

Comparative Study between Bone Flap Insertion in Abdominal Wall Versus Flail Replacement in Decompressive Craniectomy of Acute Subdural Hematoma

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Abstract

Background: Traumatic acute subdural hematoma remains one of the most lethal of all head injuries patients with Acute Subdural Hematomas (ASDHs) having higher mortality and lower functional recovery rates compared with those of other head-injured patients.

Decompressive Craniectomy (DC) for management of ASDH with accompanying brain edema and midline shift has become one of the standard guidelines in many centers. DC remains to be the standard of surgical modality for patients with poor clinical status.

Subcutaneous preservation of autologous bone flap is an inexpensive option that preserves the viability of the bone flap, resulting in good cosmetic results and the very low infection rate.

Aim of Study: To compare results of (ASDHs) managed with DC with consequent subcutaneous bone flap insertion in the abdominal wall vs subcutaneous hinged flail placement in the craniectomy site.

Patients and Methods: A retrospective review of 61 patients with (ASDHs) operated at the Department of Neurosurgery, Cairo University and Beni Souf University Hospital during the period from Jan. 2012 – Dec. 2015. Patients were divided into:

Group (A): 31 patients operated upon with subcutaneous abdominal bone flap insertion, (22 males and 9 females) median age was 42 years. On admission there were 19 patients with Glasgow Coma Score (GCS) below 8, and 12 patients with GCS 8 or above 8.

Group (B): 30 patients operated upon with subcutaneous hinged flail bone flap replacement in the craniectomy site, (22 males and 8 females) median age 44 years. On admission there were 18 patients with GCS below 8, and 12 patients with GCS 8 or above 8.

Early surgical evacuation, dural fenestration, intensive care management to monitor intra cranial pressure and follow-up CT brain were done for all patients.

Results: Group (A) 14 patients died in the hospital, 4 survived with unfavorable outcome (vegetative state), and 13 survived with favorable outcome.

Group (B) 17 patients died in the hospital, 4 survived with unfavorable outcome (vegetative state), and 9 survived with favorable outcome.

Conclusion: Analysis of the obtained data reveals that subcutaneous abdominal bone flap insertion shows a statistically significant better prognosis as compared to subcutaneous hinged flail bone flap replacement at the craniectomy site which may be due to better decompression of the brain and allowing for more room for expansion.

Key Words: Bone flap – Abdomen – ASDH – Decompressive craniectomy.

Introduction

TRAUMATIC acute subdural hematoma remains one of the most lethal of all head injuries patients with Acute Subdural Hematomas (ASDHs) have higher mortality and lower functional recovery rates compared with those of other head-injured patients [1-3].

Decompressive Craniectomy (DC) is performed in patients suffering from intractable elevation of ICP following infarction or bleeding (e.g ASDH) [6]. Despite increasing evidence regarding the benefits of the procedure [4-7], there are no standard guidelines for how to perform DC. Many options exist, from complete removal of the bone to be stored in a bone banking facility to descriptions of in situ hinge craniectomies in which the bone flap is not removed but hinged to the cranium, other authors inserted the bone subcutaneously in the abdominal wall to be stored till intracranial tension normalizes [8-11].

It remains controversial however, whether it is better to leave the bone hinged to the cranium or

insert it subcutaneously in the abdominal wall [12-16].

Aim of the study:

The aim of this study is to compare results of (ASDHs) managed with DC plus Dural Fenestration (DF) with consequent subcutaneous bone flap insertion in the abdominal wall vs subcutaneous flail hinged placement in the craniectomy site.

Patients and Methods

A retrospective review of 61 patients with (ASDHs) operated upon at the Department of Neurosurgery, in Cairo University Hospitals and Beni Suef University Hospital during the period from Jan. 2012 – Dec. 2015.

Patients were divided into two groups:

Group (A): 31 patients operated upon with subcutaneous abdominal bone flap insertion, (22 males and 9 females) median age was 42 years. On admission there were 19 patients with Glasgow Coma Score (GCS) below 8, and 12 patients with GCS 8 or above 8.

Group (B): 30 patients operated upon with subcutaneous flail bone flap replacement in the craniectomy site, (22 males and 8 females) median age 44 years. On admission there were 18 patients with GCS below 8, and 12 patients with GCS 8 or above 8.

Early surgical evacuation, dural fenestration, intensive care management to monitor and manage intra cranial pressure and next morning follow-up CT brain were done for all patients.

Pre-operative clinical status:

To evaluate the results of management it is imperative to accurately examine the clinical condition prior to surgery. All patients were examined for conscious level, signs of brain-stem dysfunction, and alteration of vital signs, pupils, motor power were also noted along with detailed history about the patient's medical conditions, mode of trauma and time lapsed before admission. All patients were subjected to early urgent CT brain, ICU admission, rapid cerebral dehydration, & preparation for urgent surgery.

Operative procedure:

When the clinical diagnosis of a large unilateral subdural hematoma as the primary intracranial mass lesion was confirmed, the following surgical procedure was employed: Under general endotracheal anesthesia, a high temporal burr hole was placed to provide an immediate release of intrac-

ranial pressure and, in addition, to exclude the possibility of a subacute hematoma that could be evacuated through a conventional opening. When an acute subdural was encountered, a skin flap was extended from the glabella along the midline, terminating 4cm above the external occipital protuberance. The skin incision was carried laterally to the level of the transverse sinus, and a one-layer myo-cutaneous flap including the periosteum was turned. A frontoparietal, occipital, and temporal bone flap was then removed to reveal almost the entire surface of the hemisphere; this was rapidly accomplished by the use of the high-speed pneumatic craniotome when available and Hudson brace together with giggly saws in other cases. The squamous temporal bone was rongeuired to the floor of the temporal fossa, making absolutely certain that no edge of bone remained that might prevent subsequent lateral displacement of swollen temporal lobe. The bone flap was either left hinged subcutaneously at the craniotomy site or placed subcutaneously on the abdominal wall. Dura was not opened and the hematoma was evacuated by many fenestrations.

Through this exposure it was possible to carry out a complete removal of all clotted and liquid hematoma. Bleeding points were controlled by surgicel and gel foam, when hemostasis was satisfactory, there was no attempt to close the dura. An epidural or subgaleal drain was placed and connected to a closed, sterile, non pressurized drainage system (which was removed after 24 to 36 hours). The scalp was closed in two layers using subgaleal vicryl 3.0 and skin proline 2.0 mattress sutures.

Post-operative care:

In the post-operative period respiratory assistance was maintained, as indicated by changes in blood gases and ventilator parameters. Antibiotics were given as a standard peri operative prophylaxis using Cephtriaxone 1 gram IV, any other antibiotics were given only when needed to combat specific infections of respiratory, urinary, or central nervous system origin. Steroids were not administered; IV anticonvulsants were given to all patients as soon as the diagnosis was made and maintained although management course.

Results

Patient characteristics, including age, sex, and pre-existing medical conditions together with site and side of ASDH; and presence of trans-tentorial herniation according to the primary admission CT and diagnosis.

Patients were divided into two groups:

Group (A): 31 patients operated upon with subcutaneous abdominal bone flap insertion, (22 males and 9 females) median age was 42 years. On admission there were 19 patients with Glasgow Coma Score (GCS) below 8, and 12 patients with GCS 8 or above 8.

Group (B): 30 patients operated upon with subcutaneous flail bone flap replacement in the craniectomy site, (22 males and 8 females) median age 44 years. On admission there were 18 patients with GCS below 8, and 12 patients with GCS 8 or above 8.

Combined median age of both groups was 42-45ys, there was a total of 44 males and 17 females enrolled, 37 patients had GCS below 8 and 24 patients had a GCS above 8. Overall clinical presentation or 37 patients with trans-tentorial herniation showed ipsilateral mydriasis and contralateral weakness.

The mean time for preparation for surgery did not exceed one hour. The average time for surgical decompression plus closure was 3-4 hs over all the study. There was extra time allowed in the subcutaneous abdominal insertion group to allow for prepping, incision and closure of abdominal wound.

Group (A) 14 patients died in the hospital, 4 survived with unfavorable outcome (vegetative state), and 13 survived with favorable outcome.

Group (B) 17 patients died in the hospital, 4 survived with unfavorable outcome (vegetative state), and 9 survived with favorable outcome.

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Table (1): Sex distribution.

	Group A	Group B
Male	22	22
Female	9	8

Table (2): Mean age.

	Group A	Group B
Mean age	30y	35y

Table (3): Pre-operative GCS.

	Group A	Group B
GCS below 8	19	12
GCS 8 or above	18	12

Table (4): Length of surgery.

	Group A	Group B
Period of surgery	3hs	4hs

Table (5): Outcome in both groups.

	Group A	Group B
Died in the hospital	14 (45.1%)	17 (66.7%)
Vegetative state	4 (12.9%)	4 (13.3%)
Favorable outcome	13 (42%)	9 (30%)

Statistical analysis was performed by the Fisher exact test is 0.5014. Results with a $p < 0.05$ were considered statistically significant.

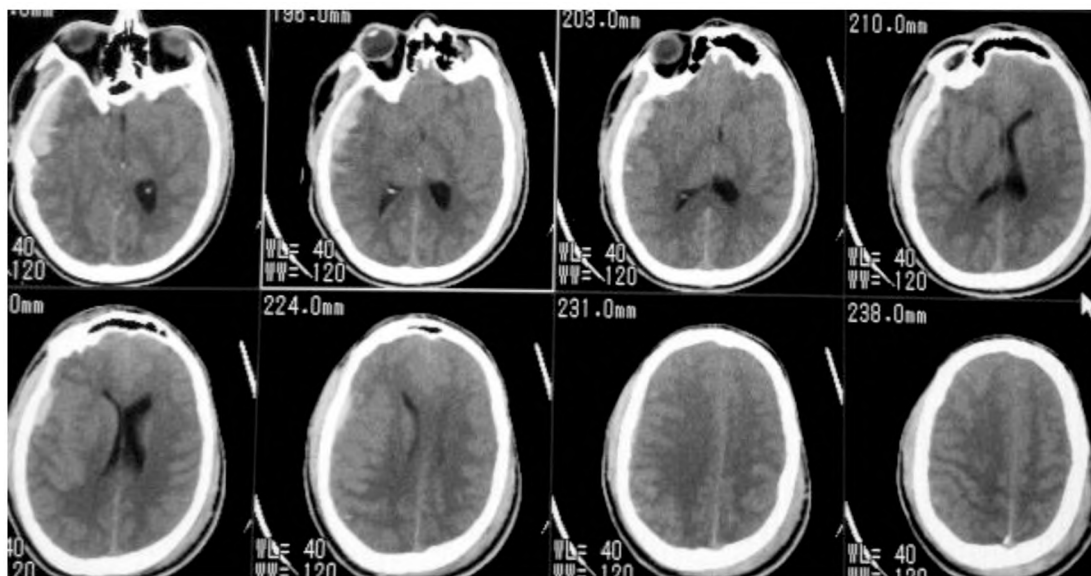


Fig. (1): Pre-operative ct brain show Rt temporo-parietal ASDH with midline shift.

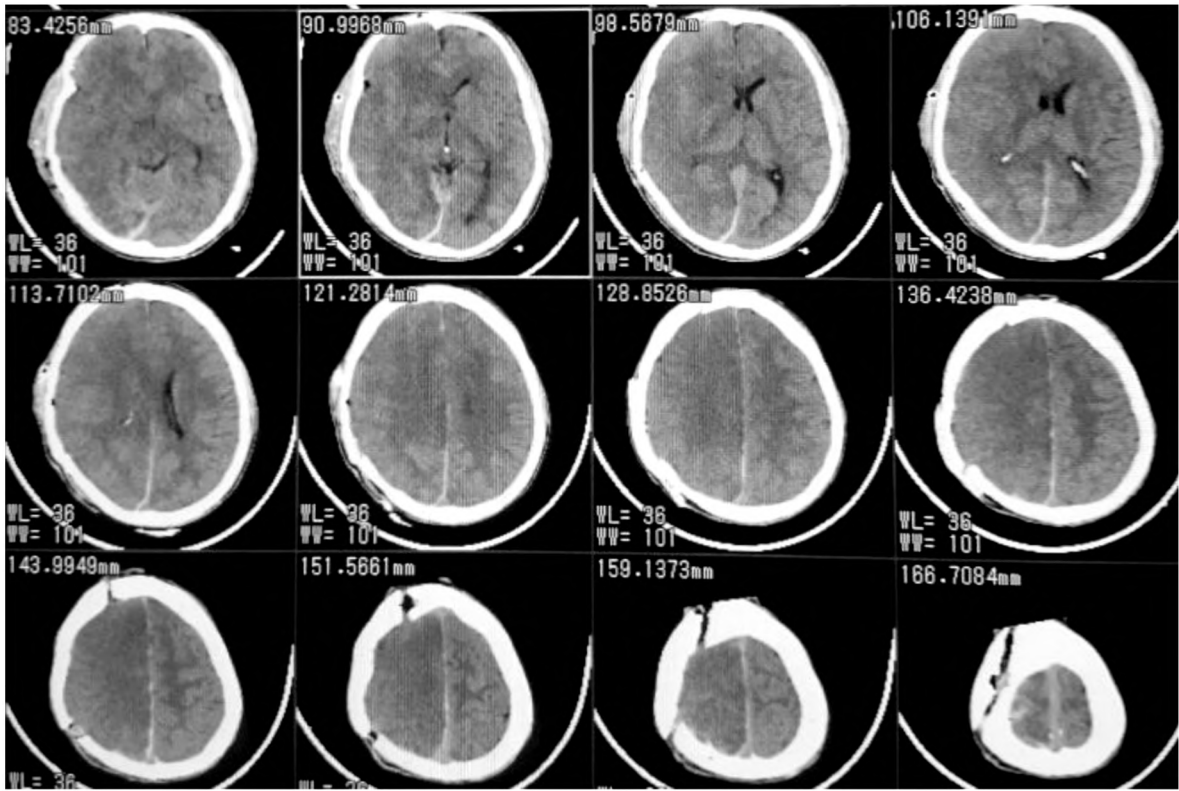


Fig. (2): Post-operative ct brain with bone hinged in temporales muscle.

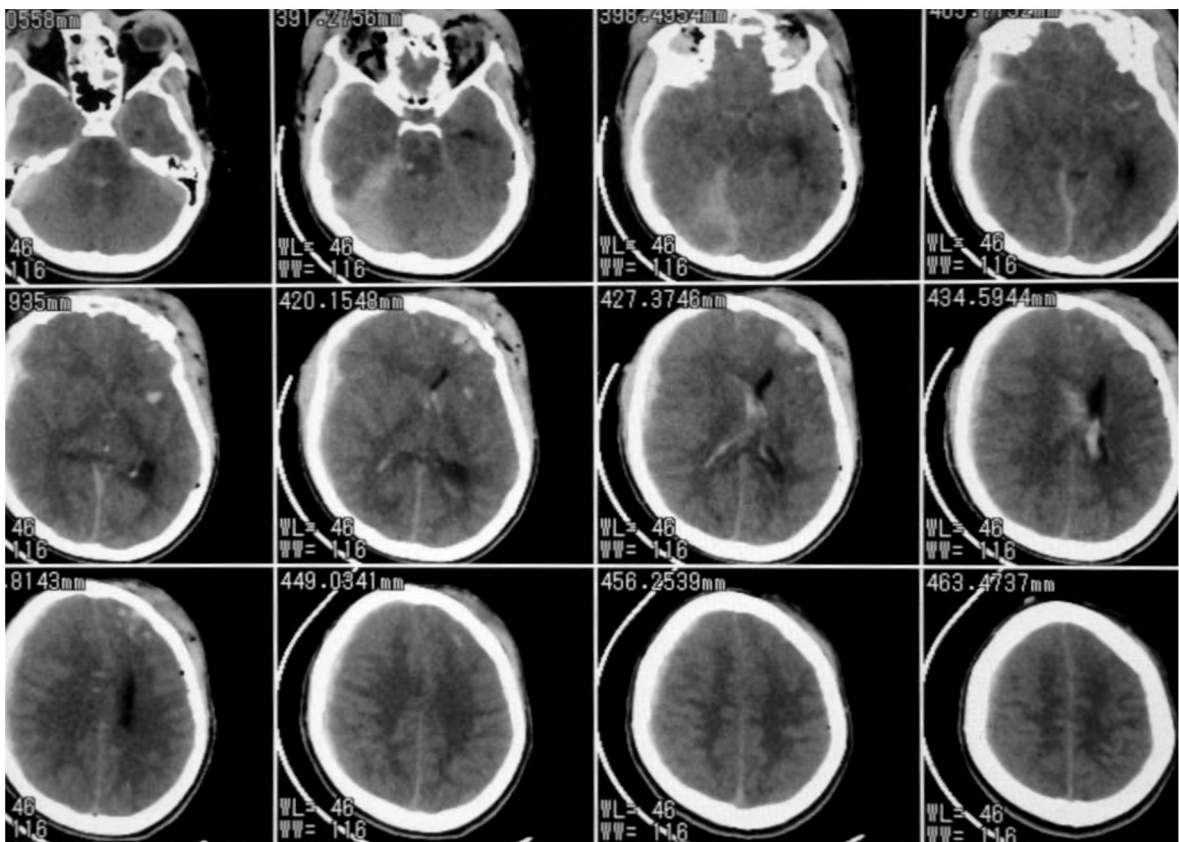


Fig. (3): Pre-operative ct brain show Rt temporo-parital ASD with midline shift.

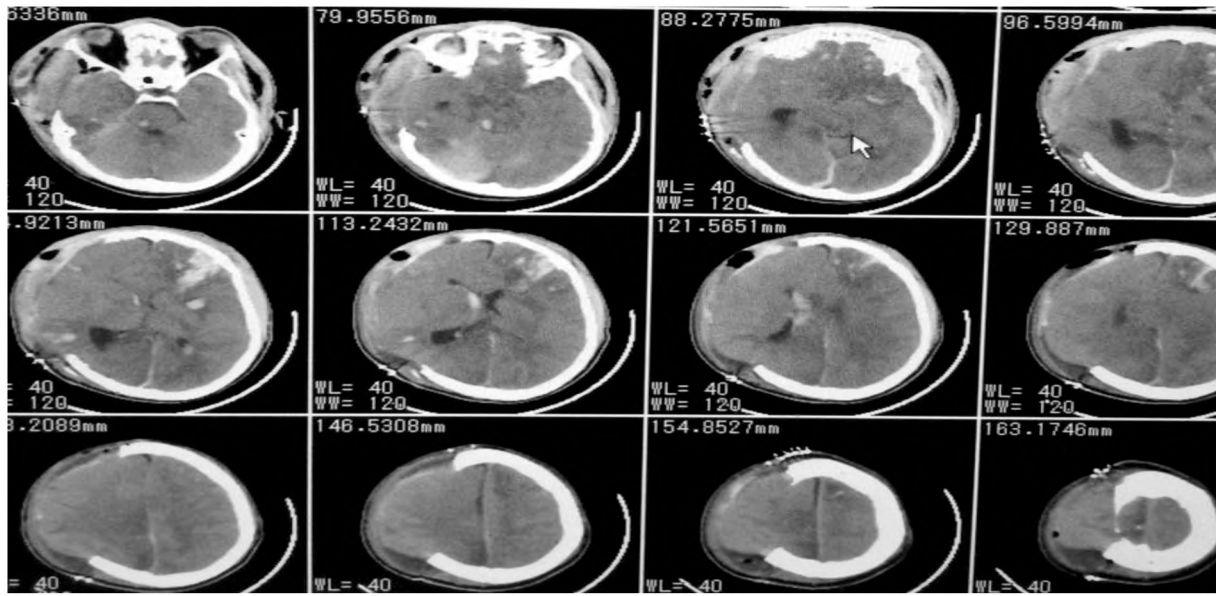


Fig. (4): Post-operative ct brain with bone inserted in abdomen.

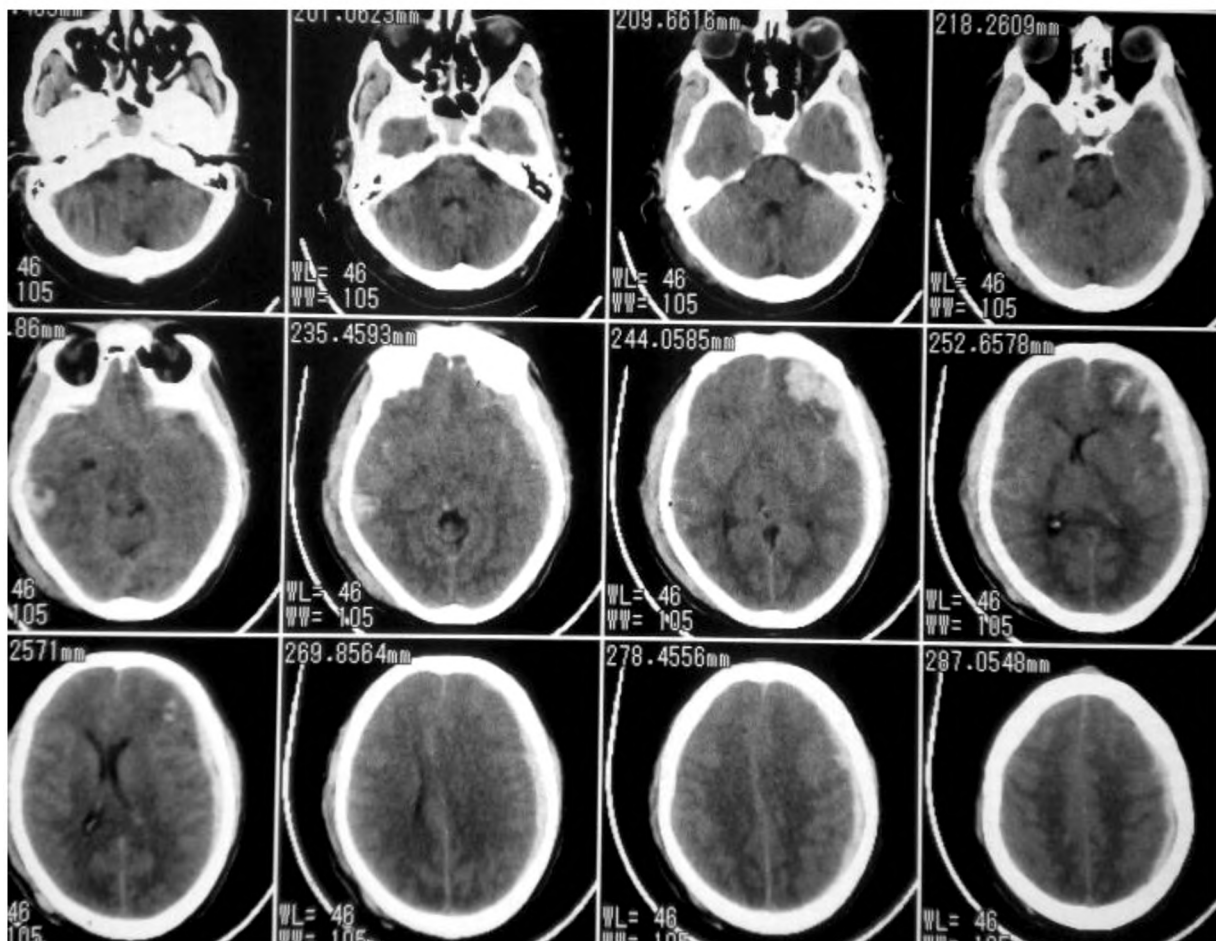


Fig. (5): Pre-operative ct brain show It tempo-praital ASD with midline shift.

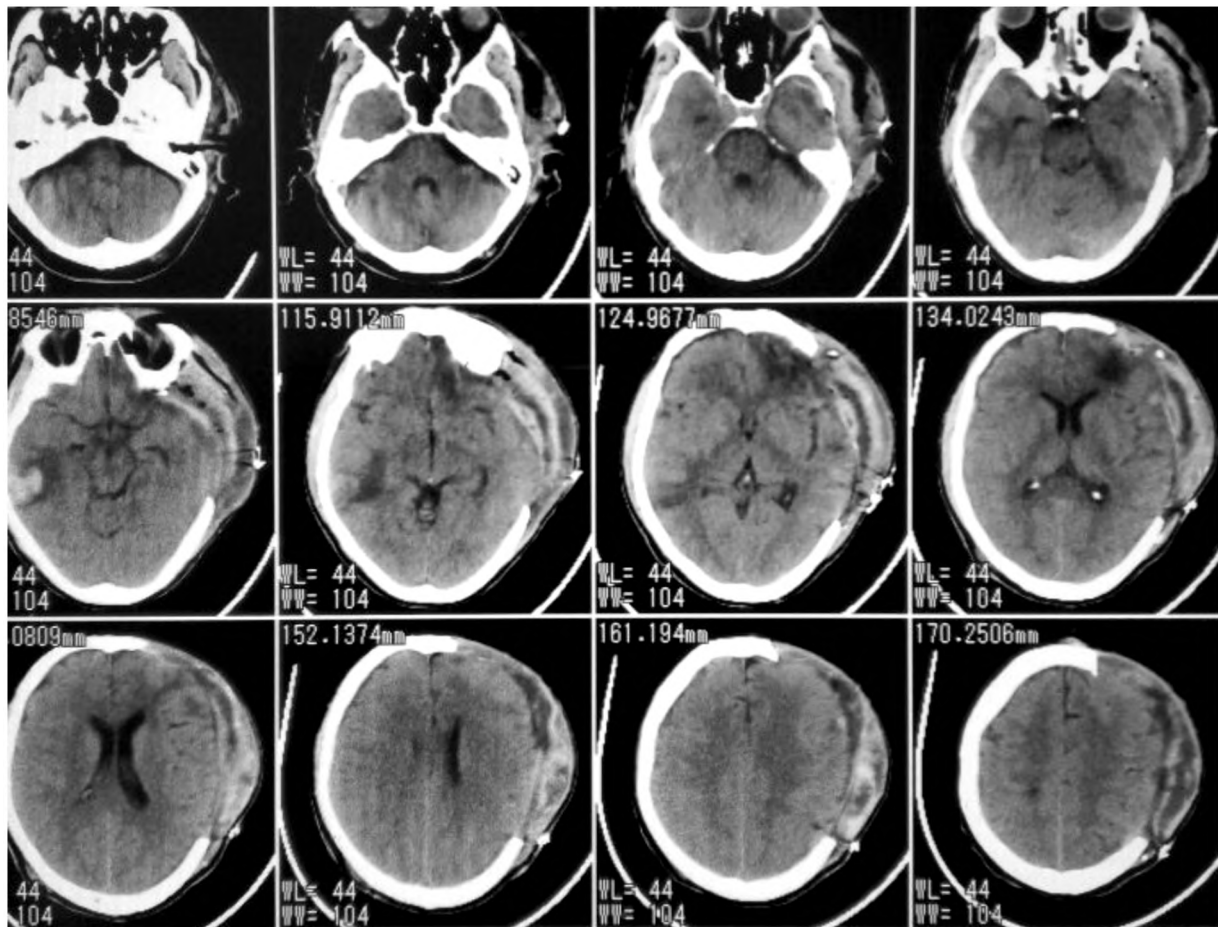


Fig. (6): Post-operative ct brain with bone inserted in abdomen.



Fig. (7): Intra operative multiple dural snipes for evacuation of ASDH.

Discussion

Traumatic acute subdural hematoma remains one of the most deadly of all head traumas. Patients suffering from ASDHs have higher mortality and lower functional recovery rates compared with patients with other head injuries [3,5,8,9].

Many surgical and non surgical techniques have been advocated in the management of ASDHs, among these burr holes, craniectomies, osteoplastic flaps, subtemporal decompression, temporal lobectomy, dural opening, dural augmentation and dural snips [1,4,6,11]. Despite all efforts, the reported mortality rate has remained at approximately 80%

to 90% with a very high morbidity rate among the surviving population [4-7].

Decompressive craniectomy is known to be effective in reducing refractory elevated ICP due to ASDH [2,5,12], there is controversy concerning the necessity of craniectomies in which the bone flap is not totally removed but hinged to the cranium, as compared to complete craniectomies where the bone flap is inserted in the abdominal wall.

We performed the current analysis to evaluate feasibility and to provide data for outcome after craniectomy in which the bone flap is not removed but hinged to the cranium, versus performing a craniectomy undertaking the extra step of inserting the bone in the abdominal wall.

In many cases when the tamponade effect of the clot was removed, extensive bleeding ensued from the torn veins. However, with the wide exposure, bleeding was rapidly controlled through the dural snips opened and we were not required to perform complete durotomies [5,8,10].

Judging the results of both groups, it is clear that taking the extra step, time and effort to place the bone flap in the abdominal wall provides a better outcome that is statistically significant.

Seelig, et al., [13] reported a mortality rate of 30% if surgery for SDH was performed within 4 hours of the accident, as compared with a 90% mortality in those who had surgery after 4 hours [18]. Our results mortality rate 45%-66% in both groups respectively but there is a long time until the patient arrives at the ER of our department, but time in ER did not exceed one hour in both groups, which means mortality rate become significantly lower in group (B).

Our opinion is that such a difference is due to the extra space provided by complete removal of the bone flap in a (complete) craniectomy versus the (incomplete) craniectomies where the flail hinged bone with the overlying stretched scalp still occupies some space and so provides less room for brain expansion.

The technique for hinging the bone grafts is surgically easier, has one scar, saves the patient the need for a second surgery to replace the bone graft and is cosmetically better looking. Although these advantages seem tempting this technique was proven to be inferior by our data as compared to the other option where the bone is inserted in the abdomen.

The abdominal placement technique has the advantage of a better prognosis as proven by our results but requires more surgical time, an extra abdominal scar and mandates a second surgery for bone flap replacement after the patient's condition stabilizes and the brain returns to its normal size. SDH.

Conclusion:

Analysis of the obtained data reveals that subcutaneous abdominal bone flap insertion shows a statistically significant better prognosis as compared to subcutaneous flail bone flap replacement at the craniectomy site which may be due to better decompression of the brain and allowing for more room for expansion.

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دراسة مقارنة بين زرع عظم الجمجمة في جدار البطن مقابل ترك العظم بدون تثبيت محكم في التجويف الجراحي في حالات النزيف الحاد تحت ألام الجافية

لا يزال النزيف الحاد تحت ألام الجافية يعتبر أحد أخطر الإصابات في الرأس. وهو السبب الرئيسي في نسب أعلى من الوفيات بالمقارنة مع إصابات الرأس الأخرى.

الهدف من هذه الدراسة مقارنة نتيجة حالات النزيف المخي الحاد تحت ألام الجافية الذين يحتاجون لاستئصال القحف في مجموعتين :

- مجموعة (أ) زرع العظام في البطن.

- مجموعة (ب) اترك العظم في الرأس بدون تثبيت محكم.

تم إجراء مراجعة استعادية لـ ٦١ مريضاً مصابين بالنزيف المخي الحاد تحت ألام الجافية في قسم جراحة المخ والأعصاب بجامعة القاهرة وجامعة بنى سويف خلال الفترة من ٢٠١٢ - ٢٠١٥.

المجموعة (أ): توفى ١٤ مريضاً في المستشفى، ونجا ٤ مع نتائج غير مواتية الحالة الخضرية، و١٣ نجوا مع نتائج إيجابية.

المجموعة (ب): توفى ١٧ مريضاً في المستشفى، ونجا ٤ مع نتائج غير مواتية الحالة الخضرية، و٩ نجوا مع نتائج إيجابية.

يكشف التحليل الحالي للبيانات أن إدخال شريحة عظمية في البطن أعطى نتائج أفضل في المجموعة أ بشكل ملحوظ وبذلك يظهر دلالة إحصائية، حيث أن هذا الأسلوب لجراحي يعطى مساحة أكبر للدماغ حتى يتمدد مما يساعد على الاستجابة الأفضل والأسرع.