ACTA SCIENTIFIC ORTHOPAEDICS (ISSN: 2581-8635)

Volume 4 Issue 2 February 2021

Movement Restricting Heterotopic Ossification After Free Functioning Gracilis Muscle Transfer to the Elbow: A Case Report

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Published: January 28, 2021
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Abstract

We report a case of development of a movement restricting heterotopic ossification after a free functioning gracilis muscle transfer performed for elbow flexion in a patient with pan brachial plexus palsy. We also present the management of the case including the repair of the brachial artery which was thinned out by the lesion. To the best of our knowledge, this is the first case in literature which reports heterotopic ossification after a free functioning muscle transfer.

Keywords: Heterotopic Ossification; Free Functioning Muscle Transfer; Brachial Plexus Injury

Introduction

Heterotopic or Ectopic ossification is the formation of lamellar bone in soft tissues or other tissues remote from the usual location of bone. Formation of heterotopic ossification (HO) following tissue transfer for reconstruction has been reported anecdotally [1-5]. One of these studies also reported that the severity of heterotopic ossification is significantly higher in muscle flaps around the joints [5]. We present a case of a large, movement restricting, heterotopic calcification which developed after a free functioning gracilis muscle transfer was carried out for elbow flexion in a patient with pan brachial plexus palsy (where all the nerves and levels of brachial plexus were damaged). To the best of our knowledge, this is the first report of heterotopic ossification after a free functioning muscle transfer (FFMT).

Our case

A 27 year old male presented to our follow-up clinic with a history of mass over his right elbow and unsatisfactory improvement of range of movements during the physiotherapy phase about 9 months after a free functioning gracilis muscle transfer to the elbow for pan brachial plexus palsy. His passive range of movements (in elbow flexion) during the physiotherapy phase gradually deteriorated from complete flexion of 150 degrees to 30 degrees.

He had a history of road traffic accident 4 years back following which he underwent left-sided craniotomy, open reduction and internal fixation of the right clavicle and distal radius fractures. He also had a fracture of the lower end of right humerus which was managed conservatively. Subsequently, he was noted to have right-sided complete brachial plexus palsy for which he underwent

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contralateral C7 transfer to the axillary, musculo-cutaneous and median nerve (Nerve grafts from contralateral C7 spinal nerve to axillary nerve, musculocutaneous nerve and median nerve). Partial recovery of shoulder abduction was achieved but he failed to get any active movement in the elbow and wrist. A decision was made to proceed with free functioning gracilis muscle transfer for elbow flexion and a wrist arthrodesis after completion of 2 years of physiotherapy post C7 transfer procedure. At that point of time, he had complete range of passive movements at the elbow. Nine months after the FFMT surgery, he presented with unsatisfactory improvement in active range of movements, mass in the right elbow and restriction of even passive range of movements.

CT scan (Figure 1) demonstrated a large (5cm diameter) heterotopic calcification around the insertion of the biceps and brachialis tendon. The right elbow was explored under general anaesthesia and heterotopic ossification mass was excised (Figure 2). During surgery, it was noted that the brachial artery was thinned out and subsequently also ruptured during the complete excision of the mass. Vascular continuity was reestablished using ipsilateral cephalic vein graft which was found locally. Patient resumed graded physiotherapy after a post-surgical break of 3 weeks and his passive range of movements have improved (Figure 3). We are awaiting improvement in active range of movements. Figure 2: Intra-operative image (2a), Brachial artery repair using Cephalic vein graft (2b), Excised specimen (2c).

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Figure 3: Pre-operative (3a) and post-operative (3b, 3c, 3d) pictures of extent of passive range of movement (flexion) at the elbow.

Figure 1: CT scan showing large 5cm diameter bony mass at the elbow around the region of biceps and brachialis tendon.

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Discussion

The development of ectopic ossification in soft tissues after injury, burns, surgery and neurological injury is a well known complication and several authors have attempted to explain the exact etiology, most prominently by McCarthy and Sundaram [6]. The underlying pathology is generally attributed to the osteogenic potential of periosteum which gets implanted onto the soft tissue and giving rise to the ossification. In our case, the gracilis muscle was sutured to the biceps tendon in the primary operation and it didn't involve periosteal manipulation. A hematoma around the surgical site and eventual development of HO could have been the possible trigger in our case. A review by Meyers., *et al.* also supports this theory that HO starts separately and then may fuse with the periosteum secondarily [7].

With little donor site morbidity, gracilis free functional muscle transfer is commonly employed in brachial plexus injury where the native muscles have undergone irreversible damage. Literature search revealed reports of heterotopic ossification following free fibula flap mainly along the vascular pedicle and also rarely distant to the site of the vascular pedicle [8,9]. Non-free fibula flap with reported heterotopic calcification includes radial forearm flap [10], supraclavicular island flap [11] and temporal fascial flap [12]. We believe that our report is the first case report of HO developing after a free functioning gracilis muscle transfer surgery in a brachial plexus patient.

Our patient had full range of passive movements before FFMT surgery. But we acknowledge that we don't have radiographic proof of absence of HO prior to surgery in the background of the old humerus fracture. There is a genuine possibility that the HO process could have been brewing and the FFMT surgery merely hastened the process and made it more severe. This is one of the limitations of our report.

The ideal timing of excisional surgery for HO has been suggested in the literature as 12-18 months post the injury/event [13], to facilitate complete maturation of bone before excision. But in our case, since the patient was in an active physiotherapy protocol for recovery from brachial plexus surgery, it was felt prudent to proceed at an earlier time (9 months post FFMT surgery).

As mentioned in the review by Meyers., *et al.* [7], HO doesn't respect anatomic borders and frequently encases neurovascular structures which may lead to inadvertent injury during excision as

was noted in our case where the brachial artery was ruptured. This needed immediate repair using Cephalic vein which was readily available in the operative site to maintain vascularity to the upper limb.

In other similar reports, the HO didn't cause serious functional issues. Our case is also unique by the fact that it caused movement restriction at the elbow joint. Surgeons adopting FFMT for brachial plexus injuries need to consider this complication if their patients are not progressing satisfactorily during physiotherapy.

Conclusion

Although not reported previously, heterotrophic calcification can occur after a free functioning muscle transfer and this needs to be considered in a patient who is not progressing satisfactorily during the physiotherapy phase or has worsening of range of movements. Early surgical excision of the restricting mass is crucial for physiotherapy to resume at the earliest.

Acknowledgements

The authors wish to thank Mr Abdul Majeed (Physician assistant – Dept of Plastic and Reconstructive surgery) and Ms Senthamarai Selvi (Plastic surgery nurse) for their help in data collection and documentation.

Conflict of Interest

None.

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