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Current problem cases

Bilateral thoracic outlet syndrome with bilateral radial tunnel syndrome: a double-crush phenomenon

Case report

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Summary. A case of bilateral thoracic outlet syndrome combined with bilateral radial tunnel syndrome is reported. Persisting complaints in the upper extremities after bilateral first-rib resection and scalenotomy were due to radial nerve entrapment in the radial tunnel. Although this bilateral double-crush phenomenon is extremely rare, and has not been reported previously, persistence of symptoms after initial treatment of a nerve entrapment is an indication to search for another site of compression.

The double-crush phenomenon was initially postulated by Upton and McComas [9]. According to this hypothesis, a nerve entrapment might diminish the capacity of the nerve to oppose another compression along its course.

A radial nerve entrapment is predominately situated in the radial tunnel, and was originally described by Roles and Maudsley [8] as the radial tunnel syndrome. Putters and Kaulesar Sukul [6] pointed out the fact that the arcade of Frohse, which predisposes the radial nerve to entrapment, is usually responsible for this compression.

The association between a peripheral nerve entrapment in the upper extremity and a thoracic outlet syndrome, as a double-crush phenomenon, was first reported by Williams and Carpenter [11]. In terms of this double-crush phenomenon, enduring symptoms after surgical treatment for thoracic outlet syndrome could be due to an unrecognized nerve entrapment.

We present an unusual case of a patient with bilateral double-crush phenomenon consisting of bilateral thoracic outlet syndrome with bilateral radial tunnel syndrome.

Case report

A truck-driver, aged 34 years and without any relevant medical history, had suffered for more than 5 years from pain in both forearms and hands. He also complained of cold hands, which frequently changed colour. There was no stiffness of the joints.

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At general examination no abnormalities were found in the cervical spine, shoulders or elbows. The grip strenght was normal. Slight hypoaesthesia was present in the median nerve region. Radiographs showed no evidence of cervical rib or intervertebral foramina compression. Additional electrophysiological examination did not show any abnormality, nor did further neurological examination. Blood laboratory tests gave results within the normal range. A primary diagnosis of bilateral Raynaud's disease was made and a regimen of vasodilatators and physical therapy prescribed.

After an initially good response to the treatment, the complaints returned with progressive severity. The same symptoms could be elicited by elevation of the arms and by low temperature. At physical examination a souffle was heard over the subclavian arteries with the arm in more than 60° abduction on the right side and more than 80° on the left side. The provocation tests for thoracic outlet syndrome were positive on both sides. The peripheral pulsations and capillary refill were normal. During provocation, Doppler frequency analysis showed no flow in the digital arteries. According to these results the diagnosis was changed to bilateral thoracic outlet syndrome with Raynaud's disease. After bilateral first rib resection with scalenotomy the symptoms improved, although the patient still suffered from a slight weariness and dull pain in both forearms. Postoperative Doppler frequency analysis was now negative for thoracic outlet syndrome.

Two years later, the patient came to our outpatient clinic again because of progressive pain in forearms and hands. There was now also intermittent proximal radiation and nocturnal discomfort, mainly on the left side. The provocation tests for thoracic outlet syndrome were negative for both arms. Vascular symptoms, e.g. pallor and coldness of the extremities, were now absent. The peripheral pulsations were present in both arms. Resisted extension at the wrist, pressure on the arcade of Frohse, and the Tinel percussion test over the radial nerve were very painful, although the results of electrophysiological examination were normal. Strength and sensibility were not affected. The symptoms were suggestive of a radial nerve entrapment in the radial tunnel.

Initially, only the left arm was treated surgically. After decompression of the radial nerve by division of the arcade of Frohse, the patient was free of all complaints in the left arm. This effect and the identical symptoms on the right side led us to release the right radial nerve as well, with similar effect. At present, more than 2 years after this treatment, the patient is free of complaints.

Discussion

The double-crush phenomenon was first described by Upton and McComas [9]. Impairment of the axonal flow led them to postulate that compression of a nerve in one

region made that nerve especially susceptible to damage at another site. This was confirmed by an experimental study [4].

The best-known double-crush combinations are cervical radiculopathy or thoracic outlet syndrome with carpal tunnel syndrome [5]. The first combination has been accepted as a clinical entity [2, 12], but the first discussion of the latter combination only appeared recently [1, 12]. This relationship between the thoracic outlet syndrome and a peripheral entrapment neuropathy was first described by Williams and Carpenter [11].

In the study by Wood and Biondi [12], 17 of the 142 patients (12%) suffered from unilateral thoracic outlet syndrome combined with bilateral carpal tunnel syndrome. Twenty-three of the patients had thoracic outlet syndrome bilaterally. Despite bilateral resection of the first rib, nine of these patients (39%) had persisting complaints in both forearms that could be attributed to the bilateral carpal tunnel syndrome. Three other patients (2%) with unilateral double-crush phenomenon had concomitant entrapment of the posterior interosseous nerve in the radial tunnel.

Bilateral entrapment of the radial nerve has already been described [3, 7, 8, 10], but to the best of our knowledge a double-crush phenomenon of bilateral thoracic outlet syndrome combined with bilateral radial tunnel syndrome has never been reported.

The study by Wood and Biondi [12] suggested that patients with bilateral thoracic outlet syndrome are at three times the risk of developing a double-crush lesion than patients with unilateral thoracic outlet syndrome are.

Unlike Carroll and Hurst [1], who doubted a relationship between the thoracic outlet syndrome and the peripheral nerve entrapment and maintained that a single procedure would alleviate all symptoms, we agree with others [5, 9, 12], that for best results both lesions should be surgically treated. The present case confirms the view that persistence of complaints in the upper extremity, which would indicate apparent surgical failure after adequate decompression at the thoracic outlet, is an indication that additional distal compression should be attempted.

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