CASE REPORT

A potentially life threatening cervical spine injury

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Case history

A 24-year-old female was involved in a road traffic accident. She was a driver of a car, which was hit on the near side by another speeding car. She was wearing a seatbelt and the airbag was deployed. Her GCS at the scene was 5 and she was transferred to the Accident & Emergency Department for acute management. On arrival at the local A&E department she had a GCS of 5 and she received care as per the ATLS protocol. She was in intubated in the department with standard cervical spine protection. At the scene she was found not to be moving her left leg but there was no evidence of any injury on assessment. She had seatbelt bruising across her anterior chest wall but no obvious lung or skeletal damage. There were no other injuries evident. She was haemo-dynamically stable. Cervical spine, chest and pelvic X-rays and her CT abdomen were all normal but the CT of her head showed large bilateral frontal contusions and traumatic subarachnoid haemorrhage in the basal cisterns, in particular, anterior to the brainstem. There was wide spread cerebral oedema (Fig. 1). She was referred to the Regional Neurosurgical Unit.

On arrival at the Regional Neurosurgical Unit she had intracranial pressure monitoring commenced opening pressure being 16 mm of mercury. She was sedated with an ICP line in place. This was removed after 4 days of normal pressure and she was gradually weaned off the sedation after 12 days. At this time percutaneous tracheostomy was needed and therefore performed. Serial CT scans of the head showed no new changes. She had MRC grade 4 weakness on her left side and bilateral nystagmus and diplopia. Her cognitive function was improving. She was fit to be discharged from the Intensive Care Unit to the normal ward to commence rehabilitation after 3 weeks on Intensive Care.

She continued to improve with no complaints and was making good progress. Her tracheostomy was removed after 5 weeks, however, 6 weeks after the accident she began to complain of lateral neck ache at the same time as she was starting to mobilise upright. On examination she was found to have right-sided muscular tenderness in the neck with no midline tenderness. There was a good range of neck movements, which were pain free. She had persistent left-sided weakness of the arm and leg of MRC grade 4 with no sensory signs. Reflexes were brisk and tone was slightly decreased on the left side. She had bilateral nystagmus and diplopia. Repeated AP and lateral neck X-rays were completely normal.

It was decided to investigate this further and subsequent MRI of cranio-cervical junction and of the cervical spine revealed atlanto occipital subluxation with settling of the odontoid on the cranial base (Fig. 2).

Due to the MRI results she went on to have 3D CT reconstruction which showed a motion fracture of the inner loop of the foramen magnum on the left with a loose bone fragment being displaced superioraly and medially (Fig. 3). There was no suggestion of any destruction of middle or posterior spinal columns in the rest of the cervical spine. Controlled flexion extension views showed no abnormal movements. Review of the presenting CT is suggestive of a fragment associated with a haematoma anterior to the brainstem. After considerable consultation it was felt that this would be best treated conservatively as it was over 6 weeks after the injury, and there was no abnormal displacement on flexion/extension views. She was therefore managed in a hard collar and successfully discharged from the Neuro-rehabilitation. On
follow up at 18 months from the injury she had repeat CT scan which showed some reabsorption of the anterior fragment with no progression of the subluxation. Plain X-rays of the cervical spine also demonstrates good fusion mass around the cranio-cervical junction (Fig. 4). She is now completely self-caring and well.

Discussion

In the literature there are few cases reported with combined subluxation and foramen magnum fractures. They were also managed conservatively whilst diagnosis was established, but with halo fixation. Obviously with the mode of injury the potential for serious injury to the cervical spine is quite high, and is more often in mid to lower cervical vertebra and so the possibility of cranio cervical junction injury may easily be overlooked, as in this case. The usual presentation of atlantooccipital injuries is sudden death from massive brainstem trauma or at the very least severe neurological deficit requiring full ventilatory support. The mechanisms for such an injury often involve high velocity deceleration with severe cranio cervical disruption from hyperextension and rotational forces, which may be combined with either a destructive or impaction force. This typically results in rupture of the alar ligament, which restricts rotation of the upper cervical spine and the transverse ligament which restricts flexion as well as anterior displacement of the odontoid peg.
It is imperative that once these injuries are diagnosed on CT or MRI that steps are taken to ensure adequate and prompt immobilisation. The mainstay of treatment even in the acute phase is either hard collar or halo brace fixation for 12–16 weeks. In some cases the patients undergo formal occipito-cervical fusion but this appears to be a preferred mode of treatment in the chronic phase where multi-directional instability becomes more evident. In this case however when the injury presented itself 6 weeks from the accident there are few people who would advocate surgical stabilisation because of the degree of fibrous union at the fracture/subluxation site. This would make the injury quite stable and external mobilisation with either halo or hard collar would be appropriate.

The EAST (Eastern Association for the Surgery of Trauma) practice guidelines suggest that trauma patients who have a reduced level of consciousness from a brain injury and are unable to complain of neck pains or neurological deficits for greater than 24 h after injury would be considered to have a stable injury if three review plain radiographs and thin cut axial CT images through C1 and C2 read as normal by an experienced physician. This combination provides a false negative rate of less than 0.1%. The addition of plain neck X-ray does not contribute to the identification of clinically significant injuries. If these are seen to be normal then MRI scanning can be done to assess the integrity of the soft tissues. If this is unhelpful and the patient has deficits or pains then flexion/extension views can be done to diagnose possible ligamentous disruption.

Combination of fracture of the anterior foramen magnum and occipital condyles is unknown. It may be associated with instability of the cranio cervical junction. Fracture of the occipital condyles following cranio-cervical injury is not uncommon in children and young adults. Unfortunately due to the force necessary to produce this type of injury the potential for serious central nervous system injury is quite high. This can be medullary or pontine avulsions or transections or lacerations of the upper cervical cord, hence the usual presentation for this injury to the cranio-cervical junction is death. Cases reported commonly involve children and it is estimated that traumatic atlanto occipital injuries are seen in up to 25% of fatal Paediatric trauma. It has also been suggested that the force behind airbag deployment could be instrumental in atlanto occipital dislocation/subluxation, especially in children and often results in fatality. There are cases however where patients are admitted with no neck symptoms or neurological deficit post trauma but on examination they suddenly deteriorate and arrest. At autopsy they are found to have atlanto occipital dislocation. This case however involves atlanto occipital subluxation in combination with the foramen magnum fracture, which is surprising considering the substantial force of injury necessary to cause such a fracture here. It is also uncommon to see a cranio cervical injury in the absence of facial (mandibular) or truncal injuries (aortic lacerations) or in fractures which may all lead to neck hyper-extension and flexion in various directions. As such her cranio-cervical junction injury was not suspected and only in retrospect was the bone fragment recognised as such, and not as was originally thought, part of the acute haemorrhage.

**Conclusion**

In major trauma patients, despite normal plain X-rays if there is haemorrhage around the brainstem or the foramen magnum and atlanto-occipital joint, then joint integrity should be investigated. In this case the prolonged acute management phase with 2 weeks of sedation and 3 weeks of immobility ensured good fibrous union prior to transfer to a regular ward and a significant bony union prior to actual patient mobilisation, i.e. essentially the standard conservative management, but without the halo brace. A low level of suspicion should be maintained for such an injury in such a case. The presence of normal standard X-rays does not help rule out such an injury.

**References**