UNIVERSITY OF NIŠ
The scientific journal **FACTA UNIVERSITATIS**
Series: **Medicine and Biology** Vol.4, No 1, 1997 pp. 35 – 39
Editor of Series: Vladisav Stefanović, e-mail: factacivil@medfak.medfak.ni.ac.yu
Adress: Univerzitetski trg 2, 18000 Niš, YU, Tel: (018) 547-095 Fax: (018) 24-488
http://ni.ac.yu/Facta

UDC 612.82; 616–001

MODERATE HEAD INJURIES IN PEDIATRIC AND OTHER AGE GROUPS

Milorad Babić, Zoran Milenković, Ivan Stefanović, Dragan Stojanov

Clinic of Neurosurgery, Faculty of Medicine Niš, Yugoslavia

Summary: Patients defined as having a moderate head injury on the basis of Glasgow Coma Scale (GCS) scores within the ranges of 9 to 12 after acute nonsurgical procedures were selected. The group studied consisted of 168 selected patients assessed separately in pediatric, adult and elderly age groups. Possible risk factors were assessed. 25% of cases required intracranial operations or ICP monitoring. The mortality in pediatric patients was significantly lower than in adults and elderly patients having the same GCS score. Our observations support the conclusion that the patients at greatest risk of inadequate diagnosis and treatment are not those at high risk dying, but rather those who are predicted to be at a relatively low risk of dying.

Key words: Moderate head injury, outcome, Glasgow Coma Scale

Introduction

Previous studies of the factors useful for predicting outcome from closed head injury have focused on characteristics that generally describe the severity of injury. In 1982. Rimel and associates (1) reported the first series of patients sustaining moderate head injury as designed by the Glasgow Coma Scale (GCS). They identified patients with moderate head injury as having a total GCS score ranging from 9 to 12. Thirty percent of their cases required intracranial operations or ICP monitoring. Subsequent studies defined moderate head injury in much the same way.

As important as these studies are, they do not address the risks or therapeutic needs of patients at the time of hospital admission. Neurosurgeons must make decisions at the time of admission regarding neurodiagnostic testing, treatment, and intensity of nurising care. These decisions must usually be made before the period of observation is adequate to assess the patient to an appropriate severity class (Table 1).

Patients who initially talk after a head injury should have the greatest chance of survival. Deterioration and death in these patients are generally the result of factors that presumably could be treated, such as intracranial haematoma, cerebral oedema, or some other associated injury (2, 3).

This report comprises a total of 168 patients who either had a total GCS score of 9 to 13 or an initial GCS verbal score 3 or higher and then some of them deteriorated to a level of 2 points or lower on the total scale together with those, designated as the "talk and deteriorate" patients. Most of these patients make a full recovery without significant sequelae. However, some patients will later prove to have a major surgical complication of the injury.

Table 1. Categorization of patients with head injury

Category	Description
Grade I	Transient loss of consciousness (<5min), now alert and oriented without neurological deficit; GCS rating, 14–15.
Grade II	Previous loss of consciousness (>5min); now impaired consciousness but able to follow at least a simple command; no other neurological deficit; GCS rating, 9–13.
Grade III	Previously unresponsive (>5min); now unable to follow even a single simple command because of impaired level of consciousness; may use words, but inappropriately; pupils may be unequal or nonreactive; motor response varies from localizing pain to posturing or nil; GCS rating, <8.
Grade IV	No evidence of brain function (brain death)

Categories are based on initial evaluation.

Material and Methods

The records of 1386 patients who were admitted at our clinic during the 4 year period from 1991 to 1994 were examined. A cohort of 168 patients with GCS score ranging from 9 to 13 at the time of admission was separated in special group. The patients who had these scores for at least 6 hours following the injury or who had deteriorated to these scores within 48 hours of impact were eligible for the present study. A total of 56 patients aged 15 years or younger, together with 21 patients aged 50 years at the time of injury entered the series. The majority of patients were male both in the adult (65%) and paedriatics (68%) age group.

Possible risk factors observed through patients medical histories and physical examination at the time of admission were analyzed. These factors were: age, sex, GCS score, anisocoria, unilateral or bilateral fixed pupils, time from injury to emergency service, aetiology, presence of linear or depressed skull fractures, space occupying mass on CT or operation (Tables 2 and 3).

Two groups of patients were formed: one group included patients who had fatal outcome, persistent vegetative state or severe disability and in the second group were patients who had good or moderate outcomes (Table 4).

Table 2. Comparison of moderate head injury related features by age

FEATURE	Number in age groups			
	0–15 yr.	16–50 yr.	>50 yr.	Total
Number of cases	56 (33%)	91 (54%)	21 (13%)	168
Gender				
Male	38 (68%)	59 (65%)	12 (55%)	109
Female	18 (32%)	32 (35%)	9 (45%)	59
Mechanism of injury				
Motor–vehicle	13 (24%)	42 (46%)	6 (29%)	61
Vehicle–pedestrian	22 (39%)	31 (34%)	7 (33%)	60
Fall	17 (30%)	6 (7%)	7 (33%)	30
Assault	4 (7%)	12 (13%)	1 (6%)	17
Time from injury to emergency	4,5	3,5	3,7	
GCS 11–13	43 (77%)	53 (58%)	17 (80%)	113
GCS 9–10	13 (23%)	38 (42%)	4 (20%)	55
Anisocoria	3 (4%)	5 (5%)	2 (11%)	10
Talk and deteriorate	8 (14%)	7 (8%)	5 (26%)	20
Skull fractures				
Linear	34 (60%)	32 (35%)	12 (58%)	78
Depressed	5 (10%)	10 (11%)	1 (3%)	16
Mass lesions on CT or operation				
Epidural	5 (9%)	13 (14%)	2 (12%)	20
Subdural	3 (6%)	15 (16%)	6 (28%)	24
Intracerebral	8 (15%)	32 (35%)	14 (58%)	54
Subarachnoid hemorrhage	1 (2%)	7 (8%)	4 (20%)	12
Operated hematomas	5 (9%)	14 (14%)	6 (29%)	25
Good recovery	54 (96%)	78 (85%)	11 (52%)	143

Table 3. Features in association with GCS scores of moderate head injury

FEATURE	GCS score		
	9 – 10	11 –13	Total
Number of cases	61 (36%)	107 (64%)	168
Mechanism of injury			
Motor–vehicle	30 (49%)	31 (29%)	61
Vehicle–pedestrian	16 (26%)	44 (41%)	60
Fall	11 (18%)	19 (18%)	30
Assault	4 (5%)	13 (12%)	17
Anisocoria	1 (2%)	9 (8%)	10
Talk and deteriorate	7 (11%)	13 (12%)	20
Skull fractures			
Linear	34 (56%)	44 (41%)	78
Depressed	6 (10%)	10 (9%)	16
Mass lesions on CT or operation			
Epidural	8 (13%)	12 (10%)	20
Subdural	11 (18%)	13 (12%)	24
Intracerebral	21 (35%)	33 (31%)	54
Subarachnoid hemorrhage	1 (2%)	11 (10%)	12

Results

Considering the mechanism of injury assaults were very rare in the toddler group compared to two other groups of patients, however, falls were very frequent in the old and children group (Table 2). Patients over 50 years of age had higher GCS score than the younger age group (Table 2) and among patients having such better scores was no aetiological difference (Table 3).

mortality (Table 4).

The mortality rate in pediatric patients was significantly lower than in adult and elderly patients had the same GCS score (Table 2 and 4).

Discussion

The data indicate that the patients at greatest risk of inadequate diagnosis and treatment are not those at high risk of dying, who might or might not be saved by the highly sophisticated intensive care, but rather those who are predicted to be at a relatively low risk of dying. Since the majority of cases with head injuries admitted to hospitals are less than severe, reducing mortality and concomitant morbidity rates in patients suffering moderate head injury would have a significant impact. Also in our head injury survey mild injuries account for half of all head injury hospitalizations and moderate injuries appear to account for at least one fourth.

Table 4. General profile with an unfavourable or favourable outcome

FEATURES	Good recovery or moderately disabled	Vegetative of severely disabled or dead	Total
No of cases	143 (85%)	25 (15%)	168
Mean age	28	56	
Gender			
Male	90 (63%)	81 (81%)	109
Female	53 (37%)	6 (19%)	59
Mechanism of injury			
Motor–vehicle	50 (35%)	11 (46%)	61
Vehicle–pedestrian	52 (36%)	8 (32%)	60
Fall	25 (17%)	5 (18%)	30
Assault	16 (12%)	1 (4%)	17
GCS 11–13	106 (74%)	7 (27%)	113
GCS 9–10	37 (26%)	18 (73%)	55
Age			
0 – 15	54 (38%)	2 (8%)	56
16 – 50	78 (55%)	13 (52%)	91
> 50	11 (7%)	10 (40%)	21
Anisocoria	6 (5%)	4 (16%)	10
Skull fractures			
Linear	65 (45%)	13 (52%)	78
Depressed	12 (8%)	4 (16%)	16
Mass lesions on CT or operation			
Epidural	12 (8%)	8 (32%)	20
Subdural	16 (12%)	8 (32%)	24
Intracerebral	44 (31%)	10 (40%)	54
Subarachnoid hemorrhage	3 (2%)	9 (36%)	12

There was a 15 % (25 cases) overall incidence of operable haematomas (Table 2). The incidence almost doubled from 9% in childhood (5 patients) to 14% (14 patients) in adults and tripled to 29% (6 patients) in those aged 50 years or older. This incidence was 31% (6 patients) in the group of patients who "talked and deteriorated". It must also be mentioned that only 8 patients had an acute large intracerebral haematoma requiring surgery. Most of the intracerebral meamatomas were minor haemoragic contusions treated consevatively.

Anisocoria was presented in 6% of the patients and was not predictive as a sign of the presence of an operable traumatic mass lesion. Only 26% of the patients with operable mass lesions had pupillary inequality on admission whereas only 4% of the patients with diffuse head injury had unequal pupils.

The presence of skull fractures also was not a significant predictor (Table 4).

Subarachnoid haemorrhage is the only independent significant risk factor in predicting

Several methods have been advocated to minimize delay in the detection of a traumatic intracranial haematoma (4). There is need for keener awareness of the danger signs and for experienced surgeons who can care for the head injured patient in facilites that have the capability of providing timely surgical intervention to avoid an adverse outcome (5, 6).

Some of our patients showed by subsequently deteriorated indicate that their head injuries were actually serious and were only mild at the time of

initial evaluation. In the mid 1970's Rielly and al. (7) called attenation to the group of patients with aviodable complications of head injury, many of whom were relatively alert soon after the injury and have been described by the term "talk and die". In these patients, death is not a result of impact damage but rather a consequence of secondary events such as intracranial haematomas, brain swelling, contusions, ischaemia, or meningitis. That this phenomen is not a rare event was shown by Marshall et al who found that 12% of comatose patients had a GCS verbal score of 4 or 5 early in their course (8). There were eight children in the group who "talked and deteriorated" (Table 2) and only one child in the group who "talked and died" (Table 4) and so, no comment is made.

Anisocoria has been found to correlate with traumatic intrecranial haematomas in previous studies (5, 9). Interestingly, in our series the presence of unilateral or bilateral fixed pupils was not found to be predictive as a prevailing sign for operable mass lesions; three–fourths of the patients with mass lesions did not have pupillary inequality.

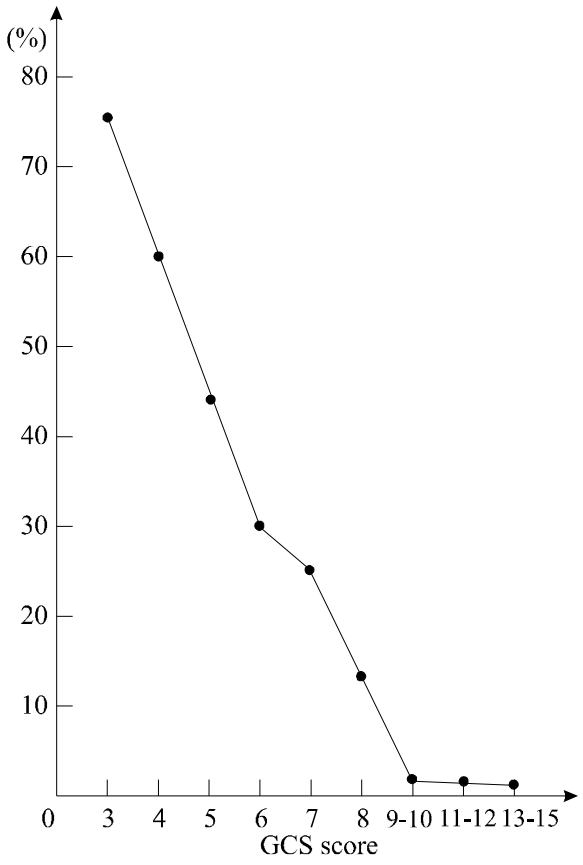

Figure 1. Percent mortality by GCS score

Our findings are in agreement with the observation of Luerssen et al. (10) that the mortality rate for children admitted with a GCS score of 9 to 13 was only 1,4% compared to 7% for adults; since our mortality are 3,5% (2 cases) and 20% (23 cases) respectively (Table 4 and 2).

The less frequent incidence of epidural haematomas was recorded in adolescents in contrast to other studies (7, 9). It has also been noted previously that traumatic intracranial haematomas occur more often in older age groups and this is confirmed in our series (11, 5) (Table 2). Possible reasons include cerebral atrophy with an increased propensity for bridging veins to tear and increased friability of vessels secondary to atherosclerotic or amyloid changes.

The group of patients with CT–visible subarachnoid blood had a theree–fold increase in mortality when compared to the group without subarachnoid haemorrhage (SAH) (Table 4). Vasospasm has been reported in 5 to 40% of SAH patients (10, 12) and in a preliminary report, 40% vasospasm was observed by transcranial Doppler ultrasonography in patients with large amounts of cisternal blood (4). Such a pathogenesis may add to the observed increase in mortality.

Although there are studies reporting that intracranial complications developed only in children having skull fractures (13) many previous studies on head injuries have emphasized that a traumatic intracranial haematomas seldom develop in the absence of a skull fracture except in children (6, 7, 13) and of all children with intracranial haematoma, only 63% are reported to sustain a fracture (14, 15). In our series skull X–ray films were not adequate to exclude intracranial pathology and its absence would have missed these lesions. We believe that all patients in this group require hospital admission and urgent cranial CT scans irrespective of the skull fracture.

The high incidence of abnormal CT scans chould not be surprising, although there are remarkably few data on these patients in the literature (1, 14, 15). Rimel et al. (1) obtained CT scans on only 31% of their moderate head injured patients and every scanned patient had an intracranial lesion.

In patients who have suffered trauma and who may or may not have other risk factors (such as anisocoria or increased age) a CT scan of the head should be expedited in the interests of the earliest possibile surgical treatment of intracranial mass lesions.

References

1. Rimel RW, Giordani B, Barth JI. Moderate head injury: completing the clinical spectrum of brain trauma. Neurosurgery 1982; 11: 344–351.
2. Rose J, Valtonen S, Jennett B. Avoidable factors contributing to death after head injury. Br J Med 1977; 2: 615–619.
3. Rockwold GL, Leonard PR, Nagib MG. Analisys of management in thirty–three closed head injury patients who "talked and deteriorated". Neurosurgery 1987; 21: 51–55.
4. Suwanwela C, Suwanwela N. Intracranial arterial narrowing and spasm in acute head injury. J Neurosurg 1972; 36: 314–323.
5. Jamieson KG, Yelland JDN. Surgically treated subdural haematomas. J Neurosurg 1972; 37: 137–149.
6. Leeds NE, Reid ND, Rosen LM. Angiographics changes in cerebral contusions and intracerebral haematomas. Acta Radiol 1966; 5: 320–327.
7. Reilly PL, Graham DI, Adams JH. Patients with head injury who talk and die. Lancet 1975; 2: 375.
8. Marshall LF, Toole BM, Bowers JA. Patients who talk and deteriorate: implications for treatment. J Neurosurg 1983; 59: 285.
9. Hendrick EB, Harwood DCF, Hudson AR. Head injuries in children: a survey of 4465 consecutive cases at the Hospital for Sick Children, Toronto, Canada. Clin Neurosurg 1964; 11: 46–65.
10. Luerssen TG, Klauber MR, Marshall LF. Outcome from haed injury related to patient's age. A longitudinal prospective study of adult and pediatric head injury. J Neurosurg 1988; 68: 409–416.
11. Amacher AL, Bybee DE. Toleration of head injury by the elderly. Neurosurgery 1987; 20: 954–958.
12. Teasdale G, Galbraith S, Murray L, Ward P, Gentleman D. Mc Kean M. Management of traumatic intracranial haematoma. BMJ 1982; 285: 1695–1697.
13. Rosenthal BW, Bergman I. Intracranial injury after moderate head trauma in children. J Pediatr 1989; 115: 346.
14. Ceviker N, Baykaner K, Keskil S, Chengel M, Kaymaz M. Moderate head injuries in children as compared to other age groups, including the cases who had talked and deteriorated. Acta Neurochir 1995; 133: 116–121.
15. Galbrraith S, Smith J. Acute traumatic intracranial haematoma without skull fracture. Lancet 1976; 1: 501–503.

UMERENE POVREDE GLAVE U DEČJEM DOBU I U DRUGIM STAROSNIM GRUPAMA

Milorad Babić, Zoran Milenković, Ivan Stefanović, Dragan Stojanov

Neurohirurška klinika, Medicinski fakultet, Niš, Jugoslavija

Kratak sadržaj: Pacijenti pripadaju grupi bolesnika sa umerenim povredama glave na bazi Glazgovske koma skale (GCS), te se ovde svrstavaju oni čiji je GCS skor od 9 do 12 u momentu prijema i pre preduzimanja aktivnih hirurških procedura. Selekcionisana grupa od 168 bolesnika je obrađena i podeljena u dečju, odraslu starosnu grupu i grupu bolesnika u odmakloj životnoj dobi. Mogući rizik faktori su analizirani. 25% bolesnika sa umerenim povredama glave iziskivalo je operativno lečenje ili monitoring intrakranijalnog pritiska. Mortalitet u dece bio je signifikantno niži nego u odraslih pacijenata i onih u odmakloj životnoj dobi sa istim GCS skorom. Naše observacije podkrepljuju zaključak da pacijenti sa najvećim rizikom za neadekvatnu dijagnostiku i tretman nisu oni sa visokim rizikom pri prijemu već naprotiv bolesnici sa relativno malim rizikom u momentu prijema u bolnicu.

Ključne reči: Umerene povrede glave, ishod, Glazgovska koma skala

Received: April 22, 1996