Retrospective Descriptive Study on Non-operative Management of Epidural Haematoma in a Cohort of Patients at the Korle Bu Teaching Hospital

Thomas K Dakurah1,*, Hadi Mohammed Abdullah2, Fuseini Adams3, Emmanuel Bannerman-Williams4 and Benjamin Abaidoo4

1Department of Surgery, Neuroscience Unit, School of Medicine and Dentistry, College of Health Sciences, University of Ghana, Ghana
2Department of Surgery, Neuroscience Unit, Korle Bu Teaching Hospital, Ghana
3Department of Surgery, School of Medicine and Dentistry, College of Health Sciences, University of Ghana, Ghana
4Department of Surgery, Ophthalmology Unit, School of Medicine and Dentistry, College of Health Sciences, University of Ghana

Abstract

Background: Head injury resulting from trauma is the main cause of death in people younger than 45 years. Extradural hematoma is the most serious treatable complication of head injury, requiring immediate diagnosis and surgical intervention.

Objective: To determine whether selected cases of Acute Epidural Haematoma can be managed non-operatively.

Methods: This is a retrospective study of acute epidural haematomas managed non-operatively from a cohort of 107 cases at the Korle-Bu Teaching Hospital from 7th November, 2012 to 15th February, 2016. Patients’ demographic and clinical information including case notes and CT scan findings were retrieved and analyzed with IBM SPSS version 20. Total cost of hospital bills including the cost of medication, CT scans and hospitalization of patients managed non-operatively were compared to those managed operatively.

Results: A total of 19 cases of EDH were managed conservatively over the study period. There was a male preponderance of 78.95%. The mean age was 30.89 years with mean duration (in days) of hospital stay as 10.42 days. Motor vehicular accident (MVA) was the main mechanism of injury (55.56%). A single mortality was recorded at 3 months post-discharge. The total estimated cost of craniotomy and evacuation of haematoma was 4 times (75% higher) that of non-operative management.

Conclusion: It has become increasingly apparent that many small epidural hematomas will resolve with nonsurgical management without neurologic sequelae. This study also showed that non-operative management of acute epidural haematoma may be cost-effective compared with operative management.

Keywords: Epidural haematoma; Non-operative management; Tempo-parietal; Neurological deficit; Glasgow Coma Scale; Middle income country

Introduction

Trauma is the leading cause of death in people younger than 45 years and head injury is the main cause of trauma mortality [1,2]. Epidural haematoma (EDH) refers to the occurrence of symptomatic bleeding within the potential space between the skull and the dura. EDH accounts for 1% of all head injuries and 5% to 15% of severe traumatic brain injuries [3,4].

EDH has a male to female ratio of 4 to 1 and remains uncommon among children under 2 years old as a result of the plasticity of the skull and beyond 60 years on account of the adherence of the dura to the inner table. The imaging standard for the diagnosis of EDH is the Computed Tomography (CT) scan [5,6]. Before the CT scan age, cerebral angiography, exploratory burr-hole and pneumo-encephalography were the main diagnostic approaches for managing patients.
with EDH. The standard treatment involved urgent evacuation of the haematoma via a craniotomy with minimal invasive procedures advocated to prevent brainstem compression or decompensation [7,8].

EDH remains an important consequence of acute head injury [9]. Notwithstanding, there are reported cases of successful management of some cases non-surgically [10-12]. The percentage of patients managed non-operatively in clinical series since the 1960s has progressively increased from less than 1% to more than 60% [12]. Other studies have also reported few cases of conservatively managed EDHs requiring surgical conversion as a result of deteriorating neurological status [13,14]. EDH patients must be admitted in a high dependency unit with careful monitoring. Such services are associated with high cost. Unfortunately many centers in Africa lack these facilities and services. Neurosurgical services in Ghana and other developing countries are still evolving, as such, there tend to be an unacceptable delay before appropriate referral of patients to a competent centre. Even when cases arrive at such a centre there may still be undue delays because of institutional and logistical challenges. Major operational problems encountered at the Neuroscience Unit at the Korle Bu Teaching Hospital (KBTH) includes inadequate operating room space and time, lack of appropriate supporting staff (operating room, critical care and specialized neuroscience nurses), inadequate anaesthetic support and equipment. This usually results in delay in accessing appropriate care including surgical intervention. There is the need therefore for non-operative management of some cases of acute EDH, when carefully selected. This research aims at studying the outcomes of conservative management of selected cases of acute EDH in a resource-constrained environment.

**Materials and Methods**

This is a retrospective cross-sectional study of acute EDH managed non-operatively from a cohort of 107 consecutive cases at the Neuroscience Unit of the Korle-Bu Teaching Hospital within the period 7th November, 2012 to 15th February, 2016.

Included in this study were patients diagnosed with acute EDH with the absence of neurological deficit corresponding to the haematoma, a Glasgow Coma Scale (GCS) greater than 9, a haematoma thickness less than 15 mm, a haematoma volume less than 30 mls and a midline shift less than 5 mm. However, patients diagnosed with acute EDH with the presence of neurological deficit, a GCS less than 9, a haematoma thickness greater than 15 mm, a haematoma volume greater than 30 mls, a midline shift greater than 5 mm and a location of the haematoma at the temporal area and posterior cranial fossa were excluded from this study. The case notes of all the 107 consecutive patients with a CT scan confirming acute EDH admitted to the neuroscience unit between November 2012 and February 2016 were retrieved and reviewed. Out of these 107 patients, those who were initially managed non-operatively had their case notes and CT scans further evaluated. A review of the initial and follow-up CT scans was done and lesion diameter, volume, midline shift and location of the haematoma were determined and documented. Other intracranial injuries including skull fractures were also noted. Measurements were made with calipers and a measuring scale (mm) devised from the scale printed on the CT images. The volume of the haematoma (EDHV) was calculated using the Peterson and Esperson equation: \(a \times b \times c \times 0.5\), where a, b and c are the widest diameters of the haematoma in the axial, sagittal and corona planes respectively.

The age, sex, and duration of hospital admission were also recorded. The Glasgow Outcome Score (GOS) by Jennett & Bond was used to determine the outcome of each patient managed non-operatively at discharge and 6 weeks, 3 months and 6 months post discharge respectively [15].

The outcomes included; death, vegetative state, severe disability, moderate disability and good recovery respectively. A good outcome measure was defined as having a moderate disability or good recovery. Poor outcomes were those who died, including those with vegetative state and severe disability.

The total hospital bill and cost of initial and follow up CT scans were determined using records from the account units of the Surgical and Radiology Departments of the Korle Bu Teaching Hospital. These were compared with bills of patients managed surgically which includes; operating room fees, peri-operative medications including anaesthesia, intensive care, and the average cost of transportation to and from hospital for wound inspection and dressing and post-discharge.

There was no voluntarily written informed consent since the study was retrospective. However, the principles in human subject protection in accordance with the Helsinki Declaration in Medical Research were upheld.

Data was entered on a Microsoft Excel version 2013 spreadsheet with analysis performed using IBM SPSS version 20 software. Clinical and background information of study participants were analyzed and presented descriptively as means (standard deviations) for continuous variables and counts and proportions for categorical variables. Mechanism of injury, site of haematoma, skull fracture and craniofacial injuries were also analyzed and presented as counts and proportions. The mean outcome score at discharge, 6 weeks, 3 months and 6 months intervals respectively were computed.

The Independent Samples T-Tests at 95% confidence interval was used to compare the mean difference in cost between non-operative and operative management of acute EDH. P-values less than 0.05
were taken as statistically significant (Table 1).

### Results and Discussion

The study recorded a total of 19 patients with a male preponderance (78.95%) and an average age of 30.89 years from Table 1. Most (84.21%) patients were aged 16-64 years. Patients were brought to the hospital an average of two days (std. dev. of 3.43 days) after injury. The mean duration of hospital admission (stay) recorded was 10.42 days (std. dev. of 5.38 days). Most (84.21%) patients were transferred from other health facilities to the KBTH. Out of 16 cases for which data on clinical signs at presentation was available, headache was the main (68.75%) presenting clinical symptom (Table 2). From Table 2 above; the main mechanism of injury was motor vehicle accident which occurred among 10 patients (52.63%). Pedestrian accident (PA), assault, fall and others (work related and a hit by a fallen television set) accounted for two cases each respectively with motor bike accident responsible for a single case (Table 3).

From Table 4 above, 42.11% of the patients reported with scalp laceration and 21.05% with facial abrasions. Subconjunctival haemorrhage was reported in 15.80% of the patients with 5.26% for each lip lacerations, facial lacerations, multiple abrasions and periorbital edema respectively (Table 5). About 95% of the patients had a GOS of 4 or above. This is a good outcome. One patient had an Outcome score of 1 (Table 6). The average cost of non-operative management was GHC 811.25 ($200). This includes the cost of CT scan, medication and hospitalization. A second CT scan was required if the GCS dropped by 2 or more points, when patient developed a lateralizing sign attributable to the haematoma and the presence of persistent headaches. The non-operatively managed patient required an average of 3 CT scans (admission and 3 months follow-up). Those who had surgical intervention required an average of 2 CT scans (admission and 3 months follow-up). The average cost of operative management was GHC 3277.89 ($819). This was inclusive of fees for CT scans, cost of medication, surgery, intensive care unit for the first 24 hr. The difference between the two modalities was significant at a p-value of 0.0001 (this is an estimated cost) (Figure 1.2).

Acute epidural haematoma is a relatively uncommon presentation in neurosurgery. It accounts for between 1% to 5% of all head injuries, and even higher in severe head injuries (15%) [3,4].

Trauma with involvement of the middle meningeal artery is the common cause [15]. Haematoma in the temporal fossa may be associated with rapid deterioration due to uncal herniation. This has been observed even with smaller volumes of haematoma in contrast to other locations [16]. The classical presentation of EDH is one of brief loss of consciousness followed by a lucid interval. However in the era of CT scan it has been found that many patients with acute EDH do not present classically [17,18]. Prior to the invention of the CT scan, there had been a reported case of chronic epidural haematoma which was managed conservatively [19]. With the advent of CT scan, 29 publications on conservatively managed acute EDH cases have been reported between 1981 and 2014 [20].

Table 2: Mechanism of injuries for subjects with EDH at the Korle Bu Teaching Hospital.

<table>
<thead>
<tr>
<th>Mechanism</th>
<th>Number (percentage)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motor vehicle accident (MVA)</td>
<td>10 (52.63)</td>
</tr>
<tr>
<td>Pedestrian accident (PA)</td>
<td>2 (10.53)</td>
</tr>
<tr>
<td>Assault</td>
<td>2 (10.53)</td>
</tr>
<tr>
<td>Fall</td>
<td>2 (10.53)</td>
</tr>
<tr>
<td>Motor bike accident (MBA)</td>
<td>1 (5.25)</td>
</tr>
<tr>
<td>Others (work related and a hit by fallen television set)</td>
<td>2 (10.53)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>19 (100.00)</strong></td>
</tr>
</tbody>
</table>

Table 3: Site of haematoma and skull fractures among the participants.

<table>
<thead>
<tr>
<th>Site of haematoma</th>
<th>Number (percentage)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Left frontal</td>
<td>6 (31.57)</td>
</tr>
<tr>
<td>Left parietal</td>
<td>5 (26.32)</td>
</tr>
<tr>
<td>Right frontal</td>
<td>4 (21.06)</td>
</tr>
<tr>
<td>Right parietal</td>
<td>3 (15.78)</td>
</tr>
</tbody>
</table>

Table 4: Craniofacial injuries among the study participants.

<table>
<thead>
<tr>
<th>Injury</th>
<th>Number (percentage)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scalp lacerations</td>
<td>8 (42.11)</td>
</tr>
<tr>
<td>Facial abrasions</td>
<td>4 (21.05)</td>
</tr>
<tr>
<td>Subconjunctival haemorrhage</td>
<td>3 (15.80)</td>
</tr>
<tr>
<td>Lip laceration</td>
<td>1 (5.26)</td>
</tr>
<tr>
<td>Facial lacerations</td>
<td>1 (5.26)</td>
</tr>
<tr>
<td>Multiple abrasions</td>
<td>1 (5.26)</td>
</tr>
<tr>
<td>Periorbital edema</td>
<td>1 (5.26)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>19 (100.00)</strong></td>
</tr>
</tbody>
</table>

Table 5: Outcome of non-operatively treated participants.

<table>
<thead>
<tr>
<th>GCS score</th>
<th>Mean (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial</td>
<td>14 (1.16)</td>
</tr>
<tr>
<td>At discharge</td>
<td>15 (0.32)</td>
</tr>
<tr>
<td>At 6 weeks</td>
<td>15 (0.00)</td>
</tr>
<tr>
<td>At 3 months</td>
<td>15 (0.00)</td>
</tr>
<tr>
<td><strong>GOS functional outcome at discharge</strong></td>
<td><strong>Number (%)</strong></td>
</tr>
<tr>
<td>Good recovery (GOS 4 and 5)</td>
<td>18 (94.74)</td>
</tr>
<tr>
<td>Death</td>
<td>1 (5.26)</td>
</tr>
</tbody>
</table>

Table 6: Cost effectiveness of conservative management of subjects with EDH at the Korle Bu Teaching Hospital.

<table>
<thead>
<tr>
<th>Method of management</th>
<th>Average cost (GHC)</th>
<th>95% CI</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-operative management of EDH</td>
<td>811.25</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operative management of EDH</td>
<td>3277.89</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean difference in cost of management</td>
<td>2466.64</td>
<td>(2388.72 - 2546.57)</td>
<td>0.0001</td>
</tr>
</tbody>
</table>

Majority of Patients in this study were transferred to the accident centre of the Korle-Bu Teaching Hospital two days after the injury. These patients thus reported more than 6 hours after the injury. Weaver et al. [27] reported 2 cases of EDH. Of these two, one had a temporal EDH with a CT scan performed 16 hr after injury, and the other with a temporoparietal extradural haematoma diagnosed 3 days after injury. This is suggestive of successful conservative care in this group of patients who present late with high coma scores. Patients who had CT scans done less than 6 hr of trauma on account of coma were found to have haematoma volume of more than 30 mls by Bullock et al. [28] Such patients did not do well with conservative management and needed surgical evacuation. This was not the case with patients in this study. In this current study most patients were brought in 2 days after injury with a GCS of 14 and minimal or no focal deficits.

The criteria for managing EDH non-operatively vary in the literature. While others considered mainly the neurological status, Bullock, Lee and Servadei chose CT scan features [28-30]. Bullock et al. [12] in 1985 reported 22 cases of EDH (12 to 38 ml in volume) which were all managed conservatively and with a complete reabsorption of the haematoma. Another study by Bullock et al. [28] in 2006 reported and strongly recommended urgent surgical management for patients in coma (GCS score <9) with anisocoria and for those with blood clot larger than 30 cm³ in size, regardless of the patient’s Glasgow Coma Scale (GCS) score. Those patients with EDH less than 30 cm³, less than 15-mm in thickness, with less than 5-mm of midline shift, and GCS score greater than 8 without focal deficits were regarded safe for nonsurgical management with close observation and serial CT scans [28]. Servadei et al. [30] also used a haematoma thickness of 1 cm and a midline shift of less than 0.5cm irrespective of location as criteria for non-operative management. Thus, the CT scan inclusion criteria in this study were reasonable. Although there are reported cases of EDH in locations such as the temporal and posterior fossa managed non-operatively, haematomas in these regions have call for closer monitoring [31,32]. This study did not include haematomas in the temporal and posterior fossa because of limited ICU/HDU space at the study centre for close monitoring. Lesions in these regions can deteriorate fast [33].

Patients in this study were admitted to the ward and put on a neurological flow chart and four hourly observations in the GCS, blood pressure, pulse and respiratory rate. The patients were also monitored for lateralizing signs. A reduction in GCS by 2 points or more necessitated a new CT scan to assess the haematoma. GCS below 9 has been found to be associated with poor outcome irrespective of the method of management [34]. In the study by Tantanaru et al. [35], 28 patients underwent urgent surgery. Thirteen patients were managed non-operatively and 15 patients required delayed surgery because of neurological deterioration or increase of the size of the haematoma.

They suggested that haematoma volume of 30 mls or more is an indication for conversion to surgery. Two of the patients in their study had GCS below 9 and both of them had poor outcomes. Bhau et al. [36] reported that, out of the 120 patients managed for EDH, 67 were managed conservatively and 31 had immediate surgical intervention. Twenty two of their study participants had delayed surgery and the main reason for conversion was neurodeterioration though majority had haematoma volume of >25 mls. In this current study, the mean GCS of patients at admission was 14, even though the inclusion criterion was 9 to 15.

Majority of the patients were on admission for an average period of 10 days. This is similar to other reports of conservatively managed epidural haematomas [5,37]. Balmer et al. [37] reported 13 cases of epidural haematoma which were managed conservatively with an average duration of admission of 9.6 days. Hamilton et al. [5] reported an average admission period of 11.2 days for 18 patients in their series who were managed non-operatively and an average of 27.6 days for 30 patients who were surgically managed from the onset.

The main presenting complaint was headache of varying intensity. Only one patient out of the 19 had a seizure. Of the 11 patients who had headaches, only one required surgical intervention on account of its persistence. A repeat CT scan showed an increase in size of the haematoma with decrease in density. Burr-hole and drainage was
done for him a week after admission resolving the headache.

The presence of an associated skull fracture is reported to have a positive influence on the resolution of EDH. It has been shown that there is epicranial transfer of the blood in the presence of an overlying fracture [38], Tuncer et al. [38] reported associated skull fracture in 70% of patients with EDH which were managed conservatively. This current study recorded skull fractures in 56% of the patients seen. Chen et al. [18] and Ahmad et al. [39] also found that skull fracture was not a positive predictor of progressive epidural haematoma. Skull fracture had been considered a risk factor for haematoma progression in earlier studies, but subsequent reports have shown different results [40].

In a study by Arvind et al. [41], the GCS at presentation was identified as the single most important predictor of good outcome in patients managed conservatively. They enrolled patients with GCS of 13 or better. However, Bullock et al. [12], Lee et al. [29], Servadei et al. [30] and Lobato et al. [40] considered both volume and neurological status as the factors which influence outcomes. The mean GCS of our patients was 14 or better and all patients were discharged home with GCS of 15. Only one patient needed surgical intervention for persistent headache with some increase in the haematoma size over time. The GCS of this patient remained 15 throughout the admission period.

One patient died 3 months into follow-up, post discharge. He had shown good recovery clinically and radiologically. His GCS remained 15 throughout admission and at 3 months follow-up. He died in a primary healthcare facility close to his home and the cause of death was not ascertained.

Balmer et al. [37] reported no adverse finding in children with acute EDH they managed conservatively. These children were followed-up for 8 years. In another series involving 65 cases, more than 50% were managed non-operatively [42]. All the patients were 16 years and below. Six cases required surgical intervention on account of deterioration with a corresponding increase in haematoma size on CT done within 48 hr of admission. Khan et al. [43] also reported a series of 17 pediatric cases in which 2 patients’ required surgical conversion. The patients had GOS score of 5 and normal schooling at 1 year of follow-up. Cayli et al. [44] used single photon emission computed tomography (SPECT) scan to follow up patients for 3 and 6 months and reported no pathological findings.

The management of EDH is based on both clinical and radiological findings. Increasingly, the percentage of cases managed conservatively has progressed from 1% to 60% since the 1960s [29-31]. Regular or scheduled examination of the patient for neurological deterioration has been reported to be the most important factor which determines the need for repeat CT scan and subsequently surgical intervention. Sullivan et al. [22] reported that haematomas that will increase in size achieve that within the first 36 hr. However this increase was not associated with deterioration in neurological status. We recorded only one haematoma expansion amongst the research participants. Neuroimaging must therefore be repeated only if the need arises. In a resource constraint environment such as ours, this is relevant. Repeat CT scans were done only when the neurological state necessitated it. On the average 2 CT scans were required prior to discharge. In the more affluent world, this will be unacceptable. The emphasis has shifted from ‘wait and see’ to ‘diagnose and treat’ especially in cases of mild head injuries.

Cases managed operatively in our institution, paid for anaesthesia, surgery and ICU services in addition to the normal ward bills and cost of CT scans. With the composite billing system employed, it implies surgery attracted huge costs. Craniotomy is designated as a ‘major complex’ surgery by the coding system. Conservative management attracted the usual ward bills, medications and cost of CT scans. This was 4 times less than the cost for operative management. Even though the cost estimates made, may not reflect the entire healthcare costs of treating these patients, to the best of our knowledge this is the first attempt in our environment.

**Conclusion**

Despite the risk of an untreated EDH, our study adds to the body of knowledge that carefully selected cases can be managed non-operatively. Neurological monitoring remains the most important factor in determining patient deterioration and not neuroimaging. When properly done, it reduces the number of repeat CT scans required to evaluate progress. The study also showed that non-operative management may be cost-effective in a resource-constrained setting. A prospective study on the subject will further enhance the knowledge and reduce unnecessary surgical interventions.

**Acknowledgement**

Our acknowledgement goes to all the staff of the Neuroscience unit, Korle-Bu Teaching Hospital.

**References**


