CASE REPORT

CT appearance of intercostal nerve neurotisation

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ABSTRACT. A nerve transfer or neurotisation procedure is performed to repair damaged nerves, in particular those of the brachial plexus following an avulsion injury. An intercostal to phrenic nerve transfer to re-innervate the diaphragm in patients with high cervical spine injury has also been reported in the literature. We present the imaging finding in a 65-year-old female who had an intercostal nerve transfer for a damaged phrenic nerve following a resection for a non-small cell lung carcinoma.

Received 3 February 2011
Revised 27 April 2011
Accepted 31 May 2011

DOI: 10.1259/bjr/71065220

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Neurotisation is rapidly becoming an accepted technique in repairing damaged nerves. A variety of nerves can be employed for this procedure. To the best of our knowledge, this is the first report of imaging findings following a neurotisation procedure.

Case report

A 65-year-old female presented with constant pain in her left submammary region, which was getting progressively worse. A chest radiograph showed a left hilar mass, which was subsequently characterised by a CT scan, and a biopsy confirmed it was a non-small cell carcinoma. Before the procedure the patient was staged as T2 N0 M0. The patient underwent a left posterolateral thoracotomy, where the tumour was found to be infiltrating through the surface of the lung and directly invading the left phrenic nerve. As a result of this finding, a left upper lobectomy with excision of the phrenic nerve involved with the tumour and a mediastinal lymphadenectomy was performed. A side-to-side anastomosis of the sixth intercostal nerve with the distal stump of the phrenic nerve was also performed. The anastomosis was supported with an intercostal muscle graft. Post-operatively, the patient was upstaged to T4 N0 M0 and received adjuvant chemotherapy and radiotherapy. A CT pulmonary angiogram was performed in the immediate post-operative period to exclude a pulmonary embolus. This showed surgical clips and a small pleural effusion at the left lung base. No radiological features of the nerve transfer procedure were identified (Figure 1).

A follow-up CT scan performed 1 year after the completion of the adjuvant therapy showed two parallel curvilinear calcific densities extending from the left lateral thoracic cage to the pericardium with no evidence of tumour recurrence (Figure 2). A forgotten retained chest

drain was considered as an explanation for the CT findings. However, there was no evidence of this. Multiplanar and volume-rendered reformatted images clearly showed calcified bony projections arising from the partially resected sixth rib and extending medially to the surface of the heart (Figures 3 and 4). The findings were consistent with an intercostal nerve transfer.

Discussion

There is increased use of heterotopic nerve transfer in dealing with a multitude of neural pathologies. Neurotisation involves the transfer of a normal nerve with an unimportant function to the site of a permanently damaged nerve with more important functions [1]. Since the first documented nerve transfer in 1907 by Klivington, where a

Figure 1. Selected axial slice of the CT pulmonary angiogram (at the level of the nerve transfer).

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(a)

(b)

Figure 2. Selected reformatted axial slice from the 1 year follow-up scan in the (a) soft tissue setting (W 350: L 50) and (b) bone window setting (W 2000: L 500) which demonstrates a curvilinear calcific body on the left side (arrows).

Figure 3. Reformatted images show calcified bony projections arising from the partially resected sixth rib.

(a)

(b)

Figure 4. Volume-rendered images showing calcified bony projections arising from the partially resected sixth rib and extending medially towards the mediastinum.

nerve crossover was undertaken to innervate a neurogenic bladder as a result of a spinal cord injury, there has been a variety of techniques and applications of nerve transfers [2, 3].

A wide range of nerves can be used for neurotisation and the most common donor nerve is the intercostal nerve [3]. Its long course, the ability to accurately identify the motor component and the minimal functional disability after it is harvested makes it an ideal choice for the repair of the brachial plexus [3]. Neurotisation using the intercostal nerve is indicated in a wide range of conditions ranging from brachial plexus injury to congenital conditions like Poland's syndrome [4]. The nerve can be used as an interposition graft or as a direct transfer. Variable success rates have been attributed to neurotisation. Success rates depends on the amount of time between the original injury and surgery and the extent and level of the injury [4].

These radiological appearances are due to the calcification of the periosteum stripped from the rib and the intervening hypodensity is the intervening muscle, all of which are supporting the interposed nerve anastomosis. It

is well recognised that periosteum has the potential to ossify by intramembranous and endochondral ossification, a property which enables it to play a pivotal role in the healing and remodelling of bone grafts [5, 6]. As neurotisation becomes a more accepted procedure, it is imperative that radiologists are aware of its appearance. It can be mistaken for a remnant of a drain. Therefore, a review of the patient's previous imaging and history will help in reaching a reasonable conclusion. To the best of our knowledge this is the first report in the English language literature describing the radiological appearances of an intercostal nerve neurotisation.

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