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THE SURGICAL OUTCOMES OF PATIENTS WITH PERONEAL NERVE INJURY: A CLINICAL STUDY

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A – study design, **B** – data collection, **C** – statistical analysis, **D** – interpretation of data, **E** – manuscript preparation, **F** – literature review, **G** – sourcing of funding

ABSTRACT

Background: Nervus peroneus communis (NPC) is the most frequently entrapped nerve in the lower extremity. Although first-line treatments for peroneal nerve injury include conservative methods, patients who do not show benefit are further treated with surgical decompression.

Aim of the study: The purpose of this study was to investigate the clinical and functional results of patients who were surgically treated for peroneal nerve injury.

Material and methods: This retrospective study reports on 20 consecutive patients who underwent surgery for peroneal nerve damage between March 2012 and December 2015. Visual Analogue Scale (VAS) pain scores and neurological examinations were evaluated preoperatively and at the last postoperative visit (mean follow-up period = 10.2 months). All parameters were analyzed using Mann-Whitney U tests and results were considered significant using a $p < 0.05$ threshold.

Results: According to the British Medical Council Motor Strength Evaluation Scale, 80% (n = 16) of patients showed an improvement and 20% showed no change (n = 4). VAS pain scores significantly decreased ($p < 0.05$) from the preoperative (M ± SD = 5.9 ± 0.4) to the postoperative time point. (1.6 ± 0.3).

Conclusions: Our data suggest positive results for surgical removal of reversible causes among peroneal nerve damage cases who do not respond to conservative treatment.

KEYWORDS: nervus peroneus communis, entrapment, surgery

Background

Compression of the peripheral nerve between ligaments or within the fibrous bone canals is known as "entrapment neuropathy". The nervus peroneus communis (NPC) is the most frequently entrapped nerve in the lower extremity [1]. The NPC originates from the sciatic nerve and passes distal to the popliteal fossa where it then separates into two main branches – the deep and superficial peroneal nerves. The NPC has an extremely superficial course below the fibula head where it is covered only by skin and subcutaneous tissue [2,3]. In addition, because the fibula head is hypermobile, the nerve is most often injured in this region [4].

Common causes of NPC injury include trauma, presence of a mass in the fibula head or in the proximal lower leg, conditions which cause increased pressure in the fibula head (e.g., related to the position or application of a plaster cast), intraneural tumors, and excessive weight loss [5–7].

The most frequently reported presenting symptom is difficulty in walking which develops in conjunction with weakness in the foot dorsoflexors. The Tinel test is also generally positive [3]. The most commonly used diagnostic method is nerve conduction study. Although first-line treatments for peroneal nerve injury include conservative methods, patients who do not show benefit are further treated with surgical decompression [8].

Aim of the study

The aim of this study was to evaluate the clinical and functional results of patients who were surgically treated for NPC injury.

Material and methods

Settings

Ethics committee approval was obtained for the study from the KTO Karatay University Faculty of

Medicine (2018/006). Written informed consent was obtained from all patients for photographing and inclusion in the study.

Participants

This retrospective study reports on 20 consecutive patients who underwent surgery for peroneal nerve damage between March 2012 and December 2015.

Data sources/measurement

Nerve conduction study of the NPC was used to determine nerve damage and entrapment at the level of the fibula head. Nerve conduction results demonstrated conduction block and a slowing in the rate of transmission in the NPC at the level of the fibula head among all patients. Patients with partial motor loss were first treated with conservative methods whereas patients who presented following trauma or with a foot drop were immediately admitted for surgery. The lesion etiologies are shown in Tab. 1.

Neurological examinations were conducted according to the British Medical Council Motor Strength Evaluation Scale and Visual Analogue Scale (VAS) leg pain was administered to each patient preoperatively and at the last postoperative visit.

Surgical Procedure: All patients underwent general anesthesia. Surgery was performed in the supine position and the knee was flexed into the appropriate position. The skin incision was made on the midline of the thigh, starting a few centimeters proximal to the popliteal fold and continuing in the inferior direction. The incision was extended to as far as 6-8 cm below the fibula head from approximately 1 cm medial of the biceps femoris tendon by turning laterally to cross the fibula. The popliteal fascia was opened by deepening the incision. The peroneal nerve was revealed below the biceps tendon. The entry of the nerve below the posterior edge of the peroneus longus muscle was followed and the separation of the nerve into the superficial and deep branches was observed. Part of the deep surface of the extensor digitorum longus muscle was opened and the deep nerve branch was released (see Fig. 1).

If a mass or cyst was identified within the nerve, entry to the nerve was made by opening the perineurium. The cyst or mass was subsequently excised with aspiration and tissue forceps (Fig. 2).

Table 1. Diagnosis of patients with peroneal nerve injury.

Diagnosis	n	%
Long time working in the squatting position	7	35
Following knee surgery	5	25
Falling down	4	20
Long plaster or orthosis	2	10
Ganglion cysts	2	10

Figure 1. This photograph shows position of the knee, skin incision and decompressed nerve in one exemplar patient.

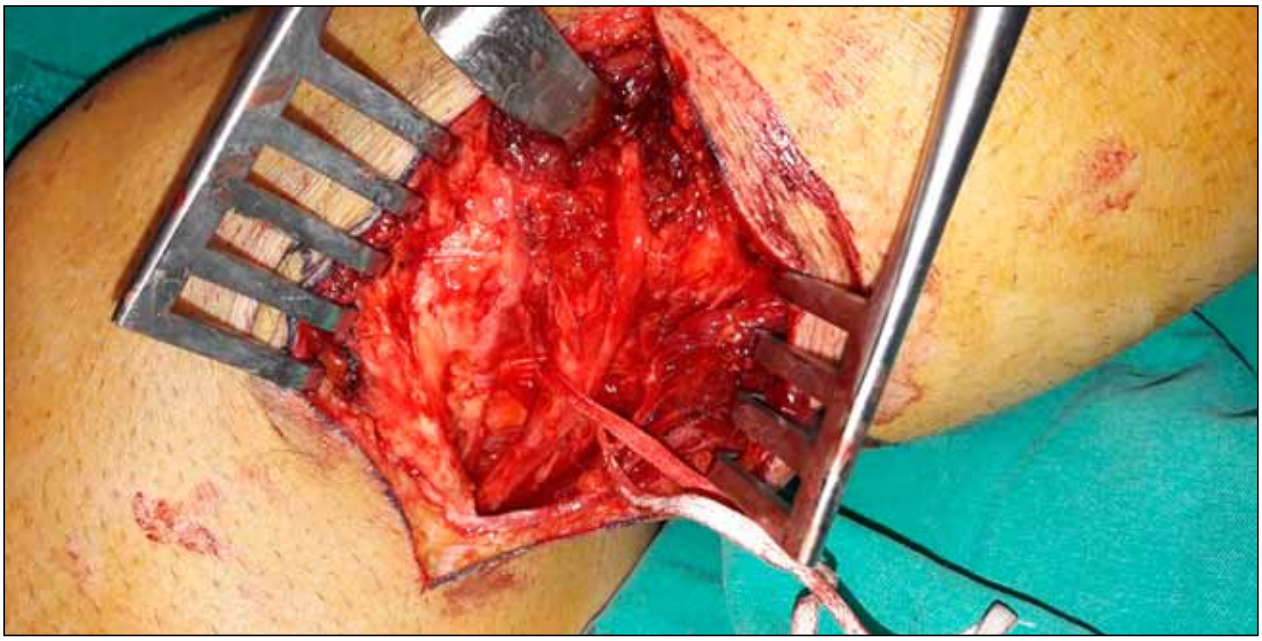

Figure 2. Intraoperative photograph demonstrating an intraneuronal ganglion cyst in an exemplar patient.

Statistical analysis

According to Kolmogorov Smirnov test, the data were not normally distributed. Thus, nonparametric tests were performed. Statistical analysis was performed using Mann-Whitney U tests with SPSS 20.0 for Windows. Results were considered significant at a $p < 0.05$ threshold.

Results

Twelve of the 20 patients were males, eight were females and the M ± SD age was 47.8 ± 4.3 years. Operations were applied to the right side of the body in 65% of patients and to the left side in 35%. The average time for operation from the onset of the symptoms was 2.8 ± 0.9 months and the mean follow-up period was 10.2 months.

According to the British Medical Council Motor Strength Evaluation Scale, 80% (n = 16) of patients showed an improvement and 20% showed no change (n = 4). VAS pain scores significantly decreased ($p < 0.01$) from the preoperative (M ± SD = 5.9 ± 0.4) to the postoperative time point (1.6 ± 0.3). No patients in the study showed major complications after surgery.

Discussion

NPC damage can be caused by knee surgery, trauma, ganglion cysts, bone tumors, nerve tumors, thyrotoxicosis, excessive weight loss, alcoholism, and vasculitis [8–13].

Clinical symptoms can vary from complete-incomplete nerve damage, include paraesthesia and pain down the outer aspect of the leg, cutaneous sensation, weakness of the foot or foot-drop. Steppage gait develops in patients to prevent stumbling due to loss of strength in the feet [8]. The Tinel test is generally positive around the fibula head [5,14].

The most useful tests include a study of nerve conduction and assessment of the lesion. Conduction block and a slowing in the rate of transmission for conduction is also frequently observed in the NPC at the level of the fibula head. Nerve conduction studies should also be performed during preoperative assessments of differential diagnosis of the foot-drop [15]. In our study, two patients had previously undergone lumbar disc herniation surgery which may have contributed to foot-drop.

The surgical strategy should be determined according to the underlying pathology and the aim should be adequate decompression of the nerve. Ganglion cysts play a significant role in compression syndromes of the peroneal nerve at the fibula head. Synovial fluid leaking from the tibiofibular joint following trauma can lead to the formation of a ganglion cyst which can put pressure on the nerve. The formation of a ganglion cyst can also create pressure effects from outside the nerve, as well as, damage by entering the nerve from the perineurium [8,10,13]. Two patients in the present study presented with ganglion cysts that had entered the peroneal nerve. These two patients presented with painful foot-drop. In both cases, the cysts were drained by opening the nerve perineurium, and adequate decompression was provided (Fig. 2). Although pain levels were reduced, there was no recovery in motor functioning. Optimal recovery of peroneal nerve damage is obtained with a full knowledge of the etiology and severity of the lesion, the application of the necessary clinical and electrophysiological tests, and appropriate treatment methods and timing.

In our study, surgical decompression was applied to NPC entrapment syndrome patients. Significant improvement was observed in motor functions and VAS pain scores of the patients, and no major complications were noted.

Limitations of the study

This study was limited by the retrospective design. Nonetheless, the present findings may contribute to the treatment of NPC entrapment syndrome. Another limitation of the study is lack of diagnostics with high-resolution ultrasound, which is now regarded as a standard complementary procedure in nerve conduction studies. High-resolution ultrasound can also be used preoperatively to delineate the site and morphological basis of peroneal neuropathy (e.g., intraneural cyst or nerve tumor).

Recommendations

Surgery should be kept in mind in case of reversible peroneal nerve paralysis according to etiology.

Conclusions

In conclusion, NPC damage generally occurs in the fibula head because of the anatomic properties. In cases that do not respond to conservative treatment, when the reversible causes are surgically removed, the results are generally good.

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