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رئيس القسم : د . / عبدالله حفى طه .

### التشريخ الجراحى للعدسات فى الحيوانات الأليفه المختلفه

رشاد فتح الباب ، نبيل مسك ، عبدالله حفى ، أنور قاسم

تم فى هذا البحث الدراسة التشريخية الجراحية للعدسات فى كل من الكلاب والقطط والخنازير والماعز ، والأبقار ، والجاموس ، والجمال ، والحصان ، والبغال ، والحمير . ودرست كل عدسه مستفيضه شامله الوزن والحجم والقطر والمحور وكذلك سمك محفظة العدسة فى المستويات المختلفه لها . وأوضحت هذه الدراسة أهمية النتائج التى توصل اليها البحث وعلاقتها بالعطيات الجراحية للعين .

## SURGICAL ANATOMY OF THE LENS IN DIFFERENT DOMESTIC ANIMALS (WITH 2 TABLES & ONE FIGURE)

BY

M.R. FATH EL-BAB, N.A. MISK, A. HIFNY and A.M. KASSEM.

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### SUMMARY

Surgical anatomy of the lens was studied in dog, cat, pig, sheep, goat, cow, buffalo, camel, horse, mule and donkey. 20 lens from each species were extracted from eyeballs of a newly sacrificed animals. Each lens was examined fully, including weight, volume, diameter, axis and thickness of the lens capsule at different levels. The aforementioned knowledge is of an importance for the success of the operations usually performed for treatment of one of the most common disease of the lens in different domestic animals "cataract". Also an anatomical study of the lens is an aid in forensic medicine.

### INTRODUCTION

Certain anatomical features of the lens are important in intracapsular extraction of the lens in cataract surgery. The literature on the morphological features of the lens in different domestic animals is meagre.

Some authors (MILLER, 1964, AKAEVSKY, 1968, DELLMAN, 1971, NICKEL and SCHUMER, 1975 and DELLMAN and BROWN, 1976) have described the lens in domestic animals but without indicating the axis, diameter, weight and volume of the lens as well as the thickness of its capsule. Other authors (SMYTHE, 1958, PRINCE, 1960, MAGRANE, 1971 GETTY, 1975) mentioned some of these measurements in some domestic animals. The available literature described nothing about the lens of the buffalo, camel, mule, and donkey.

The aim of the present work is to study some anatomical features of the lens concerning cataract surgery in different domestic animals.

### MATERIAL AND METHODS

The surgical anatomy of the lens was studied in the dog, cat, pig, goat, sheep, buffalo, cow, camel, donkey, mule and horses. Twenty eyes from each species were obtained from newly sacrificed animals and fixed in 10% formalin solution. The lenses were extracted from formalized eyeballs. Each lens was examined for some morphological features including its axis, diameter, weight, volume and the ratio of the weight and volume to that of the entire eyeball. Also the thickness of the lens capsule at different levels was measured after frozen sections about 20 micrometer and stained with methylene blue.

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

### RESULTS (Fig. 1)

The averages of the readings of different measurements of the weight and volume of the eyeball and the axis, diameter, weight, volume of the lenses and the proportion of the weight and volume of the lens to that of the entire globe as well as the thickness of the capsule are illustrated in (Table 1)

### DISCUSSION

The main principles of intracapsular cataract extraction are to remove the lens as completely as possible with the minimum amount of trauma, without leaving any gross remnants of the lens matter in the pupil, without loss of the vitreous, and at the end of the operation to close the limbal wound securely without entangling strands of lens capsule or iris in it. The surgeon performing intracapsular extraction of the lens must know accurately the different dimensions of the lens in different domestic animals as the size of the eyeball is not

as a rule an indication for the size of the lens. The weight and volume of the eyeball in dog is larger than that of the cat and vice versa concerning the lens. PRINCE ET AL. (1960) mentioned that the ratio of the volume of the lens to that of the entire eyeball is smaller in cat (1:10) than that of the dog (1:8). The present work shows opposite results. This ratio is smaller in dog (1:10) than that in cat (1:9).

The eyeball of the sheep is about twice in weight and volume that of goat while the lens of the sheep is slightly larger than that of the goat. This fact is clear when the proportion of the weight and volume of the lens to that of the eyeball in sheep and goat is observed in (Table 1). PRINCE ET AL. (1960) and SISSON and GROSSMAN (1975) stated that the diameter of the lens in sheep is 1.80 cm (similar to that of camel in the present results) and the axis 1.10 cm (equal to that of buffalo in present results). The work under discussion indicates that the diameter of the lens in sheep is 1.20 cm and axis is 0.90 cm. The differences in the results may be due to breed variations.

The lens of the pig has the smallest axis, diameter, weight and volume of any of the domestic animals. In spite of this, the eyeball of the pig is larger in weight and volume than that of dog and cat.

Concerning the measurements of the lens in buffalo and camel in comparison with that of cow, the axis, diameter, weight and volume of the lens in camel is larger and in buffalo is smaller than that of the cow. The lens of the horse, mule and donkey is absolutely larger in the above mentioned measurements than that of buffalo, cow and camel. The lens of the horse has the largest axis, diameter, weight and volume of any of the domestic animals.

The proportion of weight and volume of the lens to that of the entire eyeball is very large in cat (1:7.97 and 1:9.00 respectively) and very small in sheep (1:17.5 and 1:18.3 respectively). This fact must be taken in consideration during intracapsular extraction of the lens.

The importance of the axis and diameter of the lens in intracapsular extraction cannot be neglected. During intracapsular extraction of the lens the corneoscleral incision extends in an arc from the 3 O'clock to 9 O'clock position and the corneal flap is reflected downward (VAN KRUIJNINGEN, 1964). The dimensions of the corneal wound from which the lens is extracted are in horizontal plane equal to the transverse meridian of the cornea and in vertical plane equal to the half of the vertical meridian of the cornea. The corneal wound must be wide enough to permit the passage of the lens through it to outside without any undesirable sequelae specially in cases of calcareous cataract and other forms in which the lens is hard and cannot be moulded to take the shape of corneal wound.

Table 2 shows a comparative study between the length of the horizontal meridian of the cornea (length of corneal wound) and the diameter of the lens as well as the length of half of the vertical meridian of the cornea (width of corneal wound) and the axis of the lens. The horizontal and vertical meridians of the cornea in different domestic animals were stated by HIFNY and MISK (1977, 1979 & 1980) and MISK and HIFNY (1978). The results of the comparative study revealed that the length of corneal wound is about twice that of the diameter of the lens in pig only, less than twice in dog, goat, donkey, mule and horse and more than twice in sheep and buffalo. This fact indicates that the length of corneal wound in all domestic animals is quite sufficient to permit the passage of the diameter and the length. While the width of the corneal wound was found to be equal to the axis of the lens in pig and horse, less in goat, sheep, cow, camel, donkey and mule and more in dog, cat and buffalo. In animals where the axis of the lens is larger than the width of the corneal wound, the corneal incision must be enlarged in an arc from 4 O'clock to 8 O'clock to permit safety extraction of the lens without any rough manipulation which may lead to detachment of the endothelial lining of the reflected cornea or tearing of the iris and processus iridis.

Moreover, the thickness of the lens capsule is of importance in intracapsular extraction. The forceps is usually applied to the most thickest part of the lens capsule just in front of the equator either at the lower part of the lens at 6 O'clock meridian or in the upper part of the lens in the 12 O'clock meridian.

The present results revealed that the thickness of the anterior lens capsule is in many times larger than that of the posterior capsule. In cat the thickness of anterior capsule is 14 times as that of posterior capsule while in pig and buffalo it is only four times larger.

## SURGICAL ANATOMY OF THE LENS IN DIFFERENT DOMESTIC ANIMALS

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TABLE (1)

Shows the weight and volume of the eye ball and axis, diameter, weight volume, proportion of weight and volume of the lens to that of the entire globe as well as the thickness of the lens capsule in different domestic animals.

Animal	Eyeball		Lens				The thickness of lens capsule micrometer		at the ant.caps.	at the post.caps.
	weight (gm.)	volume (cm <sup>2</sup> )	Axis (cm.)	Diameter (cm.)	weight (gm.)	volume (cm. <sup>2</sup> )	prop. of weight	prop. of volume		
Dog	5.00	4.80	0.77	1.05	0.50	0.45	1:10.00	1:10.66	42	14
Cat	4.70	4.50	0.84	1.15	0.59	0.50	1:7.97	1: 9.00	98	7
Pig	5.80	5.50	0.80	1.00	0.40	0.35	1:14.50	1:17.70	28	7
Goat	6.50	6.40	0.80	1.10	0.48	0.44	1:13.50	1:14.50	50	10
Sheep	11.40	11.00	0.90	1.20	0.65	0.60	1:17.50	1:18.30	35	10
Buffalo	24.40	23.60	1.10	1.60	1.73	1.43	1:14.10	1:16.50	28	7
Cow	28.10	27.10	1.12	1.67	1.77	1.70	1:15.90	1:15.91	30	7
Camel	29.00	27.50	1.20	1.80	1.80	1.66	1:16.10	1:16.60	28	7
Donkey	34.50	32.00	1.16	1.75	2.20	1.80	1:15.70	1:17.70	56	7
Mule	34.80	32.50	1.20	1.90	2.25	2.00	1:15.40	1:16.20	70	14
Horse	43.30	42.50	1.35	2.00	2.70	2.50	1:16.00	1:17.00	91	14

TABLE (2)

Shows the axis and diameter of the lens as well as the half of the vertical meridian and the horizontal meridian of the cornea in different domestic animals.

Animal	axis of the lens	½ vertical meridian of the cornea	Diameter of the lens	horizontal meridian of the cornea
dog	0.77	0.78	1.05	1.78
cat	0.84	0.93	1.15	1.96
pig	0.80	0.80	1.00	2.00
goat	0.80	0.66	1.10	1.93
sheep	0.90	0.83	1.20	2.50
buffalo	1.10	1.17	1.60	3.35
cow	1.12	1.10	1.67	3.01
camel	1.20	1.00	1.80	3.30
donkey	1.16	1.06	1.75	3.18
mule	1.20	1.15	1.90	3.30
horse	1.35	1.35	2.00	3.35

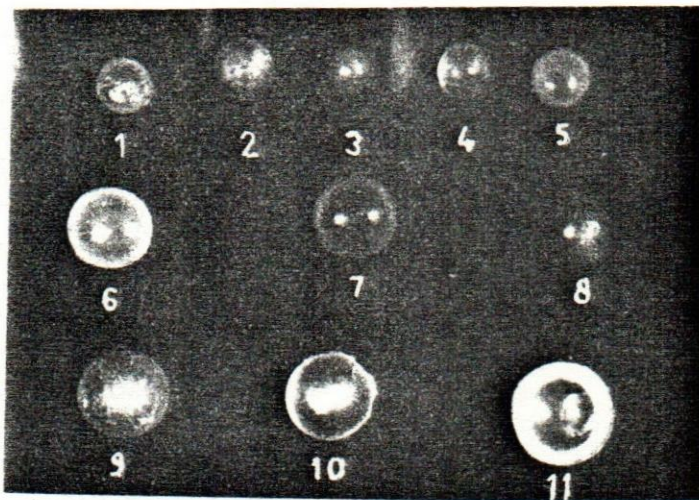


Fig. 1

Lens of the:

- |             |            |          |
|-------------|------------|----------|
| 1. dog      | 2. cat     | 3. pig   |
| 4. sheep    | 5. goat    | 6. cow   |
| 7. buffaloe | 8. camel   | 9. horse |
| 10. mule    | 11. donkey |          |