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CLINICAL INDICES OF HEAD INJURY AND MEMORY IMPAIRMENT

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SUMMARY

In a prospective follow-up of memory functions after head injury, 61 patients were tested with P.G.I. Memory Scale at the end of 18 months. Patients with acceleration injuries showed a poor performance in comparison to those with contact injuries. Memory was found to be related to indices of severity of injury, particularly post traumatic amnesia (PTA). Presence of fracture of skull or early neurological deficits was not associated with poor performance. Among contact injury patients, lateralization and location of the injury were not found to be discriminatory. Behaviour changes during follow-up were not significantly related to memory impairment.

Memory impairment of various shades of severity occurs among head injured patients. Programmes for teaching manemonics to brain injured patients have not met with much success because the bio-psychological basis of memory processes such as encoding, consolidation and retrieval has not been understood well. However, the dynamic and interdependent nature of these processes explains the complexity of the memory deficits following brain injury (Salmon and Butters, 1987). Using different approaches, disorders in various aspects of memory have been described among the head injured patients (Brooks, 1976; Roberts, 1979; Levin et al., 1979).

Not all patients suffer from severe memory deficits after head injury and the long-term outcome depends upon many factors. Prediction of memory impairment has been attempted, using various clinical indices of head injury. Apart from clinical utility, known neuropathological bases of such clinical indices serve to understand the biology of memory deficits following head injury. Coma and post traumatic amnesia (PYA) as estimates of diffuse brain damage, and skull fracture, hematoma and neurological deficits as evidences of focal damage have been used in predicting the memory deficits as evidences of focal damage have been used in predicting the memory deficits (Brooks, 1976). Sabhesan et al. (1990) pointed out that pre trauma alcohol dependency had a deleterious consequence on memory and that persistence of alcohol abuse after the injury aggravated the problem further.

In the present study, an attempt is made to correlate the early clinical indices of head injury and the memory impairment in a prospective follow-up of head injured patients.

Materials and Methods

The study was conducted in the Trauma Ward, Department of Neurosurgery, Govt. Rajaji Hospital, Madurai. A total of 141 patients admitted between September 1984 and June 1985 could be prospectively followed up for 18 months, by a team of neurosurgeon, psychiatrist, psychologist and social workers. All the patients were seen daily during the period of hospitalization when the clinical signs of early recovery were made out and assessed.

The same team followed up the patients subsequently for 18 months. Patients who sa-

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tisfied the following criteria were included in the present study:

i. Only those in whom motivation during the test was consistent and adequate were included.

ii. Only patients with minimum education were included.

iii. Patients with pre trauma disorders such as mental retardation, previous head injury, seizure disorder and alcohol dependence were excluded, as these conditions were known to adversely affect the memory test performance due to cumulative effects (Becker et al., 1982).

iv. Patients with post traumatic amnesic syndrome and post traumatic dementia were excluded.

Sixtyone patients who satisfied the above criteria were included in the study. The following definitions were used in the study:

i. Duration of unconsciousness was defined as the interval after injury when the patient reached a Glasgow Coma Scale score of eight (Teasdale and Jennett, 1974). It was classified as mild, moderate and severe if it was less than one hour, one to six hours and more than six hours respectively.

ii. Post traumatic amnesia was defined as the lapse of time between the injury and the return of continuous memory (Jennett, 1977).

iii. Injuries were classified as acceleration injuries and contact injuries on the basis of biomechanics of injury (Gennarelli and Thibault, 1985).

iv. Memory was tested with P.G.I. Memory Scale (Pershad and Wig, 1979). Age of the patient and his educational attainments were other determinants of the performance of memory test and hence, the raw scores were not comparable. Based on the norms given by the authors for various age groups and educational levels, raw scores were converted into 'z' scores. As the scores of most of the patients were in the negative, the signs were reversed for ease of computation. A positive 'z' score indicated disturbed memory functions. For all statistical calculations, only 'z' scores were used.

v. Behaviour changes were assessed in comparison to the pre trauma personality traits, and graded from 0 to 3, indicating— No change, Mild change, Moderate change and Severe change. Irritability, motivational behaviour, excessive somatic concern, depression and anxiety were the areas considered (Natarajan et al., 1987).

As only intra-group comparisons were made, no external controls were needed. Appropriate statistical methods were used to analyse the data.

Results

Total memory scores of all patients were age and education corrected and the 'z' scores ranged from − 1.475 to 4.854. Negative scores pointed to a better than normal performance in memory test and positive scores indicated impaired performance. Seven patients among the total of 61 had a negative score. The association between the memory scores and the clinical variales was as given in Table 1.

Comparisons indicated that there was significant difference between the acceleration injuries and contact injuries. Age, duration of unconsciousness, post traumatic amnesia, fracture of skull and neurological deficits were corroborated in the acceleration injury group. In the same group, behaviour changes also were related to memory scores. But, irritability ($r = -.02$, d.f. = 39, N. S.), amotivation ($r = .16$, d.f. = 39, N. S.), excessive somatic concern ($r = -.05$, d.f. = 39, N. S.), depression ($r = -.17$, d.f. = 39, N. S.), and anxiety ($r = -.10$, d.f. = 39,

TABLE I. Association between clinical variables and memory scores

	Mean	S. D.
Biomechanics of injury:		
Acceleration injury (n=41)	1.44	1.35
Contact injury (n=20)	0.56	0.92
t = 2.65, p 0.02		
*Age of the patient (in years)***		
Above 40 years (n=9)	1.13	1.47
Below 40 years (n=9)	0.53	0.54
t = 1.15, N. S.		
*Duration of unconsciousness****		
Mild (n=13)	0.94	0.67
Moderate (n=15)	1.39	1.42
Severe (n=9)	1.97	1.76
F = 1.63, N. S., r = 0.14		
Post traumatic amnesia:		
Less than one week (n=22)	0.93	0.90
One to two weeks (n=7)	1.25	1.29
Two to four weeks (n=5)	3.46	1.50
More than four weeks (n=7)	2.37	1.58
F = 7.71*, r = 0.24		
Early neurological deficits:		
Deficits present (n=8)	1.85	1.21
Rest of the group (n=33)	1.34	1.38
t = 0.96, N. S.		
Fracture of skull:		
Present (n=13)	1.32	1.07
Absent (n=28)	1.50	1.47
t = 0.40, N.S.		

* $p < .01$. As there was significant difference between the acceleration injury group and contact injury group, rest of the computations (2 to 6) was done only with the former group.

** In comparing the effects of age, two groups of acceleration injury patients were chosen with comparable severity of coma.

*** Duration of coma was compared only in those patients in whom Glasgow Coma Scale was applicable.

N. were not significantly correlated to memory scores.

As acceleration injuries were characterized by diffuse cerebral changes, and localization and lateralization could not be definitely made out in these injuries, memory scores among contact injury patients were used to know the impact of the effects of focal injuries. None of the 20 patients had suffered from any significant loss of consciousness. Mean memory score for patients with left sided injuries was 0.57 and that of right sided injuries 0.69. The difference was not statistically significant (t = 0.27, d.f. = 18, N. S.), Patients with frontal lobe injuries had a mean score of 0.06, and it was not statistically different from the mean of rest of contact injury patients (t = 0.27, d.f. = 18, N. S.). Patients with parietal injury had a mean score of 0.49 which was not significantly different in comparison to the rest (t = 0.19, d.f. = 18, N. S.). Patients with injuries to other areas of skull were very few in number and hence, their mean scores were not compared.

Discussion

Restrictive inclusion criteria were needed for the study of memory so that a relatively homogenous group of patients could be chosen. Patients with pre trauma neuropsychiatric disorders were known to suffer from cumulative effects on cognitive deficits and were left out (Becker et al., 1982). Post traumatic amnesic syndrome and post traumatic dementia were characterized by specific disorders of memory and hence were excluded. Though illiterates formed a sizable proportion of the patients included in the follow-up, they were left out because of the practical difficulties in standardizing their scores in the absence of comparable norms (Pershad and Wig, 1979). Because of the known differences in neuropathology, and the significant differences in memory scores, contact injury patients were used to study the effects of laterality and location of the injury.

The complex nature of congnitive deficits and the difficulty in spontanceous restoration following diffuse cerebral injuries have been known (Gloag, 1985). In contact injuries the damage was essentially focal, and the absence of unconsciousness at the time of trauma indicated the paucity of global disturbances (Ommaya and Gennarelli, 1974). Luria (1971) suggested that focal lesions resulted in increased blocking of traces by activities interpolated between perception and recall. Results of the study indicated that such disturbances in focal lesions tended to improve spontaneously more than diffuse lesions of the acceleration injuries.

Age was significant in predicting neuropsychological recovery, but, establishing functional age-gradients in normal ageing was difficult (Carlsson et al., 1968). Meier et al. (1978) advocated that valid age norms required the seperation of age (ontogenetic), cohort-related (generational) and historical (time of measurement) factors. Though age and education controlled scores were used in the present study, inclusion of very few patients above 60 years might have confounded the results. The scores of the aged group indicated a comparatively poor performance, which was statistically however insignificant.

Duration of coma and PTA have been considered as reliable predictors of severity of closed head injury (Jennett, 1976). Duration of coma was not found to be significantly correlated to memory scores. Though patients with increasing duration of coma suffered from growing memory deficits, the differences were not statistically singificant. Using raw scores and comparable individuals in another study, Sabhesan et al., (1989) made out that such differences were indeed significant. Post traumatic amnesia had been reported to be better related to memory deficits during the follow-up (Brooks, 1985). Duration of PTA did not correlate with memory scores, but, ANOVA between the groups pointed to significant differences between them. Patients with PTA of more than four weeks performed better than those with less PTA, indicating that there was some kind of threshold above four weeks, beyond which PTA was less predicative. Brooks (1976) contended that with increasing length, the relaiability of PTA as a predictor decreased and the possible reasons have been found to be many (Sabhesan and Natarajan, 1987).

Fracture of the skull indicated certain degree of violence to the skull and hence an increased possibility of psychological consequences. But, it was not found to be related to congnitive performances in most studies, as well as in the present one also (Brooks, 1976; Brooks, 1985). Focal neurological deficits in acceleration injuries were due to the primary injury itself or due to complications (Jennett, 1976). Lack of predicative ability, as made out in the present study had been reported by Brooks (1976), but Levin et al. (1979) observed that acute hemiparesis was related to poor memory retrieval. Lateralized cerebral dysfunctions observed in individual cases tended to obscure when mass-data were considered. Diffuse changes further tended to mask the focal effects in individual test performance.

Effects of lateralization and localization in contact injuries did not reveal any significant difference, though overlap of diffuse disturbances was absent in these patients. But, contact injury patients as a group had performed well in comparison to diffuse injury patients. It was possible that the recovery during the 18 months might have undermined true differences if any, between the effects of injury to various lobes on memory.

Results of the study indicate that certain degree of prediction of memory deficits might be possible and that larger number of confounding variables should be considered in explaining individual differences. These

factors should be taken into consideration whenever therapeutic strategies are planned for neuropsychological rehabilitation of memory.

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