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A case series of five patients

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ABSTRACT

Background: Subdural hematoma in infants is a challenging condition. Acute subdural hematomas can cause intracranial hypertension and a midline shift, but decompressive craniotomies in young patients have shown promising results with specific complications in this age group. Hinge craniotomy is an old technique used in many neurosurgical procedures associated with elevated intracranial pressure. The objective of this study is to report the usage of flail bone flap in the management of acute subdural hematoma in infants, its outcome, advantages, disadvantages and related complications.

Methods: This is a review of the medical records of 5 infants younger than one-year-old who underwent decompressive craniotomy as management of acute subdural hematoma at Mansoura university hospital.

Results: In this series, five babies were included. Operative time for decompressive craniotomy (DC) ranged from 1 h and 40 min to 3 h. Four infants survived. Three infants recovered with good outcomes and one infant developed hemiparesis.

Conclusion: The use of flail bone flap technique in decompressive craniotomy is associated with a high success rate and low incidence of complications. Large-based studies are still required for a better assessment of the results.

INTRODUCTION

Although acute subdural haematoma is considered uncommon in infants with an incidence of about 20-25 per 100000 cases but its management is a challenging condition. The most common cause in this age group is child abuse especially the shaken baby syndrome. [1].

Infantile subdural hematomas cause convulsive seizures, consciousness disorders, retinal haemorrhage, or apnea, which can progress to coma with hemiplegia or death [2]. If it is accompanied by intracranial hypertension, it will result in diffuse edoema, which will then lead to cerebral ischemia [3].

When treating infantile ASDH surgically, one must take into consideration how to best regulate intracranial pressure while minimising the risk of complications [4].

Decompressive craniectomy (DC) has been successfully used to alleviate (ICP) and massive brain swelling following infarction or

Keywords
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bleeding [5-7]. Improved cerebrovascular compliance, cerebral oxygenation, and cerebral perfusion can be achieved through reductions in ICP [8]. After a DC, a cranioplasty procedure is required [9] utilising either one's own autologous skull or more expensive synthetic materials [10].

Cranioplasty has been associated with some complications including surgical site infection (SSI) [11-13] and bone graft resorption (BGR) in pediatric populations [12-15].

During a decompressive craniotomy, a bone flap will be elevated followed by opening of the dura and evacuation of the hematoma. Finally, the bone flap will be repositioned loosely without fixation. The replacement of the bone flap eliminates the need of a second operation lead to avoidance of decompressive craniectomy and subsequent cranioplasty related complications. [16].

There is no clear guidelines for management of ASH using craniotomy, so we reported our experience with hinge craniotomy in 5 infants in our tertiary care centre.

PATIENTS AND METHODS

This retrospective case series that was conducted at Mansoura University Neurosurgery Department after obtaining approval from the local ethical committee and Institutional Review Board of Mansour Faculty of Medicine. We included five pediatric cases along one year duration.

All patients were subjected to standard history taking, general and detailed neurological examination. initial GCS and presence of other intracranial pathologies were also assessed. On admission, a CT scan of the patient's brain was analyzed to determine the hematoma's thickness as well as the amount of midline shift. The Glasgow Outcome Scale (GOS) was used to evaluate the results, and the follow-up period was increased to six months.

In addition, routine preoperative laboratory and radiological investigations were ordered. After deciding on surgical intervention, it was completely explained to the patients' guardians with its indications and complications and following that, informed written consent was obtained.

All of the procedures were carried out under general anesthesia. A large frontotemporal skin incision was done on the affected side followed by preservation of pericranial graft to

be utilized in duroplasty. After that a small burrhole was done in the temporal region as fast as possible with small opening to the dura to help in relieve of the increase intracranial pressure followed by dissection of the dura from the skull bone. Due to very thin bone we used a scissor to complete the craniotomy with continuous dissection and separation of the dura from the bone flap. At the level of coronal suture, the dissection was difficult due to tight adhesion of the dura to the bone so we utilized this limb to hinge the bone flap without doing complete bone elevation. The squamous temporal bone was rongeuired to the temporal fossa floor, ensuring that no edge of bone remained that could prevent the swollen temporal lobe from being displaced laterally. The dura was opened in cruciate shape manner followed by evacuation of the haematoma and ensuring haemostasis. Then the pericranial graft was used to do duroplasty and the craniotomy flap was left hinged without fixation followed by anatomical closure in layers.

All patients received standard post-operative care, with frequent assessment throughout the day. Any post-operative complications were noted and then recorded. Regular follow up visits were scheduled for these cases.

Early follow up C.T scan was done to all patients to document evacuation of the hematoma, improvement of the midline shift and to detect any complications that need further management. During the follow up serial follow up C.T scans was ordered to evaluate the brain and the fate of the bone flap.

STATISTICAL ANALYSIS

Microsoft Excel was used to enter and analyse the data. This was followed by data being imported into the Statistical Package for Social Sciences (SPSS 27, IBM/SPSS Inc., Chicago, IL) for windows. According to Kolmogorov-Smirnov and Shapiro-tests, Wilk's the baseline characteristics of the study population were presented in the form of frequencies and percentages (percent) or mean values and standard deviations (SD) or median and range.

RESULTS

The study included 5 infants, 3 boys (60%) and 2 girls (40%). Their age ranged from 25 days to 180 days with mean age of 81.5 days.

The cause of SDH was spontaneous in four cases (80%) and traumatic in one case only (20%). The hematoma located in the left side in 3 cases (60%) and on the right side in 2 cases (40%). The SDH was associated with ICH in one case only.

The lowest preoperative GCS was 5/15 (in one case) and the highest score was 11/15 (in two cases) while the other two cases had GCS of 8/15 and 10/15

respectively.

Coagulopathy was detected in 4 cases (80%). The mean operative time was 136 minutes with range between 100 minutes and 180 minutes. Regarding the outcome in our study, 3 cases (60%) showed favourable outcome in the form of full recovery while 1 case Survived with Rt. Sided weakness G 3. One case died that represented 20% mortality rate.

Table 1. Detailed literature

| Gender | Age | Diagnosis | Preop GCS | Coagulopathy | Operative time (min) | Outcome |
|--------|------------------|-----------------------------------|-----------|--------------|----------------------|--------------------------------------|
| Boy | 25 days | Lt. acute SDH (spontaneous) | 8/15 | Yes | 100 | Fully recovered |
| Girl | 2 months | Rt. Acute SDH (spontaneous) | 10/15 | Yes | 130 | Fully recovered |
| Boy | 4 months | Lt. acute ICH + SDH (spontaneous) | 11/15 | Yes | 180 | Survived with Rt. Sided weakness G 3 |
| Boy | 3 months 14 days | Lt. acute SDH (spontaneous) | 5/15 | Yes | 150 | Died |
| Girl | 6 months | Rt. Acute SDH (trauma, fall) | 11/15 | No | 120 | Fully recovered |

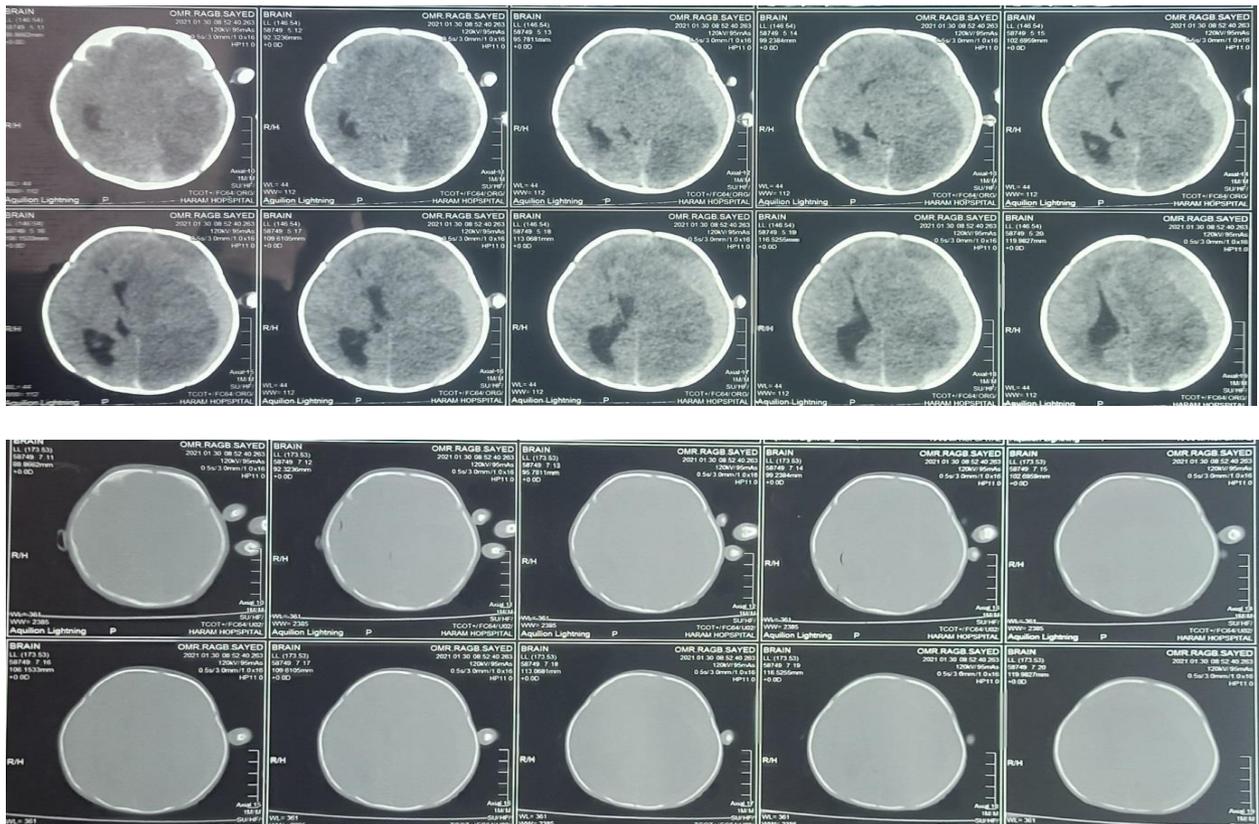


Figure 1. 25 days old male child with left acute SDH

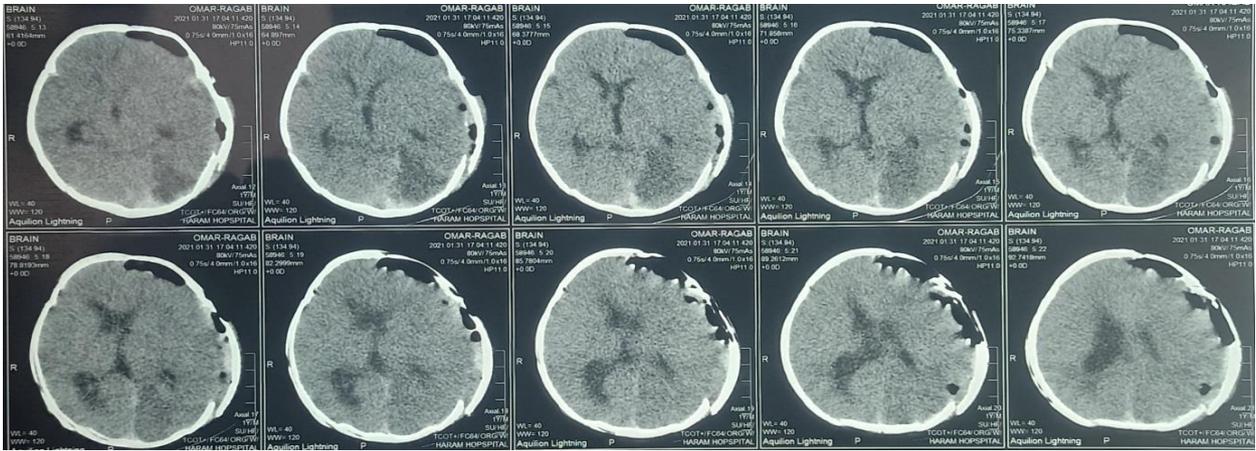


Figure 2. First day post operative after hematoma evacuation and flail bone flap position.

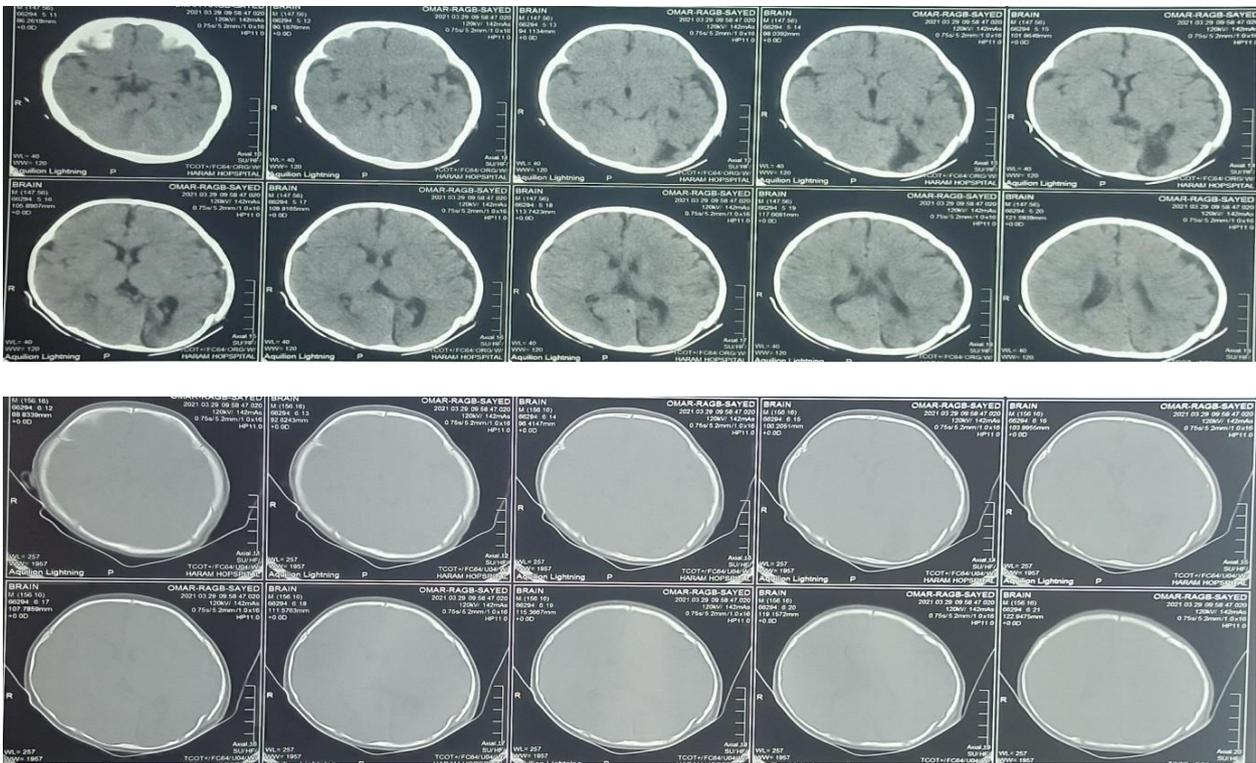


Figure 3. 2 months postoperative with disappearance of midline shift and bone flap return to normal position

DISCUSSION

There are numerous surgical and non-surgical treatments for ASDHs, including burr holes, craniectomies, osteoplastic flaps, subtemporal decompressions, temporal lobectomy, dural openings, dural augmentation, and dural snips [17-20]. In spite of everyone's best efforts, the reported mortality rate has remained somewhere between 80 and 90 percent, and the morbidity rate among the population that has managed to survive has been extremely high [18, 19, 21, 22].

In addition to being less invasive surgically, the technique for hinged bone grafts leaves only one scar, eliminates the need for a second surgery to replace the bone graft, and is more anaesthetically preferred.

Our results showed full recovery in 3 cases (60%), 1 case died that represented 20% and 1 case survived with right sided weakness represented 20% morbidity.

In a study involving 30 adult patients diagnosed with ASDHs and undergoing craniectomy, subcutaneous placement of a hinged flail was used, according to the findings of Abd El-Wahed and Ahmed, 17 patients passed away while being treated at the hospital, accounting for 66.7 percent of the total; 13.3 percent of the patients who survived did so in a vegetative state, while 9 patients made a full recovery (30 percent) [23]. The variation could be explained due to different age groups.

The DC group had a worse preoperative GCS, younger age, more extracranial injuries, and a more severe CT, according to a study by Li et al., indicating that DC may be more effective than CR based on the actual outcomes, which were comparable in the two groups despite the predicted outcomes being worse for the DC group [24].

Tsermoulas et al. evaluated a total of 99 patients, 69 of whom had DC, 17 of whom had CR with a "riding flap," and 13 of whom had CR with a "fixed retained flap." Despite the fact that patients in the DC group had worse outcomes, the baseline characteristics of the two groups were very different; those with DC had significantly more severe mechanisms, lower GCS, more extracranial injuries, and higher Rotterdam CT scores than those in the control group [25].

More herniation (pupillary changes) was found in the DC group, which was found by Woertgen et al., who looked at 180 patients (111 CR and 69 DC) and

found a higher mortality rate in the DC group. There was no significant difference in the outcomes of CR and DC for patients who did not exhibit signs of herniation; however, there was a significant difference in the outcomes of CR and DC for patients who did exhibit signs of herniation [26].

Kwon et al. found that while patients with unfavourable features (age >70, anticoagulation or antiplatelet use, time to surgery > 4 hours, GCS < 8, nonreactive pupils, and major extracranial injury) had more poor outcomes those with less unfavourable features. [27].

The CR group and the DC group were compared by Kim and his colleagues in terms of age, gender, GCS score, hematoma volume, midline shift, ICH score, and the amount of time that passed between the ictus and the surgery. During the course of the study, CR was carried out on a total of 139 patients, while DC was carried out on 125 patients. The mortality rate at 30 days was the same for both the CR group and the DC group (13.7 percent vs. 15.2 percent, $p = 0.729$). On the other hand, the CR group had a functional survival rate of 46.0 percent after 12 months, which was significantly ($p = 0.014$) higher than the DC group's survival rate (32.0 percent) [28].

Our study has some limitations; it is a single-centre study that included a relatively small sample size. It also lacks long-term follow up for the included patients. These drawbacks must be handled in the upcoming studies.

CONCLUSION

Using a flail bone flap to perform a decompressive craniotomy may be beneficial, especially in infant cases, because of a high rate of complications associated with DC and subsequent cranioplasty in children and infants. The efficacy of this technique in terms of clinical outcomes and the reduction of complications necessitates further large-scale studies.

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