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Research Article

MORPHOMETRIC VARIATIONS OF BONY NASOLACRIMAL DUCT ACCORDING TO AGE AND GENDER USING COMPUTERIZED TOMOGRAPHY IN BENGHAZI, LIBYA

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Abstract

Background: The purpose of the nasolacrimal system is to drain tears from the ocular surface to the lacrimal sac and, ultimately, the nasal cavity. Blockage of the nasolacrimal system can cause tears to flow over the eyelid and down the cheek; this condition is epiphora. **Objectives:** To determine the normal diameters of the bony canal and to assess whether there is an association between the diameter of the bony canal and primary nasolacrimal duct obstruction. **Methods**: Cranial computerized image (CT) of 112 patients (75 male and 37 female) were examined, the length and transverse diameters of the base and apex were estimated. After collection and checking of data, statical package of social science (SPSS) was used for data entry and analysis. **Results**: A total 112 patients were evaluated in this study (ranged 2 to 86 years) with median age was 32 years, the right TD of the apex and base were more in male compared to female, the left TD of the apex and base were more in male than female, the length in the right and left sides were more in male compared to female with P vale 0.01 statically significant. All parameters were more in adult age group compered to children but statically not significant. **Conclusion:** This study provides useful information of morphometric features of bony nasolacrimal canal, the transverse diameter of BNLC at the base was significantly shorter in women than in men which may be a possible factor contributing to be the higher incidence of chronic inflammation of nasolacrimal drainage system. The detailed anatomical knowledge on nasolacrimal canal morphology may help the clinicians plan the treatment options.

Keywords: Nasolacrimal canal, Cranial CT, Length and transverse diameter.

INTRODUCTION

The nasolacrimal duct (also called the tear duct) carries tears from the lacrimal sac of the eye into the nasal cavity.[1,2] The duct begins in the eye socket between the maxillary and lacrimal bones, from where it passes downwards and backwards. The opening of the nasolacrimal duct into the inferior nasal meatus of the nasal cavity is partially covered by a mucosal fold (valve of Hasner or *plica lacrimalis*).[3] Obstruction of the nasolacrimal duct may occur.[4,5,6] This leads to the excess overflow of tears called *epiphora* (chronic low-grade nasolacrimal duct occlusion).[7] A congenital obstruction can cause cystic expansion of the duct and is called a dacryocystocele or *Timo cyst*. Persons with dry eye conditions can be fitted with punctual plugs that seal the ducts to limit the amount of fluid drainage and retain moisture. Detailed anatomical knowledge is of great clinical importance to understand the etiology of the obstruction and the success of treatment techniques. There are numbers of studies that are evaluating the morphometric properties of the NLD. The NLD has different anthropometric characteristics among populations. (8,9) Considering craniometric features of the NLD during a surgical treatment is of great importance for a successful surgery and improving quality of post-operative period.

Aims of the study: The purpose of this study was to determine the normal diameters of the bony canal and to assess whether there is an association between the diameter of the bony canal and primary nasolacrimal duct obstruction.

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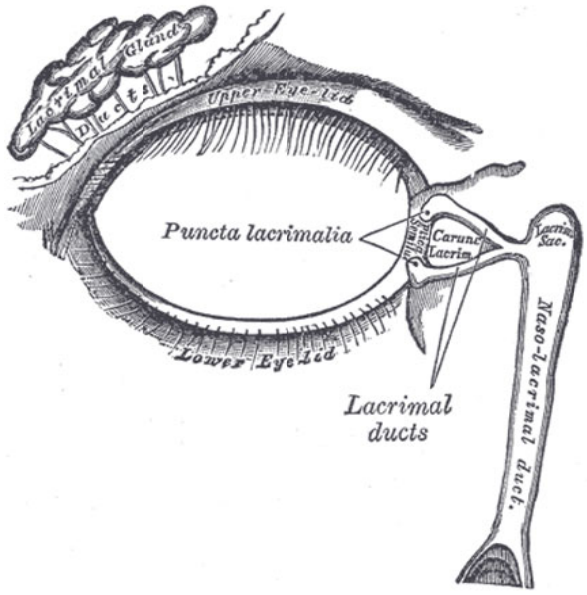

Figure 1. The anatomy of nasolacrimal duct

Subject and methods

- CT image of 112 patients were reviewed retrospectively in this research
- The place of study was Benghazi city - Libya at the department of radiology in AL Jala hospital where patients are referred from other health care facilities for radiological examination and diagnosis.
- The data collected during the period from January 2018 to December 2018.

- Inclusion criteria of cases; male and female patients whom brain CT scan was recommended by their physicians.
- Exclusion criteria of cases; patients with history of sinusitis, facial trauma or nasolacrimal duct pathology were excluded from the study.
- A record sheet was used to collect data, included: age, gender, bilateral TD of the apex and base and the length of the NLD
- CT machine was used; its model was Fast acquisition and high-quality multi-slice CT (General Electric slice CT). The axial and coronal images were used to determine the localization of nasolacrimal duct and its measurements.
- The approval of the director of the hospital was taken before reviewing the records and collection of required data with consideration of confidentiality of the data.

Statistical analysis

The Statistical Package for Social Sciences (SPSS); 21.0 program was used for statistical analysis of the measurement results. From these measurements, means, Standard Deviation (SD), minimum and maximum values were calculated Comparison between age groups and gender was performed using P value.

RESULTS

112 patients were in the study; 66.96% (75patients) were males and 33.04% (37 patients) were females.

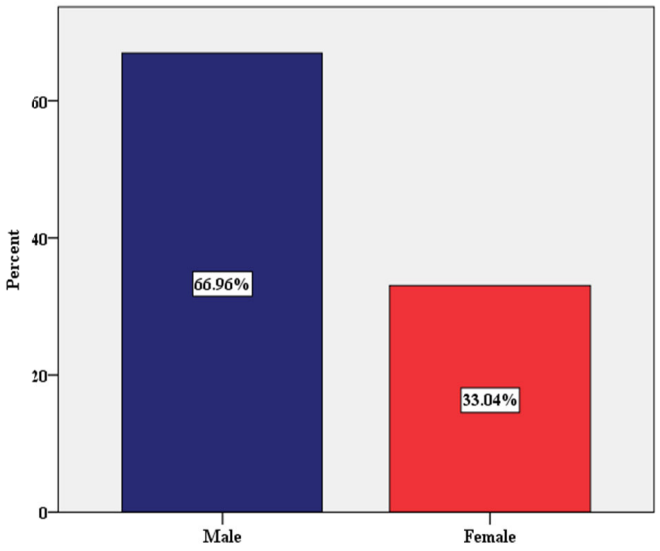

Figure 2. Distribution of studied participants according to their gender

Table 1 shows that males were 75 participants, youngest age was 2 years and the eldest was 85 years. Their median age was 32.0 years and mean ± standard deviation (SD) was 37.01±18.18 years and mode were 60.0 years. Females were 37 participants; youngest age was 5 years and the eldest was 86 years. Their median age was 34.0 years and mean ± standard deviation (SD) was 42.89 ± 23.94 years and mode were 18.0 years. Applying Mann Whitney U test, which is a non-parametric test used when the variable is not normally distributed, P = 0.369. There is no statistically significant difference between both genders regarding their mean age.

Table 1. Descriptive statistics of participants

Age in years	Mode	Median	Mean ± SD
Males	60.0	32.0	37.01±18.18
females	18.0	34.0	37.01±18.18

Table 2 shows that the mean ± SD of right transverse diameter of apex was more in males as compared to females' measurements 0.52 ± 0.10 cm vs 0.48 ± 0.10 cm. This difference was not statistically significant. P = 0.06.

Table 2. Distribution of measurements of participants' Right Transverse Diameter of Apex according to gender

Right Transverse Diameter of Apex in cm	Mean ± SD	P value
Males	0.52 ± 0.10	0.06
females	0.48 ± 0.10	

Table 3 shows that the mean ± SD of right transverse diameter of base was more in males as compared to females' measurements 0.87 ± 0.27 cm vs 0.78 ± 0.28 cm. This difference was not statistically significant. P = 0.10

Table 3. Distribution of measurements of participants' Right Transverse Diameter of base according to gender

Right Transverse Diameter of Base in cm	Mean ± SD	p value
Males	0.87 ± 0.27	0.10
females	0.78 ± 0.28	

Table 4 shows that the mean ± SD of left transverse diameter of apex was more in males as compared to females' measurements (0.51 ± 0.10 cm vs 0.50 ± 0.11 cm. This difference was not statistically significant. P = 0.80.

Table 4. Distribution of measurements of participants' Left Transverse Diameter of Apex according to gender

Left Transverse Diameter of Apex in cm	Mean ± SD	P value
males	0.51 ± 0.10	0.80
females	0.50 ± 0.11	

Table 5 shows that the mean ± SD of left transverse diameter of base was more in males as compared to females' measurements (0.91± 0.25 cm vs 0.77± 0.29 cm. This difference was statistically significant. P = 0.01.

Table 5. Distribution of measurements of participants' Left Transverse Diameter of base according to gender

Left Transverse Diameter of Base in cm	Mean ± SD	P value
Males	0.91 ± 0.25	0.01
females	0.77 ± 0.29	

Table 6 shows that the mean ± SD of right length was more in males as compared to females' measurements (1.26 ± 0.30 cm vs1.11± 0.25 cm. This difference was statistically significant. P = 0.01.

Table 6. Distribution of measurements of participants' Right length according to gender

Right Length in cm	Mean ± SD	P value
Males	1.26 ± 0.30	0.01
females	1.11 ± 0.25	

Table 7 shows that the mean ± SD of left length was more in males as compared to females' measurements (1.23 ±0.26 cm vs 1.09 ±0.27 cm. This difference was statistically significant. P = 0.01.

Table 7. Distribution of measurements of participants' Left length according to gender

Left Length in cm	Mean ± SD	P value
Males	1.23 ±0.26	0.01
Females	1.09 ±0.27	

Table 8 shows that the mean ± SD of right TD of apex was more in adult participants compared to children's measurements (0.51±0.10 cm vs 0.44±0.13 cm. This difference was not statistically significant. P = 0.06. The mean ± SD of right TD of base was slightly more in adult participants compared to children's measurements (0.84±0.27 cm vs 0.81±0.33 cm. This difference was not statistically significant. P = 0.67.

The mean ± SD of left TD of apex was more in adult participants compared to children's measurements (0.51±0.10 cm vs 0.46±0.11 cm. This difference was not statistically significant. P = 0.11. The mean ± SD of left TD of base was equal for both children & adult participants (0.86±0.28 cm vs 0.86±0.25 cm. There was no statistically difference. P = 0.94

The mean ± SD of right length was more in adult as compared to children' measurements (1.22 ± 0.30 cm vs1.15± 0.25 cm. This difference was not statistically significant. P = 0.48. The mean ± SD of left length was more in adult as compared to children' measurements (1.19 ± 0.27 cm vs1.07± 0.24 cm. This difference was not statistically significant. P = 0.16.

Table 8. Distribution of nasolacrimal canal participants' measurements of according to age groups

Nasolacrimal canal morphology	Age groups	N	Mean	Std Deviation	P value
RT TD of apex in cm	Less than 18 y	10	0.44	0.13	0.060
	A8 y and above	102	0.51	0.10	
RT TD of base in cm	Less than 18 y	10	0.81	0.33	0.67
	18 y and above	102	0.84	0.27	
LT TD of apex in cm	Less than 18 y	10	0.46	0.11	0.11
	18 y and above	102	0.51	0.10	
LT TD of base in cm	Less than 18 y	10	0.86	0.25	0.94
	18 y and above	102	0.86	0.28	
RT length in cm	Less than 18 y	10	1.15	0.25	0.48
	18 y and above	102	1.22	0.30	
LT length in cm	Less than 18 y	10	1.07	0.24	0.16
	18 y and above	102	1.19	0.27	

Figure 3. Axial CT scan of male patient shows the TD of right and left base NLD

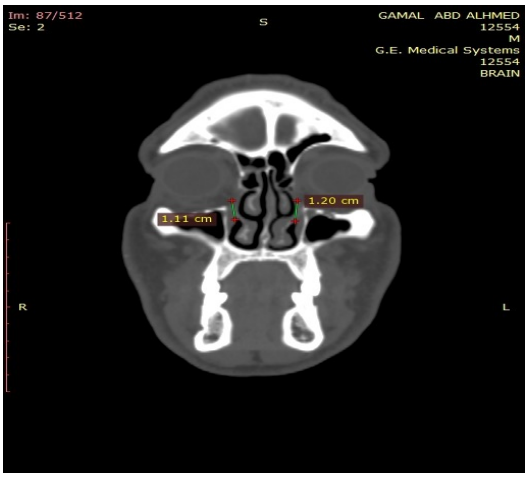

Figure 4. Coronal CT scan of male patient shows the length of right and left NLD

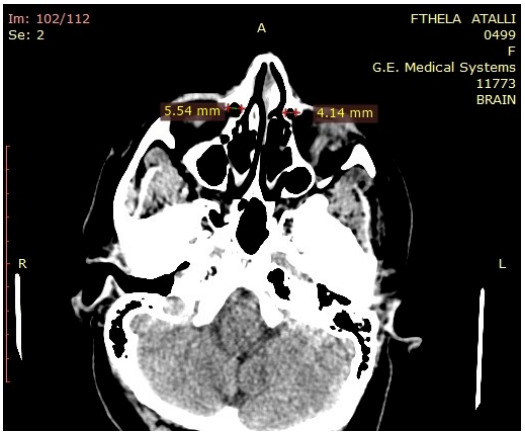

Figure 5. Axial CT scan of female patient shows the TD of the apex of the right and left NLD

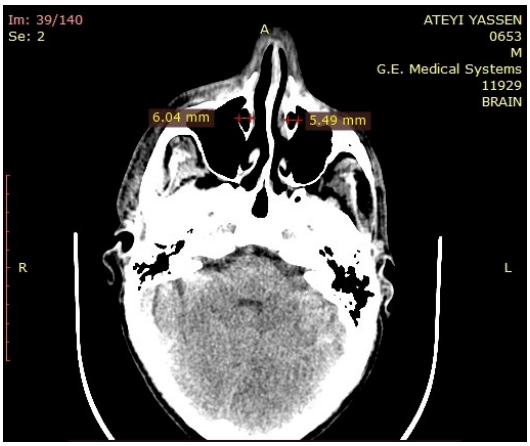

Figure 6. Axial CT scan of male patient shows the TD of right and left NLD

DISSCUSSION

In this study, the mean and standered deviation of transvese diameters of the right and left side o of nasolacrimal canal was more in males as compared to female measurment with stastically significant. Also the length parameter of the right and left NLC was more in male than in female with stastically significant 0.01, in the other hand there was no significant differences of all parameters according to age groups. Nicholas et al (USA) found the Nasolacrimal canal length and volume were significantly greater in men than those in women. A trend was noted for greater canal cross-sectional diameter in patients older than 50 years when compared with that in younger patients. Significant differences in canal diameters were noted at the canal apex and base of older patients compared with those of younger patients (10). Austin Mc Cormic and Brian Sloan (newzeland) found the same result with the presnt study (11). A G Janssen et al (Netherland) The difference between the mean minimum diameter in men (3.70 mm) and that in women (3.35 mm) was significant. The mean minimum diameter in the patient group was 3.0 mm, which was significantly smaller than that in the control group. There was, however, considerable overlap (12). Oluyemi Fesina et al (Neigeria. The mean difference in nasolacrimal canal diameter of 3.52 mm in male patients and 3.36 mm in female patients was found to be statistically significant ($t = 2.238$, $df = 400$, $p = 0.026$). There was no significant difference in the canal diameter across age groups. In addition, there was no significant difference in the diameter between the right and left sides in the authors' study population ($t = 1.551$, $df = 400$, $p = 0.122$) (13). In the other hand, Erdoghan Bulbul et al (Turkey)The mean minimum and distal end BNLD TDs measurements were significantly narrower in PANDO patients, both in PANDO and non-PANDO sides, as compared with the control group ($p < 0.001$ and $p = 0.040$, respectively); however, there were no significant differences between PANDO and non-PANDO sides within PANDO patients. The length, entrance TD, volume, coronal orientation type, sagittal orientation angle of BNLD, and relative lacrimal sac-BNLD angle were not significantly different between PANDO patients and control subjects, as well as between PANDO and non-PANDO sides within PANDO patients (14). Araz Server et al documented statistically significantly positive correlation between all measured diameters and ages ($P < 0.001$), whereas there was a negative association between mean angle and age ($P < 0.001$). Mean angle is defined as the angle between BNLD and nasal floor. The surface area of BNLD was found to be significantly increasing depending on age ($P < 0.001$). However, we could not find any significant association between gender and measured parameters ($P > 0.050$)(15) Ookumus found, the transverse diameter was 4.34 ± 1.03 mm. The sectional area of the bony nasolacrimal canal was 7.39 ± 3.29 mm2,. No significant difference transverse diameter and the sectional area of the bony nasolacrimal canal between ages (16)

Conclusion

This study provides useful information of morphometric features of bony nasolacrimal canal, the transverse diameter of BNLC at the base was significantly shorter in wmen than in men which may be a possilble factor contributing to be the higher incidence of chronic inflammation of nasolacrimal drainge system. The detalied anatomical knowladge on nasolacrimal canal morphology may help the clincians plan the treatment options.

REFERENCES

1. "Nasolacrimal System Anatomy: Embryology, Puncta, Canaliculi". 2020-02-19. {{cite journal}}: Cite journal requires |journal= (help)
2. ^ Herbert, Ronald A.; Janardhan, Kyathanahalli S.; Pandiri, Arun R.; Cesta, Mark F.; Miller, Rodney A. (2018). "Nose, Larynx, and Trachea". Boorman's Pathology of the Rat. Elsevier. pp. 391–435. doi:10.1016/b978-0-12-391448-`4.00022-8. ISBN 978-0-12-391448-4. S2CID 80517730.
3. "Medical Definition of PLICA Lacrimalis". Merriam-Webster Medical Dictionary. 2020-05-08. Retrieved 2020-05-08. an imperfect valve at the opening of the nasolacrimal duct into the inferior meatus of the nose
4. ^ Carreiro, J (2009). "Head and neck". Pediatric Manual Medicine. Elsevier. pp. 13–97. doi:10.1016/b978-0-443-10308-7.00002-8. ISBN 978-0-443-10308-7.
5. Stagner, Anna M., Jakobiec, Frederick A., Eagle, Ralph C., Charles, Norman C. (2018). "Infections of the Eye and Its Adnexa". Diagnostic Pathology of Infectious Disease. Elsevier. pp. 648–685. doi:10.1016/b978-0-323-44585-6.00021-7. ISBN 978-0-323-44585-6.
6. "Blocked tear ducts in infants" Archived 2012-07-08 at the Wayback Machine, Pediatric Views, June 2006.
7. Nerad, Jeffrey A.; Carter, Keith D.; Alford, Mark (2008). "Disorders of the Lacrimal System: Congenital Obstruction". Oculoplastic and Reconstructive Surgery. Elsevier. pp. 131–137. doi:10.1016/b978-0-323-05386-0.50010-7. ISBN 978-0-323-05386-0
8. Okumus O. Investigation of the morphometric features of bonynasolacrimal canal: a cone beam computed tomography study. Folia Morphol (Warsz) 2020;79:588–93.
9. Shigeta K, Takegoshi H, Kikuchi S. Sex and age differences in thebony nasolacrimal canal: an anatomical study. *Arch Ophthalmol,* 2007;125:1677–81.
10. Nicholas A Ramey 1, Jenny K Hoang, Michael J Richard. Multidetector CT of nasolacrimal canal morphology: normal variation by age, gender, and race
11. Austin McCormick 1, Brian Sloan. The diameter of the nasolacrimal canal measured by computed tomography: gender and racial differences
12. A G Janssen 1, K Mansour, J J Bos, J A CastelijnsDiameter of the bony lacrimal canal: normal values and values related to nasolacrimal duct obstruction: assessment with CT.
13. Oluyemi Fasina 1, Godwin I Ogbole CT assessment of the nasolacrimal canal in a black African Population
14. Erdogan Bulbul, Alper Yazici, Bahar Yanik, Hasmet Yazici, Gulen Demirpolat Morphometric Evaluation of Bony Nasolacrimal Canal in a Caucasian Population with Primary Acquired Nasolacrimal Duct Obstruction: A Multidetector Computed Tomography Study
15. Araz Server Ela, Kalaycik Ertugay Cigdem, Yesim Karagoz, Ozgur Yigit, Ecem Sevim LongurMorphometric Measurements of Bony Nasolacrimal Canal in Children
16. Ö OkumuşInvestigation of the morphometric features of bony nasolacrimal canal: a cone-beam computed tomography study.

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