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PATTERN OF A PRIMARY B-CELL LYMPHOMA IN ULNAR NERVE: INTRANEURAL OR EXTRANEURAL

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Abstract.

Introduction: Primary lymphomas of peripheral nerves (PLPNs) are extremely rare and most commonly reported in lumbar nerves and have been found in only five cases in the upper extremities. We describe two patterns of presentation focusing on clinical, radiological, and pathological findings of two patients affected by primary multifocal lymphoma of the ulnar nerve without systemic involvement or other medical conditions. **Methods:** We report a case of extraneural lymphoma in a 72-years-old (patient #1) and a case of intraneural lymphoma in a 45-years old woman (Patient #2). Magnetic resonance imaging and ultrasound findings were similar to Peripheral Nerve Sheath Tumors (PNST). **Results:** Surgical exploration and excision were performed. Morpho pathological results revealed in both cases a diffuse large B-cell non-Hodgkin lymphoma. In patient #1, the disease relapsed after only 4 months with brachial plexus involvement. The patient died about 10 months after the onset of symptoms. Patient #2 did not have post-surgical sensory or motor deficit and follow up at 6 years did not show recurrence or any other localizations. **Conclusions:** PLPN is a rare and challenging condition and is frequently misdiagnosed. PLPNs could have an intraneural or an extraneural pattern. As peripheral neuropathy may be caused by a nervous involvement by a lymphoma, in patients with atypical lesions, a complete preoperative imaging should be acquired.

Key words. Nerve tumor differential diagnosis, peripheral nerve lymphoma, ulnar nerve lymphoma, ulnar nerve tumor, peripheral nerve tumor.

Introduction.

A peripheral nervous system (PNS) involvement in patients with lymphoma very rarely occurs [1]. It can be caused by compression or invasion by lymphomatous cells or by side effects of drugs or by various disorders like as metabolic and infectious disease.

Primary lymphomas of peripheral nerves (PLPNs) should be distinguished by primary Neurolymphomatosis (NL).Primary NL is defined as a rare complication of non-Hodgkin lymphoma (NHL) when infiltration of nervous tissues by limphomatous cells is the first event of the hematological malignancy [2].

PLPNs are conditions where lymphomatous cells are only found in the PNS.2 Orthopedic and hand surgeons commonly deal with benign tumors of the nerves, but PLPNs are instead very rare malignant tumors, commonly misdiagnosed in the clinical practice because they can mimic more common lesions such as peripheral nerve sheath tumors (PNST).

Performing the appropriate pre-surgery imaging can be helpful, however, to date, there are no described imaging findings that are pathognomonic for the diagnosis. When other signs and symptoms, as well as radiological evidence of systemic involvement by hematologic disease, are lacking, we frequently assume that isolated lesions of peripheral nerves belong to the spectrum of PNST. As PNST are exceedingly more common than PLPNs, it is widely accepted to consider their atypical imaging manifestations before rarer conditions.

Nowadays only few cases of PLPNs have been described, mostly found in lumbar nerves, and only eight of which involved the nerves of the upper limb, three affecting the radial nerve [3-5], one the median nerve [6], three the ulnar nerve [7,8], one the medial cutaneous nerve of the forearm [9].

Case Reports.

We describe clinical, radiological, and pathological findings of two cases in which clinical and imaging features showed a lesion similar to PNST, but histopathological result, following excisional biopsy, revealed a diffuse large B-cell non-Hodgkin lymphoma. Infiltration by a population of large pleiomorphic lymphoid cells showing diffuse cytoplasmic immunostaining for CD20, state for a B-lymphocyte immunophenotype. In both cases, no other biological or imaging signs of generalized lymphoma were recorded.

Patient #1.

A 72-years-old man was sent to our department because of a swelling in the volar ulnar region of his right wrist, progressively grown in 4 months. His symptoms included diffuse paresthesia but not functional limitation. Ultrasound scanning showed an unevenly hypoechoic mass (Figure 1A). MRI showed a T2- hyperintense , T1-hisointense well circumscribed kidney-shaped lesion 45.7 mm-long and 16 mm-wide (Figures 1B-C).

The imaging findings did not support any specific diagnosis, however given the MRI and ultrasound appearance, and particularly the posterior acustic enhancement, the location, and the progressive growth a ganglion cyst was suggested as a possible diagnosis. However, a PNST could not be excluded.

During the surgical treatment an extraneural lesion of the ulnar nerve proximal to Guyon's tunnel was found (Figure 2). An excisional biopsy was performed and histopathological analysis revealed a diffuse large B-cell non-Hodgkin lymphoma (Figure 3).

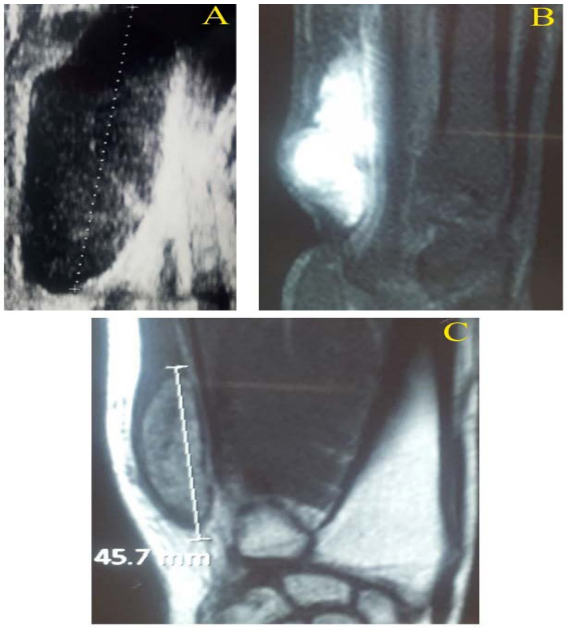

Figure 1. *Imaging studies of patient #1, a 72-years-old man presenting with swelling of the right wrist. Ultrasound, long-axis view* ***(A)*** *shows an unevenly hypoechoic mass with posterior acustic enhancement. MRI T2-weighted with fat saturation sagittal section* ***(B)*** *and coronal T1-weighted image* ***(C)*** *show respectively a homogeneously hyperintense lesion and a inhomogeneous, oval shaped, predominantly isointense lesion with well-defined margins.*

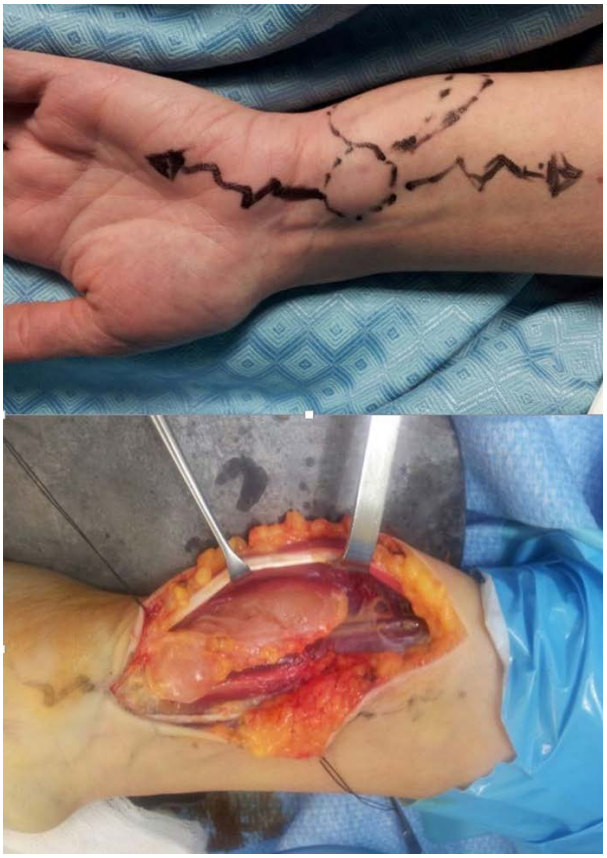

Figure 2. *Patient #1.* ***A****. the mass was on the ulnar side of the forearm. Tapping on the mass elicited a sensation of tingling or "pins and needles" in the distribution of the nerve, along the drawn arrows.* ***B****. Intraoperative findings, with the mass in continuity with the ulnar nerve.*

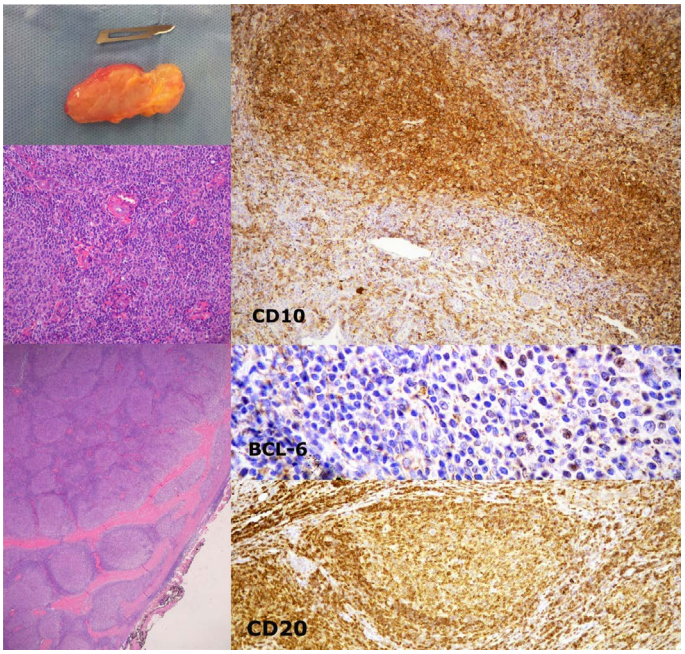

Figure 3. *Patient #1. The excised tumor.* ***Histopathological findings:*** *lymphocytic infiltrate aggregated in follicular structure with germinal centers. (Haematoxylin and eosin, 400x and 50x). The tumor is diffusely CD10 positive (10x), BCL-6 positive (20x) and CD20 positive (10X).*

After surgery the patient was underwent a complete hematologic work-up and was treated with a first cycle of chemotherapy. The disease relapsed after only 4 months with brachial plexus involvement. Given the rapid progression, the patient underwent another cycle of chemotherapy and radiotherapy at this site for 2 months. The patient died about 10 months after the onset of symptoms.

Patient #2.

The second patient was a 59-years-old woman who was referred to our department for tingling in the medial region of the left distal arm (Tinel's sign) without motor or sensory deficit lasting for 3 months. Clinically, an oval-shaped mass in subcutaneous tissues near the elbow was found.

MRI showed a homogeneous T2-hyperintense and T1-hypointense oval-shaped lesion, 37 mm-long and 19 mm-wide, with defined margins, located in the subcutaneous tissue of the medial aspect of the arm, close to the elbow (Figure 4).

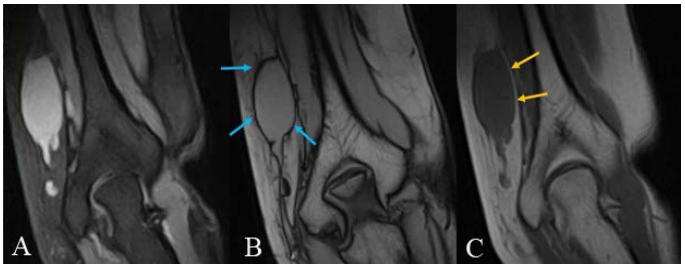

Figure 4. *Patient #2, medial region of the left distal arm.* ***MRI imaging studies:*** *Coronal T2-weighted with fat saturation* ***(A)****, T2** ***(B)*** *and T1* ***(C)*** *images through the elbow show a discrete, T2-hyperintense , oval-shaped mass in the medial aspect of the arm, measuring about 37x19 mm, well demarcated by the surrounding muscle by a fat plane (arrows in* ***E****) and with a T2-hypointense capsule (arrows in* ***D****). There is no evidence of local edema nor other aggressive features.*

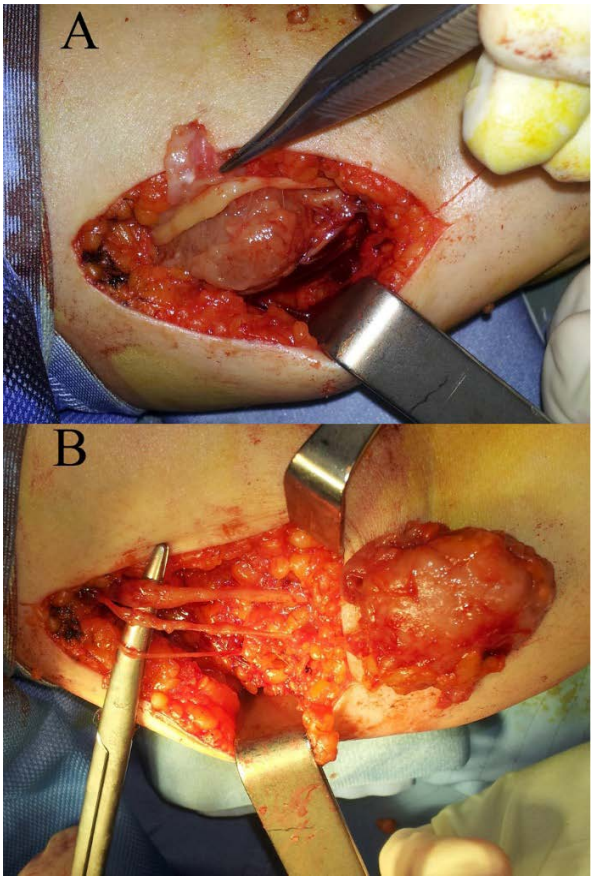

Figure 5. *Patient #2.* ***A.*** *Intraoperative findings, with the mass in continuity with the ulnar nerve.* ***B.*** *The excised tumor.*

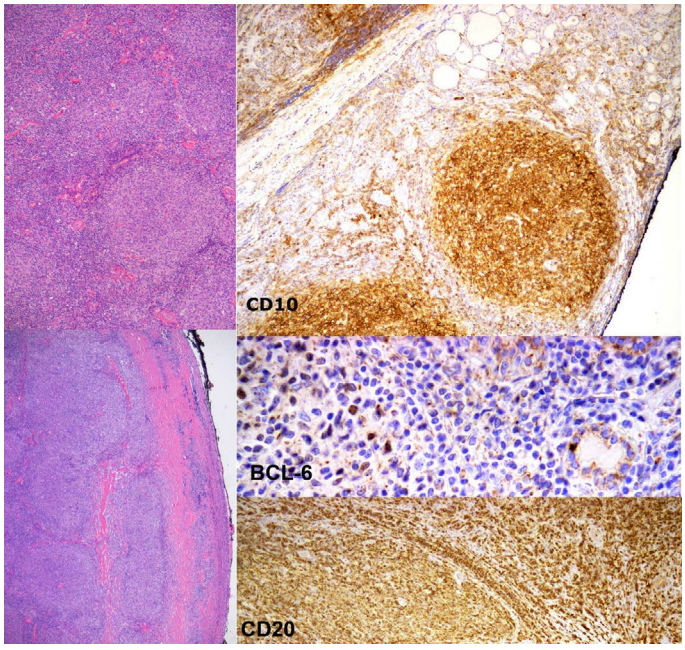

Figure 6. *Patient #2,* ***Histopathological findings****. (Haematoxylin and eosin, 200x and 50x).*
The nerve is host of a massive lymphocytic infiltrate of follicular character with CD20/CD10/BLL-6 positive and weakly BLL-2 positive germinal centers with an undirected proliferative index of 35-45%. Histological diagnosis of follicular lymphoma type G2. Neoplastic cells are diffusely CD10 positive (5x), BCL-6 positive (20x) and CD20 positive (10X).

Given the lack of clinical and radiological findings pointing towards a malignant lesion, the patient was told that the most likely diagnosis was a benign PNST.

During the surgery, an intraneural lesion of the ulnar nerve before the cubital tunnel (Figure 5) was found. An excisional biopsy was performed (Figure 5) and a diffuse large B-cell non-Hodgkin lymphoma was the final histopathological diagnosis (Figure 6).

After surgery, the patient did not have sensory or motor deficit and Michigan Hand Outcome score was 87,1 [10]. A dietary supplement with R-thioctic acid was performed after surgery [11]. A complete hematologic work-up, including a total body PET-CT scan did not reveal other lesions or localizations. The patient then underwent radiotherapy at this site for 2 months. Follow up at 6 years did not show recurrence or any other localizations.

Discussion.

Involvement of the peripheral nervous system by leukemias and malignant lymphomas is usually a manifestation of systemic dissemination. In PLPNs no signs of systemic diffusion are recorded. Only few cases of PLPNs have been reported, and sciatic nerve involvement was found in more than half of the described cases [3,12].

A rare primary B-cell lymphoma with intraneural or extraneural involvement could mimic different diseases. The presence of minor compression symptoms and a radiological investigation without malignant features are often the reasons for misdiagnosis. Clinical and radiological findings in our two patients are similar to those encountered in more common benign conditions, especially because there were no other signs of systemic disease nor remote history of lymphoma.

Nerve signs of primary lymphoma of the peripheral nerves are similar to compression neuropathies. Inflammatory polyneuropathies can be excluded thorough clinical examination that shows unilateral and asymmetrical symptoms which quite rapidly develop, and without associated comorbidities [7].

However, at the top of the differential diagnosis list there are the more common benign neurogenic tumors such as schwannomas or neurofibromas [4].

For a detailed diagnosis, it essential to carefully analyze the pre-operative radiological examinations, even though the findings are often non-specific.

Ultrasound is usually the first exam performed, and it can show a discrete hypoechoic mass, similarly to other intranodal or extranodal lymphomas. Color flow Doppler imaging can be helpful in further characterizing the mass, that may be mistaken for abscess or cyst, as it can confirm the solid nature of the lesion and show internal flow signal [8].

MRI is almost always performed next and is the most important exam to suggest the diagnosis of peripheral nerve lesions. Among them the most common are schwannomas and neurofibromas, and they share the most characteristics imaging findings. Particularly, they are fusiform in shape, may have a tubular structure entering and exiting the lesion (i.e., the involved nerve) and are separated by surrounding muscles by a rim of fat (split-fat sign). Other common imaging findings include the fascicular and target sign, which consist respectively

of multiple or single centrally located low-to-intermediate signal intensities within the T2-hyperintense mass, the presence of various abnormalities affecting the muscles supplied by the affected nerve and the presence of central cystic, necrotic, or hemorrhagic areas. Both types of benign PNST show contrast-enhancement that may be central or diffuse. There are no single findings or combinations of findings that can reliably help to distinguish between these two entities, however, the central location of the parent nerve, the target and fascicular sign, the paucity of central cavitations, necrosis or calcification and predominantly central pattern of contrast enhancement may favor the diagnosis of neurofibroma over schwannoma [13].

On the other hand, the distinction between benign and malignant PNST appears to be more straightforward. Imaging findings that can reliably direct towards the presence of a malignant lesion include: the size of lesion, a peripheral enhancement pattern, the presence of perilesional edema and intratumoral cystic changes.

In addition, other malignant soft tissue tumors, such as myxoid liposarcoma, myxfibrosarcoma, fibromyxoid sarcoma, myxoid malignant fibro-histiosarcoma and other myxoid tumors, which can be in the same differential diagnosis list of benign PNST, also have been shown to have distinct imaging characteristics. Specifically, the size of the lesion, the homogeneity of T2 hyperintensity, the homogeneous enhancement after contrast administration, the presence of internal fatty signal, the absence of fat split signal and target sign points towards a malignant connective tissue lesion.

In both our cases, the MRI findings were consistent with benign peripheral nerves lesions. Both tumors were comparable in size to the benign PNST commonly found in similar locations, they were well separated from adjacent muscular structures (split-fat sign), which did not show any sign of edema and were homogeneously T2-hyperintense. A retrospective look at imaging of patient #2 may reveal the absence of target or fascicular sign in the lesion, which are nevertheless not pathognomonic of benign PNST, and a native T2 signal which was iso- to hypointense compared to bone marrow. However, both exams were performed on low-field MRI scanners and were performed without contrast administration. We acknowledge that the MRI appearance of PLPN has not been widely described due to the rarity of the disease, but the homogenous contrast enhancement has been considered as a sign of possible lymphomatous nature, which is consistent with the appearance of lymphoma in other districts, and in the central nervous system (CNS). Moreover, the use of diffusion weighted imaging (DWI) could add important information for the differential diagnosis, as theoretically lymphomatous tissue should have restricted diffusion, similarly to CNS lymphoma, for the diagnosis of which DWI has become a fundamental sequence.

Of note, it is unlikely that DWI could be performed in every skeletal muscle MRI exam; however, we suggest that, at least in selected cases of suspicious peripheral nerve lesions, or when contrast material is administered, the addition of DWI could provide valuable information.

Radiologists and surgeons should work in team to avoid misdiagnosis, and should be aware of the rare possibility of facing a PLPN even when there is no definitive clinical or radiological evidence. At least in selected cases, a repetition of the MRI examination at a higher-field machine, with contrast medium administration and performance of additional sequences can give important clues to the right diagnosis. The suspicion of PLPN, even if faint, can significantly influence the surgical approach: to delay surgery is not recommended in case of malignancy, as PLPN have been shown to have a dismal prognosis in a substantial proportion of patients [7].

An early diagnosis is mandatory to improve patient survival because of tumor aggressiveness. Also, surgical pre-operative planning can change because of a diagnosis of malignancy. Therefore, a patient with peripheral nervous system symptoms must always be further investigated [7].

Surgery should be prudently performed. During surgery, the tumor appeared to be situated in peripheral nerves. It can appear gray and gelatinous [4], attached to the surrounding tissue with or without a clear plane between the tumor and nerve fascicles. If surgical presentation of PLPNs is suspected at the operating room, the patient should first be advised before histological exam result. A patient psychological workup is fundamental to deal with this challenging disease.

The role of the surgeon for the treatment of PLPNs is essential. First of all, surgeons are responsible for early diagnosis by a detailed evaluation of clinical and radiological findings. They should perform a biopsy, better if excisional, in order to discriminate from other pathological conditions. Finally, they should inform the patient about the rare condition of PLPNs which results in a challenging treatment [14-16].

Conclusion.

Our experience suggests it is fundamental to know that a clinical and radiological lesion that seems to be a PNST could hide a malignant lesion and could be intraneural or extraneural. An early diagnosis is mandatory due to the difficulty to treat such an aggressive tumor, in the attempt to improve the patient survival.

Conflicts of Interest.

The authors report no conflicts of interest.

Consent to participate and Ethics approval.

The study was conducted according to national ethics criteria and Helsinki convention. Written informed consents were obtained in all patients before the surgery. The patients involved approved the publication. This research has been approved by the IRB of the authors' affiliated institutions. All investigations were conducted in conformity with ethical principles of research.

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