OF TRANSVERSE DIAMETERS

TABLE I

Traits.	No.	r	t
1. Nasal breadth and head breadth ...	100	0·100	1·11
2. Nasal breadth and facial breadth (bizygomatic).	100	0·153	1·5
3. Bigonial and facial breadth (bizygomatic) ...	100	0·310	3·4
4. Head breadth and facial breadth (bizygomatic).	100	0·350	3·7

The four correlations computed from the four transverse diameters on the head and face are positive. A marked correlation exists between the head breadth and face breadth ($r = 3·7$). The correlation between the bigonial and bizygomatic diameters is also significant. There is no significant correlation between head breadth and nasal breadth and nasal and facial breadths.

Adjacent diameters on the whole show a higher relationship, as is indicated by the head and face breadths and face and jaw breadths. Distant diameters like nasal breadth and head breadth show insignificant or no correlation.

CORRELATION OF LONGITUDINAL DIAMETERS

TABLE II

Traits.	No.	r	t
1. Nasal height and head length ...	100	0·25	2·66
2. Nasal height and Phys. facial height ...	100	0·512	6·02
3. Nasal height and Morph. facial height ...	100	0·452	4·86

Correlations between nasal height and head length and nasal height and facial heights is positive. The significance of the latter is much more pronounced than the former, proving once again that the adjacent heights bear a greater relationship than the distant ones. The nasal height and the facial heights are structurally and apparently dependant upon each other.

The number of correlations with the nasal breadth as one variable was increased by calculating the coefficient of their diameters with face breadth and head breadth. The coefficients of correlation using these two diameters, apparently not depending on the size of the face are according to our expectations. Head breadth and face breadth showed very slight or no degree of correlation with nose breadth.

After being convinced of existence of a definite relationship between the measurements of the face and nose and head, as brought out above, the authors decided to correlate the indices pertaining to head, face and nose.

CORRELATION IN INDICES

TABLE III

Index.	No.	r	t
1. Nasal and cephalic indices ...	100	0·28	3·04
2. Nasal and total facial indices ...	100	0·273	2·84
3. Nasal and Phys. facial indices ...	100	0·158	1·52

The correlation of nasal index with cephalic and the facial indices is positive. It is however, interesting to note that the nasal and cephalic indices are significantly correlated despite the absence of a correlation between the nasal and head breadths. On the other hand, the value of r in nasal and physiognomic facial indices is not significant, whereas the nasal height and the

physiognomic facial heights show a marked degree of correlation. From the last observation, it might be inferred that the height of the forehead, which is involved in the total facial height-physiognomic, is not structurally dependant on the nose height or the morphological facial height.

As a result of this study, significant correlations have been established between adjacent diameters and adjacent heights of the head, face and the nose, showing the structural interdependence of these parts. These results are likely to be of greater significance in a homogenous or purely endogamous population. On the other hand, heterogeneity of the population is very likely to modify the results due to racial inter-mixture.

CONCLUSIONS

1. A significant correlation exists between face and nasal heights, nasal height and the head—length, facial and head breadths, nasal and cephalic indices and nasal and morphological total facial indices.

2. There is no significant correlation between nasal and facial breadths, nasal and head breadths and nasal and physiognomic facial indices.

3. Significant correlation has been established between adjacent heights and diameters and a slight or no correlation in distant diameters.

ACKNOWLEDGEMENTS

The authors are very much indebted to Principal B. N. B. Rao, B.SC., M.B., B.S., F.R.C.S., F.I.C.S., etc. Principal, G. R. Medical College, Gwalior and Prof. I. P. Agarwal, M.S., Professor of Anatomy, G. R. Medical College, Gwalior for their valuable guidance from time to time.

ABSTRACT

As a result of anthropometric study of nose, head and face of 100 adult males, significant correlations have been established between face and nasal heights, head length and nasal height, facial and head breadth, nasal and cephalic indices and nasal and morphological total facial indices. It has also been shown that there is no significant correlation between nasal and facial breadths, nasal and head breadths and nasal and physiognomic facial indices.

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DR. R. N. MISRA, M.S.

Present President

(1958–59)

Association Notes

The 12th Annual Conference of the Association of Otolaryngologists of India will be held at Baroda from January 3rd to January 6th, 1960 and there may be Operative demonstrations on 6th January 1960. The Conference has been fixed in the earlier part of January owing to difficulty in getting proper accommodation for the delegates during the later part of January.

The following is the Tentative Programme:

Sunday 3–1–1960

7-00 p.m. Governing Body Meeting.

8-30 p.m. Dinner.

Monday 4–1–1960

Breakfast at the place of Residence.

9-00 a.m. Registration of Delegates.

9-45 a.m. Group Photograph of the members.

10-00 a.m. Inauguration—Gandhi Memorial Hall.

11-00 a.m. Coffee Interval.

11-15 a.m. Joshi Memorial Lecture by Dr. Verhoeven "Tympanoplastic Surgery" — Gandhi Memorial Hall.

12-45 p.m. Lunch at Baroda Medical Union Hall.

2-00 p.m. Inauguration Scientific Session by Dr. P. V. Cherian.

Symposium — Malignancy — Paranasal Sinuses—

Opener: Dr. K. K. Ghosh (Calcutta).

Anatomy and Physiology—

Dr. A. Sinha (New Delhi).

Pathology—

Dr. Tulsi Das (Amritsar).

Clinical Aspects—

Dr. P. N. Sinha (Patna).

Radiological Diagnosis and Therapy—

Dr. V. Shanta (Madras).

Monday 4-1-1960		Surgical Treatment— Drs. Taneja (Amritsar), R.A.F. Cooper (Bombay) & Joe DeSa (Bombay).
	5-30 p.m.	Garden Party—University Gardens by Vice-Chancellor, M. S. University.
	8-00 p.m.	Presidential Dinner (Dr. R. N. Misra).
	9-30 p.m.	Entertainment—Gandhi Memorial Hall. (One Hour Programme).
Tuesday 5-1-1960	Breakfast at the place of Residence.	
	9-00 a.m. to 12-30 p.m. Scientific Session.	
	1-00 p.m.	Lunch—Medical College.
	2-00 p.m.	Scientific Session.
	3-15 p.m.	Visit to Alembic Chemical & Glass Works.
	5-15 p.m.	Tea at Alembic Colony.
	8-00 p.m.	Dinner.
	9-30 p.m.	Entertainment—Gandhi Memorial Hall. (One Hour Programme).
Wednesday 6-1-1960	9-00 a.m.	General Body Meeting. (Followed by Visit to Ajwa Lake).
	1-00 p.m.	Lunch.
	3-00 p.m.	Visit to *Sarabhai* Chemicals.
	5-00 p.m.	Tea at Sarabhais.
	8-00 p.m.	Dinner.
	Dispersal Arrangements from 10 p.m. onwards.	

Dr. Verhoevan is likely to Operate—*Tympanoplasty*—The date and time will be notified later.

Joshi Memorial Lecture

As Dr. Bocca is unable to come. The "Joshi Memorial Lecture" will be delivered by Dr. L. Verhoeven from Antwerp, Belgium.

BOOK REVIEW

"LA CHIRURGIE DE LA SURDITE son etat actual, son avenir"

["Deafness Surgery" written in French]

BY

G. PORTMANN, M. PORTMANN et G. CLAVERIE.

The surgery of deafness has expanded particularly in the last few years owing to several surgical techniques, especially the *tympanoplasties* and the *surgery of the stapes*. The indications of the functional surgery are considerably widened by these methods.

This work is divided in three parts. After the definition of the surgery of deafness the authors study the physiology of the transmission system, then, by turn, the problems raised by the tympanoplastic techniques and those of stapedian surgery.

Physiology: it is explained under an essentially surgical angle and schematized in four points which will constitute for the micro-surgeon a veritable "check list".

—a membrane vibrating and protector of the round window: the tympanum (the tympanic effect);

—a solid contact between this membrane and the labyrinthic fluids: the chain of the ossicles (the columellar effect);

—two windows on both sides of the cochlear canal: the round and oval windows (the action of the windows);

—an indirect and valid ventilation: the Eustachian tube.

Tympanoplasties: after a short history, the anatomo-pathologic and physio-pathologic aspects of otitis and their after-effects are considered. The clinical, audiometric and radiologic tests are reviewed; these descriptions permit the statement of the indications of the tympanoplasties.

After a technical chapter going into very great detail, a schematization of the tympanoplasties is studied according to the classification of *Wullstein* (types I, II, III, IV, V).

The results obtained by a great many authors are summarized in a large chart (inquiry made by the authors in April, May, June 1959) and their own results show that the tympanoplasty can, from the functional point of view, improve or maintain hearing in more than 70% of the cases. The problems it still raises and the failures are then analyzed.

Stapedian Surgery: a very complete history shows the considerable work that the authors of the XIX century had accomplished in this field. Nearly all the present techniques had some forerunners before 1900.

In an anatomic chapter in which the connections of the stapedo-vestibulary and endolabyrinthic organs are stated precisely in great detail in order to warn the micro-surgeon against damageable gestures, the anatomo-pathology is especially analysed in connection with the description of the seats of disorder and that of their localization. Lastly, from the physiological point of view, the authors review the experimental work hearing on the stapedian surgery, as well as those that were pursued in the Laboratory of Otology of their nursing home. It appears from this research that after the mobilization, reankylosis is likely to appear and that every method of deankylosis should aim not only to mobilize all or part of the platina of the staple but also at keeping this mobile portion in solid contact with the ossicular chain.

The clinical, functional and radiologic, and the surgical indications derived from them are then reviewed.

In the technical chapter, the ideas and methods of most of the authors are mentioned in regard to the simple mobilizations as well as to stapedio-lyses, osteotomies, fenestrations etc. The work insists particularly on the method of "interposition" of Michel *Portmann* which consists in deankylosing the staple and interposing a graft between the oval window and this ossicle in order to prevent reankylosis.

In the chapter of results a large chart gives statistics of a great many authors (publications and personal communications to the investigation made by the authors in April, May, June 1959). Actually it may be said that with the most modern methods the results are more than 80% successful and even reach 90% and even 95% in the cases of interpositions.

The analysis of the stapedian techniques and of the fenestration of the posterior labyrinth shows that the latter has certainly not totally fallen into disuse for it is possible that after several years the results of the stapedian surgery should fall rapidly from the fact that the operatory act is done in contact with the sick center.

The conclusion of the authors is that the surgery of deafness must today to reestablish the hearing system as near as possible to the normal system. Every technique should try its utmost to satisfy the functional principles of the system of transmission. The surgeon should stay in contact with the physiologist.

The work of *MM. G. Portmann, M. Portmann et G. Claverie* constitutes an objective and clear restatement of the whole problem of surgery of deafness as regards tympanoplasties and the stapedian surgery. At the present time it is fair to say that it is the most comprehensive work on these questions.

Sectional Seminars

EAR NOSE & THROAT

CONVENER

Dr. R. A. F. COOPER,

Professor of E. N. T., Sir. J. J. Group of Hospitals and Grant Medical College, Bombay.

REPORTER

Dr. PREM CHANDRA,

Professor of E. N. T., Government Medical College, Patiala.

The Seminar was held on 13th February 1959 at the office of the Medical Council of India. In all about 10 specialists in the subject took part in the discussion. The members from Calcutta had a discussion with their local colleagues and they represented the consolidated view point of all the specialists of Calcutta. The discussion was free critical and prolonged. The conclusions arrived at and mentioned below were unanimous.

I had circulated a programme of 17 items for discussion at the Seminar—copy enclosed.

Item I.—How to obviate the scarcity of specialists in E. N. T.?

To obviate paucity of specialists in otolaryngology three solutions were suggested:

(*a*) That the Status should be made attractive by dissociating it from General Surgery and Ophthalmology. At present at many places it is tagged on either to General Surgery or Ophthalmology. The maximum that an E. N. T. specialist could aspire or would be, either, lecturership or assistant professorship. To start with a separate chair should be established for otolaryngology in all medical colleges, because this speciality has extended far and wide compared to its original size and scope. To expect a single teacher to handle both otolaryngology and ophthalmology would not be a sound practice because each one is fairly extensive by itself.

(*b*) That the diplomas should not be abolished where existing and should be restarted were abolished so that the demand of the district hospitals for practising specialists as apart from the teaching specialists could be adequately met with.

(*c*) Even in all non-teaching general hospitals E. N. T. posts should be held by specialists qualified and practising in the speciality only.

Item II.—Should universities be compelled to start a course where it is non-existent?

Some of the universities have still not started post-graduate training in this speciality thus standing in the way of its development. It was further felt at the discussion that the time has come when Medical Council should intervene and call upon all universities to attend to this urgent need, so that the growing demand for the specialists in the country could be met with.

Item III.—Should Diplomas co-exist with the degree courses or should be abolished where existing?

Diplomas should co-exist with the degree courses and should be immediately restarted where abolished. As pointed out under item I this will meet with the requirements of non-teaching hospitals (particularly the district ones) in an economical way.

Item IV & V.—Paucity of facilities for post-graduate training.

To overcome the paucity of facilities for post-graduate training and practical work by the candidates the recommendations are:

(*a*) E. N. T. department in each teaching institution should have adequate space for experimental work including that on animals, for audiology and rehabilitation of the deaf, section for endoscopy and other subspecialities, for a separate small out-patient theatre, and most essential being separate cubicals for each post-graduate student, in addition to the regular in-patient and out-patient sections and separate operation theatres.

(*b*) Adequate equipment should be provided which includes proper set of instruments for all E. N. T. experimental work embracing advanced temporal bone surgery—audiometers, group hearing aid, artificial hearing aids, sound proof room, equipment for animal work, speech therapy requisites etc.

(*c*) Adequate staff both medical and auxillary should be provided. The auxillary should include, audiologist, speech therapeutist, clinical photographer, steno-typist and record keeper.

Medical staff for a single unit attending to the needs of 20 indoor and 200 out-door patients (inclusive of old ones) on three days a week should consist of:

(1) Professor.
(2) An assistant professor.
(3) One senior and one junior registrars.
(4) Two House Surgeons.

To lessen the burden on teaching staff appointment of extra non-teaching out-patient staff is recommended.

(*d*) The programme of lectures, seminars, demonstration, practical work, journal meetings and pseudo examination should be chalked out at the commencement of the year at the University level.

(*e*) Adequate facilities for pathology, bacteriology, laboratory and radiology work should be provided by creating separate sections in the respective departments.

(*f*) An up-to-date sectional library with at least 4 standard journals in E. N. T. should be provided.

Item VI.—Should a separate examination in non-clinical subjects exist or should those subjects be included at the final examination?

For both Diplomas and Degree Examinations the non-clinical and the clinical subjects should be taken up at the same examination. Applied anatomy, physiology and pharmacology should form one separate paper. In addition to above for Diploma Examination there should be two papers in clinical subjects and for Degree Examination there should be two papers and one essay in the clinical subjects plus the dessertation. In the alternative a candidate may submit a thesis on his original work and when such contribution proves to be of a high order a part or whole of the theory examination may be condoned. In all cases the clinical—viva and operative examinations shall be compulsory.

Item VII.—Lack of uniformity of standard of training and examination.

For maintaining uniformity of standard of teaching and examination it was considered desirable that a syllabus and a minimum standard at the examination should be laid down by the Medical Council of India.

Item VIII.—Are theoretical and practical examinations necessary or only a certificate could serve the purpose?

A certificate of having worked in a recognised institution should not be considered as sufficient for an appointment of a specialist—A degree or a Diploma obtained after an examination is necessary.

Item IX.—Should there be a central board or panel of examiners?

The Council should prepare a panel of Examiners out of which the Universities may be requested to select its Examiners.

THE ASSOCIATION OF OTOLARYNGOLOGISTS OF INDIA

(Hyderabad Branch)

The General Body Meeting of Hyderabad Branch was held on 29th November 1959 and the following Office Bearers were elected :—

President Dr. A. B. N. Rao.

Secretary ... Dr. S. N. Jain.

Executive Committee Members :

Dr. P. Papatla (*Past President*).

Dr. S. S. Dounde.

Dr. K. Keshav Kumar.

Dr. M. G. Faruqui.

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