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# Surgical Repair of Sciatic Nerve and its Branch Injuries in Libyan War Casualties

HANY EL NEMR, M.D.*; MOHAMED EL HAWARY, M.D.* and AHMED ATALLAH SAAD, M.D.**

*The Department of Neurosurgery, Faculty of Medicine, Benha* and Cairo** Universities*

## Abstract

*Background:* The sciatic nerve consists of two distinct divisions: Tibial and peroneal. Injuries to the sciatic nerve during combat are often severe, resulting in varying but generally major effects. These injuries are sometimes accompanied by extensive damage to soft tissues and bones, substantial neurological impairment, intense neuropathic pain, and a lengthy healing period.

*Aim of Study:* This retrospective study aimed to assess the outcomes of surgical treatment of sciatic nerve injuries in individuals who were injured during the Libyan war.

*Patients and Methods:* During the Libyan War from 2017 to 2019, we utilized nerve grafting, direct end-to-end coaptation, and neurolysis to treat 19 patients with sciatic nerve injury. Gunshot wounds affecting the upper thigh or pelvis were the most common causes of injury.

*Results:* Of the total number of patients, 75% experienced injury to the tibial nerve, whereas 85% experienced injury to the common peroneal nerve. 67% of those with upper-third lesions had excellent recovery of protective feeling in the sole. For the tibial nerve, the total percentage of motor recovery was 85%, and for the common peroneal nerve, it was 35%.

*Conclusion:* The outcomes of treating sciatic nerve damage in these patients with war-related injuries were largely favorable. Repairing tibial nerve damage in the upper thigh has a greater chance of recovery compared to the common peroneal nerve. Tendon transfer or orthopedic devices can effectively address motor impairments caused by damage to the common peroneal nerve.

***Key Words:*** *Sciatic nerve – War casualties – Neurolysis.*

## Introduction

**NEUROSURGEONS** regard combat-related injuries to peripheral nerves as intricate issues. Nerve injuries occur as a result of penetrating traumas, such as gunshot wounds, explosion fragments, or bone fractures, that damage or sever the nerves by cutting, stretching, or tearing. Both local and systemic vascular impairment, along with injury to bones and soft tissues, commonly accompany these nerve injuries **[1-5]**. Multiple investigations have shown a relatively high occurrence of sciatic nerve damage, resulting in highly unfavorable outcomes after surgical treatment. Electro-diagnostic examinations and magnetic resonance imaging provide additional physiological and anatomical information to the clinical evaluation, allowing for a more precise determination of the scope and location of the nerve damage. These tests can help determine whether to do surgery after a traumatic event and which specific methods to use. However, their contribution to long-term results remains incompletely understood. This experience highlights the necessity of ongoing efforts to ascertain the management of sciatic nerve injuries **[6-10]**.

Situations where partially injured sciatic nerves receive external neurolysis for decompression or direct end-to-end suturing of a cleanly severed nerve yield optimal functional results. In combat-related peripheral nerve injuries (PNI), it is uncommon to find substantial nerve gaps. However, when they do occur, repair typically involves nerve grafting or tubulization. When the space between nerves is longer than 3cm, it is advisable to use a nerve graft instead of tubulization. The use of sural nerve autografts has traditionally been considered the most efficient method for reconstructing peripheral nerves. However, studies have shown that obtaining enough sural nerve autograft to bridge and connect a large nerve such as the sciatic nerve can be challenging and not always successful **[11–17]**.

This retrospective study aimed to assess the outcomes of surgical treatment of sciatic nerve damage in individuals who were injured during the Libyan war.

***Correspondence to:*** Dr. Ahmed Atallah Saad,
E-Mail: ahmed.atallah09@kasralainy.edu.eg

## Patients and Methods

The study comprised 19 patients who had sciatic nerve injuries during the Libyan War between 2017 and 2019. These patients were treated at Benha University Hospital using nerve grafting, direct end-to-end coaptation, and neurolysis. Gunshot wounds to the upper thigh or pelvis were the most prevalent causes of damage. Prior to their transfer to our facility, most of the patients had already received treatment for additional injuries like vascular, muscular, or orthopedic ones at the time of the initial accident. The therapy involved performing ten reparations on the tibial division of the sciatic nerve, with five repairs in the gluteal region and four repairs in the upper thigh region. Nine patients experienced nerve damage as a result of bullet wounds, whereas ten patients suffered nerve injuries due to wounds caused by shell fragments. The patients had an average age of 30 years, with a range of 15 to 45 years. We documented the age, gender, the cause of damage, the length of time between the injury and nerve surgery, and the extent of the nerve defect during surgery. Every patient had recorded evidence of preoperative clinical and electrophysiological evaluations.

The following methods were applied for the studied cases:

A) *History taking:*

1- Personal history.

2- History of present illness:

1- *Pain:*

We assessed the level of pain caused by the nerve damage, focusing specifically on neuropathic pain, as it was the most debilitating aspect. Neuropathic pain is characterized as a sensation of searing parasthesias or electric shocks.

*2- Tingling:*

It presented distal to the site of nerve injury.

B) *Examination:*

The patients were examined for: Vital signs (pulse, blood pressure, and temperature), site of scar (Fig. 1), motor power, The examination also looked for sensory deficits, deep reflexes, and gait disturbances.

C) *Investigations*:

1- Routine laboratory investigations.

2- Radiological investigations:

- A plain X-ray may reveal the presence of foreign bodies or fractures.
- Computed tomography (CT) may show the presence of foreign bodies or fractures.
- Electrodiagnostic tests and ultrasonography provide additional physiological and anatomical information to assess the severity and location of the nerve damage during the clinical examination. These tests can assist in determining the optimal timing for surgical intervention following a traumatic event, as well as the most suitable measures to be taken.

*Surgical technique:*

Under general anesthesia, Surgery was performed with the patient in a prone position with the knees and hips flexed to approximately 15 degrees.

a- We conducted an external neurolysis procedure, beginning in parts of intact tissue and ending in regions of compromised tissue. We divided the sciatic nerve into its peroneal and tibial divisions, both proximal and distal to the injury, prior to assessing the tibial division. (Fig. 2).

b- External and internal neurolysis.

c- End-to-end anastomosis of the proximal and distal ends of the injured nerve. (Fig. 3).

Nerve grafting is performed using an ipsilateral sural nerve autograft.

*Intraoperative findings:*

A- Four individuals had no detectable NAP distal to the lesion but a neuroma-in-continuity (caused by a partial nerve damage). Resection of these non-conducting fascicles was followed by the implantation of an interfascicular graft containing a processed nerve graft. Fig. (4).

B- Nine patients exhibited stump neuromas of one or both the tibial or peroneal components of their transected sciatic nerve. In these nerves, the stump neuromas were excised until normal-looking fascicles were seen. One might use a sural nerve autograft to do an end-to-end nerve repair directly or with many interfascicular nerve grafts.

C- Neurolysis was performed only in six individuals because they had adhesions exclusively on the sciatic nerve or its major divisions.

*Post-operative follow-up:*

Every patient underwent various neurological evaluations to measure motor and sensory impairments, in addition to at least one repeated electromyography/nerve conduction study (EMG/NCS) conducted 6 months after the surgery. We conducted postoperative follow-up on patients for at least one year.

Fig. (1): Scar in the back of knee and lower thigh.

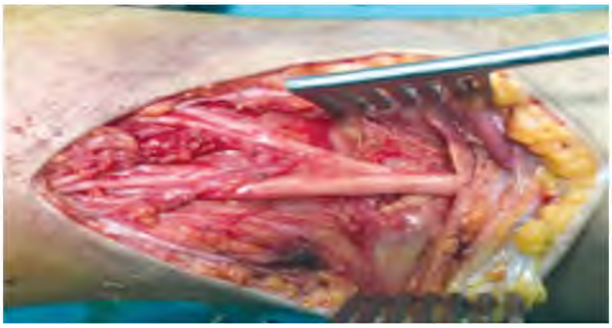

Fig. (2): Neurolysis of tibial nerve entrapment after firearm injury.

Fig. (3): End to end anastomosis of sciatic nerve injury.

Fig. (4): Picture showing the site of partial sciatic nerve injury.

## Results

*Clinical data:*

This series included 4 advanced-level and 15 intermediate-level repairs.

The tibial and peroneal branches of the sciatic nerve received repairs at an intermediate level. Four patients received surgical repairs at the gluteo-pelvic level, which required the division of the piriform muscle to facilitate better access in the sciatic notch area.

Peroneal nerve or peroneal division damage was seen in 5 individuals, and 4 of them required simultaneous repair of the peroneal nerve together with the tibial nerve.

*Factors influencing the outcome:*

A- Surgical timing: The patients received surgery on average six months following the accident, with a range of one to twelve months.

B- Injury severity: Seven patients experienced bone fractures caused by projectiles in the location where nerve restoration was needed, while five patients had significant soft tissue damage, often in the medial leg or popliteal and posterior thigh areas.

C- Patients with soft-tissue abnormalities, major artery lesions, and/or bone fractures have worse outcomes due to associated tissue damage.

D- The repair outcome was substantially connected with the amount of repair, preoperative interval, and length of nerve defect. Additionally, these parameters were found to be independent predictors of a good outcome.

E- The deterioration of the result commenced with a nerve defect over 5 cm in length and a preoperative interval surpassing 4 months.

In our study, we found that the age of the patients ranged from 15–45 years, with a mean of 30 years, and the rate of injury of tibial and peroneal branches was higher than sciatic nerve injury, as shown in Table (1).

Table (1): Number of patients.

| Nerve | No. of patient |
|---|---|
| Tibial and peroneal nerve injury | 15 |
| Sciatic nerve injury | 4 |

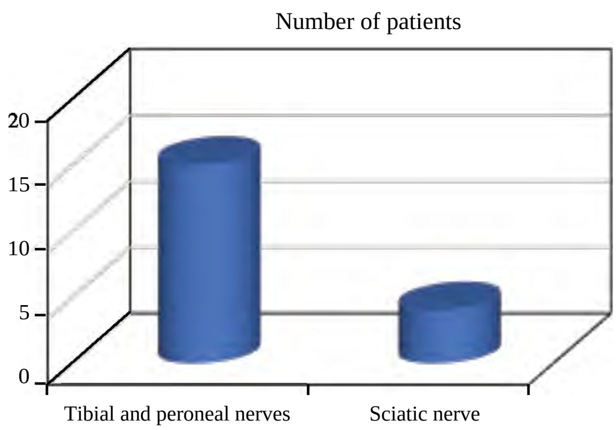


Diagram (1): Number of patients.

*Operative note:* Surgery was performed with general anaesthesia. We performed external neurolysis in 12 cases (63%), end-to-end anastomosis in 4 cases (21%), and nerve grafting in 3 cases (15.8%). Table (2).

Table (2): Type of surgery.

| Type of surgery | No. of patients |
|---|---|
| External neurolysis | 12 cases |
| End to end anastomosis | 4 cases |
| Nerve graft | 3 cases |

*Intraoperative findings:*

Foreign bodies, such as missiles or shell fragments, were present in 16 cases (84%), and we could remove them in 12 cases (63%).

Associated muscle and tendon injuries were present in 14 cases (73.6%).

Adhesions were found in most cases. (Fig. 5).

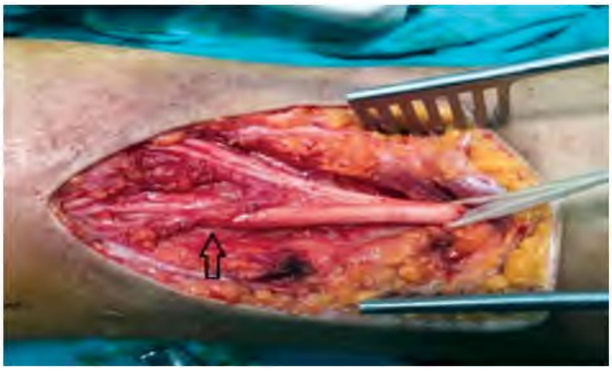

Fig. (5): Tibial nerve injury with adhesions on it (black arrow).

Postoperative improvement was seen in 16 cases in the form of motor power improvement in 12 cases and relief of neuroma pain in 5 cases, while 2 cases showed no improvement, as shown in Table (3) and Diagram (2).

Table (3): Postoperative improvement.

| Postoperative motor power improvement | Postoperative relief of pain of neuroma | No improvement |
|---|---|---|
| 12 cases | 5 cases | 2 cases |

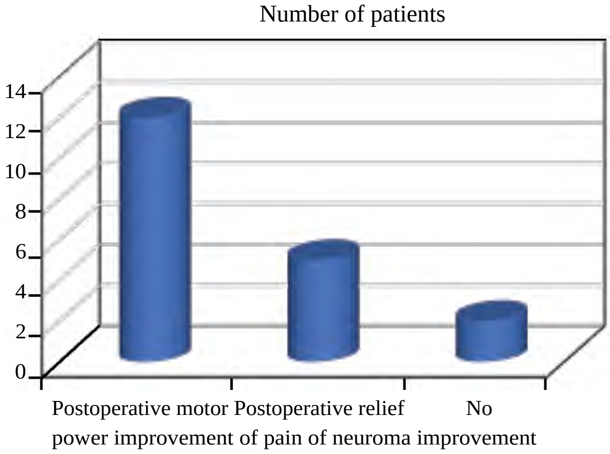


Diagram (2): Postoperative improvement

In three cases, postoperative complications were seen, including wound hematoma in one case and wound infection in two cases, which were managed. Table (4).

Table (4): Postoperative complications.

| Postoperative complications | No. of patients |
|---|---|
| Wound hematoma | One cases |
| Wound infection | 2 cases |

## Discussion

In this study, there was a male predominance. We found that the patients' ages ranged from 15–45 years, with a mean of 30 years.

Jamal Gousheh and Ehsan Arasteh **[1,5]** conducted a 2007 study on sciatic nerve repair in Iran-Iraq war casualties ranging in age from 12 to 48 years.

In this study, the rate of injury to tibial and peroneal branches was higher than sciatic nerve injury.

It is similar to a 2007 study by Jamal Gousheh and Ehsan Arasteh **[1,5]** that found a high rate of injury in the tibial and peroneal branches.

Twelve cases underwent intraoperative external neurolysis, four underwent end-to-end anastomosis, and three underwent nerve grafting.

*So we used three techniques:* External neurolysis, end-to-end anastomosis, and nerve grafting.

Similar to the 2007 study by Jamal Gousheh and Ehsan Arasteh **[1,5]**, they also employed three techniques.

In 16 cases, there was postoperative improvement in the form of improved motor power in 12 cases, relief from neuroma pain in 5 cases, and no improvement in 2 cases.

Therefore, we saw improvement in 17 cases, resulting in an 89% improvement rate.

This study's improvement rate matched the 87% improvement rate of Jamal Gousheh and Ehsan Arasteh's **[1,5]** study.

In this study, we had two patients with no improvement in motor power or pain from neuroma.

Three cases experienced postoperative complications, including a wound hematoma in one case that required a reoperation for hemostasis, and wound infections in two cases that required antibiotic management.

*Conclusion:*

According to our opinion, surgery still remains the best therapeutic possibility for injuries to the sciatic nerve and its branches.

Surgery includes three techniques to restore the nerve's continuity for function recovery (external neurolysis, end-to-end anastomosis, and nerve grafting).

Early intervention for a sciatic nerve injury allows for good function recovery and improves the associated pain to start physiotherapy and rehabilitation.

Severe nerve injury, along with other soft tissue injuries, is associated with poor surgical outcomes.

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# الاصلاح الجراحى لأعصاب الورك وإصابات فروعها في مصابى الحرب الليبية

**الخلفية:** العصب الوركى يتألف من قسمين متميزين: عصب قصبة الساق والعصب الظنبوى. الإصابات فى العصب الوركى خلال المعارك غالبًا ما تكون شديدة، مما يؤدى إلى تأثيرات متفاوتة، ولكن عمومًا ذات أثر كبير. تكون هذه الإصابات فى بعض الأحيان مصحوبة بأضرار واسعة النطاق فى الأنسجة الرخوة والعظام، وتقلصات كبيرة فيى الوظيفة العصبية، وآلام عصبية حادة، وفترة شفاء طويلة.

**الهدف من الدراسة:** هذه الدراسة الاسترجاعية تهدف إلى تقييم نتائج العلاج الجراحى لإصابات العصب الوركى فى الأفراد الذين تعرضوا لإصابات خلال الحرب الليبية.

**المرضى والطرق:** خلال الحرب الليبية من عام ٢٠١٧ إلى عام ٢٠١٩، استخدمنا زراعة الأعصاب والتقوية المباشرة الطرف بالطرف، والتحرير العصبي لعلاج ١٩ مريضًا يعانون من إصابة فى العصب الوركى. كانت الجروح الناتجة عن طلقات البنادق التى تؤثر على الفخذ العلوى أو الحوض هى الأسباب الأكثر شيوعًا للإصابة.

**النتائج:** من إجمالى عدد المرضى، شعر ٧٥٪ بإصابة في العصب السمين، فى حين شعر ٨٥٪ بإصابة فى العصب اللولبى الشائع. وكان ٦٧٪ من الذين يعانون من آفات فى الثلث العلوى للعصب يتمتعون بتحسن ممتاز فى الشعور الواقى فى النعل. بالنسبة للعصب السمين، كانت نسبة التعافى الحركى الإجمالية ٨٥٪، وبالنسبة للعصب اللولبى الشائع، كانت ٣٥٪.

**الخلاصة:** كانت نتائج علاج أضرار العصب الوركى في هؤلاء المرضى الذين تعرضوا لإصابات تتعلق بالحرب إيجابية بشكل كبير. يوجد فرصة أكبر للتعافي عند إصلاح أضرار عصب قصبة الساق فى الفخذ العلوى مقارنة بالعصب الظنبوى الشائع. يمكن لنقل الأوتار أو الأجهزة الجراحية التى تدعم العظام التعامل بشكل فعال مع الإعاقات الحركية الناتجة عن الضرر فى العصب الظنبوى الشائع.