SAR Journal of Surgery

Abbreviated Key Title: *SAR J Surg*
Home page: https://sarpublication.com/journal/sarjs/home
DOI: 10.36346/sarjs.2023.v04i03.005

ISSN 2707-7748 (P)
ISSN 2709-6912 (O)

Review Article

Pronator Syndrome and other Nerve Compressions that Mimic Carpal Tunnel Syndrome a Case Report and Literature Review

Emmanuel Stephano Bracho Ruiz(M.D)[1*], Carlos Alberto Nungarai(M.D)[2], Mariano Tovar Ponce(M.D)[3], Mauricio Martinez Hurtado(M.D)[3], Jose David Simonin Lopez(M.D)[3], David Gonzalez Garcia(M.D)[4], Javier Martinez Martinez(M.D)[5]

[1]Plastic Surgery Service, Hospital Central Norte Pemex, Mexico City, Mexico
[2]Plastic Surgery Service, Hospital San Jose, ITESM, Monterrey, Mexico
[3]Plastic Surgery Service, Hospital Regional de Minatitlan, Pemex, Veracruz, Mexico
[4]Plastic Surgery Service, Hospital General San Juan Del Rio, Queretaro, Mexico
[5]Plastic Surgery Service, Hospital General "Dr. Norberto Treviño Zapata", Victoria, Tamaulipas, Mexico

***Corresponding Author:** Emmanuel Stephano Bracho Ruiz (M.D)
Plastic Surgery Service, Hospital Central Norte Pemex, Mexico City, Mexico

Article History: | Received: 10.07.2023 | Accepted: 12.08.2023 | Published: 17.08.2023 |

Abstract: The resolution of small to intermediate-sized anomalies affecting the craniofacial region can pose a formidable problem Proximal neuropathy of the median nerve (MN) is a relatively rare condition, accounting for approximately 1% of all compressive neuropathies affecting the upper limb. The existing body of literature documents two distinct clinical presentations, which are based upon the location of entrapment. These presentations are commonly referred to as pronator teres (PT) syndrome and anterior interosseous nerve (AIN) syndrome. Pronator teres syndrome, also known as median nerve compression in the upper forearm, manifests as a constellation of clinical manifestations and indications. Carpal tunnel syndrome is a dynamic condition that is commonly characterized by the compression of the median nerve within the carpal tunnel. Although relatively uncommon when compared to carpal tunnel syndrome, pronator syndrome and anterior interosseous nerve syndrome are conditions involving compression of the proximal median nerve. These conditions may be considered as potential diagnoses when a patient with carpal tunnel syndrome does not show improvement following conservative or surgical treatment. The process of differential diagnosis primarily relies on the evaluation of symptoms, the analysis of paresthesia patterns, and the identification of distinct patterns of muscle weakness. Initial management of all patients should primarily involve nonsurgical treatment modalities. However, it has been demonstrated through empirical evidence that surgical intervention may produce favorable outcomes. Many surgical methodologies have been established, with the majority of outcome data derived from retrospective case series. A full comprehension of the anatomical structure of the median nerve, possible points of compression, and distinctive clinical manifestations of carpal tunnel syndrome (CTS) is imperative for physicians in order to correctly identify and successfully manage their patients.

Keywords: Neuropathy, Median nerve compression, Carpal tunnel syndrome, Pronator syndrome.

INTRODUCTION

The carpal tunnel has been established as the primary location for the occurrence of median nerve entrapment. However, numerous additional anatomical formations have been documented in the surrounding area of the elbow and the proximal region of the forearm. Compression of the nerve in the distal third of the upper arm may occur due to the presence of Struthers' ligament, an anatomical structure that exhibits variability and can occasionally be found attached to a supracondylar process. The neural pathway subsequently traverses a highly vascularized region characterized by the presence of potentially constrictive vascular arches. Furthermore, along the anatomical spectrum, one may observe the presence of the lacertus fibrosus, the bellies of the pronator teres (PT), and the arcade of the flexor digitorum superficialis (FDS). Moreover, it is worth noting that the presence of abnormal or accessory muscles, such as Gantzer's

muscle, has the potential to induce entrapment of the median nerve within the forearm. The extensive set of clinical manifestations associated with proximal median nerve compression poses a challenge in terms of accurate diagnosis and restricts accurate identification of the affected anatomical location.

Pronator teres syndrome (PTS), initially documented in 1951 by Seyfarth, is characterized by the compression of the median nerve due to anatomical structures located in the upper forearm. The observed condition is characterized by its dynamic nature, wherein symptoms manifest in the median territory because of activities that induce prolonged pronation. Distal compression at the carpal tunnel is frequently observed in conjunction with this condition. The phenomenon of axoplasmic flow, when subjected to compression at two distinct levels, leads to an exacerbation of symptoms related to the median nerve.

ANATOMY OF THE MEDIAN NERVE IN THE FOREARM

At the level of the brachial plexus, the median nerve gains assist from C5 to C8 and part of T1. The lateral cord is composed of up of nerve roots from C5 to C7. The smaller middle cord is formed up of nerve roots from C8 and T1. When these cords come together, they form the median nerve, which crosses the brachial artery from side to side at the middle of the arm and goes on between the biceps and brachialis. As the median nerve enters the antecubital fossa, it lies deep in the lacertus fibrosus (LF), a fibrous structure that starts at the ulnar edge of the biceps brachial. The nerve then goes between the two heads of the pronator teres most of the time. After leaving the PT, the nerve goes deep into the two heads of the flexor digitorum superficialis (FDS) and then into the wrist between the flexor digitorum profundus (FDP) and the FDS.

INDICATIONS AND CONTRAINDICATIONS

Surgical intervention is recommended for individuals experiencing persistent paresthesia's within the territory of the median nerve, particularly during activities that involve prolonged pronation, such as reading, speaking on the phone, or driving. Certain patients may perceive a discernible sensation of numbness localized specifically over the thenar eminence, while others may report a sensation of numbness extending proximally towards the elbow region. Frequently, it is commonly linked with the condition known as carpal tunnel syndrome (CTS), and we, as medical professionals, believe that the simultaneous release of this ailment can be quite beneficial in restoring balance to the axoplasmic nerve flow and subsequently alleviating the associated symptoms.

DIFFERENTIAL DIAGNOSIS

This particular syndrome requires a distinction from cervical radiculitis, thoracic outlet syndrome, brachial plexus neuritis, overuse of forearm muscles, and carpal tunnel syndrome, all of which it has the potential to coexist with.

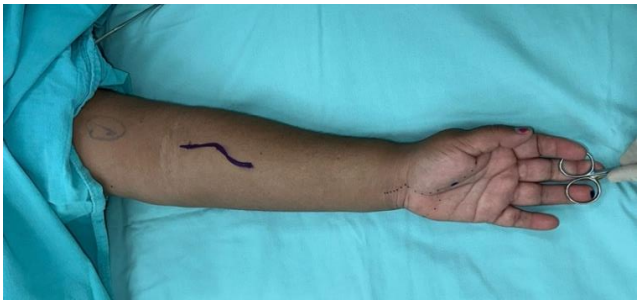

Figure 1: Preop marks / Anterior view

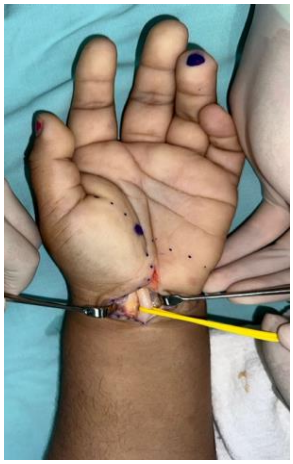

Figure 2: Carpal Tunnel

Figure 3: Anterior view, Pronator Muscle dissection

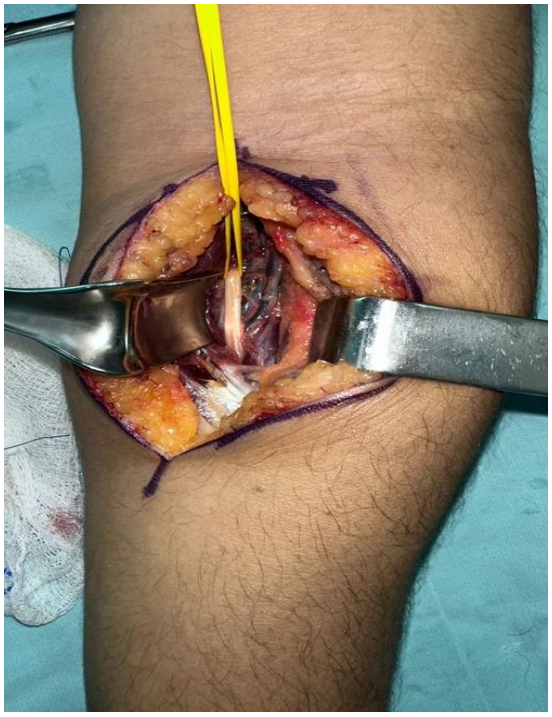

Figure 4: Median nerve at forearm, after dissection

DISCUSSION

The frequency of median nerve entrapment at the pronator teres has been reported at 9.2% of cases of median nerve compression. Patients with pronator syndrome typically complain of pain in the proximal volar (anterior) aspect of the forearm. This pain is commonly aggravated by activities such as repetitive pronation and supination. PS has also been related to repetitive exertional grasping work, such as that performed by assembly line workers, carpenters, weightlifters, and tennis players. PS usually presents in the fifth decade and is 4 times more common in women than men. The onset of symptoms are insidious and there is usually a delay in diagnosis of 9 months to 2 years. In addition to complaints of pain, patients also typically complain of paresthesia in the thumb, index, and long fingers. Patients may also complain of numbness in the palm consistent with the distribution of the palmar cutaneous branch of the median nerve. Although these neurologic signs are present, these patients have a notable absence of nocturnal symptoms in contrast to patients with CTS. Once the subjective complaints of pain and paresthesia are determined to be consistent with PS, objective tests can then be performed to further clarify the location of median nerve compression. As PS is considered rare, no

sensitivity or specificity data exist in regard to objective tests for PS. Three tests have been described to determine the site of proximal median nerve entrapment. These tests are based on creating maximal tension on the anatomical sites that can contribute to compression of the median nerve as it courses from the elbow to the wrist. The pronator teres is indicated as the source of compression by reproduction of symptoms with resisted pronation, with the forearm in neutral, as the elbow is gradually extended. Another test to aid in the diagnosis of PS is the pronator compression test, the test is performed by placing pressure over the pronator muscle in both upper extremities. A positive test is indicated by reproduction of paresthesia in the lateral 3½ digits in 30 seconds or less, while the uninvolved limb remains asymptomatic. While no sensitivity or specificity data exist regarding the pronator compression test, a study was performed by Gainor, which indicated a positive compression test in all 10 patients with surgically confirmed pronator syndrome.

The medical practitioner should also remain aware of the potential existence of a "double crush" syndrome. Double crush syndrome is a medical condition characterized by the presence of multiple asymptomatic nerve compression sites along the course of a nerve. These compression sites collectively contribute to the development of a symptomatic compressive neuropathy. In cases where double crush syndrome is observed, identifying the potential locations of proximal compression on the median nerve can pose a challenge. Additional diagnostic assessments that may prove beneficial encompass Phalen's test and Tinel's sign. In the event that the patient just presents with proximal median nerve compression, it is expected that the Phalen's test for carpal tunnel syndrome (CTS) will show a negative result. A positive Tinel's sign over the pronator teres may be observed, though exclusively in cases where symptoms have persisted for a duration over four months. Upton and McComas suggested that neural function may experience damage due to the compression of individual axons within a specific region, making them more vulnerable to potential damage at a separate site. For instance, a patient may exhibit symptoms consistent with carpal tunnel syndrome (CTS), undergo surgical intervention involving the release of the transverse carpal ligament, and subsequently report only marginal alleviation of their symptoms. In this particular instance, it is plausible that there could be an accompanying compression of the median nerve either at the pronator teres or at the cervical level, which could potentially elucidate the incomplete alleviation of symptoms subsequent to the surgical intervention.

According to available data, it has been reported that a notable proportion of patients, specifically 50%, who have undergone conservative treatment for PS (presumably referring to a medical condition) have experienced recovery within a period of 4 months. Furthermore, there have been documented reports indicating notable advancements in patient conditions ranging from 18 months to 2.5 years subsequent to the implementation of conservative therapeutic interventions. Given the uncommon nature of PS and AINS there is a lack of controlled studies available to ascertain the optimal intervention techniques for these conditions. However, in accordance with established anatomical and biomechanical principles, along with anecdotal observations and existing research, it is possible to categorize interventions into four primary groups: (1) rest or immobilization; (2) modalities; (3) nerve gliding; and (4) nonconservative treatment. One of the most crucial elements of conservative care entails providing the patient with guidance on refraining from engaging in activities that may exacerbate their condition. These activities include repetitive pronation or supination, as well as vigorous physical activities that involve forceful grip, such as weightlifting or playing tennis. In order to mitigate the potential worsening of the patient's symptoms, the healthcare provider may opt to construct a posterior elbow splint. This splint would be designed with the elbow positioned at a flexion angle of 90°, while the forearm is maintained in a state of mid-rotation. The recommended duration for wearing this splint is typically 2 weeks, during which it should only be removed for gentle range-of-motion activities. It is strongly recommended that patients exercise caution and deliberately refrain from engaging in activities that are known to exacerbate their symptoms for an extended period of 2 to 4 weeks subsequent to the removal of the splint. Subsequently, patients should gradually reintroduce these activities into their routine, taking into consideration the presence of any symptoms and adjusting accordingly.

CONCLUSION

With an understanding of the relevant anatomy, clinical presentation, and objective tests, a differentiation between these nerve compression syndromes can at least be considered and investigated. Although the Pronator Syndrome and the Anterior interosseous nerve syndrome are considered to be rare, especially in comparison to the Carpal Tunnel Syndrome, these two conditions can be differentiated from one another. The most effective conservative intervention program would include rest/immobilization, modalities, and gentle nerve gliding/mobilization techniques, according to the available literature; however, surgical intervention has been shown to result in satisfactory outcomes, so all patients should initially be managed with nonsurgical treatment.

CONFLICTS OF INTERESTS

The researchers have disclosed no conflicts of interest.

REFERENCES

- Adler, J. A., & Wolf, J. M. (2020). Proximal median nerve compression: Pronator syndrome. *The Journal of Hand Surgery*, *45*(12), 1157–1165. https://doi.org/10.1016/j.jhsa.2020.07.006
- Anagnostakos, K., Zagoreos, N. P., & Darlis, N. A. (2020). Pronator Teres Syndrome: Anterior Interosseous Nerve Compressive Neuropathy. In *Compressive Neuropathies of the Upper Extremity* (pp. 209–215). Springer International Publishing.
- Balcerzak, A. A., Ruzik, K., Tubbs, R. S., Konschake, M., Podgórski, M., Borowski, A., Drobniewski, M., & Olewnik, Ł. (2022). How to differentiate pronator syndrome from carpal tunnel syndrome: A comprehensive clinical comparison. *Diagnostics (Basel, Switzerland)*, *12*(10), 2433. https://doi.org/10.3390/diagnostics12102433
- Dubois de Mont-Marin, G., Laulan, J., Le Nen, D., & Bacle, G. (2021). Topographic anatomy of structures liable to compress the median nerve at the elbow and proximal forearm. *Orthopaedics & Traumatology, Surgery & Research: OTSR*, *107*(2), 102813. https://doi.org/10.1016/j.otsr.2021.102813
- Lee, M. J. (2004). Pronator syndrome and other nerve compressions that mimic carpal tunnel syndrome. *The Journal of Orthopaedic and Sports Physical Therapy*. https://doi.org/10.2519/jospt.2004.1359
- Leung, S. L., Daniels, S. P., Hacquebord, J. H., Ward, N., & Adler, R. S. (2023). Pronator syndrome and anterior interosseous nerve palsy due to neurolymphomatosis: a case report. *Skeletal Radiology*. https://doi.org/10.1007/s00256-023-04410-8
- Limbachiya, Y., Sheth, M., & Gahlot, P. (2022). Compression of median nerve at the carpal tunnel and Pronator Teres Syndrome - A case report. *International Journal of Health Sciences and Research*, *12*(9), 178–183. https://doi.org/10.52403/ijhsr.20220924
- Proudman, T. W., & Menz, P. J. (1992). An anomaly of the median artery associated with the anterior interosseous nerve syndrome. *Journal of Hand Surgery (Edinburgh, Scotland)*, *17*(5), 507–509. https://doi.org/10.1016/s0266-7681(05)80231-1
- Ribeiro, A., Filipe Ermida, D. A., Moreira, S., Assunção, S., Mendes, B., Gil Andrade, L., & Lains, J. (2022). Pronator teres syndrome, a challenging differential diagnosis of median nerve compression– case report. *International Physical Medicine & Rehabilitation Journal*, *7*(2), 40–42. https://doi.org/10.15406/ipmrj.2022.07.00301
- Sos, C., Roulet, S., Lafon, L., Corcia, P., Laulan, J., & Bacle, G. (2021). Median nerve entrapment syndrome in the elbow and proximal forearm. Anatomic causes and results for a 55-case surgical series at a mean 7 years' follow-up. *Orthopaedics & Traumatology, Surgery & Research: OTSR*, *107*(2), 102825. https://doi.org/10.1016/j.otsr.2021.102825
- Zancolli, E. R., III, Zancolli, E. P., IV, & Perrotto, C. J. (2012). New mini-invasive decompression for pronator Teres syndrome. *The Journal of Hand Surgery*, *37*(8), 1706–1710. https://doi.org/10.1016/j.jhsa.2012.05.033