MAK HILL Publications Research Journal of Medical Sciences

Research Article
doi:

OPEN ACCESS

Key Words
Dacryocystorhinostomy, lacrimal sac, nasolacrimal duct, intubations

Corresponding Author
Chaithra Girish,
Department of Psychiatry, National Institute of Medical Sciences and Research, Jaipur, India
anatomyshs@gmail.com

Author Designation
[1]ENT Surgeon
[2]Professor and HOD
[3,4]Assistant Professor

Received: 25 September 2023
Accepted:
Published:

Citation: Manish Bhargava, 2024. Thoughtfulness and Executive Functions of Children with Attention Deficit Hyperactivity Disorder with Learning Disabilities. Res. J. Med. Sci., 18: 187-190, doi::

Study on Morphometric Features of Nasolacrimal Canal and Groove in Adult Skulls and its Clinical Importance in Otorhinolaryngology

[1]M.K.Deepa, [2]Girish V. Patil, [3]B.R.Harsha and [4]Chaithra Girish
1Hutti Gold Mines Company Hospital, Hutti, 584115, Raichur, India
2,3Department of Anatomy, Chamarajanagar Institute of medical sciences, Chamarajanagar, 571313, Karnataka, India
4Department of Pharmacognosy, Government college of Pharmacy, 560002 Bangalore, India

ABSTRACT
Nasolacrimal canal is a bony canal accommodating nasolacrimal duct, this canal formed by indentations in the inferior nasal conchae, maxilla, and lacrimal bone. Nasolacrimal ducts drain the excess tears from the orbital cavity to the nasal cavity. Blockage of nasolacrimal duct leads to obstruction of draining of excess tears and cannot drain properly; this may lead to watery and irritated eyes. This condition can always happen. Treatment depends on the cause of blockage and age of the patients. Thirty five adult skulls were used in present study, both sides nasolacrimal ducts were studied, damaged skull any side excluded. These skulls were collected in routine dental and medical student's osteology classes. The length of nasolacrimal duct and width of nasolacrimal groove at the entrance and base were measured with vernier clippers and recorded the same. All the results were expressed in Mean+SD. The length of the nasolacrimal canal on the left side was 13.76+3.56mm and on the right it was 14.52+4.63mm. The width of the nasolacrimal groove at the entrance was 7.12+1.36mm on right and 6.96+2.06mm on left. The width of the groove at the base was 8.66+1.72mm on right and 8.12+1.26 mm on left. The knowledge about length of nasolacrimal canal and width groove at the base and entrance will be helpful to otolaryngologists. This knowledge is also helpful to emptying of blockage of nasolacrimal ducts in the canal surgically.

INTRODUCTION

The nasolacrimal canal is a short bony passage in the face along which the nasolacrimal duct courses . It is located laterally by the maxillary bone and medially by the lacrimal bone and the inferior turbinate . The lacrimal groove of the medial maxilla and the lacrimal hook of the lacrimal bone form the lateral wall of the canal, while the superior wall is formed by the lacrimal bone and the inferior wall by the lacrimal process of the inferior nasal concha bone . The nasolacrimal canal opens at the base of the lacrimal fossa.

Of all the bones in the human skeleton, the lacrimal is arguably the most delicate because of its morphological variability and microscopic size. It articulates with the frontal, ethmoidal, maxilla, and inferior nasal concha in addition to lying near the front margin of the orbit's medial wall. With four edges, it has two surfaces. The sharp anteriorly curved posterior lacrimal crest, terminating in the lacrimal hamulus, divides the lateral or orbital surface. Placing the translucent part posterior to the crest in the medial orbital wall anteriorly. When combined with the maxilla's frontal process, the region anterior to the crest forms the posteromedial wall of the nasolacrimal canal. The area posterior to the crest is where the lacrimal portion of the orbicularis oculi is attached. The medial, or nasal, surface forms part of the lateral wall of the middle meatus of the nose by covering the infundibulum and a portion of the anterior ethmoidofrontal air cells. It also completes the lateral wall of the ethmoidal labyrinth. The lower half features an articular area for the inferior nasal concha, and the majority of the surface has very thin patches that represent impressions of the sinus walls. The frontal bone is met by the tiny superior border, whereas the posterior border articulates with the ethmoid orbital plate. The inferior border contacts the orbital plate of the maxilla beneath the crest, while the anterior border articulates with the frontal process of the maxilla. It extends downward in front of the crest and articulates with the ethmoid's uncinate process and the inferior concha's lacrimal process, completing the nasolacrimal canal wall. The lacrimal sac is typically housed in a lacrimal fossa, which forms at the intersection of the maxilla and frontal bones, however its shape and borders are not always clear. The maxilla or ethmoid bones may assume the lacrimal's place to protect the orbit's medial wall if it is absent or rudimentary. The crest may differ in morphology and angulation, and the bone may only extend to the region just beneath the crest. Usually articulating at the orbital edge with the maxilla, the hamulus—which is more prevalent in males—can also meet the zygomatic bone's extended maxillary process. On all borders, perilacrimal ossicles exist between it and adjacent bones[1].

From the orbital fossa, the nasolacrimal duct bends ventromedially, passes through the foramen of the lacrimal bone and the infratrochlear incisure, enters the bony nasolacrimal canal medial to the maxillary bone next to the maxillary recess, and ends on the dorsomedial side of the naris. The nasolacrimal duct is close to the nasal cavities. Through the nasopharyngeal meatus and eustachian tubes, the nasal cavities are likewise intimately linked to the tympanic bulla. Disease of the nasal cavity can thus lead to disease of the bullae, and disease of the dental structures can therefore directly or indirectly influence the paranasal sinuses, the nasal cavity, and the nasolacrimal duct[2]. The goal of the current study was to determine the nasolacrimal canal's breadth in order to aid with nasolacrimal blockage surgical treatments.

Materials and Methods:

In this study, 70 unilateral adult dry skulls—35 on the left and 35 on the right—were evaluated for the nasolacrimal groove, the skulls were collected in routines osteology classes of dental and medical students, the length of nasolacrimal duct was measured with vernier callipers scale, The measurement of the breadth of the Nasolacrimal groove was conducted at both its entry and base. All the parameters were recorded in the table and expressed Mean +SD.

RESULTS AND DISCUSSION

We have measured the length of the nasolacrimal groove with help of Vernier callipers scale. The length of the nasolacrimal canal on the left side was 13.76+3.56mm and on the right it was 14.52+4.63mm. The width of the nasolacrimal groove at the entrance was 7.12+1.36mm on right and 6.96+2.06mm on left. The width of the groove at the base was 8.66+1.72mm on right and 8.12+1.26 mm on left (Table . 1)

To develop primary acquired nasolacrimal duct obstruction is mainly by Narrowing of the bony nasolacrimal canal. The nasolacrimal canal and groove is an important site to accommodate the lacrimal apparatus. The lacrimal apparatus includes the lacrimal gland, the lacrimal pathways consisting of puncta, lacrimal canaliculi, lacrimal sac and nasolacrimal duct. A bony portion is part of the nasolacrimal duct. The maxilla's frontal process and lacrimal bone compose the anterior and posterior halves of the bony route, respectively[3,4].

Table 1. Showing the length of nasolacrimal canal and width of nasolacrimal groove

Parameter	Right	Left
Length of nasolacrimal canal	14.52+4.63mm	13.76+3.56m
Width of nasolacrimal groove at the entrance	7.12+1.36mm	6.96+2.06mm
Width of nasolacrimal groove at the base	8.66+1.72mm	8.12+1.26 mm

In study of Shigeta K *et al.*[5] have reported the normal diameter of the bony nasolacrimal canal, and study on epiphora caused by obstruction of the nasolacrimal duct system, Their study revealed that the bony lacrimal duct's calibre and the angle between it and the nasal floor generally increased with age, especially before the age of 40. They also discovered that mucosal adhesion, debris accumulation, and tear flow stagnation may occur from nasolacrimal duct narrowing.Their research suggests that chronic inflammation of the nasolacrimal drainage system may be predisposed in females due to the narrowness of the bony nasolacrimal canal and the acute angle between the bony nasolacrimal canal and the nasal floor[5].

The nasolacrimal duct is a drainage system that carries tears from the eye to the nasal cavity. The bony nasolacrimal duct is a part of this system that is formed during embryonic development. According to the American Academy of Ophthalmology, the lacrimal drainage structures begin to form during the fifth week of gestation as a crease between the frontonasal and maxillary processes, the nasolacrimal groove. A solid cord of ectodermal tissues separates from the surface and enters this groove. This tissue canalizes and forms the lacrimal sac and nasolacrimal duct. The lacrimal canaliculi form by a similar process. Canalization begins around the eighth week of gestation and continues until birth. Canalization occurs along the entire system at the same time[6].

The present study we have conducted in 35 adult dry skulls. The length of the nasolacrimal canal on the left side was 13.76+3.56mm and on the right it was 14.52+4.63mm. The width of the nasolacrimal groove at the entrance was 7.12+1.36mm on right and 6.96+2.06mm on left. The width of the groove at the base was 8.66+1.72mm on right and 8.12+1.26 mm on left.

According to Ipek E *et al.*[7] and Takahashi Y *et al.*[8] studies the width of nasolacrimal groove at the entrance was ranged between 4.1-6.1mm, middle one-third of nasolacrimal groove was reported as mean 8.04 ± 2.05 mm and the base of nasolacrimal groove was recorded as a mean 5.94 ± 1.28 mm. In study of the Gkionoul N C[9] middle part of nasolacrimal groove was evaluated into two parts as upper one-third (right: 5.85 ± 1.06 mm; left: 5.45 ± 1.29 mm) and lower one-third (right: 6.60 ± 1.54 mm; left: 6.23 ± 1.48 mm). In the same study they also calculated the width of nasolacrimal groove at the entrance and the width of nasolacrimal groove at the base, as mean 6.15 ± 1.17 mm and 6.41 ± 1.52 mm, respectively. In the study of Takahashi Y *et al.*[8] sixty-four percent of the cadavers examined had the shortest width at nasolacrimal groove at the entrance . In study of Gkionoul N C *et al*[9] the shortest width in roughly half of the dry bones 71 skulls out of 150 skulls. According to Groessl SA[10] study, width at the entrance of nasolacrimal groove, which is most commonly affected by nasolacrimal duct obstruction, is reported to be shorter in width in females than in males. As a result, primary acquired nasolacrimal duct obstruction appears to be a complex disease involving multiple causes in females as well as most found in aging females [10]. In the Sahni SS *et al*[11] study, the mean minimum A-P diameter of the nasolacrimal duct was 1.96 ± 0.56 mm (1-3 mm).

CONCLUSION

The human nasolacrimal ducts are a borderland of the disciplines ophthalmology and otorhinolaryngology, which work closely together in the treatment of nasolacrimal disorders. During recent years a bulk of new diagnostic and the rapeutic methods, such as nasolacrimal endoscopy, laser-assisted dacryocystorhinostomy, trans canalicular surgery, and interventional radiological therapies, have been applied to the nasolacrimal system. Our study finding may be helpful in otorhinolaryngology practice.

REFERENCES

1. Cunningham, C., L. Scheuer and S. Black, 2016. The skull. Dev. Juveni. Osteol., 1: 43-148.
2. Lennox, A.M. and E. Mancinelli, 2020. Respiratory Disease. 1st Edn., Elsevier, ISBN-13: 9780323484350, Pages: 200.
3. Purevdorj, B., U. Dugarsuren, B. Tuvaan and B. Lkhagvasuren, 2022. Morphometric evaluation of bony nasolacrimal canal in mongolians with primary acquired nasolacrimal duct obstruction. Cent. Asian J. Med. Sci., 8: 30-38.
4. Bulbul, E., A. Yazici, B. Yanik, H. Yazici and G. Demirpolat, 2016. Morphometric evaluation of bony nasolacrimal canal in a caucAsian population with primary acquired nasolacrimal duct obstruction: A multidetector computed tomography study. Korean. J. Radiol., 17: 271-276.
5. Shigeta, K.I., 2007. Sex and age differences in the bony nasolacrimal canal. Arch. Ophthalmol., 125: 1677-1681.
6. Gregg, T.,M.D. and Lueder,, 2015. Nasolacrimal duct obstruction in children.
7. Ipek, E., K. Esin, K. Amac, G. Mustafa and A. Candan, 2007. Morphological and morphometric evaluation of lacrimal groove. Anatomical. Sci. Int., 82: 207-210.
8. Takahashi, Y., H. Kakizaki and T. Nakano, 2011. Bony nasolacrimal duct entrance diameter: Gender difference in cadaveric study. Ophtha. Plast. Reconstr. Surg., 27: 204-205

9. Gkionoul, C., Nteli, 2023. Anatomical evaluation of the nasolacrimal groove in 150 dry bones in the Anatolian population, 08 November 2023, PREPRINT, https://www.researchgate.net/publication/375503113_Anatomical_evaluation_of_the_nasolacrimal_groove_in_150_dry_bones_in_the_Anatolian_population.
10. Groessl, S.A., 1997. An anatomical basis for primary acquired nasolacrimal duct obstruction. Arch. Ophthalmol., 115: 71-74.
11. Gupta, T., S.S. Sahni and R. Goyal, 2014. Surgical anatomy of nasolacrimal duct and sac in human cadavers. An. Int. J. Clin. Rhinol., 7: 91-95.