



Clinical and Anatomical Changes induced by Sciatic Nerve Section of Weaning Age Rabbits

Ban Ismael Sedeeq¹, Ayad Hammeed Ibrahim², Abul Kareem Salem Mahood³

¹ College of Dentistry, University of Tikrit, Tikrit, Iraq

² College of Veterinary Medicine, University of Tikrit, Tikrit, Iraq

³ College of Medicine, Wasit University, Kut, Iraq

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Corresponding Author:

Name: Ban Ismael Sedeeq

E-mail:

drbanasnan@gmail.com

Tel:

Abstract

The aim of the study was to explore the clinical and anatomical changes occurred after Sciatic nerve section in the weaning age in rabbits. Twenty-five rabbits were used in this study ranging from 1-2.5 months. Divided into five subgroups according to the number of survival days (W7) (W14) (W30) (W60) (W90). Surgery was performed under general anesthesia. The nerve was sectioned using a small surgical scissor. Clinically a few days later, the sign of right hind paws paralysis was observed clearly. The results revealed of a gap formation between the two nerve stumps [proximal and distal], and the gap increases on the day fourteenth.

During the following two weeks, ulcers began to appear in the skin at the dorsal side of the ankle joint, and there was also an enlarged popliteal lymph node. Within 30-60 days another area was invaded by ulcer with or without bone exposure, the anterior part of the posterior side of the hind limb. After 90 days, there was severe ulceration and bone exposure with enlarged lymph nodes and the ulceration extended to the ventral side of the hindlimb. Results showed a gradual worsening of the condition and without improvement in peripheral nerves.

Introduction

Nerve injury, repair, and regeneration are difficult study areas to in human clinical situation, because of the inability to sample tissues to elucidate the injury, inflammation, and repair events without causing significant damage to the peripheral nerve. This inability to obtain tissue also precludes the ability to evaluate the effect of an injury on central and peripheral neurons. Imaging modalities to evaluate the peripheral nerve are limited in their ability to image nerve injury, except when the nerve is divided.^[1]

Therefore, approximately all nerve injury researches have taken place in an experimental animals. Although, many studies were performed on this topic in different mammals specially in rat ^[2-4], little were performed in rabbit and no study was found concerning clinical and anatomical changes after sciatic nerve injury in rabbit. So the present study was designated to clarify clinical manifestations associated with complete sciatic nerve section at mid thigh region in different age groups in rabbits.

Materials and methods

Total number of rabbits used in this study was 25 rabbits, their ages range between 1 -2.5 months. This representing weaning age [W] in rabbits ^[5&6]. All were allowed free access to food and water before the experiment and were divided into five subgroups [5 animals in each] according to their survival day after operation. Group (W7) was sacrificed 7 days post operation, group (W14) was sacrificed at day 14 post operation, group (W30) sacrificed at day 30 post operation, group (W60) sacrificed day 60 post operation, and group (W90) was sacrificed 90 days post operation.

Surgical operations were made under general anesthesia (IM) of [50mg/kg] Ketamin hydrochloride with xylazine hydrochloride [10mg/kg]. A longitudinal incision about 2.5 cm was made on the lateral side of the thigh parallel to longitudinal axis of Femur bone, and then separation between muscles continues until reaching the area where the sciatic nerve lies.

The nerve was sectioned using small surgical scissor. Then the two edges were returned back to their original position. The muscles were then returned back to their original positions and sutured using continuous suture using (chromic catgut) size 3.0. The skin sutured using interrupted suture using (Black silk) size 3.0. Prophylactic antibiotic solution injected (IM) for three days after operation to prevent infection.

Results

Immediately after surgical operation and during the walking, the staggering of all animals were shown but, the sign of right hind paws paralysis was absent. Few days later, the sign of right hind paws paralysis was observed clearly.

Post sacrificing the animals of W7 group, the right thigh was dissected to expose the areas of sciatic nerve section and popliteal fossa for examination if there was any anatomical changes. The results revealed a gap formation between the two nerve stumps [proximal and distal sectioned ends], range between 1-4 mm, adhesion and intermingling of nerve connective tissue [epineurium] with adductor magnus connective tissue [epimysium] was observed (fig 1) and there was no any sign of popliteal lymph nodes enlargement in any animal.

The same results was observed in W14 group, but the gap length was increased and it was 5-8 mm. Neuroma was observed in one animal and again there was no sign of lymph nodes enlargement in any animal. During the following two weeks, skin ulceration of the dorsal aspect of ankle joint was began to form. This ulceration was appeared clearly in most animals of W30 group (fig 2). Different results were observed in W30 group concerning the gap of sectioned sciatic nerve, ranging between the remaining of the gap and buildup the defect. The result revealed also a popliteal lymph node enlargement (fig 3).

During the period of 30-60 days, another area was invaded by ulcer with or without bone exposure, which was the anterior part of the dorsal aspect of animal paw. most of the hind paw of the animals of W60 group, were ulcerated. In W90 group, there was severe ulceration and bone exposure in all animals except one with lymph node enlargement. The ulceration extended to the ventral aspect of the hind paw (fig 4).

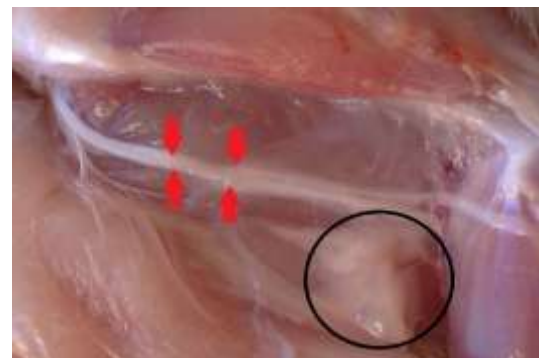
Examination of sciatic nerve, revealed different results, which included Small or large neuroma formation at proximal stump, with the remaining of the gap or approximation of the two stumps with weak or good connection (fig 5 , 6 & 7).



Fig[1]: W7 group, gap formation at the site of sciatic nerve section [circle] with adhesion and intermingling of nerve connective tissue [epineurium] with adductor magnus [A] connective tissue [epimysium]



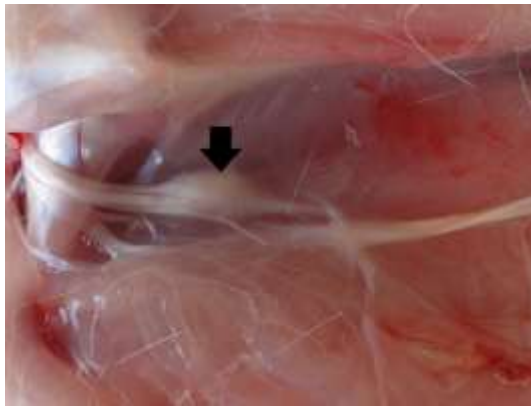
Fig [2]: W30, ulceration of skin of the dorsal aspect of ankle joint



Fig[3]: W30 group, disappearance of the gap between the original location of the two stumps of sectioned sciatic nerve [gray arrows] and Popliteal lymph node enlargements [circle]



Fig[4]: W90 group, severe ulceration in the animal hind paw with metatarsal bone exposure [gray arrows] and only one finger nail was remain [black arrow].



Fig[5]: W90 group, neuroma at the proximal stump [arrow]

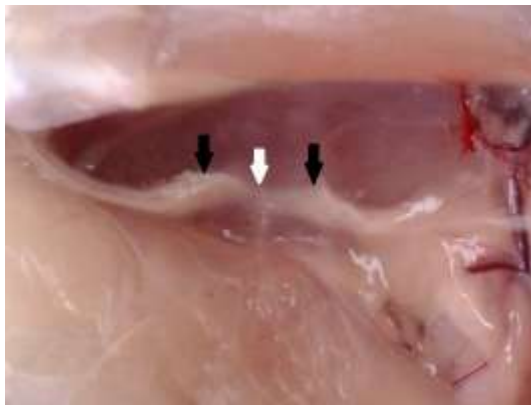


Fig [6]: W90 group, approximation of the two nerve stumps [black arrows] with weak connection [white arrow]

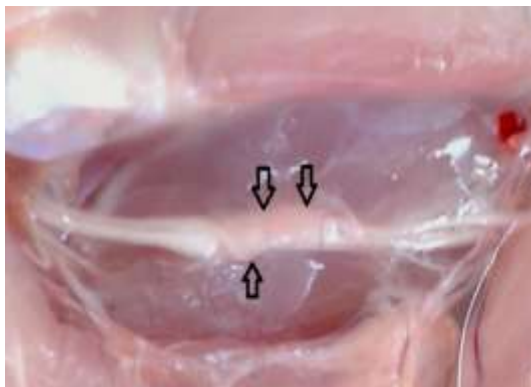


Fig [7]: W90 group, good connection with thickening in the epineurium [black arrows].

Discussion

The observation in the present study revealed that, immediately post surgical operation, the sign of right hind paws paralysis was absent. Within few days, paralysis was propagated and became clear. This result was in agreement with electromyographical study made by Quan & Bird ^[7]. They found that, in the immediate minutes to first several days after nerve transaction, the distal axon fragment remains electrically excitable. During this period, distal stimulation to the site of injury may result in normal

or mildly abnormal values despite severe proximal nerve injury.

Chaudry and Cornblath ^[8] clarify in their study that, motor neuron remain excitable for up to 7 days after injury and sensory axons remain excitable for up to 11 days.

Sacrificing the animals of all major groups day seven post operation clarified, gap formation at the site of sciatic nerve section in most animals specially, that of weaning and maturation groups. This retraction, related to the connective tissues surrounding the nerve fibers rather than nerve fibers themselves. Bahcelioglu et al ^[9] found that, both collagen and elastic fibers were less resistant to age relates loss in the peripheral nervous system. So, the longitudinally arranged elastic fibers, responsible for retraction and collapse of the proximal and distal stumps in the weaning age rabbit.

In the present study, neuroma formation was observed in some animals at day fourteen and later. Traumatic neuroma (also known as amputation neuroma or pseudoneuroma) ^[10] is a type of neuroma which results from trauma to a nerve ^[11].

Traumatic neuroma, an attempt by an injured nerve to regenerate, may present as an unorganized, bulbous or nodular mass of nerve fibers and Schwann cells produced by hyperplasia of nerve fibers and their supporting tissues ^[12]. In addition to that, the mesenchymal cells proliferate in response to the inflammatory process and initiate collagen deposition at the proximal stump, this in conjunction with fibrin remnants from the initial hemorrhage, may lead to neuroma formation Raffé ^[13].

During the period of 14 - 60 days, the skin which innervated by sciatic nerve branches was invaded by ulcer with or without bone exposure, however, in mild cases, only the hair was lost from the skin. Dunnen & Meek ^[14] were categorized the decrease in the length of nails, atrophy of the skin and superficial wounds of the skin as trophic anomalies and the extensive wounds [e.g. exposed bone] or loss of a part of the foot or toes as auto-mutilation.

These changes in the hind paw were observed in most [e.g. about 75%]. however, the skin of some animals remain intact during their period of survival [e.g. about 25%]. This result was in disagreement with the result of Dunnen & Meek ^[14]. They found, that post sciatic nerve section in rats, up to 60% of the rats showed signs of auto-mutilation. It might be due to the differences in the body reaction of different experimental animals against the nerve section.

Popliteal lymph node enlargement, closely related to the presence or absence of skin changes. Even in mild cases, there was a slight changes in the size of the lymph node. The enlargement resulted from skin infection during friction or contamination of the ulcer.

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التغيرات السريرية والتشريحية بسبب قطع العصب الوركي في عمر الفطام للارانب

بان اسماعيل صديق¹ ، أياد حميد ابراهيم² ، عبد الكريم سالم ماهود³¹كلية طب الاسنان ، جامعة تكريت ، تكريت ، العراق²كلية الطب البيطري ، جامعة تكريت ، تكريت ، العراق³كلية الطب ، جامعة واسط ، الكوت ، العراق

الملخص

الهدف من هذه الدراسة هو معرفة التغيرات السريرية والتشريحية التي تحدث بعد قطع العصب الوركي في عمر الفطام في الارانب. استعملت 25 أرنباً في هذه الدراسة تتراوح اعمارهم ما بين 1-2.5 شهر. تم تقسيمها إلى خمس مجموعات فرعية وفقاً لعدد ايام بقائها بعد العملية (W14) (W7) (W30) (W60) (W90). أجريت العمليات الجراحية تحت تأثير التخدير العام. تم قطع العصب بواسطة مقص جراحي صغير. سريرياً وبعد بضعة أيام، لوحظ بوضوح وجود شلل في الطرف الخلفي الأيمن. وكشفت النتائج عن وجود فجوة بين نهايتي الأعصاب المقطوعة [الدانية والقاصية] وتزداد الفجوة في اليوم الرابع عشر. وخلال الأسبوعين التاليين بدأ ظهور تقرح في الجلد من الجانب الظهري من مفصل الكاحل، كما لوحظ ان هناك تضخم في العقدة الليمفاوية المأبضية. وخلال فترة 30-60 يوماً غُزيت منطقة أخرى بالقرح مع أو بدون تعري للعظام، وهي الجزء الأمامي من الجانب الظهري من الطرف الخلفي. وفي يوم 90، كان هناك تقرح شديد وتعري العظام مع تضخم العقد الليمفاوية وأمتد التقرح إلى الجانب البطني للطرف الخلف. دلت النتائج على تردي الحالة بصورة تدريجية وعدم وجود تحسن في الاعصاب الطرفية.