



Cost-effectiveness of carpal tunnel syndrome ambulatory surgery with WALANT

Custo-benefício do WALANT da cirurgia ambulatorial da síndrome do túnel do carpo

Rentabilidad de la cirugía ambulatoria del síndrome del túnel carpiano con WALANT

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ABSTRACT

Objectives: To compare procedure time, costs, and complications for STC correction between the WALANT technique performed in an outpatient setting and a conventional surgical center. **Methods:** This is a randomized clinical trial with 47 patients who had an absolute indication for surgery and underwent surgical opening of the transverse carpal ligament. Patients were randomized into a group that would undergo outpatient surgery and another in the conventional surgical center. Procedure time, total cost, and perioperative complications were evaluated. The variables and outcome measures were plotted and data normality was evaluated via the Student's t-test, the Chi-square and Mann-Whitney tests were used when indicated, using SPSS software (version 21). **Results:** Among the 47 patients, 25 underwent the procedure in an outpatient setting and 22 in the conventional surgical center. A shorter preparation time, surgery time, and hospital stay were observed in the outpatient group. This group also had lower costs and fewer complications. **Conclusion:** The WALANT technique used in an outpatient setting for carpal tunnel decompression surgery is safe, effective, and provides a shorter hospital stay, significant reduction in medical-hospital costs, and fewer complications.

Keywords: Carpal tunnel syndrome, Ambulatory surgical procedures, Hand surgery, WALANT, Ambulatory care.

RESUMO

Objetivos: Comparar tempo de procedimento, custos e intercorrências, entre os procedimentos para correção da STC utilizando a técnica WALANT em ambulatório e no centro cirúrgico convencional. **Métodos:** Trata-se de um ensaio clínico randomizado com 47 pacientes, com indicação absoluta de realização de cirurgia, submetidos ao procedimento cirúrgico de abertura do Ligamento transverso do carpo. Os pacientes foram sorteados em um grupo que fez a cirurgia ambulatorial e outro no centro cirúrgico convencional, avaliou-se tempo de procedimento, custo total e intercorrências peri-operatórias. As variáveis e medidas de resultado foram plotadas e submetidas ao teste de normalidade de t-student, foram utilizados os testes Qui- quadrado e de Mann Whitney, quando indicados, utilizando-se o software SPSS (versão 21). **Resultados:** Entre os 47 pacientes, 25 foram submetidos ao procedimento em ambiente ambulatorial e 22 no centro cirúrgico convencional. Observou-se, um menor tempo de preparo, de cirurgia e de internamento dos pacientes do grupo ambulatorial. Neste grupo, também se observou menor custo e menos intercorrências. **Conclusão:** A técnica WALANT empregada ambulatorialmente, para a cirurgia de descompressão do túnel do carpo é segura, eficaz e proporciona um menor tempo de internamento hospitalar, uma diminuição significativa nos custos médico-hospitalares e menores casos de intercorrências.

Palavras-chave: Síndrome do túnel carpal, Procedimentos cirúrgicos ambulatoriais, Cirurgia de mão, WALANT, Assistência ambulatorial.

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RESUMEN

Objetivos: Comparar el tiempo del procedimiento, los costos y las complicaciones para la corrección del STC entre la técnica WALANT realizada de forma ambulatoria y un centro quirúrgico convencional. **Métodos:** Se trata de un ensayo clínico aleatorizado con 47 pacientes que tenían indicación absoluta de cirugía y fueron sometidos a apertura quirúrgica del ligamento transversal del carpo. Los pacientes fueron asignados al azar a un grupo que se sometería a cirugía ambulatoria y otro en el centro quirúrgico convencional. Se evaluaron el tiempo del procedimiento, el costo total y las complicaciones perioperatorias. Se trazaron las variables y las medidas de resultado y se evaluó la normalidad de los datos mediante la prueba t de Student, se utilizaron las pruebas de Chi-cuadrado y Mann-Whitney cuando estuvo indicado, utilizando el software SPSS (versión 21). **Resultados:** De los 47 pacientes, 25 se sometieron al procedimiento de forma ambulatoria y 22 en el centro quirúrgico convencional. En el grupo ambulatorio se observó un menor tiempo de preparación, tiempo quirúrgico y estancia hospitalaria. Este grupo también tuvo costos más bajos y menos complicaciones. **Conclusión:** La técnica WALANT utilizada de forma ambulatoria para la cirugía de descompresión del túnel carpiano es segura, efectiva y proporciona una estancia hospitalaria más corta, una reducción significativa de los costos médico-hospitalarios y menos complicaciones.

Palabras clave: Síndrome del túnel carpiano, Procedimientos quirúrgicos ambulatorios, Cirugía de la mano, WALANT, Atención ambulatoria.

INTRODUCTION

Among the compressive syndromes of the upper limbs, carpal tunnel syndrome (CTS) is the most prevalent, reaching up to 5.8% in women aged 25 to 74. Approximately 90% of mononeuropathies are caused by CTS, leading to pain and paresthesia. Also noteworthy is its prevalence among the working population and people with diabetes mellitus (JENKINS PJ, et al., 2012; LUCKHAUPT SE, et al., 2013).

The pathophysiology of the disease is not fully elucidated; however, it is believed to originate from increased pressure within the carpal tunnel, resulting in compression of the median nerve. As a consequence of this compression, local nerve ischemia occurs, manifesting with typical symptoms of numbness, tingling, nocturnal paresthesia, and/or neuritic "pins-and-needles" pain in the radial 3.5 digits (BLAND JDP, et al., 2007). Another consequence of compression is nerve demyelination and alteration of the perfusion of the endoneurial capillary system, a small network of blood vessels located within the nerve.

Ultimately, this promotes dysfunction of the blood-nerve barrier, leading to edema, which may partly explain the rapid relief of symptoms following surgical decompression (OSIAK K, et al., 2022). Also, anatomical anomalies such as synovial cysts, tumors, and even fractures that increase pressure in the carpal canal can cause neural compression (CHAMMAS M, et al., 2014; D'AURIA JL, et al., 2021; FENG B, et al., 2021). Considering this scenario, carpal tunnel syndrome is not only a health problem, but also a social and economic problem, given the physical and mental disorders resulting from it. Another important problem faced by individuals affected by CTS is related to work limitation, which occurs due to the loss of muscle strength caused by the reduced capacity of electrical activation of the muscles (LUCKHAUPT SE, et al., 2013).

A diagnosis is primarily clinical, consisting of evaluating present symptoms and conducting physical examinations. Complementary examinations are useful when the diagnosis is uncertain; examples of these tests include studies of alterations in median nerve conduction, as demyelination may reduce the speed of electrical impulses, as well as electromyography. Ultrasound has also been utilized for diagnosis, as it may reveal an increased cross-sectional area of the nerve before compression occurs (TAI TW, et al., 2012).

One critical aspect is determining the treatment approach for CTS. Conservative treatment is indicated for patients who do not exhibit signs of neurological deficit, typically in the initial phase of the disease, with mild and intermittent symptoms. This treatment modality encompasses physiotherapy, local corticosteroid injections, oral medications, and wrist splinting. Conversely, surgical treatment is recommended for individuals with persistent and progressive signs and symptoms, with no satisfactory response to conservative measures (PADUA L, et al., 2016; WESTENBERG RF, et al., 2020). These indications for surgical approach represent a crucial aspect in the management of carpal tunnel syndrome.

Offering a surgical procedure in a safe, effective way, without the use of a tourniquet, with no pain, and in a consulting room environment, should be considered due to the high costs currently present for performing this procedure in a conventional surgical center (PADUA L, et al., 2016). In this context, the Wide Awake Local Anesthetic no Tourniquet (WALANT) technique has been gaining more space among hand surgeons. This fact is due to the effectiveness of this technique, which consists of an effective anesthetic blockade without the use of a tourniquet and without bleeding that would compromise the performance of procedures in hand surgeries, as evidenced in the literature (SRAJ S, 2021; AYHAN E e AKASLAN F, 2020; KI LEE S, et al., 2020).

Evaluating the effectiveness of anesthetic blockade using the WALANT technique is essential to disseminate the safety of this technique among surgeons and patients. Additionally, we must consider that the high hospital medical costs for performing carpal tunnel decompression surgery should be reviewed using the WALANT method in an outpatient setting (LALONDE DH and WONG A, 2013).

Some factors affect the increase in a patient's total length of stay, such as time for hospital admission, travel between hospital environments, as well as preparation of anesthetic medications, anesthetic blocks, surgeries, and discharge from the anesthetic recovery room. Those factors increase infections and the costs of the entire hospitalization chain (BAEK H, et al., 2018).

Another data of relevance is the total cost of the procedure. Hospital and medical fees are of significant importance in the increase of surgical expenses and should be better evaluated, as well as the length of hospital stay aforementioned. This research aimed to compare procedure time, total cost, and number of interurrences between procedures for CTS correction using the WALANT technique in an outpatient setting and a conventional surgical center.

METHODS

This is a randomized clinical trial with patients undergoing a surgical procedure for opening the transverse carpal ligament, where 47 patients, with an absolute indication for surgery, that is, with failure of conservative treatment.

The board of the Research Ethics Committee from the Federal University of Pernambuco approved this study, waiving the use of informed consent (CAAE: 48411121.0.0000.5208) (Ethics committee opinion number 4887891). All patients agreed with the participation, signing an informed consent where they were informed of the risks and benefits of participating in the study, and any questions were addressed.

Patients with CTS who did not respond satisfactorily were included in the treatment with orthoses, physical therapy sessions, painkillers, or infiltrations with analgesics and corticoids. All patients had more than 12 months of conservative treatment and had positive ultrasound or electroneuromyography for CTS. Patients with CTS with an associated diagnosis of fibromyalgia, those who had previously undergone surgery for carpal tunnel decompression on the same side of their recurrence, and patients younger than 18 or older than 90 were excluded.

Patients were divided, through simple randomization by draw, between those who would undergo the intervention in an outpatient setting, using the WALANT technique, at the Recife Naval Hospital (HNRe) and those who would undergo the procedure in a conventional surgical center, also located at HNRe.

Patients in the outpatient procedure group did not receive requests for preoperative exams or a perioperative cardiovascular evaluation. They had their surgeries performed by a medical specialist in hand surgery without an anesthesiologist in the office. The patients in the control group were requested to undergo preoperative tests and, when necessary, to obtain a cardiological evaluation, the values of which were not included in the comparison, thus mitigating possible biases. They were operated on in the conventional surgical center by a hand-surgery specialist, with the presence of an anesthetist to perform the axillary blockade.

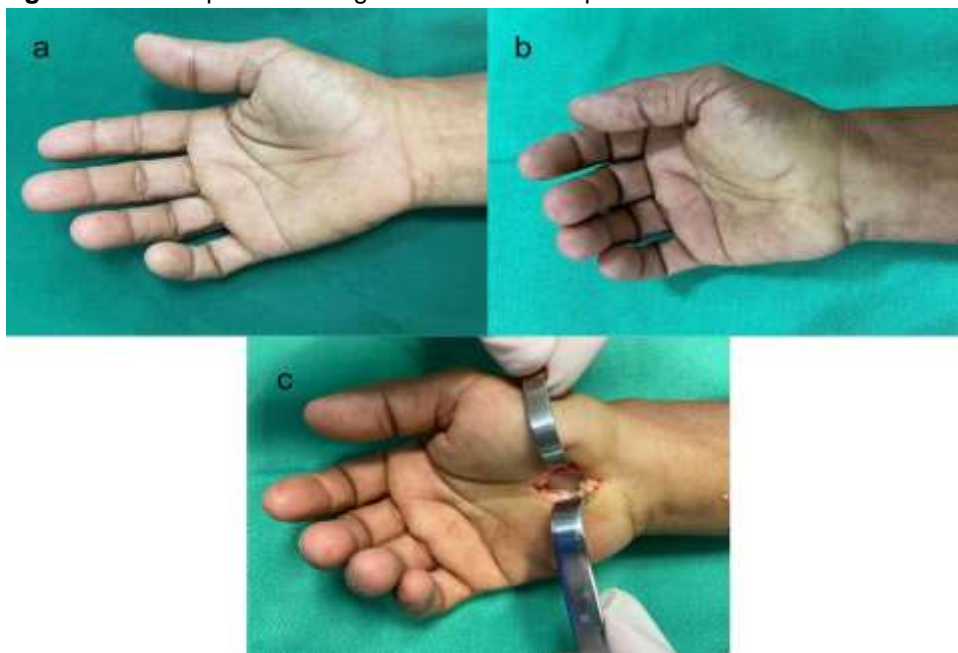
For the patient's procedure, through the WALANT technique, ambulatory surgery kits were used, without retinaculotome or endoscopes and with the professional help of only a surgical scrub technician. As for the

procedures performed in the conventional surgical center, the surgeon and the anesthetist had all the items present in the conventional surgical center surgery kit.

The anesthetic solution for outpatient procedures was prepared using 80 ml of saline solution, 20 ml of 2% lidocaine without vasoconstrictor, 3 ml of bicarbonate 8.4%, and 1 ml of epinephrine 0.1%. The anesthetic solution was infiltrated into the region, where skin pallor was noted after a few moments due to vasoconstriction. During carpal tunnel decompression, an incision was made in the palm of the hand.

The transverse carpal ligament was carefully divided to relieve pressure on the median nerve, responsible for hand sensation and movement. The aim was to alleviate symptoms of nerve compression, such as numbness, tingling, and weakness in the hand and fingers.

Figure 1- Hand operated using the walant technique.



Legend: a) Hand before surgery; b) Vasoconstriction present after the anesthetic block with the WALANT technique; c) Carpal canal decompressed with the WALANT anesthetic technique, with minimal bleeding, in a patient who had already been operated on and without the use of a pneumatic tourniquet.

Source: Macêdo KR, et al., 2024.

Using a digital stopwatch, the preparation time, anesthesia time, and surgical procedure time in both groups. In addition, to calculate the cost of each procedure, the reference tables SIMPRO April 2017 (united reference) and BRASINDICE were used to value the prices of materials and medicines, respectively, in force on the date of the consultation (05/24/2021), without commercialization margin additions, for medical fees, the 2014 Brazilian Hierarchical Classification of Medical Procedures (CBHPM) table of references and the prices of the official announcement of the same year were considered.

To convert values from Brazilian currency (Brazilian reais) to the dollar, US Federal Reserve exchange rates for the same date as the query were used, where 1 dollar is equivalent to 5.3223 Brazilian reais. All patients were evaluated in the first week after surgery, with the second postoperative evaluation performed two weeks later and the third 30 days after surgery.

The outcomes evaluated were total treatment costs per patient, surgery preparation time, anesthesia time, surgery time, and entire hospital stay. In addition, intraoperative and postoperative complications related exclusively to the surgery were evaluated.

Intercurrences were considered: Pain during anesthetic blockade or surgery, manifested through muscle contractions of the hand, in patients operated in the conventional surgical center and reported by patients operated on an outpatient basis, which implied reinforcement of the blockade or sedation; nausea, dizziness, or vomiting during blockage or surgery; in addition to nausea, dizziness, vomiting or drowsiness, within one hour after the end of the surgery. To avoid possible overestimation or underestimation of these interurrences in the study groups, they were aggregated, and the distribution was analyzed regarding the occurrence of interurrences or non-occurrence.

Categorical variables are represented as rates, and continuous variables as mean \pm standard deviation. Then, all variables and outcome measures were plotted, and the student's t-normality test was performed to determine the type of distribution. Chi-square and Mann-Whitney tests were used when indicated. Data were analyzed using IBM SPSS Statistics Version 21, with $p < 0.05$ defined as statistically significant.

RESULTS

Forty-seven patients with CTS from the HNRe were included in this study. All patients had alterations in complementary exams, 10 had a positive electroneuromyography exam for CTS, and the remaining 37 had altered ultrasonography. Of these 47 patients, 25 underwent the procedure for opening the transverse carpal ligament in an outpatient setting, and 22 underwent the procedure at a conventional surgical center.

There was no loss of follow-up of patients during this study. When observing the demographic data of the operated patients, no statistically significant differences were found in the distribution of sex, treatment side, associated diseases, age, and disease duration of the patients in the two samples (**Table 1**).

Table 1- Demographic characteristics of the study.

Procedure place			
Variable	Outpatient clinic	Surgery center	P value
Sex			
Female	19	17	-
Male	6	5	0,918**
Treatment side			
Right	12	13	-
Left	13	9	0,446**
Associated conditions			
None	16	14	-
Trigger finger	7	8	
De Quervain tenosynovitis	0	3	
Hand Tumors	2	0	
Dupuytrain's contracture	0	1	0,125**
Age (Mean \pm -SD)	64,79(15,63)	63,33(20,42)	0,296***
Symptoms duration*(Mean \pm -SD)	29,72(22,36)	34,59(27,39)	0,554***

Legend: *Time in months; **Chi-square test; *** Mann-Whitney's test.

Source: Macêdo KR, et al., 2024.

Observing the preparation for the procedure, the group that underwent outpatient intervention presented a shorter preparation time than the group that operated in a surgical center, with an average of 14.16 minutes compared to 214.36, respectively.

Regarding anesthesia, the outpatient procedure also required less time to anesthetize the patient, with an average of 4.4 minutes, compared to 22.36 minutes in the surgical center. However, considering the surgery itself, the group submitted to the procedure in the surgical block took less time to perform, with an average of 7.09 minutes, compared to 11.8 minutes in the outpatient clinic (**Table 2**).

Table 2- Time of preparation, anesthesia, surgery and total length of stay.

Variable	Procedure place			P value
	Outpatient clinic	Surgery center	Total	
Prepare Time (mean+/-SD) *	14,16(6,9)	214,36(51,51)	107,87(106,92)	< 0.001**
Anesthesia time (mean+/-SD) *	4,4(1,96)	22,36(9,67)	12,81(11,26)	< 0.001**
Surgery time (mean+/-SD) *	11,8(7,75)	7,09(3,74)	9,60(6,59)	< 0.005**
Total hospitalization time (mean+/-SD) *	30,44(10,18)	239,5(45,62)	128,30(110,13)	< 0.001**

Legend: SD=Standard Deviation; * Time in minutes; ** Mann-Whitney's test.

Source: Macêdo KR, et al., 2024.

All patients operated on an outpatient basis spent a period of less than one hour of total hospitalization time, between 16 and 55 minutes, with an average time of 30.44 minutes inside the hospital, against an average of 239.5 minutes for the operated patients in the conventional surgical center, which ranged from 3 hours to 5 hours and 24 minutes.

It was observed a statistically significant decrease in the costs of procedures in the group operated on an outpatient basis, using the WALANT technique, compared to the group operated in a conventional surgical center. The average cost of the procedure in a surgical center corresponded to a value of 513.18% higher than that of outpatient procedures (**Table 3**).

Table 3 - Total procedure cost.

Variable	Procedure place			P value
	Outpatient clinic	Surgery center	Total	
Procedure cost (mean+/-SD)	US\$:229,38(1,15)	US\$:1406,53(3,11)	US\$:780,41(593,75)	< 0.001*

Legend: SD=Standard Deviation; * Mann-Whitney's test.

Source: Macêdo KR, et al., 2024.

Among the intraoperative and postoperative interurrences, the following were identified: Pain during anesthetic blockade or surgery, manifested through muscle contractions of the hand, in patients operated on in the conventional surgical center and reported by patients who underwent surgery on an outpatient basis, which involved reinforcing the blockade or sedation; nausea, dizziness, or vomiting during blockage or surgery, in addition to nausea, dizziness, vomiting or drowsiness within one hour after the end of the surgery. It is possible to notice that the procedures in the surgical center had a higher rate of interurrence (86.36%) compared to outpatient procedures (24%). (**Table 4**)

Table 4 - Perioperative complications.

Perioperative complications	Procedure place		P value
	Outpatient clinic	Surgery center	
Yes	6	19	< 0.001*
Pain	6	6	
Nausea, dizziness, or vomiting	0	1	
Pain and Nausea, dizziness, or vomiting	0	12	
No	19	3	

Legend: *Chi-square test. **Source:** Macêdo KR, et al., 2024.

In addition, all patients reported improvement in complaints of pain and paresthesia after performing the surgical procedure in both settings. Two patients operated on in a conventional surgical center evolved with a superficial skin infection. These patients returned to the surgeon's clinic complaining of edema associated with local hyperemia, accompanied by a small purulent collection in the surgical wound in both cases. Daily dressings were performed by the patients in their residences, and hygiene guidelines were given by the surgeon, and these patients evolved with the resolution of the infection without the need for surgical debridement, antibiotic therapy, or hospitalization.

DISCUSSION

To quantify the total length of hospital stay of a patient, several factors are related to the increase in the period of stay in the hospital, such as the time it took for the insurance to release the admission to the hospital, completion of hospital documents, transportation from the patient to the place of hospitalization, shower, change of clothes and transfer to the surgical center. These variables contributing to the increase in hospitalization time can change according to the institution and may be more optimized in some institutions and reasonably delayed in others. In addition to all these factors, the duration of surgery and anesthesia must be added, which can also vary according to the team. The information presented was quantified in the HNRe, which limits the interpretations to this sample space and should not serve as an absolute time parameter.

Performing an effective anesthetic block that eliminates the use of a tourniquet and with the presence of bleeding that does not compromise the performance of the surgery means that we dispense not only the need for an anesthesiologist but also the need for a perioperative cardiovascular evaluation. Excluding the anesthetic block saves more time for the surgical act, considering that the patient will not be exposed to anesthetic drugs. This will affect the patient's length of stay in the unit and subtract the total hospitalization time. The decrease in hospital stay time is beneficial in several aspects. It leads to lower infection rates and a reduction in the use of materials that can be used during hospitalization to reduce the total hospitalization costs. Furthermore, the procedure performed in a surgical center is more expensive, because this intervention is performed with an auxiliary physician and the entire team necessary for the surgical procedure to be completed. In addition to the surgeon and his assistant, the anesthetist, nursing staff at the hospital and surgical center, receptionists, cleaning staff, porter, and anesthetist in the recovery room are part of the hospital chain.

In addition to savings in human resources, the outpatient procedure using the WALANT technique is also more economical from the point of view of costs with medical-hospital supplies. Several anesthetic drugs and materials used by the anesthetist increase costs in surgical centers, such as Stimuplex[®], (a peripheral nerve stimulator used for regional anesthesia) which is relatively expensive in Brazil. Our research showed similar results for carpal tunnel decompression in a surgical and outpatient setting as in other scientific articles. Additionally, in other studies, the average length of stay for outpatient procedures showed a statistically significant decrease compared to operations in the operating room.

Several scientific articles demonstrate the effectiveness of the WALANT technique in different surgical specialties. This anesthetic technique has gained more and more space among hand surgeons in recent years. Such a fact is due to its effectiveness in surgeries of the upper limbs and at all ages (KI LEE S, et al., 2020; LECH L, et al., 2021; FRANK SG and LALONDE DH, 2012). Few studies refer to the applicability and impact of the WALANT technique for CTS carpal tunnel syndrome in an outpatient setting.

As well as the limited literature on the subject, this work showed that the WALANT technique for CTS surgery is safe and effective. The present study also showed that, due to its safety, it could be used outside the conventional surgical center environment, being possible to be used and easily reproducible in an outpatient setting with risks of intercurrents similar to procedures performed in a conventional surgical center (RELLÁN I, et al., 2021). The present study also corroborates the current literature, (AYHAN E e AKASLAN F, 2020; KI LEE S, et al., 2020; LALONDE DH e WONG A, 2013; LECH L, et al., 2021; NETO PJP, et al., 2017; THOMSON CJ, et al., 2007; RELLÁN I, et al., 2021; SRAJ S, 2021;) which shows that using epinephrine in hand surgery is safe and effective in controlling bleeding. Epinephrine works by inducing vasoconstriction mediated by α -1 adrenergic receptors. This mechanism is responsible for reducing bleeding and post-operative edema. The myth of adrenaline related to digital necrosis has data before the 1950s. What was observed throughout this period is that the relationship between adrenaline and digital necrosis is an unfounded precept in safe doses, (NETO PJP, et al., 2017) dispensing with the need to use the adrenaline antagonist (phentolamine) for a possible reversal of the vasoconstrictor effect, even with high accidental doses. There is the possibility of ischemia due to the vasoconstriction effect generated by adrenaline. However, this possibility is minimal, as reported in scientific articles (NETO PJP, et al., 2017; THOMSON CJ, et al., 2007).

CONCLUSION

In summary, the Wide Awake Local Anesthetic no Tourniquet (WALANT) technique, when applied in outpatient settings for carpal tunnel decompression surgery, demonstrates safety and efficacy when compared to conventional surgery performed in a surgical center. This approach significantly reduces hospital stays, lowers medical and hospital costs, and minimizes the occurrence of complications. Its adoption stands as a promising avenue for improving healthcare efficiency and patient outcomes in the management of carpal tunnel syndrome. A review of the literature, as well as the authors experience, leads to the conclusion that the use of adrenaline in the proposed dilution is safe and effective for the anesthetic technique in extremities, eliminating the need for a tourniquet. More studies are necessary to determine if this approach can be generalized and become routine in the non-surgical management of CTS.

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