

Cervical spine fracture in a boxer — a rare but important sporting injury

A case report

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Summary

Cervical vertebral injuries are rare in boxing. The case of an adult boxer with an isolated vertical fracture of the anterior arch of the atlas is described. The mechanism of injury, clinical presentation, complications and treatment are discussed. Measures to prevent head and neck injury in boxing are discussed.

S Afr Med J 1983; 63: 328-330.

Jefferson¹ in 1920 published a comprehensive review of atlantal fractures. These fractures may occur in association with fractures of other cervical vertebrae, or they may occur in isolation. Isolated atlantal fractures comprise 2 - 13% of fractures of the cervical spine² and may be classified anatomically into those involving the posterior arch, the lateral masses or the anterior arch, or any combination thereof.

Isolated anterior arch fractures are rare and are conveniently classified into horizontal and vertical fractures. A review of the English literature revealed only 3 cases of isolated horizontal fractures³ and 4 of isolated vertical fractures.^{1,4} We believe that we are reporting the 5th case of an isolated vertical fracture of the anterior arch of the atlas. We feel that the paucity of reports indicates that these fractures are not looked for with sufficient frequency and are probably overlooked on routine radiographs.

Although much attention has been drawn to head injuries in boxers,^{5,6} little is given to cervical spine trauma. Analysis of our patient's injury reveals the importance of understanding the mechanism of injury and emphasizes the need for definitive measures to prevent or minimize head and neck injuries in this sport. In addition, we advocate a high index of suspicion for cervical spine damage in boxing injuries.

Case report

An extremely fit 27-year-old light-heavyweight amateur boxer attended hospital in April 1981 with recurrence of a headache which had started suddenly after a sparring session in December 1978. During this session he had received several hard blows to the head. The initial headache lasted for 4 weeks and was partially relieved by manipulation. Six months later he resumed boxing despite mild persistence of the headache.

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Date received: 10 May 1982.

He reached the national semifinals in October 1979, losing on points after receiving a severe blow during the third round. This exacerbated the headache. The next twelve fights he won uneventfully and again reached the national semifinals in 1980.

In March 1981, without adequate preparation, he lost a fight which had to be stopped in the third round when, in a dazed, defenceless state, he received several powerful blows to his head. A diagnosis of concussion was made after medical attention had been given at the ringside. The patient 'slept' for 3 days and awoke with a severe headache and a transient disturbance of balance. He reported to us a month later with persistence of the headache which had troubled him since 1978. The headache was experienced in the occipital region from where it radiated to the front. It was worse in the afternoon and after running, but was not aggravated by coughing. Nausea, vomiting, syncope or neurological deficit never occurred. Only partial relief was obtained from conventional oral analgesics.

Clinical examination of this mesomorphic 79,5 kg Asian adult male revealed no external evidence of any neck injury or systemic disease. The neck muscles were particularly well developed. Neck movements were full and without crepitus. Mild muscle spasm was detected in the occipital region. Spurling's sign was elicited on the right. The posterior pharyngeal wall was normal. Neurological examination revealed no abnormality of higher mental function and completely intact motor and sensory systems.

The only skull radiograph that revealed an abnormality was the basal view (Fig. 1) which showed a fracture in the anterior arch of the atlas, the features being consistent with an old ununited fracture. Anteroposterior tomography confirmed this, and final proof was obtained by computed tomography (CT) of the upper cervical spine (Fig. 2).

Discussion

Mechanism of injury of anterior arch fracture

Fractures of the first cervical vertebra are caused by direct or indirect force. Direct injuries are usually caused by penetration of the oropharynx. The mechanism involved in those produced by indirect violence is one of transmitted force; during hyperextension of the head, the odontoid process comes to lie against the anterior arch of the atlas. With extreme force, fractures of either odontoid process or atlas may result.¹ We suggest that in boxing an unexpected direct blow to the head may deliver sufficient force for this fracture to occur.

Clinical features

The manifestation of these fractures is nonspecific. Suboccipital pain and headaches are accompanied by neck stiffness, rigidity of neck muscles and limitation of neck movement. Other findings reported^{1,2} include retropharyngeal swelling as well as tenderness and crepitus on palpation of the posterior pharyngeal wall opposite the level of the soft palate. Nodding is especially restricted in the acute phase following an uncomplicated atlas

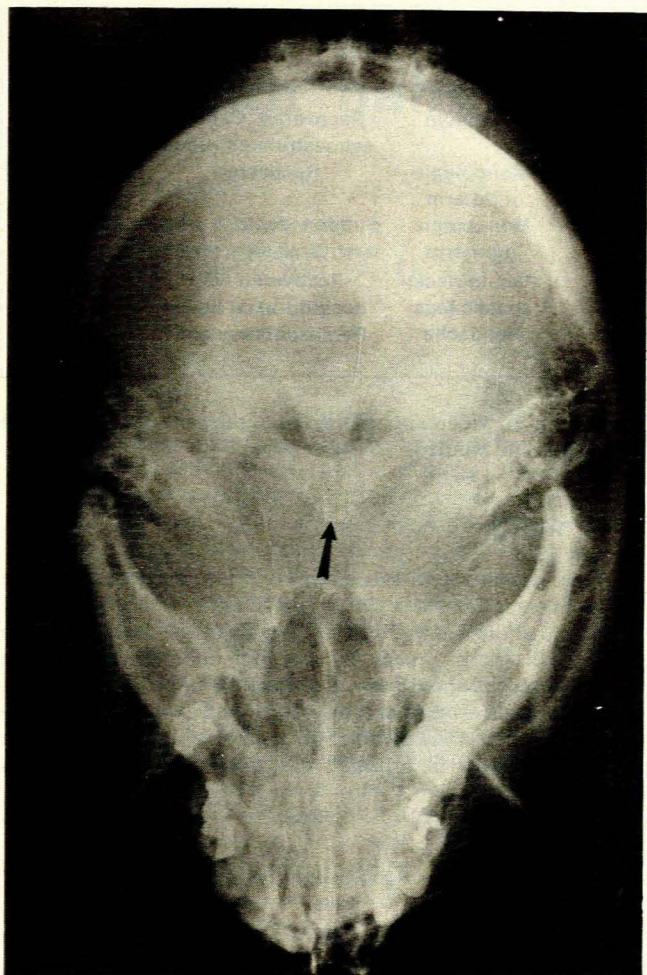


Fig. 1. Basal radiograph showing a fracture to the right of the midline (arrow) in the anterior arch of the atlas.

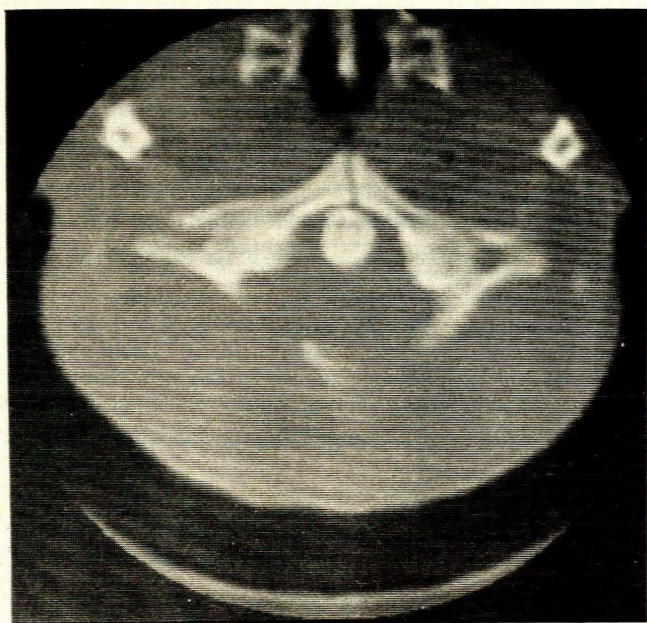


Fig. 2. Whole-body CT scan demonstrating the anterior arch fracture. Note the sclerotic edges and the absence of 'mushrooming'.

fracture. Compression of the head onto the body may elicit occipital neuralgia (Spurling's sign).⁷ Occasionally dysphagia^{1,2,8} and speech changes may occur. Evidence of associated neurovascular injury should always be sought.

Diagnosis

Persistent headaches in patients involved in contact sport should arouse suspicion, particularly when there is a past history of neck injury.

Routine cervical spine radiographs may not reveal an isolated fracture of the anterior arch of the atlas, and basal skull views are essential to demonstrate these fractures. CT is ideally suited for cross-sectional visualization of the cervical spine⁹ and is to be recommended when fractures are suspected on clinical or radiological grounds.

Differentiation between congenital and traumatic lesions of the anterior arch may be difficult.^{10,11} Isolated congenital fissures of the anterior arch of the atlas are rare, as opposed to those of the posterior arch which may be found in approximately 3% of the population.¹⁰

Radiological features of the congenital abnormality^{10,11} are: (a) a mushroom-like broadening of the anterior arch on lateral and axial views; (b) a keel-like appearance of the terminal segments of the arches on the axial view; and (c) median positioning.

Complications

Injury to the occipital and cervical nerves is more common with posterior arch fractures owing to their proximity. Similarly, the vertebral artery escapes harm. Cord injury has been reported with fractures of the anterior arch^{1,4} but is commoner with multiple fractures and/or dislocations of the cervical spine. Osteomyelitis in the bony sequestrum is more likely when the nasopharynx has been penetrated. There is no evidence in the literature as to whether these fractures unite with bed rest.

Management

Conservative treatment is advocated in uncomplicated stable fractures. It seems reasonable to treat this as any other stable cervical fracture, with immobilization for 6 - 12 weeks and anti-inflammatory and analgesic medication. Neck-strengthening exercises should be considered once the patient is symptom-free and the stability of the fracture confirmed on flexion-extension views. Contact sport is not to be resumed. Surgical intervention may be necessary when the fracture is complicated by neurological deficit, particularly when subluxation can be demonstrated on investigation.

Prognosis

The outcome in isolated closed fractures appears favourable, although reported cases are few. The only fatality was from a direct suicidal bullet injury while the only patient operated upon recovered from neurological deficit and was symptom-free 1 year later (Table I).

Prevention of head and neck injuries

Injuries to the head and neck in boxers include soft-tissue injuries, fractures, intracranial haemorrhage¹² and the 'punch-drunk' syndrome.⁶ Cervical spine injuries have not, to our knowledge, been reported in the English literature.

Several measures may be taken to reduce the risk and severity of head and neck injuries in boxing.

An awareness of the risk in injury should be engendered in the boxer, the trainer and the medical personnel. Apart from general

TABLE I. REPORTS OF ISOLATED VERTICAL ANTERIOR ARCH FRACTURES

Patient	Author	Mechanism	Force	Clinical	Outcome
1	Jefferson ¹	Unknown	Unknown	Unknown	Recovered. Carious sequestrum extruded
2	Jefferson ¹	Fell down stairs	Indirect	Monoplegia right arm	Recovered
3	Jefferson ¹	Suicidal shot through mouth	Direct	Monoplegia right arm	Sudden death 6 weeks later. 'Brainstem myelitis'
4	Tolo and Weiland ⁴	Rocket fragment	Direct	Pain in neck; spastic legs	Recovered with occipito-axial fusion
5	Our case	Boxing injury	Indirect	Headache	Persistent headache

physical fitness the training programme should specifically concentrate on strengthening the neck muscles. Isotonic exercises are superior to isometric exercises for this purpose.¹³

Boxing technique needs more emphasis. The neck is particularly vulnerable to injury when receiving an impact in flexion or hyperextension.¹⁴ Voluntary splinting of the neck by muscle contraction is impractical since the reaction time may be too long, especially in a dazed defender.

Injury may be lessened by reducing the impact of a blow. An alert boxer will 'ride' an oncoming blow when not able to avoid it. Better padding of gloves will also reduce the transmitted force on impact. Brightly coloured gloves (e.g. orange) may be more noticeable, thus providing the defender with more time to prepare for oncoming blows.

Fights in which serious injury is being incurred should be stopped immediately. The potential for serious damage is greatly increased in the dazed defender with altered muscle tone and reaction time. This difficult decision to stop a fight should be based on objective criteria. A demerit system to limit brain damage in boxers has been suggested.¹⁵

Efficient medical attention at the ringside is vital. Observation of the mechanism of injury may help in making an accurate diagnosis in a boxer who has suddenly collapsed. Apart from concussion and acute intracranial haemorrhage, we wish to draw attention to the possibility of neck injury and even cervical spinal cord injury in boxing. Improper handling may cause extension of such an injury and even death.

It is therefore vital that provision for such instances be made, so that medical personnel may have ready access to the ring. Special care is required in the handling of patients with suspected cervical spine fractures and the 'ringside team' should be well rehearsed in a safe method of transferring a patient on to a stretcher.¹⁴

Sport medicine, being a new field, can benefit from pooled information and experience. A register of all neck injuries will aid the analysis and understanding of the mechanism of injury, its manifestation, and its treatment and prognosis. Where pos-

sible, films or videotape recordings of relevant matches should be sought and studied.

Comment

We have drawn attention to a rare cervical spine fracture. In the light of recent interest in cervical spine injuries in South Africa, we urge that the Rugby Neck Injuries Registry¹⁶ be expanded to include all sporting neck injuries. An understanding of the biomechanics of these injuries is essential in order to arrive at effective preventive measures. It is only with the full co-operation of persons involved in high-risk contact sport that sufficient data can be collected to institute an active prevention programme.

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