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## CASE REPORT

# Penetrating spinal injury by a projectile diamond bead in a limestone quarry

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## Introduction

Penetrating spinal injuries in the civilian population are uncommon. Gunshots account for the majority of cases, with infrequent reports of other foreign bodies as causative agents.<sup>1–5</sup> This unique case describes cauda equina syndrome as a result of a penetrating spinal injury by a projectile diamond bead.

## Case report

While operating a jackhammer, a 39-year-old man stood approximately 100 m behind a diamond wire saw, a stone cutting device commonly used in the stone quarry industry. The diamond wire (Fig. 1) snapped resulting in high-speed projection of its components including the diamond beads (Fig. 2). One such bead impacted with the patient's lower back.

On presentation to the National Spinal Injuries Unit a 1 cm circular puncture wound was noted in the right paravertebral region at the level of the third lumbar vertebra (L3). Neurological assessment

revealed reduced power in the left lower limb, with Medical Research Council (MRC) grades of four out of five in knee extension and ankle dorsiflexion and three out of five in extensor hallucis longus (EHL) and ankle plantar flexion recorded. Voluntary anal contraction was absent.

Radiographs of the lumbar spine confirmed the presence of the diamond bead posterior to the body of L3 (Fig. 3). Computed tomography (CT) of the lumbar spine demonstrated a metallic foreign body within the spinal canal at L3. Fragmentation of the right lamina with bony particles within the spinal canal at this level was also noted (Fig. 4).

Pre-operatively tetanus toxoid was administered in addition to intravenous cefuroxime and gentamicin. Under general anaesthetic, the patient was placed in the prone position. A midline incision, incorporating the puncture wound, was made. A right paravertebral tract extending through the lamina at L3 was noted. Right L3 laminectomy revealed a 12 mm dural tear. The diamond bead was identified within the spinal canal and removed. The nerve roots at this level were intact. The dural tear was repaired using a combination of dural graft matrix and fibrin glue.

A supine position was maintained for 48 h post-operatively and intravenous antibiotics were continued for 7 days. During this time motor function in

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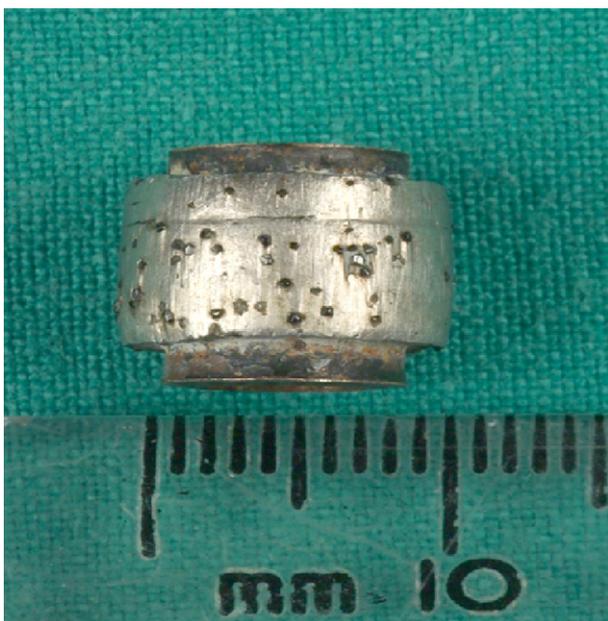


**Figure 1** Segment of diamond wire; a steel cable threaded through steel beads to which diamond is bonded.

left EHL and plantar flexion improved to MRC grade four out of five. Voluntary anal contraction remained absent and trial without catheter was unsuccessful. The patient was discharged to a specialist rehabilitation centre. On review 3 months later anal tone and bladder function were clinically normal.

## Discussion

This is the first reported case of a penetrating spinal injury as a result of a projectile diamond wire saw component, although breakage of diamond wires is a recognised occupational hazard.<sup>1</sup> Gunshots are the most frequently reported causative agents of such injuries although other foreign bodies have also been implicated including knives,<sup>2</sup> glass,<sup>4</sup> wood<sup>5</sup> and chopsticks.<sup>3</sup>



**Figure 2** The diamond bead, a component of the diamond wire, which was retrieved from the spinal canal at the level of L3.



**Figure 3** Lateral plain radiograph of the lumbar spine. Radiopacity consistent with diamond bead projected posterior to the L3 vertebral body with no discrete fracture identified.



**Figure 4** Sagittal reconstruction of non-contrast CT lumbar spine: diamond bead with associated streak artefact located within the spinal canal posterior to L3. In addition there is a comminuted fracture of the right lamina with displacement of fragments into the spinal canal.

Plain radiographs will identify radio-opaque foreign bodies. The increased spatial and contrast resolution of CT improves perspicacity of foreign bodies, metallic and otherwise, within the spinal canal. The high soft tissue resolution and tissue characterisation capabilities of magnetic resonance imaging is of use in the detection of non-metallic foreign bodies,<sup>5</sup> in addition to associated spinal cord injury, haematoma and/or oedema.

The environmental debris associated with such foreign bodies increases the infection risk and necessitates protection against both *Pseudomonas aeruginosa* and gram-positive organisms. Anaerobic cover may also be required. Tetanus prophylaxis is essential.<sup>7</sup>

Indications for surgery include spinal instability, cord compression, nerve root compression and cerebrospinal fluid leak. Cauda equina lesions carry a better functional prognosis than spinal cord injuries. Recovery, however, is unpredictable. Age, energy transfer to neurovascular structures and timing of decompression may all play a role, although the latter is controversial.<sup>6</sup>

Penetrating spinal injuries warrant multimodality radiological imaging in addition to early transfer to a spinal injuries unit. When indicated, surgical explora-

tion, foreign body extraction and decompression allow for potential recovery of neurological function. Antibiotics and tetanus prophylaxis are important adjuncts to surgical management. Additional rehabilitation in a specialist centre is recommended.

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