Case report of cranio-cervical dislocation in a child

Mayuri Govind MBChB (Natal), FCRad. Diag (SA), Dept of Radiology, Inkosi Albert Luthuli Central Hospital
J Maharajh MB ChB (Natal), FC Rad. Diag (SA), M Med (Natal), Dept of Radiology Nelson R Mandela School of Medicine (UKZN)

Abstract
This case report covers cranio-cervical dislocation in a child and the role of imaging to arrive at a diagnosis [1-3]

Keywords: spine; trauma; distraction.

Case report
A 10-year boy was referred from a regional hospital to the neurosurgical department at our institution with the history of having fallen from a shopping trolley with a sudden drop of Glasgow Coma Scale (GCS) to 3/15. Upon resuscitation the GCS increased to 7/15.

A computed tomography (CT) scan of the brain done at the regional hospital revealed diffuse cerebral injury and a subarachnoid hemorrhage in the prepontine cistern. Trauma assessment of the cervical spine did not reveal any abnormality.

On arrival at our institution the patient was haemodynamically stable and intubated with good saturations and a respiratory rate of 23 beats per minute. His GCS was E2M4V1 with equal pupils and normal right pupillary reflex.

On review of the CT scan, subarachnoid hemorrhage with features of diffuse brain injury was confirmed by the neurosurgeons. A right frontal burr hole craniotomy for insertion of the intracranial pressure monitor was performed.

In the intensive care unit he subsequently dropped his GCS to E2M6V1 and became a complete quadriplegic. The clinical diagnosis at the time was that of spinal cord injury without observable radiologic abnormality with a possible odontoid peg fracture. He was maintained on a cervical collar and his GCS improved. A right frontal burr hole craniotomy for insertion of the intracranial pressure monitor was performed.

The patient was subsequently discussed with the orthopedic unit at a local hospital for further management. He was to be transferred to be seen by the head of the said orthopedic unit but two days before transfer he vomited 500mls of frank blood and aspirated. Resuscitative measures failed.

Non-enhanced CT images (Figure 1) demonstrate preoptine cistern subarachnoid hemorrhage with features of raised intracranial pressure. On review of the scout image (Figure 2) a dislocation should have been queried.

MRI findings (see Figures 3, 4, 5, 6). Type 1 occipito-cervical dislocation (anterior dislocation of the occipital condyles on the atlas) is noted with narrowing of the spinal canal at that level and compression of the upper cervical cord at C1/2 level by the odontoid process. Increased T2 signal within the cord is in keeping with compressive myelopathy. Basal cistern and preoptine cistern subarachnoid hemorrhage is noted. In the anterior vertebral space of C1-3, a CSF intensity collection is noted which does not demonstrate contrast enhancement and is suggestive of a CSF leak. No arterial dissection is noted.

Discussion
Cranio-cervical junction injuries may be unil or bilateral and involve the occiput and C1; and or C1 and C2. It is an osseoligamentous injury and is grossly unstable with significant associated neurological and vascular compromise. The clinical presentation is variable; survival and prevention of secondary injury may depend on accurate diagnosis [1]. It usually follows high speed motor vehicle accidents and is a combination of rotational and shearing injury [2] with disruption of the three stabilizing ligaments at that level.

Dislocation is defined as complete loss of articular contiguity with varying degrees of distraction. Subluxation is less severe as some of the articular contiguity is retained. Cranio-cervical dislocation is uncommon but more prevalent because of the variability of the bone ossification at the cranio-cervical junction, especially at the dens [2]. The normal fulcrum for cervical motion is at C2-3 in a child compared with C5-6 in an adult [3].

Failure of the atlanto-occipital joints and hypoplastic occipital condyles [2,3]. Assessment of cranio-cervical dislocation in a child is complicated further because of the variability of the bone ossification at the cranio-cervical junction, especially at the dens [2]. The normal fulcrum for cervical motion is at C2-3 in a child compared with C5-6 in an adult [3].

Occipital condyle fractures are rare [3] and can be unilateral, bilateral or form a ring around the foramen magnum. They are classified as impaction fractures, extension of occipital skull fractures or avulsion fractures at the insertion of the alar ligaments. The latter fracture is unstable especially if there is displacement with the occipital condyle. Fracture palsies of the lower cranial nerves, especially the 12th may occur due to fracture through the hypoglossal canal. These are best seen on CT scan.

The basion-dens interval is unreliable in patients less than 13 years of age. However the basion-posterior axial line is reproducible. A line drawn along the posterior longitudinal ligament extends <12mm posterior or <4mm anterior to the dens. A helpful feature is that of pre-vertebral soft tissue swelling which is normally flat or concave and measures less than 6mm at the C2 vertebral. The atlanto-occipital articulation normally measures 1-2mm.

The tectorial membrane and transverse membrane are well seen on MR images but the alar ligaments are difficult to visualize due to lack of...
The role of MR imaging is in the evaluation of extent of ligamentous injury especially in patients with neurological deficit or those requiring closed reduction of a post traumatic spinal subluxation, those with altered sensorium, morbid obesity or suspicion of malingering. It is primarily used to assess the extra-dural space, the integrity of the ligaments [3] and spinal cord injury which is of prognostic value.

The MR imaging protocol includes a sagittal T1, STIR, GRE, fat sat FSE T1, STIR and axial FSE GR T2. In addition to the three stabilizing ligaments, the following need to be assessed:

- The bone marrow signal intensity,
- The atlanto-occipital junction,
- The atlanto axial junction,
- Prevertebral soft tissue,
- Epidural haematoma,
- Nuchal ligament, interspinous ligament signal intensity and,
- Spinal cord.

Complications include:

- Subdural hemorrhage,
- Subarachnoid hemorrhage: common but small,
- Epidural haematoma,
- Spinal cord injury.
- Brainstem compression, laceration of the pontomedullary junction, contusion or laceration of the caudal medulla or rostral spinal cord, stretch or laceration of the midbrain,
- Vasospasm or dissection of the internal cerebral arteries or vertebral arteries.

In view of the high fatality rate and increased prevalence in children a high index of suspicion is needed to ensure detection and appropriate management. The latter entails a fusion of the occipital condyle to either C1 or C2 [3].

Abnormal basion axial or basion dental interval [4], pre-vertebral soft tissue swelling with an abnormal anterosuperior upward oblique contour [4], divergent articular processes and widened posterior aspect of the disc space, are indications of pediatric spinal instability [3].

Careful review of the lateral radiograph and scout image in all children who have CT brain examinations is a good place to begin. Increased survival needs immobilization of the spine, and prompt referral to a trauma unit.

References