Vol. XVII – Nr. 2 – 2018 **ORIGINAL PAPERS**

LACRIMAL GLAND FOSSA

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LACRIMAL GLAND FOSSA. ORIGINAL COMMUNICATION (Abstract) : The lacrimal glands are rarely surgically removed or examined during autopsy. Not even during the anatomical dissections the lacrimal gland is not frequently studied, this being the reason is why the configuration, dimensions and means of suspension of the lacrimal gland have not been updated until recently. Our paper purpose is to present the macroscopic and microscopic appearance of the lacrimal gland and the structures related to it at this level. The macroscopic study was performed by dissections on 5 formalized corpses, where the lacrimal fossa was approached up and down. In a study of 55 corpses of both sexes, Lorber M., Vidić B. demonstrated that the relation between the lacrimal gland and the lateral expansion of the levator palpebrae superior muscle aponeurosis may be variable, resulting in four divisional variants of the gland in the lobes. Inside the fossa, the gland is surrounded by an adipose tissue mass which contain fibrous condensations that fix the gland and form the Soemmering or the Schwalbe ligament, both being a way of suspending the gland.

Key-words : LACRIMAL GLAND, LEVATOR PALPEBRAE SUPERIOR MUSCLE, ORBIT, SUPPORT AND SUSPENTION OF THE GLAND

INTRODUCTION

The lacrimal glands are rarely surgically removed and in fewer cases are examined during autopsy. Neither during the anatomical dissections the lacrimal gland is not frequently studied, which is why the configuration, dimensions and means of support and suspension of the lacrimal gland have not been updated until recently (1).

With improved CT and MRI examinations of the orbit and surgical techniques, the detailed anatomical information of the region has become more and more necessary.

Our paper aims to present the macroscopic and microscopic appearance of the lacrimal gland and the connective tissue structures at this level.

With the evolution from aquatic life to terrestrial life, animals with cameral eyes with cornea developed of a wetting mechanism to maintain its transparency – the lacrimal apparatus.

In the course of evolution, for reasons yet incompletely elucidated, the lacrimal gland migrated to the lateral side, losing direct contact with excretory pathways and reaching the upper eyelid and lacrimal fossa in humans.

MATERIALS AND METHODS

The macroscopic study was performed by dissections on 5 formalized corpses, where the lacrimal fossa was approached up and down.

For lacrimal gland development issues, were used images from the department's collection.

The microscopic study of lacrimal gland was performed on images prepared from autopsy specimens. Given the difficulty in obtaining the pieces, they were harvested from a single male corpse and 56 years of age, with no known ophthalmological history.

The samples were processed according to the techniques for optical microscopy. Usual stains, hematoxylin-eosin and Masson's trichrom, were used.

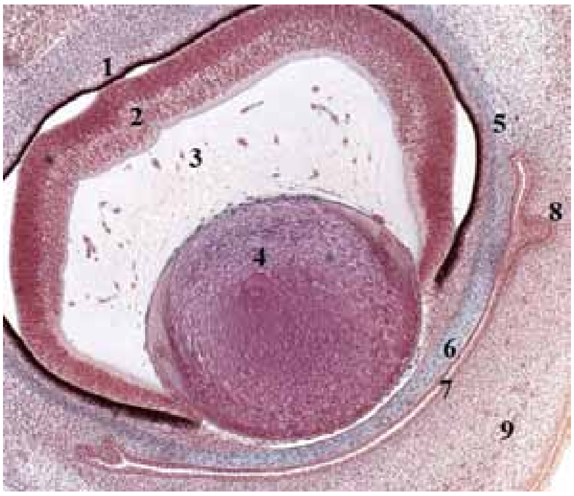

Fig. 1. Human Embryo 7th week : 1. Retinal pigmentary epithelium ; 2. Neuroretina ; 3. Primitive vitreous with branches of the hyaloid artery ; 4. Lens ; 5. Sclera ; 6. Cornea ; 7. Palpebral conjunctiva ; 8. Evagination of the lacrimal gland ; 9. Upper eyelid

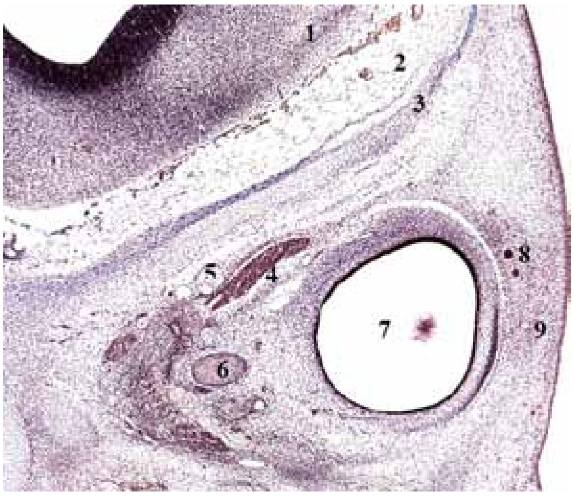

Fig. 2. Human embryo 7th week : 1. The wall of the prozencephalic vesicle ; 2. Primitive meninges with vessels from the dural vascular plexus ; 3. Desmocranium ; 4. The levator palpebrae superioris muscle ; 5. The frontal nerve ; 6. The optic nerve ; 7. The ocular globe ; 8. The buds of the tear gland ; 9. The eyelids

Optical microscopic images were carefully examined selected the most suggestive ones.

RESULTS AND DISCUSSIONS

With the evolution from aquatic life to terrestrial life, animals with cameral eyes with cornea required the development of a wetting mechanism to maintain its transparency – the lacrimal apparatus.

Phylogenetically, the first lacrimal gland that appears in the medial part of the lower eyelid is the Harder gland, whose secretion, predominantly sebaceous, has the role of lubricating the anterior pole and preventing the secretion of the conjunctive glands to evaporate. Then, the primary lacrimal gland appeared to supplement the serous secretion (2).

In the course of evolution, for reasons yet incompletely elucidated, the lacrimal gland migrated to the lateral side, losing direct contact with excretory pathways and reaching the upper eyelid and lacrimal fossa in humans. In parallel with the development and migration of the lacrimal gland and the development of the palpebral muscular apparatus, the nictitant membrane became atrophied, becoming the semilunar conjunctiva, and the Harder gland regressed and even disappeared (in some mammals and primates), sebaceous secretion being ensured by the development of Meibomius tarsal glands.

Ontogenetically, in humans, the lacrimal gland develops from epithelial buds of the ectoderm supero-lateral conjunctival fornix, which clogs in the adjacent lower mesenchyme, inferior to the desmocranium, and laterally by the preottic mezodermal condensation from which the levator palpebrae superior muscle differentiates, which will maintain a close relation with the gland (3). The mesenchymal condensation around these buds subsequently forms the stroma of the lacrimal gland and the ligaments that sustain it to the adjacent structures (fig. 1, 2).

During its development, the gland maintains a close relationship with the levator palpebrae superior muscle. Although they develop as an unitary structure (4) between the weeks 10-12, from the tendon of the levator palpebrae superior muscle will expand a mezodermal structure, the future aponeurotic expansion which will divide the gland in two lobs, orbital and palpebral (fig. 3). The lacrimal gland continues to develop until the age of 3-4 years.

The orbital part of the lacrimal gland is located in a osteo-fibrous area delimited as it follows (fig. 4, 5) :

- Supero-laterally to the lacrimal gland fossa, located in the anterior-lateral side of the orbital blade and on the medial face of the zygomatic process of the frontal bone
- Anterior the orbital septum (fig. 6), which is inserted anterior to the insertion of the lateral palpebral ligament, which determines the formation of the Eisler recess. In older ages, the alteration of the septum structure

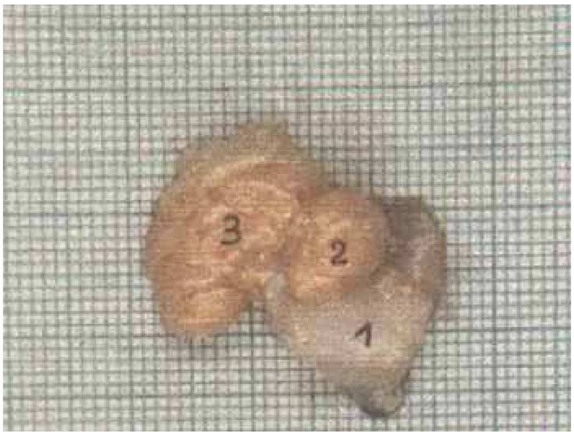

Fig. 3. Lacrimal gland harvested from unformolinized body : 1. Palpebral fragment with the upper tarsus, lateral horn of aponeurotic expansion of the levator palpebrae superioris muscle and muscle part of this muscle ; 2. Palpebral lobe ; 3. Orbital lobe

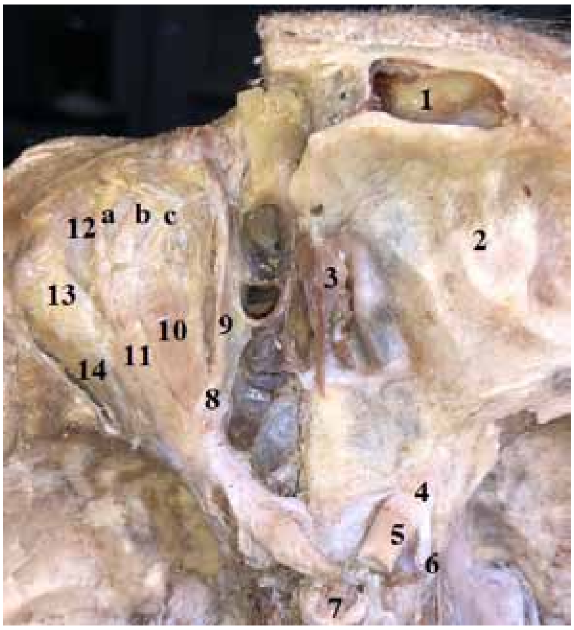

Fig. 4. Dissection of the orbite, superior approach, through the anterior fossa of the endobase : 1. Frontal sinus ; 2. Orbital frontal process ; 3. Apophisis crista galli ; 4. Optic channel ; 5. Optic nerve ; 6. Ophthalmic artery ; 7. Pituitary gland ; 8. Trochlear nerve ; 9. Superior oblique muscle (posterior part) ; 10. Levator palpebrae superior muscle ; 11. Frontal lateral, medial, supratrochear nerves ; 12. Aponeurosis of the levator palpebrae superior ; 13. Orbital lobe of the lacrimal gland ; 14. Lacrimal nerve, artery and vein in Schwalbe ligament

can lead to the protrusion of the extraconal fat or even the orbital part of the lacrimal gland (5).

- Posterior, to a conjuctival condensation that separates it from the extraconal fatty tissue occupying the Rochon-Duvigneaud (the posterior part of the lacrimal gland). When it is well represented, this condensation is inserted on a fine, transverse shaped-crest bone inside of the fossa (6).
- inferior-medial to the expansion of the aponeurosis of the levator palpebrae superior muscle (the lateral horn – fig.7) dividing the gland into the two lobes adhering to the glandular capsule, then inserting on the lateral edge of the orbital additus on the tubercle Withnall, where it changes fibers with external cantalum tendon.

In a study of 55 corpses of both sexes, Lorber M., Vidić B. (7) demonstrated that the relation between the lacrimal gland and the lateral expansion of the levator palpebrae superior muscle aponeurosis may be variable, resulting in four divisional variants of the gland in the lobes :

- I variant, the most common is what is described as classic
- Variation II consists of the presence of a very small palpebral lobe
- Option III consists of the presence of a very large palpebral lobe
- Rare variant IV consists of the presence of two almost equally lobes, the palpebral lobe being confused in this case with a patho-

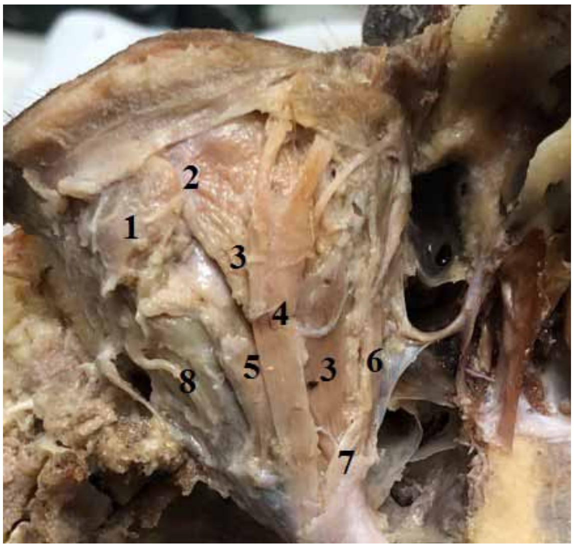

Fig. 5. Dissection of the orbite, superior approach, through the anterior lobe of the endobase : 1. The orbital lobe of the lacrimal gland ; 2. The levator papebrae superios muscle aponevrosis ; 3. Levator papebrae superios muscle ; 4. The frontal nerve ; 5. Rectus superior muscle ; 6. The superior oblique muscle (the posterior part) ; 7. The trochlear nerve ; 8. The lacrimal artery

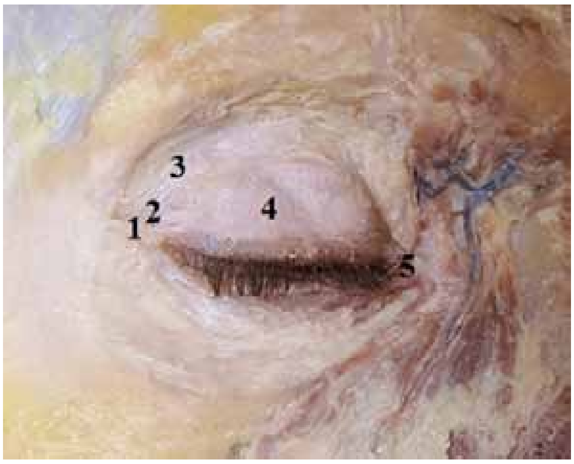

Fig. 6. Dissection of the orbit, anterior approach : 1. Lateral palpebral ligament or external cantalum tendon ; 2. Eisler recess ; 3. Orbital septum ; 4. Superior tarsus ; 5. Internal cantalum tendon

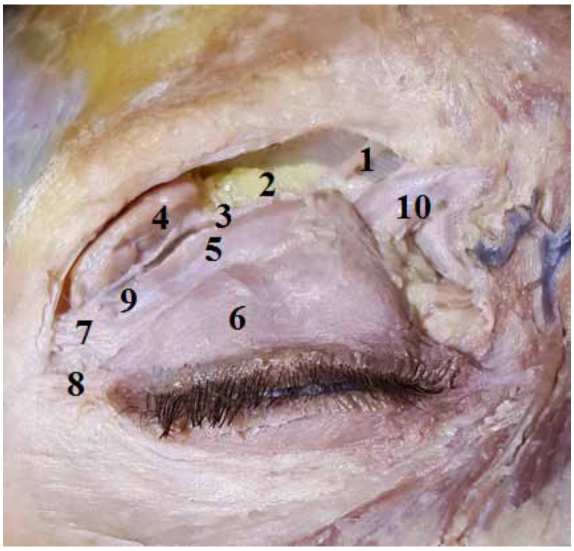

Fig. 7. Dissection of orbit, anterior approach : 1. Frontal nerve ; 2. Extraconal adipose tissue ; 3. Withnall ligament ; 4. Orbital lobe of the lacrimal gland ; 5. Levator palpebrae superior muscle ; 6. Upper tarsus ; 7. Lateral horn of the aponeurotic expansion of the levator palpebrae superior muscle ; 8. External cantalum tendon ; 9. Palpebral lobe of the lacrimal gland ; 10. Superior oblique muscle (anterior part)

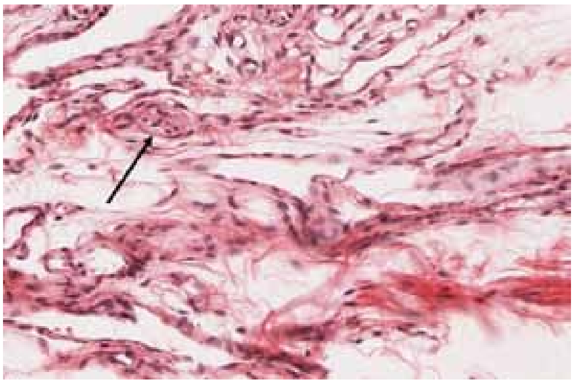

Fig. 8. Periglandal adipose tissue (HE coloration) An area with a dense vascular network (arteries, venules and capillaries sectioned longitudinally and transversally) and a nerve fiber bunch.

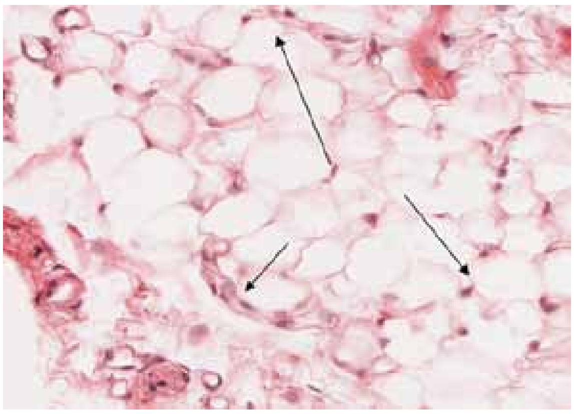

Fig. 9. Capillary network at the periphery of an adipose lobule. (HE coloration)

logical condition (tumor, dermoid cyst, subconjunctival prolapse of the palpebral lobe).

Inside the fossa, the gland is surrounded by an adipose tissue mass that belongs to the extraconal fat (fig. 8, 9) and where there are fibrous condensations that fix the gland on the periostum of the fossa and form the Soemmering ligament (fig. 10-11) or which can go together with the vasculonervous bundle of the gland, forming the Schwalbe ligament (fig. 4), which is also a way of suspending the gland.

Another fibrous condensation with the role of supporting the lacrimal gland is the ligament described by Withnall in 1910 and redefined by Fink in 1959 as the upper transverse ligament (8) – condensation of the levator palpebrae superior muscle sheath, located at the limit between the muscular and aponeurotic parts, consisting of transversal fibers placed anteriorly and posteriorly to the levator muscle and which are inserted medially on the trochlea and around it, descending to the inner cantalum ligament and laterally, on the capsule of the lacrimal gland, reaching to the orbit periostum and to the lateral cantalum ligament (fig. 7).

Recent studies, made by Lim et al. (8), have demonstrated the great variability of this ligament, in contrast to classical concepts.

CONCLUSIONS

Inside the fossa, the gland is surrounded by an adipose tissue mass which contain fibrous

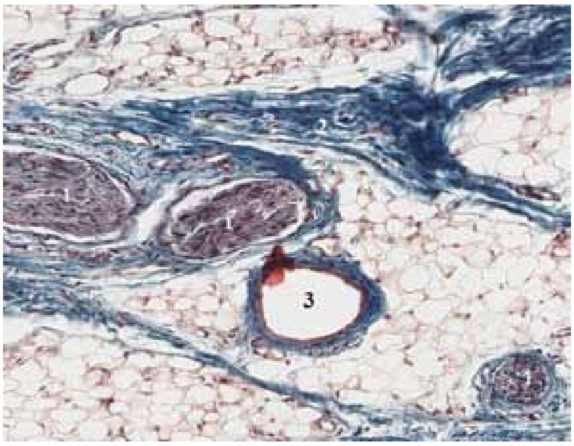

Fig. 10. Periglandular fat tissue (Masson coloration) : 1. Nerve fibers ; 2. Connective tissue fibers ; 3. Arteriole

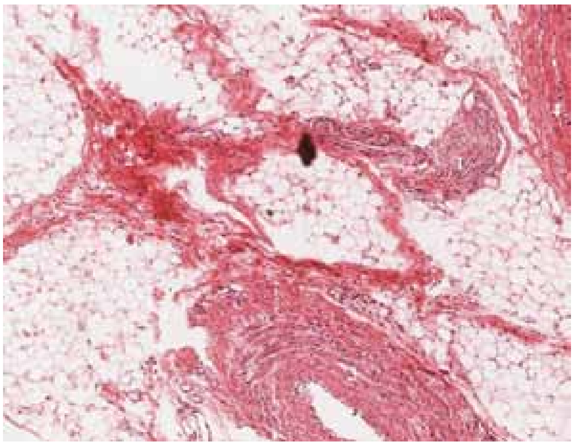

Fig. 11. Periglandal adipose tissue (HE coloration) : 1. Nerve fibers ; 2. Connective tissue fibers (Soemering ligament) ; 3. Lacrimal artery ; 4. Lacrimal gland capsule

condensations that fix the gland and form the Soemmering or the Schwalbe ligament, both being a way of suspending the gland.

The expansion of the aponeurosis of the levator palpebrae superior muscle divides the gland into the two lobes adhering to the glandular capsule, so we can observe again the close relation between the levator palpebrae muscle and the lacrimal gland.

A good knowledge of this region is very important especially for the clinicians like ophtalmologists, neurosurgeons or plastic surgeons.

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