Introduction

Atlanto-occipital dissociation (AOD) comprises 35% of fatal cervical spine injuries acquired in motor vehicle accidents. Diagnosis of AOD is challenging due to the complex anatomy and biomechanical factors involved, and no single measurement or abnormal finding provides a definitive diagnosis. Current standards for evaluation of cervical spine injuries involve computed (CT) imaging of three occult-C1 joint parameters as a reliable proxy for CCJ integrity with high diagnostic sensitivity, but complementary use of several additional diagnostic craniofacial references of varying sensitivity has been recommended to minimize false negative results and associated catastrophic outcomes.

We report a case of unstable AOD in a neurologically intact 37-year-old patient who presented with normal CT findings, but subsequent MRI of the CCJ demonstrated disruption of the atlanto-axial and tectal membranes and the posterior longitudinal ligament at the level of the dens, thereby identifying AOD.

Methods

- A 37-year-old female was hit head-on by an intoxicated driver at high speeds. She was fully conscious with stable vital signs and neck pain.
- The patient had multiple distracting injuries, and multiple orthopedic extremity injuries requiring external fixators.
- Atlanto-occipital dissociation (AOD) comprised 35% of fatal cervical spine injuries acquired.
- Diagnosis of AOD is challenging due to the complex anatomy and biomechanical factors involved, and no single measurement or abnormal finding provides a definitive diagnosis.
- Current standards for evaluation of cervical spine injuries involve computed (CT) imaging of three occult-C1 joint parameters as a reliable proxy for CCJ integrity with high diagnostic sensitivity, but complementary use of several additional diagnostic craniofacial references of varying sensitivity has been recommended to minimize false negative results and associated catastrophic outcomes.

Results

Figure 1: Pre-operative CT. A) Head CT with blood in the basilar cisterns. B) Initial cervical CT showing no sign of atlanto-occipital dissociation (HDI < 8.5 and power’s ratio (BC/AO) < 1). C) Preoperative coronal CT showing normal atlanto-occipital interval (AOI < 1.4mm).

Figure 2: Pre-operative MRI. MRI for work-up of basilar cistern SAH shows disruption of the atlanto-occipital membrane and the ligamentum flavum.

Figure 3: Intraoperative imaging: A) Initial X-ray showing initial BDI. B) X-ray showing increased BDI. C) Final intraoperative X-ray. D) O-arm spin to further evaluate the degree of atlanto-occipital dislocation; revealed < 8.5mm of dislocation.

Discussion

- This AOD injury presented with normal clinical and CT radiographic anatomy and craniofacial ranges, but MRI of the entire spine demonstrated disruption of the crucial and stabilizing atlanto-axial and tectal membranes and posterior longitudinal ligaments.
- This case highlights the importance of maintaining a high degree of clinical suspicion and using multiple detection modalities for patients who have experienced traumatic injury, especially when there is concurrent unexplained perimesencephalic SAH with and/or neck pain.
- With no gold standard for AOD diagnosis and complex diagnostic methods, our case expands the spectrum of documented radiographic presentations of AOD, which warrants consideration in future grading systems to standardize and inform the diagnosis of AOD.

- "Absolute" diagnosis of ligamentous injury by MRI should be considered, as these are clinically very unstable injuries.

Summary

- Normal occiput-C1 craniofacial parameters in the setting of unexplained perimesencephalic SAH does not eliminate the possibility of missed and/or delayed diagnosis of traumatic AOD injuries.
- Atlanto-occipital dissociation (AOD) comprises 35% of fatal cervical spine injuries acquired in motor vehicle accidents.
- Diagnosis of AOD is challenging due to the complex anatomy and biomechanical factors involved, and no single measurement or abnormal finding provides a definitive diagnosis.
- Current standards for evaluation of cervical spine injuries involve computed (CT) imaging of three occult-C1 joint parameters as a reliable proxy for CCJ integrity with high diagnostic sensitivity, but complementary use of several additional diagnostic craniofacial references of varying sensitivity has been recommended to minimize false negative results and associated catastrophic outcomes.

Disclosures

Mohamed Elsherif and Puja Patel contract with Superior Medical Experts, who provided research and drafting assistance for this poster and manuscript in progress.