Chemical neuritis after steroid injection in a patient with carpal tunnel syndrome
Case report

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Abstract
Local steroid injection is one of the conservative treatment options for the mild or moderate carpal tunnel syndrome; there are few reports on injury of the median nerve by intraneural injection. We report one case of median nerve chemical neuritis by local steroid infiltration in a 42 year-old male with carpal tunnel syndrome. We carried out neurolysis and epineurotomy and removal of the injected material. There are descriptions of several techniques for carpal tunnel infiltration. This report discusses the anatomical limits of the carpal tunnel, infiltration techniques and the therapeutic options for this potential complication. We recommend performing injection ulnarly to the tendon of the palmaris longus muscle, 1.5 cm proximally to the wrist flexion crease. Once the needle is inserted the patient should be asked if he or she feels paresthesia or pain in the median nerve territory; if the answer is "yes", the procedure should be discontinued and the needle redirected.

Key words: Carpal tunnel syndrome; median nerve; steroids; injection; conservative treatment.
Level of evidence: IV

Neuritis química posinfiltración con corticoide en un paciente con síndrome del túnel carpiano. Reporte de un caso

Resumen
La inyección local de corticoide es una de las opciones de tratamiento conservador para el síndrome del túnel carpiano leve o moderado, son pocos los reportes de lesión del nervio mediano por inyección intraneural. Comunicamos un caso de neuritis química del nervio mediano posterior a la infiltración con corticoide local en un hombre de 42 años con síndrome del túnel carpiano. Se le realizó neurólisis, epineurotomía y desbridamiento del material inyectado. Se han descrito varias técnicas de infiltración a nivel del túnel del carpo. En este reporte, se discuten los límites anatómicos del túnel del carpo, las técnicas de infiltración y las opciones terapéuticas si surge esta complicación. Se recomienda aplicar la inyección cubital al tendón del palmaris longus 1,5 cm proximal al pliegue de flexión de la muñeca. Colocada la aguja se pregunta al paciente si siente parestesias o dolor en el territorio del nervio mediano, si la respuesta es afirmativa, el procedimiento debe detenerse y se debe redireccionar la aguja.

Palabras clave: Síndrome del túnel carpiano; nervio mediano; corticoide; inyección; tratamiento conservador.
Nivel de Evidencia: IV

Conflict of interests: The authors have reported none.

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Medical case

Forty-two year-old right-handed nurse male with symptoms of carpal tunnel syndrome (CTS) (night pain and paresthesia in the median nerve territory) consecutive to right hand impact suffered at work. He consulted at an orthopedic center, where he was asked to undergo electromyography, which informed bilateral CTS, moderate in the right upper limb (Table). First he was prescribed analgesic treatment with p.o. non-steroid anti-inflammatory drugs, with no improvement of symptoms; therefore, they opted for local infiltration with depot steroids. The patient reported that, at the time of infiltration, while the needle was entering the skin, he felt paresthesia in the first three fingers. As needle enter opening he pointed out a landmark (approximately 2 cm) distal to the wrist flexion crease, on an imaginary line that is continued by the interdigital space between the third and fourth fingers. Symptoms did not disappear; on the contrary, they worsened progressively as days went by, and this is why he decided to consult the institution we work at.

The patient refers burning pain in his right hand, radiated to the arm, which prevents him from sleeping; intense paresthesia in the first four fingers and impossibility to carry out daily-life activities. In physical examination, we detect allodyina and severe hyperalgesia in the hand and fingers palm, utterly evident Tinnel and Phalen signs, 2/5 strength, with decreased mobility due to sharp pain in any movement. The pre-operative DASH (*Disabilities of the Arm, Shoulder and Hand*) score is 85, while that in the visual analogue scale is 10. Electromyography reveals moderate CTS. The patient is suggested undergoing surgical release of the median nerve, with risks and benefits explanation, and upon the patient's consent, he undergoes surgical treatment.

Under mid-humeral anesthetic block, we practice a curve approach following the axis of the fourth finger projected into the carpal tunnel; it is widen proximally traversing the wrist distal crease. We protect the palmar cutaneous branch of the median nerve and sever the carpal annular ligament. We see abundant inflammatory fluid surrounding the nerve and the finger flexor tendons. Macroscopically the median nerve looks thickened, with fibrosis of the epineural sheath, and opaque; on its surface we see storage of the whitish material that characterizes depot steroids (Figure). Under magnifying lens, we carry out neurolysis and epineurotomy in the median nerve; interwoven into the nerve fibers, we find the aforementioned material (Figure), which is cautiously removed. Once we are done with the procedure, we put the wrist into a forearm splint for 10 days, and the patient starts finger early motion. One week later, pain perception improves, but paresthesia in the first three fingers and muscular weakness remain. Three weeks after the surgery, we remove the stitches and prescribe physiotherapy for the first time (ultrasound, magnetotherapy, and assisted passive and active mobility). The patient continues daily rehabilitation for six months; then we tell him to restart working activities and he is reinserted in his position. Ten months after the surgery, the patient reports sporadic mild pain with no paresthesia (visual analogue scale= 2-3 marks; DASH= 58.33 marks). Physical examination shows preserved mobility, grip strength 19% lower than that in the unaffected limb, hypoesthesia in the remains of the median nerve territory, with a static two-point discrimination of 8 to 10 mm. Up-dated electromyography reports: distal latency of 4.9 ms and motor nerve conduction velocity of 56 m/s; prolongation in sensitive nerve conduction velocity in median nerve at the level of the thumb and the wrist (Table).

Table. Subjective and objective evaluation of the affected limb during the treatment lapse.

Results	Pre-infiltration		Two weeks after infiltration		Ten months after the surgery	
Electromyograpy	Motor distal latency	MNCV	Motor distal latency	MNCV	Motor distal latency	MNCV
	4.8 mseg	41 m/s	4,2 mseg	57 m/s	4,9 mseg	56 m/s
	Sensitive nerve conduction: prolonged sensitive latency		Sensitive nerve conduction: decreased width, retarded conduction velocity		Sensitive nerve conduction: prolongation in median nerve at thumb and wrist level	
DASH			85 points		58,33 points	
VAS		10 points		2 points		

DASH = Disabilities of the Arm, Shoulder and Hand; VAS = visual analogue scale; mseg = miliseconds; m/seg = meters/seconds; VCM = motor nerve conduction velocity

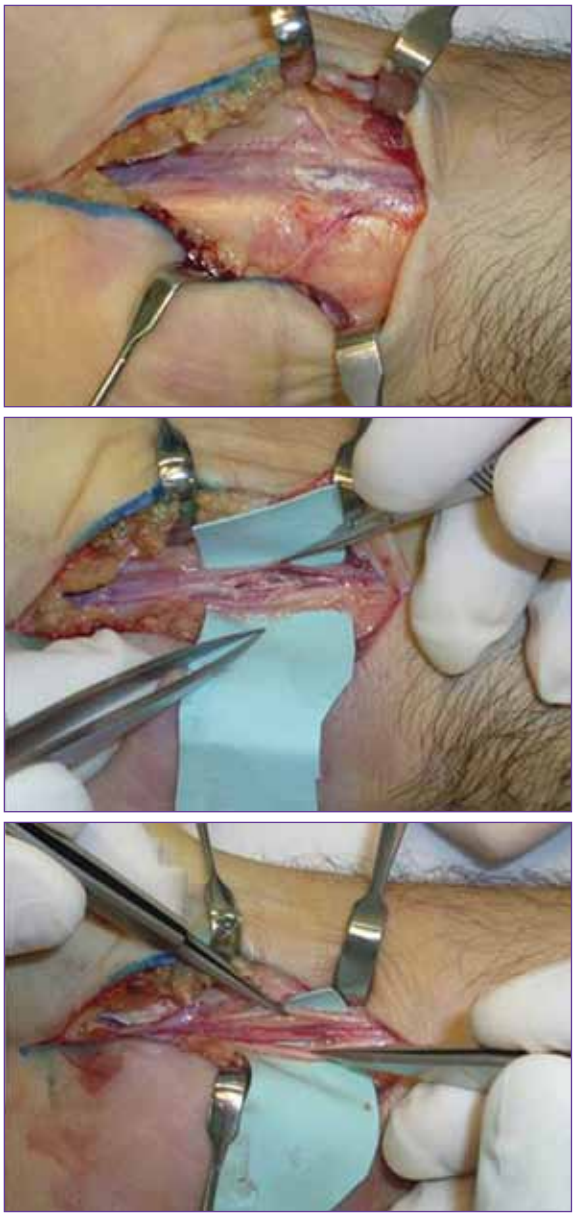

Figure. Intra-operative views. **A.** Storage of whitish substance on the median nerve surface. **B** and **C.** Same substance interwoven into nervous fibers; neurolysis and epineurotomy.

Discussion

The CTS is one of the highest-incidence compression neuropathies in the general population.[1,2] Local injection of steroids is one of the options in the conservative treatment of the CTS; it is the procedure of choice in patients with mild or moderate symptoms, no muscular trophism impairment and no signs of advanced compression.[1,3]There are reports on satisfactory results at one-year follow-up and low complication rates (0.1%) in proficient surgeons' hands.[4,5] However, in this paper we present a case of median nerve injury after local infiltration with steroids in a patient with CTS. The highest risk associated with this procedure is chemical neuritis by steroidal intraneural injection,[6,7] although the precise incidence of this injury within the complication rates is unknown.

There are few reports on this complication.[6-12] In 1966, Phalen[8] analyzes his experience in 654 patients with CTS; 270 were treated with local steroids. Among the described complications there is the case of median nerve chemical neuritis in a patient subject to 28 previous infiltrations, and Phalen produces a picture depicting the intra-neural steroid injection, which shows the storage of a whitish substance on the nerve, with no description of the patient's symptoms. In an experimental study, Mackinnon et al.[13] analyze the effects of intraneural steroids comparing five microscope slides and conclude that neurotoxic damage comes when there are intrafascicular steroids. Steroids could affect axons and Schwann cells myelin, and they also could impair the nerve blood supply. There is no standardized protocol for the treatment and rehabilitation of this complication; all authors recommend that, when steroidal intraneural injection is inferred, it is necessary to carry out surgical exploration, release the nerve and eliminate the steroids from the nerve surface.[6-11] There is only one author who presents the case of a patient who was subject to immobilization combined with nervous relaxation exercises and analgesic treatment with gabapentin, acetaminophen associated with tramadol, with improvement on symptoms at six-month follow up.[12] In all the cases, recovery was partial, with improvement on symptoms but weakness and sensitivity impairment, similarly to what our patient experienced.[6-12]

Steroids infiltration for the treatment of CTS is a frequent procedure and, so as to avoid complications, it is essential to know the anatomy of the normal carpal tunnel,[14] the anatomical variability and the safety margins for injection. Several authors have described the infiltration technique, [6-10,15] but the injection landmark is still to be debated. It is recommended carrying it out ulnarly to the palmaris longus tendon, since the nerve lies dorso-radial to such tendon; on the contrary, some other authors prefer to insert the needle radial to the palmaris longus tendon, between this one and the tendon of the flexor carpi radialis muscle.[2] Racasan et al.[16] conducted an experimental study in 92 patients with CTS (93 hands); by means of endoscopy they assessed the distance between the median nerve and the tendons of the flexor carpi radialis, the palmaris longus and the flexor carpi ulnaris muscles. They found that the nerve was ulnar to the tendon palmaris longus muscle in 88% of the cases, and concluded that the safest location for infiltration is through the tendon of the flexor carpi radialis muscle proximally to the carpal tunnel. At inserting the needle in the skin, the surgeon should ask the patient if he or she feels any paresthesia in the median nerve territory; if the answer is "yes", the needle needs removal and redirection.

We believe that local steroid infiltration is an effective and safe procedure for the treatment of mild or moderate CTS, with no muscular trophism impairment, if it is followed taking the carpal tunnel anatomy into account. We usually combine depot steroids with 5% lidocaine 2cm^3 without epinephrine and inject the nerve 1.5 cm proximally to the wrist proximal crease and ulnarly to the tendon of the palmaris longus muscle; right then the patient should be asked if he or she feels changes in symptoms in the median nerve territory and, if the answer is "no", it is possible to continue with slow instillation of the substance. In the case we present, we carried out neurolysis and epineurotomy in the median nerve and got significant improvement in pain, without good subjective recovery at 10-month follow-up (DASH=58 marks) and no changes in electromyography.

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