Research Journal of Biological Sciences 3 (2): 233-235, 2008
ISSN: 1815-8846

Prognostic Value of Brain Shift in Epidural Haematoma

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Abstract: In severe head injury brain midline shift in Computerized Tomography (CT) scan is a diagnostic sign. The aim of this study was to investigate prognostic value of brain shift by studying of correlation between brain shift and interpeduncular cisternal effacement with long term outcome, in patients with Glasgow Coma Scale (GCS) ≤ 8 with epidural haematoma. One hundred patients with sever head injury and epidural haematoma (GCS≤8) were enrolled in this study. All of the patients underwent clinical examination and brain CT scan. Brain shift and interpeduncular cisternal effacement measured from CT scan. Outcome in surviving patients was determined at 3 and 9 months after admission. Of the 100 patients admitted to the study, 18 had GCS = 8. 22 had GCS = 7. 25 had GCS = 6 and 17, GCS = 5 and 18 had GCS = 4. As mental status declined, uncal herniation in CT scan was significant. There was meaningful relationship between GOS and midline shift (p = 0.045 for GCS = 8, p = 0.033 for GCS = 7, p = 0.048 for GCS = 6, p = 0.021 for GCS = 5 and p = 0.038 for GCS = 4). Analysis of outcome for all cases showed a statistically meaningful correlation between outcome and interpeduncalar cisterns effacement (p = 0.044 for GCS = 8, p = 0.038 for GCS = 7, p = 0.031 for GCS = 6, p = 0.047 for GCS = 5 and p = 0.050 for GCS = 84). There was a meaningful relationship between admission GCS and lateral brain shift and interpeduncular cisternal effacement with 3 and 9 months GOS in patients with sever head injury (GSC≤8) with epidural haematoma.

Key words: Midline shift, CT scan, epidural haematoma, prognostic, injury

INTRODUCTION

Among patients with sever head injury; there is a great variety in both the clinical course and the type of intracranial lesion. Brain shift has been used widely as a diagnostic sign, but recently brain shift has been considered as a prognosis factor (Maas *et al*., 2007; Sahuquillo *et al*., 1999; Lehmann *et al*., 1997; Maas *et al*., 2005; Lannoo *et al*., 2000; Hiler *et al*., 2006; Kuchiwaki *et al*., 1995; Massaro *et al*., 1996; Toutant *et al*., 1984).

Careful evaluation of CT scans of patients with severe head injury (GCS≤8) with epidural haematoma revealed that many patients had horizontal brain shift, interpeduncular cisternal effacement and uncal herniation, which suggested that brain shift rather than midbrain compression might be responsible for decrease of GCS (Lehmann *et al*., 1997; Hardemark *et al*., 1999; Miller *et al*., 2004).

In an attempt to confirm the correlation between midline shift and long term outcome a prospective study of 100 severe head injured patients with epidural haematoma (GCS≤8) was conducted.

MATERIALS AND METHODS

Patients with severe head injury (GCS≤8) with epidural haematoma admitted to the neurosurgery service underwent computerized tomography scan. Brain shifts were measured from CT Scans. Patients were excluded if the scan was of poor quality or showed asymmetrical placement of the head, also patients with penetrating injuries, multiple lesions and major vascular injury and GCS=3 patients has been excluded. The location of the midline was determined by halving the distance between the inner tables. Distance between septum and the midline considered as lateral shift.

Herniation of the temporal lobe was diagnosed when there was marked asymmetrical protrusion of the uncus over the tentorial edge with effacement of the interpeduncular cisterns or the lateral recess of the pontine cisterns (Toutant *et al*., 1984; Ropper, 1986). Asymmetry or absence of one or both perimesencephalic cisterns was recorded outcome in surviving patients was determined at 3 and 9 months after admission.

This study protocol was approved by the institutional review board at our institution and the established guidelines of our institution have been adhered to in the treatment of our subjects.

All data were expressed as mean±SD. One-way Analysis of Variance (ANOVA) was done to compare the sciatic nerve MDA levels and apoptotic cells between groups using LSD for the Post-Hoc. Analysis was performed by SPSS version 11.0. A P values less than 0.05 was considered to indicate statistical significance.

Table 1: Relationship between Septal shift and GOS

GCS	Patients	GOS Discharge Mean±SD	GOS 3 Month Mean±SD	GOS 9 Month Mean±SD	Septal Shift	p-Value
8	18	3.42±0.20	3.90±0.25	4.20±0.30	9.00	0.045
7	22	2.75±0.32	3.24±0.25	2.06±0.32	9.10	0.033
6	25	2.50±0.51	2.96±0.30	2.46±0.50	11.2	0.048
5	17	2.44±0.02	2.96±0.05	2.64±0.05	11.14	0.021
4	18	2.30±0.02	2.12±0.02	2.12±0.02	12.42	0.038

Table 2: Relationship between Cisternal effacement and GOS

GCS	Patients	Unilatera Effacement (%)	Bilateral Effacement (%)	p-Value
8	18	15.20	3.00	0.044
7	22	19.00	7.30	0.038
6	25	27.60	9.50	0.031
5	17	40.10	10.10	0.047
4	18	75.00	13.23	0.050

RESULTS

Of the 100 patients admitted to the study, 18 had GCS = 8, 22 had GCS = 7, 25 had GCS = 6 and 17, GCS = 5 and 18 had GCS = 4. As mental status declined, uncal herniation in CT scan was significant. There was meaningful relationship between GOS and midline shift ($p = 0.045$ for GCS = 8, $p = 0.033$ for GCS = 7, $p = 0.048$ for GCS = 6, $p = 0.021$ for GCS = 5 and $p = 0.038$ for GCS = 4) (Table 1).

Analysis of outcome for all cases showed a statistically meaningful correlation between outcome and interpeduncalar cisterns effacement ($p = 0.044$ for GCS = 8, $p = 0.038$ for GCS = 7, $p = 0.031$ for GCS = 6, $p = 0.047$ for GCS = 5 and $p = 0.050$ for GCS = 84) (Table 2).

DISCUSSION

Midline shift after traumatic brain injury is widely recognized as an important marker of severe injury.

Data collected prospectively in 100 patients confirm that patients with good outcome would be expected to have smaller shifts than those with poor outcome. There are meaningful relation between 3 and 9 months outcome and lateral septal shift and cisternal effacement.

Greater midline shift on CT Scans correlated with a significantly lower likelihood of recovery (Maas *et al*., 2007; Sahuquillo *et al*., 1999; Lehmann *et al*., 1997; Muuszgnski *et al*., 1999) in our series only one patient of 52 patients whose brain shifts were over 10 mm recovered who was an 80 years old man with brain atrophy. Conversely no patient with less than a 5 mm lateral shift had a poor prognosis (Sullivan *et al*., 1999). Patients in whom shifts were not sufficient to explain, diminished consciousness might have had other lesions that could not be detected on CT scans but could be seen by MRI, poor neurological status inspite of little or no shift may be an indication for MRI imaging (Wilberger *et al*., 1987).

Compression of ipsilateral perimesencephalic cistern was more likely to be associated with poor outcome (Lehmann *et al*., 1997), in our service 60% of patients with both cistern effaced had poor outcome, while 11% of patients without cisternal effacement had poor outcome. Factors such as the size and shape of the tentorial incisura and the rate of development of the shift and degree of brain atrophy may affect the ability of the brain stem to accommodate these changes in our series, old patients with brain atrophy and shift had better recovery than young patients with small shift. This study demonstrated that the large lateral shift and cisternal effacement are poor prognostic factor in severe head injured patients.

As has been described by other authors (Kotwica *et al*., 1993; Marshall *et al*., 1992) we found that patients with severe traumatic brain injury and shift fared worse than those without shift. The association of shift with poor outcome was somewhat stronger in epidural haematoma patients. A similar result was reported by Athiappan (Athiappan *et al*., 1993).

Although an increasing duration of follow-up may result in a more accurate assessment of ultimate neurologic outcome, the proportion of patients lost to follow-up inevitably increases with time. Despite this limitation, the association between shift and poor outcome remained constant in epidural haematoma.

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