

قسم التشريح والهستولوجيا  
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## توزيع الشرايين العينية فى البغل

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تم فى هذا البحث دراسة المدد الشريانى للعين فى البغل وقد وجد أن المدد الشريانى الاساسى يأتى الى العين عن طريق تفرعات الشريان العينى الخارجى كما أن الشريان العيى الداخلى يشارك فى تغذية الشبكية ومقلة العين هذا وقد وجد أن الشريان المركزى للشبكية الى جانب فرع شبكى يقومان بتغذية الرداء العصبى لمقلة العين .  
وقد تمت مناقشة نتائج هذا البحث مع النتائج المستخلصة من المراجع والأبحاث التى عالجت نفس الموضوع .



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**THE DISTRIBUTION OF THE OPHTHALMIC ARTERIES IN THE MULE**  
(*Equus hircus*)  
(With One Fig.)

By  
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**SUMMARY**

The arterial vasculature of the eye in mule depends mainly on the branches of the A. ophthalmica externa, however, the internal ophthalmic artery shares also in the vasculature of the retina and eye ball. A retinal branch, in addition to the central artery of the retina was found to share in the nutrition of the nervous tunic of the eye ball.

A great similarity was found between mule and other equines in the pattern of branching and distribution of the ophthalmic arteries.

**INTRODUCTION**

The study of the arterial blood supply of the eye in the domestic animals was carried out by several authors, however, several details are not yet adequately explained. In their illustrated anatomical Nomenclature, SIMOENS/ DE VOS and LAUWERS (1979) stated that the branching of the A. ophthalmica externa in the different species needs further investigation. The ophthalmic arteries in horse and donkey were described and the present work was carried out to complete the picture of the ophthalmic arteries in equines.

**MATERIAL and METHODS**

The work was carried out on ten heads of adult mules (*Equus hircus*). The specimens were injected by red coloured gum milk latex through the common carotid arteries after ligation of the vertebral arteries and occlusion of the vertebral canal.

The nomenclature used in this work is that suggested by Nomina Anatomica Veterinaria (1973).

**RESULTS**

**A. ophthalmica externa:**

The external ophthalmic artery (1/3) is detached within Canalis alaris together with A. temporalis profunda rostralis by a short stem vessel from A. maxillaris.

It leaves the alar canal through the For. alare rostrale and ascends in a rostral direction, crossing the lateral aspect of N. maxillaris. It then pierces the periorbita to continue rostrally between M. rectus lateralis dorsally and V. ophthalmica externa ventralis. The artery then curves sharply

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in a medial direction between M. recuts ventralis and N. opticus forming a double curve and detaches A. centralis retinae and continues its course as A. ciliaris posterior longa medialis.

Along its course, the external ophthalmic artery gives off A. supraorbitalis, A. lacrimalis, A. ethmoidalis externa and a stem vessel for A. ciliaris posterior longa lateralis and A. ciliaris anterior ventralis, in addition to R. retinae and A. centralis retinae.

#### **A. supraorbitalis:**

The supraorbital artery (1/4) is detached from the external ophthalmic artery just after piercing the periorbita. However, it may arise in few dissected cases by a stem vessel with A. lacrimalis either from A. ophthalmica externa or A. temporalis profunda rostralis.

The supraorbital artery pierces the periorbita to pass via the supraorbital canal to ramify in the region of the forehead. During its course, it detaches 6-8 branches for Mm. rectus dorsalis, retractor oculi, levator palpebrae superioris and temporalis, in addition to a considerable vessel which enters the Sinus frontalis via a foramen situated in the medial wall of the supraorbital canal.

#### **A. lacrimalis:**

The lacrimal artery (1/5) springs just after the origin of the supraorbital artery. It ascends rostrally between Mm. rectus dorsalis and rectus lateralis to continue its course between the lobules of Gl. lacrimalis where it terminates near its rostral border. In addition to 2-3 muscular branches for the dorsal and lateral recti and retractor oculi muscles, the lacrimal artery detaches the lateral superior and inferior palpebral arteries.

#### **A. ethmoidalis externa:**

The external ethmoidal artery (1/6) is detached from the external ophthalmic artery as the next branch after the lacrimal artery. It curves medially under cover of M. rectus dorsalis, pierces the periorbita and gains the cranial cavity via For. ethmoidale. It shares in the vasculature of the eye ball through the dorsal anterior ciliary artery.

#### **A. ciliaris anterior dorsalis:**

The dorsal anterior ciliary artery (1/7) is detached from the external ethmoidal artery under cover of M. rectus dorsalis. It courses rostrally deep to the later muscle to pierce the sclera caudal to the corneoscleral junction and detaches 2-3 Aa. conjunctivales (1/9) and the dorsal long posterior ciliary artery.

#### **A. ciliaris posterior longa dorsalis:**

The dorsal long posterior ciliary artery (1/8) is detached at a level about 2 cm caudal to the posterior pole of the eye ball. It courses in a rostral direction within the dorsal portion of the Corpus adiposum intraperiorbitale and pierces the dorsal portion of M. retractor oculi and the sclera just caudal to the equator. It then continues in the suprachoroid lamina to reach the dorsal portion of the ciliary body where it joins the other ciliary arteries.

Just before the external ophthalmic artery forms its double curve, it detaches a stem vessel (1/1) which courses rostrally between Mm. recti lateralis and ventralis then divides into A. ciliaris anterior ventralis and A. ciliaris posterior longa lateralis.

#### **A. ciliaris anterior ventralis:**

The ventral anterior ciliary artery (1/12) passes between Mm. recti lateralis and ventralis and pierces the M. obliquus ventralis and the sclera just caudal to the corneoscleral junction. It gives off A. palpebrae tertiae, 1-2 Aa. conjunctivales, 1-2 Aa. episclerales (1/14) and a muscular branch for the before mentioned muscles.



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**A. palpebrae tertiae:**

The artery of the third eyelid (1/13) leaves the ventral anterior ciliary artery about 0.5 cm from its origin. It passes in a rostromedial direction between Mm. rectus ventralis and retractor oculi then continues its course within the Corpus adiposum intraperiorbitale to reach the third eyelid where it divides into a dorsal and a ventral branches. Each branch courses along the corresponding border of the cartilage of the third eyelid to terminate as Aa. conjunctivales.

**A. ciliaris posterior longa lateralis:**

The lateral long posterior ciliary artery (1/15) passes in a rostradorsal direction deep to M. rectus lateralis then through the Corpus adiposum intraperiorbitale and M. retractor oculi to pierce the sclera caudal to the equator. It then continues rostrally within the lamina suprachoroidea to reach the lateral portion of the ciliary body. The lateral long posterior ciliary artery detaches a single A. ciliaris posterior brevis lateralis and 2-3 Aa. episclerales.

**R. retinae:**

The retinal branch (1/17) springs from the rostral aspect of A. ophthalmica externa as it lies ventral to the optic nerve. It pursues rostralward along the ventral aspect of the optic nerve for about 1.5 cm then curves to gain the dorsolateral aspect of the nerve where it pierces the Area cribrosa sclerae to share in the vasculature of the retina.

**A. centralis retinae:**

The central artery of the retina (1/18) originates from the external ophthalmic artery at the same level or just after the later receives the internal ophthalmic artery. It courses in a rostral direction along the ventral aspect of the optic nerve surrounded by its external fibrous sheath. It then continues via the Area cribrosa sclerae to supply the retina.

**A. ciliaris posterior longa medialis:**

The medial long posterior ciliary artery (1/19) forms the direct continuation of the external ophthalmic artery after detaching the central artery of the retina. It courses rostrally between M. rectus medialis and N. opticus for about 0.5 cm then between the medial and ventral portions of M. retractor oculi to pierce the sclera caudal to the equator.

**Aa. ciliares posteriores breves medialis and lateralis:**

The medial and lateral short posterior ciliary arteries (1/16,20) are detached from the corresponding long posterior ciliary arteries. Each artery runs along its respective aspect of the optic nerve to pierce the Area cribrosa sclerae to distribute in the vascular tunic.

**A. ophthalmica interna:**

The internal ophthalmic artery (1/18') springs from the medial aspect of A. carotis interna just after piercing the Diaphragma sella. It courses rostrad on the lateral aspect of the optic nerve surrounded by its meninges. It then traverses the optic canal along the dorsomedial aspect of the optic nerve to join the A. ophthalmica externa. It detaches 1-2 twigs for the optic chiasma and 3-4 for the optic nerve.

**DISCUSSION**

The origin of the A. ophthalmica externa in mule is similar to that described by WILKENS/MUNSTER (1981) in all domestic animals except in cat where it arises from the Rete mirabile a. maxillaris.

The continuation of A. ophthalmica externa as A. ciliaris posterior longa medialis was also reported in sheep by AHMED/MUNSTER/POHLMAYER (1978). However, BRADLEY/GRAHAME



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(1947); GHOSHAL (1975) and SIMOENS et al. (1979) in horse and ABD EL-MOATY (1980) in donkey considered the external ethmoidal artery as the continuation of the external ophthalmic artery.

The origin of the supraorbital and lacrimal arteries in mule simulates that described in horse by BRADLEY/ GRAHAME (1947) and in donkey by ABD EL-MOATY (1980). Moreover, the lateral superior and inferior palpebral arteries arise from the lacrimal artery in mule as described by ZIETZSCHMANN (1943), NICKEL/ SCHWARZ (1963) and BERG (1976) in horse; PRINCE/ DIESEM/ EGLITIS/ RUSKELL (1960) in pig and BADAWI/ EL-SHAIEB/ KENAWY (1977) in camel.

The origin of A. palpebrae tertiae from A. ciliaris anterior ventralis in mule differs from that found in other domestic animals where it originates from A. malaris in dog, pig and ruminants and from A. ophthalmica externa in horse as stated by WILKENS/ MUNSTER (1981).

The R. retinae which shares together with the A. centralis retinae in the vasculature of the retina was described in sheep by AHMED (1977).

In agreement with GHOSHAL (1975) in horse and ABD EL-MOATY (1980) in donkey, the central artery of the retina is given off the external ophthalmic artery in mule. However, it arises from R. anastomoticus cum a. ophthalmica interna in dog and horse as stated by SIMOENS et al. (1979) or from A. ciliaris posterior longa in pig as reported by BECKER (1960). AHMED et al. (1978) considered the A. centralis retinae as the direct functional and anatomical continuation of A. ophthalmica interna in sheep.

The long posterior ciliary arteries are given off the external ophthalmic artery in mule similar to their origin in horse as reported by GHOSHAL (1975), however, SIMOENS et al. (1979) and WILKENS/ MUNSTER (1981) recorded their origin in horse from R. anastomoticus cum a. ophthalmica interna.

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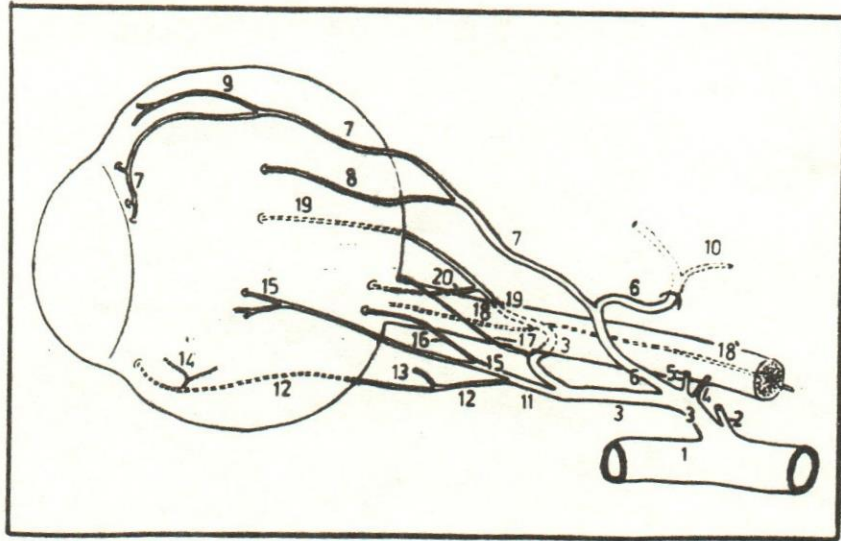


Fig. (1)

The distribution of the ophthalmic arteries in mule

- |   |  |
|---|--|
| 1 A. maxillaris,                          | 2 A. temporalis profunda rostralis,        |
| 3 A. ophthalmica externa,                 | 4 A. supraorbitalis,                       |
| 5 A. lacrimalis,                          | 6 A. ethmoidalis externa,                  |
| 7 A. ciliaris anterior dorsalis,          | 8 A. ciliaris posterior longa dorsalis,    |
| 9 A. conjunctivalis,                      | 10 A. meningea rostralis,                  |
| 11 Stem vessel for 12&15,                 | 12 A. ciliaris anterior ventralis,         |
| 13 A. palpebrae tertiae,                  | 14 Aa. episclerales,                       |
| 15 A. ciliaris posterior longa lateralis, | 16 A. ciliaris posterior brevis lateralis, |
| 17 R. retinae,                            | 18 A. centralis retinae,                   |
| 18' A. ophthalmica interna,               | 19 A. ciliaris posterior longa medialis,   |
| 20 A. ciliaris posterior brevis medialis. |  |

