

MORPHOMETRIC STUDY OF PHARYNGEAL ORIFICE OF AUDITORY TUBE AND ITS CLINICAL RELAVANCE

ABSTRACT

Background

The Auditory tube (AT) extends from the anterior wall of the middle ear to the lateral wall of the nasopharynx, approximately at the level of the inferior nasal concha. The pharyngeal orifice of AT being an important landmark for endoscopic avaiation in patients with chronic otitis and also for the transnasal approach to the infratemporal fossa, the present study was undertaken to locate the pharyngeal orifice of auditory tube in relation to the important anatomical landmarks in fetuses and adults.

Material and methods

The study was carried out on 25 sagittal head and neck sections of adult formalin fixed cadaversand 25 sagittal head and neck sections of fetuses. The anatomical landmarks with reference to AT taken were upper border of C1 vertebra, posterior end of hard palate (HP), midpoint of choana (PC), tip of uvula (U) and midpoint of floor of sphenoid sinus (SP). The distances from these landmarks to the pharyngeal orifice of AT were measured using digital vernier calipers.

Results

The mean and standard deviations of the distances were calculated and tabulated. All the measured distances were higher on left side except AT to SP in fetuses, whereas in adults all the distances were higher on left except for AT to U. Differences were not statically significant.

Conclusion

As the pharyngeal orifice of AT is an important landmark for endoscopic avaiation in patients with chronic otitis, so the present study would be useful to locate the pharyngeal orifice of AT in relation to important anatomical landmarks.

Keywords: auditory tube, hard palate, posterior choana, fetus

INTRODUCTION

The Auditory tube (AT) extends from the anterior wall of the middle ear to the lateral wall of the nasopharynx, approximately at the level of the inferior nasal concha. It is derived from the first pharyngeal pouch, which during embryogenesis forms the tubotympanic recess. The distal part of the tubotympanic recess gives rise to the tympanic cavity, while the proximal tubular structure becomes the AT.^[1] The key feature of the lateral wall of nasopharynx is the pharyngeal orifice of the AT. Located in the middle of the lateral wall, it is about 1.5 cm equidistant from the roof, posterior wall, choana and the floor. The tubalelevation (torus tubarius), formed by the elastic cartilage of the tube, is particularly prominent in its upper and posterior lip. Between AT and the posterior wall, lies the lateral pharyngeal recess or the fossa of Rosenmuller.^[2]

A portion of the tube proximal to the middle ear is made of bone; the rest is composed of cartilage^[3] and raises a tubal elevation, the torus tubarius, in the nasopharynx where it opens. It is known that the AT plays an important role in maintaining middle ear physiology and functions, and that the AT of an infant is short and located horizontally compared with that of an adult^[4]. These anatomical features are

speculated to be related to high susceptibility to otitis media with effusion (OME) in infants and children.

The pharyngeal orifice of AT being an important landmark for endoscopic evaluation in patients with chronic otitis and also for the transnasal approach to the infratemporal fossa, the present study was undertaken to locate the pharyngeal orifice of auditory tube in relation to the important anatomical landmarks in fetuses and adults.

MATERIAL AND METHODS.

The study was carried out in the Department of Anatomy, Kasturba Medical College, Manipal on 25 sagittal head and neck sections of adult formalin fixed cadavers (12 right and 13 left) and 25 sagittal head and neck sections of fetuses (13 right and 12 left). The anatomical landmarks with reference to AT taken were upper border of C1 vertebra, posterior end of hard palate (HP), midpoint of choana (PC), tip of uvula (U) and midpoint of floor of sphenoid sinus (SP). Land marks were pinned and then the distances from these landmarks to the pharyngeal orifice of AT were measured using digital calipers (Fig 1). Results were tabulated after statistical analysis.

RESULTS AND DISCUSSION

The present study was carried out using sagittal head and neck sections of adults (N=25) and term fetuses (N=25) sections. The mean and standard deviations of the distances were calculated and tabulated in table 1 and table 2. It showed all the measured distances were higher on left side except AT to SP in fetuses, whereas in adults all the distances were higher on left side except for AT to U. The differences were not statistically significant.

The auditory tube plays an important role in the ventilation of the middle ear^[5]. To prevent injury to the carotid artery during AT dissection, the surgeon should identify the junction of the cartilaginous and bony AT as a landmark by following the AT lumen from the nasopharyngeal orifice to the junctional part^[6].

Nasopharyngeal carcinoma (NPC) arises most often posterosuperiorly in the postnasal space in the region of the Fossa of Rosenmuller^[7]. Clinical examination, including endoscopic examination of the nasopharynx can provide valuable information on mucosal involvement and local tumor extension.

Small blockages of A.T. which create negative pressure in the middle ear can take to secretion aspirations of rhinopharynx to the tympanic cavity. In children, for having the widest, more horizontal and shorter A.T., the protection function is less efficient^[8, 9]

The tubal ostium has a lymphoid accumulation of tissue that forms tubal tonsil. The hypertrophy of this tonsil is observed and limited to the tubal ostium, Rosenmuller fossa and the posterior wall of the tubal orifice. The hypertrophy of the lymphoid peritubal tissue can distort the normal morphology of the tubal orifice. Sometimes it is difficult to distinguish tubal tonsil, the tubal ostium and the adjacent adenoidal tissue^[10]. We measured the distances from various anatomical landmarks in relation to nasopharyngeal orifice of AT so that it can be located in case of inflammatory conditions. This anatomical knowledge would be essential for the surgical procedures involving the nasopharynx.

TABLES

Parameters in cm	Right (N=13)	Left (N=12)
AT- C1	1.66±0.44	1.85±0.15
AT- HP	0.70±0.14	0.86±0.41
AT- U	0.91±0.07	0.93±0.48
AT-SP	1.35±0.14	1.26±0.32

HP- Hard palate, U- Uvula, SP- Midpoint of floor of sphenoid sinus, AT- Auditory tube opening

Table 1: Mean and standard deviations of the parameters measured in sagittal sections of term fetuses

Parameters in cm	Right side (N=13)	Left side (N=12)
AT- C1	2.41±0.46	2.27±0.47
AT- HP	1.74±0.35	1.80±0.42
AT- PC	0.94±0.56	1.25±0.47
AT- U	3.18±0.77	3.33±0.74
AT-SP	1.15±0.36	1.45±0.39

HP- Hard palate, PC- Posterior choana, U- Uvula, SP- Midpoint of floor of sphenoid sinus, AT- Auditory tube opening

Table 2: The mean and standard deviations of parameters measured in adult sagittal sections

FIGURE

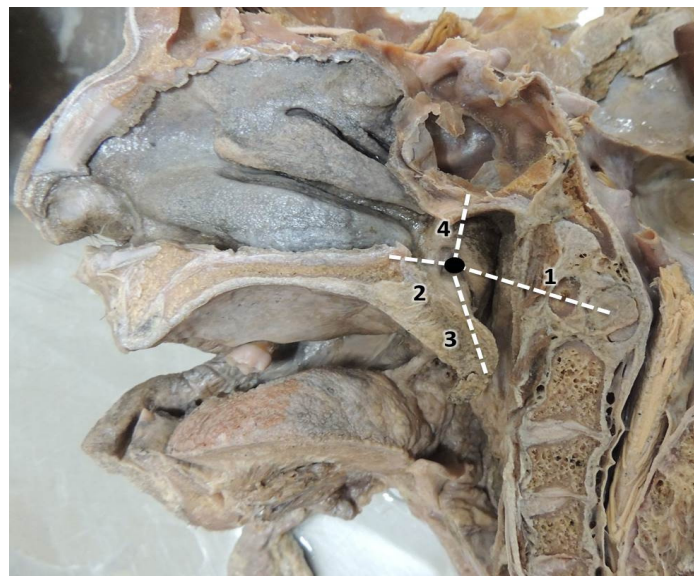


Figure legends: 1: AT to C1, 2: AT to posterior end of hard palate, 3: AT to tip of uvula, 4: AT to floor of the sphenoid sinus
AT- auditory tube

CONCLUSION

As the pharyngeal orifice of AT is an important landmark for endoscopic evaluation in patients with chronic otitis, so the present study would be useful to locate the pharyngeal orifice of AT in relation to important anatomical landmarks.

ACKNOWLEDGEMENT

The authors whole heartedly thank the postgraduates who helped in this study.

REFERENCES

1. Standring S. Grays Anatomy, The anatomical basis of clinical practice, 40th edn. Churchill Livingstone, 2008.
2. L E Loh, TSG Chee, AB John, The anatomy of the Fossa of Rosenmüller - Its possible influence on the detection of occult nasopharyngeal carcinoma: Singapore Medical Journal. 32: 154-553.
3. Sando I, Takahashi H, Matsune S, Aoki H. Localization of function in the eustachian tube: a hypothesis. Ann Otol Rhinol Laryngol. 1994;103:311-314.
4. Proctor B. Embryology and anatomy of the Eustachian tube. Arch Otolaryngol 1967;86:503-514.
5. Koch KHH. Skelett Wachstumsanalyse fünf Jahre nach Abschluß der Primärbehandlung von Kindern mit einer Segel-Gaumen-Vomer-Fehlbildung. Giesen, Germany: University of Giesen; 1994. Thesis.
6. Koch KHH, Grzonka MA, Koch J. The pathology of the velopharyngeal musculature in cleft palates. Ann Anat. 1999;183:123-126.
7. Sham JS, Wei WI, Zong YS, Choy D, Guo YQ, Luo Y, et al. Detection of subclinical nasopharyngeal carcinoma by fiberoptic endoscopy and multiple biopsy. Lancet 1990;7: 371-374.
8. Yanagisawa E, Joe JK. Endoscopic view of the torus tubarius. Ear Nose Throat Journal, 1999; 78(6):404-6. Bluestone CD, Alper CM, Buchman CA. Eustachian Tube, Middle Ear, and Mastoid Anatomy; Physiology, Pathophysiology, and Pathogenesis. Ann Otol Rhinol Laryngol Suppl, 2005; 194:6-30.
9. Jose Evandro Andrade, Prudente de Aquino, Dorothy Eliza Zavarezzi, Maria Rosa M. S. Carvalho, Julia Negro Prudente de Aquino. Endoscopic Evaluation of Pharyngeal Orifice of Eustachian Tube in Patients with Chronic Otitis. Minim Invasive Neurosurg. 2010;53(5-6):2619.

¹Vrinda Hari Ankolekar, ²Mamatha Hosapatna, ³Anne D Souza, ⁴Sushma R.K., ⁵Antony sylvan D Souza

^{1,2,3}Assistant Professor, Department of Anatomy, Katurba Medical College, Manipal University

⁴Lecturer, Department of Anatomy, Katurba Medical College, Manipal University

⁵*Professor and Head, Department of Anatomy, Katurba Medical College, Manipal University