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DESCENDING TRANSTENTORIAL HERNIATION IN TRAUMATIC BRAIN INJURY: A STUDY OF THE IMAGING AND OPERATIVE PROFILES OF THREE CASES IN A TERTIARY CARE CENTRE

Surgery

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ABSTRACT

INTRODUCTION: Brain herniations have been labelled as 'Brain Code' to signify the emergent need for diagnosis and intervention. Traumatic Brain Injury is the most common cause of brain herniation which could be lateral, subfalcine, descending transtentorial, tonsillar, upward or transcalvarial.
CASE: Three cases of descending transtentorial herniation,their imaginary and their operative intervention are discussed.
DISCUSSION: The clinical features and the previous works on descending transtentorial herniation are discussed in brief.
CONCLUSION: In conclusion, the three cases discussed had a rapid resolution of symptoms after surgical intervention.

KEYWORDS

Descending Transtentorial Herniation, Traumatic Brain Injury, Lateral brain displacement, Coma

INTRODUCTION:

Brain herniation is a disastrous process that can lead to compression of vital structures and subsequently arrest of the respiratory centres in the medulla.To connote the emergent need to timely counteract this process, it has been labelled as 'Brain Code'[1].The Monroe Kellie doctrine states that to some extent the increase in intracranial pressure as a result of mass lesions can be limited by the compensatory changes in cerebrospinal fluid and cerebral blood volumes.After a certain point, the brain structures start herniating through the foramina and tentorial incisura. Traumatic Brain injury presenting with mass lesions like contusion and hematoma is the most common cause of brain herniation.Other causes include infarction,tumors and infections of the brain parenchyma.Herniation can be one of the following types: subfalcine, lateral, uncal , descending transtentorial, tonsillar, upward and transcalvarial [2].We discuss three cases of descending transtentorial herniation in the context of traumatic brain injury that were operated in a tertiary care centre.

Case 1

A 72 year old male presented to the emergency services in a comatose state after a fall.His Glasgow Coma Scale (GCS) score was 6/15.His left pupil was dilated..His blood pressure was 170/100 mmHg and pulse was 62/minute.He was intubated and stabilised in the intensive care unit.On further questioning his relatives gave a history of previous falls the last of which was two weeks ago and required hospitalisation.His CT scan showed the presence of an acute on chronic subdural hematoma of size 2.5cm in the left frontoparietal lobe convexity accompanied by lateral herniation of 8mm towards the right and a remarkable lateral brain displacement with descending transtentorial herniation as shown in the image.

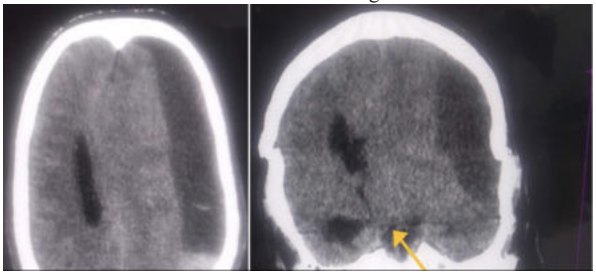

Fig 1. The figure on the left depicts acute on chronic subdural hematoma with midline shift.The figure on the right is a coronal view of the same patient showing brain displacement and descending transtentorial herniation caused as a result of the mass effect.

Frontoparietal Burr hole trepanation was done,dura incised and the hematoma was drained.The clots were washed off with irrigation.A subdural drain was placed and closure was done.

The drain was removed on the third postoperative day.The patient showed marked recovery with a Glasgow Outcome Score of 5 at the time of discharge.

Case 2

A 45 year old male was brought by his relatives to the emergency department with a history of fall under the influence of alcohol.He had previously been admitted multiple times for the same.He had a GCS score of 8/15 with a dilated right pupil.Emergency CT scans revealed an acute on chronic subdural hematoma along the right frontoparietotemporal lobe convexity of maximum size 2.6cm. There is a lateral herniation of 16mm towards the left with a medial and downward transtentorial herniation of the right medial temporal lobe with indentation on the brainstem as shown.

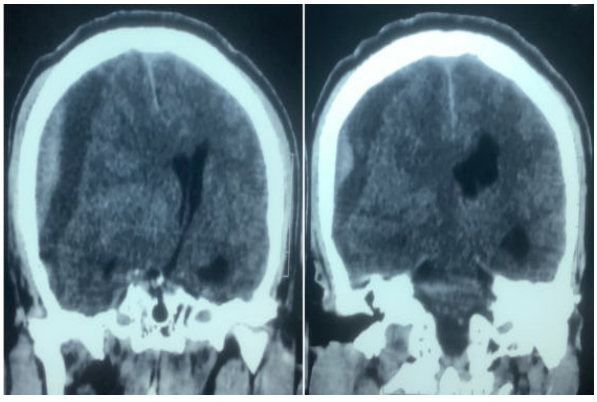

Fig 2. The images above show coronal view of an acute on chronic subdural hematoma causing mass effect leading to lateral and descending transtentorial herniations

Recognising the position and nature of the acute component of the hematoma, craniotomy was done and a frontoparietotemporal bone flap was raised on the right and placed in the abdomen. The dura was opened and the hematoma drained.All the clots along with the pseudo membrane of the hematoma were removed.The dura was left open and a subperiosteal drain was placed which was removed on the fourth postoperative day.The patient had an uneventful recovery.

Case 3

A 31 year old male was brought in a comatose state after having a fall from a moving truck with the primary area of impact being the back of his head.His GCS was 8/15 with both pupils reacting to light.CT scans revealed a Posterior fossa extradural hematoma of maximum thickness 22mm with contrecoup brain injury.Paramedian Suboccipital craniectomy was done and the hematoma was evacuated.The patient recovered well but presented with signs of frontal lobe syndrome even till the twelfth postoperative day.A repeat CT scan showed a chronic subdural hematoma of 8mm in the left frontoparietal region with a descending transtentorial herniation and midline shift of 9mm towards the right side.The patient's symptoms improved after Burr hole surgery and evacuation of the chronic subdural hematoma.

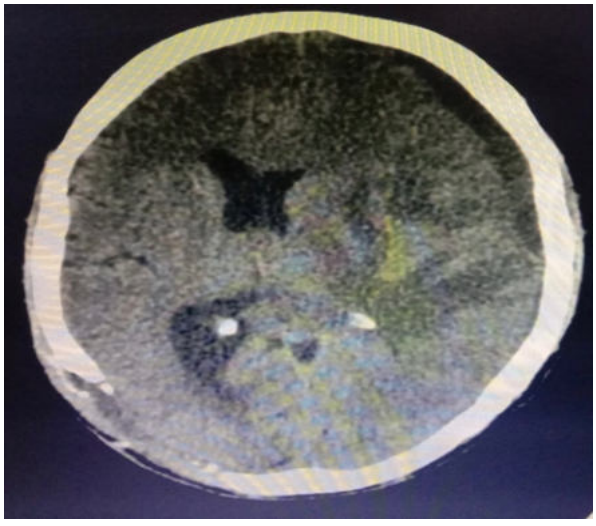

Fig 3 As the patient was operated for paramedian suboccipital craniectomy, post craniectomy defect can be seen.There is a chronic subdural hematoma in left frontoparietal region leading to mass effect causing lateral and descending transtentorial herniations.

DISCUSSION:

Brain herniation is an emergency and immediate diagnosis is essential to identify causes that require surgical intervention. Lateral herniation or displacement of the septum pellucidum commonly referred to as 'midline shift',is the most common brain herniation syndromeThis is followed by subfalcine herniation which occurs due to compression of the cingulate gyrus under the falx cerebri.Descending Transtentorial Herniation is the third most common subtype but may be accompanied by other herniation syndromes as seen in the above cases.Descending transtentorial herniation occurs when the forces are directed downwards and medially (as in a supratentorial mass lesion) displacing brain tissue downward through the tentorial notch [3]. The vital structures compressed involve the third cranial nerve, posterior cerebral artery and cerebral aqueduct. This leads to ipsilateral constriction followed by dilatation of pupil,cortical blindness and obstructive hydrocephalus.In severe cases, there may be stretching and shearing of the perforating branches of the basilar artery.This leads to ischemia and haemorrhage of the brain stem and carries a dismal prognosis.The first event in most cases of DTH is pushing of the uncus (the medial most part of the temporal lobe) over the free edge of the tentorium [4].This leads to effacement of the suprasellar cistern followed by widening of the perimesencephalic cistern and displacement of the brainstem.Kernohan notch phenomenon is a false localizing sign seen in advanced herniation where there is compression of the contralateral cerebral peduncle containing the descending corticospinal tracts leading to an ipsilateral hemiparesis. A decreased level of consciousness (stupor or coma) is present in almost all cases of descending transtentorial herniation. There have also been cases of gaze palsy and diabetes insipidus.

Although Brain Herniations have long been a focus of neurosurgical works , it was the legendary Harvey Cushing who first studied the brain's reaction to compression more carefully than the previous researchers.Cushing,s work in Europe in 1901 and 1902 led to the understanding of 'Cushings reflex': a phenomenon of increased systolic pressure,bradycardia and irregular respiration as signs of increasing intracranial pressure leading to cerebral herniations and brainstem compression [5]. Miller Fischer, who studied brain herniations in 1955 mentioned in his work that transtentorial herniation is a harmless accompaniment to the more dangerous phenomenon:lateral displacement of the brain at the tentorium which is the prime mover for the clinical deterioration of the patient's condition.

CONCLUSION

To conclude, Descending Transtentorial Herniation in traumatic brain injury requires urgent diagnosis and imaging.All three patients described above presented with a poor GCS but there was drastic improvement after surgical intervention.

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