Pathology of the peripheral nervous system

Abstract This review deals with papers on important topics in peripheral nerve surgery. Some new diagnostic tools and microsurgical procedures are brought to the attention of neurosurgeons. The first four papers are related to new surgical strategies in treating brachial plexus injury (BPI), particularly root avulsion. Concepts based on experimental studies are applied to clinical practice. Re-establishment of the continuity of interrupted spinal roots or reimplantation of the avulsed spinal roots into the spinal cord are attempted. The authors demonstrate how computed tomography (CT) myelography can be used to plan surgical treatment correctly. The use of reinnervated free-muscle transfer after complete brachial plexus C5-T1 root avulsion is described and critically evaluated. The results obtained after repair of interrupted spinal roots or reimplantation of avulsed spinal roots into the spinal cord are not as clear as described by the authors. Further experimental studies and surgical outcomes are necessary before accepting the efficacy of such surgical procedures in BPI. Reinnervated free-muscle transfer appears to be a promising method for treating such severe lesions. The fifth paper is a case report in which the trapezius branch of the spinal accessory nerve was neurotized with the dorsal branch of the third cervical nerve. This procedure was performed after an injury to the spinal accessory nerve in the neck. The proximal stump of the spinal accessory nerve was available only intracranially. Using this procedure, the risk related to an intracranial approach to the spinal accessory nerve is avoided. A review of one case of primitive neuroectodermal malignant tumor of the median nerve is used to discuss some controversies related to the treatment of malignant tumors involving peripheral nerves.

Key words Brachial plexus avulsion · Nerve repair · Accessory nerve · Peripheral nerves · Peripheral nerve neoplasms · Neurotization · Computed tomography

Introduction

In the pathology of the peripheral nervous system, one of the most important controversies is related to the treatment of brachial plexus injury (BPI). For this reason, four of the six papers reviewed are related to the brachial plexus. BPI is an extremely broad term indicating a wide variety of lesions affecting the numerous plexus elements. The large debate about the management strategies of BPI is mainly between two view-
The diagnosis of site and extent of lesion is a crucial aspect in defining prognosis and treatment in BPI. To study this problem, the neuroradiologic findings of CT-myelography and/or MR imaging were compared with the picture found at surgical exploration. The CT-myelography proved to be the most reliable method to demonstrate the complete or partial rupture of the spinal root or avulsion of the spinal root from the spinal cord. These findings are the most common and difficult conditions in severe BPI. Generally, these kinds of injuries are not considered to be surgically treatable, because the lesion occurs close to the interface between the peripheral and the central nervous system (PNS and CNS). Nonetheless, the second and third reviewed papers have proposed new surgical strategies for treating these lesions; some positive results obtained in experimental studies have also been achieved in clinical practice. The problems related to the peculiar and different regrowth activity of dorsal and ventral spinal roots in mammals and their clinical application were presented. These recent efforts consisted in either re-establishment of the continuity of the interrupted spinal root or reimplantation of the avulsed spinal root into the spinal cord. The fourth paper reports a new surgical approach in one case of severe BPI considered irreparable. It used a reinnervated free-muscle transfer to restore the prehensile activity in the completely paralyzed upper limb. Because these first four papers are related to several aspects of the same problem, i.e., root avulsion or rupture, they have been analyzed together.

The fifth article is related to the reconstruction of the main trunk of the spinal accessory nerve when this nerve is injured in the neck and the proximal stump is no longer accessible in that area but only intracranially. In this situation, a new surgical technique is presented to neurotize the distal stump of the spinal accessory nerve with the dorsal branch of the third cervical nerve (C3). This procedure is free from remarkable neurologic deficits, avoiding the risks of an intracranial manipulation of the spinal accessory nerve.

The last paper reviewed is a report on a very rare case of primitive neuroectodermal malignant tumor originating from the median nerve.

[1] Diagnosis of root avulsions in traumatic brachial plexus injuries: value of computerized tomography myelography and magnetic resonance imaging


Information. The diagnosis of site and extent of lesion of the spinal roots is a crucial aspect in defining prognosis and treatment in BPI. To study this problem, the neuroradiologic findings of CT-myelography and/or MR imaging were compared with the surgical findings in a prospective study. During a period of 6 months (1993–1994), 40 patients (38 male, 2 female) were evaluated. Motorcycle accidents were the cause of injury in 95% of the cases. Clinical and electrophysiologic findings were not considered reliable enough to clarify whether the ventral and dorsal roots were both avulsed or not. Therefore, CT-myelography and/or MR imaging were obtained for all the patients. CT-myelography was obtained from C4-T1 with the scan angle parallel to the cervical disks using either 3-mm axial slices or 1-mm axial slices when more definition was necessary. CT-myelography was performed in 25 patients to study 75 cervical root levels. MR imaging was performed using a 1.5-T unit; axial slices were 3-mm thick. MR imaging was used in 15 patients to study 60 cervical root levels. The patients in which the dorsal and the ventral roots of the healthy side were not recognizable on CT or MR imaging were excluded from the study, the imaging being considered not reliable.

A partial hemilaminectomy of C4 and a total hemilaminectomy of C5–7 were enough to allow the intradural inspection of C5–8 ventral and dorsal roots from the spinal cord to the intervertebral foramen. Using an operating microscope, the exact site of the rupture was established. Anterior cervical roots are formed by a