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FACTORS INFLUENCING THE OUTCOME OF SEVERE HEAD INJURY AT KENYATTA NATIONAL HOSPITAL
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FACTORS INFLUENCING THE OUTCOME OF SEVERE HEAD INJURY AT KENYATTA NATIONAL HOSPITAL

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ABSTRACT

Objective: **To study the factors influencing the outcome of severe head injury.**
Design: **A retrospective study.**
Setting: **Kenyatta National Hospital, Nairobi, Kenya.**
Subjects: **Six hundred and seventy seven patients with severe head injuries who were seen at Kenyatta National Hospital between January 1992 and December 1996.**
Results: **Six hundred and seventy seven patients with severe head injuries were treated at Kenyatta National Hospital, between January 1992 and December 1996. Three hundred and eighty one patients died while undergoing treatment, 56.2% overall mortality. Age specific mortality was 35.7% in patients below 13 years, 44% in age group 14-25 years, 56% in age group 26-45 years. The admission Glasgow coma scale (GCS) was recorded in 637 patients. Patients with admission GCS of 3-4 had a mortality of 88%, those with GCS 5-6 had a mortality of 60% and those with admission GCS 7-8 had a mortality of 52%. Ninety per cent of the patients who had bilaterally dilated pupils not reacting to light on admission died and 66% of the patients with bilaterally constricted pupils at the time of admission died. Only 20% of patients with severe head injury who had normal pupillary reaction to light at the time of admission died. Eighty five per cent of the patients with systolic BP of less than 90 mmHg on admission died while 60% of those with systolic BP greater than 120 mmHg died.**
Conclusion: **In this study, factors associated with poor outcome in severe head injury patients at Kenyatta National Hospital were age, admission GCS, admission blood pressure (systolic), presence of other associated injuries and pupillary reaction to light.**

INTRODUCTION

Factors which have been associated with poor prognosis in severe head injury patients are low initial score on Glasgow coma scale (GCS), abnormal motor responses, loss of brainstem reflexes, high intra-cranial pressure, mass lesions and their effects and midline shifts shown by computerised tomography (CT) scan(1). Head injury can be divided into three groups of severity, severe head injury (GCS 8 and less), moderate head injury (GCS 9-12) and mild head injury (GCS 13-15).

The Glasgow coma scale consists of five categories namely death, persistent vegetative state, severe disability state, moderate disability and good recovery(2). Other causes of death should be ruled out before primary brain damage is assumed to be the cause of death. Patients in persistent vegetative state remain unresponsive and speechless for weeks or months until death after acute brain damage. Patients with severe disability are conscious but disabled. They have mental or physical disability and need daily support. Patients with moderate disability are disabled but independent. They may have disabilities such as dysphasia, hemiparesis, ataxia, intellectual and memory deficits and personality changes. Good recovery is resumption of normal life even though there may be minor neurological and psychological deficits. The period of time between trauma and assessment of outcome should always be stated. One third of patients severely disabled after three months improve to moderate disability by one year(3). The outcome scales can be used to evaluate new methods of management of severe head injury patients and their relative efficacy.

MATERIALS AND METHODS

Records of all the patients admitted at the Kenyatta National Hospital with severe head injury (GCS 8 and below) between January 1992 and December 1996 were reviewed. The data were analysed to obtain the following information: number of patients who died while undergoing treatment, age distribution, time interval between trauma and admission into hospital, the Glasgow coma scale score on admission, presence of other associated injuries, presence of cerebrospinal fluid leak on admission, pulse rate on admission, systolic blood pressure on admission, pupillary size and reaction to light on admission. The outcome following treatment was assessed using the Glasgow outcome scale and the relationship between outcome and the above factors were nalysed

to find out the significant factors associated with poor outcome in severe head injury patients in this study.

RESULTS

Six hundred and seventy seven patients with severe head injury were treated at the Kenyatta National Hospital between January 1992 and December 1996 (Table 1). Three hundred and eighty one patients were males and seventy four were females. Majority of the patients were between the ages of 26 and 45 years (21.8%) while 15.8% were between 14 and 25 years (Table 1). Ten per cent of the patients were below 13 years. Mortality in patients below 13 years of age was 35.7% while 45.7% had a good recovery. Mortality in the age group 14-25 years was 44% and patients who had good recovery constituted 32.7%. In the age group 26-45 years, mortality was 56% and 23% had a good recovery. Mortality was over 65% in patients above 45 years and 22% had a good recovery (Table 1). Mortality rate seemed to increase with the age of the patient with lower mortality rate in patients below the age of 13 years and high mortality rate in those of over 45 years.

Ninety per cent of the patients with severe head injury came to hospital within 24 hours from the time of trauma while only eighty per cent were admitted after 24 hours (Table 2). The mortality rate in patients with severe head injury who came to hospital within 24 hours of injury (56.8%) was nearly the same as that in patients who arrived in hospital 24 hours after the initial trauma (54.5%). This may be a reflection of the severity of the trauma and the subsequent primary brain damage. However, in those patients who did survive the effects of the initial trauma, the time interval between the trauma and admission into hospital was significant since 29% of those who came to hospital within 24 hours had a good recovery compared to 16% of those who came to hospital after 24 hours (Table 2).

Glasgow coma scale (GCS) on admission was recorded in 637 patients with severe head injury. Three hundred and eighty one of these died (59.8%) and eight recovered but with severe disability (1.3%). Two hundred and forty eight had a moderate to good recovery (38.9%). When outcome was compared to the admission GCS it was observed that the number of patients with poor outcome increased gradually from 32.3% at GCS 8 to 93.5% at GCS 3. Similarly the percentage of patients with moderate to good outcome increased gradually from 6.5% at GCS 3 to 66.7% at GCS 8 (Table 3). Outcome in severe head injury patients was therefore directly related to the admission GCS. Twenty five per cent of the patients with severe head injury had other associated injuries. The common associated injuries were fractures of the long bones (12.7%), chest injuries (5.4%) and cervical spine injuries (2.5%). Seventy two per cent of the patients with fractures of the long bones and 58% of those with chest injuries had a poor outcome. One hundred and two patients with severe head injury had CSF otorrhoea and rhinorrhoea (28%). Mortality in those who had CSF leak varied from 48% for rhinorrhoea to 57% for rhinorrhoea and otorrhoea. The outcome was good in 28% of the patients who had no CSF leak and in 30% of the patients who had CSF leak. The presence of CSF leak did not seem to influence the outcome of severe head injury patients in this study.

Table 1

Outcome in relation to age of patient

Outcome disability	Age in years 0-13	14-25	26-45	46-65	>65	Adult	M:F=8:1 Total
Died	25 (35.7%)	47 (43.9%)	83 (56.1%)	31 (67.4%)	5 (71.4%)	190 (63.5%)	381 (56.2%)
Severe	2	2	3	0	0	2	9
Moderate	8	17	15	3	0	15	58
Good	32 (45.7%)	35 (32.7%)	35 (23.6%)	10 (21.7%)	2 (28.6%)	79 (26.4%)	193
Not available	3	6	9	2	0	13	36
Total	70 (10.3%)	107 (15.8%)	148 (21.8%)	46 (6.8%)	7 (1.1%)	299 (44.2%)	677

Table 2

Outcome in relation to time interval between injury and admission

Time (hours)	No. of patients	Outcome / disability Died	Severe	Moderate	Good	Total
Not known	1	3 (0.8%)	0	1 (1.7%)	5 (2.6%)	10 (1.3%)
< 24	27	348 (56.8%)	8 (1.3%)	50 (8.2%)	179 (29.3%)	612 (90.4%)
>24	9 (61.4%)	30 (54.5%)	0	7 (12.7%)	9 (16.4%)	55 (8.1%)
Total	37	381	8	58	193	677

Table 3

Outcome in relation to the admission Glasgow coma scale

Outcome	GCS in admission						Total
	GCS 3	GCS 4	GCS 5	GCS 6	GCS 7	GCS 8	
Died/poor	145 (93.5%)	55 (77.5%)	60 (68.2%)	51 (53.1%)	37 (37%)	41 (32.3%)	389 (61.1%)
Moderate/good	10 (6.5%)	16 (22.5%)	28 (31.8%)	45 (46.9%)	63 (63%)	86 (66.7%)	248 (38.9%)
Total	155	71	88	96	100	127	637

Table 4

Outcome in relation to the admission pulse rate and systolic blood pressure

Outcome	Pulse rate on admission per minute (n=610)			Systolic blood pressure mmHg (n=547)			
	<60	60-120	>120	<90	90-100	101-120	>120
Poor	14 (100%)	322 (58.8%)	33 (68.8%)	30 (85.7%)	68 (69.4%)	106 (53.3%)	139 (64%)
Good	0 (0%)	226 (41.2%)	15 (31.2%)	5 (14.3%)	30 (30.6%)	93 (46.7%)	76 (35.3%)
Total	14	548	48	35	98	199	215

Table 5

Outcome in relation to pupillary reaction to light (n=487)

Pupillary reaction	Outcome (disability)				
	Not known	Died	Severe	Moderate	Good
Normal	12	36 (13.1%)	2 (33.3%)	23 (56.1%)	102 (71.8%)
Constricted	5	36 (13.1%)	1 (16.7%)	3 (7.3%)	10 (7.1%)
Dilated reacting	4	70 (25.6%)	2 (13.3%)	9 (22%)	25 (17.6%)
Dilated not reacting	3	132 (48.2%)	1 (16.7%)	6 (14.6%)	5 (3.5%)
Total	24	274	6	41	142

Details of the recorded pulse rate on admission were available in 610 patients. All the patients who had a pulse rate of less than 60 per minute on admission had a poor outcome (Table 4) (100% mortality). Sixty nine per cent of patients with pulse rate of more than 120 had a poor outcome (Table 4).

Details of the recorded systolic blood pressure on admission were available in 547 patients. Eighty six per cent of the patients with systolic blood pressure of less than 90 had a poor outcome, 70% of those with systolic blood pressure of between 90-100 had a poor outcome and 65% of the patients with systolic blood pressure of above 120 had a poor outcome. Only 53% of those with systolic blood pressure of 101-120 had a poor outcome (Table 4).

Records of pupillary reaction to light on admission were available in 487 patients with severe head injury. Two hundred and seventy four patients out of the 487 died while undergoing treatment. Most of those who died (48.2%) had dilated and fixed pupils on admission and only thirteen per cent of the patients who died had normal pupillary reaction to light (Table 5). Seventy per cent of the patients who had a good outcome had normal pupillary reaction to light. Only 3.5% of the patients with good outcome had dilated and not reacting pupils at the time of admission (Table 5). Ninety per cent of the patients with dilated non-reacting pupils died. Mortality in patients with constricted pupils and in patients with dilated but reacting pupils was 65% and 64% respectively. Mortality in patients with normal pupillary reaction was twenty per cent.

DISCUSSION

Factors associated with outcome in severe head injury patients in this study were age, admission GCS, admission blood pressure (systolic), pupillary reaction to light and presence of trauma to long bones and chest injury. Similar results have been reported by Mamelak *et al*(4) on severe head injury patients. They found that age, best motor response and pupillary reaction to light, at admission and 24 hours after admission were significant predictors of outcome. Through statistical analysis, they found that age was the most important independent predictor followed by best motor score. Another study by Lang *et al*(5) on severe head injury patients found that age, admission GCS and admission hypertension were important factors in predicting outcome.

Mortality in patients below 13 years was 35% and mortality in the age group 14-25 years was 44%. In the age group 26-45 years, mortality was 56% while mortality in patients above 45 years was over 70%. In this study, age

seems to be a significant factor in the outcome of severe head injury patients. Michaud *et al*(6) reviewed 75 children sixteen years or younger with severe non penetrating traumatic brain injuries to assess factors predictive of survival and level of disability. They reported a mortality rate of 33%. Thirty one per cent had good recovery, 12% had moderate disability and five per cent remained in vegetative state. They found that Glasgow coma scale scores 72 hours after injury were good predictors of quality of survival. In their study the severity of the brain injury and the presence and severity of extracranial injuries were strongly related both to survival and quality of survival. Chest injuries, in particular, were associated with increased mortality and morbidity, as was level of oxygenation. Factors most significantly predictive of survival in their study were severity of total injuries and pupillary responses, while factors most predictive of disability were Glasgow coma scale motor responses 72 hours after injury and level of oxygenation in the emergency room.

Patients who receive aggressive therapy from the time of trauma usually have a good prognosis. In this study it was found that 92% of the patients with severe head injury arrived in hospital within 48 hours and 82% within 24 hours. Patients with pulse rate of less than 60 per minute at the time of admission had a mortality of 100% while 69% of those with pulse rate greater than 120 per minute had poor outcome. Eighty five per cent of the patients with systolic BP of less than 90mmHg and 60% of those with systolic BP greater than 120 had poor outcomes. Hypoxia and shock are frequent findings in patients with severe head injury at the accident scene, and while hypoxia is more frequently detected and promptly corrected arterial hypotension is more difficult to control(7).

A previous study by Vulekovic *et al*(8) showed that mortality rate in patients with intracranial pressure less than 20 mmHg was significantly lower (25%) while mortality for those with controllable pressures of more than 20 mmHg was high (80%). Uncontrolled intracranial hypertension was associated with 100% mortality. They recommended early aggressive treatment based on intracranial pressure monitoring. In this study, mortality was related to the GCS score at the time of admission. Patients with GCS score of 3 had a mortality of 90% while those with GCS score 7 and 8 had a mortality of 37% and 41% respectively. Patients who had bilaterally dilated pupils not reacting to light on admission had a mortality of 90% and those whose pupils were bilaterally constricted had a mortality of 66%. Only twenty per cent of those with normal pupillary reaction to light died. Ritter *et al*(9) have shown that pupillary dilatation in severe head injury patients is associated with decreased brain stem blood flow and that ischaemia rather than mechanical compression of the third cranial nerve is an important causal factor. Pupil dilation may be an indicator of ischaemia of the brain stem. If cerebral blood flow and cerebral perfussion pressure can be rapidly restored in the patient with severe head injury who has dilated pupils, the prognosis may be good,

Steiger *et al*(10) have reported that subarachnoid haemorrhages on computed tomography in severe head injury patients, and to a lesser extent subdural and intracerebral haemorrhages, were correlated with an unfavourable outcome. Factors which are considered to have an effect on patient outcome after severe penetrating missile injury are bilateral hemispheric injury, ventricular haemorrhage, intracerebral haemorrhage, mass effect and missile or bony fragmentation.

In this study, age, admission GCS, admission systolic BP and pupillary reaction to light, and presence of other associated injuries have been shown to be associated with outcome in severe head injury patients.

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