Taser barb penetration causing phalangeal fracture

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SUMMARY

We present an unusual case of phalangeal fracture resulting from direct penetration by the barb of a conducted electrical weapon (Taser). When a Taser is triggered, compressed gas propels two barbs with trailing insulated wires which deliver a pulsed electrical discharge on contact. A 51-year-old man presented with a single barb of the Taser embedded in the diaphysis of the proximal phalanx and an associated open fracture. The barb was removed under local anaesthesia. The fracture was stable and was mobilised in a flexible splint. Oral antibiotics were commenced in recognition of the risk of flexor sheath and bone inoculation. While the most severe complications associated with Taser are related to the electrical component, the most common injuries are associated with falls and barb penetrations. Clinicians must be mindful of the risk of fracture, infection and soft tissue injury when such a foreign body penetrates a phalanx.

BACKGROUND

The global trend of increasing adoption of Tasers by law enforcement organisations is also seen in England and Wales where its use by police forces increased by 39% in 2018/2019 compared with the previous year.[1] The upper limb accounts for 7.9% of Taser injuries.[2]

When the trigger is depressed, a Taser fires two barbs with trailing insulated wires up to 7.6 m at 50 m/s. On contact with a suspect's skin or clothing, an electrical discharge of 50 000 V (2 mA) is delivered in a pulsed fashion over 5 s, resulting in muscular tetany and incapacitating the subject.[2] Larger or repeated doses can be delivered by keeping the trigger depressed or by depressing it repeatedly.

Osteomyelitis or suboptimal management of a phalangeal fracture can lead to long-term pain and dysfunction in the hand. It is therefore critical to recognise the potential for these complications and take steps to mitigate them.

CASE PRESENTATION

A 51-year-old man was apprehended by Taser and was brought to the Urgent Treatment Centre (UTC) at the Rugby site (peripheral hospital) of University Hospitals Coventry and Warwickshire NHS Trust during the COVID-19 pandemic. There was a wound over the dorsum of the digit at the level of the proximal phalanx where the barb had entered and was still present. Clinical examination demonstrated intact neurovascular and tendon function. The wound appeared clean and there was no exit wound. Radiographs were requested to identify the location of the barb and to identify any fracture.

INVESTIGATIONS

Radiographs revealed that a single Taser barb was embedded in the diaphysis of the proximal phalanx of the right ring finger. There was an associated, minimally displaced, long oblique fracture originating at the penetration site and exiting the phalanx distally via the radial cortex (figure 1).

DIFFERENTIAL DIAGNOSIS

The diagnosis of foreign body penetration and open fracture is clear from the history, examination and radiographic examination of the patient.

TREATMENT

The barb was removed easily with a needle holder in a treatment room in the UTC under 1% plain lidocaine digital block (figure 2). This was facilitated by a stab incision which also allowed for irrigation to the depth of the wound. The fracture was clinically stable. The extensor tendon was perforated but did not require repair. Repeat radiographs showed that the fracture had spontaneously reduced after barb removal and did not require fixation. The digit was dressed with Inadine and Cosmopore and was mobilised in a Bedford splint. A course of oral co-amoxiclav was commenced in recognition of the risk of flexor sheath and bone inoculation, and the patient was discharged back to police custody.

OUTCOME AND FOLLOW-UP

Fracture clinic with radiographs at 1 week and telephone follow-up at 4 weeks confirmed that the patient made a full recovery.

DISCUSSION

Developed by physicist Jack Cover in the late 1960s and commercialised in 1974, the device and acronym were inspired by the novel 'Tom Swift and his Electric Rifle' (TASER), which features a character who invents a rifle that shoots bolts of electricity.[3] The initial 'A' was added to facilitate the acronym.

The Taser was initially available for sale to the public in the USA in 1993, but supply to law enforcement agencies did not begin until 1999.[4] Since then, the global use of Tasers has grown to over 13 000 agencies in 44 countries, including law enforcement and correctional and military agencies in the USA, Canada, UK, France, Australia and New Zealand.[4]

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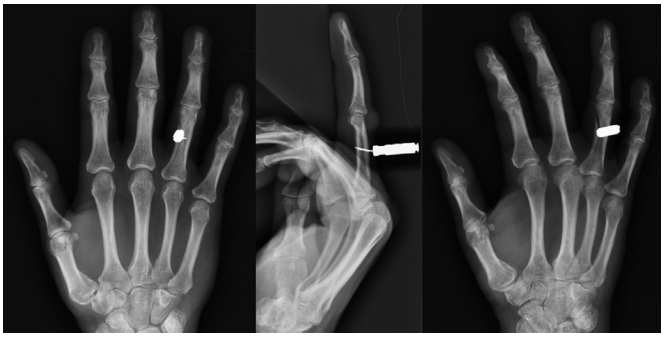

Figure 1 Radiographs demonstrating embedded barb and fracture of the proximal phalanx, right ring finger.

Reports of arrhythmias and sudden death are among the most severe adverse events of its use in the field. It is recognised that a greater proportion of those who died following Taser exposure had pre-existing cardiovascular disease (50%), use of stimulants (>75%), a state of 'excited delirium' (>75%) and prolonged exposure (median discharge durations of 17–25 s).[3] A review of complications following Taser exposure concluded that while the most severe events (such as cardiac arrhythmia) relate to the Taser's electrical component, the most common causes of injury are barb penetration and falls.[3]

Penetrating hand injury from a Taser barb is rare. TASER International advise that the back should be the point of aim where feasible.[5] The recommended frontal point of aim has been amended from the centre of mass to the lower centre of mass to minimise the risk of facial injuries and potential arrhythmias from cardiac involvement.[5] This also increases the effectiveness in close-spread discharges of Tasers by increasing the likelihood that at least one barb will engage the major muscles of the pelvic girdle or thigh.[5]

To date, there has been only one other case of Taser-related hand injury treated at our institution, and in that case, there was no bony involvement. In the literature, there are four other reported cases of phalangeal penetration worldwide,[2] but this is the first reported case of phalangeal fracture from direct barb penetration. This may be because the other patients were younger and had a higher bone density. Fractures attributable to direct barb penetration are rare due to soft tissue interposition and are more likely a result of falls from pain or temporary paralysis on device activation.[2] It is interesting to note a case report of frontal bone penetration in a 23-year-old requiring surgical removal of barb from skull and cerebrum, emphasising the significant force associated with the Taser barb and the relevance of anatomical site in injury severity.[6]

Figure 2 Barb removed from the patient. Taser X2 barb dimensions: 11.5 mm (length), 0.76 mm (thickness) and 1.7 mm (widest point).

The Taser can also be deployed in 'drive stun' mode, where, instead of firing the barbs from a distance, the device is directly applied to the subject. A patient was reported to develop a complete brachial plexus palsy, with residual deltoid weakness and forearm paraesthesia at 2 years of follow-up, when a Taser was applied to Erb's point in this way.[7]

In summary, penetrating injury to the hand as a result of a Taser is rare. Injuries are more likely to result from falls secondary to temporary paralysis. However, it is paramount for clinicians to be aware of the potential for penetrating injury to the hand on the background of wide and increasing adoption of Tasers. This case illustrates the pertinent aspects of managing an open penetrating hand injury from a Taser barb with associated foreign body embedment and open fracture.

Patient's perspective

The finger has recovered reasonably well. The scarring is raised and, being the ring finger, I find it too uncomfortable to wear a ring. I get the odd twinge in the finger. However, I can ride my motorbike again and I have not lost any strength or dexterity in my hand.

Learning points

- A targetted history and examination is mandatory to characterise bony and soft tissue trauma in cases of Taser-related injury, including barb penetration, falls, neurological deficit and arrhythmias.
- Recognise the risk of osteomyelitis and other deep infections as a result of foreign body penetration and prescribe prophylaxis accordingly.
- Early mobilisation is critical in the rehabilitation of all hand injuries and should be undertaken as soon as the injury pattern will allow.

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