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SURGICAL EXPOSURE OF THE NERVES OF THE LIMBS IN DOG

(With 5 Figures)

By

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الكشف الجراحي لاعصاب الاطراف في الكلاب

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اجرى هذا البحث على عشرين كلبا بغرض دراسة أنسب الاماكن للكشف الجراحي لاعصاب الاطراف ولقد تم تحديد طول وقطر وعلاقة هذه الأجزاء من الأعصاب التي توجد سطحيا تحت الجلد وأنسب الأماكن للفتح الجراحي عليها ولقد تم أيضا تطبيق هذه الدراسة على عدد من الحيوانات الحية حيث أجرى تخدير لهذه الأجزاء السطحية من أعصاب الأطراف وتم تحديد المناطق التي تفقد الاحساس نتيجة لهذا التخدير وكذلك مايحدث من خلل في اتزان الحيوان نتيجة لتخدير العضلات التي تغذيها هذه الأعصاب .

SUMMARY

Twenty dogs were used in the present study to delineate the proper sites of exposure of the radial, median and ulnar nerves in the thoracic limb and tibial and fibular nerves in the pelvic limb.

The site, length, width and topographic relations of the subcutaneous parts of these nerves were perfectly described. The length and direction as well as the proper site of the incision were also determined. Blocking of the nerves at these sites was undertaken and the desensitized area for each was outlined.

INTRODUCTION

Peripheral nerve surgery such as nerve anastomosis, nerve grafts and nerve gaps may be used for repair of the damaged nerves which always takes place as a result of bone fractures and trauma (SWAIM, 1972).

The course, distribution and function of the nerves of the limbs in dogs were described by MILLER, CHRISTENSEN and EVANS (1964), GHOSHAL (1976), SKERRITT and McLELLAND (1964) and DYCE, SACK and WENSING (1987). Blocking, transection and neuroectomy of these nerves were dealt with at the brachial plexus or near its origin from the spinal cord. The present study, however, aims to determine the

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subcutaneous course of these nerves and the proper site at which these nerves can be easly exposed. It is a preliminary study needed by next ones to be applied in the field of nerve surgery in dogs.

Injury involving the brachial plexus may be partial or complete. The roots from C6 and C7 are not apt to be damaged. While the radial, median and ulnar nerves which arise mainly from C8 and T1 are involved in this damage (WORTHMAN, 1957). Also, these nerves are passing along the whole length of the limb, therefore these nerves are enlighten in the present work.

MATERIAL and METHODS

Twenty dogs were used in the present work. Five of them were submitted for anatomical description. The site, width, length and relationship of the subcutaneous parts of the radial, median, ulnar, tibial and fibular nerves were precisely determined. The length and direction of the proper incision were also recorded. These nerves were exposed in the other fifteen living dogs. Blocking of these nerves using xylocaine (2%) was carried out individually and by using pinprick the desensitized area for each nerve was maped. Great care must be taken to avoid infection and to minimize trauma.

RESULTS

N. radialis :

The radial nerve has no subcutaneous course but its ramus superficialis (Fig. 1) gains its subcutaneous postion on the flexor aspect of the elbow joint at the cranial border of the lateral head of the triceps brachialis muscle and continues subcutaneously along the whole length of the forearm and metacarpal region as the N. cutaneus antibrachii lateralis. Along its course this branch is accompanied by the cephalic vein. The ramus superficialis of the radial nerve is band like, 3.5 mm width and 2.1 cm length. It is properly exposed by making a vertical incision of 3 cm length 2.2 cm crnial to the lateral epicondyle of the humerus which is easly distinguished in the living animal. Proximal to this level the ramus superficialis is found between the lateral head of the triceps brachialis and the underlying brachialis muscle. Distal to this level it continues as the lateral cutaneous antibrachial nerve which come in contact with the cephalic vien.

Blocking of the superficial branch of the radial nerve result in desensitization of the skin over the lateral aspect of the forearm (Fig. 1) but the gait did not affected.

N. medianus :

The subcutaneous part of the median nerve (Fig. 2) is easiy exposed on the flexor aspect of the elbow joint caudal to the tendon of insertion of the M. biceps brachialis which is easly palpated in the living animal. Proximal to this level the median nerve is crossed superficially by the V. mediana cubiti and distal to this level it dives

under the M. pronator teres. This part is cord like, 3.2 mm in diameter and 3.3 cm in length. It is accompanied by the brachial blood vesels. An incision about 4 cm is made up vertically caudal and parallel to the tendon of insertion of the biceps brachialis muscle, but you have to avoid the injury of the brachial blood vessels.

Blocking of the median nerve at its subcutaneous course resulted in loss of sensation of the foot pad (Fig. 2) and slight sinking (over extension) of the carpal and digital joints.

N. ulnaris :

The subcutaneous part of the ulnar nerve (Fig. 3) could be palpated just caudal to the medial epicondyle of the humerus. This part is cord like, 3 mm in diameter and 5 cm in length. Proximal to this level the ulnar nerve is situated deep to the brachial blood vessels and loosely bound with the median nerve. Distal to this level the ulnar nerve dips under the ulnar head of the deep digital flexor muscle.

For exposure, a vertical incision 6 cm length was done on the medial aspect of the elbow joint just caudal to the medial epicondyle of the humerus and the joint must be completely extended.

Blocking of the ulnar nerve at the site of exposure leads to desensitization of the skin on the caudal aspect of the forearm and the lateral aspect of thefifth digit (Fig. 3). Also produce more or less over extension of the joints of digits.

Blocking of the ulnar nerve at the site of exposure leads to desens itization of the skin on the caudal aspect of the forearm and the lateral aspect of the fifth digit (Fig. 3). Also produce more or less over extension of the joints of digits.

At the begining of the distal third of the humerus the ulnar nerve gives off the N. cutaneous antibrachii caudalis which passes subcutaneously on the caudomedial aspect of the forearm. This branch is available for exposure at the medial surface of the olecranon tuberosity.

N. tibialis :

The available part of the tibial nerve (Fig. 4) is cord like, 4 mm in diameter and 7 cm in length. It is found in the web of skin cranial to the comman calcaneal tendon. It is accompanied by the caudal branch of the saphenous blood vessels and is easly exposed either from the lateral or the medial side. Proximal to this level the nerve is found between the two heads of gastrocnemious muscle and distal to this level the nerve passes in contact to the joint capsule of the tarsal joint. A vetrical incision of about 8 cm in length (Fig. 4) was performed cranial to the common calcaneal tendon.

Blocking of the tibial nerve result in desensitization of the skin on the planter aspect of the paw (Fig. 4).

Fig. (1): Site of exposure of the superficial branch of the radial nerve (left) and a diagram to its desensitized area (right). Left thoracic limb, lateral aspect.

Fig. (2): Site of exposure of the subcutaneous part of the median nerve (left) and a diagram to its desensitized area (right). Right thoracic limb, medial aspect.

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Fig.(1)

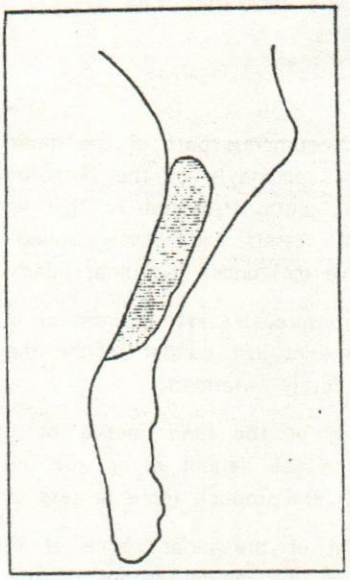
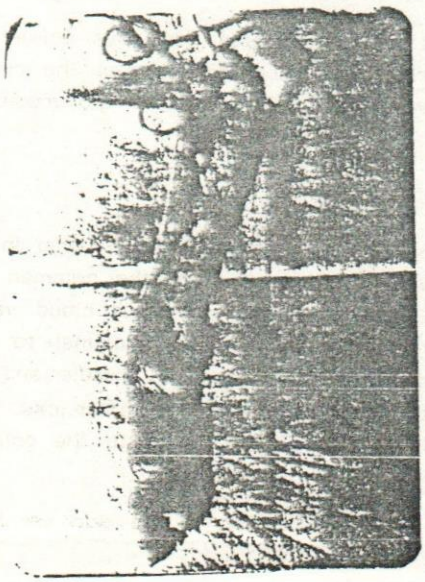


Fig. (2)



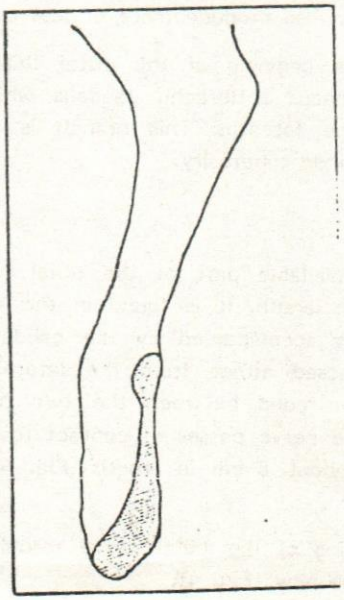
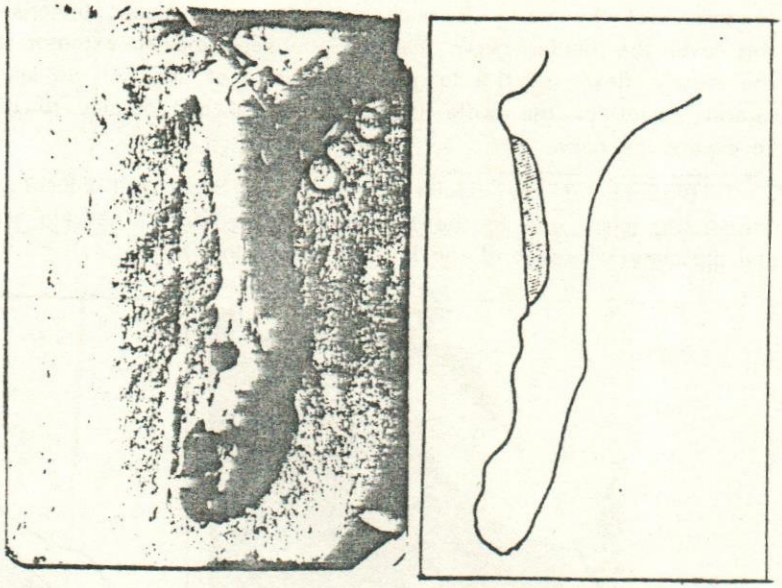


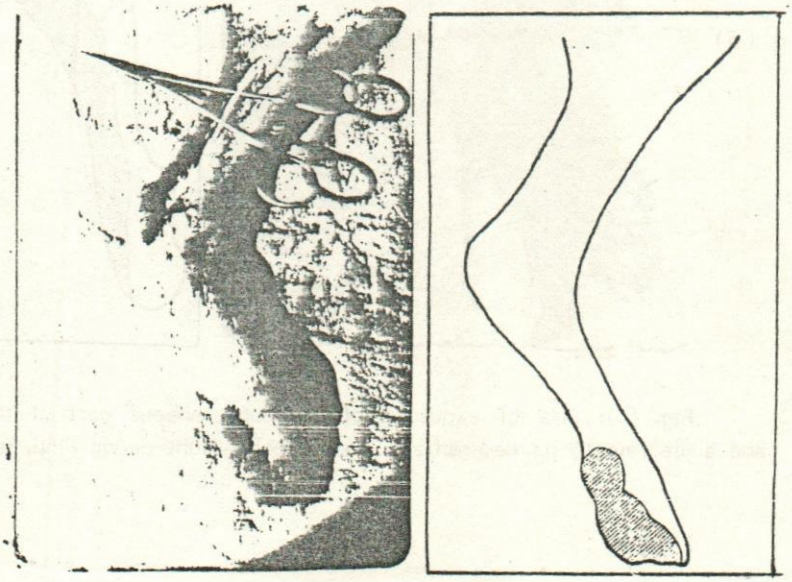
Fig. (3): Site of exposure of the subcutaneous part of the ulnar nerve (left) and a diagram to its desensitized area (right). Left thoracic limb, medial aspect.

Fig. (4): Site of exposure of the subcutaneous part of the tibial nerve (left) and a diagram to its desensitized area (right). Left pelvic limb, medial aspect.

Fig.(3)



Fig(4)



N. fibularis :

The superficial part of the fibular nerve (Fig. 5) is band like, 4.2 mm in width and 3.4 cm in length. It is found caudal to the head of the fibula, which is easly palpated, and undercovered by the aponeurotic tendon of M. biceps femoris. Proximal to this level the nerve is undercovered by the biceps femoris muscle and distal to this level the fibular nerve insinuate between the M. extensor digitorum lateralis and the muscle flexor digiti I longus. An incision of about 3 cm length performed on the lateral aspect of the stifle joint just caudal and parallel to the femur is sufficient to expose the nerve.

Blocking of the fibular nerve at its superficial course produces knuckling in the digital joints due to the flexion of these joints. The skin sensation was lost over the dorsolateral aspect of the leg and paw (Fig. 5).

Fig. (5) :

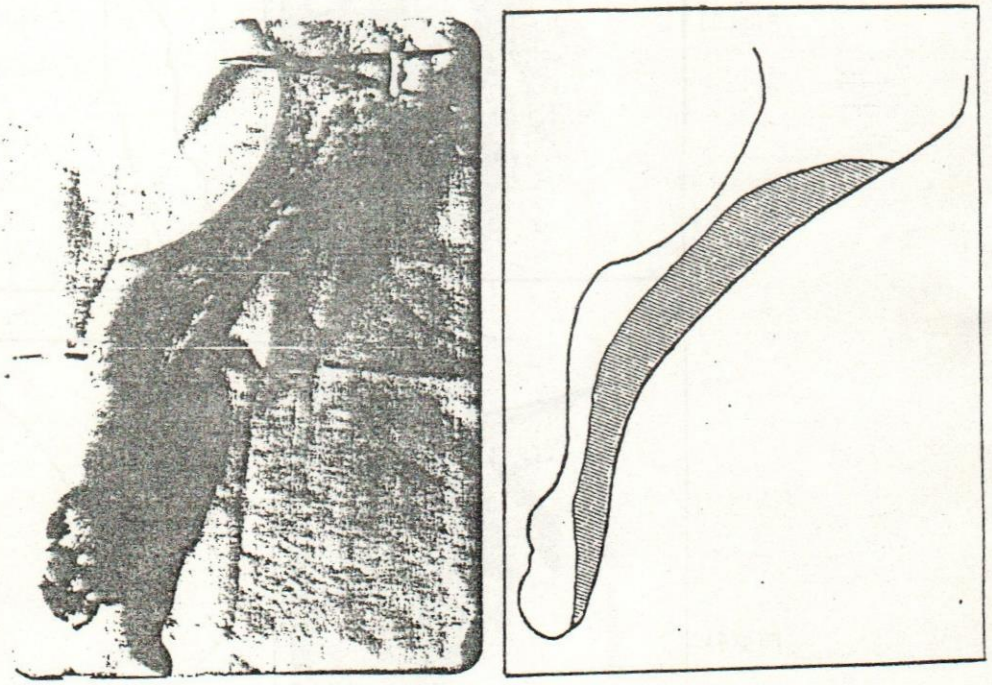


Fig. (5): Site of exposure of the subcutaneous part of the fibular nerve (left) and a diagram to its desensitized area (right). Right pelvic limb, lateral aspect.

DISCUSSION

Transection of the major nerves of the limbs were carried out by KNECHT and St, CLAIR (1969) and WORTHMAN (1972) near the brachial plexus or near it origin from the spinal cord. However the present study throw a light on the subcutaneous course of these nerve which is more suitable to be used in surgical interferences.

In agreement with the present investigation, GHOSHAL (1976) stated that the superficial branch of the radial nerve emerges upon the flexor aspect of the elbow joint. BOWNE (1959) has demonstrated that the radial can be interrupted just distal to the point where the last branch goes to the triceps brachii with no permanent impairment of location. This corresponds to the superficial branch of the radial nerve described in the present work which is also the favourate site for exposure. In the same respect DYCE et al. (1987) mentioned that the radial nerve is eminently vulnerable in fracture and from the tumors that commonly affected the humerus as that part of the radial nerve cross the elbow joint.

The present study investigated that blocking of the superficial branch of the radial nerve did not affect the gait because the elbow joint was not affected. This is due to the detachment of the muscular branches to the triceps brachialis muscle proximal to this level. Also, the present study showed that blocking of the superficial branch of the radial nerve resulted in loss of sensation over the lateral aspect of the forearm. This complies with that given by DYCE et al. (1987) who mention that radial paralysis may be stimulated by the ischemia that sometimes results from prolonged lateral recumbency.

DYCE et al. (1987) stated that the median nerve passes on the elbow joint cranial to the lateral collateral ligament before its dipping under the pronator teres. Similar finding was given in the present work.

The present study revealed that exposure of the subcutaneous part of the ulnar nerve must be done while the elbow joint is extended because flexion of the elbow joint result in displacement of this part of the ulnar nerve cranial to the medial epicondyle of the humerus.

GHOSHAL (1976) mentioned that the ulnar nerve shortly after it separates from the median nerve gives off the caudal cutaneous antibrachial nerve which courses subcutaneously over the medial surface of the olecranon. This complies the present investigation.

Blocking of either the median or ulnar nerve produced a slight degree of knuckliing. Aiso, WORTHMAN (1957) stated that when both nerves are cut there is little or no alteration of the gait and incomplete sensory loss. He added, if trnsection involves the musculocutaneous nerve, which joins the median nerve at the elbow joint, the sensory loss is complete.

DYCE et al. (1987) mentioned that the tibial nerve continues distally within the web of skin between the caudal crural muscles and the common calcaneal tendon. Similar description was offered in the present work.

The present study investigated that blocking of the tibial nerve produced no motor disability as the function of the flexor muscle remains well. This is because blocking of the tibial nerve was carried out distal to the origin of the muscular branches to these muscles. Moreover, DYCE et al. (1987) stated that the consequence of lesion that affect the sciatic nerve are less disasterous than might be supposed. He attributed this to the retention of activity of the quadriceps which enable the animal to fix the stifle and, through the reciprocal apparatus, the hock. It is thus able to support weight upon the limb.

HOERLEIN (1978) mentioned that the peroneal nerve is vulnerable to trauma as it crosses the lateral aspect of the stifle joint quite superficially. It is the subcutaneous course of the fibular nerve described in the current study. WORTHMAN (1957) stated that the fibular nerve passes superficially across the proximal end of the fibula. Also, he added that pressure on the peroneal nerve in its superficial course on the lateral side of the stifle joint may account for this action in animals which have been recumbent for long period in the form of knuckling of the fetlock which is simillar to that seen when the so called "doner" cow are first helped to stand. The present work revealed that blocking of the fibular nerve resulted in similar finding.

For exposure of the fibular nerve the present study reported that the incision must be performed parallel to the femur i.e. in the same direction of the fibers of the aponeurotic tendon of the M. biceps femoris. Elsewhere long part of the tendon will be teared.

For blocking of the tibial and fibular nerve you have to put in your mind the statement of WORTHMAN (1957) who mentioned that intramuscular injection into the caudal thigh muscles may inadvertently affects the function of these nerves.

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