

The lower extremity nerve injuries – own experience in surgical treatment

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Abstract

The frequency of the lower extremity nerve injuries is assessed to about 20% of the overall lesions to the peripheral nerve system. Peroneal neuropathy is the most common lower extremity nerve palsy. In this study, results of the surgical treatment of the lower extremity nerve injuries have been presented. The clinical material consisted of 270 patients (192 males, 78 females aged from 3 months to 74 years) with injuries of the common peroneal nerve – 125, sciatic nerve – 93, common peroneal and tibial nerve – 21, tibial nerve – 17, femoral nerve – 10, others – 4. The following surgical procedures were performed: external neurolysis – 164, internal neurolysis – 27, reconstruction with sural nerve grafting – 63, direct neurorrhaphy – 12, neurotisation – 3, supplementary tenomyoplasty – 23. Evaluation of the results with the use of BMRC scale (M_0 - M_5) and Highet scale (S_0 - S_4) included the group of 120 patients. After the surgical treatment a significant improvement was found in 63.3%. The efficacy of the treatment is strictly dependent on an early surgical intervention, mechanism and degree of the nerve injury as well as appropriate method of surgical therapy.

Key words: sural nerve grafting, neurorrhaphy, common peroneal nerve, sciatic nerve, tibial nerve, femoral nerve, lower extremity nerves

Introduction

The lower extremity nerves injuries are relatively rare and their frequency is assessed to about 20% of overall lesions to the peripheral nerve system [12]. The injuries of the common peroneal nerve are the most frequent and the lesions of the sciatic and tibial nerve are rather rare [6,9-11,16]. Lesions of the femoral and obturator nerve are unusual [2,7,8]. The mechanism of injury of the lower extremity nerves includes laceration,

compression, traction and focal ischemia [23,27]. All degrees of severity of the injury from neurapraxia to axonotmesis to neurotmesis may be observed in medical practice [27]. The relatively frequent causes of the lower extremity nerve injuries are penetrating trauma, bone fractures, joint dislocations, injection injuries and operative iatrogenic lesions [3,4,8,9,13,18,21,22,24]. Nerve injuries in the lower limbs are said to have a worse prognosis than those in the upper limbs [23,25].

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Material and methods

In the period of 1980-2004, 270 patients with the lower extremity nerve injuries were treated surgically (Department of Trauma and Hand Surgery Medical University of Wrocław). The clinical material consisted of 192 males and 78 females aged from 3 months to 74 years. In the collected material we observed injuries of the following nerves: common peroneal nerve – 125 cases, sciatic nerve – 93 cases, simultaneous common peroneal and tibial nerve – 21, tibial nerve – 17, femoral nerve – 10, medial plantar nerve – 1, superficial

peroneal nerve on the foot – 2, deep peroneal nerve on the foot – 1. The reasons of the lower extremity nerve injuries included: wounds – 67 (51 cases with discontinuity), bone fractures – 46 (7 cases with discontinuity), injection injuries – 31, operative iatrogenic lesions – 42 (9 cases with discontinuity), contusions – 38 (5 cases with discontinuity), joint dislocations – 27 (2 cases with discontinuity), other causes – 19 (4 cases with discontinuity). The following surgical procedures were carried out during the treatment: external neurolysis – 164 (Fig. 1), internal neurolysis – 27 (Fig. 2), reconstruction with 2 – 8 sural

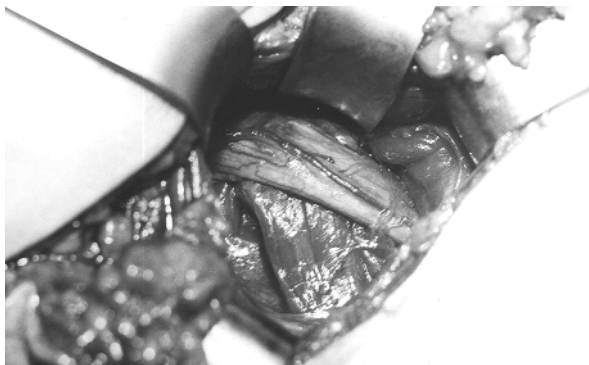


Fig. 1. Intrasurgical view: status after external neurolysis of the sciatic nerve. The fill of the nerve blood vessels is visible

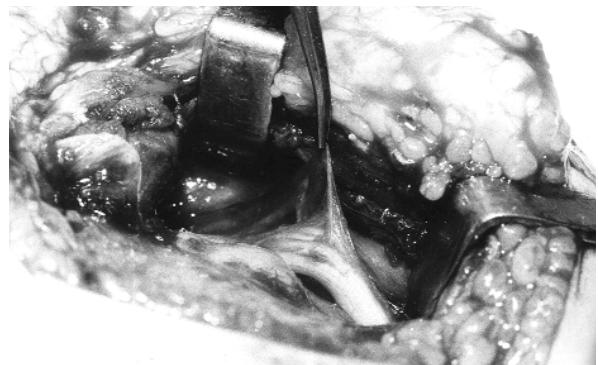


Fig. 2. Intrasurgical view: the excision of the perineural and interfascicular fibrous tissue (internal neurolysis)

Table I. The results of the surgical treatment

Name of nerve	Number of cases	Type of operation	Results			
			Very good	Good	Poor	Bad
sciatic	40	neurolysis	10	16	10	4
	2	sural nerve grafting	1	–	–	1
tibial	7	neurolysis	4	2	1	–
	3	sural nerve grafting	–	1	1	1
	3	direct suture	–	2	–	1
tibial and common peroneal	8	neurolysis	3	4	1	–
	4	sural nerve grafting	–	1	1	2
femoral	10	neurolysis	5	2	–	3
common peroneal nerve	24	neurolysis	7	8	5	4
	1	direct suture	–	–	1	–
	18	sural nerve grafting	3	7	5	3
total	120		33	43	25	19



Fig. 3. Intrasurgical view: status after reconstruction of the tibial nerve with sural nerve grafting



Fig. 4. Intrasurgical view: status after direct neurorrhaphy of the sciatic nerve



Fig. 5. Intrasurgical view: transposition of the tendon of the tibialis posterior muscle

nerve grafting from 1 to 20 cm – 63 (Fig. 3), direct neurorrhaphy – 12 (Fig. 4), neurotisation – 3, supplementary tenomioplasty (tendon transfer) – 23 (in 1 case without revision of the sciatic nerve) (Fig. 5). Seventeen (17) reoperations were performed: neurolysis of the distal anastomosis after previous reconstruction of the common peroneal nerve – 5,

reconstruction after previous neurolysis of the common peroneal nerve – 2, reconstruction after early reconstruction – 3, repeated neurolysis of the sciatic (3), femoral (1) and common peroneal nerve (1) – 5, neurolysis of the common peroneal nerve after previous neurolysis of the sciatic nerve – 2. The control examinations and evaluation of the results of the surgical treatment include the group of 120 patients. The shortest time of after – surgical observation was 2 years. We evaluated the power of muscles based on the BMRC scale (M_0 - M_5) [6,19] and the sensory recovery based on the modified Hight scale (S_0 - S_4) [20]. The examination of the following muscles was performed: quadriceps and sartorius, semimembranosus and semitendinosus, biceps femoris, gastrocnemius and soleus, tibialis anterior and posterior, flexor digitorum longus, flexor hallucis longus, peroneus longus and brevis, extensor digitorum longus, extensor hallucis longus, intrinsic on the plantar aspect of the foot. The following methods of evaluation have been established [23]: very good result – $M_{4,5}$ $S_{3,4}$, good result – $M_{3,4,5}$ S_2 , poor result – M_2 S_1 , bad result – M_{0-1} S_0 .

Table II. The results in the aspect of the performed surgical procedure

Type of operation	Results			
	Very good	Good	Poor	Bad
neurolysis	29	32	17	11
sural nerve grafting	4	9	7	7
direct suture	–	2	1	1
total	33	43	25	19

Results

The results of the surgical treatment are shown in table I. The obtained results were analysed in the aspect of the performed surgical procedure and the outcome of this analysis is shown in table II. The efficacy of the surgical intervention (very good and good results) in these groups was: neurolysis – 68.5% (61 from 89 cases), reconstruction – sural nerve grafting – 48. 1% (13 from 27 cases), reconstruction – direct suture – 50% (2 from 4 cases). Proportional participation of the particular surgical procedures in



Fig. 6. Clinical examination: lesion of the left common peroneal nerve

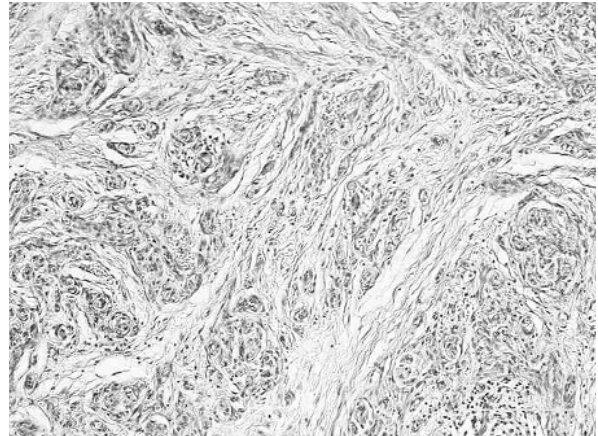


Fig. 7. Histopathological specimen result – posttraumatic neuroma of the common peroneal nerve. Stain. HE. Magnification x 160

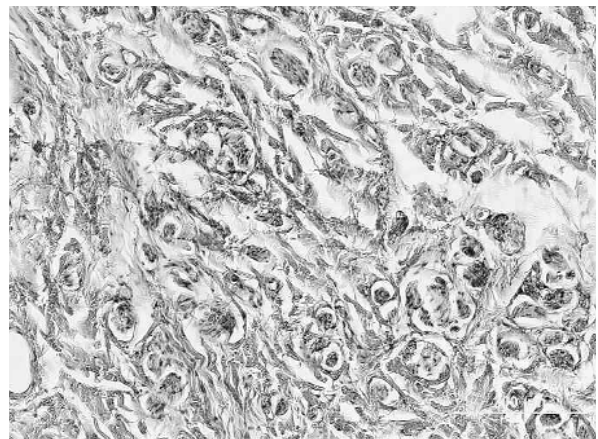


Fig. 8. Histopathological specimen result – posttraumatic neuroma of the tibial nerve. Stain. HE. Magnification x 160

very good and good results were: neurolysis – 80.3%, reconstruction – sural nerve grafting – 17. 1%, reconstruction – direct suture – 2.6% and in poor and bad results were: neurolysis – 63.6%, reconstruction – sural nerve grafting – 31.8%, reconstruction – direct suture – 4.6%.

Discussion

In our material most often we observed injuries of the common peroneal nerve (54%) and high lesions of the sciatic nerve (34.4%). It confirms the observations of the other authors about the extreme sensibility of the common peroneal nerve to trauma factors [6,16,18,23,25] (Fig. 6, 7). Post – traumatic lesions of the tibial (Fig. 8) and femoral nerve were rather rare. The injuries without discontinuity of the neural trunks were predominant (71.1%) and the mechanism of lesion was different and more than once composed (traction, compression, ischemia). The most frequent cause of neurotmesis was

penetrating trauma (wounds) – 65.4%. After the surgical treatment the significant improvement (very good and good results) was found in 63.3% of cases – table I. The best results were obtained in lesions in – continuity treated by neurolysis, which efficacy was 68.5%. During analysis of the reasons of the failure in this group of patients, a strong correlation between ultimate therapeutic results and timing of the operation was found. Very good and good results were obtained when the delay was not more than 8 months. No improvement after the surgical treatment in continuity lesions may be also connected with intrafascicular fibrous tissue proliferation (grade C). This process may occupy a large part of the nerve [14]. The improvement in

these cases can be obtained only after reconstruction with sural nerve grafting and the condition of the success is resection of a whole, non-conducts part of the nerve. This kind of decision is not simple and needs wide experience. The choice of the appropriate operative technique should be based on preoperative clinical examination and emg result as well as a microscopic assessment of the nerve structure and intraoperative tests (electrical stimulation) [12,15]. In our material in 2 cases the decision about resection of the common peroneal nerve has been taken due to no improvement after previous neurolysis. Reconstructions with 3 – 5 sural nerve grafting (8 and 14 cm) have been performed, but in these cases the delay was very long. After microsurgical reconstructions very good and good results were observed in 48.1% (sural nerve grafting) and in 50% (direct neurorrhaphy). A significant improvement was obtained when a gap of the nerve trunk was not more than 8 cm and it was possible to put the sural nerve in good blood supply tissues. Cases, in which it is necessary to supplement very large gaps and the bed for the sural nerve is scarred and fibrous, have a worse prognosis [14,23,25]. This type of lesions is most often the result of extensive damage including not only the peripheral nerve system, but also the muscular, skeletal and vascular systems [1,17]. The results obtained in our own material are comparable with the results of the other authors [1,5,6,16,23,25,26]. Encouraging results of the surgical treatment of the lower extremity nerve injuries observed in our own and other authors' materials fully motivate usefulness of this type of management. With the low risk of worse lower extremity function it is possible, in favorable conditions, to achieve a significant improvement of its efficiency. The patient is allowed to live with the activity like before trauma. The efficacy of the treatment is strictly dependent on an early surgical intervention, mechanism and degree of the nerve injury as well as appropriate method of the surgical therapy.

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