

# A Case of Bilateral Ulnar Nerve Palsy in a Patient with Traumatic Brain Injury and Heterotopic Ossification

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## ABSTRACT

**Heterotopic ossification after head injury may occur in the elbow joint. Rarely does this lead to entrapment of the ulnar nerve. We describe the case of a 20-year-old patient who developed heterotopic ossification 6 weeks after a traumatic brain injury. She subsequently developed bilateral ulnar nerve palsy which was confirmed by electrodiagnostic studies and treated by transposition of the ulnar nerve.**

**Keywords:** heterotopic ossification, brain injury, ulnar nerve palsy

## INTRODUCTION

Heterotopic ossification represents a biological process that results in new bone tissues that do not, under normal conditions, ossify<sup>(1-3)</sup>. When it occurs in the elbow, it can lead to ulnar nerve entrapment<sup>(3,4)</sup>. In a 1981 review of 254 patients with head injury, Garland and Bailey<sup>(5)</sup> found 15 peripheral nerve lesions in the upper limb and entrapment by heterotopic ossification was the cause in one case. Keenan and Kauffman<sup>(4)</sup> found that in patients with head injury, heterotopic ossification was the most frequent cause of ulnar nerve entrapment, being found in 78% of all elbows. This is a significant finding, since the incidence of heterotopic ossification at the elbow is only 4%. The heterotopic ossification was found to be causing compression in 16 out of 25 cases.

We describe a young female with head injury who showed signs of heterotopic ossification at the right elbow within 6 weeks of initial trauma. She subsequently developed bilateral ulnar nerve lesion at the elbow 6 months after injury, which was confirmed by electrodiagnostic studies and treated by bilateral transposition of the ulnar nerves.

## Case Report

A 20-year-old Chinese female with a history of schizophrenia for 5 years, jumped from a height of 10 storeys and sustained multi-system injuries, including closed head injury with brain concussion. Six weeks later, she complained of right elbow pain and stiffness. Clinically, there was tenderness over the medial aspect of the right elbow and joint movement was rather painful and restricted. She also had increased tone and spasticity in both upper limbs. Power was grade 3 bilaterally. A plain X-ray<sup>(6)</sup> showed soft-tissue calcification at the medial aspect of the right

elbow joint and her serum alkaline phosphatase level was 369 U/L. She was diagnosed to have heterotopic ossification and was treated with disodium etidronate<sup>(1,2)</sup>.

Six months after the injury, she was noted to have marked wasting and weakness of the intrinsic muscles of both hands. Power in the myotomes was as follows:- on the right side C8(3+), T1(1); on the left C8(3), T1(1). There was no sensory loss. Electromyogram showed denervation in the ulnar innervated muscles of the right forearm and hand. Surgical exploration at the elbow showed compression behind the medial epicondyle. Transposition of both ulnar nerves was done.

## DISCUSSION

The cause of the ulnar nerve neuropathy may be multifactorial. It could be due to a traumatic origin from persistent contracture as a result of head injury, catatonic schizophrenia, or heterotopic ossification. The latter occurs in 11% of patients with head injury with the elbow being a common site<sup>(4)</sup>. Garland et al reported an incidence of heterotopic ossification of 5% at the elbow joint. In a review of 254 patients with head injury, Garland and Bailey found 29 undetected peripheral nerve lesions, 15 of which were in the upper limb. Heterotopic ossification was implicated in the etiology of one of these<sup>(5)</sup>. Keenan and Kauffman<sup>(4)</sup> found that in patients with head injury, heterotopic ossification was the most frequent cause of ulnar nerve entrapment being found in 78% of all elbows. This is a significant finding, since the incidence of heterotopic ossification at the elbow is only 4%. In a case report, Wainapel and colleagues cited heterotopic ossification-induced ulnar nerve compression in a patient with head injury without trauma to the upper limb. This patient also required surgical decompression to relieve the symptoms<sup>(7)</sup>.

The pathogenesis of heterotopic ossification is unknown<sup>(1)</sup>. Diasthesis or metaplasia of bone-marrow derived cells or local mesenchyma cells in the intramuscular connective tissues are the most commonly accepted reasons. Two recently identified proteins (bone morphogenetic protein and human skeletal growth factor) may give some insight into this bone formation. In addition, studies of human leukocyte antigens have suggested positive co-relations with HLA-B18 and HLA-B27<sup>(1)</sup>. Immobilisation seems to be one of the important factors in its pathogenesis in neurological conditions. Immobilisation alters blood

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Fig 1 - Lateral X-ray of the elbow done on 5 May 1994



Fig 2 - AP X-ray of the elbow done on 5 May 1994



Fig 3 - Lateral X-ray of the elbow done on 12 September 1994



Fig 4 - AP X-ray of the elbow done on 12 September 1994

flow to the extremities and causes venous stasis, which in turn affects tissue pH, cellular metabolic activity and causes oedema. Stasis also seems to accelerate the process of fracture healing. Immobilisation alone, however, does not lead to the development of heterotopic ossification in experimental animals. Local factors like trauma and electro-physical or chemical mediators may be important in its etiology.

Another possible cause for ulnar nerve palsy in this patient is head injury, which causes a neuropathy either by compression or heterotopic ossification. Sixty-five percent of patients with head injury have diffuse axonal injury, while 35% have focal injury<sup>(1,4)</sup>. Diffuse axonal injury often produces flexor spasticity<sup>(8-10)</sup> of the upper limbs and may lead to elbow contractures. This causes the patient to lean on the elbow for prolonged periods of time, causing a compressive neuropathy. This problem is compounded by her catatonic schizophrenia and the patient maintains her upper limbs in a fixed flexed posture most of the time. In addition, spasticity from head injury is known to be associated with heterotopic ossification. The spastic tetraparetic patient has the highest incidence of heterotopic ossification. In patients with ulnar neuropathy and head injury, spasticity and ulnar neuropathy always occurred in the spastic limb<sup>(1,4)</sup>.

Lastly, trauma to the elbow may cause ulnar nerve injury either directly or indirectly via heterotopic ossification, scarring and nerve entrapment.

Electrodiagnostic studies are required for confirmation of diagnosis. The time lapse between injury and decompression in this patient was 11 months. In the series by Keenan, the mean time to surgery<sup>(11-15)</sup> was 11.6 months, with a range of 2 to 3.9 months. Resolution of the ulnar neuropathy was achieved in 85% of all cases. The longer the time to surgery, the worse the prognosis.

## CONCLUSION

Heterotopic ossification after traumatic brain injury may lead to nerve entrapment. If entrapment is clinically significant, surgical decompression is required.

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