Manual reduction and Anterior Stabilisation for traumatic C2-C3 Subluxation, A case report
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Abstract : A rare case of c2 c3 subluxation in a 19 year old man without neurological defect following a low violence injury. Xrays and CT of cervical spine revealed a subluxation at C2 C3 level with no cord involvement in MRI. With the patient in conscious sedation under fluoroscopy, reduction was done but the subluxation was not stable. So Anterior cervical stabilisation with tricortical bone graft and anterior cervical locking plate was done. Subluxation and dislocation of the cervical spine in adults commonly occur at the highly mobile lower segments (C4-C7). This is in contrast to the occurrence in children, where it involves the upper cervical spine due to anatomical differences in the developing spine. In conclusion, the rare case with unstable subluxation in an adult male is reported for management by anterior stabilisation.

Keyword : closed reduction, Anterior stabilisation, cervical subluxation

Introduction
Upper cervical fractures and dislocations account for 24% of cervical spine injuries, with the atlantoaxial region being the commonly involved site. Subluxation and dislocation of the cervical spine in adults commonly occur at the highly mobile lower segments (C4-C7). This is in contrast to the occurrence in children, where it involves the upper cervical spine due to anatomical differences in the developing spine. Subluxation at the level of C2-C3 is an uncommon injury in adults and usually results in mortality or complete quadriplegia. Only two cases of C2-C3 dislocation in the sagittal plane have been reported in adults. Subluxation at the level of C2-C3, has not been cited in the literature so far. We present a rare case of unstable C2-C3 subluxation, with no neurological defect managed surgically.

Case Report
A 19-year-old man presented with severe neck pain and deformity following a self fall in which his occiput hit against the ground and sustained a flexion distraction type of injury. He was evaluated and treated conservatively with a soft cervical collar in the local hospital. As his neck pain and deformity was persistent, he presented to us for further management. There was no weakness of lower limbs or gait disturbance following the injury. His bowel and bladder habits were normal. Clinical examination paracervical muscle spasm and severe restriction of neck movements. Neurological examination revealed normal power in all limbs. There was no sensory disturbance and his deep tendon reflexes were normal with a negative Babinski sign.

Xray taken in emergency showed C2 C3 subluxation, with 40% displacement with alignment of spinal-laminar line and . Swischuk line drawn along anterior aspect of C1-C3 spinous process was with in 2mm of c2 spinous process Facet angle at C2-C3 less than 30 degrees which is 60-70 degrees in an adult male might be a likely cause for the subluxation CT Cervical Spine

CT cervical spine showed translation of C2 vertebral body over C3 and revealed no fractures. Magnetic resonance imaging (MRI) of the cervical spine revealed no cord changes

The hyperintensity noted in T2 weighted image is suggestive hematoma which shows that the trauma is significant.

Closed reduction under conscious sedation was attempted under fluoroscopy with traction along both the shoulders with countertraction maintaining neck in extension and using C2 spinous process as a fulcrum, and the subluxation was successfully reduced but it was not stable.
Fluoroscopic image, pre reduction and post reduction
Operative Procedure
The patient was placed supine on a radiolucent table with neck in maximum extension. A left lateral anterior exposure with anterior oblique incision from C1 to C3 was performed. Carotid sheath with its contents retracted laterally, longus colli muscle retracted disc extracted out, and tricortical bone graft harvested from ipsilateral iliac crest placed and anterior cervical locking plating was done with locking bolts. Wound was closed in layers. Post operatively patient had minimal pain at surgical site and neurology was maintained. Patient was advised to use Philadelphia collar for 3 weeks.

Follow up
After 2 months patient is comfortable with no restriction of neck movements with no worsening of neurological symptoms.

Clinical picture at follow up showing no restriction of movements, and CT cervical spine showing anterior cervical locking plate in position

Hypoplasia of Facet at C2-C3, which would had predisposed to C2-C3 subluxation

Discussion
Injuries of the upper cervical spine commonly involve the atlantoaxial region. Subluxations and dislocations of the cervical spine in adults usually involve the lower segments (C4-C7), as they are highly mobile in contrast to the upper segments. However, dislocation in children is common in upper cervical spine due to anatomical differences of the developing spine. About 5-20% of Although few reports of C2-C3 dislocation are described in the pediatric age group, only two cases are reported in adults so far. Delayed or missed diagnosis of C2-C3 dislocation in adults can lead to serious consequences including complete tetraplegia and even death. The degree of subluxation of cervical spine need not necessarily correlate with clinical symptoms and neurological signs. Fountas et al. evaluated the size of the cervical spinal cord using post myelogram computed tomographic measurements. He reported that the diameter of the cervical spinal cord is 15-20% smaller than what has been reported by autopsy studies and a small diameter spinal cord is less susceptible to injury by compression. This is probably the reason of no neurological deficit seen in our case. Pediatric pseudosubluxation refers to normal mobility of C-2 on C-3 in flexion which may be so pronounced as to be mistaken for pathologic motion; (is normal in children < 8 years old). It may be seen in 40% of children at C2-C3 level and in 14% of children at the C3-C4 level) in paediatric cervical spine (up to 8 yrs of age) has greatly increased physiologic mobility as compared to the adult; and occurs because of increased ligamentous laxity, more horizontal nature of facet joint (30 deg vs. 60-70 deg in adult); in children, fulcrum of motion that is relatively greatest at C2-C3 level (compared with C5-C6 in the adult) 70% of C-spine fracture in infants and children occur from C1 to C3; hence increased atlantoaxial rotatory subluxation as compared to the adult; in normal circumstances, this anterior displacement only occurs in flexion, and should not occur in extension. In Radiographs anterior displacement of C2 on C3 of up to 4 mm or 40% displacement; with absence of significant soft tissue swelling; Distinguish between Normal and Abnormal Radiographs:
- lack of anterior swelling and alignment of posterior interspinous distances & posterior cervical line (Schwisk) on radiograph.
- Swischuk’ Line:
  - line is drawn from the anterior aspect of C1-C3 spinous processes;
  - this line should be within 2 mm of the anterior C2 spinous process;
- spinal-laminar line:
  - normally should remain intact;
  - straight-line relationship of spinal-laminar line of C-1, C-2, & C-3 in flexion is helpful in differentiating physiologic from pathologic anterior displacement of C-2 and C-3.

The surgical approach for acute subluxation of cervical spine is highly controversial. The presence or absence of traumatic intervertebral disc herniation, neurological status and experience of the surgeon are some of the factors that need to be considered while planning the surgical approach. An anterior procedure is advocated when there is a traumatic disc herniation, at the level of subluxation to decompress the neural elements. Additional posterior stabilisation is necessary if the dislocation is bilateral or if the anterior reduction fails. Posterior reduction and instrumented fusion is recommended for patients with irreducible unilateral or bilateral dislocation without associated disc herniation. Machnis et al. performed a 360-degree stabilisation in two stages for their patient with C2-C3 dislocation. Sharma et al. reported delayed pharyngeal perforation and spontaneous graft extrusion with the fixation device in a case of traumatic C2-C3 dislocation stabilised by an anterior approach. Reduction of cervical spine dislocation through a posterior approach in the presence of an associated disc herniation can lead to neurological deterioration. Abumi et al. reported the...
successful use of posterior surgery alone using cervical pedicle screws in the management of acute cervical spine injuries associated with a traumatic disc herniation. The initial distractive force applied by the pedicle screws allows restoration of the disc height and reduction both disc herniation and injured cervical segment without additional need for anterior decompressive procedures. In this case, it's an adult male with x-rays and MRI showing anterior swelling suggestive of a extradural hemorrhage which makes a pseudosubluxation highly unlikely though the facetial angle is 30 degrees and other x-ray features are suggestive of a pseudosubluxation, a anterior approach was selected for stabilisation taking into account the significant morbidity and post operative pain due to extensive stripping of muscles associated with posterior stabilisation.

**Conclusion**

Subluxation at the level of C2 and C3 is rare with very few single case reports. In our case we noticed hypoplasia at C2-C3 level and probably would have been the predisposing factor for subluxation to occur following a low violence flexion injury. Hence it is proposed to conduct CT screening of cervical spine for those involved in contact sports and gymnastics.

**References**
