material, may cause a burn. All those responsible for the treatment of soft tissue injuries must be aware of the consequences of inappropriate application of an ice pack.

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An unusual case of thoracic outlet syndrome associated with long distance running

Y F Leung, O M Chung, P S Ip, A Wong, Y L Wai

Abstract

An amateur marathon runner presented with symptoms of thoracic outlet syndrome after long distance running. He complained of numbness on the C8 and T1 dermatome bilaterally. There were also symptoms of heaviness and discomfort of both upper limbs and shoulder girdles. These symptoms could be relieved temporarily by supporting both upper limbs on a rail or shrugging his shoulders. The symptoms and signs would subside spontaneously on resting. An exercise provocative test and instant relief manoeuvre, which are the main diagnostic tests for this unusual case of "dynamic" thoracic outlet syndrome, were introduced.

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Keywords: thoracic outlet syndrome; long distance running; marathon running; upper limbs; shoulder girdle

Case report

A 39 year old male amateur marathon runner presented with sports related numbness and discomfort of both upper limbs and shoulder girdles. The symptoms had been present for three years. He was asymptomatic in normal daily activities and ordinary recreational activities which included badminton and basketball. In 1995, the patient noticed numbness of the left upper limb on the C8 and T1 dermatome after he had run 10 km. The numbness gradually disappeared over the 10 minutes after he had stopped running. In early 1997, he developed bilateral symptoms after a marathon race. The symptoms persisted for two days. Since that episode, the patient had bilateral symptoms on every occasion after running 10 km. The numbness would vanish within 10 seconds if the upper limbs were supported either on a rail or his own iliac crests. The symptoms would return immediately if the support for the upper limbs was removed.

We initially postulated the cause to be hyperventilation or excessive ulnar nerve excursion at the cubital tunnel. The differential diagnosis such as entrapment of the lower brachial plexus could not be excluded.

There was no history of Raynaud's phenomenon, pain, resting numbness, clumsiness, or coldness of the hands. Physical examination gave essentially normal results, including sensation in the four limbs, muscle and hand grip power, reflexes, other neurological examination of the upper limbs, Adson's test, neck tilting test,

Halsted (costoclavicular) test, Wright (hyperabduction) test, Roos' test, and provocative tests for other nerve entrapment syndromes.

An on site physical examination was carried out to document the clinical features immediately after 10 km of running. Two manoeuvres—full extension of both elbows to alleviate entrapment of the ulnar nerve and self controlled ventilation to eliminate factors of hyperventilation—were performed. However, the patient did not show any improvement.

There was diminished touch and pinprick sensation on the C8 and T1 dermatome bilaterally which represented entrapment of the lower brachial plexus. Finally, we discovered that the symptoms and signs would disappear within 10 seconds if both upper limbs were supported on a rail or his iliac crests, or if he shrugged his shoulders.

The x ray picture of the cervical spine was normal. No radiological evidence of cervical rib could be detected. The result of the nerve conduction test was also within the reference range. The F wave and H wave were also normal. No other associated peripheral nerve entrapment could be found. Upper limb dexterity functional assessment and hand grip measurement performed by an occupational therapist was also unremarkable at rest.

The patient was diagnosed to be suffering from strenuous exercise induced thoracic outlet syndrome. To our knowledge, it has not previously been reported in the literature. It is an usual case of thoracic outlet syndrome associated with long distance running.

Discussion

Thoracic outlet syndrome is a well known disease which is due to entrapment of the neurovascular bundle of the upper limbs around the shoulder girdle. It can be classified into arterial, venous, and neurological types of compression.¹ The first two entities are easily diagnosed and there is objective physical documentation¹—for example, an angiogram.² However, the neurological type is vague³ and many cases can only be diagnosed by the history and physical examination. Spiral computed tomography scan of the thoracic outlet is futile for soft tissue compression⁴ because about 70% of the cases involve soft tissue elements only. Magnetic resonance imaging sometimes offers a better delineation of the compression elements. The sensitivity was 79%, the specificity 87.5%, and the false posi-

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Figure 1 Pathoanatomy of dynamic thoracic outlet syndrome. (A) Resting. (B) After exercise: (i) elevation of first rib; (ii) expansion of scalene muscles; (iii) increase in blood flow and the size of the subclavian vessels; (iv) the space for the brachial plexus is narrowed, and the dependent posture of the upper limb exerts traction force on the brachial plexus.

tive rate 9.5% in one study.⁵ However, the patients were all symptomatic at rest and some of them had neurological deficits including sensation loss and muscle wasting. The role of magnetic resonance imaging is still not well defined. Some authors have suggested that the major use of computed tomography scan and magnetic resonance imaging is to exclude spinal problems or other pathology rather than confirming the diagnosis of thoracic outlet syndrome.⁶ It is also difficult to define the optimal space of the thoracic outlet to accommodate the neurovascular structure.

The compression elements are heterogeneous. They can be fibrous tissue, abnormal cervical rib, callus from fractured clavicle,⁶ abnormal muscle belly and muscle insertion, soft tissue hypertrophy, traumatic fibrosis of soft tissue,⁷ and tumours. However, these patients are all symptomatic, especially when they adopt particular postures with their upper limbs. The symptomatology is considered to be a "static" form: the compression elements are constantly exerting a constrictive effect on the brachial plexus. In contrast, the symptoms of

our patient reflect a classical case of thoracic outlet syndrome but they can only be induced by long distance running. The physical findings at rest are all normal.

The mechanism for this unusual "dynamic" thoracic outlet syndrome is still not known. Based on a knowledge of the syndrome, the compression elements are likely to be the dynamic components. The scalene anterior and medius muscles may be responsible. These are also the structures that most commonly produce the neurological type of "static" thoracic outlet syndrome. These muscles are also involved in active and vigorous respiration, being well known accessory respiratory muscles.

The patient may actually have a suboptimal amount of space at the thoracic outlet to accommodate the neurovascular structures. During ordinary activities, the patient may be asymptomatic. However, the venous return and arterial blood flow increase tremendously during strenuous exercise, and the accessory respiratory muscles (scalene muscles) expand because of recruitment of the circulation within them. The other contributing factors may include elevation of the first rib because of hyperventilation and a gravitational effect of the upper limbs on the brachial plexus in the period after exercise. These factors narrow the space significantly at the thoracic outlet and give rise to neurological compression (fig 1). By supporting the upper limbs on a rail or his iliac crests, the patient widens the thoracic outlet space and also eliminates the gravitational effect of the upper limbs on the brachial plexus. He can then rapidly relieve his symptoms. It explains the pathoanatomy of this unusual case of "dynamic" thoracic outlet syndrome.

Management of the neurological type of thoracic outlet syndrome is mainly conservative,⁶ including shrugging shoulder exercises, posture advice, and training of the shoulder girdle muscles. Operative treatments should be reserved for the resistant cases. Scalenotomy, scalenectomy, excision of the constricting fibrous band, and resection of the first rib are the alternatives.¹ For a total decompression of thoracic outlet syndrome, a combination of first rib resection and anterior and middle scalenectomy can be considered.

As the symptoms of our patient occurred solely in long distance races, we reassured him and advised an exercise programme, including in particular shrugging shoulder exercises, to strengthen his shoulder girdle muscles. However, there was no significant improvement and he could no longer finish a marathon. The symptoms had neither deteriorated nor improved at a two year follow up. We do not know whether surgical decompression would be beneficial as we have no experience in managing this type of "dynamic" thoracic outlet syndrome. Further follow up should be carried out to monitor progress.

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Take home message

The telltale history, the exercise provocative test, and the instant relief manoeuvre are the diagnostic triad for this syndrome.

Late repair of simultaneous bilateral distal biceps brachii tendon avulsion with fascia lata graft

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Abstract

A 50 year old rock climber sustained a bilateral rupture of the distal biceps brachii tendons. He retained some flexion power in both arms but minimal supination, being weaker on the non-dominant right side. As the patient presented late, with retraction and shortening of the biceps muscle bellies, reconstruction was carried out using fascia lata grafts on both sides. Because of residual weakness on the left (dominant) side, three further surgical procedures had to be carried out to correct for elongation of the graft. A functionally satisfactory outcome, comparable with that on the right side, was eventually obtained. In summary, bilateral fascia lata grafts to bridge the gap between the retracted biceps bellies and the radial tuberosities were successful in restoring function and flexion power to the elbow. Despite being the stronger side, the dominant arm did not respond as well to the initial surgery. This may be due to overuse of this arm after the operation.

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Keywords: elbow; biceps brachii tendon; avulsion; fascia lata graft; tendon

Avulsion of the distal biceps brachii tendon is an uncommon injury,¹ and bilateral ruptures are extremely rare.² The incidence varies from 3 to 10% of all biceps tendon lesions,³ and usually occurs at the tendon insertion into the radial bicipital tuberosity.⁴

We present a case of an active male amateur climber with a late presentation of a simultaneous bilateral distal biceps brachii rupture. Several reconstructive procedures were required to repair the defect but a functionally acceptable outcome was finally achieved.

Case report

A 50 year old male amateur climber slipped while climbing on a rock face but held on with his fingertips while his elbows were forcefully extended against resistance. He felt a sudden give and extreme pain in both his arms

but still held on to the rock. He manoeuvred to a place of safety, and then found he was unable to straighten either arm because of pain and he carried both arms with the elbows flexed.

Rupture of the bicipital tendons was suspected and conservative treatment with analgesia was initiated. He found outdoor activities difficult and even his routine daily tasks were restricted because of weak elbow flexion. He was left hand dominant, but found his right arm weaker than the left, particularly when supinating.

The patient was referred to our clinic two years after the injury. Clinical examination confirmed that he had sustained a detachment of the insertion of both distal bicipital tendons, his right (non-dominant) arm being weaker than the left.

He underwent a right distal biceps tendon reconstruction, using fascia lata from his right thigh to bridge the defect between the retracted proximal biceps muscle and the distal bicipital tuberosity. After the operation, his right elbow was kept at 90° of flexion in a collar and cuff for two weeks; this was followed by gentle passive exercises to a maximum of 90° elbow extension for a further four weeks. He was advised not to do any heavy lifting or pulling with the arms for six months.

Six months later, the right biceps muscle was functioning and the tendon graft was palpable and pulling through with good power. At this stage he was keen to have a similar operation performed on the left side.

Eight months later, he underwent a similar operation with a fascia lata graft to the left distal biceps tendon. At review five months later, although clinically the distal insertion of the biceps tendon was intact, the result was less satisfactory than that on the right.

He admitted to overuse of the left arm after the operation compared with his right arm despite being given the same advice to avoid over stressing it. He underwent a revision of the reconstructed left biceps tendon and during surgery it was found that his bicipital tendon reconstruction was intact and a thick tendon

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