SPEECH DISORDERS IN CLOSED HEAD INJURY PATIENTS

E B Menon, S Ravichandran, E S Tan

ABSTRACT

Head injuries vary in type and degree of severity and clinicians agree that most individuals who suffer head injury have cognitive, speech injury, behavioural and sensory motor problems immediately after and during their rehabilitative phase.

***Method:** The hospital courses of thirty-one closed head injury (CHI) patients admitted to our Rehabilitation Department from January 1990 to April 1991 were studied with particular reference to their speech disorders.*

***Results:** Severity of the initial brain injury, best measured by length of coma using the Glasgow Coma Scale (GCS) was the most significant predictor of outcome, defined by the Glasgow Outcome Scale (GOS). Eighty-one percent of our patients were unconscious immediately following their injury. Upon admission into our neurosurgical department, thirty-nine percent were comatose with a Glasgow Coma Scale score of eight or less. Fifty-two percent had a score of twelve or more and the rest were in between. Twenty-six percent had skull fractures, while seventy-four percent had one or more extracranial injuries. Neurologically eighty-one percent of our patients had either a left or right hemiplegia/paresis. In the assessment of speech, thirty percent were aphasic, twenty-five percent had motor speech disorders, thirty-two percent had mixed speech deficits and thirteen percent did not have any significant speech problems. Average stay in the Rehabilitation Department was ten weeks.*

***Conclusion:** Although most patients showed an overall trend of speech improvement across time, the severely injured (Glasgow Coma Scale less than eight) continued to manifest permanent residual deficits especially those with expressive, mixed or global aphasia. The mild to moderately injured (Glasgow Coma Scale more than eight) seem to have anomia and word retrieval difficulty with little receptive language impairment, and these persisted months after discharge.*

Keywords : Closed head injury, aphasia, rehabilitation

SINGAPORE MED J 1993; Vol 34: 45-48

INTRODUCTION

Despite major innovations in trauma care, prognosis after traumatic head injury remains difficult to determine precisely. Sixty-five percent of patients who sustain severe brain injuries survive and one-third of these survivors are moderately to severly disabled[1,2]. Predicting survivors' outcome is a prerequisite for providing realistic prognoses for families of patients and making decisions about long-term care and rehabilitation. Most patients will have cognitive, speech, behavioural and motor problems which may be prolonged, often with permanent sequelae.

The purpose of this study was to examine one major sequel of closed head injury patients; that is the speech-language ability and also to investigate if the severity of brain injury as measured by the Glasgow Coma Scale, can be used as an index of speech-language recovery.

Department of Rehabilitation Medicine
Tan Tock Seng Hospital
Moulmein Road
Singapore 1130

E B Menon, MBBS(S'pore), MRCP(Lond)
Registrar

S Ravichandran, BSPTHY(Hons) QLD, MAASH(Aust)
Speech Pathologist

E S Tan, FAMS, MBBS, DPRM, FACRM
Head

Correspondence to : Dr E B Menon
St. Stephens Hospital
Tis-Hazari
Delhi-110054
India

METHOD

The hospital courses of thirty-one closed head injury patients admitted to our Rehabilitation Department from January 1990 to April 1991 were studied (twenty-eight men, three women). Patients with significant pre-morbid alcohol or drug abuse, seizure disorders, cerebral vascular disease, previous head injuries or speech impairment were excluded from the study.

The severity of the initial brain injury was assessed using the Glasgow Coma Scale score indicating responsiveness in three modalities - motor response, verbal score and eye opening, with a maximum score of fifteen. Coma was defined as a Glasgow Coma Scale score of eight or less. However, if patient was intubated or had facial injuries, the motor response score of three or less was used. The duration of coma was computed (from the casesheets) as the number of days until the Glasgow Coma Scale score is greater than eight or, if in intensive care, the patient must have exhibited eye response to give a score greater than one[3,4].

All patients referred for speech therapy were assesssed qualitatively for aphasia, dysarthria, dyspraxia and dysphagia (swallowing disorder). Since formal assessment tools standardised on our local population were not available, subtests from the Western Aphasia Battery, Boston Diagnostic Aphasia Examination and the Aphasia Screening test were employed to assess speech and language functions (see Tables I to VI). English and Malay were the media of assessment for English and Malay speaking patients respectively and Chinese dialect interpreters were called in to translate Chinese dialect speaking patients' responses and therapists' instructions during the periods of therapy while in the Rehabilitation Department.

Following assessment, patients were divided into 4 broad categories namely aphasia, motor speech disorders, mixed speech disorders, and no speech problems (see Table VII). They were also divided into two main groups based on their Glasgow Coma Scale score and analysed.

Aphasia: Disruption in the organisation of concepts and their symbolic formulation and expression. It involves linguistic reception (comprehension), expression or both.

Table I – Tests of Receptive Language

Colour matching
Number matching
Pointing to common objects
Pointing to colours
Pointing to numbers
Body Parts Identification

Table II – Tests of Expressive Language

Naming of colours
Naming of numbers
Naming of common objects
Naming of pictures
Picture Description
Serial Speech
a. Counting 1 to 10
b. Saying the days of the week.

Patients' responses were analysed for preseveration, word retrieval difficulty and fluency.

Patients were classified as having receptive, expressive, mixed (receptive and expressive) and global aphasia. Global aphasia is used to describe patients with no receptive and expressive language skills.

Dysarthria: Disruption of externalisation of thought in speech through the concurrent motor functions of respiration, phonation, resonance, articulation and prosody.

Table III – Assessment of Five Processes of Dysarthria

1. Phonation	Status of vocal cords assessed perceptually in items of: a. Voice Quality b. Presence of inhalatory stridor due to vocal cord palsy
2. Resonance	Soft palate assessed: a. At rest: symmetry of soft palate b. On phonating |a:| or |ah| : symmetry and the ability to maintain velopharyngeal seal.
3. Articulation	Tongue movements assessed in terms of accuracy, range and timing. a. retraction/protrusion b. elevation/depression c. lateral movements Lip movements assessed in terms of: a. rounding/spreading b. alternate rounding/spreading c. puckering Cheeks assessed to determine the: a. ability to puff cheeks up b. ability to alternate the 'puffing' from one side to another
4. Respiration	Assessed for the following: a. Weak incoordinated breathing pattern b. Ability to control expiration
5. Prosody	The following were perceptually assessed to determine prosody: a. Pitch b. Timing (Speed) c. Loudness

Based on the intelligibility of speech, dysarthria was classified as mild, mild to moderate, or moderate to severe by the speech pathologist.

Dyspraxia:
Oral Dyspraxia: Impaired programming of motor skills in the volitional production of individual oral movements and their combination into sequences.
Verbal Dyspraxia: Impaired programming of motor skills in the volitional production of individual sounds and their combination into sequences to form words.

Table IV – Tests of Oral Praxis

1. Imitate oral movements
2. Carry out verbal commands of therapist
a. tongue protrusion/retraction
b. lateral tongue movements
c. lip rounding/spreading
d. alternate lip round/spreading
e. alternate lateral tongue movements

Table V – Tests of Verbal Praxis

a. Sequencing of sounds in diadochokinetic tasks. /pa/pa/pa/ /patal/patal/patal/ /pataka/pataka/pataka/
b. Observe for the presence of any struggling or grouping behaviour with misarticulations characterised by inconsistent substitutions, omissions or additions.

Based on the intelligibility of speech dyspraxia was classified as mild, moderate or severe by the speech pathologist.

Dysphagia: Inability to swallow fluids of any consistency

Table VI – Tests of Dysphagia

Reflexes	**Normal**		
	a. Cough	:	Voluntary Involuntary
	b. Gag	:	Unilateral Bilateral
	c. Swallow	:	Voluntary Involuntary
	Abnormal		
	a. Bite		
	b. Jaw Jerk		
Swallowing Stages	a. **Oral**	:	Delay Co-ordination Pocketing Propulsion
	b. **Pharyngeal**	:	Initiation Inco-ordination Aspiration

Table VII – Speech Assessment

Aphasia (receptive, expressive or mixed)	9	30%
Motor Speech Disorders (dysarthria or dyspraxia)	8	25%
Mixed Speech Disorders (one or more combinations of aphasia, dysarthria, dysphagia or dyspraxia)	10	32%
No Speech Problem	4	13%
Average time from Injury to Therapy – (range 10 to 140 days)	22 days	
Mean Therapy time –	32 mins per patient (range 20-50 minutes)	

Table VIII – Racial Composition

Chinese	22	71%
Malay	6	19%
Indians	2	7%
Thai	1	3%
Right Handedness – 30		
Left Handedness – 1		

Table IX – Causes of Head Injury

Road Traffic Accident	18	58%
Work	8	26%
Assault	3	10%
Suicide	2	6%

Table X – Glasgow Coma Scale (On Admission)

Score	≥ 12	16	52%
	9 – 11	3	9%
	≤ 8	12	39%

Coma defined as Glasgow Coma Scale score ≤8, or Best Motor Response score ≤3.

RESULTS

The mean age of the patients included in the study was thirty-six years of age, the range being from ten to seventy-five years. The highest proportion of patients, fifty-eight percent, had only primary education, followed by thirty-nine percent with secondary education and three percent with tertiary qualifications. The racial composition, the causes of head injury and the distribution of Glasgow Coma Scale of patients in the study are set out in Tables VIII, IX and X respectively.

Speech remediation in our department is always aimed at reorganising the impaired cognitive and linguistic faculties of these patients, rebuilding avenues that will help him or her to achieve his/her maximum functional communication capabilities. Hence this study to examine the language-speech sequelae after closed head injury and to understand the types of communication deficits and their significance to the Glasgow Coma Scale score.

The mean duration of stay in our Department was ten weeks for patients in this study. The average time from the onset of injury to the start of speech therapy at our Department was twenty-two days depending on the initial severity of the patient's clinical condition, his duration of coma and associated medical problems. The mean therapy time our speech pathologist spent with each patient was thirty-two minutes with assessment done upon admission to our Department and weekly thereafter for up to 6 weeks.

A thorough assessment of speech impairments was not possible in the absence of a standardised test battery applicable to a bilingual population. Nevertheless qualitative assessment with the aid of interpreters was possible. Assessment findings revealed that thirty percent of our patients had aphasia with the other fifty-seven percent of them having mixed or motor speech disorders, thirteen percent had no speech problems (refer to Table VII).

In dividing the patients into two groups, on the basis of Glasgow Coma Scale, those patients whose scores were more than 8 (n=15) had no receptive language impairments. Dysarthria was mild. Problems in word retrieval, naming and verbal fluency were evident and dyspraxia when present, showed least recovery.

For subjects with severe dysarthria, recovery to mild to moderate level of severity was noted after 6 weeks of intensive therapy. The dyspraxic subjects showed the least recovery despite a marked improvement in dysphasia and dysarthria. For these patients persistence of dyspraxia was the only limiting factor as far as communication was concerned.

The mixed group comprising a combination of dysphagia, dyspraxia or dysarthria demonstrated better recovery in terms of aphasia, dysarthria or dysphagia than their counterparts with Glasgow Coma Scale score of less than or equal to 8.

Patients whose score was less than or equal to 8 (n=12) had global, mixed and expressive aphasia with only one patient improving in his receptive ability after 6 weeks of therapy. These deficits persisted even on outpatient assessment at 6 months post injury.

Another interesting finding that emerged from the two groups was that all the patients in the latter group had a duration of coma of more than 132 hours (range 132 hours to 6 weeks) in comparison to the first group where the mean duration of coma was 12 hours (range 0 to 32 hours).

DISCUSSION

Before brain damage from a head injury can be accurately assessed, it is essential to characterize the range of cerebral injuries. Brain damage can be divided into four major areas: 1) motor system, 2) speech and communication system, 3) cognitive damage, and 4) personality and behavioural changes. In the initial phase, whether in an intensive care unit or in an acute neurosurgical ward, there should be a stimulus-filled environment. Family visits are encouraged to bridge the gap between the patient's known past and his new uncertain situation.

Clinical experience has shown that more patients are returning to consciousness level from a comatose state, immediately after their head injury and even upon transfer to a rehabilitation department from an acute neurosurgical ward[5]. In our cohort sample, eighty-one percent of our patients were unconscious immediately following their injury. Upon admission into the neurosurgical ward, only thirty-nine percent were still comatose with a Glasgow Coma Scale score less than or equal to 8 (see Table X).

The rehabilitation process continues after transfer to a rehabilitation department where the first and probable significant disruptions resulting from brain damage are expressed and all the dynamic processes through which the patient passes when he wakes up in a completely strange surrounding must be understood.

Closed head injury is predominant in younger adults between the ages of 18 and 30. The fact that the mean age of our subjects was thirty-six years concurs with the study by Rimel and Jane (1984)[6]. Eighty-four percent of the injuries were sustained at work or during a traffic accident (Table IX). The experience is traumatic in the fullest sense of the word for he re-enters life with little prior knowledge, curious, agitated, naive, usually inarticulate and with great difficulty grasping new information with his impaired memory and cognitive processes.

The closed head injury patient perceives his body as dismembered. His limbs and organs no longer obey instruction and he loses control over everything. Physically, emotionally, cognitively, communicatively and personally he is a broken object in need of help and repair. Eighty-one percent of our patients has either a left or right hemiplegia/paresis upon admission while the remainder had associated spinal cord injuries. Seventy-four percent of them had one or more

extracranial injuries involving the face, chest, abdomen or limbs (see Tables XI and XII).

Table XI – Neurological Deficit (On Admission)

Right hemiplegia/paresis	16	52%
Left hemiplegia/paresis	9	29%
Tetraplegic/paretic	2	6%
Paraplegic/paretic	4	13%

26% of patients had associated skull fractures (n=8); the location being in the basilar, frontal and parietal region respectively.

Table XII – Extracranial Injuries

74% of our patients had one or more extracranial injuries. The breakdown is as follows:	
Facial Fractures	3
Chest	7
Abdomen	6
Orthopaedic	16
Laceration	28

Although most of our patients showed an overall trend of speech improvement in the six weeks of therapy, differences were noted upon dividing the patients into their Glasgow Coma Scale score of more or less than 8. The severely injured patients with a Glasgow Coma Scale score of 8 (n=12) continued to manifest global, mixed and expressive aphasia with only one patient improving in his receptive ability after six weeks of therapy. This recovery was sufficient to enable him to cope with communicative demands of his daily life. These deficits by and large tended to be permanent, even at outpatient assessment, six months after the injury.

Those patients whose Glasgow Coma Scale score was more than 8 (n=15), had no receptive speech impairments. The major linguistic deficits noted in these subjects with Glasgow Coma Scale greater than 8 were that of word-retrieval, naming and verbal fluency. These deficits were also documented by other researchers[7-12].

CONCLUSION

Head injury strikes at the very core of fundamental structures that determine our humanity and always constitutes an abrupt turning point in our patients' life. Speech is one of the cardinal factors that determine the outcome after a lengthy process of rehabilitation as to whether a closed head injury patient will be able to integrate himself back to daily life, both at home and at work.

We have shown the types of speech impairments that closed head injury patients sustain, the relationship to their initial Glasgow Coma Scale score and the predictive value of speech-language recovery based on their initial Glasgow Coma Scale score. A longer period of follow-up is required to determine the effect of speech recovering sequelea on these patients' Glasgow Outcome Scale (see Table XIII and XIV). Our aims in closed head injury patients are to improve their quality of life where a number of elements such as independence, self esteem, self fulfillment, and earning ability are integral to put him back to his rightful place in society, a desire common to all of us and on which the pillars of rehabilitation treatment rest.

Table XIII – Glasgow Outcome Scale (On Discharge)

Dead		0%
Vegetative	1	3%
Severely Disabled	5	15%
Moderately Disabled	6	19%
Good Recovery	19	63%

Table XIV – Glasgow Outcome Scale (6 Months)

Dead		0%
Vegetative	1	3%
Severely Disabled	5	15%
Moderately Disabled	9	30%
Good Recovery	16	53%

ACKNOWLEDGEMENTS

We are indebted to our dedicated team of nursing staff and medical officers, who have painstakingly documented all our patients' investigations and grateful to our typist Zaiton for her zeal, patience and dedication in typing the manuscripts.

This paper has been presented at the Silver Jubilee Malaysia - Singapore Congress of Medicine, Academy of Medicine of Malaysia, Kuala Lumpur, Malaysia on 4 October 1991.

REFERENCES

1. Najenson T, Mendelson L, Schnechter I, David C, Mintz N, Groswasser Z. Rehabilitation after Severe Head Injury. Scand J Rehabil Med 1974;6:5-12.
2. Najenson T, Groswasser Z, Mendelson L, Hackett P. Rehabilitation Outcome of Brain Damaged Patients after Severe Head Injury. Int J Rehabil Res 1980;2:17-22.
3. Teasdale G, Jennett B: Assessment of Coma and Impaired Consciousness. Lancet 1974;ii:81-4
4. Jennett B, Teasdale G. Aspects of Coma After Severe Head Injury. Lancet 1977;i:878-81
5. Jennett B, Teasdale G, Braakman R, Minderhoud J, Knill-Jones R. Predicting outcome in individual patients after severe head injury. Lancet 1976;i:1031-4.
6. Rimel RW, Jane JA Characteristics of the head-injured patient. In: Rosenthal M, Griffith ER, Bond MR, Miller DJ. Eds. Rehabilitation of the Head Injured Adult.Philadelphia: FA Davis Company 1983
7. Levin HS, Benton AL, Grossman RG. Neurobehavioural Consequences of closed head injury. New York: Oxford University Press 1982.
8. Levin HS, Grossman RG, AL, Kelly PJ. Aphasic disorder in patients with closed head injury. Neurol Neurosurg Psychiatry 1976;39:1062-70.
9. Sarno MT. The nature of verbal impairment after closed head injury. Nerv Ment 1980;168:685-92.
10. Sarno MT. Verbal impairment after closed head injury. J Nerv Ment Dis 1984;172(8): 475-9 RC346.
11. Sarno MT. Language and Speech Defects. Scand J Rehabil Med (Suppl) 1988;17:55-64.
12. Ylvisaker M, Szekeres SF. Management of the patient with closed head injury. Language Intervention Strategies in Adult Aphasics (2nd edition). Baltimore: Williams amd Wilkins. 1986