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

A case report

S. D. STRANO, A. D. MARAIS

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.


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 fractures1 and 4 of isolated vertical fractures.3 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.

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 vertebrae 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 reported1,2 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

2 Military Hospital, Wynberg, CP
S. D. STRANO, M.B. B.CH (Present address: Department of Anatomy, University of Cape Town)
A. D. MARAIS, M.B. CH.B.

Date received: 16 May 1982.
fracture. Compression of the head onto the body may elicit occipital neuralgia (Spurling's sign),\(^7\) Occasionally dysphagia\(^1\),\(^2\) 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 spine\(^9\) 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.\(^1\)\(^,\)\(^11\) 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.\(^1\)\(^,\)\(^10\)

Radiological features of the congenital abnormality\(^1\)\(^,\)\(^10\)\(^,\)\(^11\) 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 1).

**Prevention of head and neck injuries**

Injuries to the head and neck in boxers include soft-tissue injuries, fractures, intracranial haemorrhage\(^1\)\(^,\)\(^2\) and the 'punch-drunk' syndrome.\(^5\) 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
physical fitness the training programme should specifically concen-
trate on strengthening the neck muscles. Isotonic exercises are su-
uperior to isometric exercises for this purpose.13

Boxing technique needs more emphasis. The neck is particu-
larly vulnerable to injury when receiving an impact in flexion or
eryperextension.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 pre-
pare 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 sus-
pected 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.

**REFERENCES**

52: 1017-1023.
3. Stewart GC, Gehweiler JA, Laib RH, Martinez S. Horizontal fracture of the
4. Tolo VT, Weiland AJ. Unsuspected atlas fracture and instability associated
6. Mawdsley C, Ferguson FR. Neurological disease in boxers. Lancet 1963; II:
795-801.
9. Kershner MS, Goodman GA, Perlmutter GS. Computed tomography in the
10. Kühne D. Fissures in the anterior arch of the atlas diagnosed by careful study of
Radiology 1974; 114: 341.
12. Gonzales TA. Fatal injuries in competitive sports. JAMA 1951; 146: 1506-
1511.
77.
14. Schneider RC. Head and Neck Injuries in Football Baltimore: Williams &