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مجال الطب الشرعي .

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THE ANATOMY OF THE TENDONS OF INSERTIONS
OF THE EXTRINSIC MUSCLES OF THE EYEBALL
IN THE SHEEP AND GOAT
(With Two figures)

By

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SUMMARY

The insertions of the extraocular muscles in sheep and goats are characterized by many common anatomical features but there are some differences between sheep and goats concerning the insertions of the dorsal and medial recti the ventral oblique and the retractor bulbi muscles.

The study of the insertions of the extraocular muscles is of importance for the treatment of some surgical affections of the eyeball, and in forensic medicine.

INTRODUCTION

The extraocular muscles are not inserted at equal distances from the corneo-scleral junction and the movements of the eyeball are by no means so simple as might be inferred from the general statements about the ocular muscles. All movements are particularly produced by the coordinated action of these muscles, involving combinations which are quite complex. The study of the insertion of the ocular muscles is of importance for the treatment of some surgical affections such as strabismus which necessitates the recession or resection of one or more of the muscles, suppurative endophthalmitis which needs enucleation of the eyeball by severing the tendons of insertion of the extraocular muscles and in other instances which necessitate the knowledge of the accu-

rate length, direction, distance of the line of insertion of each muscle from the corneo-scleral junction, and the length of its tendinous part.

Finally, an anatomical study of the ocular muscles is an aid in forensic medicine.

MATERIAL AND METHODS

The extrinsic muscles of the eyeball were studied in balady sheep and goats (2 - 5 years old). Twenty eyes (10 left and 10 right) were obtained from each species from the slaughter house. Each extrinsic muscle was examined fully, including the length, breadth and direction of insertion of its tendinous part, and distance of its line of insertion from the corneo-scleral junction.

For the muscles having a curved or oblique line of insertion more than one measurement was taken to identify more accurately the distance of this line from the corneo-scleral junction.

The horizontal and vertical diameters of the cornea were also measured to know the relative size of the eyeball on which the extrinsic muscles were studied.

The average of the readings of the different measurements in the twenty eyes in each species was obtained.

RESULTS

Sheep (Fig. 1):

The dorsal rectus muscle can be distinguished by having the longest tendon and widest line of insertion of all the straight muscles of the eyeball. The line of insertion is nearly straight and measures 1.76 cm. The tendon of insertion is 1.12 cm long and is inserted at the sclera 0.64 cm from the limbus.

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The tendon of insertion of the ventral rectus muscle is 0.68 cm long and forms a line of insertion which is convex towards the cornea. The apex of the curve is 0.45 cm from the limbus. Its lateral end is nearer to the cornea (0.73 cm) than its medial end (0.77 cm). The line of insertion in the narrowest (1.21 cm wide) in comparison to the other straight muscles.

The medial rectus muscle has the most caudal line of insertion of the straight ocular muscles. It lies 1.04 cm from the limbus. It is 1.28 cm wide symmetrically distributed dorsal and ventral to the horizontal plane of the eyeball. This muscle has the shortest tendinous insertion (0.54 cm long) of any of the extrinsic muscles of the eyeball. The insertion of the lateral rectus is the nearest to the limbus of any of the extraocular muscles. The line of insertion is 1.51 cm long and is directed obliquely dorsally and caudalwards. Its dorsal end lies 1.19 cm from the limbus whereas its ventral end lies 0.10 cm from the limbus. The tendon is 0.74 cm long.

The line of insertion of the dorsal oblique is the narrowest of any of the muscles of the eyeball being 1.05 cm wide and is obliquely directed caudalwards and laterally. The medial end of this line is covered by the lateral part of the tendon of insertion of the dorsal rectus and lies 1.33 cm from the limbus. The lateral end lies midway the insertions of the dorsal and lateral recti 1.76 cm from the limbus. The tendon of insertion of the dorsal oblique muscle is the longest (1.27 cm) of all the extrinsic muscles of the eyeball.

The ventral oblique has the widest line of insertion of all the extraocular muscles. The line of insertion lies in the

latero-ventral part of the globe. It is 1.87 cm wide and is directed obliquely caudalwards and dorsally. The dorsal end of this line lies ventral to the tendon of insertion of the lateral rectus muscle and is 1.10 cm behind the limbus. The ventral end lies ventral and caudal to the ventral end of the lateral rectus and 0.12 cm from the corneo-scleral junction. The dorsal part of the insertion of the ventral oblique is tendinous and is 0.70 cm long but the ventral part is completely muscular.

The retractor bulbi is situated further from the corneal margin dorsally (2.14 cm) than ventrally (1.34 cm), and is further medially (1.34 cm) than laterally (1.29 cm). The vertical diameter of the cornea is 1.66 cm and the horizontal 2.50 cm.

Goat (Fig. 2):

The dorsal rectus muscle can be distinguished by having the longest tendon and widest line of insertion of all the straight muscles of the eyeball. The tendon of insertion is 1.18 cm long and the line of insertion (1.24 cm) is convex towards the cornea. The apex of the curve is 0.40 cm from the limbus and its medial and lateral ends are equally placed (0.60 cm) apart from the limbus.

The tendon of insertion of the ventral rectus is 0.83 cm long and forms a line of insertion which is convex rostrally. The apex of the curve is 0.30 cm from the limbus. Its lateral end is nearer to the cornea (0.54 cm) than its medial end (0.57 cm). The line of insertion is the narrowest (1.04 cm) of any of the straight muscles.

The medial rectus has the most caudal line of insertion of any of the straight muscles. This line lies 0.84 cm from

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the limbus and is 1.09 cm wide. The tendon of insertion is the shortest (0.80 cm) of any of the straight muscles of the eyeball, and is symmetrically distributed dorsal and ventral to the horizontal plane of the eyeball.

The lateral rectus insertion is the nearest to the cornea of all other extraocular muscles. It is 1.21 cm wide and is directed caudalwards and dorsally. Its dorsal end lies 0.89 cm from the limbus whereas its ventral end lies 0.11 cm from the limbus. The tendon is 1.02 cm long.

The dorsal oblique muscle has the narrowest line of insertion (0.92 cm) and the longest tendon (1.38 cm) of all the extrinsic muscles of the eyeball. The medial end of the line of insertion is situated ventral to the lateral part of the tendon of insertion of the dorsal rectus 0.91 cm from the limbus. The lateral end lies midway between insertions of the dorsal and lateral recti and is situated 1.34 cm caudal to the limbus.

The ventral oblique has the widest line of insertion and the shortest tendinous part of all the extrinsic muscles. The line of insertion lies in the outer ventral part of the globe and is convex caudalwards. It is 1.38 cm wide and is directed obliquely caudalwards and dorsally. The dorsal end of this line lies ventral to the tendinous insertion of the lateral rectus muscle about 0.99 cm from the corneo-scleral junction. The ventral end lies below and caudal to the ventral end of the lateral rectus insertion about 0.21 cm from the limbus. The tendon of insertion is 0.70 cm long. The retractor bulbi is inserted further from the limbus dorsally (1.90 cm) than ventrally (1.12 cm), and further laterally (1.25 cm) than medially (1.16 cm).

The vertical diameter of the cornea is 1.33 cm and the horizontal 1.93 cm.

DISCUSSION

Some authors (Miller, Christensen & Evans 1964; Akaevsky 1968; Williams 1971; Bradley 1973; and Sisson & Grossman 1975) described the insertions of the extrinsic muscles of the eyeball into the sclera in domestic animals but without indicating the width, direction and distance of the line of insertion of the tendons of these muscles from the limbus. We could not find a detailed description of the characteristic features of the tendons of these muscles in different domestic animals.

Surgical exposure of the extraocular muscles is much concerned with their tendinous insertion. The insertions of the extrinsic muscles of the eyeball in sheep and goats are characterized by several features. The dorsal rectus has the longest tendon and broadest line of insertion of any of the straight muscles of the eyeball whereas the ventral rectus has the narrowest line of insertion of these muscles. The line of insertion of the lateral rectus is the nearest to the limbus than any of the extraocular muscles. The medial rectus has the most caudal line of insertion of the straight muscles. The dorsal oblique has the narrowest line and longest tendon of insertion of any of the extraocular muscles. The line of insertion of the ventral oblique is the widest of any of the extrinsic muscle. The retractor oculi is inserted further from the limbus dorsally than ventrally.

The study of the insertions of the extraocular muscles showed some differences between sheep and goat. The line of insertion of the dorsal rectus is straight in sheep and convex in goat. The shortest tendon of insertion of the extraocular muscles in goat is that of the ventral oblique whereas in

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sheep is that of medial rectus muscle. The dorsal part of insertion of the ventral oblique muscle in sheep is tendinous and the ventral part is muscular, but in goats this insertion is completely tendinous. The retractor bulbi is inserted further from the corneal margin medially than laterally in sheep and vice versa in goats.

Knowledge of the insertion of the ocular muscles is of importance in the treatment of many surgical affections.

The distance of the line of insertion from the corneal limbus and the breadth of the tendons of the ocular muscles are of importance in the treatment of many surgical affections which necessitate enucleation of the eyeball as in cases of suppurative endophthalmitis and massive anterior staphyloma. The latter knowledge is needed to detect accurately the method of surgical exposure of each tendon and to ascertain the direction of the surgical tenetome at the point of insertion of each muscle.

In cases of strabismus also the distance of the line of insertion from the corneal limbus and the mode of insertion of each tendon are required to postulate the method of exposure of each tendon and its position and to know whether this type of strabismus can be corrected by recession, resection, advancement, tucking or by marginal tenotomy.

The obtained results show that the most preferable position for the lens extraction in cases of cataract and cyclodialysis in cases of glaucoma is at the medial and dorsal parts of the corneo-scleral junction as this position is apart from the line of insertions of the dorsal rectus, dorsal oblique and medial rectus muscles. Operations which are carried on the lateral or ventral parts of the limbus may expose the insertion of the lateral rectus, ventral rectus

and ventral oblique to injury as the above mentioned muscles are closely inserted to the limbus.

In operations for retinal detachment, a knowledge of the anatomy of the extraocular muscles is essential. Some problems of identification in forensic medicine can be solved by a knowledge of the detailed anatomy of the insertions of the extraocular muscles.

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