

Isolated Traumatic Diastasis of the Clival Synchondrosis Amir H. Faraji MD PhD; Alp Ozpinar MD; Pawel G. Ochalski MD; Ian F. Pollack MD Department of Neurological Surgery Children's Hospital of Pittsburgh University of Pittsburgh Medical Center Pittsburgh, Pennsylvania

Introduction

Diastasis of clival synchondroses have been previously observed in the setting of crushing skull injuries and were uniformly associated with clival fractures. The mortality of clival fractures in pediatric patients is roughly 30%, and is often correlated with vascular injury at the skull base. Traumatic diastasis of the clival synchondroses in isolation have not been previously reported.

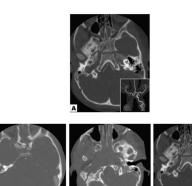
Methods

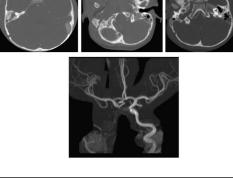
A focused search of the electronic medical record database at the Children's Hospital of Pittsburgh was performed to identify patients with fractures of the clivus that were diagnosed using CT of the head following trauma work up as part of initial evaluation. A retrospective review of the charts and radiographic imaging were then performed to elucidate patient demographics, mechanism of injury, skull and brain parenchymal injuries, and clinical outcomes.

Case No.	Age (yrs), Sex	Mechanism of Injury	Type of Fracture (location)	Type of Traumatic Diastasis	Associated Complications	Admission GCS Score	Outcome GOS Score at Discharge
1	3, M	crush injury (TV)	oblique (basisphenoid)	occipitomastoidal	calvarial fxs; no hemorrhage	15	5 (home)
2	4, F	MVA	oblique (basisphenoid)	occipitomastoidal	calvarial fxs; contusion, IVH	4	1 (brain death
3	2, F	MVA	transverse (basisphenoid)	petrooccipital; occipito- mastoidal	no calvarial fxs; SDH	5	5 (home)
4	16, M	MVA	transverse (clival com- plex)	none	calvarial fxs; tSAH, ICA dis- section	7	4 (rehab)
5	15, F	ped vs auto	transverse (dival com- plex)	sphenooccipital; petrooc- cipital; occipitomastoidal	calvarial fxs; EDH, SDH, contusion, bilat MCA & ACA infarcts	6	1 (brain death
6	13, M	ped vs auto	oblique (basisphenoid)	none	calvarial fxs; SDH, contu- sion, brainstem bleed	4	1 (brain death
7	10, F	sledding (no hel- met)	oblique (basisphenoid)	none	calvarial fxs; no hemor- rhage, CN VII palsy	15	5 (home)
8	12, M	ped vs auto	longitudinal (clival com- plex)	occipitomastoidal	calvarial fxs; tSAH, contu- sion, diffuse edema	4	1 (brain death
9	5, F	crush injury (roof)	longitudinal (basisphe- noid)	petrooccipital; occipito- mastoidal; ant intraoc- cipital	cranial fxs; tSAH, IVH	3	1 (brain death
10	6, M	crush injury (TV)	transverse (basisphenoid)	occipitomastoidal	calvarial fxs; tSAH, contu- sion, CN VII & VIII palsies	14	4 (home)
11	1, F	fall (occiput)	longitudinal (basisphe- noid)	petrooccipital; occipito- mastoidal	calvarial fxs; SDH, CN VII palsy	15	5 (home)
12	6, M	ped vs auto	longitudinal (basiocciput)	petrooccipital; occipito- mastoidal	calvarial fxs; SDH	9	5 (home)
13	8, M	bike (no helmet)	oblique (basiocciput)	none	calvarial fxs; contusion	14	5 (home)
14	7, M	ped vs auto	oblique (basisphenoid)	petrooccipital; occipito- mastoidal	calvarial fxs; SDH	9	5 (rehab)
15	15, M	ATV (no helmet)	longitudinal (clival com- plex)	petrooccipital	calvarial fxs; tSAH, CN II palsy	8	5 (home)
16	16, M	ATV (no helmet)	transverse (basisphenoid)	none	calvarial fxs; EDH, CN VII palsy, bilat CN VIII palsy	7	5 (rehab)

Case Report

Figure 1. Imaging Findings of Case Report Patient





A 4-year-old boy presented to our Level 1 trauma center after reportedly being overrun by a motor vehicle. The child was initially unresponsive in the field but on arrival to our trauma center, his initial GCS was 14 with eyes opening spontaneously, following commands, but having mild difficulty speaking full sentences. On further physical examination, the patient was alert and crying. He had hemiparesis of the right arm and leg. Moreover, the patient had a right facial droop with inability to close his right eye consistent with a House-Brackman grade IV facial nerve palsy. He ultimately did require intubation due to hemodynamic instability.

Computed tomography (CT) imaging indicated no initial parenchymal brain findings, however a large complicated fracture was detected within the right occipital bone extending into the parietal bone. Additionally, diastasis of the right spheno-occipital synchondrosis was observed. A CT angiogram was completed, which was suggestive of dissection at the right internal carotid artery with complete occlusion and obstruction of the right internal jugular vein. Magnetic resonance imaging revealed a right middle cerebellar peduncle infarct with an associated contusion of the right anterior and inferior cerebellar hemispheres. There were FLAIR and gradient echo signal abnormalities within the subcortical white mater suggesting a diffuse axonal injury pattern.

On post-trauma day 6, the patient was started on heparin, with an eventual plan to complete three to six months of therapeutic Lovenox. Hearing test demonstrated normal hearing on the right and mild-to-moderate reduction on the left, primarily conductive in nature. Facial electromyelography showed 79% reduction on the right side with zygomatic lead placement. On post-trauma day 11, he was transferred to an inpatient rehabilitation facility.

Two months following the incident, the patient was neurologically stable with improvement of his leg and arm hemiparesis and persistence of his right facial nerve palsy. He demonstrated complete eye closure on the right with maximum effort. He continued to display no motion on the upper face, however. Four months later, repeat MRA was performed, which demonstrated reconstitution of the right internal carotid artery however a small luminal diameter was observed. The right sigmoid sinus and right internal jugular artery remained occluded.

Results

Sixteen patients with fractures of the clivus were identified over a five year period. The mean age of these patients was 9 years (range 1-16 years). Eleven (68.8%) of the patients had an associated traumatic diastasis of the central skull base. Five (31.3%) of the patients died. However, of the 11 patients who survived, all had a good outcome with a Glasgow Outcome Scale score of 4 or 5 at the time of discharge. The incidence of clival fractures among patients with head injuries was 0.33%. One patient had an isolated diastasis of a clival synchondrosis with associated vascular injury in the absence of bony fracture.

Conclusions

Our data regarding traumatic fractures of the clivus and associated vascular injury and outcomes has been previously reported. Isolated traumatic diastasis of the clival synchondroses may also result in similar vascular injury in the absence of bony fracture. It is therefore essential to perform focused radiological evaluation of the clival synchondroses in pediatric crush injuries, as further vessel imaging may be warranted if evidence of diastasis is present.

Learning Objectives

Trauma, Vascular Injury may occur in absence of skull base fractures due to diastasis of synchondroses

References

Ochalski PG, Adamo MA, Adelson PD, Okonkwo DO, Pollack IF. J Neurosurg Pediatr. 2011 Mar; 7(3): 261-7.