

## Posterior interosseous nerve palsy caused by a parosteal lipoma seated over the proximal radius; a case report and review of the literature

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### ABSTRACT

Several different pathologies may play a role in the etiology of posterior interosseous nerve (PIN) palsy such as trauma, radial tunnel syndrome, tumors, vasculitis, septic arthritis, and rheumatoid synovitis. The most common atraumatic factor is the compression of the nerve through its anatomic path. Parosteal lipoma around the proximal radius is the leading solid tumor seen among the neoplastic lesions. Although it is common, there are only case reports or few case series reported in the current literature and a comprehensive review is missing. Herein a rare case of PIN palsy due to parosteal lipoma of the proximal radius is presented together with a thorough literature review. A 48-year-old woman was presented with elbow pain and wrist drop that lasted for ten months. Electrodiagnostic and imaging findings lead to a diagnosis of PIN palsy due to parosteal lipoma seated over the proximal radius. Total surgical excision was performed, and the patient had been followed up for one year. Removal of the lipoma failed to recover the patient's symptoms. We reviewed all the reported cases and discussed, epidemiology, clinical findings, imaging studies, electrodiagnostic studies, pathology, treatment and prognosis of PIN palsy due to parosteal lipoma.

**Key words:** Posterior interosseous nerve, palsy, lipoma, parosteal

### Introduction

The radial nerve is divided into superficial (sensory) and posterior interosseous (motor) branches at the cubital fossa after passing by the lateral capsule of the elbow joint. Then, posterior interosseous nerve (PIN) enters the Arcade of Frohse and pierces the supinator, innervating all muscles of the forearm extensor compartment. Thus, it provides for the extension of fingers

and the wrist; ulnar deviation; 5th-finger abduction; and forearm supination [1].

Even though a partial or total loss of function is seen in the PIN in palsy, some cases may present pain as the only symptom. It should also be noted that the innervation of brachioradialis and extensor carpi radialis longus muscles occurs before the radial nerve gives the posterior interosseous nerve branch. Therefore a

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slight radial deviation of the wrist can be observed during wrist dorsiflexion in PIN palsy.

PIN palsy can be induced by traumatic or atraumatic factors (Table 1) [1]. Traumatic PIN palsy may arise in the aftermath of Monteggia fractures; radial head fractures; posterior dislocations of the radial head; forearm injuries around the elbow; and iatrogenic injuries. Atraumatic PIN palsy is caused by radial tunnel syndrome or PIN syndrome. Even though their clinical findings are similar, the differential diagnosis is established through local anesthetic injections, EMG, and radiological findings [1].

The PIN compression syndrome is most commonly caused by tumors, and its other causes include septic arthritis, rheumatoid synovitis, and vasculitis [1]. Lipomas are the most common solid tumors that lead to PIN compression syndrome [2,3]. Lipomas most frequently settle in subcutaneous tissue and also, they can be observed at deep locations under the fascia, i.e., where there is adipose tissue [4]. Deep lipomas are defined by localization as intermuscular, intramuscular, parosteal, and interosseous [5]. Parosteal lipomas occur most commonly among patients over the age of 40, and they are observed primarily in the proximal radius, humerus, femur, clavicular, and pelvis [6].

Parosteal lipomas exhibit a silent progression. Although as a tumor grows, various uncommon presentations and complications occur as a result of the compression of paratumoural structures, peripheral nerve entrapment represents less than 5% of all cases [7].

Parosteal lipomas located around the proximal radius result in PIN compression and the PIN compression syndrome. Its diagnosis is established on the basis of radiological findings, and the clinical prognosis is generally good after surgical excision.

In the present study, a case with PIN palsy developing secondary to parosteal lipoma is presented. Furthermore, our article is the most comprehensive article that discusses the clinical and demographic characteristics, radiological findings, treatment methods and prognoses of the known cases of similarity in the current literature.

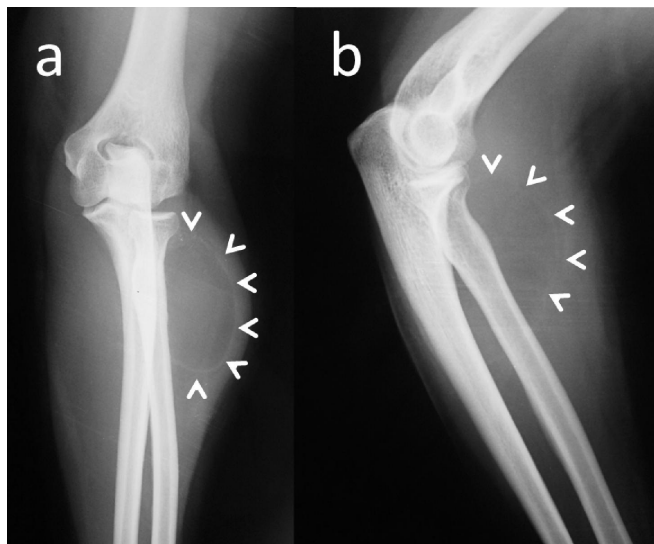
### Case Report

A 48-year-old woman was presented to our outpatient clinic with a history of elbow pain and wrist drop. She was unable to extend her fingers and had difficulty in performing her daily routine activities with her right hand. She claimed that these symptoms had gradually increased in the last ten months, and the wrist drop had occurred four months ago. There was no history of trauma to her right upper extremity or neck, and her past medical history revealed no metabolic disease including diabetes mellitus, vitamin deficiency, alcohol abuse, or chemical exposure. On physical examination, there was slight swelling on her right forearm just distal to the common flexor origin which was painful on palpation. The passive ranges of motion were normal in both the elbow and the wrist; however, she could not extend her wrist or any fingers including the thumb. There was no sensory loss, and the result of the vascular examination was normal.

Direct radiographic examination of the elbow and proximal forearm showed an oval shaped soft tissue lesion around the proximal radius (Figure1). In electromyography (EMG), all the muscles innervated by the posterior interosseous nerve (PIN) distal to the supinator muscle were found to be denervated. Magnetic resonance imaging (MRI) of the elbow revealed a mass surrounding the proximal radius with signal intensity compatible with a lipoma (Figure2). A provisional di-

**Table 1.** Causes of posterior interosseous nerve palsy [1].

Traumatic	Atraumatic
Fracture and Dislocation around elbow	Radial Tunnel Syndrome
Penetration Injury	Tumours (Lipoma, ganglion cist, Schwannoma, intraneural fibroma, perineurium)
Forearm Injury	Septic Arthritis of the elbow
Iatrogenic Injury	Rheumatoid Synovitis, Rheumatoid cyst
	Vasculitis



**Figure 1.** (a) Anteroposterior and (b) Lateral elbow radiographs show soft tissue shadows around proximal radius (white arrows).

agnosis of parosteal lipoma causing PIN entrapment was established on the basis of radiological and electrophysiological findings.

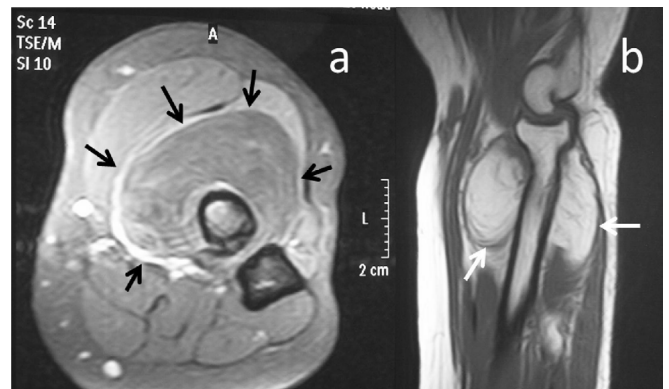
A total excisional biopsy was performed under tourniquet control. Through an anterolateral approach, a 6cm incision was made over the mass. The forearm was pronated to protect the PIN. A well-encapsulated lesion, measuring 5×3×2.5 cm, was slipped from the radius after releasing the nerve with gentle dissection (Figure 3). During the dissection, the most prominent compression of the nerve was seen at the proximal part of the Arcade of Frohse. After removal of the nerve there was slight edematous but no fibrosis within and around the nerve. Thus, we decided waiting for nerve recovery and did perform neither neurolysis nor immediate tendon transfer.

The postoperative period was uneventful. The patient was prescribed a resting hand splint for fingers and wrist support in the neutral position during the first two weeks, followed by a Kleinert splint for the continuous passive motion for additional two months. Pathological diagnosis was consistent with a lipoma. After the surgery, the pain in the elbow and forearm was immediately relieved and ceased, but the wrist drop did not improve in the one-year follow-up. Follow-up

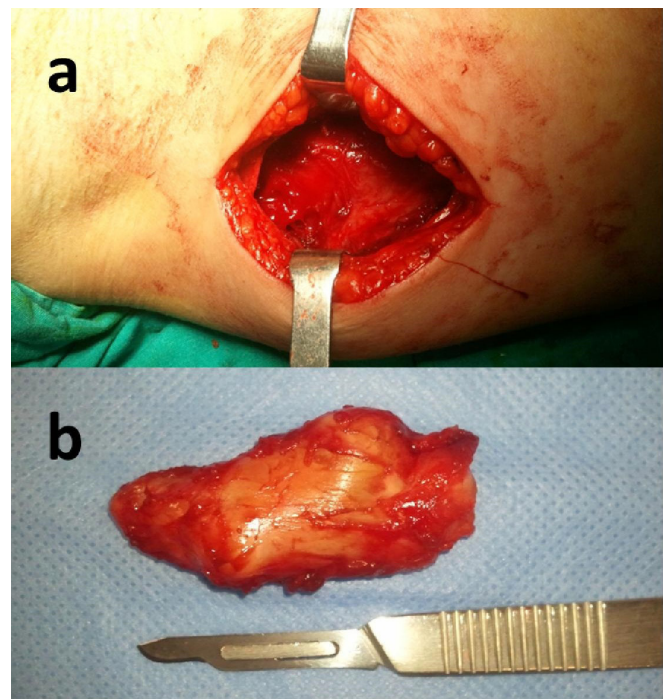
EMG performed one year postoperatively revealed total axonal degeneration. A tendon transfer was planned and offered to the patient for PIN palsy, but she denied.

#### Literature review

PubMed, Clinical Key/Elsevier, EBSCO Discovery Service, MD Consult Science Direct, Scopus, EMBASE, Medscape, and Google Scholar electronic databases were used for a literature search in any language. The following terms were adopted for each database



**Figure 2.** (a) T2 weighted axial (black arrow) and (b) T1 weighted sagittal MRI sections demonstrated a mass surrounding the proximal radius with signal intensity compatible with a lipoma (white arrow).



**Figure 3.** Intraoperative appearance. (a) Anterolateral approach. (b) Appearance of the totally excised lipoma (5×3×2.5 cm).



search: 'posterior interosseous nerve palsy,' 'lipoma,' 'parosteal lipoma,' 'radius,' and 'periosteal lipoma.'

43 published case reports were found. The texts were all examined in detail, and all cases from 1950 to the present were evaluated. Age, sex, clinical findings, duration of symptoms, imaging studies, treatments and outcomes of all cases were analyzed (Table 2) [2, 8-34]. Any missing data were not taken into consideration.

## Discussion

### Epidemiology

Parosteal lipomas are uncommon benign tumors composed of mature adipose tissue similar to conventional subcutaneous lipoma. However, they are deeply located and closely related to an adjacent bone. It was first defined as "periosteal lipoma" by Seering in 1836 [35]. Later, in 1888, Power suggested that these tumors did not originate from the periosteum and therefore "parosteal lipoma" would provide a better definition and nomenclature [36]. Parosteal lipomas represent 0.3% of all lipomas [37,38]. Parosteal lipomas occur most commonly between the 5th and 7th decades [39]. Parosteal lipomas are generally located upon the diaphyses of long tubular bones such as the femur, humerus, tibia, and proximal radius [40]. Similarly, Avram and Hynes examined PIN compression secondary to lipoma in 2004 on 29 cases and found their mean age to be 54.15 (30-77); 13 of these cases were male (54.2%) and 11 female (%45,8). 5 cases presented no information in this context. It was found in this study that the percentage of parosteal lipomas leading to compression represented 90% among those in known subgroups [20].

In our literature review, 44 similar cases (including our patient) were identified the current literature review showed that 13 of cases were male (33.3%); 26 of cases female (66.7%). 5 of the cases did not present any about sex. The location of lipomas was found to be in the left for 55.2% (16 patients) and in the right for 44.8% (13 patients) and the side was not defined for 15 cases. Furthermore, the mean age of the patients in the age range of 40-83 was 58.12 years.

### Clinical Findings

Parosteal lipomas are usually asymptomatic [41]. Symptomatic patients initially present with complaints of a painless mass or pain around the lateral epicondyle [28]. Hypoesthesia caused by the compression of the superficial branch of the radial nerve and loss of muscle strength resulting from the compression of PIN occur with the growth of tumor and progression of the disease. In other words, the clinical picture is progressive, while in the course of time with the growth of mass, symptoms worsen [2,41]. Moreover, the duration of symptoms and time to admission are subject to variations. Avram et al. reported the average duration of symptoms as 22.6 months (1 month-12 years) [20].

In the 44 cases that have been analyzed in the present study, the most common symptom was determined to be motor deficit 61.3% (27 patients). The other symptoms were identified as sensorial dysfunction (6 patients), painless mass (4 patients), pain and paresthesia (3 patients), and motor and sensorial dysfunction (2 patients). The average duration of symptoms was 12.59 months (0.5- 72 months) [2, 8-34].

Radial nerve entrapment has a similar clinical presentation to that of PIN palsy; therefore the differentiation should be established with care. Radial nerve entrapment usually occurs in five distinct anatomical location. These structures include, from the proximal to the distal, fibrous bands anterior to radiocapitellar joint; Leash of Henry (radial recurrent vessels); the tendinous medial edge of Extensor Carpi Radialis Brevis; the Arcade of Frohse (the proximal aponeurotic edge of the supinator-most common); and the distal edge of the superficial layer of the supinator [1]. Diagnostic injections and MR imaging are utilized in the differentiation of PIN palsy from radial nerve entrapment [1,42].

### Radiodiagnostic Studies

In patients presenting with wrist drop, any space occupying lesion that leads to compression of radial nerve should be considered. The major known causes of nerve compression include myositis ossificans; hemat-

**Table 2.** Details of 44 patients with posterior interosseous nerve palsy caused by a parosteal lipoma seated over the proximal radius [2,8-34].

Case #	Author	Year	Age	Sex	Side	Clinical findings	Duration of symptoms	Treatment	Follow-up	Outcome
1	Richmond DA	1953	62	M*	L***	inability to extend his left index finger and thumb	12 week	Total excision. NR Approach	5 months	Complete Recovery (5 months)
2	Campbell CS, Wulf RF	1954	40	F**	L	could not use the left index finger	3 months	primary excision; Anterior Approach	NR****	No Recovery
3	Hustead AP et al.	1958	63	F	L	weakness of extension in the fingers of the left hand	18 months	surgical excision; NR approach	9 months	Complete Recovery
4		1958	56	M	R****	unable to extend his right third finger	18 months	surgical excision; NR approach	NR	NR
5	Norman Moon; Leonard Marmor	1964	62	F	L	painless mass; no motor or sensory loss	2 years	surgical excision; Thompson (dorsal) approach	NR	NR
6	Capener N.	1966	58	M	L	lost all power in the long extensors of the fingers and thumb.	over two weeks	surgical excision; Thompson (dorsal) approach	5 years	Complete Recovery
7	Wu KT et al.	1974	NR	NR	NR	NR	Less than 5 years	surgical excision	NR	Complete Recovery
8	Bieber EJ et al.	1986	61	F	NR	Paresthesia	NR	Surgical excision	Between 10 months — 4 years	Immediate Complete Recovery
9			52	F	NR	Paresthesia	NR	Surgical excision		Immediate Complete Recovery
10			45	F	NR	Paresthesia	NR	Surgical excision		Complete Recovery in 4 weeks
11			53	F	NR	Paresthesia; lost the ability to extend the metacarpophalangeal joints of the index through small fingers and the ability to extend or abduct the thumb	NR	Surgical excision		Complete Recovery in 3 months
12	Lidor et al.	1992	40	F	R	pain in the proximal right forearm and numbness of the fingers	8 months	En blok excision. NR Approach	NR	Complete Recovery
13		1992	53	NR	NR	Painful growing tumor with paresthesia of ring finger	10 months	En blok excision. NR Approach	NR	Complete Recovery
14		1992	72	NR	NR	Complete extensor paralysis	24 months	Patient refuse surgery	18 months	No Recovery
15		1992	55	NR	NR	Slow-growing mass	3 months	En blok excision. NR Approach	NR	Complete Recovery
16		1992	40	NR	NR	Painful growing tumor with paresthesia of fingers	8 months	En blok excision. NR Approach	2 years	Complete Recovery
17	M. M. Hanlon et al.	1996	48	M	R	feeling of numbness and weakness of right hand.	6 months	surgical excision; NR approach	3 months	Complete Recovery
18	H. Hashizume et al. (12)	1996	71	M	L	NR	6 weeks	Extirpation release; NR approach	6 months	Complete Recovery
19	Nishida et al.	1998	60	F	NR	inability to extend the metacarpophalangeal joints of all digits in her left hand and wrist joint	2 months	marginal excision; anterolateral approach	40 months	Complete Recovery (5 months)
20		1998	61	F	L	all fingers in her left hand and the wrist joint was weakened.	NR	marginal excision; anterolateral approach	1 year 3 months	Complete Recovery (2 months)
21	E. Monteiro et al.	2002	68	F	R	inability to extend the right hand fingers	2 years	Surgical excision; anterior approach	6 months	No Recovery
22	Fitzgerald	2002	71	F	NR	Loss of Extension Thumb and index; Sensory loss Nil	Less than 1 month	primary excision; Posterior Approach	5 months	No Recovery

\*M: Male; \*\*F: Female; \*\*\*R: Right; \*\*\*\*L: Left; \*\*\*\*\*NR: Not Reported.

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**Table 2.** Details of 44 patients with posterior interosseous nerve palsy caused by a parosteal lipoma seated over the proximal radius [2,8-34].

Case #	Author	Year	Age	Sex	Side	Clinical findings	Duration of symptoms	Treatment	Follow-up	Outcome
23		2002	62	M	NR	Loss of Extension Nil; Sensory loss Radial N	2 months	primary excision; Anterior Approach	2 years	Complete Recovery
24		2002	64	M	NR	Loss of Extension Wrist, little, ring and middle fingers; Sensory loss Nil	3 months	primary excision; Anterior Approach	1 year	Complete Recovery
25		2002	68	F	NR	Loss of Extension Thumb and index; Sensory loss Nil	5 months	primary excision; Anterior Approach	6 months	Complete Recovery
26		2002	63	F	NR	Loss of Extension All digits; Sensory loss Nil	2 months	primary excision; Anterior Approach	6 months	No Recovery
27	Avram and Hynes	2004	69	M	L	progressive difficulty with extending his left long and ring fingers	4 months	Total excision. Posterolateral Approach.	3,5 months	Partial Recovery
28	Chung-Yuh Tzeng and Tu-Sheng Lee	2005	56	F	L	pain over the left forearm left thumb and progressive numbness and pain over the dorsal aspect of the	2 months	Excision ; anterior-lateral and posterior-lateral approach	15 months	Complete Recovery
29	Eralp et al.	2006	45	M	R	Lack of wrist and thumb extension	4 months	En blok excision. Anterior approach	6 weeks	Complete Recovery
30	Werner P et al.	2007	53	M	L	weakness of the finger extensors IV and V on his left hand	4 years	surgical resection; anterior approach (over supinator)	3 years	Partial Recovery (minor weakness)
31	Nelson G	2007	49	M	R	inability to straighten his thumb and middle finger	4 months	Surgical excision; anterior (Modified Henry) incision	7 Months	NR
32	Hamdi et al.	2010	59	M	L	Lack of all finger MCP extension	2 months	Total excision. Posterolateral Approach.	4 months	Complete Recovery
33	P. Borman and F. Tuncay	2010	69	F	L	unable to extend her fingers and had difficulty to perform her routine daily activities with her left hand	6 months	marginal excision; anterolateral approach	4 months	Partial Recovery
34	Salama H et al.	2010	83	F	R	progressive weakness of the right-hand extensors with painless swelling in the proximal part of the right forearm	NR	surgical excision; Anterior approach	6 months	Complete Recovery
35	Posadzy - Dziedzic et al.	2011	50	F	R	lateral elbow pain radiating to the forearm and weakness of the extensor muscles	3 months	surgical resection; NR approach	1 year	Complete Recovery
36	A. Elbardouni et al.	2011	56	F	L	paresthesias and or paralysis of finger	2 years mass; 1 months paralysis	NR	2 years	NR
37		2011	48	F	L	painless mass	6 years	NR	5 years	NR
38	Seki et al.	2012	67	F	L	Lack of extension of 3rd and 4th fingers	2 months	Marginal excision. Anterior approach	2 years	Complete Recovery
39	M. Allagui et al.	2014	48	F	L	inability to extend the fingers of the left hand; weakness and paresis of left hand	6 months	Surgical excision; anterolateral approach	18 months	Complete Recovery
40	El Hyaoui H et al.	2014	68	F	R	inability extension of the fingers at the metacarpophalangeal joint and slight radial deviation of the wrist in extension force	14 months	surgical excision; NR approach	NR	NR
41	Cha J et al.	2014	40	M	R	progressing sensory and motor changes to his right upper limb	NR	surgical excision; Anterior approach	over a 3 months	Complete Recovery
42	Maldonado AA et al.	2016	78	F	R	difficulty extending the right little and ring fingers initially, and then all fingers and the wrist	8 months	Surgical excision; anterior (Henry) approach	NR	at Simultaneous surgery tendon transfer
43		2016	65	F	R	weakness of her right index finger	2,5 years	Surgical excision; anterior (Henry) approach	NR	at Simultaneous surgery tendon transfer
44	Current Case	2016	48	F	R	unable to extend her fingers	10 months	Total Excisional (anterolateral approach)	1 years	No Recovery

\*M: Male; \*\*F: Female; \*\*\*R: Right; \*\*\*\* L: Left; \*\*\*\*\*NR: Not Reported

oma formed after trauma; soft tissue tumors (especially lipomas); cystic masses and inflammatory conditions (e.g., rheumatoid arthritis, tuberculosis) [1]. Therefore, whole radial nerve track, particularly the elbow should be examined radiologically, and any lesion involving this region should be eliminated accordingly [42].

Direct radiography is the first imaging modality that usually performed for screening musculoskeletal tumors. In direct radiography, small-sized lipomas may not be detected, while big lipomas may present with a radiolucent appearance [42,29]. In a study of 5 patients published by Fitzgerald et al., 4 of 5 cases had been diagnosed by this radiolucent appearance under direct radiography; however, one of them had been diagnosed with CT [29]. Furthermore, in the study published by Lidor et al. in 1992, radiolucent masses had appeared under direct radiography in all five patients [15]. Avram et al. reviewed the radiological findings of 29 cases and established that radiolucent masses were observed among the radiological findings of 15 of the cases (51.7%) and calcification was seen in one of the cases (3.5%). However, no radiological findings were observed in 2 of the cases (6.9%) (5 patients did not provide sufficient information, and an X-Ray had not been performed on six patients) [20]. In contrast to conventional lipomas located totally within the fat tissue, osseous pathologies such as cortical erosion and periosteal reaction can be observed in parosteal lipomas. Although mineralization is rare, there are some cases in the literature with chondroid or osteoid calcification. Fleming et al. reported that approximately 70% of 32 cases had abnormal bone appearance and 50% of them had osseous or periosteal reaction [37]. Therefore, direct radiography alone may provide important clues for the diagnosis.

In this context, the role of CT is limited to the identification of such bony changes. MRI is quite helpful to define mass characteristics and to obtain essential information that is necessary for the differential diagnosis. A heterogeneous appearance is inevitable in the

MRI of parosteal lipomas. T1-weighted MRI shows an intermediate signal increase, whereas T2-weighted MRI shows a high signal increase [42]. Apart from these methods, ultrasound can be used to identify the lesion. Ultrasound will indicate soft masses of variable echogenicity [28]. Despite all of these methods, the definitive diagnosis is established through histopathological examination [42].

In the present case, there was radiolucent silhouette of the mass on direct radiography, yet failed to signify any cortical erosion, calcification, or reactive osseous changes. Findings on MRI were consistent with fat tissue suggesting the diagnosis of lipoma.

### ***Electrodiagnostic Studies***

The diagnosis of PIN palsy is rather difficult merely by utilizing clinical testing. Proximal radial palsy, radial tunnel syndrome, PIN palsy, and superficial radial nerve entrapment syndrome may be underlying cause of radial deficit. Electrodiagnostic studies assist in determining both the level of nerve lesion and its severity in patients presenting with a radial deficit. Electrodiagnostic studies on radial tunnel syndrome usually reveal normal findings, but slight neurapraxia can also be identified. In these cases, nerve transmission speed, distal latency, and needle EMG may provide normal values [43].

In PIN palsy, nerve transmission can be measured by superficial or needle electrodes on extensor indicis or extensor or abductor pollicis longus muscles [1]. Motor nerve transmission studies exhibit a slower transmission speed, a prolonged latency, and lower amplitude compared to the contralateral healthy side. Needle EMG examinations are used to determine the localization of a lesion and exclude a lesion in brachial plexus. Needle EMG findings are more reliable for PIN palsy [44].

### ***Histopathology***

Parosteal lipomas are broad-based multi-lobular masses in contact with bone and are covered with a thin fibrous tissue [45]. Chondral or osteoid metaplasia, cortical thickening of the bone around the lesion and osseous spikes are observed commonly [46]. These are dis-

tinctive that distinguish parosteal lipomas from other soft tissue lipomas [47]. Moreover, current studies pointed out to 3;12 translocation in parosteal lipomas [48].

### **Treatment**

The main principle in the treatment of all space-occupying lesions is total surgical excision of the tumor [49]. All of the authors in the literature had removed the tumor. However, there are differences in the surgical approaches utilized for removal. In the posterior approach, the supinator is exposed by dissecting the area between the extensor digitorum and extensor carpi radialis brevis cleavage and this is followed by the retraction of the supinator. In the anterior approach, access is secured through the cleavage between brachioradialis and brachial muscles.

Whereas the posterior approach requires a faster and less deep dissection, posterior interosseous nerve injury is observed more frequently. In addition, the lipoma excision becomes more difficult due to the position of nervous branches and muscular structures on the lipoma. The anterior approach provides a direct view and easy lipoma retraction, and therefore, nerve or motor branch injury is observed to a lesser extent. For this reason, some authors had used the anterior approach, while others had removed the mass with the posterolateral approach. Regardless of the incision used for removal, the main principle is to remove the lesion as a whole without causing any additional soft tissue and neurovascular damage and without leaving any residual tumor [19].

### **Prognosis**

Parosteal lipomas exhibit excellent prognosis following excision, and the recurrence rate is quite low [49,15]. Moreover, there is no malignant transformation recorded in the literature [38]. However, some cases were observed to have failed to recover despite surgical decompression similar to the presented case here.

We think that the most important reason behind failure of nerve recovery is related to the duration of symptoms or duration of compression. An early surgi-

cal intervention seems to play an important role in surgical success [50]. Fitzgerald specified that cases with symptoms lasting up to 2 years had been observed to recover fully following decompression [19]. Performing surgical decompression in neglected cases with a long history of compression does not guarantee the full recovery of the PIN palsy. Therefore, it is necessary to provide this explanation to the patients.

We preferred the posterolateral approach because of the lower risk of nerve injury, and the advantage of this approach in providing a direct vision and the mass was removed totally through a marginal excision. Despite the fact that the removal had been completed without any neurovascular damage in our case, who had a symptomatic history of 10 months, their symptoms did not exhibit any recovery within the 1-year follow-up process. We believe that the most important factor for clinical recovery is the duration of symptoms.

Previous case studies in the literature defined an inverse proportion between clinical prognosis and the duration of symptoms. Moreover, we are of the opinion that the anterior approach is more reliable because of the risk of iatrogenic injury brought forth by the posterior surgical approach. Considering the preferences of all surgeons in the literature, we see that the anterior approach is the most frequently employed method (77.8%). Moreover, we believe that the mass size and the application of postoperative rehabilitation affect prognosis in the mass compression syndrome. In fact, any increase in the mass size will also lead to an increase in the compression effect. For the same reason, we think that the presence of large and complex multilobulated lipomas and residual tumor are poor prognostic factors. Furthermore, Allagui also highlighted that the application of postoperative rehabilitation contributed to the prognosis [31].

However, clinical recovery could not be observed by Campbell in a case with three months symptom duration or by Fitzgerald in a case with two months symp-



tom duration despite the use of the recommended anterior approach, and symptomatic durations below the average defined in the literature [9,19]. This indicates that the presence of good prognostic factors do not guarantee definitive and complete recovery and therefore, it should be kept in mind that a tendon transfer might be indicated in the future periods.

### Conclusion

Parosteal lipomas should be considered in the differential diagnosis of cases presenting with wrist drop. The observation of a radiolucent mass, periosteal reaction [29,42] and calcification in elbow radiograph; soft tissue masses of varying echogenicity under ultrasound [28]; slower rate of transmission than that of the healthy side under EMG [44]; delayed latency and low amplitude; intermediate signal increase under T1-weighted MRI; and high signal increase in T2-weighted imaging all support the diagnosis of PIN palsy secondary to lipoma. However, definitive diagnosis should be established through the identified presence of broad-based multi-lobular masses covered with thin fibrous tissue in contact with a bone and parosteal changes in the bone bordering the lesion in histopathological examination [42].

A total number of 43 previous cases of PIN palsy secondary to parosteal lipoma were published in the current literature up to date. Including our patient, there were 44 patients. Of these cases, 13 (33.3%) were male 26 (66.7%) were female and 5 without any definition of sex. The location of lipomas among 16 patients for whom such locations were not described was found to be in the left side for 55.2% (16 patients) and in the right side for 44.8% (13 patients) and the side was not defined for 15 cases. Furthermore, the mean age of the patients was 58.12 years with a range of 40-83 years. The treatment is performed through the marginal excision of the mass [49]. Although the surgeon's experience is pertinent for the selection of the preferred approach, the anterior approach has been used more often in the literature because it allows for

a direct view of the PIN and easier lipoma retraction, thereby reducing the possibility of posterior interosseous nerve injury. After surgery, the prognosis is excellent, and the rate of recurrence is quite low. In addition, there is no malign transformation reported in the literature [15,38,49]. The extension function recovered in most patients within one year postoperatively. Therefore, even though reconstructive surgery concomitant with mass excision is not performed routinely, Maldonado AA et al. reported on 2 cases that had been made subject to simultaneous tendon transfers [38]. Early excision is the most significant factor affecting the prognosis. Moreover, we believe that mass size and postoperative rehabilitation of patients affect the prognosis, as well. It is also important not to leave any residual tissue after the excision since there are recurring cases reported in the literature.

In conclusion, our case emphasizes the need for early diagnosis followed by an immediate surgical exploration and subsequent appropriate rehabilitation in patients suffering from PIN compression due to lipoma. The delayed removal of lipoma can be associated with a lack of neurological recovery as can be seen in our case. However, early excision and nerve decompression do not guarantee definitive and complete recovery, and it should be kept in mind that tendon transfer may be needed in the forthcoming periods.

### Conflict of interest statement

The authors have no conflicts of interest to declare.

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