ORIGINAL PAPER

Nervous Regeneration Allograph Type of Periferic Nerv

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Abstract

This article completes the problem of nerve regeneration on the allograft model harvested from the same type of individual (in this case the Wistar laboratory mouse).The approach to major trauma produced by various mechanisms and the development of a well-established algorithm, applied in a multidisciplinary team, results in a distinctly different result, both sensory and motor recovery, depending on the operative technique, the operative logistics and the type of graft. The article explains the experimental model, the subjects that were previously prepared for the operating time, the type of anesthesia that was administered, explaining why dosages and administered substances were used, the techniques used in the two batches that are totally different anatomic approach path, different as a bed of nerve regeneration but with operating technicians that do not differ in the two batches. The results are visibly different and are compared by the fingerprint sample. The regeneration times are different, the sensitive recurrence, the resumption of motor activity differs very little in the variables of each lot but are appreciable and different as the dynamics and value from one batch to the other.

Keywords: nerve regeneration, allogrefa, Wistar mice.

Rezumat

Articolul de față completează problema regenerării nervoase pe modelul allogrefei recoltate de la același tip de individ (în acest caz, șoarecele de laborator de tip Wistar). Abordarea traumei majore produse prin diferite mecanisme și desfășurarea unui algoritm bine pus la punct, aplicat într-o echipă multidisciplinară, duce la un rezultat vizibil, diferit ca recuperare atât senzitivă, cât și motorie, în funcție de tehnica operatorie, logistica operatorie și de tipul de grefă. Articolul explică modelul experimental, subiecții care au fost pregătiți în prealabil timpului operator, tipul de anestezie ce a fost administrat, explicându-se de ce s-au folosit dozele și substanțele administrate, tehnicile operatorii abordate în cele două loturi care sunt total diferite față de cele cu abord anatomic, diferite ca pat al regenerării nervoase dar cu tehnici operatorii asemănătoare în cele două loturi. Rezultatele sunt vizibil diferite și sunt comparate prin proba amprentei. Timpii de regenerare sunt diferiți, recuperarea senzitivă, reluarea activității motorii diferă foarte puțin în variabilele fiecărui lot, dar sunt apreciabile și diferite ca și dinamică și valoare de la un lot la celălalt.

Cuvinte cheie: regenerare nervoasă, allogrefa, șoarece Wistar.

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INTRODUCTION

Trauma produced on the peripheral nerves was underestimated in emergency rooms. In a total of polytrauma lesions presented in a emergency room, over a year, about 5% are also interested in injuries corresponding to the peripheral nervous system. The appearance of major injuries at the periphery of the peripheral nervous system produces a chain of hard-to-control mechanisms, a change that affects the individual both in the family and in society. Peripheral nerve lesions, spontaneously recoverable hard, affect the quality of life as a distinct unit[1,2].

Statistically, 80% of peripheral nerve injuries are produced by various traumas, surgical interventions (operator incidents) are incriminated in about 10%. The percentage of 81% is produced in the upper limb and 11% in the lower limb[3]. Nervous elements trauma to soft parts may fall into a distinct and statistically significant category in Europe, there are reported about 300,000 cases per year[4]. Referring to how the lesion is produced there are several elements that can cause trauma[5]. Here we can describe mechanical agents, usually tough objects that overcome the skin barrier and in their movement through the tissues intersects a nervous element. These may cause partial or total severing of a nerve element, crushing it or traction / elongation of the nerve element. Other provoking agents may be of a chemical nature. Following any form of trauma to a nerve structure, the traumatic factor action time is a defining element, more precisely a short time may install a block that disrupts nerve conduction for a short time.

The operative moment will oblige the surgeon to make some basic general principles that apply to trauma of the nerves. Trying to simplify the structure of peripheral nerve treatment, we first need to think about the patient's comfort, who has already traumatized the event that produced the lesion, but also through the surgery room where he underwent surgery that allowed the restoration of bone continuity, repair of major vascular axes or muscle re-insertion, repair of cut tendons. Nervegraft from patientcan be considered a „gold standard" for surgical practice but they also reach their limits if they are longer than 4 cm[6]. Most nerve grafts surgeons prefer the sural nerve due to ease approaches, harvests and the loss of a small sensitive area as a dimension[7]. The harvesting of the nerve structure also depends on the experience of the surgeon, the knowledge of the anatomical features, the patient's comorbidities, the operating time that increases with the number of grafts harvested[8].

Complications are also to be taken account in any complex trauma. Sympathetic-reflex pain occurs in most cases about 3 months after the injury. The subacute stage takes up to 9 months from the trauma in which the pains begin to appear almost daily but also the limitations of movements that do not interest the territory served by the nerve both motorically and sensitively. Chronic stage starts at 9 months from trauma and can go up to years.

Evolution also depends from factors such as the patient's state of health (associated diseases such as diabetes or stroke, ischemic or haemorrhagic strokes), the volume of the affected nerve axis, the size of the nerve defect that affects regeneration by direct nervous coaptation or requires grafting.

MATERIALS AND METHOD

For this we used two batches of 22 and 24 laboratory animals (Wistar rats) that were subjected to surgical procedures, in which a standard size allograft (length = 1 cm) was transplanted. To each batche, a Wistar rat was used as a control maine. The repair of the sciatic nerve defect was done using the currently used elective method, namely the epi-perineural nerve allograft suture. After the fingerprinting, the sciatic nerve was harvested from the operative limb from both rats in the same team and the histopathological examination was performed, the results being compared both within each batche and between the two batches. After analyzing all the results, it will be able to determined, experimentally, allografts can be the optimal model of nervous conduct.

Thus, the objectives of this study are:

1. Analyzing the efficiency of nerve allograft through the surgical approach of the two batches;
2. Determining the advantages and disadvantages of each surgical approach;
3. Comparative and evolving evaluation, fingerprinting and subsequent histopathological examination of the nerve harvested after the slaughter of the rat;
4. Producing a nerve defect in the rat sciatic nerve of 1 cm that would be equivalent to a human adult with a defect located between 9-13 cm. This reasoning was done anatomically based on the measurement of the sciatic nerve in an adult (about 40 cm) and the sciatic nerve measurement in the Wistar rat (about 3 cm). So I thought that 1 cm of the sciatic nerve of the rat equals about 11 cm of human sciatic nerve.

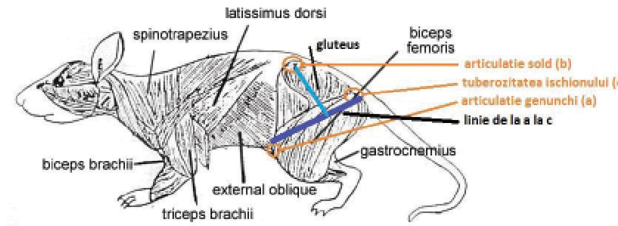
5. Establish the optimal variant for the surgical approach pathway involving rat minimal stress and a rapid recovery of the sciatic nerve.

Legislation in this field has been studied and served as an orientation element of the study, we refer to Law 43/2014 transposing EU Directive 63/2010. Ketamine, dexmedetomidine and butorphanol were used as anesthetics. A cocktail was prepared which was injected intraperitoneally for each subject[9,10]. The proposed doses were: Ketamine 80 mg / kg body weight; Dexmedetomidine 0.25 mg / kg body weight and Butorphanol 0.5 mg / kg body weight[11].

The operator protocol for batch 1 assumed the position of the subject (rat) in the ventral decubitus and the pelvic limb is positioned and fixed in abduction. Fixing is on a rough plan. Positioning the subject in this position is done after the anesthesia that has been done intraperitoneally. After the anesthesia is installed, an incision can be made which cannot be defined as a direction, but will be performed in all cases on the plane of the femoral biceps. This detail to explain that we were unable to identify anatomical elements in the surgical technique that would define the incision length or landmarks. The incision of the skin will be followed by the anchoring of the two skin flaps that will be oriented as a wound to expose the muscle. The muscle is cut with the scalpel and is to be restored later. By cutting it, a fibrous plane separating the deep plane of the adductor and the posterior biceps of the femoral biceps will be observed. The plan is an avascular, bleeding-free one, providing operator comfort, but it will affect nerve regeneration. We mention this because the opening of this plan reveals the sciatic serum in its mean third. Another mention is that the whole nerve is in tension due to the positioning of the limb in the ventral decubitus. The three-point sutured nerve positioned in the „Mercedes star"[12,4,8] will be positioned in the avascular plan described above.

For batche 2, the operative protocol under the rat tail was placed under the limb to be operated, putting pressure on the gluteus muscular plane and lifting the sciatic nerve. If the tail does not have the appropriate volume, or in the case of the study, the tail was fitted with a loop, it will be replaced by a volume volume of 2ml or max. 5ml. Keeping the preoperative markup stage done after the anesthesia and the operation of the limb to be operated. Marking is done with a permanent marker and involves 3 points: the knee joint (a); hip joint (b); the tuberosity of the ischion (c).

The line that goes from point „c" to point „a" is the point where the sciatic nerve goes. At about 2 mm from the point „b" from „c" to „a", the sciatic nerve breaks off the branches (peronier, posterior tibial). The correct preoperative markings lead to precise, accurate dissection, with sciatic nerve identification immediately separating the two muscles. The tension in the operative wound is minimal, the nerve is relaxed from the plexus. In the approach of the nerve on this path, we do not encounter the fibrous septum between the femoral adductor and the femoral biceps, located before the dissection plane. Lack of tension in the nerve suture plans limits trauma to the epineural elements. The nerve graft is „trapped" in previously separated muscle plans (gluteus / femoral biceps) and do not need the suture to be repaired. These two muscle masses behave as two vascular beds for the nerve graft but also for the proximal and distal end of the sciatic nerve.



Bain[12] develops a formula expressing the function index of the sciatic nerve: SFI= -38.3[(EPL-NPL) / NPL]+109.5 [(ETS –NTS) / NTS] +13.3 [(EIT-NIT) / NIT]-8,8. The formula was created to appreciate the functional recovery rate. Subsequent replacement of these terms in Bain's equation will yield the following results: Batche 2014 (No 1) -25.559 vs. 2015 (No 2) -20.631. We recall that Bain equation, specifies the result of the equation as closest to „0" to confirm the best nerve regeneration and that it would tend to „-100", the lack of regeneration. As a conclusion we can say that we are in the first quarter, close to „0" as nervous regeneration, appreciating a good quality regeneration for both batches. And if we only compare batche 2 with the alternative approach path proposed by study, we can say that we are in the first 1/5 of constants that are approaching „0".

DISCUSSIONS AND CONCLUSIONS

The real problem of nerve regeneration is not when axon regeneration, physiological processes carried out at the microcellular level, but their ability to bind the target organ and succeed in developing a specificity with which will serve the target organ. alternative nervous repair has penetrated the medical market. There is talk of „tubularization" that currently has the potential to improve regenerative results. There are innumerable biological and synthetic materials, easily accepted by the body, without producing an exaggerated fibrotic reaction. All of these have been tested in the laboratory and with very encouraging results. But only a small part of them went beyond the experimental lab door. Although the differences were not great, in the case of the operator technique, the pathway approach and bed avascular / vascular where the allograft was stationed in the regeneration process, made the difference of the functional impact.

We conclude by saying a few words: using nerve graft is a „golden standard" in nervous repair, in defective lesions even if there are prosthetic materials that could replace it, obvious advances in substitution of allograft, but the results are not comparable with it. The existence of nerve regeneration in case of sciatic nerve repair in the Wistar rat cannot be challenged. The surgical pathway is an important point of regeneration as close as possible to normal nerve function. An easy approach path leads to increased quality of nerve regeneration. The existence of a muscular bed where the graft area can be placed is superior to a fibrous area that does not provide good nutritional intake.

Compliance with ethics requirements:
The authors declare no conflict of interest regarding this article.
The authors declare that all the procedures and experiments of this study respect the ethical standards in the Helsinki Declaration of 1975, as revised in 2008(5), as well as the national law. Informed consent was obtained from all the patients included in the study.

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