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Acute Subdural Haematoma in Adults: an Analysis of Outcome in Comatose Patients

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Summary

The authors analysed a series of 200 adult patients admitted to the Department of Neurosurgery, Medical University of Łódź with a diagnosis of acute subdural haematoma (ASDH). 63% of them were surgically treated within the first 4 hours after head injury, the others were operated on 4 to 16 hours after trauma. All patients had GCS below 10 for the whole time period from trauma to surgery. Younger patients 18–30 year old had lower mortality – 25%, while patients above 50 revealed 75% mortality.

Analysis of operative timing and outcome, no benefit revealed when surgery was performed within first 4 hours. However, the patients operated on later than 4 hours after trauma had smaller midline shift and less pronounced brain contusion. It must be taken into account that some patients who could benefit from early surgery – those with quickly developing haematomas and intracranial hypertension – had no chance to arrive and died in peripheral hospitals. Despite our results we advocate an urgent evacuation of haematoma, as early as possible after trauma.

Significant correlation was found between midline shift, cerebral contusion on CT scans and results of surgery. Patients with bigger midline shift or presence of focal cerebral contusion revealed higher mortality and worse outcome than patients with smaller shift and no cerebral contusion visible on CT pictures.

Keywords: Acute subdural heamatoma; age; midline shift; cerebral contusion.

The mortality of patients operated on for acute subdural haematoma (ASDH) is still very high and varies between 50% and 90%[1, 5, 7, 8, 18, 25, 43]. Some studies have suggested, that prompt surgical evacuation of ASDH, within first two to four hours after head injury could reduce the high mortality rate[2, 13, 39].

Another important prognostic factors are the age of patients – children and youngsters have a better prognosis[1, 11, 14, 26]; and the state of consciousness – mortality in pre-operatively comatose patients proved to be more than 5 times that of conscious trauma victims [18, 40].

In this study we analysed a group of patients with ASDH, who were in coma since the moment of trauma and did not regain consciousness before surgical intervention.

Patients and Methods

The present series comprises of 200 adult patients, 18 to 65 years old with ASDH treated in our Department between 1982 and 1990. 126 patients were admitted directly from the scene of the accident, and were treated surgically within the first 4 hours after trauma, and 74 were transferred from peripheral hospitals, and the surgical evacuation of ASDH was delayed from 4 to 12 hours in 41, and 12 to 16 hours in 33. All patients were assessed according to the Glasgow Coma Scale (GCS) (44). Only patients who had GCS below 10 for the whole time period – from the moment of trauma to surgical intervention were included. Also patients with multiple injuries or prolonged hypotension with systolic blood pressure less than 90 mmHg for at least 30 minutes were excluded from this study in order to avoid eventual influence of hypotension or extracranial injury on outcome[19, 20].

In 75% of patients trauma was due to traffic accidents, in 25% was due to falls or assaults.

All patients underwent similar initial treatment which included assisted ventilation adjusted to maintain pAO_2 above 100mmHg and $PACO_2$ 26–29 mmHg. In all 74 patients in whom surgery was delayed beyond 4 hours, mannitol 0,25 g/kg every 4 hours was administered[27, 41]. Diagnosis was made by CT scanning.

All patients were treated by the same surgical technique – a large craniectomy was made and haematoma was evacuated[6, 38]. We usually perform a decompressive operation in order to improve the intracranial pressure-volume relations[12]. Postoperatively, all patients received intravenous phenytoin – 15 mg/kg, prophylactic antibiotics, and fluid restriction – 2000 ml/24 h. All patients with symptoms of elevated ICP were treated with hyperventilation and mannitol, both to reduce ICP and also to improve cerebral flood flow[4, 16, 29, 30, 34, 35]. No ICP measurements were performed, and intracranial hypertension was diagnosed based on direct check of the craniectomy.

Outcome was asessed three months after injury according to the Glasgow Outcome Scale (GOS)[17].

Table 1. *Patient's Age an Interval Between Trauma and Surgical Evacuation of Haematoma*

Age (y) / Time interval between trauma and surgery (h)	18–30	31–40	41–50	51–60	61–65	Total
<4	18	25	39	31	13	126
5–11	7	8	12	9	5	41
12–16	5	7	9	8	4	33
Total	30	40	60	48	22	200

Table 2. *Glasgow Coma Score on Admission to the Hospital According to the Time Interval Between Trauma and Surgery*

GCS (points) / Time interval between trauma and surgery (h)	3–6	7–9	Total
<4	103	23	126
5–11	35	6	41
12–16	28	5	33
Total	166	34	200

Table 1 shows the age of patients, and Table 2 GCS before surgery, with regard to the interval between trauma and surgical intervention.

Statistical analysis was performed using chi-square testing and pooled t-test. A statistically significant difference was indicated by a p value of less than 0.05.

Results

Of 200 patients, 166 (84% had GCS on admission below 7 points with the same proportions in all groups regarding the time interval between trauma and evacuation of ASDH. Also in different age groups there were no statistical difference regarding GCS on admission.

An analysis of the patient's age and outcome revealed that younger patients had lower mortality: 25% in patients 18–30 years old and 75% in patients older than 50 years. This difference is statistically significant. Also younger patients had a better outcome – 30% of patients younger than 40 had GOS I or II, while the same result was obtained in only 10% of patients older than 50. Table 3 shows the relationship between the age and outcome. A statistically significant difference was found between patients admitted with GCS 3–6 and GCS 7–9, the latter having the lower mortality 44% compared to 60% and also better outcome 33% to 21%. Table 4 shows the comparison between outcome and GCS on admission.

Table 3. *Outcome In Glasgow Outcome Scale According to the Patient's Age*

Age (y) / Outcome (GOS)	18–30	31–40	41–50	51–60	61–65	Total
I	8	8	15	1	2	34
II	3	2	3	3	1	12
III	5	7	8	4	3	27
IV	6	2	2	2	1	13
V	8	21	32	38	15	114
Total	30	40	60	48	22	200

Table 4. *Outcome in Glasgow Oucome Scale According to Glasgow Coma Score on Admission*

Outcome (GOS) / GCS on admission	I	II	III	IV	V	Total
3–6	29	6	25	7	99	166
7–9	5	6	2	6	15	34
Total	34	12	27	13	114	200

Table 5. *Outcome in Glasgow Outcome Scale According to the Time Interval Between Trauma and Surgery*

Outcome (GOS) / Time interval between trauma and surgery (h)	I	II	III	IV	V	Total
<4	19	4	15	10	78	126
5–11	5	2	7	2	25	41
12–16	10	6	5	1	11	33
Total	34	12	27	13	114	200

Table 6. *Midline Shift on Pre-operative CT Pictures According to the Time Interval Between Trauma and Surgery*

CT midline shift (cm) / Time interval between trauma and surgery (h)	<1.5	1.5–3	<3	Total
<4	21	62	43	126
5–11	10	17	14	41
12–16	10	17	6	33
Total	41	96	63	200

Comparing the outcome and operative timing there was no difference between patients operated on within 4 hours or after 4–12 hours following trauma. In both groups mortality was about 60% and results were sat-

isfactory in 17–18% of patients. Patients who survived for 12 hours and in whom haematoma was evacuated 12 to 16 hours after injury had significantly lower mortality – 33% and morbidity – 48% of satisfactory results. Also in the latter group, midline shift was less pronounced, and was above 3 cm in 18%, while in the former 34%. Table 5 shows outcome related to operative timing and Table 6 the extension of midline shift and operative timing.

Table 7 shows the relation between outcome and midline shift. A significant difference was found between these two parameters, outcome worsens with a bigger midline shift on initial CT scan.

Analysis of CT pictures revealed that 164 patients had associated areas of brain contusion. It was seen in almost 90% of patients treated within the first four hours and only in 60% of patients who survived at least twelve hours before evacuation of haematoma (Table 8). 40% of patients had large contusions of one hemisphere, 22% had both hemispheres injured, 19% had unilateral moderate hemispheric contusion. The presence of brain contusion had a very important effect on outcome, 85% with large unilateral contusion died, and no one satisfactory result was obtained in these patients, while in patients with no contusion on CT, mortality was only 17%, with good results in 58% of patients. Also bilateral contusion gave mortality of 55% with good outcome in only 18% (Table 9).

Table 7. *Outcome in Glasgow Outcome Scale According to CT Midline Shift*

Outcome (GOS) CT midline shift (cm)	I	II	III	IV	V	Total
<1.5	15	2	6	2	16	41
1.5–3	18	6	12	10	50	96
>3	1	4	9	1	4	63
Total	34	12	27	13	114	200

Table 8. *Detection of Cerebral on CT Pictures and Time Interval Between Trauma and Surgery*

Time interval between trauma and surgery Cerebral contusion on CT picture	<4	5–11	12–16	Total
No contusion	15	9	12	36
Moderate-one hemisphere	27	3	8	38
Large-one hemisphere	56	20	6	82
In both hemispheres	28	9	7	44
Total	126	41	33	200

Table 9. *Outcome in Glasgow Outcome Scale According to Cerebral Contusion Seen on CT Pictures*

Outcome (GOS) Cerebral contusion on CT picture	I	II	III	IV	V	Total
No contusion	17	4	8	1	6	36
Moderate-one hemisphere	14	3	4	3	14	38
Large-one hemisphere	0	0	8	4	70	82
In both hemispheres	3	5	7	5	24	44
Total	34	12	27	13	114	200

Discussion

Acute posttraumatic subdural haematoma remains a difficult challenge for a neurosurgeon because of the high mortality and limited recovery. From many variables which have been found important for results of treatment two could be influenced by a neurosurgeon – the time interval from injury to surgical evacuation of the lesion and the control of ICP[1, 2, 13, 22, 28, 39, 45, 46]. Other important factors – age and associated cerebral injury independently modify the overall results[1, 8, 13, 14, 15, 18, 22, 24, 26, 32, 45].

Our findings strongly support the conclusion, that age is a very important factor in results of ASDH treatment[1, 14, 45, 46]. Young adults 18 to 30 year old revealed 25% mortality, while in older groups mortality exceeded 50%, in people above 50 being almost 80%. However, we cannot support the crucial role of timing of operative intervention established by Seelig *et al.* in 1981[39]. Timing of surgery has been strongly emphasized in the literature, but in fact, little hard evidence is available to support such a conclusion. In our series we found no difference between patients who covered Seelig's criteria and patients operated on later than 4 hours after injury. However, this cannot prove the necessity for urgent evacuation of haematoma. Patients operated on later than 4 hours after trauma are only the part of the whole group of trauma victims in whom acute haematoma develops and a number of patients, with rapidly developing intracranial hypertension and pronounced midline shif probably die before arriving at the neurosurgical centre.

The lowest mortality rate was found in patients treated later than 12 hours after trauma. This result is not surprising. These patients were in better clinical condition from the onset of coma, had smaller midline shift, and less pronounced co-existing brain contusion.

Similar results were found by Lobato *et al.*[23] among patients treated for epidural haematoma. In this group of patients the course of ASDH is more benign[40], and maybe, some of them could be treated conservatively[21, 42]. However, we emphasize prompt surgical evacuation in all patients because in the acute period of trauma it is impossible to determine, which patients will take benign[40], acute[45], or hyperacute[10] course during their illness. Midline shift seen on CT is one of the most important factors in the prognosis of ASDH[22]. Mortality increases greatly with an increase in the shift. However, midline shift is not only a result of haematoma presence but also of concomitant brain contusion. The presence of an area of contused brain was seen in almost 80% of patients and it was revealed that the larger the contusion the less satisfactory the results of treatment. With large hemispheric contusion mortality was 85% and no satisfactory results were obtained. Brain contusion, especially when associated with subdural haematoma, leads to a rapid development of brain swelling[1, 15, 24] and decreases cerebral blood flow[3, 36, 37], increasing ischaemic damage[9, 31] caused by the direct effect of blood overlying the cortex[33].

In this study we did not use ICP measurements, which can be crucial for proper postoperative treatment, and also are important prognostic factors[1, 34, 36, 41, 45]. However, intracranial hypertension may, in our opinion, rely on a direct check of the hemicraniectomy. From our observations we can conclude, that proper ICP control is crucial for the prognosis and requires aggresive treatment.

Our patients show the lack of benefit from early operative intervention in acute subdural haematoma, but we also want to stress that probably there is a group of patients in whom an early evacuation of mass lesion is beneficial for eventual recovery. In our opinion impact brain damage may be substantial and will affect recovery from ASDH and the timing of subdural blood removal – within the first 4 hours – may not be so critical, as was emphasized by Seelig *et al.*[39]. Thus we think, that the time interval between trauma and surgery should be limited to 2 hours and it is possible, that a prompt avacuation of ASDH, within first 2 hours could improve our results[13]. But our Department covers a large urban area, with distances up to 80 kilometers, and it is usually impossible to operate upon the victim of the accident within 120 minutes. In conclusion we must say, that inspite of the great improvement in neurosurgical treatment, mortality of ASDH will almost certainly remain high, until more effective pharmacological approaches become available for the management of intracranial hypertension and the prevention of secondary injury to the brain.

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