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Silent Trauma: A Forearm Neuroma With No Traumatic Clue

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Abstract
Introduction: Traumatic neuroma is a rare, benign nerve tissue proliferation resulting from injury or surgery. It occurs when nerve regeneration is disrupted, forming a tumour-like growth. This condition, most common in middle-aged women, is characterized microscopically by neural tissue patterns, stroma, inflammatory infiltration, and vascularity. Case presentation: A 33-year-old male presented with a 10 day history of swelling on the left forearm without trauma or surgical history. Examination revealed a firm, non-adherent 2 x 2 cm swelling. Initial imaging suggested various diagnoses. The lesion was excised, and histopathology confirmed a traumatic neuroma with mature ganglion cells. The patient remained symptom-free for one year post-surgery. Conclusion: Traumatic neuroma should be considered in differential diagnoses of forearm swellings, even without clear trauma history. Surgery is effective, but further research into non-surgical treatments and recurrence prevention is needed to enhance management and outcomes.
Keywords*: Traumatic neuroma, Nerve proliferation, Forearm swelling, Histopathology.*

INTRODUCTION:

The English literature only reports a small number of examples with traumatic neuromas, which is extremely uncommon[1]. After an injury or surgery, a nerve can proliferate wildly without becoming malignant. This condition is known as traumatic neuroma. The formation of reactive hyperplasia follows direct trauma or surgical manipulation in the majority of instances, and the aetiopathogenesis is an excessive reaction to nerve damage[2]. These lesions are not thought to be real neoplasms. Following trauma or surgery that results in the crushing or transecting of a nerve, the proximal section tries to develop new axons through tubes of proliferating Schwann cells in order to reestablish innervation of the distal segment. The regenerative tissues cannot restore innervation when they come into contact with a scar or experience aberrant healing. At the location of damage, a growth resembling a tumour may subsequently form[3]. Although traumatic neuromas can affect people of any age, they are most commonly detected in middle-aged women, who frequently report discomfort as a symptom[4-7]. Four factors can be used to describe the traumatic neuroma's microscopic appearance: (1) neural tissue pattern; (2) stroma; (3) inflammatory infiltration; and (4) vascularity. The traumatic neuromas exhibit extremely distinctive electron microscopy, with many tiny nerve fascicles encircled by collagen fibres. Both myelinated and unmyelinated axons found in each fascicle are connected to Schwann cells.

The majority of axons are small and unmyelinated. The cytoplasm of all axons is electronluscent and contains a large number of neurofilaments and neurotubules[4]. In our institution we came across number of traumatic neuroma cases following an history of injury or any other previous surgical history, but this is about a rare case presentation of an young adult who had a traumatic neuroma of the forearm without any signifcant history of trauma or any other surgical injuries. The purpose of this is to tell about traumatic neuroma can occur in non-traumatic patient, which has to be a differential for swelling over anywhere in the body.

Case presentation:

A 33-year-old male presented with a chief complaint of swelling with pain on the inner side of the upper left forearm for 10 days. He reported a gradual onset and non-progressive swelling over the upper left forearm, accompanied by intermittent pain. He had no history of trauma or previous surgeries, and his medical history was non-contributory. On physical examination, the swelling was located on the anteromedial aspect of the proximal forearm, 5 cm below the medial epicondyle. The swelling measured approximately 3 x 2 cm, was firm in consistency, and was not adherent to the skin. Initial investigations included an ultrasound, which showed a well-defined homogeneously hypoechoic avascular superficial nodule, raising the suspicion of pleomorphic sarcoma (figure 1).

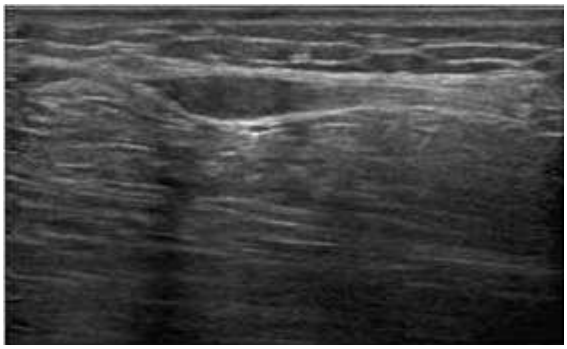

Figure 1 : Ultrasound of forearm swelling

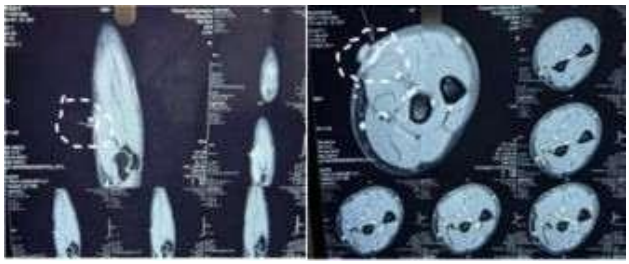

Figure 2 : Image on left coronal. On right Axial view of MRI showing location of mass in the Proximal

forearm

Figure 3: Intra operative image of gross specimen of 3x2cm

An MRI suggested possibilities of a thrombosed low-flow vascular malformation, subcutaneous glomus tumour, and nodular fasciitis (figure 2). The lesion was excised under local anaesthesia. A superficial midline

incision was made, and the lesion was enucleated intact. The excised tissue measured approximately 2.5 x 1.5 x 0.5 cm with soft to firm in consistency (figure 3).

Histopathological findings:

The histopathological slide demonstrates adipose tissue characterized by large, clear spaces indicative of adipocytes, interspersed with fibrous connective tissue and nerve bundles identified by their dense, wavy appearance. Additionally, there are regions of increased cellularity with dense, darker purple staining suggestive of possible tumour tissue, and scattered inflammatory cells are also present. The combined features were suggestive of traumatic neuroma with correlated findings of the MRI and ultrasound report.

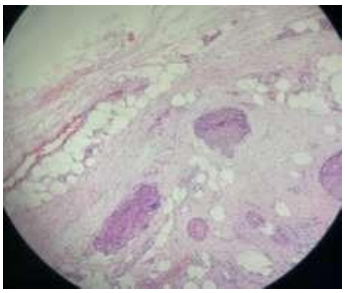

Figure 4 : Histopathological image of resected specimen showing humerus nerve bundles.

REVIEW OF LITERATURE :

Ambroise Pare initially documented the agonizing neuroma in 1634 and used massage and oil treatment to alleviate its symptoms. Odier [8] found in 1811 that the bulbous stump tissue at the proximal end of a transected nerve might have a high degree of sensitivity. Wood [9], who carried out the first pathological investigation on these types of nerve lesions, did not invent the name "neuroma" until 1828. From then on, knowledge of traumatic neuromas increased gradually with the introduction of Morton's neuroma by Morton [10], the clarification of the actual mechanism forming these neuromas by Huber and Lewis [11], and the proposal of a classification scheme by Swanson [12], who also classified neuromas as post-traumatic and cutaneous. A neuroma is a localized non-neoplastic growth of the wounded nerve rather than a typical neoplasm that develops from malignant cells. Neuromas generally arise from injury, insufficient surgical healing, or, in certain situations, persistent fibro-inflammatory irritation that compromises normal nerve transmission. There are two types of traumatic neuromas: spindle neuromas and terminal neuromas. After an accident or surgery, terminal neuromas develop at the proximal nerve terminal. Distal axons die during nerve division, and Schwann cells make a space for neighbouring axons to proliferate [13]. Proximal axons develop in many directions, giving rise to a bulbous form, and combine with other cells such as mast cells and fibroblasts because nerve tissue grows more slowly when the distance between nerve segments is too great [14]. Conversely, persistent stimulation and friction cause spindle neuromas in undamaged nerves [15]. They may also develop from diseases like haemangiomas of the facial nerve, even in the absence of trauma or prolonged stimulation [16]. Katarzyna wrona [17] et al., in 2019, observed a traumatic neuroma in distal end of sciatic nerve while performing routine investigation of MRI after 12 years of follow up in a post amputated distal thigh patient. It was not operated or treated because of no serious clinical symptoms were present. A case reported by bela Agrawal [18] et al., under the topic atypical presentation of traumatic neuroma were the presentation of traumatic neuroma was over the lip due to repeated trauma by lip biting in a female patient which was initially misdiagnosed as mucocele and later revealed to be traumatic neuroma. Then excision was done and no recurrence was noted after follow up.

In 2014, Bruno c. jham [19] et al., found a traumatic neuroma over the mandible which was considered after investigating with immunohistochemical analysis and marker ki-67 for proliferative index. Patient was closely followed up for one year which showed spontaneous regression. Even though traumatic neuroma is a benign

condition there is a chance of recurrence is present. In 2016, jian kang [20] et al., published a case report on a 44 year old male who had a recurrent neuroma formation which was initially formed after the right leg cavernous haemangioma resection. Patient developed traumatic neuroma twice, where resection was done on both the times and follow up showed no symptoms afterwards. In 2019, Keir johnson [21] et al., found a traumatic neuroma in the median nerve of without the evidence of any trauma. Patient had underwent surgical excision with protective nerve wrap.

There are even cases reported in the visceral organ without any surgical or trauma history. Tianyu lin [22] et al., reported a rare case of gall bladder traumatic neuroma without previous surgery. However it was misinterpreted as hilar cholangiocarcinoma and with help of multi-disciplinary team, patient undergone surgery. The resected specimen was sent for histopathology came out to be traumatic neuroma. Likewise there are minimal number of cases that has been reported as traumatic neuroma without the history of trauma. Sussan J salas et al in 2013., mariko doai et al in 2020., Elias Elias et al in 2023, all this author published an article on traumatic neuroma of an intradural cervical nerve root without trauma [23-25].

DISCUSSION :

Traumatic neuroma is a non-neoplastic proliferation of nerve tissue that usually arises as a result of injury or surgery [26]. Despite the absence of a clear traumatic history in this case, the diagnosis was confirmed through histopathological examination, which revealed characteristic features of a traumatic neuroma. The successful excision of the lesion and the absence of recurrence over a one-year follow-up period indicate a favourable outcome. This case highlights the importance of considering traumatic neuroma in the differential diagnosis of forearm swellings, even in the absence of a clear traumatic event. There should be always a suspicion or kept as differential diagnosis when noticing a swelling in a subcutaneous plane. It has been reported in many article that it can occur anywhere in the body not alone in the limbs, can occur in the visceral organ also. There are only few articles as per our knowledge, that has reported traumatic neuroma without the any history of injury or surgery. It seems necessary to have a thorough grasp of the traumatic neuroma. There are various treatment option available which are categorized into conservative and surgical. Conservative treatment of traumatic neuroma includes pharmacotherapy with drugs like opioid analgesics, antidepressants, antispasmodics, α receptor blockers, and lidocaine, which provide short-term relief but have significant side effects [27-29]. Gabapentin and pregabalin are effective for long-term use by reducing neurotransmitter release [30]. Other methods include repeated lidocaine-corticosteroid injections, ultrasound-guided ethanol injections, transcutaneous magnetic stimulation (TMS), tumor necrosis factor α blockers like enalapril, cryotherapy, and radiofrequency ablation [31-34]. These approaches vary in efficacy, with some offering more sustainable pain relief than others. Surgical options include neuroma resection, often combined with ethanol injections or targeted nerve implantation (TNI), which transplants the nerve ending into a denervated muscle to prevent recurrence [35]. TNI shows promise in providing more effective long-term outcomes. But there are still a lot of issues that need to be investigated further. For example, should further corrective procedures such B ultrasound-guided percutaneous ethanol injection be performed once the postoperative pathology report confirms the presence of traumatic neuroma? And is traumatic neuroma recurrent? Will the injury occur in the motor or sensory branch? (3) Does it progress to the proximal trunk, away from the site of injury? (4) Is lidocaine injection helpful in cases when the nerve stump is closed? So this all question should make the treating surgeon to decide the correct management and proper follow-up for the patients.

CONCLUSION:

For medical professionals and researchers, traumatic neuromas have long been a therapeutic difficulty. Although Seddon's and Sunderland's ideas have established the standard categorization scheme, there is still disagreement about the best imaging technology, with views ranging from Ultrasound, MRI, High Resolution Ultrasound, Electromyography, and so forth. Using imaging technologies, the diagnosis of traumatic

neuromas is mostly dependent on the patient's medical history of nerve damage or surgery, as well as symptoms such as pain sensitivity and the existence of trigger sites that result in neuralgic pain. While surgery is currently the most effective treatment for traumatic neuromas, researchers are working hard to provide new non-surgical approaches, such as physical therapy and medicines, for both the treatment and prevention of these conditions. It is evident that appropriate surgical techniques are essential for the prevention of traumatic neuromas, even if doctors are still unable to agree on a standardised therapy plan for them.

Clinical message: In clinical practice, consider traumatic neuroma in patients presenting with unexplained forearm swellings, as timely diagnosis and surgical intervention can lead to successful outcomes even in the absence of a clear history of trauma.

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