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Head-Injured Adult Patients with GCS of 3 on Admission – Who Have a Chance to Survive?

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Summary

The authors analysed a series of 111 adult patients admitted to the Department of Neurosurgery, Medical University of Łódź directly after trauma with initial GCS of 3 points. 74% of them had intracranial haematoma, mainly subdural, and were treated surgically within the first 3 hours after trauma. 8 patients had no abnormalities on CT scans.

99 (89%) patients died 2 to 30 days after injury, 8 (7%) survived in a vegetative state, and only in 4 (4%) was a satisfactory result noted, but 2 of them had a stable neurological deficit. 3 of these 4 patients had epidural haematomas and 1 had not abnormalities on repeated CT examinations.

We conclude, that among patients with GCS of 3 on admission, only those without major CT abnormalities or with epidural haematoma have a chance of survival. Cases with cerebral leasions on the initial CT examination have an invariably bad prognosis. They could be taken into account as a potential organ donor from the very moment of admission, but only after cerebral circulatory arrest occured and brain death has been proved according to internationally accepted standarts.

Keywords: Severe head injury; GCS 3; prognosis; change of survival.

Introduction

The principal elements in determining the outcome in patients with severe head injury are the level of consciousness, the degree of associated brain damage, and in patients with post-traumatic intracranial haematoma the motor examination before the time of operation and timing of the evacuation of haematoma[3, 5, 9, 11, 12, 20]. Mortality significantly increases in patients with GCS below 8, and with GCS of 3 there are practically no chances of survival[10, 15].

This study was performed in order to find, if there are patients with GCS of 3 who have a chance of survival and what factors can eventually suggest that such a chance exists.

Clinical Material

The present series comprises of 111 adult patients treated in our Department between 1985 and 1990. All patients were admitted directly from the scene of the accident, and all of them were assessed according to the Glasgow Coma Scale[18] as 3 points. The patients with significant extracranial injury, as well as all patients intoxicated with drugs or alcohol were excluded from this study.

All patients had a CT scan performed on admission and the patients with indications for surgery were treated surgically within the first 3 hours after trauma.

In this group of patients ICP monitoring was not performed. We have, however, started a similar prospective study in which ICP monitoring is one of the routine diagnostic measures, but we plan to evaluate these results in 1995, when a significant number of patients will be taken into accout.

There were 94 (85%) men and 17 women (15%), 18 to 82 years old, 77 of them (77%) were younger thgan 50 years, a 9 (8%) were older than 70. Table 1 shows age and sex of these patients.

In 92 patients (83%) trauma was due to traffic accidents, in 13 (12%) to assaults, and in 6 (5%) due to falls.

Table 1. *Age and sex Of the Analysed Group of Patients*

Sex	Male	Female	Total
Age /y/			
Below 20	2	2	4
21–30	19	3	22
31–40	22	3	25
41–50	25	1	26
51–60	15	1	16
61–70	9	0	9
71–80	1	5	6
Above 80	1	2	3
Total	94	17	111

Table 2. *The Kind of Treatment According to the Clinical and Radiological Diagnosis*

Treatment	Surgical	Conservative	Total
Diagnosis			
Contusion	3	16	19
SDH	62	2	64
EDH	8	0	8
EDH + SDH	1	0	1
ICH	6	1	7
SDH + ICH	1	0	1
Intraventricular haemorrhage	0	1	1
Intracerebellar haematoma	1	0	1
Open skull fracture	1	0	1
Brain stem insufficiency (no CT abnormalities)	0	8	8
Total	83	28	111

SDH subdural haematoma, *EDH* epidural haematoma, *ICH* intracerebral haematoma.

All patients, those treated conservatively, as well as all the patients treated by surgery had the same pharmacological treatment, which included artificial ventilation with pCO_2 within normal levels, mannitol 0,35 g/kg every 4 hours, phenytoin 15 mg/kg, and prophylactic antibiotics. When systemic hypotension was noted, the blood pressure was raised with inotropic agents. All patients who survived till the second day had repeated CT examinations on the second day, and thereafter, 5, 7 and 10 days after trauma in order to exclude delayed intracerebral haemorrhage[4].

Outcome was assessed 60 days after injury according to the Glasgow Outcome Scale (GOS)[6].

Statistical analysis was performed using pooled t-test, and a statistically significant difference was indicated by a p value less than 0.05.

Results

In 82 (74%) patients the CT revealed intracranial haematoma, in 79 the haematoma was evacuated surgically, the remaining 3 were treated conservatively, because of the small size of the intracranial clot. 1 patient had cerebral contusion with a coexisting open skull fracture and was treated surgically, in 1 case ventricular haemorrhage was treated by ventricular drainage. The next 19 (17%) patients had large cerebral contusions, and 3 of them, because of pronounced intracranial shift and a young age were treated by decompressive craniectomy. The last 8 (7%) patients had a normal CT scan, neither intracranial haematoma, nor cerebral contusion, intracranial shift or basal cistern compression were noted. in 24 (22%) patients no intracranial shift was noted. In 16 (14%) cases intracranial shift was below 1 cm, in 25 (22%) it was 1–2 cm, and 46 (42%) patients had a shift exceeding 2 cm. Table 2 shows the clinical diagnosis, and table 3 the extension of the intracranial shift according to the kind of treatment, conservative or surgical.

Table 3. *The Kind of Treatment According to the Extension of an Intracranial Shift*

Extent of shift (cm)	0	< 1	1–2	Above 2	Total
Treatment					
Surgical	4	11	23	45	83
Conservative	20	5	2	1	28
Total	24	16	25	46	111

Table 4. *Results of Treatment (in Glasgow Outcome Scale) According to the Clinical and Radiological Diagnosis*

GOS	I	II	III	IV	V	Total
Diagnosis						
Contusion	0	0	0	2	17	19
SDH	0	0	0	5	59	64
EDH	0	1	2	1	4	8
EDH + SDH	0	0	0	0	1	1
ICH	0	0	0	0	7	7
SDH + ICH	0	0	0	0	7	7
Intraventricular haemorrhage	0	0	0	0	1	1
Intracerebellar haematoma	0	0	0	0	1	1
Open skull fracture	0	0	0	0	1	1
Brain stem insufficiency (no CT abnormalities)	0	1	0	0	7	8
Total	0	2	2	8	99	111

SDH subdural haematoma, *EDH* epidural haematoma, *ICH* intracerebral haematoma.

99 (89%) patients died 2 to 30 days after injury. 8 (7%) patients survived in a vegetative state, and in 4 (4%) a satisfactory result was noted, but 2 (2%) of them had a stable neurological deficit. Of these 12

Table 5. *Results of Treatment (in Glasgow Outcome Scale) According to the Extension of an Intracranial Shift*

Extension of shift (cm)	0	< 1	1–2	Above 2	Total
GOS					
I	0	0	0	0	0
II	1	1	0	0	2
III	0	1	1	0	2
IV	2	1	2	3	8
V	21	13	22	43	99
Total	24	16	25	46	111

patients who survived, 4 were operated on for epidural haematoma, 5 had subdural haematoma, 2 cerebral contusion, and 1 had no abnormaltis on repeated CT scans. However a favourable outcome (GOS to III) was noted in 3 patients with epidural haematoma and in 1 patient with a normal CT appearance. An analysis of the patient's age revealed that all patients who survived were younger than 50 years. No other age dependent correlations were noted. In the whole group in no case did a repeated CT scan examinations reveal a delayed intracranial haemorrhage.

An analysis of the correlation between intracranial shift and survival revealed that the poorest outcome was in the group with the largest intracranial shift. Table 4 shows a result of treatment according to the clinical diagnosis, and Table 5 shows outcome according to the extent of the intracranial shift.

Discussion

The most important prognostic factors after brain trauma are the age of the patients, the level of consciousness, the presence of intracranial space occupying lesions, and the degree of brain damage[3, 5, 9, 11, 12, 20]. Brain damage produced by head injury is caused by mechanical damage to neurons and their processes, especially axons, and by ischaemia[2, 10, 16]. Mortality increases with lowering of GCS on admission, the presence of extracranial injury, especially those producing systemic hypotension, and with noted cerebral lesions on initial CT examinations[10, 15, 17]. In this series we exclude all patients with extracranial injury as well as all patients intoxicated by drugs or alcohol in order to diminish an effect of extracranial factors on results of treatment[7, 8, 16].

The main mechanism of injury was vehicular accidents in most cases, and a large number of intracranial haematomas, especially subdural were noted. These support other findings, that with a low GCS score, the number of subdural haematomas significantly increases[1, 9, 10].

With the presence of intracranial space occupying lesions the timing of evacuation is also an important factor in prognosis, especially in epidural haematoma[5, 10, 11, 20]. In this series, all intracranial haematomas were evacuated within the first three hours after injury, but all epidural haematomas were promptly evacuated, in all cases within the first two hours. From 8 patients with EDH 4 patients survived (50%), 1 of them in a vegetative state. Satisfactory result / GOS I to III/ was obtained in 4 out of 111 patients, except those 3 patients with epidural haematomas and in one 27-year old woman in whom repeated CT examinations revealed no CT abnormalities.

8 patients had no abnormalities on initial CT examination. 1 of them died within 4 hours after admission, but in the other 7 repeated CT examinations were performed an in no case were any anomalies noted. However all except one patient died.

All 95 patients with cerebral contusion or intracerebral or subdural haemorrhage has a bad outcome–only 7 of them survived till the 60th day after injury, but all of them were in a vegetative state with no clinical signs of improvement. This probably indicates, that the great majority of them had diffuse axonal injury[1, 10]. Also the presence or absence of intracranial shift is not very important in outcome prediction, although all patients who had a favourable outcome had an intracranial shift below 2 cm. An analysis of the appearance of basal cisterns on CT scans did not reveal any correlation between their appearance and the outcome, almost 50% of patients who died had basal cisterns seen on CT scans.

Head injuries, especially those producing focal lesions lead to persistent global or regional ischaemia which can significantly influence the prognosis. Ischaemia is detected in 1/3 of brain trauma victims and influences early mortality greatly[2, 16, 17]. In order to avoid cerebral ischaemia we decided not to use artificial hyperventilation, which can induce cerebral hypoperfusion[3, 16], and used mannitol, which lowers ICP but also significantly improves cerebral perfussion[3, 13, 14]. Also all patients had systemic blood pressure and oxygen delivery within normal limits, thus we think that all measures to avoid the lowering of cerebral perfusion pressure be taken.

Andrews and Pitts[1] pointed out, that in deep coma some preservation of pupillary responsiveness can result in a functional outcome, while bilaterally fixed or dilated pupils are an indicator of a bad prognosis.

In our series all patients had pupillary unresponsiveness, however some of them, with epidural haematoma survived, with a functional outcome in 40% of cases.

Our study shows, that despite the progress in neuro-intensive care the successful management of a very severe head injury still remains rare. With a GCS of 3 only patients with a promptly evacuated epidural haematoma have a chance to survive. Medical efforts should also be taken for patients with no abnormalities on initial CT examinations, but when a CT examination detects intracerebral lesions the prognosis is invariably bad. Such patients could be taken into account as potential organ donors, but only after the occurrence of circulatory arrest and proven brain death.

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