

Open Carpal Tunnel Release: Performed Axillary Brachial Plexus Block Versus Wide Awake

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Ropivacaine and lidocaine are used in surgical anaesthesia for the upper extremity. The first one is indicated for the axillary brachial plexus block and the second one as a local anaesthetic. A retrospective study was realized to evaluate the differences between the two anaesthetic methods used for the carpal tunnel release.

Keywords: ropivacaine, lidocaine, carpal tunnel release

Carpal tunnel syndrome (CTS) is one of the most frequently diagnosed upper extremity compression neuropathies [1], being described as an entrapment of the median nerve at the level of the wrist [2]. In the general population, the prevalence of CTS is up to 5%. The main pathophysiologic mechanisms involved in the median nerve compression are the impairment of the epineural blood flow and axonal conduction [1]. The distribution of the median nerve is represented by the thumb, index, middle finger, and the radial side of the ring finger, so the presenting symptoms are hand pain, numbness, paresthesias and weakness in the palmar, radial hand. It is considered that up to 65% of cases CTS are bilaterally, being associated with hypothyroidism, diabetes, and rheumatoid arthritis [3].

The recommended first-line treatments are the anti-inflammatory medications and steroid injections, but the majority of patients do not respond to this therapeutic plan [1] and the surgical release of the flexor retinaculum is indicated [4], reducing the pressure of the median nerve [2]. The surgical intervention can be performed under local or general anesthetic, with or without a tourniquet [5], being recommended to all the patients with moderate to severe CTS. It is mandatory for patients with muscular atrophy [2]. In literature, a variety of techniques have been presented, each with its merits and disadvantages [4]. Nowadays, wide-awake decompression of the carpal tunnel with local anesthesia and no sedation is becoming more and more used [5].

The study evaluated the results, complications and differences from carpal tunnel release by means of an open route, using different anesthetic techniques.

Experimental part

A retrospective study was realized in which were enrolled 48 patients with carpal tunnel syndrome. They were treated in the Plastic Surgery Department of Emergency Clinical Hospital Prof. Dr. Agrippa Ionescu for a

period of six months, from January-June 2018. The age, gender, physical evaluation findings, electrophysiological examination reports of the patients were recorded. Inclusion criteria were constant numbness, complaints for at least 3 months, no additional neural pathology and persistent conduction disorders in sensory and motor fibers observed through electromyography (EMG). Patients with diabetes mellitus, chronic kidney disease, thyroid or rheumatic disorders and pregnant women were not included in the study. All patients had primary CTS. Local ethical agreement and informed consent of the patient were obtained.

During the clinical examination, we evaluate the hypoesthesia in the median nerve sensation area, loss of strength in the radial three fingers, thenar muscle atrophy, thumb abduction, but also Tinel and Phalen signs. Preoperative and postoperative EMG images were examined for each patient. Regarding the prophylaxis of the infection, three doses of a parenteral antibiotic were administered, the first one before the intervention. Open surgery with a standard incision was performed and the arm tourniquet was used in all cases. We preferred an incision, approximately 4 to 5 cm in length cm, so that all the structures could be visualized. For thirty patients axillary brachial plexus block with 0.75% ropivacaine was performed and for the rest of the patients wide-awake release of the carpal tunnel using a solution of lidocaine, epinephrine was decided. The following day after the operation, dressings were changed and finger exercises were started. Postoperative splint was used for immobilization the radiocarpal joint for 2 weeks. The stitches were removed on the 14th day and exercises with a softball were initiated.

Results and discussions

In 1854, Paget described for the first time the median nerve compression in the carpal tunnel, but just after a century the first description of an operation for idiopathic

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CTS appeared. Brain and Phalendefined CTS from both clinical and anatomopathological aspects. Since 1960, it is considered that CTS is the most common peripheral compression-induced neuropathy [6], affecting mainly middle aged women [2].

In our study, from all 48 patients, 30 were female. Their ages ranged from 36 to 67 years, with a mean of 54. All the patients were from urban areas. The dominant hand was affected in all cases, 40 patients having the right hand as dominant. 13 patients presented at admission bilateral carpal tunnel syndrome.

In general, the diagnose is established by the overall evaluation that includes the history of symptoms, the physical examination, x-ray and EMG [7]. Our patients declared to have constant numbness, weakness with pinch and grip and dropping things from the affected hand. Moreover, nocturnal pain, sensory loss and pain increasing with activity over the median nerve distribution area were reported. Tinel sign and Phalen test sign were positive in 42 and in 29 cases, respectively. The thenar atrophy was detected in 30 cases. The X-ray did not reveal any modifications for any of the patients. Preoperative EMG examinations revealed conduction disorders both in sensory and motor fibers in 41 cases, with prolonged distal motor latency to the abductor pollicis brevis and conduction disorders affecting only the sensory fibers in 7 patients.

For 30 patients, axillary brachial plexus anesthesia with 0.75% ropivacaine ($C_{17}H_{26}N_2O$) was performed. The patients were premedicated with midazolam at an initial dose of 0.04 mg kg⁻¹ in 10 mL of normal saline infused over 10 min, which was followed by maintenance infusion of 0.04 mg kg⁻¹ h⁻¹. Midazolam is a benzodiazepine used for intraoperative sedation, having anxiolytic, amnesic and sedative properties, along with a low incidence of unpredictable outcomes and a vast margin of safety [8]. The axillary block was done in the supine position with the arm abducted to 90° and the hand lying on the bed next to the head. The brachial plexus was discovered using a nerve stimulator. The total volume of the solution with ropivacaine that was injected in the midaxilla was 30-40 mL. The mean time needed for each patient to become ready for surgery was 17 min. Ropivacaine is an amide-type local anesthetic. It is structured as the hydrochloride monohydrate of the (S)-enantiomer [9]. The activity duration is between 8-13 h for peripheral nerves block [10].

For 18 patients, tumescent local anesthesia was used. We inject 20 mL of 1% lidocaine ($C_{14}H_{22}N_2O$) with 1:100,000 epinephrine: 10 mL in the wrist between the median and ulnar nerves, and 10 mL in the palm. Lidocaine is a water-soluble and temperature stable substance being the most frequently used topical anaesthetic [11]. Due to the fact that the time to maximal vasoconstriction after injection is 25 min, to reduce the surgery time, we used the arm tourniquet.

The main two surgical techniques, used to treat the CTS are the open and endoscopic release [2]. In all cases, the surgery started after the application of the pneumatic tourniquet and the mean duration of the operation was 20 min (range: 15-40 min). We used in all cases the traditional option more exactly the open carpal tunnel release. This surgical approach was used for the first time in 1924 by Herbert Galloway [2]. We performed a 4-5 cm curved longitudinal inter-thenar incision, opening the subcutaneous tissue, superficial fascia and cutting the transverse carpal ligament. Once the median nerve was identified, external neurolysis was performed. None of the cases had any complications concerning the motor and



Fig. 1 Median nerve in open carpal tunnel release

sensory branch of the median nerve. The mean duration of return to daily living was 18 days (range: 15-24 days).

The patients with axillary brachial plexus anesthesia did not received any analgesics postoperatively, but they spent the night in the hospital. They reported the numbness of the upper extremity for 10-12 h. No complications in these patients were described.

The patients with tumescent local anesthesia received analgesics after 3-4 h postoperatively, due to local pain, but they all got up and went home after the surgery without having to recover from other drugs. For them, there was no wasting time on unnecessary preoperative testing that was required for sedation. Even if the intraoperative monitoring is not mandatory, we used it in all cases. One patient developed a minimal hematoma that was solved nonsurgically. In addition, this technique enhances intraoperative communication between the surgeon and the patient. It is cheaper, due to the fact that the the anesthesiologist, the recovery room staff, and the preoperative testing costs are not required [12].

In all cases, the EMG examination performed in the 6th month after the intervention revealed ameliorated latency in motor and sensory fibers of the median nerve.

Conclusions

In conclusion there was no significant evidence to demonstrate a difference between methods. These findings can provide support for the equivalency of the techniques and subsequently free the patient and surgeon to choose the anesthetic methods most comfortable for both parties.

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Manuscript received: 5.11.2018