CASE REPORT

Penetrating brain stem injury from crossbow bolt: a case report and review of the literature

A. A. SALAM, K. S. EYRES, A. D. MAGIDES & J. CLEARY

** The Orthopaedic Department, Huddersfield Royal Infirmary, Huddersfield; Orthopaedic Department, King Edward VII Hospital, Sheffield; and Royal Hallamshire Hospital, Sheffield*

SUMMARY

Because injury to the brain stem is usually associated with diffuse brain damage, recovery is rare and mortality high. A non-fatal penetrating injury involving the brain stem is described from a crossbow bolt. The diagnosis and management of such injuries are discussed.

INTRODUCTION

Because injuries to the brain stem are usually associated with diffuse brain damage, mortality is high and recovery from coma prior to death is unusual.

Reversible damage to the brain stem from a closed injury has been reported (Shakir, 1984), but the authors were unable to find such an outcome following a penetrating injury in the literature.

A case is presented to demonstrate the remarkable recovery from a penetrating injury to the brain stem from a crossbow bolt.

CASE

A 24-year-old man was found unconscious with a cross-bow bolt arrow penetrating the right temporal region. The bolt, thought to have been fired accidentally, was

wooden and metal-tipped and had been removed by the patient's brother. On admission, he was breathing spontaneously, but unconscious and bleeding from the right ear and the scalp wound. The pupils were constricted and reacting equally to light stimulus. Tendon reflexes were sluggish with bilateral plantar responses. Brain stem auditory and visual evoked responses were normal.

He was ventilated and transferred to the Neurosurgical Unit at Pinderfields Hospital, Wakefield for a computed tomographic (CT) scan of his head. CT scan showed the entry point in the right temporal bone and a haemorrhagic track containing air crossing the right temporal lobe. The track passed between the tectum and tegmentum at the ponto-mesencephalic level of the brain-stem. Sub-arachnoid blood was present in the circumpeduncular and in posterior fossa cisterns. Although the intracranial contents were tight, there was no significant haematoma or mid-line shift. (Fig. 2) Surgical decompression was not considered necessary and the prognosis thought to be extremely poor.

However, having been ventilated for 5 days, he regained consciousness, but lacked motor function in the limbs. A tracheostomy was performed and the endotracheal tube was removed. At 10 days post-injury, he was still aphasic but able to move all four limbs (power grade 111). After 2 weeks, speech had returned, although dysarthric and he was able to sit out unaided. The relatives noticed a personality change. The tracheostomy was closed 3 weeks post injury and he mobilized using an electric wheelchair and was allowed home for short periods. The CT scan at this stage showed resolution of the bolt tract. (Fig. 2)

At 4 months following the injury, he can feed and dress himself, walk with a frame and sit unsupported.

Fig. 1. Track from bolt is shown crossing the brain stem of ponto-mesencephalic level.

Fig. 2. Four weeks post injury, the track has resolved (scan performed at different hospital, hence identical slice not available).

The outcome from this brain-stem injury has been remarkable.

DISCUSSION

Discrete injuries to the brain stem are rare and more often associated with a diffuse injury to the intracranial contents. As a result, recovery from coma in such lesions is rare and mortality is high.

From a necropsy study of head injury patients with prolonged coma, Crompton (1971) found that brain stem haemorrhages were a common finding and that coma occurs due to injury to the rostral part of the brain stem.

Recovery following brain-stem injury is rare. Shakir *et al.*, (1984) reported haematoma of the upper brain stem due to a direct blow to the head. Headache, vertigo and difficulty in sitting occurred 2 h after regaining consciousness with ophthalmoplegia. CT showed a small haematoma in the midline of the upper brain stem which had resolved on subsequent scans taken 4 weeks later as did the clinical features.

Most penetrating injuries of the brain are caused by metallic objects (Thomas, 1987) or low-velocity missiles (Suddaby *et al.*, 1987). Jooma *et al.* (1984) described a penetrating injury to the frontal lobe from a piece of wood. He stated that wood may not be evident on CT scanning due to its low attenuation which can be

confused as pneumatocele. Careful debridement was essential to avoid suppuration common after such injuries (Miller *et al.*, 1977).

Conversely, Suddaby *et al.*, (1987) reviewed 49 cases of 0.22 caliber gunshot wounds to the head and concluded that tract exploration in most cases was not indicate because of the low incidence of complications such as infection. Haematoma should be treated independent of aetiology. As a general rule, penetrating head wounds, especially if due to wood, are best treated by early radical debridement, with thorough exploration of the tract to remove debris and indriven hair. (Small, 1957)

However, despite the conservative approach to this case, the outcome has been suprising. The entrance hole made by the bolt may have acted like a burr hole to reduce intracranial pressure. The wound was clean with no evidence of cerebral infection.

The authors were unable to find a similar case of survival from a penetrating brain stem injury.

ACKNOWLEDGEMENTS

The authors wish to thank the Medical Illustration Department at the Northern General Hospital, Sheffield for their contribution to this manuscript.

REFERENCES

- Crompton M. R. (1971) Brainstem lesions due to closed head injury. *Lancet*, **i**, 669–73.
- Jooma R., Bradshaw J. R. & Coakham H. B. (1984) Computed tomography in penetrating cranial injury by a wooden foreign body. *Surgical Neurology* **21**, 236–8.
- Miller C. F., Brodkey J. S. & Colombi B. J. (1977) The danger of intracranial wood. *Surgical Neurology* **7**, 95–103.
- Shakir A., Khan A. (1984) Traumatic brain stem haematoma without prolonged loss of consciousness. *British Medical Journal* **288**, 446–7.
- Small J. M., Turner E. A. (1957) A surgical experience of 1200 cases of penetrating brain wounds in battle. *British Journal of Surgery* **1**, 2–74.
- Suddaby L., Weir B. & Forsyth C. (1987) The management of .22 caliber gunshot wounds of the brain: A review of 49 cases. *Canadian Journal of Neurology Science* **14**, 268–72.
- Thomas M. D. & Siu K. (1987) An unusual cranial injury caused by an industrial nail-gun. *Medical Journal of Australia* **147**, 602–3.