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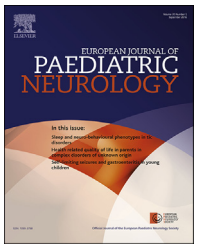

Case Study

Backpack palsy: A rare complication of backpack use in children and young adults – A new case report

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ABSTRACT

Backpack palsy is a well-recognised, albeit rare, complication of carrying backpacks. Although it has been mostly described in cadets during strenuous training, sporadic cases of brachial nerve impairment have been reported in children and young adults.

Here we reported the case of a 15-year-old girl who presented with a left-side brachial palsy with axonal denervation of C5–C7 motor roots following a school challenge for the Duke of Edinburgh Award. Her symptoms began soon after starting the challenge and included weakness of shoulder abduction and elevation, as well as forearm, wrist and fingers extension. After 6 months of physiotherapy her motor function was completely restored.

Backpack palsy can sometimes present in children and young adults. This disorder should be taken in consideration when planning for daily, as well as more challenging, physical activities in these age groups.

1. Introduction

Carrying a backpack is a common activity that many children and adults perform in their daily routines. Although largely safe, backpacks can in some circumstances impact on children's health.

Rarely backpacks can compress the brachial plexus and potentially cause plexopathies, which present mainly as motor palsy of the upper limb, though loss of sensitivity can sometime co-exist. This disorder, known as 'backpack palsy' or 'rucksack palsy', is thought to affect mostly those who carry heavy loads for long hours during the day. It is mainly described in the Army and mountain hikers.[1–4] In the former group an incidence of 29.7–53.7 per 100.000/year has been reported.[3,4] In children and young adults, backpack palsy has been reported rarely; the overall prevalence and incidence in this population is currently unknown.

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Here we present an interesting case of brachial plexus injury following the Duke of Edinburgh Silver Award Expedition, a popular activity among school aged young people in UK.

2. Case study

A 15-year-old female student took part in the 2015 challenge for the Duke of Edinburgh Silver Award Expedition. The girl had been otherwise healthy with no previous symptoms of peripheral neuropathy and with unremarkable personal and family medical history. She was of Indo-Asian ethnicity, post-menarche and weighed 36.1 kg with a BMI of 14.2.

The exact weight of her backpack was not checked at the time but based on items included it was estimated to be about 10 kg. She used a soft shell backpack with a waist strap. During the expedition she walked with her classmates for 8–10 h/day for two consecutive days. Short rests were taken several times each day. At the end of the first day, she began to develop numbness in her left hand, which did not improve after rest. She subsequently developed a profound left arm weakness during the second day with inability to extend it against gravity at the elbow, wrist or fingers with minimal shoulder abduction; of significance she did not experience any painful symptoms. After 10 days of no improvement, her primary care physician referred her to the local paediatric team for an urgent review.

At presentation, her cardiovascular, respiratory and abdominal examinations were normal. In particular there was no bruise or swelling of the left supraclavicular area suggestive of a major trauma. The neurological examination of her left arm showed no reduced muscle bulk or fasciculations. There was full range of passive movements; however, active movements were markedly reduced when compared to the contralateral arm. The most marked limitations were seen at wrist, fingers (MRC 0) and elbow extension (MRC 1). Less marked deficit was detected at shoulder elevation and abduction (MRC 3), elbow flexion, finger flexion and thumb abduction and adduction (MRC 4) (Fig. 1 a,b). Brachial, triceps and brachioradial deep tendon reflexes were absent. Sensory examination was normal. Coordination could not be tested for the left arm but was normal on the right side and lower limbs. The rest of her neurological examination was normal. The overall findings were suggestive of a peripheral motoneuropathy involving the lateral and posterior chords of the brachial plexus (C5–C7).

A plain radiograph of the cervical spine and upper arm was performed and excluded any bone injury or abnormality. An MRI was not performed. Electromyography (EMG) and nerve conduction studies were performed approximately 2 and 6 weeks after the onset of initial symptoms. The initial results showed normal sensory conduction with EMG showing a mixture of conduction block, seen in triceps, and active denervation found prominently in deltoid and to a lesser extent, extensor digitorum communis (EDC). Evidence of involvement outside of the posterior cord was suggested by abductor pollicis brevis (APB) and adductor digiti minimi, demonstrating F-wave abnormalities. The repeated study at 6 weeks post injury confirmed axonotmesis had taken place with reinnervation in deltoid and EDC. Triceps appeared still only affected by conduction block. F-waves had returned when APB was studied. EMG of biceps was normal.

The patient was managed conservatively. She was reviewed by the community physiotherapy team and instructed with daily exercises. She gradually started to recover her motor function about 4 months after the injury. A follow-up visit 6 months after the initial presentation revealed a complete recovery (Fig. 1 c,d).

3. Discussion

Brachial plexus injury secondary to backpack carrying is a rare disorder in the paediatric population. These injuries were initially described in adolescents participating in scouting or trekking activities but has subsequently only been studied in adults and particularly military populations.[1,3,4]

Studies in military personnel have attempted to identify possible risk factors associated with backpack palsy. Heavier loads and longer exercises are considered to increase the risk of injury.[3,4] Backpack design has also been reviewed in the past with the aim to distribute weight evenly through the shoulders, back and hips.[2]

Some authors have hypothesised that the risk of palsy is increased in individuals suffering from hereditary neuropathy with liability to pressure palsy (HNPP).[2] This is a rare autosomal dominant disorder caused by deletion of the PMP22 gene encoding peripheral myelin protein-22. This association has not been convincingly demonstrated, possibly given the low prevalence of both conditions in the studied population.[1,3,4] However, it has been inferred that symptoms may be induced by lighter loads in patients with HNPP. We are unable to state unequivocally that this was not present in this child as no leg sensory nerve was tested or the gene abnormality sought. However extensive testing of nerves in both affected and unaffected arms, showed no abnormality and there was no hint from the history.

Physical fitness has been also suggested as possible determinant: some Authors suggested that increased fitness may result in heavier loads carried thus increasing the risk of injury[4]; on the other side others have hypothesised that even with light loads a lower muscle bulk and a lower BMI could contribute to nerve damage.[1] In our case it was interesting to note that the patient had a very slim physical constitution with a low BMI; this may have been a predisposing factor in her case. Interestingly the expedition guidance booklet which accompanies the Duke of Edinburgh scheme already advices pack loads should not exceed 25% of total body weight. No supporting evidence for this advice is provided.

Compression of the brachial plexus may result in nerve damages of the individual roots, cords and branches and thus has reasonably varied clinical presentations. The most commonly affected muscles are the deltoid, biceps, triceps and serratus anterior and both sides are equally affected.[3,4] Sensory impairment has been reported but is rare despite paraesthesia being a common presenting feature. Pain is also very rare and would in fact suggest an alternative diagnosis such as thoracic outlet syndrome, Stinger/Burner syndrome, sporadic/hereditary neuralgic amyotrophies or