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MEDIAN AND ULNAR NERVES IN DONKEY

(With 4 Figures)

By

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(Received 23/9/1992)

العصب الوسطاني والزندى في الحمار

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اجرى هذا البحث بغرض دراسة الصفات التشريحية للعصبين الوسطاني والزندى فى الحمار من ناحية المسار والموقع والنهاية والتفرعات الجانبية والعضلات والجلد التى تغذى بواسطتهما بالإضافة الى ذلك فقد تم تحديد انسب الاماكن للتخدير الموضعى للعصبين السابقين. وقد تبين من النتائج انه يجب ان يؤخذ فى الاعتبار أن موقع التخدير الموضعى المشطى الدانى يختلف فى الناحيتين حيث يكون على الناحية الوحشية اعلى منه على الناحية الانسية. وقد اوضح البحث من الناحية التشريحية التراكيب المختلفة التى تتأثر بالتخدير الموضعى للعصبين الوسطاني والزندى فى الاماكن المختلفة.

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SUMMARY

In this work the anatomical features of the median and ulnar nerves in donkey were studied in detail concerning the course, position, termination, collateral branches as well as supplied muscles and skin. It can be concluded that the ulnar neurectomy in donkey has evident signs than the median neurectomy. It is important to take in consideration that the site of the proximal metacarpal nerve block differs in both sides, it is located in the lateral side higher than in the medial one.

INTRODUCTION

In the last years many studies has been carried on the donkey with few findings concerning its nervous system specially that of the limbs. In addition, from the functional point of view it was recorded by MANSMANN; MCALLISTER and PRATT, 1982 that the paralysis of the ulnar nerve has a great effect on the support of the animal than that of the median one without any anatomical clearans. Therefore the aim of this study is to throw a light on the anatomical features of the median and ulnar nerves of this animal and to deterime the sutiable sites for their blocking.

MATERIAL and METHODS

The material used in this work consists of 15 adult healthy donkeys of both sexes. All the examined animals were anaesthetized by chloroform then bled throughly through the common carotid artery. Eleven specimens were preserved by the ordinary routine method using 10% formaline, dissection was performed after a week of preservation. The remaining animals were dissected in fresh state to investigate the fine cutaneous nerves. The nomenclature used is that adopted by N.A.V. (1983).

RESULTS

N. medianus:

The median nerve (Fig. 1,2,3/1) descends in the shoulder region cranial to the ulnar nerve crossing the medial aspect of the axillary artery to gain the arm region. Here it continues

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distally cranial to the brachial artery and medial to the M. pectoralis ascendens till reaching the distal fourth of the arm where the nerve becomes medial to the artery. After that it continues distally and slightly caudally on the medial aspect of the elbow joint to reach the forearm region.

At the level of the shoulder joint, the median nerve connects cranially a large branch of the musculocutaneous nerve forming the axillary loop which suspends the axillary artery. Distal to this loop the median nerve descends on the medial aspect of the arm region together with the musculocutaneous nerve within a common sheath till reaching the distal third of this region where the two nerves are separated from each other.

In the forearm the median nerve descends caudal to the radius and the corresponding blood vessels undercover the M. flexor carpi radialis. It terminates by dividing into a larger N. palmaris medialis and a smaller N. palmaris lateralis about 6 cm proximal to the carpus. During its course, the median nerve detaches the antebrachial interosseous nerve in addition to muscular branches.

N. interosseus antebrachii:

The antebrachial interosseous nerve (Fig. 1/2) arises from the caudal aspect of the median nerve just above the elbow joint. It runs distally caudal to the brachial artery on the medial aspect of the elbow joint till reaching the interosseous space where it detaches a small branch to the radial head of the M. flexor digitorum profundus, then the nerve enters this space with the common interosseous artery to terminate in the periosteum.

Rr. musculares:

The median nerve detaches a large muscular branch and another small one (Fig. 1/3) below the proximal extremity of the radius. The large muscular branch passes distally and caudally crossing the medial aspect of the brachial artery undercover the M. flexor carpi radialis to end in the humeral head of the M. flexor digitorum profundus. While the small branch ends in the M. flexor carpi radialis. In four examined cases the large muscular branch detached the antebrachial interosseous nerve.

Nearly at the junction between the proximal and middle thirds of the radius another muscular branch is detached from the median nerve, passing also distally and caudally to terminate in the M. flexor carpi radialis. In three investigated specimens, this branch was not demonstrated.

N. palmaris medialis:

The medial palmar nerve (Fig. 1,2,3/4) is the larger terminal branch of median nerve. It passes distally in the carpal canal dorsal to the corresponding artery, then it completes its course in the metacarpal region on the medial aspect of the digital flexor tendons and palmar to the corresponding vessels, but in the distal half of this region the nerve lies superficial to the artery. At the fetlock region the medial palmar nerve continues as the N. digitalis palmaris (proprius) medialis.

Along its course, the medial palmar nerve detaches R. communicans and cutaneous twigs in the metacarpal region. In addition, a thin branch originates from the medial palmar nerve above the fetlock joint passing distally to terminate in the palmar aspect of the fetlock region.

R. communicans:

A large communicating branch (Fig. 1,2/6) arises from the medial palmar nerve nearly at the junction of the proximal two thirds of the metacarpus. It passes obliquely crossing the palmar aspect of the digital flexor tendons to join the lateral palmar nerve about 7 cm above the fetlock joint. In one case the communicating branch originated from the parent nerve directly distal to the carpus.

N. palmaris lateralis:

The lateral palmar nerve (Fig. 1,2,3/5) passes distally and caudally undercover the tendon of the M. flexor carpi radialis and the tendon of the M. flexor carpi ulnaris where it receives the palmar branch of the ulnar nerve about 3 cm above the carpus. At the carpal region the nerve continues its course in the flexor retinaculum caudomedial to the accessory carpal bone to reach the metacarpal region where it descends in the lateral aspect of the digital flexor tendons accompany the artery and vein.

During its course and above the carpal joint, the lateral palmar nerve gives off a small branch to the flexor retinaculum. After that it joins the ramus communicans and then has a distribution identical to those of the medial palmar nerve.

Nn. digitales palmares (Proprius) medialis and lateralis:

The palmar digital nerves (Fig. 1,2/7.8) which are the direct continuation of the palmar ones descend subcutaneously on the

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palmar aspect of the fetlock and digit and also palmar to the corresponding vessels. At the pastern joint the nerve becomes dorsal to the artery and courses distally undercover the cartilage of the distal phalanx to terminate in the coffin joint and the corium of the hoof.

Along its course, the palmar digital nerve gives off the following branches:

A small branch detached directly after the origin of the parent nerve, to terminate in the skin covering the palmar aspect of the proximal phalanx.

R. dorsalis (F.g 1,2/9) is a relatively strong nerve arising from the dorsal aspect of the palmar digital nerve at the level of the fetlock joint. It runs distally and crossing the palmar digital blood vessels to end in the hoof and also supplies the pastern joint and the overlying skin. In two cases and just above the origin of the dorsal branch an another one arose from the palmar digital nerve to innervate the corresponding aspect of the fetlock joint.

Directly above the pastern joint, the palmar digital nerve detaches a considerable branch which supplies the digital cushion, navicular bursa and the hoof. Also, another branch originates from the beforementioned nerve at the pastern joint that runs dorsodistally to innervate this joint and the cartilage of the distal phalanx.

N. ulnaris :

The ulnar nerve (Fig. 1,2,3/10) passes at the middle of the arm distally along the caudal border of the medial head of the M. triceps brachii and then accompany the collateral ulnar blood vessels undercover the M. tensor fasciae antebrachii till reaching the medial epicondyle of the humerus, where it curves to direct distally in the forearm.

In the forearm, the ulnar nerve descends firstly between M. flexor carpi ulnaris and the ulnar head of the M. flexor digitorum profundus to gain the ulnar groove. Nearly at the middle of this groove the nerve becomes superficial and covered caudally only by fascia and skin. On the deep aspect of the tendon of the M. flexor carpi ulnaris and about 3.5 cm above the accessory carpal bone, it divides into R. dorsalis and R. palmaris.

The ulnar nerve gives off N. cutaneous antebrachii caudalis and Rr. musculares.

N. cutaneus antebrachii caudalis:

The caudal cutaneous antebrachial nerve (Fig. 2/11) originates from the cranial aspect of the ulnar nerve nearly at

the junction of the distal two third of the arm. It passes caudal words and distally with the parent nerve for about 2.5 cm, then continues its course between the M. tensor fasciae antebrachii laterally and the M. pectoralis transversus medially. About 2 cm distal the elbow joint the nerve emerges from the latter muscle and descends subcutaneously on the caudal aspect of the forearm to end in the skin 2 cm above the level of the carpal joint.

Rr. musculares:

Immediately distal to the elbow joint the ulnar nerve gives off two small and one large muscular branches (Fig. 1/12). The small branches supply the ulnar head of the M. flexor digitorum profundus. While the large one divides into two twigs to innervate the M. flexor carpi ulnaris and M. flexor digitorum superficialis.

R. dorsalis:

The dorsal branch of the ulnar nerve (Fig. 1,2,3/13) descends under the tendon of insertion of the M. ulnaris lateralis for about 1.5 cm, then it passes between the two part of its tendon to become under the skin. While in two examined cases the dorsal branch emerged between the M. flexor carpi ulnaris and the M. ulnaris lateralis. Then after it descends subcutaneously in the lateropalmar aspect of the carpus and metacarpus till the middle part and then courses on its lateral aspect to terminate directly above the fetlock joint.

R. palmaris:

The palmar branch of the ulnar nerve (Fig. 1,2,3/14) descends undercover the tendon of insertion of the M. flexor carpi ulnaris. It connects the lateral palmar nerve of the median nerve about 3 cm above the carpus undercover of the beforementioned muscle and then descend together in the carpal region. About 0.5 cm distal to this region the palmar branch detaches R. profundus and continues as R. superficialis (Fig. 3/16) in connection with the lateral palmar nerve.

Shortly after its origin, the palmar branch gives off a small twig which descends between the M. flexor carpi ulnaris and the M. flexor digitorum superficialis to innervate the carpal joint.

R. profundus:

The deep branch (Fig. 1,2,3/15) is detached from the palmar of the ulnar nerve 0.5 distal to the carpus. It passes

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distally and deeply crossing the lateral aspect of the digital flexor tendons where it releases 2-3 twigs to the M. interosseus medius. Here it pierces this muscle to gain the palmar surface of the large metacarpal bone and it divides into Nn. metacarpei palmares lateralis and medialis (Fig. 2,3/17,18). Each palmar metacarpal nerve descends along the corresponding side of the large metacarpal bone undercover the M. interosseus medius to terminate in the fetlock joint.

Sites of nerve block:

The blocking of the median nerve (Fig. 4/1) carried out on the middle of the medial aspect of the forearm just caudal to the subcutaneously located radius. The nerve lies in this area caudal to the homonymous blood vessels undercover the M. flexor carpi radialis.

The suitable site for the ulnar nerve blocking (Fig. 4/3) lies 10 cm above the accessory carpal bone in the palpable groove between the M. flexor carpi ulnaris and the M. ulnaris lateralis where the ulnar nerve lies superficial to the blood vessels. Blocking the ulnar nerve at this site affects the nerve before its terminal division into palmar and dorsal branches.

The site of the proximal metacarpal blocking differs at both sides. At the lateral side (Fig. 4/4) it lies just below the palpable accessory carpal bone between the digital flexor tendons and the distal ligament of the accessory carpal bone. In this case it is important to block the lateral palmar nerve after its connection with the palmar branch of the ulnar nerve and before the latter detaches the deep branch, accordingly the M. interosseus medius will be desensitized. At the medial side the proximal metacarpal blocking (Fig. 4/2) is taken place about 1 cm below the carpus on the medial aspect of the flexor tendons and palmar to the second splint bone. The proximal metacarpal block desensitizes the structures which are innervated by the palmar nerves of the median and the palmar branch of the ulnar nerve including M. interosseus medius, fetlock, pastern and coffin joints as well as structures of the hoof and the covering skin.

The distal metacarpal blocking (Fig. 4/5) is located 2 cm above the proximal sesamoid bones in a palpable groove laying between the large metacarpal bone dorsally and the digital flexor tendons palmarly where the nerve presents palmar to the vein and superficial to the artery. The distal metacarpal blocking affects the medial and lateral palmar nerves, it desensitizes the same structures as the proximal metacarpal

metacarpal blocking except the M. interosseus medius and the fetlock joint.

The palmar digital blocking (Fig. 4/6) is carried on 1 cm above the pastern joint, here the palmar digital nerves are palmar to the corresponding blood vessels. In this case, all structures of the hoof except its paminar corium are desensitized in addition to the navicular bursa as well as the coffin joint.

DISCUSSION

Concerning the site of the terminal division of the median nerve into medial and lateral palmar nerves, the present work indicates that the division lies about 6 cm proximal to the carpus. In horse the site of division at the distal half of the forearm (SEIFERLE and HOHME, 1984), or in the distal third or distal fourth (SISSON and GROSSMAN, 1969; GHOSHAL, 1975).

SISSON and GROSSMAN (1969) recorded that in horse the median nerve gives off a musculocutaneous branch at the middle of the arm. However, in the present work this branch could not be recorded in any case.

The antebrachial interosseous nerve originates from the median one just above the level of the elbow joint in donkey, while in horse it arises at the level of the interosseous space as reported by SEIFERLE and BOHME (1984). The present work revealed that the beforementioned nerve supplies the periosteum of the forearm and the radial head of the M. flexor digitorum profundus as recorded by SISSON & GROSSMAN (1969) and GHOSHAL (1975) in horse. The latter author added that this muscle is also supplied by other muscular branches of the median nerve.

In the examined donkeys the lateral palmar nerve of the median one connects the palmar branch of the ulnar nerve about 3 cm above the carpus. In horse the two nerves join at the carpus (GHOSHAL, 1975; DYCE; SACK and WENSING, 1987).

The present study shows that the R. communicans arises from the medial palmar nerve nearly at the junction of the proximal two thirds of the metacarpus and joins the lateral palmar nerve about 7 cm above the fetlock joint. While, in horse it arises at the middle of the metacarpus (SISSON and GROSSMAN, 1969; POHLMAYRE & REDECKER, 1974; GHOSHAL, 1975; SEIFERLE and BOHME, 1984 and DYCE *et al.*, 1987) and joins the lateral palmar nerve at the distal third of the same bone (SISSON & GROSSMAN, 1969; POHLMAYER & REDECKER, 1984; GHOSHAL, 1975 and SEIFERLE & BOHME, 1984).

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The present study revealed that the dorsal branch originates from the palmar digital nerves at the fetlock joint as mentioned by SKERRITT and McLELLAND (1984) in horse. Also in the horse MILLINE (1967); Sisson & GROSSMAN (1969); POHLMYER & REDECKER (1974); GHOSHAL (1975); DE-LAHUNTA & HABEL (1986) and DYCE et al. (1987) stated that the dorsal branch has a different level of origin in relation to the fetlock joint.

At the digital region, the palmar digital nerve descends palmar to the corresponding artery till reaching the pastern joint where the nerve becomes dorsal to the artery. In the horse, the nerve descends in this region palmar to the artery as mentioned by GHOSHAL (1975) and DE-LAHUNTA and HABEL (1986).

The ulnar nerve in the examined specimens terminates 3.5 cm above the accessory carpal bone by dividing into dorsal and palmar branches. This division takes place in horse a few centimeters above the carpus as mentioned by DYCE et al. (1987), or about the level of the accessory carpal bone as stated by Sisson and GROSSMAN (1969) as well as GHOSHAL (1975).

In the present work the caudal cutaneous antebrachial nerve arises, from the ulnar nerve at the junction of the distal two third of the arm. However, in horse it originates slightly proximal to the middle of the arm (GHOSHAL, 1975).

The present investigation revealed that the dorsal branch of the ulnar nerve emerges between the two parts of the tendon of insertion of the M. ulnaris lateralis as stated by SEIFERLE and BOHME (1984) in horse. While, only in two investigated cases this branch emerged between the tendons of insertion of the M. flexor carpi ulnaris and M. ulnaris lateralis. This is in accordance with that described by GHOSHAL (1975) in horse.

Our investigation agree with SEIFERLE & BOHME (1984) and de-lahunta & HABEL (1986) in horse, that the deep branch originates from the palmar of the median nerve as recorded by Sisson and GROSSMAN (1969) as well as GHOSHAL (1975) in horse.

MANSMANN et al. (1982) stated that in horse the median neurectomy results in a stiff gait in the limb, with dragging of the toe due to decreased flexion of the carpus and fetlock. They added that the ulnar neurectomy results in a similar, though more pronounced, change in the gait than in the median neurectomy.

The site of the proximal metacarpal block in donkey lies directly below the accessory carpal bone in the lateral side and 1 cm below the carpus in the medial side. In horse (DYCE et al., 1987) this site is located on the axial surface at the proximal end of the splint bones.

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LEGENDS

Fig. 1,2 & 3: Distribution of the median and ulnar nerves of the thoracic limb in donkey on;

Fig. 1: Medial aspect.

Fig. 2: Palmar aspect of the manus.

Fig. 3: Area marked in figure 2.

- 1- N.medianus.
- 2- N.interosseus antebrachii.
- 3- Rr.musculares of the median nerve.
- 4- N.palmaris medialis.
- 5- N.palmaris lateralis.
- 6- R.communicans.
- 7- N.digitalis palmaris mediais.
- 8- N.digitalis palmaris lateralis.
- 9- R.dorsalis of the palmar digital nerve.
- 10- N.ulnaris.
- 11- N.cutaneous antebrachii caudalis.
- 12- Rr.musculares of the ulnar N.
- 13- R.dorsalis. of the ulnar nerve.
- 14- R.palmaris.
- 15- R.profundus.
- 16- R.superficialis.
- 17- N.metacarpi palmaris medialis.
- 18- N.metacarpi palmaris lateralis.

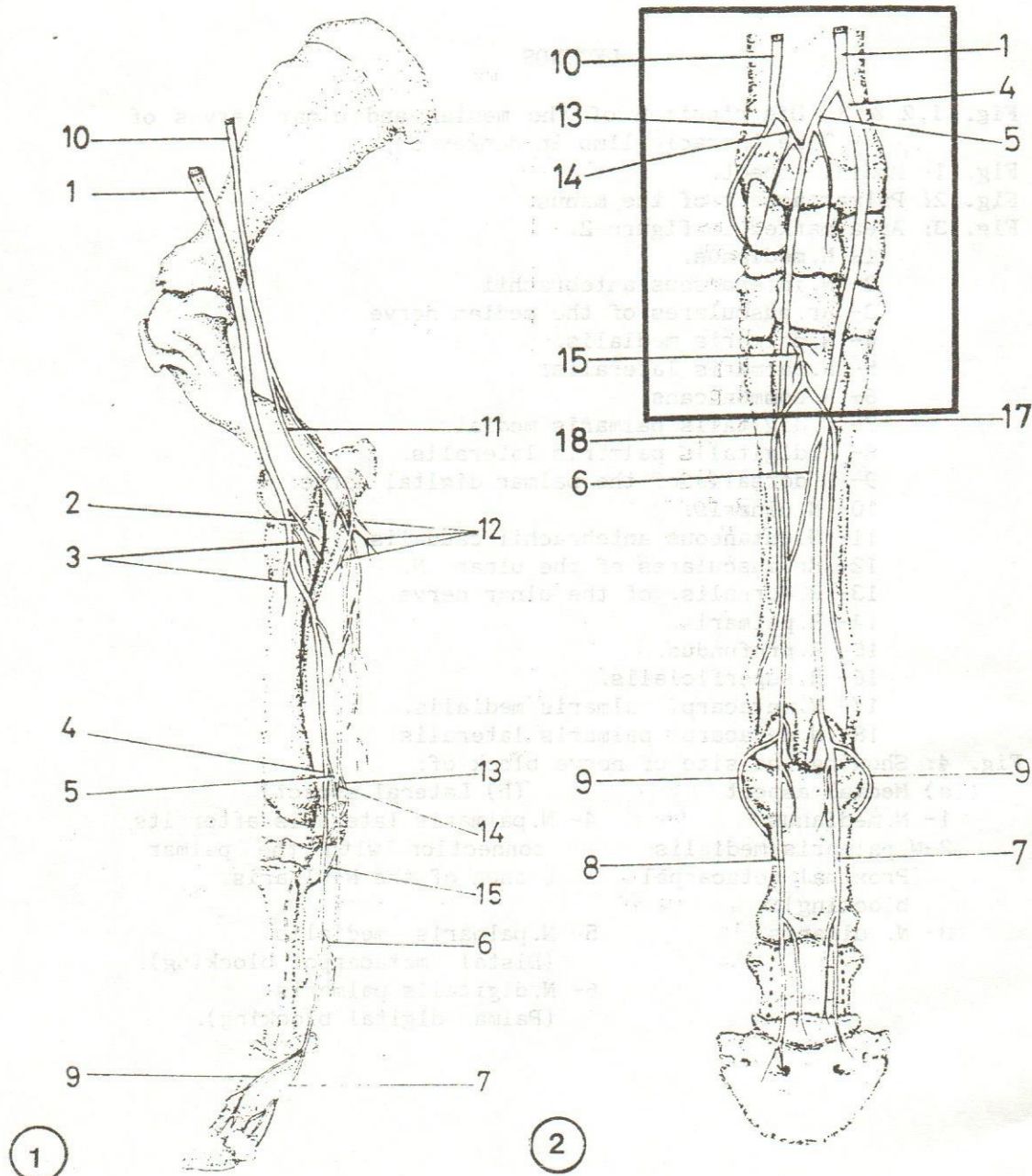
Fig. 4: Showing the site of nerve block of:

[(a) Medial aspect

- 1- N.medianus
- 2- N.palmaris medialis
(Proximal metacarpal blocking).
- 3- N. ulnaris.

[(b) Lateral aspect]

- 4- N.palmaris lateralis after its connection with the palmar branch of the N-ulnaris.
- 5- N.palmaris medialis
(Distal metacarpol blocking).
- 6- N.digitalis palmaris
(Palmar digital blocking).



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