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Case Report

Heterotopic ossification or unusual foramen in radius?

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ABSTRACT

The interosseous membrane (IOM) runs obliquely from radius to ulna attached to their respective interosseous borders. The membrane provides surface for attachment for muscles; stabilizes the radius and ulna during forearm rotation and actively transmits forces from the radius to the ulna. IOM is an occasional site for heterotopic ossification (HO) that involves development of mature lamellar bone, in a variety of soft tissues such as muscles, ligaments and other soft tissues causing significant functional limitation of upper limb. We describe unusual findings equivocal of congenital or acquired features in a dry adult radius where two thick bony spurs/processes emerging from the middle third of interosseus border approach towards each other joined by a thin bony fragment to form a huge foramen 2.4 cm in length and 6 mm in width abutting an uneven rough area of about 3.6mm x 1.6 mm on anterior surface. A prominent groove leading to a foramen at its junction with the shaft was present on the posterior surface of the bone. Knowledge of such HO as anatomical variants or possible sequel of trauma or neurological insult is indispensible and call for further research and trials to obviate such complications.

Keywords: Foramen, Fractures, Heterotopic ossification, Interosseous membrane

INTRODUCTION

The interosseous membrane (IOM) is a fibro membranous tissue that runs obliquely from radius to ulna attached to their respective interosseous borders. The interosseous border of radius begins superiorly behind the tuberosity. Its upper part is rounded and indistinct which becomes sharp and prominent as it descends. At the lower end, it divides into two ridges which are continued to the anterior and posterior margins of the ulnar notch. The lower part of the interosseous membrane is attached to the posterior of the two ridges.[1]

IOM has an oval opening near its distal margin for passage of the anterior interosseous vessels to the back of the forearm. Between its proximal border and the oblique cord is a gap for the posterior interosseous vessels. The membrane apart from providing surface for attachment for muscles; stabilizes the radius and ulna during forearm rotation and actively transmits forces from the radius to the ulna through its five ligaments: central band, accessory band, distal oblique bundle, proximal oblique cord, and dorsal oblique accessory cord.[2]

Three dimensional MRI observations suggest that the thick and strong central tendinous part of IOM remains taut throughout rotation to provide stability between the radius and ulna. The thin and soft membranous parts of IOM present adjacent to proximal and distal borders of central band, deform and becomes wavy.[3] IOM is an occasional site for heterotopic ossification (HO) that involves development of mature lamellar bone, indistinguishable from normal bone exterior to the skeleton in a variety of soft tissues such as muscles, ligaments, tendons, fascial planes and other mesenchymal soft tissues. This may cause significant functional limitation in imperative movements of pronation-supination in forearm and thus upper limb.[4]

CASE REPORT

The authors came across unusual features in dry adult radius bone while conducting routine osteology demonstrations for the 1st year undergraduate students in the Department of Anatomy. There were two thick bony spurs/processes emerging from the interosseus border of the shaft of radius (right side) in the middle third approaching towards each other. The dimensions were measured using spreading calipers. The proximal and distal bony spurs were about 11.5 and 14.7 cms respectively from upper end of radius. The two bony spurs were joined by a thin bony fragment forming a foramen at the site of interosseous border of right radius abutting an uneven rough area of about 3.6mm x 1.6 mm on anterior surface (Figure 1).

Figure 1: Anterior and posterior views of radius.

This rough area approached up to the posterior surface but was less discernible there (Figure 2).

Figure 2: Lower end of radius showing superior (a) and inferior (b) processes enclosing foramen and callus (c) abutting the inferior spur (anterior view).

The enclosed foramen was 2.4 cm in length and 6 mm in width when measured on anterior surface. The inferior spur directing upwards was substantial and measured 8 mm in thickness.

The thin fragment which was brittle somehow got broken in the upper part of the foramen during handling of the bone. On the posterior surface of the shaft of radius the inferior process was bridged to the shaft by bone. This surface had a prominent groove leading to a foramen at its junction with the shaft (Figure 3).

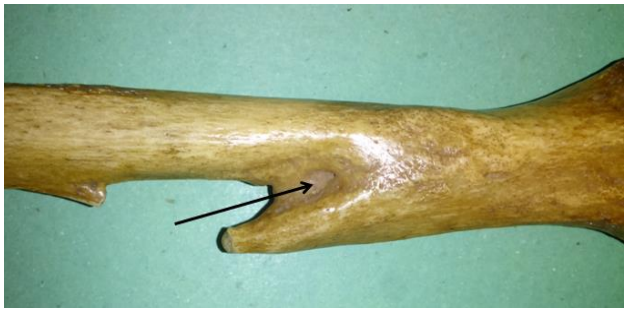

Figure 3: Superior and inferior processes enclosing foramen (posterior view). Note the groove leading to the foramen (arrow is in the groove).

DISCUSSION

To the best of our knowledge presence of a huge foramen outlined by bony spicules in the interosseous membranes of limb bones has never been documented till date. The authors cannot comment upon the attachment of IOM on radius in the present study as it involved dry adult bone. In the present bone the position of attachment of IOM is unclear whether the IOM was attached to the rounded medial border forming the margin of large foramen or it was attached to the bony spicule between the spurs.

The radius under consideration shows two bony processes joined by thin spicule of bone forming a foramen. The rough area near the large foramen is probably a callus that developed after fracture at this site (Figure 1). But authors in the present case have reported the undocumented formation of a large foramen at the site. Any abnormal contour of the bone should have been remodelled after fracture healing. Additionally, the bone which is bridging the inferior spur with the shaft is not complete and grooved on posterior surface leading into a foramen. These features also connote a possibility of such foramen to be present since birth.

Alternately, it can be suggested that the lower spur would have developed as HO in IOM after fracture at the site where callus is observed. The resulting haematoma might have got infected or there would have been a delayed reduction in fracture leading to formation of heterotopic bony processes. The diseased or inflamed connective tissue attached to bone stimulate release of bone morphogenetic protein (BMP) and prostaglandins E2 from surrounding healthy bone which mediate transformation of primitive dormant mesenchymal cells into osteoblasts that further lay the osteoids.[5,6]

The heterotopic bone formation may begin at some distance and later join the normal bone.[7] Therefore, it is suggested in the present study that the bone started to form in the IOM and extraordinarily joined the shaft at

site that was undergoing callus formation. Development of inflexible structures in IOM of forearm can limit the movements of supination and pronation and thus impact the functions of entire upper limb. Few important nerves and vessels (anterior and posterior interosseus) traverse the corresponding surfaces of interosseus membrane and anterior interosseous artery courses from anterior to posterior aspect through a gap in the IOM. In view of these neurovascular relations, there is increased likelihood of arterial and nerve impingement around the site of HO that may cause compression symptoms distally.

Heterotopic bones can be of genetic or acquired form. Genetic variant fibrodysplasia ossificans progressiva is rarest. Others include progressive osseous heteroplasia, osteogenesis imperfecta type V; both interestingly manifest as HO in the IOM.[8,9] The acquired forms occur as sequel to trauma as in fractures, dislocations, arthroplasty surgeries, soft tissue injuries or neurogenic insult as in spinal cord or central nervous system injury. Once in a while HO can occur in abdominal incisions, wounds, kidneys, uterus, corpora cavernosa, and the gastrointestinal tract.[10-12]

Rarely, non-anatomic fracture reduction with diminution of interosseous space, incorrect screws used in grafting that reach interosseous membrane may result in HO in IOM. It has even been suggested that close to one thirds of these patients will develop significantly limited joint motion in the long run.[4] The possible differential diagnosis of non-traumatic calcification in interosseous membrane are: X linked hypophosphataemic rickets, fluorosis and osteogenesis imperfecta type V.[13]

CONCLUSION

A possibility of development of HO at or near any fracture site especially in presence of infection or surgical intervention cannot be ruled out. Therefore, a sound knowledge of such HO as anatomical variants or as potential sequel is indispensable for surgeons and orthopedic surgeons to obviate any unintended consequences to the patient. Relevant prophylactic measures such as radiotherapy or corrective surgeries should be performed to prevent any aforementioned outcomes. We also recommend further trials to decide a treatment protocol for such musculoskeletal injuries.

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