CASE REPORT

Persistent anterior interosseous nerve palsy following forearm crutch use

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SUMMARY

A 43-year-old man presented with weakness of the interphalangeal joint of his right thumb following the use of forearm crutches. On examination he was unable to oppose his thumb and index finger to form the 'ok' sign. Nerve conduction showed anterior interosseous nerve (AIN) damage along its path to the flexor pollicis longus. The patient was managed conservatively with little clinical improvement seen at 4 months. AIN palsies are very rare and account for <1% of all upper limb lesions. Although AIN palsies resulting from other causes such as surgery and blunt trauma are more common, we report the second case of AIN palsy following crutch use, and the first case in which clinical identification was confirmed using electrodiagnosis. Usual clinical practice recommends a prolonged period of conservative management with surgical management withheld for a minimum of 12 months. Correct crutch fitting and early identification of signs of associated injuries are of paramount importance.

BACKGROUND

Anterior interosseous nerve (AIN) palsies are very rare, and account for <1% of all upper limb lesions.^{1 2} The AIN arises 5–8 cm distal to the lateral epicondyle as a branch of the median nerve with entirely motor function. It passes distally under the pronator teres, and then between the flexor digitorum profundus (FDP) and the flexor pollicis longus (FPL), before travelling along the anterior interosseous membrane to the wrist.^{2–4} The AIN supplies the deep flexor compartment of the forearm, comprising pronator quadratus (PQ), FPL and the FDP tendon of the index and occasionally the middle finger.^{5 6} Clinically, the nerve palsy manifests with a characteristic inability to pinch with the tips of the index finger and thumb; known as the Kiloh-Nevin sign.³

Here we report a case of AIN palsy following the use of forearm crutches and discuss investigations and management based on the recent literature.

CASE PRESENTATION

A 43-year-old right-hand-dominant man was referred to the upper limb clinic by his general practitioner, reporting weakness of the interphalangeal joint of his right thumb for 2 weeks, having been using standard forearm crutches for a calf injury for that period. On examination, FPL tendon was intact, and functioning well when the thumb was held in abduction or extension; however, on flexion of the metacarpophalangeal joint of the thumb, he was unable to perform an

opponens test. There was no sensory component to his symptoms. Some bruising was also noted over the flexor aspect of the right forearm.

INVESTIGATIONS

An ultrasound scan of the right forearm was organised, which demonstrated an intact FPL musculotendinous unit. Nerve conduction studies revealed evidence of acute neurogenic changes in the right FPL, in the distribution of the AIN, with axonal loss.

OUTCOME AND FOLLOW-UP

The patient was managed conservatively and reviewed in 4 months. On review, there was very little improvement in clinical findings; however, the patient had adapted to the situation, for example, by altering his writing style. He found difficulty only in opening jars and removing plugs from their sockets. It was discussed with the patient that given his relatively good level of power in extension and abduction, his nerve would likely recover, although this was not guaranteed. He declined an offer of referral to a peripheral nerve unit, and as such will be followed up in 6 months.

DISCUSSION

AIN palsy is a rare upper limb neuropathy with an aetiology which can be divided into traumatic or non-traumatic/spontaneous causes. Spontaneous, or non-traumatic, causes include neuralgic amyotrophy,⁷ transient neuritis⁸ and nerve-entrapment.⁹ Traumatic injuries described have included complications of surgery,^{10 11} venous line insertion,¹² fractures, use of slings,¹³ constrictive dressings¹⁴ and due to pressure from a partner sleeping on the affected arm; coined 'honeymoon palsy'.¹⁵

There are two common types of crutches: axillary, which extend to the axilla, and forearm crutches, where weight is taken through the handles and there is a cuff around the forearm intended for balance. Forearm crutches are also known as 'elbow crutches'. To the best of our knowledge, there is only one reported case of AIN palsy following forearm crutch use;⁵ although the diagnosis was made only clinically and without the use of nerve conduction studies.

AIN palsy may be complete, with weakness of both the FDP and the FPL, or partial when one of the muscles is affected; the FPL alone was affected in this case. Both variants of AIN palsy can be identified clinically with the inability to form the 'OK' sign between the index finger and thumb, in the absence of sensory symptoms.³ It is also important

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to distinguish AIN palsy from tendon rupture, for example, of the FPL. Passively extending the wrist fully and observing for flexion of the distal interphalangeal joints of the fingers and interphalangeal joint of the thumb will demonstrate intact tendons.³ In the current case, these diagnostic tests were not performed prior to imaging and nerve conduction studies.

Electrodiagnostic studies comprising nerve conduction studies or electromyography (EMG) are considered the gold standard diagnostic test to confirm the clinical diagnosis of AIN and exclude tendon rupture.^{2–5} Imaging in the way of MRI or US scan may be considered to assess for tendon rupture, although it does not confirm or guide management of AIN lesions.¹⁶

Owing to the relative paucity of reported cases and the absence of randomised controlled trials, a management protocol has not yet been agreed. Furthermore, there is controversy around whether compressive injuries (as in this case) result in a transient neuritis which is best managed conservatively or whether a nerve entrapment plays a role; with a requirement for surgical decompression.^{2–3} All groups advocate conservative management initially, which usually comprises rest, removal of compressive precipitants and use of anti-inflammatories.^{3–5} However, the recommended time prior to surgical decompression for persisting paralysis ranges from 8 weeks to 2 years.^{6–17}

Although studies using surgical decompression have shown symptomatic relief in a number of cases,^{2–18–19} other studies using conservative management reported full symptomatic recovery up to 18 months after onset of palsy.^{2–16} In a retrospective study of 14 patients reported by Ulrich *et al*,² eight patients were managed conservatively with near full recovery in all patients, while six patients were managed surgically after not showing any signs of recovery after 3 months. Of the surgical patients, five recovered almost fully, while one later required tendon replacement due to persistent paralysis. Additionally, while reviewers have identified eight different anatomical structures causing AIN compression,^{6–9} surgical decompression studies reported no definitive source of compression in up to 40% of cases performed.^{2–20}

On account of the uncertainty surrounding the natural history of the condition, and given the recovery some patients experience even at a year after the onset of symptoms; a prolonged period of observation is the first-line treatment for most cases. On the basis of reviewed evidence, surgical management may be considered for patients showing no signs of recovery after a minimum of 12 months of conservative management.^{2–3}

Although palsy of the axillary nerve,²¹ ulnar nerve,²² radial nerve²³ and brachial plexus²⁴ has followed axillary crutch use, forearm crutch use has only been reported to cause ulnar nerve palsy,²⁵ and a single case of AIN palsy.⁵ Novel crutch designs

seek to spread the user's weight over a greater surface area, reducing discomfort and potential damage to structures.²⁶ However, there is no long-term evidence to validate their claim and they pose additional cost implications. With any crutches, care should be taken to ensure correct fit, and padding should be used if any signs of injury appear.

Contributors CRC (joint first author) identified the case report and involved in planning the draft, as well as formulating the key points of the history to write the case report. PM (joint first author) reviewed the paper in the context of recent literature to write the background and discussion sections of the paper. SMCN involved in the planning of the case report and critically reviewed the draft prior to submission.

Competing interests None declared.

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Learning points

- ▶ Anterior interosseous nerve palsy may be identified clinically by the inability to form the 'ok' sign between the index finger and thumb.
- ▶ Clinical suspicion of nerve injury should be confirmed with electrodiagnostic studies.
- ▶ Evidence indicates a prolonged period of conservative management for a minimum of 12 months prior to consideration of surgical management.
- ▶ Care should be taken when fitting crutches to prevent compressive injuries and any signs of injury should be carefully reviewed and managed in follow-up.

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