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Common peroneal nerve injuries in knee dislocations: results with one-stage nerve repair and tibialis posterior tendon transfer

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Abstract We report our experience in the treatment of common peroneal nerve (CPN) palsy following knee dislocations: a twelve-year surgical series of 26 patients presenting with a traumatic injury of the lateral sciatic nerve and no spontaneous recovery is reviewed. From 1988 to 1991, we performed nerve surgery alone on 3 patients. Their results were highly disappointing and in none did we observe muscle recovery. Since 1991 nerve surgery was associated with a palliative procedure for 23 patients. Although at surgical exploration, severe nerve damage was found in 87% of these patients (thereby indicating the need for graft repair), the overall outcome was good, with a score of M3 on the BMRC scale in about 75% of the cases. These results suggest that the one-stage association of microsurgical nerve repair and tibialis posterior tendon transfer changed the destiny of these injuries.

Key words Common peroneal nerve palsy • Foot drop • Knee dislocations • Nerve graft • Tibialis posterior tendon transfer

Introduction

Severe dislocations of the knee can be associated with a common peroneal nerve (CPN) injury [1]. In a high percentage of cases CPN injuries are irreversible, yet these patients are seldom selected for nerve surgery. This is probably due to the fact that the results following CPN repair [2–5] are extremely poor and therefore many physicians have treated these injuries only by a palliative pro-dorsiflexion procedure [6–8].

The aim of this study was to evaluate the outcome of nerve repair associated with tibialis posterior tendon transfer in a one-stage procedure in patients with knee injury.

Materials and methods

The surgical series included 26 patients presenting with a peroneal palsy following a closed injury of the knee. None presented signs of spontaneous recovery at three months from injury. They were 25 males and one female; their mean age was 19 years (range, 14–39 years).

From 1988 to 1991 we treated 3 cases surgically by nerve repair with graft procedure (2 cases) or decompression at the head of the fibula (1 case). From 1991 on, we associated the palliative pro-dorsiflexion procedure with nerve repair. Although we advocate surgery after 3–6 months from injury if no spontaneous recovery occurs, the majority of the patients were operated on 6–12 months after trauma, and this was due to a late referral. The one-stage procedure was performed on 23 patients: 20 cases had a graft

repair, while in 3 cases we performed a simple decompression at the head of the fibula.

Surgical technique

The patient was prone, with the leg slightly flexed. A skin incision exposed the peroneal nerve from its division at the sciatic trunk to the neck of the fibula.

The distal peroneal canal was always opened. The patient was then turned supine and the palliative procedure started. A pre-operative test of passive dorsiflexion indicates if a Z-plasty elongation of the Achilles tendon may be necessary, although such decision is ultimately taken intraoperatively.

The tendon of the tibialis posterior muscle was harvested through a retromalleolar incision prolonged towards the scafoid and first cuneiform bones. As its length is crucial, a thorough subperiostal dissection is required. The tendon was then passed through the interosseous membrane, taking care to avoid angulations. It emerged medially to the extensor digitorum communis (EDC) and, through two separate dorsal incisions, it was tunneled subcutaneously and anchored to the third cuneiform bone, maintaining the foot positioned at 90°. More foot dorsiflexion is not advisable for the possibility of toe retraction due to a tense flexor digitorum profundus. An elongation of this tendon was sometimes required in the presence of a severe clawing to reduce the tenodesis effect.

Postoperative care

Cast immobilization was maintained for 6 weeks. Patients were advised to start loading gradually only after 15 days. After removing the cast, rehabilitation was started.

Muscle reinnervation testing

Muscle reinnervation was evaluated electromyographically and clinically according to the British Medical Research Council (BMRC) guidelines [9]. Muscle testing concerned the function of tibialis anterior, peroneal muscles and ECD. Outcome was classified as good (M3 or more), fair (M2), or poor (M0-M1).

Results

Different pathological findings were found at surgery: neuroma in continuity with no electrical conduction (Fig. 1) was present in 13 patients (50% of all the cases), neuroma with nerve rupture (Fig. 2) was found in 9 (35%), and stretch injury with epineural petechiae and preservation of the fascicular architecture (Fig. 3) was present in the remaining 4 cases (15%). Neuromas (22 patients) were treated with nerve resection and graft repair while stretch injuries (4 patients) were treated with myofascial decompression.

Fig. 1 Neuroma in continuity. *CPN*, common peroneal nerve

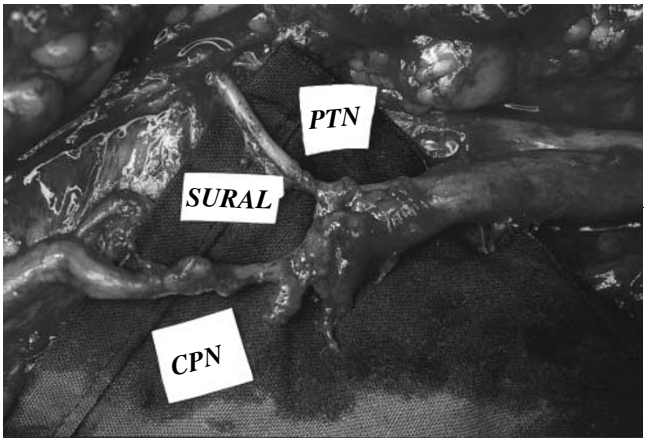

Fig. 2 Neuroma with nerve rupture. *PTN*, posterior tibial nerve; *CPN*, common peroneal nerve

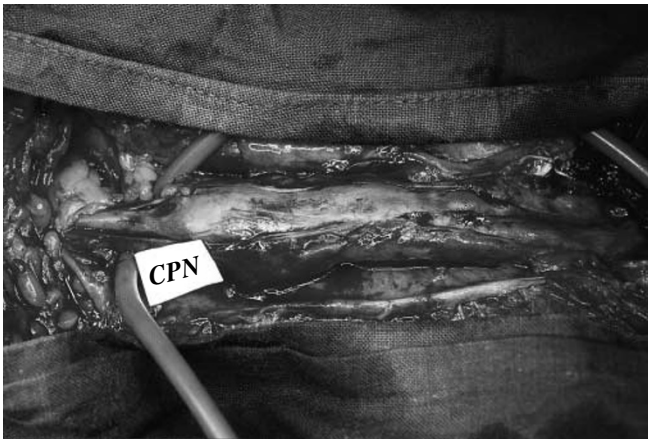

Fig. 3 Stretch injury with epineural petechiae. *CPN*, common peroneal nerve

At the 2-year follow-up, none of the 3 patients receiving nerve repair alone showed signs of nerve regeneration (Table 1). They later required a palliative pro-dorsiflexion procedure. In contrast, in 22 (96%) of the 23 patients who

Table 1 Neural regeneration at 2 years in 26 patients with common peroneal nerve injury, by surgical treatment

Treatment group	Patients n	Neural regeneration		
		M3 (good)	M2 (fair)	M1-M0 (poor)
Nerve repair alone	3	0	0	3
Nerve repair and pro-dorsiflexion	23	17	5	1

received nerve repair and pro-dorsiflexion procedure, neural regeneration at EMG was evident (Table 1) with clinical results of M3 in 17 cases (74%).

Discussion

The common peroneal nerve is particularly exposed to traumatic damage, due to its peculiar anatomical site and vascularization. Lundborg's experimental studies have demonstrated that a trauma with elongation equal to 15% of the length of the nerve can cause a complete failure of its blood supply [10]. Being fixed both at its proximal and distal extremities, the CPN is particularly vulnerable even to stretch injuries far below such threshold [11]. This explains why severe adduction injuries and dislocations of the knee can often give a peroneal palsy.

CPN injuries after knee dislocations are generally treated in a conservative way, but in the vast majority of these patients the nerve injury is irreversible. The reluctant attitude of many surgeons towards nerve surgery in such cases is certainly justified considering that the results following CPN repair are poorer than any other peripheral nerve. Many factors are advocated to explain this poor prognosis, including excessive length of the nerve and the abundance of connective tissue.

Since in a short time the foot fixes in the equinovarus position by shortening of the non-paralysed muscles, the resulting imbalance between the foot flexors and the overstretched extensors may represent a severe obstacle to reinnervation. Therefore early correction of these forces may favor reinnervation [12, 13].

The results of our series support this assumption: the one-stage nerve repair and tibialis posterior tendon transfer was highly successful.

As timing is concerned, we recommend surgery 3 months after injury if there are no initial signs of spontaneous recovery. In 85% of our cases, we found severe nerve damage at surgical exploration. This observation supports the necessity of early exploration and repair. Thereafter, it is straightforward that the sooner the procedure is carried out, the better. In particular it is paramount to avoid irreversible changes in the ankle joint and extensor muscles, which may severely impair final results.

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