Functional outcome following severe head injury in decerebrating patients

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Citation

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Abstract

Aim; To examine the outcome in patients with decerebration due to severe head injury.Method: All the patients of severe head injury were admitted to the hospital. Out of these patients, those who were having decerebration were included in the study (n=48). Various factors were analyzed to assess their effect on outcome.Outcome was assessed on basis of Glasgow outcome scale at three months following injury. Results: The patients who were normal or had minimal deficits were categorized as having good outcome while those with moderate or significant disability or death were categorized as having poor outcome. Patents in the pediatric group had lesser mortality as compared to adults (50% versus 81.6%). Age, eye opening, pupillary status, and surgical intervention were the factors having significant impact on outcome (p<.05). Those patients who had operable lesion had better survival than those with diffuse injuries. Over all good outcome was seen in 5 (10.4%) patients. Mortality in our series was 75 %(36 patients).Conclusion: Patients who have decerebration after severe head injury have high mortality. However, some of these patients have functional recovery, hence they must be managed aggressively and every effort must be made to intervene in them before features of decerebration occur.

INTRODUCTION

Abnormal motor response in form of decerebration signifies either injury or compression of brain stem (8). The most significant factor prognosticating outcome in head injury is Glasgow Coma Score (GCS) and motor response pattern being the most specific one (19,20,24,28). The mortality in severe head injury (GCS < 8) is approximately 33% (3) but after the patient shows signs of transtentorial, herniation it may reach up to 70% (2). The high mortality however does not prevent some patients to have good outcome after decerebration. In our series, we had good outcome in 14.6% patients.

MATERIAL & METHODS

The study was prospective study including all the patients with severe head injury (GCS < 8) who were admitted in neurosurgery department. After initial resuscitation they were evaluated and investigated. We included those patients in our study who were decerebrating (having extensor posturing). CT scan was done in all the patients and if any significant operable lesion was found, they were operated immediately. In those who had diffuse injuries, conservative management was done using ventilatory support and decongestants . Check CT scans were done after 24 hours in all the patients who were managed conservatively and earlier if they showed neurological deterioration. In case of development of localized mass lesion, surgery was undertaken.

EXCLUSION CRITERIA

The patients who had associated systemic injuries, who were under the influence of alcohol, or who died before CT scan could be done were excluded from the study.

Outcome assessment: The outcome was assessed on basis of a Glasgow outcome scale (GOS) ; Grade I (death), grade II (vegetative) , Grade III (mostly dependent), Grade IV (minimally dependent) and Grade V (normal) (19,20). All the data was analysed using SPSS statistical software. The effect of each variable on outcome was assessed. Patients with GCS of IV and V were classified as good outcome.

RESULTS

During the period from June. 2006 to June 2007, forty eight patients of severe head injury who were having decerebrate posturing as best motor response were enrolled on the study. There were 39 males and 9 females (M: F ratio 4.3: 1). (Table 1)

Figure 1

Table 1: Relationship between various epidemiological factors and outcome in patients with decerebrate rigidity

	GOS I Death	GOS II Vegetative	GOSIII Mostly dependent	GOS IV Minimally dependent	GOS V Normal	Total
Age (years)						
<=18	5(50 %)	1(10 %)	2 (20%)	1 (10%)	1 (10%)	10 (100%)
>18	31(81.6%)	3(7.9%)	1(2.6%)	2(5.3%)	1(2.6%)	38(100%)
Sex						
Male	29(74.4%)	4(10.3%)	3(7.7%)	2(5.1%)	1(2.6%)	39(100%)
Female	7(77.8%)	0(0%)	0(0%)	1(11.1%)	1(11.1%)	9(100%)
Mode of injury						
Vehicular Accident	24(82.8%)	1(3.4%)	2(6.9%)	2(6.9%)	0(0%)	29(100%)
Fall	7(63.6%)	2(18.2%)	0(0%)	0(0%)	2(18.2%)	11(100%)
Assault	3(60%)	1(20%)	0(0%)	1(20%)	0(0%)	5(100%)
Penetrating	2(66.7%)	0(0%)	1(33.3%)	0(0%)	0(0%)	3(100%)

Mode of injury: It was variable with vehicular accidents being the commonest etiological agent (60.4%). 22.2% patients had history of fall from buildings or trees. Only 8.9 %patients had history of being assaulted. Mode of injury did not have any effect on outcome. (Table 1)

Age and outcome: The age in our patients ranged from 3 to 80 years with mean age being 37 years. Good outcome was seen in 20% of patients in age group of less than or equal to 18 years and in 7.9 % of patients more than 18 years. Mortality was 50% and 81.6% respectively ($p<0.05$). (Table 1)

Radiological diagnosis: Most of the patients had multiple findings on CT scan; however, they were grouped on basis of the principal finding in CT scan. The commonest CT findings included contusion (37.5%) and brain edema (29.1%). Other findings included acute subdural hematoma (SDH) (16.6%), extradural hematoma (EDH) (7.5%). Best outcome was seen in EDH patients (16.7% good outcome). (Table 2)

Figure 2

Table 2: Relation ship between various clinicoradiological factors and outcome in patients with decerebrate rigidity

	GOS I Death	GOS II Vegetative	GOSIII Mostly dependent	GOS IV Minimally dependent	GOS V Normal	Total
Pulse						
<60	7(63.3%)	2(18.2%)	1(9.1%)	1(9.1%)	0(0%)	11(100%)
>60	29(78.4%)	2(5.4%)	2(5.4%)	2(5.4%)	2(5.4%)	37(100%)
Eye opening to pain						
Yes	0(0%)	1(100%)	0(0%)	0(0%)	0(0%)	1(100%)
No	36(76.6%)	3(6.4%)	3(6.4%)	3(6.4%)	2(4.3%)	47(100%)
Verbal response						
Yes	2(66.7%)	0(0%)	1(33.3%)	0(0%)	0(0%)	3(100%)
No	34(75.6%)	4(8.9%)	2(4.4%)	3(6.7%)	2(4.4%)	45(100%)
Pupil						
Normal	0(0%)	1(33.3%)	1(33.3%)	1(33.3%)	0(0%)	3(100%)
Anisocoria	10(76.9%)	0(0%)	1(7.7%)	1(7.7%)	1(7.7%)	13(100%)
Fixed dilated	26(81.3%)	3(9.4%)	1(3.1%)	1(3.1%)	1(3.1%)	32(100%)
CT diagnosis						
SDH	6(75%)	0(0%)	1(12.5%)	0(0%)	1(12.5%)	8(100%)
EDH	3(50%)	2(33.3%)	0(0%)	0(0%)	1(16.7%)	6(100%)
Brain Edema	11(78.6%)	1(7.1%)	1(7.1%)	1(7.1%)	0(0%)	14(100%)
Contusion	15(83.3%)	0(0%)	1(5.6%)	2(11.1%)	0(0%)	18(100%)
Normal	1(50%)	1(50%)	0(0%)	0(0%)	0(0%)	2(100%)
Management						
Operative	15(62.5%)	2(8.3%)	3(12.5%)	2(8.3%)	2(8.3%)	24(100%)
Non operative	21(87.5%)	2(8.3%)	0(0%)	1(4.2%)	0(0%)	24(100%)

Pupillary status and outcome: Only 3(6.2%) patients had normal reacting pupils. 32 (66.6 %) patients had fixed dilated pupils and 13 (27.0%) patients had anisocoria. Patients with normal pupils had better outcome as compared to those with anisocoria and worst outcome was seen in patients with fixed dilated pupils ($p<0.05$). (Table 2)

Eye opening and outcome: only 2 patients had eye opening to pain as best response while all others had no eye opening. The patients with eye opening had good outcome while it was seen in only 5 patients (10.7%) with no eye opening. ($p<0.05$) (Table 2)

Verbal response and outcome: The patients with verbal response had lesser mortality as compared to those with no response. However, there was no statistically significant difference. ($p>0.05$)

Intervention and outcome: Good outcome was seen in one patient (4.2%) in conservatively managed group and in four patients (16.6%) who were operated. Mortality was seen in 21(87.5%) and 15(67.5%) patients respectively ($p<0.05$). (Table 2)

DISCUSSION

The classical description of decerebrate rigidity (DR) was given by Sherrington for the state of hypertonia that occurred when brain stem of cat was transected at intercollicular level (40). It is gamma rigidity with arms in extension, adduction and hyper pronation with feet in extension and plantar flexion. It is called decerebrate rigidity as this state occurs once cerebral hemispheres are removed.

The lesion in brain stem between red nucleus and vestibular nucleus disrupts the rubrospinal pathway, which normally facilitates flexion in upper limbs. The intercollicular transection also removes the inhibitory influences to reticulospinal and vestibulospinal tracts, which leads to exaggerated excitation of extensor muscles in lower limbs (40, 7). The initial features of DR is usually change in the level of consciousness followed by respiratory, ocular and motor signs (33).As the syndrome progresses there is uncal and parahippocampal herniation leading to compression of third nerve and brain stem leading to third nerve palsy and gaze disturbance. This may progress to distortion of aqueduct and obstructive hydrocephalus (23, 40). The vessels may be compressed at tentorial incisura leading to infarction in various territories (11, 12). There is ischemia and distortion of brain stem leading to disturbance in functioning of corticospinal and corticobulbar pathways. Durett hemorrhages can occur in brain stem due to shearing of brainstem vessels. This leads to DR and physiological changes related to it (9,10,18,16,34,38,42).

There is a wide range of change in normal homeostasis including respiration, cardiac activity, temperature, blood gases, serum electrolytes and blood sugar level. One of the main causes of all these are hypothalamic malfunction due to direct compression or ischemia due to vascular causes. This leads to autonomic dysregulation. The patients can have arrhythmia, which includes both tachyarrthymia (due to sympathetic overdrive) and bradyarrhthmia (due to vagal stimulation). There can be wide array of changes in ECG including T wave changes, bundle branch block and change in various intervals (3, 38).

Patient may develop pulmonary edema due to dysautonomia. There can be hyperventilation leading to respiratory alkalosis and decrease in cerebral blood flow or hypoventilation with retention of CO_2. Irregular breathing pattern like Chenye- Stokes pattern can occur (29, 35, 36).

Commonest electrolyte abnormality encountered is hyponatremia, which can be due to SIADH (syndrome of inappropriate antidiuretic hormone secretion), or CSW (cerebral salt wasting syndrome) (27, 32).

Age is one of the factors that effects the outcome after head injury (17, 33). Some studies revealed outcome decreasing with increasing age (7, 20). While a few studies found no effect of age (2, 44). Gutterman and Shenkin found that among the patients who decerebrate after head injury, younger patients did better than older ones (14). In our series functional outcome was seen in 20%of patients aged <= 18 years and in 8.6 % of patients in adult group. Age effects the outcome in many ways and commonest ones are the mechanism of injury and association of medical illnesses (30).

Severity of head injury is the most important factor prognosticating the outcome. Jennet and Teasdale found functional outcome (GOS 4, 5) in only 7% of patients having GCS 3 or 4. GCS 8 especially motor response has been found to be an important predictor of outcome, with outcome improving with increasing GCS (1,19,20,24,28,43). In our study since only M2 (decerebrating patients) were included so no comparison could be done on that basis. In a study by Butterworth et al, there was overall mortality of 76% in patients with M1 response while all patients who were operated died (5).

The nature of lesion seen on CT scan has been seen to predict outcome (13,24,25,21). Intracerebral hematomas have poor outcome as compared to epidural one (2, 26). In our series 16.7% patients with epidural hematoma had functional outcome as compared to 11.1% patients having contusion and 12.5% patients having acute SDH.

Pupillary changes reflecting extent of brain stem compression have a significant effect on outcome (6). Patients having normal reacting pupils have better outcome than the patients with unreative pupils (6). Only 6.2% of patients with dilated unreactive pupils had functional outcome in our study as compared to patients with anisocoria (15.4%) or normal pupils (33.3%). The recovery in DR usually implies that the deterioration is because of compressive effect on brain stem because of hematoma or displaced medial temporal region secondary to hematoma or edema rather than brain stem injury itself. A unilateral fixed dilated pupil is thought to be due to third nerve compression while bilateral dilatation signifies disturbed brainstem function (22,37, 39). Pupillary examination is an important aspect of examination in severely head injury patients as they are often paralyzed and mechanically ventilated leading to difficulty in neurological assessment.

Patients who underwent surgical intervention had better outcome than those who underwent conservative management (16.6%versus 4.2%) Clusmann also found similar results in their study (6). This is possibly due to localized nature of lesion in surgical group leading to rapid reduction of ICP after surgery. While in patients managed conservatively injuries were, diffuse hence only medical methods were used to reduce ICP.

Mortality is high in patients who have decerebrate features. In a series by Bricolo (4) only 16%patients had good outcome, while in series by Sousa it was 18.2% (41). In our series, good outcome was seen in 10.4% patients.

CONCLUSION

Decerebration in head injury is an ominous sign signifying brain stem compromise and need for urgent intervention. Every effort must be made to treat the patients before signs of DR are there as functional outcome decreases significantly once these occur.

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