

Societies' Proceedings

With regard to the effects of blast, a patient had been severely wounded in Sicily in his right axilla and groin and came to the hospital for plastic treatment. He developed acute appendicitis, and appendicectomy was performed. Twenty hours later he had a respiratory rate of 33, he was cyanosed, and had a temperature which increased within an hour from normal to 103.8. He had no air entry into the right lower lobe, but no other signs of collapse of the lung. A suction catheter was of little use. Therefore bronchoscopy was done. The right lower lobe bronchus was found to be filled with sticky mucus, which was removed by suction. Respiratory rate came down to 20 immediately. Later radiological study of the chest demonstrated an emphysema of the right lung confined to the lower lobe. On forced expiration this lung failed to collapse, and the mediastinum shifted sharply to the left as the left lung collapsed. On this basis a diagnosis of obstructive emphysema was made. Bronchoscopy and lipiodol bronchograms failed to demonstrate any obstruction, but emphysematous areas were filled by the lipiodol. There was still no satisfactory reason for the failure of the lung to collapse, except the possibility of a blast effect, since the man was wounded by H.E. shell.

ABSTRACTS

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The Eustachian Tube: a review of its descriptive, microscopic, topographical and clinical anatomy. GRANT O. GRAVES and LINDEN F. EDWARDS. (*Arch of Otolaryng.*, May, 1944, No. 5, xxix.)

At the beginning of this detailed study the writers remark that a survey of the Eustachian tube seems timely in view of its importance in relation to some problems of aviation and submarine medicine.

The tube is often assumed to be straight, although the majority of textbooks of anatomy describe an obtuse angle of 160 degrees between the cartilaginous and osseous portions. The writers agree with Spileberg in regarding the course of the tube as an inverted S, as has been confirmed by roentgenograms from living material. All descriptions agree that the pharyngeal orifice is a vertical slit, which becomes triangular when the palate is raised, as during swallowing. The average distance of the orifice from the anterior nasal spine is 7.9 cm., from the posterior edge of the nasal septum 11 mm., from the vault of the nasopharynx and from the posterior end of inferior turbinal 1 cm. in each case. The cartilage of the tube is a triangular sheet, thickest inferiorly and narrowing gradually above to become a hook or crook, bounding the Eustachian canal above and in front. The antero-lateral and inferior walls of the tube are supported by the fibrous structure known as the salpingo-pharyngeal fascia. Various accessory cartilages have been described, related mainly to the floor of the tube. On transverse section the lumen of the tube, triangular at the

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pharyngeal end, becomes like an inverted comma as the isthmus is approached, and eventually is reduced to a narrow vertical fissure. The amount of ciliated epithelium lining the tube is variable and it may even extend into the middle ear. A lymphoid layer may be distinguished in the wall of the tube, especially towards the pharyngeal end, where it produces rugae or folds in the mucosa. The isthmus is that point where bone is formed inferior to the tube, the upper boundary being still cartilaginous. The mucosa of the osseous part is a thick muco-periosteum with few mucous glands and no lymphoid tissue. The carotid canal is close to this portion and the bone separating the structures may be deficient. Subtubal air cells are present in 90 per cent. of children up to 6 years of age and constitute one route of infection leading to the petrous apex. The action of the muscles related to the tube has been a subject of much discussion. They act upon the palate in the manner indicated by their names tensor palati and levator palati. The tensor palati, by its contractions, dilates the pharyngeal orifice of the tube; it is thus a dilator tubae. According to A. R. Rich, *no other muscle has any effect upon the tube.* The voluntary acts accompanied by opening of the orifice and lumen are swallowing, yawning, and sneezing. At rest, the tube is never completely closed, a small aperture remaining in the upper part of the lumen. There is a free blood supply to the tube from the tubal branches of the following arteries—ascending palatine, internal maxillary, ascending pharyngeal and middle meningeal. As for the sensory and vasomotor nerve supply, it is derived from the glosso-pharyngeal nerve (sensory), and from the sympathetic plexus on the internal carotid artery (vasomotor). The tensor palati muscle is supplied from the trigeminal nerve and the other muscles from the pharyngeal branch of the vagus nerve.

Studies of the tube by X-ray examination after the injection of iodized oil showed that the obstruction was in the central part of the cartilaginous canal in 90 per cent. of the affected tubes, at the isthmus in 7 per cent., and at the pharyngeal end in 3 per cent.

Developmental defects of the tube appear to be rare. Tumours have been reported but are not easy to diagnose. Carcinoma is the most frequent. It causes unilateral deafness, the result of secretory catarrh, and a feeling of fulness or pain in the ear. Metastases in the cervical lymph nodes may appear within three months. Foreign bodies in the tube are usually surgical instruments such as portions of bougie, applicator, etc.

Having thus discussed the anatomy and pathology of the Eustachian tube in the adult, the writers add a note on this structure in the new-born child. The infant's tube is one-half the length of that of the adult; it is straight, and horizontal in direction. The pharyngeal orifice lies close to the vault of the nasopharynx.

As the function of the tube is developed at birth, it is customary on air liners to encourage babies to suck a nipples water bottle so as to induce frequent swallowing. In the descent of sleeper planes, babies as well as adults must be awakened, as the rate of swallowing is only one in every three minutes when the infant is asleep.

Microscopic examination shows a profuse vascularity of the tubal orifice in the infant, also numerous mucous glands, and a subepithelial collection of lymphoid tissue, sometimes as large as to merit the term "tubal tonsil". This

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lies well within the tube and on the medial wall. The mucosa of the osseous portion is ciliated in the infant. A series of excellent microphotographs illustrates this portion of the paper.

The concluding section deals with the importance of the tube in aviation, etc. On the ground and in low-level flying, variations of pressure in the middle ear are readily adjusted by swallowing. An adult swallows once a minute when awake and once in five minutes when asleep. This rate is accelerated while chewing. During ascent in an aeroplane no difficulty is experienced, as the air within the tympanum readily escapes by way of the Eustachian tube. Descents from altitude almost always require some conscious act, such as swallowing, to ventilate the middle ear so as to equalize the barometric pressure. In rapid descent the continuous yell is favoured by dive bombers. During commercial flying, the rate of descent is limited to 500 feet per minute, which causes little or no discomfort to passengers. Only the sleeping air traveller or the drugged wounded soldier will suffer pain in the ears, even during slow descent. When the normal swallowing rate is not consciously accelerated, descents of 1,000 feet per minute may cause pain or even the clinical condition described by McGibbon as *aero-otitis*. Dive bombing descents up to 40,000 feet per minute bring out the complete picture of *aero-otitis*. The distress is not felt in the rarified atmosphere of the higher altitudes but begins at about 20,000 feet. According to McGibbon, the frequency of these aural symptoms in the air forces is 27 per cent. of the air crew personnel. Deafness is the most frequent as well as the most prolonged symptom. It is of the low tone variety (128 to 2048 D.V.) and lasts for four to twenty-eight days. Pain occurs in 61 per cent. of blocked tubes and it may be severe. Usually located in the ear, it may radiate to the cheek and temporal region. Tinnitus occurs in 5 per cent. and vertigo in 3 per cent. of the cases. The signs vary from slight reddening of the drum to intense congestion or even hæmorrhage. Treatment consists in the application of 1 per cent. ephedrine to the Eustachian orifice by means of an applicator. Inflation by the Eustachian catheter may help if the condition is not improving within several days. Should infection occur, incision of the drum may be necessary.

Studies of the ear in caisson workers is far older than aviation. There is no characteristic of the deafness. It has been found that the administration of 80 per cent. helium and 20 per cent. oxygen under positive pressure will prevent symptoms during decompression.

Only recently has there been any investigation of the effect of increased pressure on the ears of submarine crews. They are liable to symptoms identical with those of aviators or caisson workers. Deafness is partial or complete; pain, which may be severe, is almost a constant complaint, and tinnitus is frequent. Symptoms occur in about 10 per cent. of the men but permanent injury is very rare. Deep sea divers are seldom affected as they are lowered to the depths very slowly.

This important and comprehensive paper is illustrated by thirty figures and there is a bibliography of seventy-eight items.

DOUGLAS GUTHRIE.