Abstract

There is rising importance of the brachial plexus injury firstly due to its increasing incidence as a result of higher survival rate of the patients after polytrauma and due to the higher success rate of the surgical treatment. Recently, the obstetric brachial plexus palsy is the area of interest of many articles. The indication criterion is one of the most important problems to be solved as well as increasing awareness about the possibility of the surgical treatment.

Many of injured elements of the brachial plexus are reconstructed by a donor nerve transferred onto the recipient nerve, i.e. by neurotization. This method can have better outcome than the suturing of the proximal parts of the plexus especially due to its main advantage – suturing as close to the muscle as possible.

It is still not clear which donor nerve is better to use for neurotization of specific recipients due to the lack of large randomized clinical trials. End-to-side anastomosis (ETS) was re-discovered at the beginning of 90’s at the same time when the Oberlin method (OT) was firstly described in the literature. These techniques are applicable only in the Erb’s palsy with functional lower part of the plexus. The basis of the effect of ETS anastomosis is the collateral sprouting of the axons which is one of the most important manifestations of neuroplasticity. ETS anastomosis is the object of interest of many theoretical articles among others due to the continuing discussion about the necessity of the donor’s nerve injury (perineurial window) to initiate the collateral sprouting. There are only few clinical studies dealing with ETS anastomosis, mostly only case reports series. OT is a variant of the classic end-to-end neurotization with the use of only one specific fascicle without sacrificing of the whole donor nerve. This fascicle is sutured onto the distal stump, originally onto musculocutaneous nerve (MCN). The high success rate of this technique is confirmed by several clinical studies. There is no reference in English literature about the using of this method for the reconstruction of different nerves other than the MCN.

These two methods which are almost of the same age are the point of the clinical part of this PhD thesis. We used these methods for neurotization of axillary nerve (AXN) in the most of the cases because of the very good experience with the neurotization of MCN with medial pectoral nerve.

Although ETS anastomosis was thought to have a good effect, we have demonstrated that its success rate is rather low, in our group 47, 6 % (10 / 21) patients with reconstructed AXN and in total only 43, 5 %. On the other hand, OT surpassed our expectations even if it
was used mostly to reinnervate the AXN. Neurotization of AXN was successful in 77.8% (7/9) and 100% in MCN, with a total success rate of 83.3%.

We think that ETS anastomosis is now an obsolete technique in the case of adult posttraumatic brachial plexus palsy. On the contrary, OT provides a very good alternative method which can be used in AXN injury.

The outcome of surgical treatment of nerve injury is influenced both by the appropriate choice of reconstructive method and the reinnervation potential, i.e. by the speed and amount of growing axons. These attributes are very individual. They can be induced by neurotrophic factors.

The neurotrophic nature is well documented in many different substances, e.g. NGF, BDGF, BFGF, IGF and so on. This effect is known that VEGF has also this effect but there is still not any reference about its influence on the collateral sprouting.

In our experiment, we have evaluated the character of regenerating axons after the addition of VEGF plasmid into the distal stump of MCN both during end-to-end and end-to-side anastomosis. We have found out that this substance does not influence axon maturation, i.e. the diameter of axons and of the myelin sheath. On the other hand, the increase of the amount of the regenerated myelinated axons by unit area of the nerve (10 000 µm²) is statistically significant. This is confirmed in both types of anastomosis. We can state that VEGF amplifies the number of the lateral branches of both injured and intact axons.

Our experiment has confirmed the outcomes of previously published papers, i.e. elevated number of regenerated axons after the end-to-end suture. In addition, we have also demonstrated its effect on the collateral sprouting after end-to-side anastomosis.

VEGF is one of the well effecting neurotrophic factors and we hope it will be used in the future for the facilitation of the reinnervation especially in the old injuries. This finding can possibly change the view on the ETS anastomosis, which can have better outcome with the use of such factors.