Outcome Evaluation of Chronic Subdural Hematoma Using Glasgow Outcome Score

Mehdi Abouzari, Marjan Asadollahi, Hamideh Aleali

Amir-Alam Hospital, Medical Sciences/University of Tehran, Tehran, Iran

Introduction

- Chronic subdural hematoma (CSDH) is an encapsulated collection of old blood, mostly or totally liquefied and located between the dura mater and arachnoid.
- It was first described by Virchow in 1857 as “pachymeningitis haemorrhagica interna”.
- Later Trotter put forward the theory of trauma to the bridging veins as a cause of what he named “subdural haemorrhagic cyst”.

- It has a peak incidence in the sixth and seventh decade of life.
- Fogelholm and Waltimo estimated an incidence of 1.72/100000 per year, the incidence increasing steeply with advancing age up to 7.35/100000 per year in the age group 70-79.
- This incidence is expected to rise further due to the continuing growth of the older population.

- The common occurrence of CSDH in the older patients causes a variety of diagnostic and therapeutic challenges due to the frequently described and nonspecific symptoms and accompanying diseases.
- Although both clinical and CT scan findings in CSDH has been described previously, the relationship between them has not been studied extensively and the few studies conducted have not revealed significant correlations.

- To the best of our knowledge, the relationship between Glasgow Outcome Score (GOS) and its probable effective factors has not been determined, yet.
- The purpose of this study was to evaluate whether clinical and abnormal CT scan findings in CSDH patients are correlated with postoperative GOS.

Literature Review

- **Surgical treatment of chronic subdural hematoma in 500 consecutive patients: clinical characteristics, surgical outcome, complications, and recurrence rate**
- Neurol Med Chir (Tokyo) 2001; 41: 371-81

- Mori et al, evaluated the clinical features, radiological findings, and surgical results in 500 consecutive patients with CSDH. Most patients (89.4%) had good recovery, 8.4% showed no change, and 2.2% worsened. Six patients (1.2%) died, three due to disseminated intravascular coagulation.

- Recurrence of hematoma was recognized in 49 patients (9.8%), at 1 to 8 weeks (3.5±1.9 weeks) after the first operation. Twenty-seven patients (5.4%) suffered postoperative complications, of which 13 cases were acute subdural hematoma and four cases were tension pneumocephalus.

- **Burr-hole versus twist-drill drainage for the evacuation of chronic subdural hematoma: a comparison of clinical results**
  - J Clin Neurosci 2001; 8: 551-4

- Williams et al, evaluated the results of 62 patients with CSDH for technique, postoperative CT scan results, and complications.
- Of the patients who underwent twist-drill and closed system drainage, 43% had smaller lesions on CT follow up scans, as compared with 74% of those who underwent the burr-hole only procedure, and 65% with burr-holes with drains.

- Clinical outcome results showed that 64% of twist-drill and closed system drainage patients deteriorated as compared with 16% of those with burr-holes only and 7% with burr-holes and closed system drainages.
- Sixty-four percent of twist-drill patients required repeat evacuations as compared with 11% of those with burr-holes only, and 7% with burr-holes plus drains.

- **Chronic subdural hematoma: surgical treatment and outcome in 104 patients**
  - Surg Neurol 1997; 48: 220-5

- Retrospective analysis was performed by differentiating age≤60 years (n=28) versus age>60 years (n=76) and burr-hole craniostomy with a size range from 12-30 mm (n=94) versus larger craniotomy (n=10). All patients received closed system drainage of the subdural space for 2-4 days.

- Four patients older than 60 years died within 30 days after surgery, two in each operative group. Excluding these postoperative deaths, 17 out of 92 patients (18.5%) after burr-hole craniostomy and one out of eight patients (12.5%) after craniotomy required reoperation due to rebleeding (n=6), residual subdural fluid (n=4), and residual thick hematoma membranes (n=8).

- Clinical outcome was good in both operative groups. The percentage of patients without or with only mild neurologic deficits at the time of discharge from the hospital was 72.3% in the burr-hole and 70% in the craniotomy group, respectively.

- The authors concluded that burr-hole craniostomy with closed system drainage should be the method of choice for the initial treatment of CSDH, even in cases with preoperative detection of neomembranes.
- Craniotomy should be carried out only in patients with reaccumulating hematoma or residual hematoma membranes, which prevent reexpansion of the brain.

Materials and Methods

- Study design: Historical cohort
- We studied 116 consecutive patients (99 men and 17 women) with CSDH who were admitted to the Department of Neurosurgery, Sina Hospital, where they underwent surgery for the hematoma between 1996 and 2006.

Variables

- Age and Sex
- Trauma-surgery interval
- Type of surgery
- Type of trauma
- Glasgow Coma Score (GCS) on admission
- Hematoma density
- Postoperative hospitalization
- Glasgow Outcome Score (GOS) at discharge

- Postoperative condition was evaluated with GOS and classified as good recovery (score 1), moderate disability (score 2), severe disability (score 3), persistent vegetative state (score 4), and death (score 5). Favorable and unfavorable outcomes were defined as GOS scores of 1-2 and 3-5, respectively.

Statistical Analysis

- Univariate analysis including the Chi-square and Fisher's exact tests was performed to determine the relationship between GOS and qualitative and quantitative variables, respectively.
- SPSS 11.5 was used for statistical analysis.
- Throughout the analysis, $P<0.05$ was considered significant.

Results

Age and Sex

- A total of 99 (85.3%) men and 17 (14.7%) women aging 9-88 years with a mean age of 56.57±20.45 years were studied.
- Although men had a higher favorable outcome rate, the difference was not significant.
- Age of patients was not found to have a significant relationship with outcome.

Trauma-surgery Interval

- The mean trauma-surgery interval was 41.28±41.45 days with a range of 7-180 days.
- Shorter trauma-surgery interval was significantly correlated with unfavorable outcome (P=0.015).

Type of Surgery

- A total of 40 (34.5%) patients underwent small craniotomy, 69 (59.5%) underwent burr-hole craniostomy, 3 (2.6%) underwent twist-drill craniostomy, and 4 (3.4%) underwent subdural-peritoneal shunting.
- Burr-hole craniostomy had significantly more favorable outcome when compared with small craniotomy ($P<0.001$).

Type of Trauma

- Type of trauma in 16 (13.8%) were falling down, 35 (30.2%) were vehicle accident, 28 (24.1%) were strike a hard material with head, and 37 (31.9%) had unremembered trauma history.
- There was no significant difference between patients with favorable and unfavorable outcomes regarding type of surgery.

Glasgow Coma Score

- A total of 82 (70.7%) patients had mildly impaired consciousness (GCS>12), 16 (13.8%) had moderately impaired consciousness (8≤GCS≤12), and 18 (15.5%) had severely impaired consciousness (GCS<8).
- Higher GCS scores on admission significantly predicted higher GOS scores (P<0.001).

Hematoma Density

- Hematoma densities were hypodense in 80 (69%) patients, isodense in 25 (21.6%), and hyperdense in 11 (9.5%).
- There was a significant relationship between hematoma density and outcome (P=0.001), as 75% of patients with favorable outcome had hypodense hematomas.

Postoperative Hospitalization

- The mean of postoperative hospitalization was 8.88±7.59 days with a range of 1-39 days.
- There was no significant difference between the two groups regarding postoperative hospitalization, but patients had shorter postoperative hospitalization after burr-hole craniostomy when compared with small craniotomy (P=0.003).

Glasgow Outcome Score

- Additionally 92 (79.3%) patients had favorable and 24 (20.7%) had unfavorable outcomes.
- In details, 74 (63.8%) patients had good recovery, 18 (15.5%) had moderate disability, 5 (4.3%) had severe disability, 2 (1.7%) had persistent vegetative state, and 17 (14.7%) with death.

Discussion

- Many risk factors for recurrence (as a measure of outcome) of CSDH have been reported previously, including advanced age, bleeding tendency, brain atrophy, alcohol abuse, bilateral CSDHs, hematoma density, inflammation markers, arachnoid cyst, postoperative subdural air accumulation, and some technical aspects of surgery. The results obtained have sometimes been inconsistent, however.

- Reports in the literature do not agree on the role of age in CSDH outcome. Older age of the patient has been considered to be a risk for recurrence by some authors (Robinson, 1984 and Probst, 1988), while others do not agree. The results of our study are in support of the latter group of authors. Sex has never been associated with altered risk of recurrence as a measure of unfavorable outcome in either previous or the present study.

- Shorter trauma-surgery interval showed to be significantly associated with unfavorable outcome. Previous studies except two (which showed that a shorter interval predisposes to recurrence as a measure of unfavorable outcome) do not support the latter finding.

- History of trauma has been shown previously to increase the risk of recurrence in a number of studies (Oishi et al, 2001), but not in all (Mori et al, 2001 and Yamamoto et al, 2003). Our study is one of those which did not reveal an association between trauma history and outcome.

- It is believed that GCS and GOS are closely related scores on which the patient's condition is rapidly assessable. A report of 10 years' data on 484 head-injured patients revealed a loss of correlation between admission GCS and GOS (at six months) from 1997 to 2001 and concluded that the traditional link between GCS and GOS is now under question (Balestreri et al, 2004).

- A previous study (Vavilala et al, 2001) on 69 children with head injury demonstrated a significant correlation between GCS and GOS in mild and severe head injuries (GCS<7 and GCS>12), but no significant correlation between the two scores existed in moderate trauma (GCS 8-12). Our results showed that a significant correlation exists between GCS and GOS in CSDH.

- GCS is an indicator of the level of consciousness, which is itself correlated with the severity of head trauma in acute head injuries. However, the level of consciousness in CSDH as a chronic state mainly depends on non-traumatic factors, that is, those not related to the head injury itself.

- It is then rational to consider GCS as an indicator of the level of consciousness rather than the severity of head trauma in CSDH. This difference between CSDH (where GCS is mainly a measure of altered consciousness) and acute head injuries (where GCS is a measure of both altered consciousness and the severity of head injury) may provide an explanation for why GCS and GOS are correlated in CSDH in contrast to acute head injuries.

- High density hematomas have been previously shown to increase the recurrence rate of CSDH as a measure of unfavorable outcome (Oishi et al, 2001). In another study, hematoma density was not related with the incidence of recurrence (Mori et al, 2001). The results obtained in the present study support those achieved in the former (P=0.001).

- Hematoma density is known to decrease with time, passing from a high-stage to an iso- and finally a low density stage. Therefore, higher hematoma densities are expected to be seen in the acute stage.
- We propose that the reason for the association between a high hematoma density and unfavorable outcome is their simultaneous tendency to occur in acute stages of hematoma course.

- Weigel et al, 2003; reviewed 48 publications. Evaluation of the results showed that twist-drill and burr-hole craniostomy are safer than craniotomy; burr-hole craniostomy and craniotomy are the most effective procedures; and burr-hole craniostomy has the best cure to complication ratio. They concluded that, twist-drill and burr-hole craniostomy can be considered first tier treatment, while craniotomy may be used as second tier treatment.

- As our study showed, the three principal techniques (burr-hole craniostomy, twist-drill craniostomy, and craniotomy) have different profiles for morbidity, mortality, recurrence rate, and cure rate.
- On the other hand, burr-hole craniostomy has shorter postoperative hospitalization when compared with small craniotomy.

Conclusion

- Higher hematoma densities, lower GCS and shorter trauma-surgery interval increase the risk of unfavorable outcome after CSDH.
- Burr-hole craniostomy is more cost effective procedure when compared with small craniotomy because of its shorter postoperative hospitalization.

Suggestions

- A prospective case-control method with the groups carefully matched might be a good alternative to more accurately determine the correlation between GOS and its probable effective factors in CSDH.
- Further studies with larger sample sizes are needed to confirm the results obtained so far.

- Randomized clinical trials are suggested in order to compare the results of burr-hole craniostomy and small craniotomy with twist-drill craniostomy and subdural-peritoneal shunting.
- Prospective studies are suggested to evaluate whether GOS is evaluated with MRI findings in CSDH.

- Brain atrophy, Hydrocephalus, midline shift, hematoma location, sedimentation level, hematoma thickness, and postoperative subdural air might be good variables in order to asses the relationship between abnormal CT scan findings and GOS in future studies.

- Converting the stratified variables such as GCS to quantitative variables will increase the quality of future studies.
- Evaluating the relationship between GOS and recurrence of CSDH might be a good alternative for future studies.