

The Role of MRI in the Diagnosis of Post-sternotomy Injuries of the Brachial Plexus

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ARTICLE INFO

Article type:
Case report

Article history:
Received: 30 Dec 2014
Revised: 15 Jan 2015
Accepted: 27 Jan 2015

Keywords:
Brachial plexus
Magnetic Resonance Imaging
Sternotomy

ABSTRACT

Brachial Plexus Injury (BPI) is an uncommon complication of median sternotomy capable of causing a permanent or transitory sensitivity and/or motor function impairment in the upper limbs.

During a cardiac surgery through sternotomy, for the assessment of the thoracic cage configuration and the site of mediastinal structures, a broader surgical field may be required. If the sternal retractors are overstretched, the costovertebral junctions are likely to be dislocated damaging the adjacent soft tissues at the same time.

Magnetic Resonance Imaging (MRI) is the modality of choice for estimating the degree of physical damage to the brachial plexus. In this paper, we intended to report the MRI findings of a chronic case of BPI following a cardiac surgery.

► Please cite this paper as:

Alves GRT, Concatto HN, Harrington D, McCann C, Hochhegger B, Irion K. The Role of MRI in the Diagnosis of Post-sternotomy Injuries of the Brachial Plexus. *J Cardiothorac Med.* 2015; 3(1):281-283.

Introduction

Brachial plexus injuries (BPI) are the potential complications of cardiac surgery, especially in the patients who undergo sternotomy (1). When a larger surgical field is required for assessing deep intrathoracic structures, overstretching of the sternal retractors might do damage to the nerve fibres. Other contributing factors to the development of this condition are certain features of the chest wall like hyperkyphosis or the rigidity of the costal cartilage.

Although direct surgical sectioning of the brachial plexus nerve bundles is quite uncommon, it might occur during other surgical procedures than sternotomy. In such cases, the emerging symptoms largely depend on the nature and degree of the damage. The most frequent complaints in this regard are ipsilateral limb weakness, paraesthesia and/or having tingling sensations (2).

The incidence of BPI after cardiac interventions ranges from 2% to 38% (3). However, some medical centres might underestimate this rate. Yet, the prevalence of this particular complication is diminished in minimally invasive procedures. In this paper, we presented a case of chronic BPI following a cardiac surgery and discussed the findings of the related Magnetic Resonance Imaging (MRI).

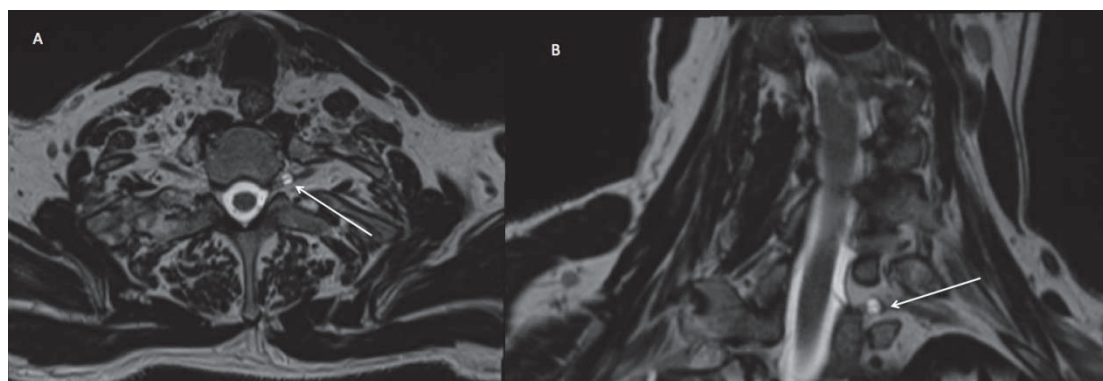
Case Report

A 56-year-old diabetic man, with angina and triple vessel coronary artery disease, underwent cardiac surgery. The procedure consisted of four coronary artery bypass grafts using a left internal mammary artery to the left anterior descending coronary artery and three reversed saphenous vein grafts to the diagonal obtuse marginal and the right coronary artery.

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Figures 1A and 1B. Axial and coronal assessments of the MRI study of the brachial plexus demonstrating the presence of a focal hyperintense change within the left root of C8 (arrows). Given the typical clinical features, the diagnosis of post-sternotomy brachial plexus injury was confirmed

Pre-operatively, the patient confirmed a history of a previous road traffic accident causing multiple rib fractures along with another old, traumatic injury on his shoulder. Neither of the injuries had resulted in neurological dysfunction.

Post-operatively, the patient made an uncomplicated recovery except he was noted to have a feeling of numbness in the ulnar distribution of his left hand. Eventually, he was discharged five days after the completion of the procedure.

At the 6th week of follow-up period, the patient was presented again with left-sided wrist drop and a diminishing physical ability to extend his fourth and fifth left fingers. Moreover, he manifested a reduced sensation in the distribution of the C8 territory.

Imaging assessments through the MRI scan of the brachial plexus were indicative of the presence of a hyperintense signal in T2-weighted sequence affecting the left C8 root (Figure 1). Consequently, the patient was referred to a neurologist for further evaluations. Four months after his surgery, the patient was re-examined and he was found to be still suffering a minor weakness on his little finger and ring finger.

Discussion

The brachial plexus comprises of a group of ventral fibres emerging from the roots of C5, C6, C7, C8 and T1. It is an essential structure providing most of the upper limbs' sensitivity and motor functions (4). Occasionally, certain supplementary branches can also arise from C4 and T2 roots.

Various mechanisms are involved with the pathogenesis of post-operative symptoms or signs. When a broader opening of the sternal retractors becomes necessary for providing a larger surgical field to assess certain intrathoracic structures, the plexus might be overstretched with the rupture of its fibres.

A number of elements could also be responsible for this condition. For instance, reduced muscular tonus of the patients under anaesthesia, such deformities of thoracic cage as hyperkyphosis or scoliosis and the rigidity of the thoracic cage in elderly patients with calcified rib cartilage.

The occasional misplacement of shoulder braces has also been known as an underlying cause (5). In addition, the dissection of vessels with inadvertent sectioning of nerve fibres during the procedure may contribute to the development of BPI (3).

Many other clinical conditions have also been reported as predisposing or contributing factors. Such examples are the presence of cervical ribs, cervical band, a prolonged procedure and coagulopathies (2).

The clinical onset of BPI often occurs after the patient is discharged (6). Some patients may experience a mild, asymmetrical weakness in their upper limbs as well as various degrees of sensitivity impairment which might pass undetected. On the other hand, some other patients may demonstrate more obvious signs and symptoms that will presumably indicate the diagnosis. While symptoms arising from minor injuries generally tend to remit within a few weeks, other sequelae might remain permanent, particularly in the presence of nervous and vascular ischemia.

In the face of a compatible history, the investigation of post-operative BPI should account for Electroneuromyography, especially in the assessment of residual motor impairments (2, 7, 8).

MRI is capable of displaying the site and the extent of the brachial plexus lesion and under the circumstances, it might also be able to demonstrate such predisposing factors as the ones described above. Moreover, MRI provides valuable information on ruling out alternative diagnoses (4, 8).

The current strategies for treating BPI consist mainly of long-term rehabilitation measures and/or reconstructive surgery (9, 10). Recent experimental treatments with botulinum toxin have also achieved remarkable success (11). However, it should be noted that the primary prevention of BPI requires further efforts in identifying those patients at risk before starting the surgical procedure. One must be aware of the unpredictable response of each patient to the limited treatment options.

Conclusion

In summary, BPI figures as a potential complication during the post-operative period of thoracic surgeries, remarkably among those involving sternotomy procedure. Albeit its clinical presentation reveals hugely variable, MRI consists in an excellent tool to detect either substantial or minor lesions and allow timely and effective management of this condition.

Conflict of Interests

The author has no conflict of interests.

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