

Title: Early urgent cranioplasty for symptomatic hygroma: report of two cases

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## **Abstract**

Following craniectomy, hygromas are relatively common. While many cases resolve spontaneously, some patients develop neurologic deficits. Management of symptomatic hygromas often involves shunting or drainage. We present two patients who three weeks after decompressive hemicraniectomy developed declining neurologic status secondary to enlarging hygroma. Failing conservative management, both were treated with urgent cranioplasty and returned to neurologic baseline. Early cranioplasty may be safe and effective for symptomatic collections.

## **Introduction**

Following decompressive craniectomy patients remain at risk for hemorrhage, infection, cerebrospinal fluid (CSF) disturbances, and are vulnerable to trauma before cranioplasty [1]. Specific complications tend to occur in a predictable time course with hemorrhage and fluid collections occurring in the weeks following craniectomy and paradoxical herniation occurring after months [2,3]. Standard practice is to delay cranioplasty until edema, extra-axial fluid collections, or infection have resolved, often a delay of several months [4]. Cranioplasty has been shown to improve neurologic function and some argue that it should be performed earlier to enhance rehabilitation [5]. While some surgeons wait a minimum period before cranioplasty, a review found no association between complications and timing [6].

## **Case 1**

A 43-year-old male suffered a ground level fall. His Glasgow Coma Scale (GCS) was 15 on arrival yet imaging demonstrated a subdural hematoma and intraparenchymal hemorrhages (Fig. 1A). We performed emergent hemicraniectomy and extraventricular drain (EVD) placement.

Postoperatively, he remained intubated with GCS 6T. His craniectomy flap remained sunken and intracranial pressure within normal limits (Fig. 1B). His EVD was removed after four days. His neurological exam slowly improved, however he was unable to be weaned from the ventilator.

Two weeks after his craniectomy his neurologic exam declined. His GCS remained 6T but his craniectomy flap was full and tense. Imaging revealed a large

hygroma with midline shift (Fig. 1C). This was aspirated at the bedside but reaccumulated. A repeat aspiration was followed by cranioplasty (22 days post-craniectomy). Postoperative imaging confirmed hygroma resolution (Fig. 1D). Over days the patient's neurological exam improved, his pupillary exam normalized, and he moved all extremities spontaneously. He was weaned from the ventilator and discharged to rehab.

Four months after his initial injury the patient was living at home with normal neurologic exam and GCS 15.

## **Case 2**

A 22-year-old male was ejected during a motor vehicle crash. His GCS was 3T on admission and imaging revealed a holohemispheric subdural hemorrhage with midline shift (Fig. 2A). After resuscitation his GCS improved to 10T. He was taken for emergent hemicraniectomy. Post-operative imaging showed new hemispheric and falxine subdural hematomas (Fig. 2B).

He remained intubated with GCS 9T and a full, soft flap. His EVD was removed after eight days and his exam slowly improved to where he followed commands, opened eyes spontaneously, and mouthed words. His exam remained stable over the following days, but serial imaging revealed a hygroma without significant midline shift or mass effect, and he remained on the ventilator.

Fifteen days after craniectomy he became agitated and his craniectomy flap was swollen. Imaging showed the hygroma had enlarged to 3 cm (Fig. 2C). This was aspirated (165cc) but reaccumulated the following day. During this time, his neurologic exam declined, he became drowsier, non-verbal, and only intermittently followed

commands. The decision was made to perform cranioplasty (21 days post-craniectomy). Over the following days, he improved to GCS 11T with antigravity strength and was reliably following commands. The remainder of his hospital course was uncomplicated with no collections on follow-up imaging (Fig. 2D). Thirty days after craniectomy he was discharged to home.

Four months after his initial injury he was living at home with no focal neurological deficits and normal postoperative changes on imaging.

## **Discussion**

Following decompressive craniectomy the most common complications in the trauma subpopulation are CSF disturbances such as hydrocephalus, fistulas, or most commonly a hygroma [1].

Hemorrhage and fluid collections tend to occur days to weeks after craniectomy while paradoxical herniation tends to occur months later [2,3]. To understand this temporal pattern, studies have examined the effect of cranioplasty finding it improves perfusion and restores autoregulation [7]. While cranioplasty has traditionally been delayed months while edema, fluid collections, and inflammation subside, there has been increasing interest in earlier cranioplasty with some studies reporting greater neurologic improvement [5,6,8,9].

The pathophysiology of these extra-axial collections is unknown; however it has been suggested that a combination of arachnoid tears, subarachnoid inflammation, damage to arachnoid villi, and the lack of cranial pressure forcing fluid absorption all contribute to their development [10]. We believe that these collections represent a low-pressure phenomenon where CSF flows into the extra-axial space but is unable to egress.

Several studies have analyzed risk factors and management strategies for CSF disturbances. Hygromas have been found to be associated with diffuse, high impact trauma [10,11]. The earliest imaging evidence appears in the first week post-craniectomy, the volume peaks between weeks 3-4, and they tend to resolve by four months with few requiring surgical intervention [11]. The cases presented both developed neurologic symptoms just prior to this peak, but due to their neurologic decline conservative management was tried only briefly.

For patients with hydrocephalus or extra-axial fluid collections, shunting is a common approach [12]; however, collections may still develop [10]. When planning early cranioplasty, patients with high EVD output ( $> 150$  cc/day) may require simultaneous shunt placement [13]. In one study a shorter delay resulted in better resolution of post-cranioplasty hydrocephalus without need for permanent shunting [12]. Symptomatic contralateral collections may also develop, and when these fail conservative management, early cranioplasty has shown success [10].

After decompressive craniectomy, many patients develop extra-axial CSF collections likely due to the effects of inflammation and injury altering normal CSF circulation. While many of these disturbances resolve spontaneously, some patients develop progressive symptoms. Early cranioplasty may be safe and effective at providing opposing pressure and restoring CSF dynamics.

## Figure Captions

**Fig. 1** CT of first case, 43-year-old male after ground level fall. (A) Early imaging shows temporal intraparenchymal hemorrhage (5x2 cm). (B) Post-craniectomy flap remained sunken. (C) After neurologic decline and flap bulge were noted, repeat imaging

revealed hygroma with midline shift. (D) Cranioplasty was performed 22 days after craniectomy with complete neurologic recovery.

**Fig. 2** CT of second case, 22-year-old male after motor vehicle crash. (A) Initial imaging shows 7mm right holohemispheric subdural hemorrhage with midline shift. (B) Post-craniectomy imaging shows new left-sided and falcine subdural hematomas. (C) After neurologic decline, repeat imaging revealed hygroma. (D) Cranioplasty was performed 21 days after craniectomy with complete neurologic recovery.



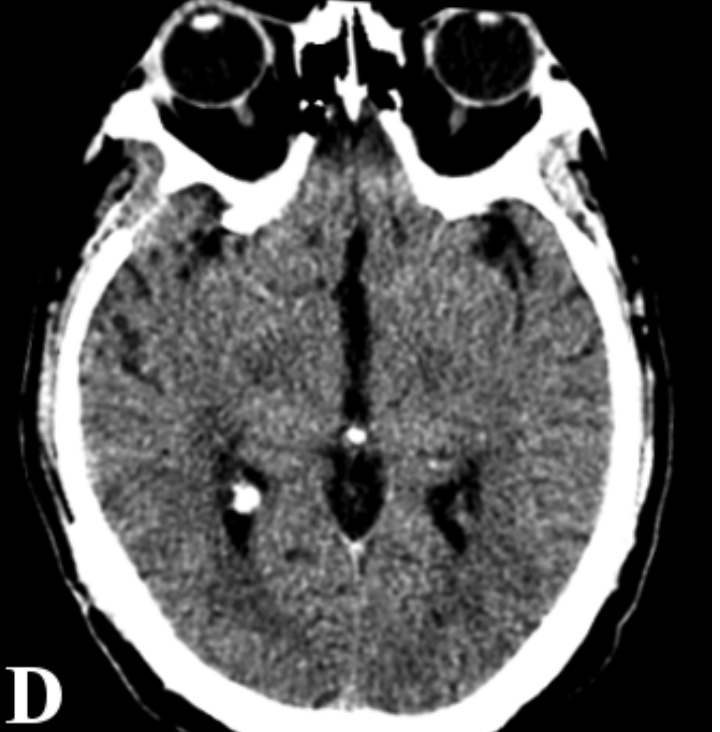
**A**



**B**

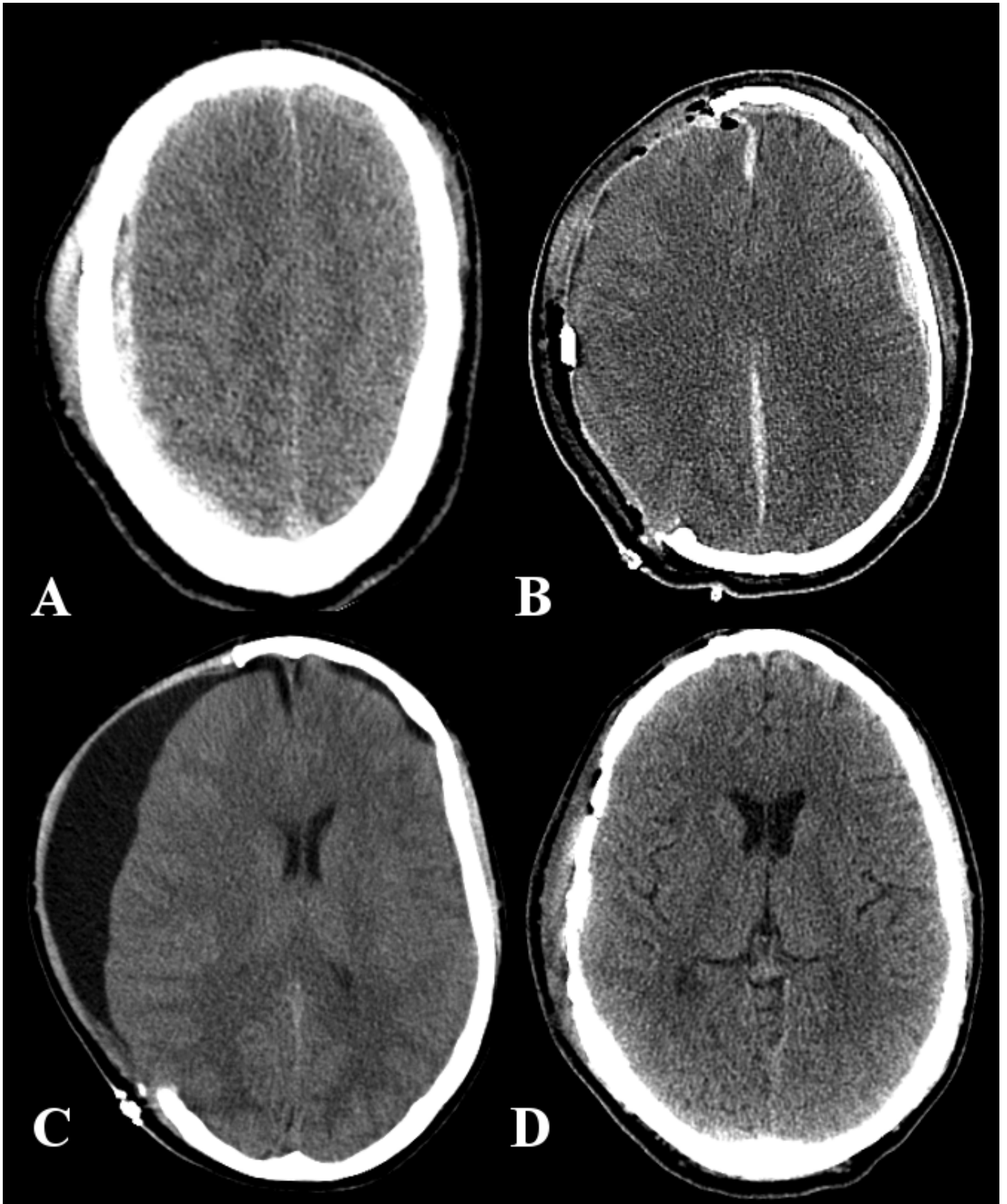


**C**



**D**





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