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Sciatic Nerve Injuries At Buttock And Thigh Levels: Review Of 15 Cases, Presentation And Outcome Of Surgical Repair

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Abstract

OBJECTIVE: To review 15 cases of sciatic nerve injuries at buttock and thigh levels as regards (clinical presentation, outcome of surgical repair) and to analyze results of the treatment.

METHODS: Data of 15 patients were retrospectively reviewed. All patients had sciatic nerve injuries at the buttock and thigh levels and were evaluated and treated between 2012 and 2015. Eight patients had bullet injuries, 3 patients were direct injection related injuries at the buttock level, 1 patient sustained sciatic nerve injury after a total hip arthroplasty, and 3 had crush injuries at the thigh level.

RESULTS: The age of the patients was ranging between 18- 42 years with mean 27±7.6. The sciatic nerve injury was caused by bullets in 8 (53%), faulty injection in 3 (20%) of cases, crush injuries in 3 patients (20%) and 1 case post hip arthroplasty (6%). The site of injury was at the buttock in 6 (40%) and 9 patients (60%) presented with thigh-level injuries. Five cases (33.3%) suffered complete but isolated common peroneal territory palsy. one patient (6.6%) had solitary complete tibial division palsy. In 3 cases (20%) the injury included complete tibial and common peroneal deficits. Four cases (26.6%) had partial injury included the common peroneal division and two cases (13.3%) had partial injury included both divisions. The time interval between time of injury and surgical repair ranges from 2 weeks to 1 year with a mean of 6.7 months ±2.9 months. Follow up period ranges from 11-22 months with mean of 16±3.7 months. Seven cases had undergone neurolysis, 4 cases had end to end anastomosis with excision of neuroma involving the peroneal division and neurolysis of the tibial division and in 4 cases, neuroma had been excised and sural grafting was used. Out of 14 patients in whom peroneal division was repaired by either of the three techniques, good recovery of sensory and motor functions was achieved in 6 patients (43%). Out of 6 cases in which tibial division was treated by either of three techniques. Four cases achieved full recovery (66.6%) as regard both motor and sensory functions.

CONCLUSION: Surgical exploration and neurolysis, or repair with sutures or grafts is worthwhile in selected cases of sciatic nerve injuries at the buttocks or thigh. The tibial functional outcome was consistently better than the peroneal outcome at both levels for all the traumatic injury mechanisms encountered and for the different surgical repair techniques.

INTRODUCTION:

Sciatic nerve is the longest nerve in the human body, representing the continuation of the main part of the sacral plexus deriving its fibers from L4 -S3 spinal segments [1]. The rami converge at the inferior border of piriformis to form a thick flattened band approximately 2 cm wide which leaves the pelvis through the greater sciatic foramen commonly inferior to piriformis. The sciatic nerve is composed of two independent tibial and common peroneal components over its entire length covered with a common sheath in the thigh region [2].

The two nerves eventually diverge, with the tibial nerve descending medially through the popliteal fossa into the back of the leg and the common peroneal diverging laterally from the midline to pass behind the head of the fibula and lateral to its neck [3].

The sciatic nerve supplies no structure in the gluteal region. It supplies the posterior thigh muscles, all leg and foot muscles, and the skin of most of the leg and foot (except the medial aspect, which is innervated by the saphenous nerve, a branch of the femoral nerve) [4].

Lesions involving the sciatic nerve comprise the largest subset of lower extremity nerve injuries. Injuries to the sciatic nerve at buttock and thigh levels cause neurologic deficits in the common peroneal or tibial nerve distribution [3].

Thus, presentation and response to surgical interventions and postoperative sequelae of the sciatic nerve are not identical along its length. Most injuries result in more deficits to the peroneal division compared with the tibial division [4].

Besides the obvious difference in size of the two nerve components, the peroneal division is usually in the form of one major bundle, so that nourishing vessels are usually located peripherally and have less protection than those of the tibial division, which lie in the crevices between the bundles [5].

As the tibial nerve has a richer and more protected blood supply than the peroneal division, it is probably less vulnerable to damaging injuries and can also be dissected over a longer length without jeopardizing blood supply. This can be considered a main reason for the major difference in favorable results of the surgical treatment of sciatic nerve injury [6].

Moreover, it was observed that the largest arteriae nervorum in the body are those supplying the sciatic nerve in the buttock and the thigh. This rich blood supply to the sciatic nerve can be troublesome during its repair due to intense bleeding [5].

Aim of the study: In this study, we elucidate our experience with 15 cases of sciatic nerve injuries at the buttock and thigh levels describing clinical presentation, type of repair and outcome in relation to the mode of injury.

PATIENTS AND METHODS:

We conducted a retrospective review of 15 cases of sciatic nerve injuries diagnosed and underwent surgical repair during a period of 3 years (2012–2015) at Ain Shams University Hospitals. Two injury sites for the sciatic nerve were designated in this study at the buttock, marked inferiorly by the gluteal skin crease and at thigh level, extending from the gluteal skin crease to a point located four finger breadths (about 7 cm) proximal to the popliteal skin crease.

Data of these patients has been retrospectively collected from their medical records. Each patient underwent detailed clinical assessment of sciatic nerve lesion which included mode of trauma, clinical presentation in addition to a thorough neurologic examination augmented by neurophysiologic studies in which motor and sensory functions in the distribution of both tibial and common peroneal territories of the sciatic nerve were assessed. The neurophysiologic examination included electromyography of the extensor digitorum brevis, abductor hallucis, tibialis anterior, and gastrocnemius muscles and Nerve conduction tests of the posterior tibial and common peroneal divisions of the injured limb.

Operative data including timing of repair, intraoperative findings, type of repair and whether graft was used or not were also analyzed. Finally, postoperative outcome was assessed based on clinical improvement of motor and sensory functions, in addition to neurophysiological studies.

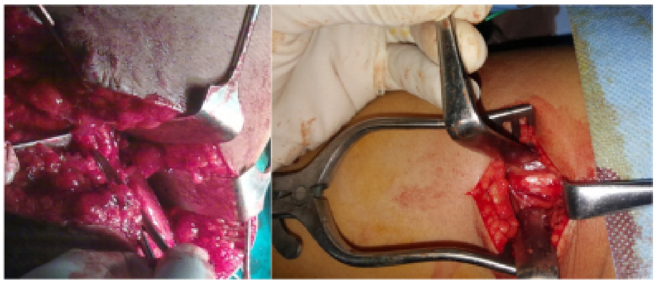
Surgical indication, timing and technique:

The time interval between injury and repair ranged from 2 weeks to 1 year, depending on the cause of injury, wound characteristics and other associated injuries which needed prioritization such as head, thoracic, or abdominal injuries or infection in the injured extremity. In such circumstances, the sciatic nerve repair was postponed. Good skin coverage using a skin graft or flap was also obtained before sciatic nerve repair in patients with exposed vital elements in the injured thigh. Surgical intervention was considered only if no signs of recovery were observed within 3 months except for 3 cases where there was an anatomical evidence of nerve injury intraoperative during bone fracture management.

Surgery consisted of complete exposure of the sciatic nerve in the area of the lesion and examination of the nerve by microscopic observation (fig.1). According to the type of the injury, direct coaptation, nerve grafting, or neurolysis was performed.

Figure 1

Sciatic nerve exposure in the thigh region. The sciatic nerve consists of two individual tibial and common peroneal components that can be easily separated.

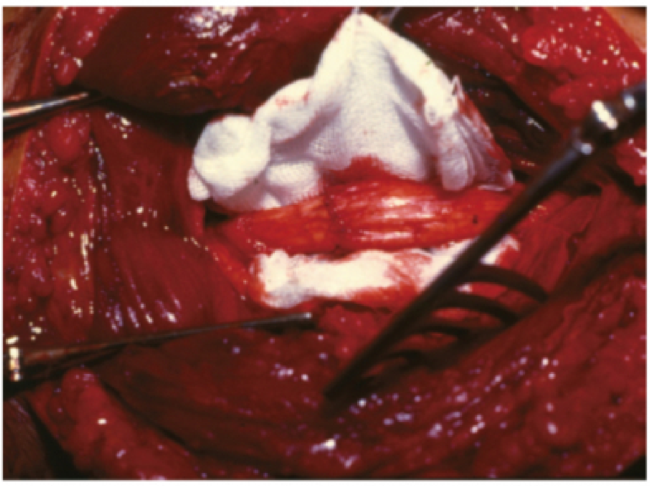


Direct Coaptation (fig.2)

A neuroma was excised proximally and distally to a level at which obvious fascicles were evident at the both ends. The injured nerve was then repaired by an end-to-end approximation using 8-0 nylon suture in a group fascicular manner. When necessary, proximal and distal dissection of up to 6 cm was performed to overcome tension on the suture line. Dissecting the tibial component of the sciatic nerve carries a less risk of devascularization because of its extensive blood supply. Achieving a tension free coaptation of a nerve defect was sometimes difficult and is not advised (occurred in 3 cases at the thigh level (even with knee flexion) hence sural grafting was needed.

Figure 2

Coaptation was performed when tension free approximation of the two ends of the sciatic nerve was possible.



Nerve Grafting

If the gap between the two ends of the nerve was long, nerve grafting was performed. The tibial and peroneal nerves were identified and grafted separately. The sural nerve was used in all cases in the form of multiple cables when grafting was performed using 8-0 or 10-0 sutures, and biological glue was not used.

Neurolysis

Neurolysis including epineurotomy and endoneurolysis was chosen for cases with apparent intact continuity of the sciatic nerve with clinical and electrodiagnostic evidence of paralysis or partial injury. In cases where injury was caused by a high-velocity bullet with extensive and diffuse nerve contusion (evidenced by hemorrhagic patches observed under the microscope) neurolysis was performed.

RESULTS

In the current study, the age of the patients was ranged from 18- 42 years with mean 27±7.6, and they comprised 11 males and 4 women. The sciatic nerve injury was caused by bullets in 8 (53%), faulty injection in 3 (20%) of cases, crush injuries in 3 patients (20%) and 1 case post hip arthroplasty (6%).

All patients were presented with unilateral sciatic nerve injury, in 9 (60%) cases the left sciatic nerve was involved and 6 cases (40%) have involved the right one. The site of injury was at the buttock in 6 (40%) and 9 patients (60%) presented with thigh-level injuries, 5 patients had an associated femur fracture.

Five cases (33.3%) had complete but isolated common peroneal territory palsy. one patient (6.6%) had solitary complete tibial division palsy. In 3 cases (20%) the injury included complete tibial and common peroneal deficits. Four cases (26.6%) had partial injury included the common peroneal division and two cases (13.3%) had partial injury included both divisions table (1).

Table 1

Demographic Features and site of Sciatic Nerve Injury.

Feature	Number of cases	%
Mode of injury		
Bullets	8	53%
Crush	3	20%
Iatrogenic		
Faulty injection	3	20%
Post hip arthroplasty	1	6%
Sciatic nerve injured		
Right	6	40%
Left	9	60%
Site of injury		
Buttock	6	40%
Thigh	9	60%
Injured component		
Peroneal division complete	5	33.3%
Tibial division complete	1	6.6%
Peroneal division partial	4	26.6%
Both complete	3	20%
Both partial	2	13.3%

Clinically, those patients presented with total injury of sciatic nerve (3 patients) have complete paralysis and flail foot. The patient with complete tibial division injury presented with paralysis of planter flexors of the foot and knee flexors. For those patients with complete peroneal division injury (5 patients), the symptoms included decreased sensation, numbness, or tingling at the top of the foot, sometimes hyperesthesia, weakness of the ankles or feet, walking abnormalities, slapping gait, foot drop, and toes drag while walking. On examination, difficulty with dorsiflexion and eversion was encountered in all patients. 3 patients with partial injury (either isolated peroneal or both divisions) had only severe neuritic pain with no motor deficits.

Neurophysiologic Data

On electromyography examination, all the patients with complete injury (9 patients, 60%) showed signs of denervation presented by a prolonged insertion activity and spontaneous activity of a lot of positive sharp waves and fibrillation potentials. None of them was able to do an effort and thus no interference pattern was recorded from the muscles tested. Absence of sensory- or motor-evoked response was estimated to be the key for defining the complete injury of the nerve examined. 6 patients (40%) had transmittable nerve action potentials (NAPs), suggesting some nerve sparing and/or a potential for regeneration.

Operative data and outcome results:

The time interval between time of injury and surgical repair ranged from 2 weeks to 1 year with a mean of 6.7 months ±2.9 months. Follow up period ranged from 11-22 months with mean of 16±3.7 months.

Seven patients underwent neurolysis, 4 patients had end to end anastomosis with excision of neuroma involving the peroneal division and neurolysis of the tibial division and in 4 patients, a neuroma had been excised and sural grafting was used to connect the gap involving peroneal division (2 cases) and for both divisions (2 cases). Dissection distance in cases affecting peroneal division ranged from 3-5 cm while in cases affecting tibial division ranged from 4-7 cm.

As regards Common Peroneal division repair: Out of 14 patients in whom peroneal division was repaired by either of the three techniques, Good recovery of sensory and motor functions was achieved in 6 patients (43%) with motor function reaching grade 4 in the final follow up. In this group of patients, one patient was treated by nerve grafting, 2 patients were treated by direct coaptation, and 3 patients were treated by neurolysis.

Partial recovery of motor functions with predominant sensory improvement and disappearance of neuritic pain was achieved in 5 patients (35.7%) 4 of them had underwent neurolysis and one of them had underwent direct cooptation.

Failure to achieve any improvement at final follow up was attained in 3 patients (21.4%) in whom 2 patients were treated by nerve grafting and one patients was treated y neurolysis.

As regards tibial division repair: out of 6 patients in which tibial division was treated by either of three techniques. Four patients achieved full recovery (66.6%) in both motor and sensory functions (3 patients were treated by neurolysis and one patient treated by direct coaptation). The other 2 patients underwent sural grafting with a partial recovery achieved.

Table 2

Outcome of the different techniques used to repair both divisions of sciatic nerve in buttocks and gluteal areas.

	Good recovery	Partial recovery	No improvement
Common peroneal division (14 cases)			
Total	(6/14) = 43%	(5/14) = 35.7%	(3/14) = 21.4
Neurolysis	3/6	4/5	0
Direct coaptation	2/6	1/5	0
Nerve grafting	1/6	0	3/3
Tibial division (6 cases)			
Total	(4/6) = 66.6%	0	(2/6) = 33.3%
Neurolysis	3 / 4	0	0
Direct coaptation	1 / 4	0	1 / 2
Nerve grafting	0	0	1 / 2

DISCUSSION

There are many studies which have been performed regarding sciatic nerve repair [1] [2][3][4] . In the present study, we evaluate the sciatic nerve injury at buttock and thigh levels where both peroneal and tibial divisions were enclosed in the same perineural sheath. Although, the most common mechanism for injury at this level was gunshot (GSW) (53%) which was also reported in other studies. Iatrogenic causes had come as the second most common cause of injury at this level (26%) in particular faulty injection (20%) which occur at the buttock level and are associated with the use of the dorsogluteal site for injection , this was similar to what reported in other studies [5][7][8] . Other mechanisms included laceration, stretch/contusion, and fracture compression (20%) [8][9].

The present study revealed trauma to the sciatic nerve at buttock and thigh level particularly penetrating trauma (GSW or faulty injection) can cause neurologic deficits in the peroneal and tibial nerve distributions. However interestingly, most injuries (70%) resulted in more severe deficits to the peroneal division compared with the tibial division (30%) either in isolated form (45%) or in conjunction with tibial nerve (25%) while tibial division was solely affected in one case (5%). This greater tendency of the peroneal division to injury has been subjected to many speculations and explained by several factors which were largely dependent on anatomical topography of sciatic nerve [6][8]. In the buttock, it is supposed that the peroneal's lateral position relative to the tibial and location close to the hip joint makes it vulnerable to blunt and penetrating trauma as well as fracture dislocations around the joint [9].

However, this basis was insufficient to explain the similar incidence of peroneal compared with tibial dysfunction after trauma especially GSW in the thigh region. Factors other than the position might be involved in this predilection that may include a relatively poor blood supply, less protective connective tissue between fascicles, and relative tethering of the common peroneal nerve in its distal course as the nerve is entrapped between the attachments of peroneus longus to the head and body of the fibula distally [10].

Beside these factors, the fact that common peroneal nerve constitutes the smaller component of the sciatic nerve presenting one-third of the area of the sciatic nerve makes it more subjected to damage more readily than the tibial component whose larger contribution may spare some of its fibers especially with the high-velocity GSW which causes shock waves and pressure disturbance in the tissues [9] [10].

This was also supported by recovery which was first observed in the gastrocnemius–soleus muscle group in the earlier series of sciatic nerve injuries. This occurred in part because tibial nerve branches enter this muscle group proximally in the leg and in addition, as stated earlier, only a relatively small number of fibers are needed to re-innervate the gastrocnemius– soleus muscle for function to occur [11].

Regarding the time interval between time of injury and surgical repair has ranged in our study from 2 weeks to 1 year with a mean of 6.7 months ±2.9 months. This wide time range has been attributed to the diversity in mechanism of injury where most sciatic nerve fracture- and contusion-associated lesions and GSWs were followed and evaluated periodically for 4 to 6 months before exploration and repair while in sharp transections of the sciatic nerve an attempt was made to repair these as acutely as possible.

In the present study, the results of tibial nerve repair were more favorable than the results of common peroneal nerve (CPN) in the buttock- thigh zone regardless of the mechanism of injury and also regardless of the technique used for repair. This is consistent with findings from previous studies [11,12]. Stancic´ et al., [13]. have analyzed 49 interfascicular graft repairs and found useful functional recovery in 5 of 9 sciatic nerve repairs (56%), 4 of 7 peroneal nerve repairs (57%), and 2 of 2 tibial nerve repairs (100%) Samardzic´ et al. [14]. analyzed 45 sciatic nerve missile injuries. Useful functional recovery was found in 87% of repairs of the tibial division, 53% of repairs of the peroneal division, and 87% of repairs of the sciatic nerve complex These studies reflect the good functional outcomes of tibial division repair over the peroneal one despite not being uniform with our study in the site of injury.

This favorable outcome of tibial nerve repair could be due several factors as reported by Murovic et al. [11]. These factors include: 1) the lateral position of the common peroneal nerve which makes it more vulnerable to injury, 2) The tibial nerve is more elastic at impact owing to its singular-fixation site while the CPN has a dual fixation sites, 3) the tibial nerve has rich blood supply in comparison to CPN and thus better regeneration, 4) the tibial nerve has higher force absorbing capacity owing to its connective tissue count than CPN, 5) the tibial nerve-innervated gastrocnemius soleus requires less reinnervation for functional contraction than deep peroneal branches, which innervate long, thin extensor muscles at multiple sites which in turn require coordinated nerve input for effective contraction. All these previous factors contribute to the favorable outcome of tibial division repair in contrast to CPN division1. It is also unclear whether this was the result of worse initial injury to the peroneal division or to poorer intrinsic ability of this nerve to regenerate.

From other perspective, the results of sciatic nerve repair in our study were largely dependent on the mechanism of repair. Useful functional outcome was usually achieved after neurolysis in case of in-continuity injuries and suture repair respectively. On the other hand, much less useful functional outcome was capable to be achieved after nerve grafting technique of repair regardless the affected nerve division. Also this finding was strongly consistent with the results from many previous reports [15, 6]. Matejcík [15]. found that, in 40 peroneal nerve injuries, good recovery was achieved in 18 of 20 neurolysis (90%), 6 of 8 end-to-end sutures (75%), and 3 of 12 nerve graft procedures (25%) Taha and Taha [6] repaired 23 missile-caused sciatic nerve injuries. They found better results after suture of nerves at the thigh level (71%) versus buttock level (31%) and after end-to-end anastomosis (74%) than after graft repairs (39%) Korompilias et al. [10]. treated 12 peroneal nerve injury cases. Eight patients treated with neurolysis had functional recovery in all cases, and patients who underwent end-to-end suture repair had a favorable outcome in 1 of 2 cases, as did those who underwent nerve graft repairs Although also the previously reported results are not necessarily in the buttock or thigh level, but they are still supporting the fact that neurolysis (in case of positive nerve action potential) and direct suturing are superior to nerve grafting in achieving better functional results [12]. These conclusions are probably relating to the fact that the severity of the initial injury determined the intraoperative findings and the need for the various surgical procedures, instead of the relative efficacy of any one procedure.

CONCLUSION:

Sciatic nerve injuries can cause significant disability if they are not treated in a timely manner and if the correct surgical techniques are not used. In this retrospective study, we examined outcomes in 15patients with traumatic lesions of the sciatic nerve at the buttock and thigh levels that were treated surgically at Ain Shams University.

We conclude that traumatic lesions in the thigh recovered better than those in the buttock because there was a shorter regeneration distance in the thigh injuries, and that tibial functional outcome was consistently better than peroneal outcome at both levels for each traumatic injury mechanism and for each surgical technique used. Also, the outcomes of neurolysis and nerve suturing were consistently superior to nerve grafting regardless the affected division of the sciatic nerve.

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