

Nerve compression due to benign tumors or ganglion cysts in the upper limb – case series

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ABSTRACT

Tumor nerve compressions in the upper limb are relatively rare, usually involving ganglion cysts and benign tumors.

We present a case series of five patients with peripheral nerve compression in the upper limb due to tumor or cystic masses- ulnar nerve compression in the Guyon's tunnel due to a ganglion cyst, large median nerve schwannoma compressing anterior interosseous nerve and median nerve, voluminous lipoma compressing median nerve in the proximal forearm, superficial branch of radial nerve compression by a synovial cyst and elbow region lipoma compressing radial nerve. In the beginning, those benign lesions are asymptomatic but, as they continue to grow adjacent to a peripheral nerve clinical manifestations appear progressively as compressive neuropathies.

After a preoperative imagistic analysis, tumor resection with careful dissection, in order to preserve the neurovascular structures, is the elective surgical procedure in order to obtain an optimal functional recovery.

Keywords: upper limb, lipoma, schwannoma, ganglion cyst, nerve compression

INTRODUCTION

Nerve compressions due to benign tumors or ganglion cysts are mechanical pressure injuries being applied to a site, due to a space occupying mass. Benign tumors in the upper limb, that determine compression of a peripheral nerve, are a rare finding and can originate from peripheral neural sheath such as schwannomas or neurofibromas, or non-neural, which can further be divided into: intraneural, such as lipomas, hemangiomas or hamartomas, or extrinsic, such as lipomas or ganglion cysts [1-4]. Symptoms usually have a slow onset, with sensory and motor deficits findings according to site lesion [3]. Neural-sheath benign tumors are more frequent displaying compressive phe-

nomena on the nerve than non-neural, with schwannomas found most often [5]. Non-neural lesions are mainly represented by lipomas, the most common mesenchymal benign tumor [6] Ganglion cysts are also a common occurrence in the upper limb, representing around 50 to 70% of hand and wrist tumors [7].

A detailed clinical examination with accurate medical history and precise neurological evaluation is needed, defining the type of nerve palsy and compression site. Nerve conduction tests are a complementary evaluation, further indicating the lesion site. Confirmation of a peripheral nerve compression can be made with imaging tests such as ultrasonography, computer tomography or magnetic resonance imaging, which can detect space occupying masses [3,8]. Straightforward

surgery is mandatory in symptomatic cases, for each type of mass compressing the nerve, minimizing disease progression, while also determining recovery of sensory and motor function [3].

AIM

The purpose of this paper was to present a series of cases of upper limb compressions due to benign tumors or ganglion cysts. All the patients have received surgical treatment-excision of the compressive masses with consecutive releasing of the nerves with good clinical results in terms of symptom remission and functional recovery

The patients were admitted to Clinical Emergency Hospital Bucharest. Formal consent was obtained from each patient pertaining to this paper. Data were gathered from inpatient observation charts, both physical and digital archives (eHealth program Hipocrate). Cases are detailed and discussed in comparison with current literature, drawn from PubMed database, regarding therapeutic options and outcome.

CASES PRESENTATION

Table 1 summarize each patient characteristics with specific clinical findings. Clinical and imagistic evaluation were performed via either ultrasonography or MRI examination, with no electric conduction tests, not being necessary in those particular patients.

Case 1

A 61-year-old male patient presented with numbness and tingling of the medial palm, the ulnar half of the fourth digit and the volar surface of the fifth digit (the dorsal aspect of the hand displaying normal sensibility), the symptoms appearing a few months prior to presentation, as declared (figure 1).

Clinically, diffuse swelling was noted in the hypotenar area. The patient presented sensory deficit associated intermittent pain irradiating both proximally and distally in the inner aspect of the radio-carpal joint. Marked muscular atrophy was noted in the first web space of the hand, involving both first dorsal interossei muscle and adductor pollicis muscle, as well as muscle

wasting of the intrinsic compartments of the hand. In the neurological examination, he presented pain and tingling in the ulnar-sided digits on finger percussion (Tinel test) along the path of the ulnar nerve, which started at the wrist and went towards the palm. Motor deficits include weakness in digit adduction and abduction; weakness in flexion, abduction and opposition of the little finger; difficulty in extending the fourth and the fifth fingers; positive Froment sign with adductor pollicis muscle weakness. The radial and ulnar arterial pulses were palpable, with good tissue perfusion in the hand, and the Allen test was negative.

Clinical symptoms correlate with the zone in which ulnar nerve compression occurs: combined motor and sensory deficit leads to the assumption of truncular ulnar nerve lesion in Guyon's canal (zone 1 lesion). Ultrasound examination revealed a lesion with cystic consistency, which was confirmed intraoperatively with finding of a carpal ganglion cyst with visible signs of ulnar nerve trunk compression in Guyon's canal. The cyst was resected with subsequent nerve decompression and rapid remission of sensitive symptoms.

Case 2

A 35-year-old male patient presented with a prominent, well circumscribed, non-mobile soft tissue mass located in the proximal anterior forearm. Palpation over this area caused tenderness and diffuse pain in the forearm and cubital fossa. Physical examination also showed weakness of the flexor pollicis longus and flexor digitorum profundus of the index finger with a positive pinch grip test. The patient complained of having difficulty in forming a fist and performing precision tasks. Sensory deficits were also noted in the distal median nerve territory including hypoesthesia and tingling on the volar aspect of the first three radial digits.

Intraoperatively, an ovoid tumor was discovered with origin within the nerve sheet of the median nerve, positioned anatomically at the emergence of the anterior interosseous nerve, compressing both median nerve and anterior interosseous nerve. The tumor was excised and histopathological examination revealed a schwannoma. Long term follow-up revealed good functional recovery (figure 2).

TABLE 1. Clinical cases brief presentation

Case	Gender	Age	Tumor	Nerve	Compression site	Clinical findings
1	M	61	Ganglion cyst	Ulnar	Guyon tunnel	Sensory+ Motor
2	M	35	Schwannoma	Median	Forearm-AIN emergence	Sensory + Motor
3	F	37	Lipoma	Median	Proximal forearm	Sensory
4	F	20	Ganglion cyst	Radial-superficial branch	Wrist	Sensory
5	M	57	Lipoma	Radial	Elbow	Sensory +Motor(mild)

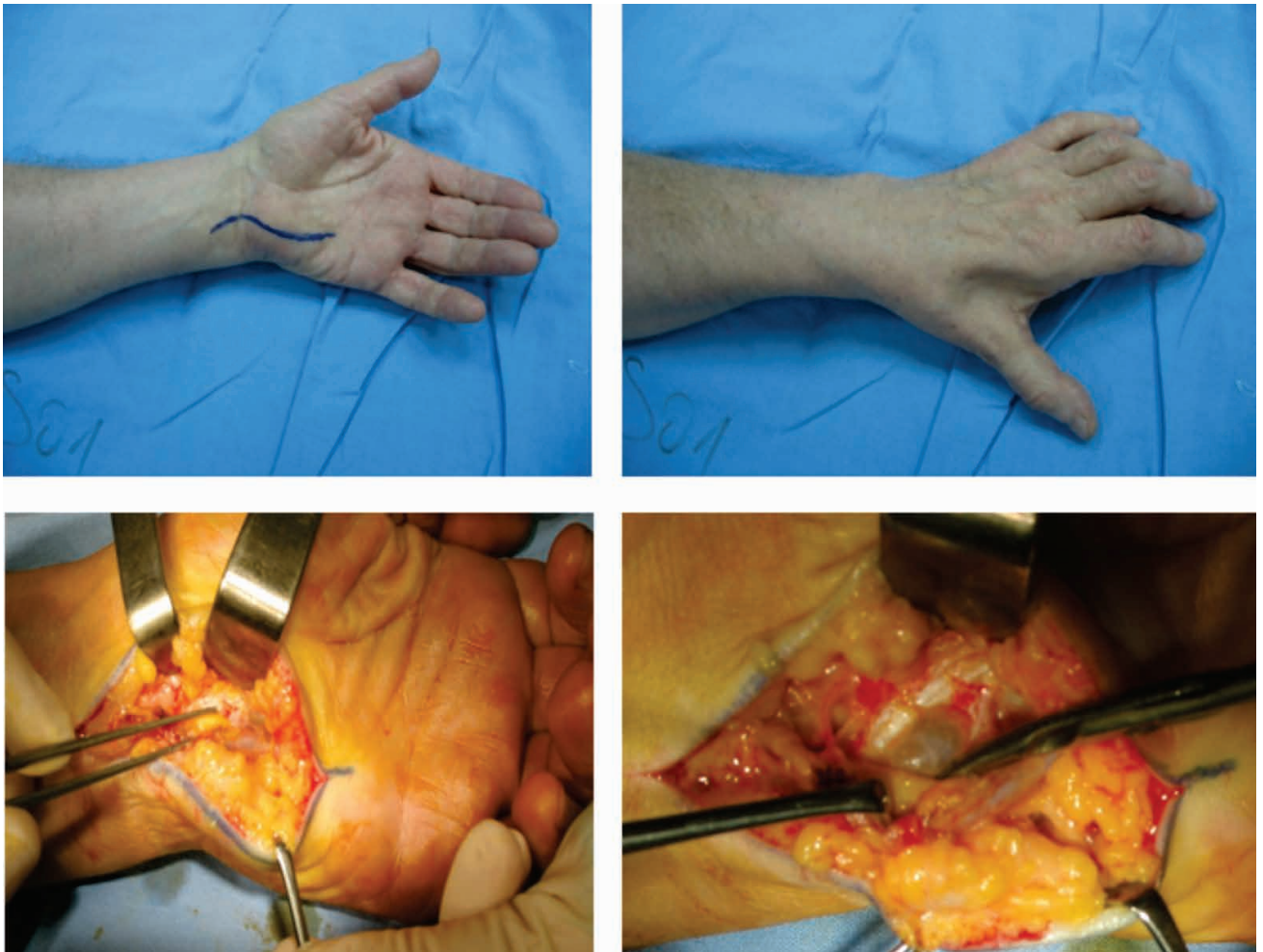


FIGURE 1. Case 1, a 61-year-old male with ulnar nerve compression in Guyon's tunnel by ganglion cyst



FIGURE 2. Case 2, a 35-year-old male with anterior interosseous nerve compressed by schwannoma

Case 3

A 37-year-old female patient that presented with an enlarged soft tissue mass localized in the proximal third of the forearm and inner aspect of the cubital fossa. The mass caused intermittent, diffuse pain in the territory of the median nerve. The radial and ulnar pulses were palpable. There was no regional lymphadenopathy. The range of motion of the elbow and the forearm were moderately restricted due to the enlarged mass.

Intraoperatively, a large lipomatous tumor was found and was completely excised, confirmed by the histopathologic examination as lipoma, with post-operative complete remission of the symptoms (figure 3).

Case 4

A 20-year-old female patient presented with a progressively growing lesion, for over five months, with increasing pain. She did not recall a specific traumatic injury preceding the onset of symptoms. On physical

examination, the patient had a 2.5 cm tender mass localized on the radial side of the wrist. There was a mild limitation of the wrist radial deviation. The patient also complained of numbness over the dorsal aspect of the thumb and first web space with intermittent cold sensation in aforementioned area. Ultrasound examination suggested a cystic lesion, confirmed intraoperatively. The ganglion cyst was excised, with rapid alleviation of symptoms (figure 4).

Case 5

A 57-year-old male patient presented in our unit after having observed a mass in his elbow region, on the lateral aspect, around 3 months before presentation, accusing hypoesthesia and paresthesia in the in the sensory territory of the radial nerve. During clinical examination, mild muscle weakness strength was noted, for the wrist extensors.

He was complaining of difficulty in fully extending his wrist, with normal extension of the fingers and met-



FIGURE 3. Case 3 of a 37-year-old female with enlarged lipoma compressing the median nerve



FIGURE 4. Case 4 of a 20-year-old female with superficial radial branch compression by ganglion cyst

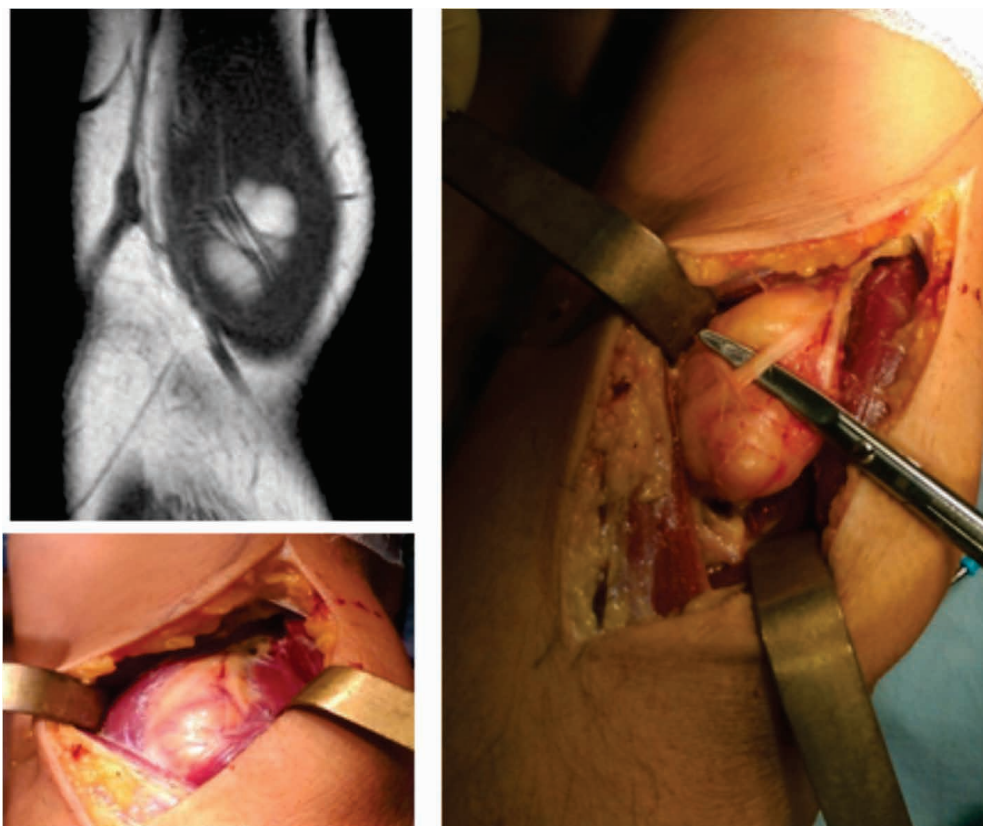


FIGURE 5. Case 5: A 57-year-old male patient with lipoma compressing the radial nerve

acarpophalangeal joints. Magnetic resonance imaging of the elbow and left forearm revealed a mass, suggestive of intermuscular lipoma located in the lateral elbow area. Intraoperatively, a well-defined, multilobulated lipomatous tumor was found at the division of the radial nerve into its superficial and deep branches, which underwent complete surgical excision and nerve decompression (figure 5). The diagnosis of a lipoma was confirmed histologically. The patient had complete functional recovery after 3 months, with no evidence of recurrence and has returned to his former activities.

DISCUSSIONS

In the majority of cases, the etiology of nerve compression is unknown [9].

Tumors that produce nerve compressions are rare, among these the most common being benign lesions as synovial cysts, lipomas and fibromas [3].

In case 1, the upper limb contains multiple closed compartments area, such as the Guyon's canal, in which a small tumoral volume growth can rapidly determine neuropathic symptoms [10].

Causes of Guyon's canal ulnar nerve compression mainly involve arthritis, pisiform instability, lipomas or other tumors and repetitive trauma. A ganglion cyst compression should be suspected in rapid onset of symptoms, such as sensory loss and motor deficit of the intrinsic muscles [11]. Compression of the isolated

motor branch of the ulnar nerve in the Guyon canal by a ganglion cyst is a very rare occurrence. The ganglion usually originates from the intercarpal joints. Inaparthly et al. reported two clinical cases of ulnar nerve deep branch compression by ganglion cysts, both patients presenting sudden onset of symptoms with hand progressive weakness and wasting of the hand intrinsic muscles. The ultrasound examination revealed cyst lesions as compression cause. They achieved complete recovery after surgical decompression [12].

Our clinical case presented sensitive symptoms, but the unusual occurrence was the marked motor muscle atrophy. A case of a 51-year-old man with ganglion cyst compressing the ulnar nerve in Guyon canal with similar clinical findings that our patient was reported by Wai-Yin M, presenting both sensitive and motor compressive signs [13].

Rapid onset of symptoms, in just a few weeks is particular to the nerve compressions caused by the ganglion cysts, in contrast to the usual clinical presentation of ulnar nerve compressions in the Guyon's canal and should alert the clinician of possible rapid functional impairment [12].

If early surgical decompression is performed, good clinical outcome can be obtained with complete recovery [12]. The rehabilitation process is more difficult in elderly patients or in therapeutically neglected cases presenting with neuromuscular damage [14].

Tumor development in Guyon's canal are also rare findings, lipomas being also uncommon due to the scarcity of adipose tissue in the area [15]. MRI is not always reliable in diagnosing lipomas in the Guyon's canal, therefore surgical intervention is recommended wherever investigations are inconclusive [16]. Another uncommon finding of nerve compression, in addition to ganglia cysts and lipomas, in the Guyon's canal can be due to arteriovenous malformations [17].

Case 2 revealed a median nerve compression in the proximal forearm.

Pronator syndrome represents median nerve compression in the proximal area of the forearm by structures such as Struthers ligament, bicipital aponeurosis, the two heads of the pronator muscle or flexor digitorum superficialis arch [18]. Atypical compression sites at this level due to expanding space occupying tumors can also be found, such as schwannoma or neurilemmoma [19].

The most common benign tumor of the peripheral nerve is the schwannoma, presenting as a mass with slow growth, with frequent symptoms such as paresthesia or pain on a nerve trajectory with positive Tinel sign [20].

In severe forms of pronator teres syndrome, besides sensory findings, motor deficits in the median innervated muscles like flexor pollicis longus, flexor digitorum profundus of the index and middle finger and also thenar group muscles were encountered [18].

Anterior interosseous nerve (a motor branch of the median nerve) compression syndrome can have primary and secondary causes, the latter due to an extrinsic mass, an infrequent finding [21].

In addition, cases of interosseous anterior nerve compression syndrome due to glomus tumors have been described, with patients with slow onset of deficits in the flexor pollicis longus and flexor digitorum profundus for the index and middle finger [22].

The second case patient presented sensory symptomatology of upper median nerve compression, which is usually encountered in pronator syndrome. In addition, findings of marked muscle weakness in the flexor pollicis longus and flexor digitorum profundus of the index. Individual motor muscle weakness, without sensitive findings are specific to a deep and different compression site involving the anterior interosseous nerve (AIN), a motor branch of the median nerve. The patient's clinical findings do not overlay with the classical AIN syndrome, despite severity of motor involvement during physical exam. This particular situation was explained by the preoperative MRI, later confirmed by intraoperative findings, where a schwannoma was found at the emergency of the AIN from the median nerve compressing both the main trunk and the AIN deep to the pronator muscle.

Case 3 is represented by a 37-year-old patient with compression of the median nerve in the proximal forearm, displaying only sensitive deficits. The cause was a voluminous lipoma.

Lipomas are the most common encountered type of soft tissue benign tumor of the limbs, found mostly in the lower limb, but with atypical localizations in the hand. Progressive, slow, asymptomatic growth is confirmed by the patient, diagnosed usually when a compression of a structure due to mass syndrome occurs. Pain is a frequent finding in nerve compression by a lipoma, due to its possible intraneural or extrinsic origin and the tumor capability of reaching large dimensions [23,24].

Lipomas can be found in different anatomical planes such as subcutaneous area, intra or intermuscular areas. Imagistic investigations are useful in preoperative planning and surgical intervention is most of the times curative, with low recurrence rates. Differential diagnosis should also be made with liposarcomas, the most common type of soft tissue sarcoma, which have a tendency to reoccur and metastasize [24-26].

The particular aspect of the third case is the late patient presentation, only after nerve compression symptoms have occurred, despite large and visible forearm mass in young female patient.

Case 4 is represented by a 20-year-old female patient with a ganglion cyst compressing the radial nerve in the anatomical snuffbox. The superficial branch of the radial nerve is susceptible to trauma and compression due to its subcutaneous trajectory. The compression usually occurs at the level of the fibrous bands from the subcutaneous tissues between the tendons of brachioradialis and extensor carpi radialis longus [27]. Understanding the anatomy and recognizing the intermuscular septa, the fibrous bands and muscular borders is essential in understanding localization, as well as the etiology of nerve compressions. Although considered a rare finding, radial nerve compression due to ganglion cysts have also been described. Dorsal wrist ganglia in the snuff box can determine neuropathic pain or hypoesthesia in the radial sensory nerve area. Compression lesions of the superficial branch of the radial nerve may cause severe neuropathic pain [28,29]. Besides ganglion cysts, other types of tumors may compress the superficial branch of the radial nerve, leading to Wartenberg syndrome clinical findings, such as lipomas [30].

The fourth case presented a rapid growth of a mass in the volar area of the wrist extending onto its radial aspect, alleviated completely after surgical resection of the cystic mass. The anatomical snuffbox is traversed by radial artery and superficial branch of the radial nerve. Any surgical intervention in this area requires a careful approach using magnification loupes and fine

dissection instruments in order not to traumatize the vasculo-nervous elements. Even mild injuries to the superficial branch of the radial nerve in aforementioned area can lead to painful neuromas, which are managed with difficulty afterwards.

Case 5 is represented by a 57-year-old male patient with radial nerve branching point at the level of Frohse's arch compression by enlarged lipoma.

For some peripheral nerves, such as the radial nerve, the motor function is more important than sensory recovery. The postoperative results in radial nerve surgeries can be interpreted as unfavorable in conditions where cutaneous sensory recovery is accompanied by severe persistent pain, regardless of the motor recovery degree. The most important prognosis factors on which nervous recovery depend on are: patient age, lesion level, the nature of the lesion, timing of surgery, lesion cause [31].

Literature described cases of intramuscular or parosteal lipomas with similar localizations, that affected either the superficial branch of the radial nerve or the posterior interosseous nerve. Lipomas are usually tumors with slow growth, initially asymptomatic, and often diagnosed during surgical exploration. In most cases, they can be totally resected without causing any nervous deficit [32-34].

Frohse's arch is one of the most common compression sites of the radial nerve, usually with idiopathic onset, in patients who suffered repetitive local trauma, overuse of the supinator muscle with subsequent inflammation. Local expanding masses at this level can mimic a classic compressive syndrome, especially in

cases of deep or intramuscular localizations of the tumors. Jou IM et al. reported two cases of nerve compression in the radial tunnel at the elbow due to ganglion cysts, resolved by surgical excision [35].

The fifth patient presented favorable post-operative outcome with complete pain remission and functional recovery at 3 months follow-up. Due to the proximal level of the lesion, the functional impairment could have been severe due to involvement of both motor and sensitive branches (long-term compression of motor component of the radial nerve leads to muscle denervation and neuromuscular degeneration), but early symptom detection followed by immediate surgery thereafter avoided further aggravation of the compressive syndrome.

CONCLUSIONS

Nerve compression due to benign tumors or ganglion cysts in the upper extremity is relatively rare, with progressive symptoms and functional impairment. The first steps in the diagnostic workup are a complete history and clinical examination. Confirmation of a peripheral nerve compression can be obtained using imaging techniques which can detect space occupying masses and depict the anatomic level of compression. Complete surgical removal with maximum preservation of neurologic function is the appropriate intervention for these benign lesions, minimizing disease progression, while also determining recovery of sensory and motor function.

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