

# Post - Traumatic Thick Acute Subdural Hematoma in Child Showing Rapid Deterioration Managed with Burr - Hole Evacuation Surgery with Drain: A Novel Rescue Technique

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## Abstract

Children with post-traumatic intracranial haematoma causing mass lesion need surgical evacuation. Usually craniotomy is the preferred method and different approaches are decompressive craniotomy, hinge cranioplasty after hematoma evacuation or evacuation of acute subdural hematoma (ASDH) with expansile duraplasty. However all these procedure are time-consuming, require general fitness of anaesthesia and normalisation of raised of intracranial pressure following haematoma evacuation may not occur till dural opening, which is approximately an hour after beginning of scalp incision till raising bone flap, and most important is the availability of operation theatre and anaesthetist dedicated for that case, and excessive patient load with limited operation theatre facility and lack of trained anaesthetist in developing country with resource constrained and limited skilled man power. Authors report an interesting case a 2-year child, who had thick fronto-temporoparietal acute thick subdural hematoma following trauma, was initially planned for decompressive craniotomy, however, he developed rapid neurological deterioration, so he was taken up for surgery in between scheduled routine cases. He underwent burrhole evacuation of ASDH and drain placement. After hematoma evacuation, he was kept on ventilatory support for three days. The postoperative noncontrast CT scan head revealed complete evacuation of ASDH with no residual hematoma and subsidence of complete mass effect with opening of Sylvian fissure, sulci and basal cisterns. A subgroup of cases may possess a special challenge in the management, who develop very rapid deterioration in the current neurological status while awaiting in the emergency for surgical intervention. [1, 2] Overall the prognosis of ASDH is usually unfavourable in the cases of head injury associated with coagulant disorder and associated intracerebral contusion and laceration. [3] Authors advocates an emergent burr-hole with drainage tube placement technique for evacuation of thick acute subdural hematoma, as an alternative method in the desperate situation of non-availability of routine operation theatre in attempt to save life and halt progression of the secondary brain injury.

## Keywords

Acute Subdural Hematoma, Rapid Neurological Deterioration, Burr Whole Surgery, Pediatric Age

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## 1. Introduction

Traumatic acute subdural hematoma is an important cause of disability and morbidity in the pediatric age-group. [1-3] A better prognosis in case of acute subdural hematoma is

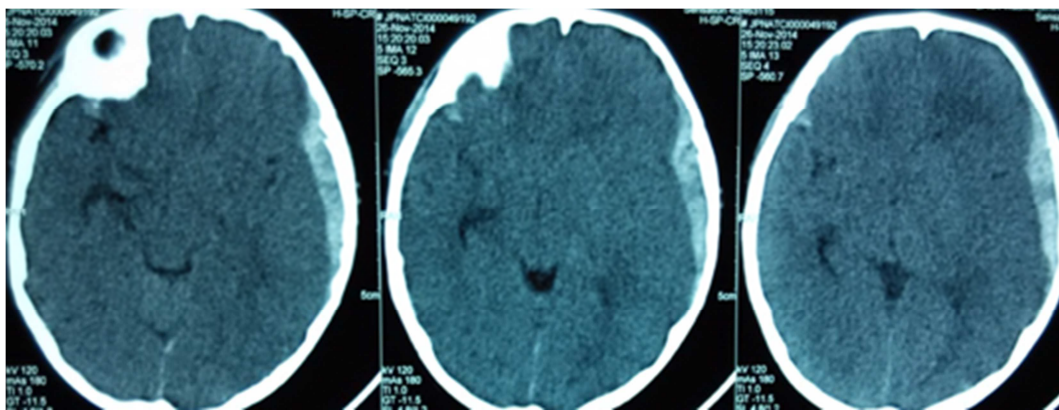
younger age, isolated thick acute subdural hematoma, shorter time interval between accident and surgery, absent contusion or intra-ventricular hemorrhage. Craniotomy remains the surgical treatment of choice. [4-6] Unfortunately, few cases in the emergency room are not suitable for prolonged surgery under general anesthesia, in such desperate situation, with

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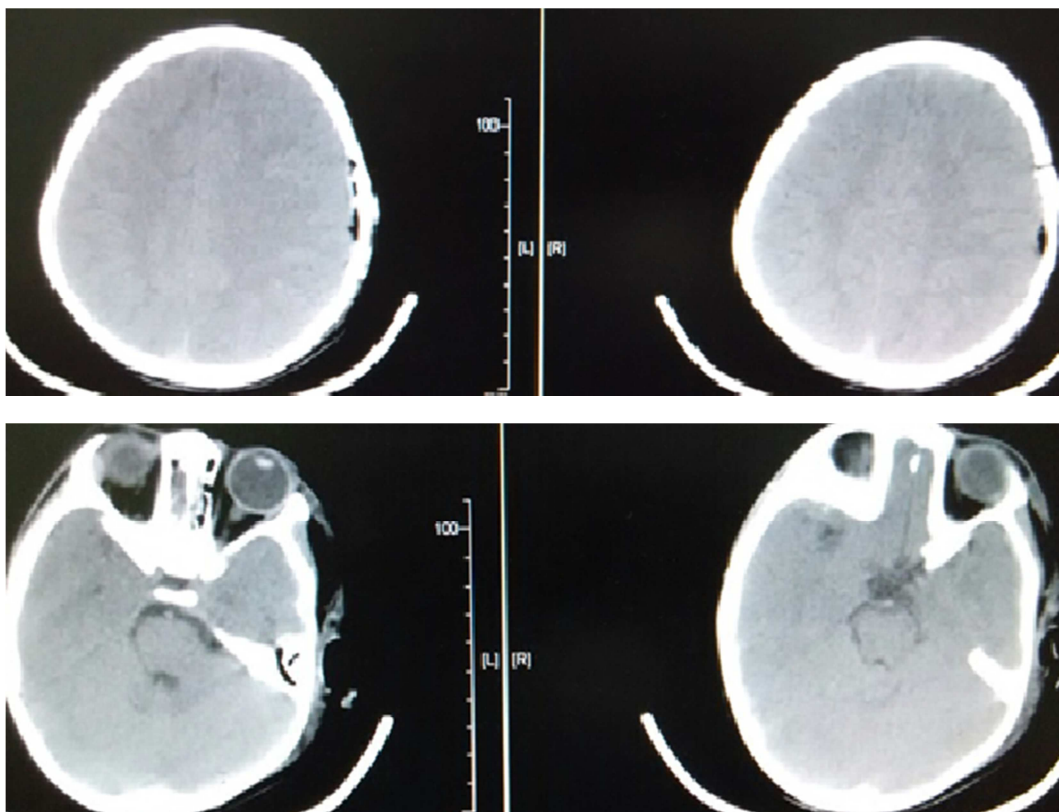
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patient showing rapid neurological deterioration without giving time for corrective therapy to be given, a rescue surgery may be an option to salvage neurological status and life saving measure. [7, 8] As Coagulopathy or poor general condition or frail patient, who are not suitable candidate for larger craniotomy or prolonged general anaesthesia may be subjected to burr-hole surgery as rescue surgery in these category of cases. [4, 11] Any coagulopathy needs to be fully corrected prior to planning of craniotomy surgery as partial correction can have more worse prognosis. So, in these cases, a minimally invasive surgical procedure like burr-hole drainage of specially thick acute subdural with no associated intracerebral hematoma or intra-ventricular hemorrhage,

infarct or hydrocephalus. Also in the emergency setting where, patient showing rapid neurological deterioration while awaiting their turn to be shifted to the operation theatre, can also be considered potentially suitable candidates. Minimally invasive surgery is preferred to reduce the operative time, operative cost, recovery time, tissue damage, hospital stay and reduces incidence rate of complication. As few cases waiting for their turn to be shifted for operative procedure needing surgery, who are intubated and can even also undergo burr-hole evacuation surgery in between the schedule operative cases list without postponing any routine case. [5, 11, 12]



**Fig. 1.** NCCT head axial section showing post-traumatic thick acute subdural hematoma in the left frontotemporal region with gross mass effect causing compressed ipsilateral ventricle with subfalcine herniation (pre-operative).



**Fig. 2.** Postoperative NCCT head axial section showing complete evacuation of post-traumatic acute subdural hematoma with subsidence of the mass effect.

## 2. Case-Illustration

Author presents a case of 2- year –old male baby with history of fall and brought to emergency in unconscious state. Examination, at admission his GCS was E3V3M5 with pupillary asymmetry, left pupil was dilated and none reacting to light. Urgent NCCT head was carried out, which revealed presence of left frontotemporal acute SDH of thickness of about 1.2cm with gross midline shift, associated with subfalcine herniation and transtentorial herniation. (Fig-1) However, patient immediately deteriorated to E2V2M4 in emergency department itself while waiting this turn to be shifted to the operation theatre for surgery. Immediately he was intubated and rushed to Operation theater. After painting draping, he underwent left temporal bigger burr-hole was made for acute SDH evacuation. Intraoperatively dura was tense after making burrhole; dura was opened in a cruciate manner, after opening the dura thick dark clot was observed in the subdural compartment under microscope. Thick blood clots were gently irrigated and evacuated. Dura was left open and wound closed in layers. Post operatively child was electively ventilated for two days and gradually weaned of the ventilator and extubated. In the postoperative period, following ASDH evacuation, pupillary asymmetry completely disappeared. He received decongestant therapy, antibiotics and antiepileptic medication continued and gradually improved to a GCS of score E4V5M6 with no focal neurological deficits. Post -operatively non-contrast CT scan head revealed complete evacuation of acute subdural hematoma with subsidence of the mass effect. (Fig-2) At the time of discharge, child was E4V5M6, accepting orally and playing actively. At the one year of follow-up he was doing well with mild delay in the developmental mile -stones.

## 3. Discussion

Traumatic brain injury constitute one of the important and leading causes of acquired disability and death in children and infant age group. [1] Falls and motor vehicle accidents are commoner non-inflicted causes, while child abuse in infants and young children are inflicted causes of traumatic brain injury. [2] Subdural hematoma is the most common intracranial pathology. [3] The most common mechanisms of head injury in very young children are falls from a short height, imparting a predominantly translational force to the head, which may result in local skull deformations, sufficient enough force to cause simple skull fractures, and extradural hematomas and typically subdural hematomas result from displacement of the brain relative to the dura, sufficient enough leading rupture of the bridging veins, which runs from

the surface of the brain to the overlying venous sinuses. [4, 5] In contradiction to epidural hematomas, which develops from the focal impact injuries, subdural hematoma almost always results from angular deceleration of the head, in which the brain continues to rotate relative to the more stationary skull and dura, usually associated with some form of diffuse parenchymal damage. This type of brain damage often results in severe and permanent neurologic sequelae. [6-7] Management is mainly aim to limit the progression of the primary brain injury and minimizing secondary brain injury.

Burr-hole evacuation of acute subdural haematoma can be a novel technique in special situation of non-availability to manage intracranial isolated thick acute subdural hematoma to arrest or attempt to reverse the worsening neurological state of patient in the desperate adverse event. Our case was showing extremely rapid neurological deterioration, so original plan of craniotomy and subdural haematoma evacuation was changed to the shorter swift approach of burr-hole evacuation of acute subdural hematoma with subdural drain placement. The most important implication of this alteration was reduction in the operation theatre time. Burr-hole drainage is definitely considered as less invasive than craniotomy. [8, 11] In addition relative shorter procedure, also provides almost immediate release and dissipation of the high intracranial pressure, can be achieved with lesser risk of bleeding. However, one important precaution is placement of the burr-hole especially over thickest part of subdural clot. Moreover, burr-hole can be performed outside operation theatre in special situation, even in an examination room or even at the emergency Service centre. [9, 11]

One major limitation of burr-hole drainage is the inability to evacuate hematoma, containing a firm clot. Another important limitation is the inability to perform hemostasis through a burr hole inside the subdural cavity and If haemorrhage is not recognized intraoperatively and detected later on after hematoma drainage or clots are very firm or failure to removal through burr-hole leaving large residual hematoma, additional craniotomy may be required later on. [8, 11] Decompressive craniectomy or other major cranial procedure can be performed if required on repeat CT scan showing mass effect or significant residual hematoma after initial burr hole surgery. [11]

However, ASDH with thick component showing transtentorial herniation in the acute phase of injury, the hematoma usually remain relatively soft and contains a grossly major liquid component than in the subacute phase, so it further assists in expulsion of hematoma out of the burr holes, as it is easily extruded, further assisted by pre-existing raised intracranial pressure. [10, 11]

Various prognostic factor affecting favourable outcome however, younger patients carry better potential for recovery than older, a short duration from injury to operation can minimize the damage resulting from hypoxia due to traumatic cerebral perfusion, even If the patient shows signs of cerebral herniation. [9-11]

During craniotomy, in cases with pre-existing coagulopathy usually show exaggerated hyperaemic response leading to profuse oozing of blood and difficult hemostasis and it is evident from immediate after skin incision, even at the stage of scalp flap rising , during dural opening, hematoma evacuation or contusion excision or at the final hemostasis stage. However, minor coagulopathy may be acceptable for abdominal or limb surgery but it can make neurosurgical procedure extremely hazardous. So complete normalization of coagulation abnormality should be carried. [4]

Coagulopathy or poor general condition or frail patient, who are not suitable candidate for larger craniotomy or prolonged general anaesthesia may be subjected to burr hole surgery as rescue surgery in these category of cases. [4, 11]

In 1915, Satyarthee et al reported an adult patient with coagulopathy, who had rapid neurological deterioration in the casualty, author reported to select a suitable procedure among the percutaneous needle aspiration, subdural drainage, placement of burr holes alone or burr hole with placement of subdural drain.<sup>11</sup> Intraoperatively two burr- holes were made, hematoma evacuated and subdural drain was placed for five days.<sup>11</sup> Authors further concluded burr hole drainage is less invasive than craniotomy and can lower the high intracranial pressure once dura is entered after cutting dura, moreover, this procedure can be performed in an examination room. [10, 11]

However better recovery in current cases can be attributed to a conglomerate of favourable factors younger baby, short interval from injury to surgical intervention, minimizing timing of firm clot formation of haematoma is less, thicker subdural hematoma, selection of a simple burr-hole procedure, with maximal mass effect caused by ASDH and fortunate spontaneous hemostasis and no associated cerebral contusion, hydrocephalus, intra-ventricular hematoma or infarct. [9-11]

## 4. Conclusion

Traumatic brain injury is considered as one of the leading causes of acquired disability and death in infancy and children age group. Subdural hematoma constitutes the most common intracranial traumatic pathology in the pediatric age-group. Ideal method of acute subdural hematoma remains craniotomy and duraplasty with complete removal of acute subdural

hematoma. However, optimal condition for craniotomy may not be possible either due to poor condition of patient i.e. coagulopathy or rapid worsening of case, non-availability of operation theatre or lack of infrastructure, an alternative rescue surgery in the form of burr -hole evacuation can be tried in selected cases. Ideal candidates are thick acute subdural hematoma, without associated cerebral contusion, hydrocephalus, intra-ventricular hematoma or infarct. Burr-hole drainage is less invasive than craniotomy and can lower the high intracranial pressure once dura is entered after cutting dura. So, every patient should be offered neurosurgical help to salvage the life at earliest possible opportunity.

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