MACROLINGUISTIC ANALYSIS OF DISCOURSE IN TBI: RIGHT VS LEFT HEMISPHERE INJURY

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Abstract

The present study aimed to assess and compare the macrolinguistic ability of discourse in terms of coherence measurement in predominantly right and left hemisphere injured participants among a group of traumatic brain injured (TBI). The participants included 10 each of right and left hemisphere injured. The sample for the study included elicited gist of the picture of a picnic spot taken from Western Aphasia Battery (Shyamala & Ravikumar, 2008). An attempt was made to infer the coherence ability using the macrolinguistic analysis of discourse. For the same, Discourse Analysis Scale (Hema & Shyamala, 2008) for picture description task was used to measure the time duration taken to tell the gist of the picture and this latency value was determined for each of the participants using Wave Surfer 1.5.7 computer software. The time taken to give the gist of the given picture was measured in terms of seconds. The results of the study showed a significant difference in the duration value between the TBI participants with left hemisphere injury and right hemisphere injury statistically. But the mean value for right hemisphere injured participants among the TBI group was higher which suggests that the former group took more time to give the gist of the picture compared to left hemisphere injured participants among the TBI group. The picture description task can be used as a means of eliciting discourse samples to identify the factors contributing cognitive-communication impairments. Thus, the cognitive processing speed of coherence can be inferred by using macrolinguistic analysis in TBI discourse which is important for theoretical and clinical consideration pertaining to diagnosis and management. Reaction time could be an important measure pertaining to coherence. However, this finding needs further research support.

Key words: *Gist, Microlinguistic, Macrolinguistic, Predominant*

Introduction

Discourse is defined as ‘‘continuous stretches of language or a series of connected sentences or related linguistic units that convey a message’’ (Cherney, 1998). Discourse can also be broadly defined as language use “in the large”, or as extended activities that are carried out via language (Clark, 1994). Discourse can be studied at mainly comprehension or expression level and also be examined via text view. Under comprehension or expression level it can be distinguished at microlinguistic and macrolinguistic levels. The ability to process syntactic, lexical-semantic and phonological aspects of single words and sentences are referred to as microlinguistic levels. Measures of syntactic complexity and expression at the single word level are often used here. But at macrolinguistic level it deals with the maintenance of conceptual, semantic, and pragmatic organization at the suprasentential level. Coherence and cohesion are often used as measures of macrolinguistic abilities (Halliday & Hasan, 1976). Thus, it relies on the interaction of both linguistic and non-linguistic knowledge, especially the non-linguistic systems of executive control and working memory (Cannizzaro & Coelho, 2002). Thus, the discourse linguistic units can be at microlinguistic and macrolinguistic level (Ulatowska, North, & Macaluso-Haynes, 1981; Ulatowska, Freedman-Stern, Doyle & Macaluso-Haynes, 1983; Glosser & Deser, 1990; Cannizzaro & Coelho, 2002).

Inquiries in the neurolinguistic studies of discourse by Luria (1980, 1982), has a large body of work that points to the importance of using tasks of macrolinguistic structure to assess intellectual abilities in patients with brain lesions. Many of the tasks described in his writings tap the global semantic meaning/coherence of a text. The stimuli were stories and thematic pictures with probes asking the patients to derive a theme, provide a gist, sequence a series of thematically related pictures and formulate the unifying theme as opposed to describing each picture separately. He also suggested tasks that require the patient to identify the important (essential) details in a text, to synthesize the information, and to reach an interpretation of the global theme in terms of coherence. To a large degree, the nature of these tasks involved sorting the information according to importance. This process is critical to understanding the central meaning of a text/gist

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and or/coherence. None of these tasks had objective measurements for any type of responses by the participants.

As mentioned earlier the term "coherence has been used to characterize conceptual organizational aspects of discourse at the suprasentential level or the macrolinguistic level" (Glosser & Deser, 1990). Thus, it can be considered as a substitute to measure macrolinguistic abilities of discourse. Coherence is one aspect among the list of different propositional aspects of discourse. The "global" and "local" organizations are the two separate aspects of coherence which can be more precisely quantified when computed under the propositional aspects of discourse (Agar & Hobbs, 1982; Tracy, 1984). Global coherence deals with the manner in which discourse is organized with respect to an overall organization of goal, plan, theme or topic (Kintsch & van Dijk, 1978). But according to Agar and Hobbs (1982) at least in part, the coherence of a written text or discourse depends on the individual speaker's ability to maintain thematic unity. Since any discourse of an individual denotes conditionally related facts of the "real world", the thematic unity can be achieved by the combination of propositions which form a coherent representation (van Dijk, 1977; Keenan, Baillet & Brown, 1984). Thus, an overall thematic unity is sustained by the effect of coherence. To achieve the impression of coherence linguistically, it is expressed through cohesive devices such as co-reference and anaphora which serve to produce the overall elements together. These are the "link" which binds the individual elements together to attain the notion of coherence. Thus, a specific relation of meaning between elements within discourse is addressed as "cohesion". In this study, a measure of global thematic coherence is considered as an index of macro-linguistic abilities. Other ways of tapping macro-linguistic structure include generating the central event or the gist, providing a summary, and even retelling a story. Siklaki (1984) described a telegram task where the subjects were asked to leave out as much as possible of the original story while trying to retain as much as the important information as possible. In all these tasks it is necessary to extract what is relevant or essential to the central meaning based on world knowledge and textual knowledge.

All these tasks described here place heavy demands on the language system. In order to explore the cognitive factors, some investigators have designed tasks of macrostructure that reduce the linguistic demands. These tasks involve pictures or responses to probe questions like identifying the main props or characters, responding to sentence completions, answering multiple choice questions and answering questions relevant to setting information (Ulatowska & Chapman, 1991; Pierce & Grogan, 1992). Thus all these tasks target only the elicitation of correct responses, but do not discuss about the participant's efficiency at giving correct response within minimal required time. Two points can be picked up from these various tasks that tap macrostructure, first the information from the original stimulus can be transformed or reconstructed in discourse production. This transformation involves a reduction of information while preserving the central meaning. In this process, the information is not simply deleted but, rather it is reconstructed and generalized to an abstract level. The second, intactness of macrostructure may be examined by utilizing tasks with varying demands including temporal for example on the cognitive and linguistic systems. To conclude, the clinical importance lies in its potential value in defining communicative competence of speakers in terms of coherence (organizational structure), cohesion (its linguistic form) and the speed with which it is conveyed. It also elucidates the relationship between discourse coherence and efficiency. This is checked with subjective terms like quantity of information, quality of information and manner in which the information is distributed in any discourse production. To assess the participant's correct response efficiency objectively, all of these tasks can be modified into a timed task which results in measureable responses.

In the present study an attempt is made to objectively measure macrolinguistic ability using a timed picture description task. This reaction time measurement could be a revealing factor of how efficiently an individual is giving the required information correctly and within what time limits. Thus, an inference can be made about the cognitive processing speed of coherence. This macrostructure analysis as an implication can contribute to the process of making a differential diagnosis between different groups like focal lesions versus diffuse lesions, or right- versus left-hemisphere damage. Here, an attempt is made to use timed picture description task of macrostructure in individuals with traumatic brain injury (TBI) and compare the coherence/gist production competence between the TBI individuals with left and right hemisphere injury.

According to a set of researchers study on adults who have suffered traumatic brain injury (TBI) have revealed that they exhibit varying levels of impairment in the discourse abilities like informational content, coherence and cohesion of their extended verbal production although on

traditional aphasia tests these individuals score "normal" or "near normal" language (Hagen, 1984; Ylsivaker & Szekeres, 1989, 1994; Hartley & Jensen, 1991; Coelho, Liles, & Duffy, 1994). A study by Ehrlich (1988) has also concluded that, for persons with TBI assessment at the discourse level should always be included. Since the deficits in established linguistic tests for these individuals are more understated than what are observed in aphasia and/or other adult communication disorders (Hough, 1990). Coelho (1995) also noted that TBI participants were comparable to the neuro-typical adults in terms of the amount of salient and critical information produced in narratives. This result of lengthier and slower spoken language of the TBI participants was noted to prove their decreased communicative efficiency. Thus, he concluded that more words and time is required to convey the important information through spoken language by the TBI participants. The earlier studies by Wyckoff (1984) on individuals with traumatic brain injury also attributed these findings to several factors like decreased cognitive processing speed, inability to assume the listener's role, deficits in memory, and reduced linguistic abilities particularly word fluency. This research clearly attests the importance of an in depth study of the discourse capabilities of the head-injured adult. In the present study, an attempt is made to quantify the time taken and the number of sentences used to convey the important information/gist in a picture description task by the TBI participants.

Hartley and Jensen (1991) also reported that their closed head injured (CHI) participants produced only one-half or two-third the amount of accurate content produced by the neuro-typical adults. This means that in both the narrative and procedural discourse genre/tasks the CHI participants used significantly fewer cohesive ties per communication unit compared to the neuro-typical adults. Unlike the neuro-typical adults the CHI participants introduced inaccurate content into their narratives. Since the CHI participants' failed to interpret the visual stimulus correctly, they could not determine the most relevant aspects of the pictures, and as well as during the story retelling tasks they had a reduced auditory verbal memory. These findings were felt and attributed to provide evidence that the TBI participants' discourse lacked continuity. Snow and Douglas (2000) also reported that TBI participants when producing procedural discourse displayed greater difficulties with clarity of reference, than when producing narratives. Thus, there is evidence that different genres of discourse place various cognitive and/or linguistic demands. Whereas we can hypothesize that picture description task relatively requires less cognitive demand on CHI participants when compared to narrative and procedural discourse task. Picture description task has concrete and quicker response. Thus, in the present study picture description task is considered as a measure for global coherence and an attempt is made to study the same within the TBI group. In view of Glosser and Deser (1990) reports, the TBI participants were significantly impaired relative to the neuro-typical adults in both global and local coherence of conversational discourse. However, a greater impairment was observed for global coherence.

Any subjective measurement of discourse is done by using the principles of Gricean maxims. For instance the primary technique in explaining a novel procedure whether in terms narration or picture description to an inexperienced listener by the people who have sustained TBI have been found to exhibit difficulty observing so-called 'Gricean maxims'. These mean the cooperative principles which include the quantity and quality of information with relevant tie and appropriate manner that should be considered in any discourse to evaluate it as normal (Grice, 1975). Following this, to elicit procedural discourse from TBI participants a number of techniques have been used. They include requests for descriptions of a few aspect of the individual's work or treatment programme (e.g. Mentis & Prutting, 1987), outlining the sequential steps in a routine daily task, for example in an American supermarket buying groceries (Hartley & Jensen 1991), from a bank account withdrawing money (Snow, Douglas & Ponsford, 1995), making a sandwich, or changing a tyre, or mailing a letter, (Coppens 1995). As mentioned earlier, these are a subjective measurement of discourse. Thus, they show a reduced use of reference, in association with overall reduction in communicative efficiency, and in addition produce fewer target content units (Hartley & Jensen 1991; McDonald 1993). At present, there is a need for objective measurement of discourse efficiency.

Relative to neuro-typical group, the TBI participants might be expected to show impairment on both macrolinguistic and microlinguistic measures of discourse production. In the present study, the macrolinguistic abilities of discourse were assessed in terms of coherence to infer the cognitive processing speed using a timed picture description task. Here, the participants were supposed to describe the picture and provide the gist of the picture and these responses were measured in terms of reaction time. Thus, reaction time would be a possible unit to assess the coherence during the gist production and thus infer the cognitive processing speed of coherence.

Aim

To assess the macrolinguistic abilities of discourse at coherence level in TBI participants and to compare their reaction time between left vs right hemisphere injured individuals with TBI using a timed picture description task.

Method

Participants: The participants chosen for the study were 20 persons diagnosed as non-aphasic individuals with traumatic brain injury (TBI) following road traffic accidents. These were considered as clinical group and among these 16 were males and 4 were females in the age range of 20-40 years (Appendix-A). These TBI individuals were classified and diagnosed based on the first investigation of the impact side done by the neurologist and the findings of Computed Tomography (CT) scan respectively. The Glasgow Coma Scale (GCS) (Jennet & Teasdale, 1981) was administered by the neurologists to assess the severity of TBI. All the participants in the clinical group had a GCS score ranging from 12-15 and since they were all verbal only these participants were considered for the study. Thus, this GCS score corresponded to a severity of mild to moderate TBI. An individual with TBI having any other associated speech motor problems was not considered as a participant of the study. At the time of the study all these TBI participants had a post traumatic brain injury period of 3-4 months. Further this clinical group was divided into two groups, group 1 containing ten TBI individuals with predominant injury on the left hemisphere and in group 2 ten TBI individuals with predominant injury on the right hemisphere. This grouping was done because there is no specific literature which can directly support the present study where an effort is made to do the comparison between these groups based on single picture description task. All had suffered a mild to moderate traumatic brain injury with no evidence of nonlinguistic deficits like impairment of attention, memory, and executive control as confirmed by Mini Mental State Examination (Folstein, Folstein, & McHugh, 1975) (Appendix-B). Thus, they had to obtain a score of 25 or above on mini mental state examination. These participants received a confirmation from a speech language pathologist (investigator) regarding the absence of aphasia component using Western Aphasia Battery (Shyamala and Ravikumar, 2008) and their linguistic skills were found to be within normal limits. Although Kannada mother tongue was the criteria, knowledge of other languages were also noted. As per the rating on re-adapted version of National Institute of Mental Health (NIMH) Socioeconomic Status Scale, (Venkatesan, 2009), all the TBI participants belonged to a middle/high socioeconomic status.

Procedure: The target task was a timed picture description task; picture was taken from adapted version of Western Aphasia Battery in Kannada (Shyamala & Ravikumar, 2008) (Appendix-C). A picture was shown to the TBI individuals and there were two kinds of instructions to expect a correct response from this picture description task. In first condition they were asked to give the gist of information 'a picnic spot' from the picture and then describe the picture in detail (Appendix-D). The same timed picture description task had a second condition where participants were asked or assisted to first describe the picture in detail and then give the gist of information 'a picnic spot' (Appendix-E). In the present study the first condition was followed and the verbatim instruction provided was like "I am going to show you a picture, please tell me the scene depicted in the picture"- the gist of the picture picnic spot. If there was an inaccurate response (example: village scene, school set up etc) from the participant, then the second condition was followed with another verbatim instruction. That was to "describe the picture using sentences and then give the gist of the picture". Thus, among these accurate or inaccurate types of responses individuals with TBI may demonstrate any one type of response. Among the total 20 TBI participants, a majority of 16 participants (group 1- 8 participants and group 2- 8 participants) followed the first instruction and had a correct response (picnic spot) with specific reaction time measurements. Only this value in seconds was noted and considered for the statistical analysis. The remaining 4 participants had to follow the second instruction to get an accurate response and they used few sentences to get an accurate response. For the same the maximum duration considered was up to three minutes and at the same time, recording was done. The WaveSurfer 1.5.7, computer software program was used to record the picture description. The TBI individuals were aware that their speech was being audio recorded. Multimedia microphone was used for the recording and the microphone to mouth distance was kept constant by 5 cm. The recordings were carried out in a quiet room surrounding an environment with no distraction during or in between the recordings. The time taken by the TBI individuals to give the gist of information from the given picture was noted from the same WaveSurfer 1.5.7 computer software. From the recorded audio sample, transcription was done using Schiffman (1979) symbol of IPA. During transcription, initiation time, pause time, filled pauses, unfilled pauses

and false start etc, were carefully noted, for each episode.

Scoring: Using Discourse Analysis Scale for picture description task in Kannada language (Hema & Shyamala, 2009) (Appendix-C) the sample of picture description task was analyzed for 'information adequacy', 'information content', 'message accuracy', 'global coherence', 'response time' and 'gist of information'. All these parameters can be assessed under the propositional aspects of discourse (Hartley, 1995) and a high score for each parameter indicates the appropriateness of the behaviors and thereby infer good coherence efficiency. Among these, the parameter 'gist of information' was only the parameter which is the sum of all the parameter and objective in evaluation. Thus in the present study, only this parameter 'gist of information' is considered for statistical analysis and a general discussion is made to assess the minimum number of sentences used to get the gist of information and by this means the coherence efficiency can be inferred.

Results

In the present study, the TBI participants who told the gist of the picture as per the first instruction only were considered for analysis (Appendix- D). These individuals' responses were measured in terms of time duration under the parameter 'gist of information' and only this parameter was considered for statistical analysis. The scores of eight TBI individuals with predominant injury on the left hemisphere and eight TBI individuals with predominant injury on the right hemisphere were considered for statistical analysis to see the significant difference between the two groups. The SPSS (PASW) Version 18 was used to execute the statistical analysis. The mean and standard deviation were calculated for the parameter 'gist of information'. From Table 1, the mean value for the TBI group with injury on right hemisphere was higher which suggests that they took more time to tell the gist of the picture compared to TBI group with injury on left hemisphere. Since the overall discourse assessment was based on a three point perceptual rating scale and the standard deviation for the parameter 'gist of information' was high and not within the normal distribution, the non-parametric Mann Whitney test was carried out to study the significance of the value obtained between group 1 and group 2**.** Results showed significant difference between the TBI individuals with injury on left hemisphere and right hemisphere at 0.05 level. Thus, RT measurement conveys how efficiently one is giving a correct coherence.

Table 1: Mean, standard deviation and results of Mann-Whitney on propositional aspects of discourse

Parameters	Groups	Mean	Std. Deviation	Results of Mann-Whitney test *(p)*
Gist of information (in secs)	LHD	85.10	19.48	$p<0.05$
	RHD	115.66	25.27	

Note: Legend: LHD- Left Hemisphere Damage/Insult, RHD- Right Hemisphere Damage/Insult.

Discussion

From Table 1, the results reveal an inference that the right hemisphere injured group was taking more time to give the gist of information compared to left hemisphere injured group. This result is in support with Zalla, Phipps and Grafman (2002) who reported that right hemisphere damaged participants had difficulty in processing inference, recalling narrative components of a story, and appreciating the gist or story's thematic aspects distinctively in the context of story-telling task. Yet another study by Long, Baynes and Prat, (2005) is also in support with the results of the present study, where they used lateralized item-priming-in-recognition paradigms with reaction time measurements. They found that the left hemisphere and the right hemisphere were equally sensitive to discourse model relations. There is however, no specific literature which can directly support the present finding based on single picture description task.

Most studies have examined changes in the expressive language of TBI participants using referential communication tasks. One such example is a study by Wyckoff (1984) who published her doctoral thesis on referential communication task. She compared the procedural and narrative discourse genre in terms of expressive language of head-injured adults who showed fairly early recovery with those of matched neuro-typical speakers. Among the head-injured group an overall reduction in discourse abilities were found. The participants all of whom were considered under head-injured group had some degree of oral language impairment. They produced fewer meaningful words and cohesive ties, reduced syntactic complexity and more inaccurate content with increased dysfluencies such as repetitions, revisions, and fillers as a hesitating phenomenon. She attributed these findings to several factors like decreased cognitive processing speed, inability to assume the listener's role, deficits in memory, and reduced linguistic abilities particularly word fluency. This research clearly attests the importance of an in depth study of the discourse

capabilities of the head-injured adult. In comparison with the Wyckoff's research finding, results of the present study are in support for picture description task. In TBI individuals the longer reaction time in discourse production predicts the propositional aspects of discourse to be poorer and consequently infers the poor cognitive processing speed.

Another supporting study was by Ehrlich (1988) who noted that TBI subjects were comparable to the neuro-typical subjects in terms of the amount of critical and salient information produced in narratives. Like the lengthier and slower spoken language of head injured individuals was noted to result a decreased communicative efficiency. Ehrlich also concluded that to convey the important information through spoken language by the head-injured individuals, more time and words may be required. Thus, in the present study also the TBI participants have taken more time to convey the gist of the information.

Hartley and Jensen (1991) also reported that their CHI participants were poorer in producing accurate content. They produced only one-half or two-thirds the amount of accurate content produced by the neuro-typical groups. In contrast to the neuro-typical group, the CHI participants introduced inaccurate content into their narratives. As mentioned in the earlier sections these findings are attributed to the CHI participants' reduced auditory verbal memory during the story retelling task as well as failure to determine the most relevant aspects of the pictures, or interpret the visual stimulus correctly. But in the present study, TBI individuals did not fail completely to interpret the visual stimulus correctly, but took more time to interpret. Thus, our study contradicts with Hartley and Jensen's study and gives new result w.r.t TBI individuals having a delay in giving the gist of the picture while still maintaining fair amount of coherence in their discourse topic. This could be due to the impact and other compounding variables like severity of CHI. Thus longer reaction time is reflective of the reduced efficiency in giving correct coherence, while shorter reaction time and correct gist production reflect better proficiency.

Overall, left hemisphere injured group performed better compared to right hemisphere injured group in all the aspects of discourse. Although difference is seen with respect to the side of injury in TBI participants, this cannot be generalized, because in spite of strict selection criteria, there could be individual variations among the participants selected in this group, sample size considered was also small and the picture description task was the only single discourse genre used in the present study. Thus, this procedure will help in assessment of discourse deficits in individuals with TBI. It would further help in formulation of therapy baseline and development of appropriate treatment strategies for such population.

Of the many possible narratives types, picture description during diagnostic assessment remains as a most commonly used task. Since it is the interesting and simplest of tasks to elicit a discourse sample. But the discourse typically generated through picture descriptions has led to respond some research questions in brevity, like whether such tasks present great enough cognitive-linguistic challenges and elicit acceptable language to reveal the language production abnormalities of adults with TBI. This has been justified, taking into consideration that this task with short duration is having the additional benefit of predictable content that yields relatively brief language samples and requires less time to assess, transcribe, infer the abstract information, and check the efficiency of coherence among concrete items in the stimuli. Another question is describing a picture scene that the listeners and speakers are simultaneously viewing is not representative of most everyday communicative interactions. The answer for this question is that the day-to-day communicative interactions are very highly influenced by a few extraneous variables like world's knowledge and individual's intelligence. Using a timed standard picture stimulus possibly may rule out the above mentioned extraneous variables. Thus, make the task more comparable among different participants. Thus, among the clinical populations it may help in making differential diagnosis and also to establish the normative data in discourse.

Conclusion

Discourse analysis scale was used to assess the macrolinguistic ability in terms of coherence in individuals with TBI using a timed picture description task. Using this paradigm of testing the discourse parameter "coherence" was mainly inferred by means of testing "the gist of the information" parameter in Discourse Analysis Scale. Participants' response to tell the gist was measured in terms of reaction time and was only considered for statistical analysis. A non parametric test showed a significant difference for reaction time measurements on comparison across TBI participants with left hemisphere insult and right hemisphere insult. However the mean reaction time measure was higher for right hemisphere damaged than left hemisphere. It is concluded that TBI participants have a delay in inferring discourse coherence because of cerebral

insult. This time delay can be objectively measured using a picture description task. This reaction time measurement corresponding to the efficiency in giving correct gist reveals and infers the cognitive processing speed. Thus, by analyzing the concrete content of TBI participants' picture descriptions, the current findings suggest that the clinicians can obtain significant information specifying the nature of cognitive-communication impairments. This means comparing measured reaction time value as individual's score and carefully taking into consideration the potential factors prompting the generation of coherence and gist. The clinical importance lies in its potential value in defining and objectively measuring the communicative competence of speakers in terms of coherence (organizational structure) and cohesion (its linguistic form) in gist production. Thus, this macrolinguistic analysis in these participants is important for theoretical and practical reasons. Hence, as an implication it contributes to the process of making a differential diagnosis between TBI individuals with left and right hemisphere injury. A larger sample study however, is necessitated to facilitate generalization. In diagnostic settings, time is a valuable commodity and using picture description task can significantly facilitate objective results. This task can speed up the process and performance of the discourse analysis procedure that can be used as a means of eliciting discourse samples to identify the factors contributing to cognitive-communication impairments. Thus, the limitations associated with tasks like natural conversation, narration, and procedural discourse may be outweighed by using picture description.

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APPENDIX- A

Demographic details of TBI participants with left hemisphere insult under Group 1.

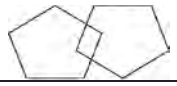
SL No	Age	LK	Lesion
1.	50/M	K,E,H	RTA with concussive head injury with fracture of left frontal bone with underlying fracture haematoma (small extra dural haematoma). Left frontal haemorrhagic contusion
2.	40/F	K, E	RTA with concussive head injury with deep lacerated wound on left side of occipital scalp
3.	20/M	K, H, E	RTA with severe concussive head injury.
4.	28/M	K, H, E	RTA with severe concussive head injury. Fracture of right temporal bone and right zygoma with multiple intra cerebral contusion in left frontal and temporal region with gross cerebral edema
5.	40/M	K, E	RTA with moderate head injury with left frontoparietal subdural haematoma with faciomaxillary injury
6.	38/M	K, E	RTA with severe head injury
7.	40/M	K, E, H, Te	RTA with concussive head injury
8.	40/M	K, E	RTA with head injury with left temporomastoid bone fracture with left parietal bone fracture with underlying pneumozephalum
9.	45/M	K, E	RTA with severe head injury with large temporal contusion
10.	34/M	K, E, H	RTA with head injury with fracture post column left acetabulum with deep laceration of left frontal region
11.	26/M	K, E, H, Ta	RTA with closed head injury with right temporal bone fracture with underlying moderate sized extra dural haemorrhage
12.	23/M	K, E, H, Ta, Te	RTA with severe head injury with right temporal bone fracture
13.	50/M	K, E, H	RTA with severe head injury
14.	21/M	K, E, H	RTA with concussive head injury with right temporal bone fracture with mild cerebral edema
15.	45/M	K, E	RTA with concussive head injury with hematoma in occipital region
16.	28/M	K, E	RTA with severe head injury
17.	50/M	K, E	RTA with concussive head injury with soft tissue injury. Right parieto occipital scalp haematoma
18.	23/M	K, E	RTA with severe concussive head injury with traumatic subarachonoid haemorrhage with extensive faciomaxillary injury
19.	26/M	K, E	RTA with concussive head injury left temporal lobe small hyperdense area ? contusion
20.	50/M	K, E, H	RTA with severe head injury with fracture of left sphenoid and zygomatic arch and gyriform hyperdensity right parietal lobe suggestive of ? subarachnoid haemorrhage with small pneumocephalus

Note- M-Male, F-Female, RTA-Road Traffic Accident, LK-Language Known, K-Kannada, E-English, Te-Telugu, Ta-Tamil.

APPENDIX-B
The Mini-Mental State Exam

Patient…… Examiner …….

Date……

Orientation	Maximum	Score
What is the (year)(season) (date) (day) (month)?	5	
Where are we (state) (country) (town) (hospital) (floor)?	5	
Registration		
Name 3 objects: 1 second to say each. Then ask the patient all 3 after you have said them. Give 1 point for each correct answer. Then repeat them until he/she learns all 3. Count trials and record. Trials ……..	3	
Attention and Calculation		
Serial 7's. 1 point for each correct answer. Stop after 5 answers. Alternatively spell "world" backward.	5	
Recall		
Ask for the 3 objects repeated above. Give 1 point for each correct answer.	3	
Language		
Name a pencil and watch.	2	
Repeat the following "No ifs, ands, or buts"	1	
Follow a 3-stage command: "Take a paper in your hand, fold it in half, and put it on the floor."	3	
Read and obey the following: CLOSE YOUR EYES	1	
Write a sentence.	1	
Copy the design shown. 	1	
Total Score		
ASSESS level of consciousness along a continuum- ***Alert*** ***Drowsy*** ***Stupor*** ***Coma***		

APPENDIX- C
Discourse Analysis Scale for picture description task

(Hema & Shyamala, 2008)

Points to be considered while using Discourse Analysis Scale:

The parameters of propositional and non-propositional aspect of picture description can be quantified with few general instructions to the evaluator as follows:

1. Initially read the keys provided in the sub headings which explain the exact meaning of the parameters to be scored as good, fair and poor with respect to the particular context of conversation.
2. Scoring procedure involves the use of rating scale. Three points perceptual rating scale is used to evaluate each parameters.
3. Each appropriate behavior *(normal)* is given a *higher score* and the inappropriate behavior *(abnormal)* is scored *low*.

Propositional aspects of communication.

This includes the notion of relevancy, clarity of reference and coherence of information. It deals with how discourse is organized with respect to overall plan, theme or topic and how individual utterances are conceptually linked to main theme/topic.

1) Discourse Structure

Good- The discourse is organized with respect to overall plan, theme or topic and how individual utterances are conceptually linked to maintain unity.
Fair- The discourse is partially confusing even if it is partially organized with respect to overall plan, theme or topic and how individual utterances are conceptually linked to main theme/topic.
Poor- The discourse is completely confusing since it is unorganized with respect to overall plan, theme or topic and how individual utterances are conceptually linked to each other.

a) Discourse forethought----------→ ( )
[Score: 0-Poor, 1-Fair, 2-Good]
b) Organizational planning ----------→ ( )
[Score: 0-Poor, 1-Fair, 2-Good]

2) Communication intent

This parameter can be evaluated using frequency count, so check for the presence or absence. If present, make a note whether an individual use this parameter only in required circumstances or in all the circumstances.

Good- Individuals using this parameter in all required circumstances.
Fair- Individuals using this parameter inconsistently in the required circumstances.
Poor- This parameter is absent in the entire context of picture description.

a) Initiation of picture description----------→( )
[Score: 0-Poor, 1-Fair, 2-Good]
b) Asks for assistance in understanding picture----------→( )
[Score: 0-Poor, 1-Fair, 2-Good]
c) Criticizes the picture by agreeing/disagreeing to a part in the picture→( )
[Score: 0-Poor, 1-Fair, 2-Good]
d) Imagines events correctly----------→( )
[Score: 0-Poor, 1-Fair, 2-Good]

3) Coherence

a. Global coherence----------→( )

Good- Presence of good relationship between the meaning and context of verbalization with respect to the general topic of picture description.
Fair- Presence of partial relationship between the meaning and context of verbalization with respect to the general topic of picture description.
Poor- Relationship between the meaning and context of verbalization with respect to the general topic of picture description is completely absent.

[Score: 0-Poor, 1-Fair, 2-Good]

b. Local coherence----------→ ( )

Good- Presence of good relationship between the meaning and context of verbalization with that of the immediately preceding utterance produced by the participant.

Fair- Presence of partial relationship between the meaning and context of verbalization with that of the immediately preceding utterance produced by the participant.
Poor- Relationship between the meaning and context of verbalization with that of the immediately preceding utterance produced by the participant is completely absent.
[Score: 0-Poor, 1-Fair, 2-Good]

4) Topic management
a) Introducing topic----------→ ( )
Good- Correctly introducing the topic.
Fair- Partial but correct introduction to topic.
Poor- Irrelevantly introducing topic or no response.
[Score: 0-Poor, 1-Fair, 2-Good]
b) Topic shift----------→ ( )
Good- Staying within the given topic.
Fair- Gradual shift from the given topic.
Poor- Rapid shift from the given topic.
[Score: 0-Poor, 1-Fair, 2-Good]
c) Topic changes----------→ ( )
Good- Coherent topic change where the topic is within the context of verbalization.
Fair- Partially inappropriate topic change but still the topic is within the main context of verbalization.
Poor- Non coherent topic change is present.
[Score: 0-Poor, 1-Fair, 2-Good]
d) Perseveration in the topics----------→ ( )
Good- Perseveration not present.
Fair- Perseveration partially present.
Poor- Perseveration continuously present.
[Score: 0-Poor, 1-Fair, 2-Good]
e) Minimal elaboration----------→ ( )
In presence of prompts from the investigator, the participants attempting to give yes/no responses along with very few sentential level discourse to elaborate the topic.
Good- Minimal elaboration appropriately present in all required circumstances
Fair- Minimal elaboration partially present in all required circumstances.
Poor- Minimal elaboration absent in required circumstances or minimal elaboration only present throughout the context of picture description.
[Score: 0-Poor, 1-Fair, 2-Good]
f) Elaboration of topics----------→ ( )
Good- Adequate elaboration of topic.
Fair- Partial elaboration of topic.
Poor- Extra elaboration of topic.
[Score: 0-Poor, 1-Fair, 2-Good]

5) Information adequacy
Good- Completely adequate picture description at word level/ single sentence level/ multiple sentence level without any prompts from the investigator.
Fair- Partially adequate picture description at word level/ single sentence level/ multiple sentence level in the presence of few prompts from the investigator.
Poor- No picture description at word level/ single sentence level/ multiple sentence level despite several prompts from the investigator.
a. Word level/ Single sentence level/ Multiple sentence level------→( )
Underline the level at which the participant is positioned.
[Score: 0-Poor, 1-Fair, 2-Good]

6) Information content
Good- Meaningful and adequate information of the picture description in terms of initiating and/or sustaining the task.
Fair- Meaningful and adequate information of the picture description in terms of initiating and/or sustaining the task or if you know what the person is talking about, even if the information doesn't appear to be available or more than half of the picture described.
Poor- Nonmeaningful and inadequate information of the picture description in terms of initiating and or/sustaining the task or less than half of the picture described.
a. Meaningful and adequate information----------→ ( )
[Score: 0-Poor, 1-Fair, 2-Good]

7) Message Accuracy ----------→( )
Good- An attempted picture description involving correct descriptions of picture without any confabulation or any inaccurate information within the same context of picture description.

Fair- An attempted picture description involving correct description of picture and few accurate information without any confabulation within the same context of picture description.
Poor- An attempted picture description involving incorrect descriptions of picture with confabulation within the same context of picture description with all inaccurate information.
[Score: 0-Poor, 1-Fair, 2-Good]

8) Vocabulary specificity----------→ ( )
Good- Using specific vocabulary when specific information is required.
Fair- Partially using specific vocabulary when specific information is required.
Poor- Overuse of generic terms such as "thing" and "stuff" when more specific information is required.
[Score: 0-Poor, 1-Fair, 2-Good]

9) Linguistic fluency ----------→ ( )
Good- Fluent discourse without any repetition, unusual pauses or hesitations.
Fair- Partially fluent discourse with very few repetitions, unusual pauses or hesitations.
Poor- Presence of repetition, unusual pauses, hesitations
[Score: 0-Poor, 1-Fair, 2-Good]

10) Speech Style ----------→ ( )
Good- Appropriate use of any dialectal structural forms, code switching and style-shifting.
Fair- Inappropriate use of dialectal structural forms, code switching, style-shifting is partially present.
Poor- Presence of totally inappropriate dialectal structural forms, code switching, style-shifting.
[Score: 0-Poor, 1-Fair, 2-Good]

11) Intonation ----------→ ( )
Good- Absence of any inappropriate or abnormal rising, falling, flat intonation with respect to a particular context of picture description.
Fair- Inappropriate or abnormal rising, falling, flat intonation with respect to a particular context of picture description is partially present.
Poor- Presence of inappropriate or abnormal rising, falling, flat intonation with respect to a particular context of picture description.
[Score: 0-Poor, 1-Fair, 2-Good]

12) Response time----------→ ( )
Time taken to start the picture description and is measured in terms of seconds.
Good- Response at 0.5-2sec.
Fair- Response at 3-5 sec.
Poor- Response delayed beyond 6-8 sec.
[Score: 0-Poor, 1-Fair, 2-Good]

13) Gist of information ----------→ ( )
What does the whole picture represent as? Please record the time (in seconds) taken to carry out this particular task.
Good- Presence of correct depiction (picnic spot).
Fair- Partially correct depiction (picnic spot) with good local and poor global coherence.
Poor- Completely wrong depiction (picnic spot) with poor local and global coherence.
[Score: 0-Poor, 1-Fair, 2-Good]

Non propositional or Interactional aspects of communication
This is one of the important categories of social communication behavior. These behaviors reflect the reciprocal nature of conversation and the joint co-operation required of the participant. *(Note: In picture description it is only from participants' point of view)*
The following subcategories are considered:

1) Revision behaviors ----------→ ( )
Good- Absence of false starts and self interruptions in the entire context of picture description.
Fair- Presence of false starts and self interruptions in some contexts of picture description.
Poor- Continuous presence of false starts and self-interruptions in the entire context of picture description.
[Score: 0-Poor, 1-Fair, 2-Good]

2) Repair strategy
This parameter can be evaluated using frequency count, so check for the presence or absence. If present, make a note whether an individual use this parameter only in required circumstances or in all the circumstances.
Good- Individuals using this parameter in all required circumstances.
Fair- Individuals using this parameter inconsistently in the required circumstances.
Poor- Individuals not using this parameter at all in the entire context of picture description.

a) Use of self correction ----------→ ( )

Participants find a word or sentence after giving a small pause and continue the topic of picture description.

[Score: 0-Poor, 1-Fair, 2-Good]

b) Use of repair through repetition/revision----------→ ( )

Repeating themselves and correcting the discourse without the investigators help.

[Score: 0-Poor, 1-Fair, 2-Good]

c) Use of other initiated correction----------→ ( )

Participants not able to find the right word, so the investigator fills it with the correct word to continue the topic of picture description.

[Score: 0-Poor, 1-Fair, 2-Good]

d) Use of request for clarification ----------→ ( )

Requesting the investigator to modify the discourse and use the corrected version of discourse to continue the topic of picture description.

[Score: 0-Poor, 1-Fair, 2-Good]

Picture card from Western Aphasia Battery, (Shyamala & Ravikumar, 2008)

APPENDIX- D

Sample of a TBI participant following the first instruction where there is no delay in giving the gist of the information.

P: pravasakke bandidaare. ondu naayi ide. matte ella avara kelasaddali toDagiddare. appa amma avara kelasa maaDataa iddare. ondu huDuga gaaLi paTa haarisutta iddane. idu ondu citra ashTe. naahi nintide. ondu dvajaaroohaNa naDedide. aa pravasi taaNada munde ondu dvaja ide. aa ganDasu appa avana cappal biTTu caape mele kuuttiddare. hengasu kaafi baeraesutta iddare. ondu buTTi ide avara munde, ivaru ondu doDDa marada keLagaDe kuLitu vishranti paDedu koLLutta iddare. alli haaDu keLutta iddare. ivaru kaarinalli bandu kaarannu pravaasi gruhadalli nillisiddare. pakkadalli ondu samudra atava nadi ide. alli ondu dooNi ide. pakkadali jana eno baTTe hogeyutta kelasa maaDutta iddare. (They have come for a picnic. One dog is there and all are involved in their work. Dad and mom are doing their work. One boy is playing with kite. This is one picture that is all. Dog is standing. One flag hoisting is done. aa.. in front of the guest house flag is there. That men dad has left his chappal and is sitting on the mat. A woman is preparing coffee. One basket is there in front of them. They are sitting under a big tree and taking rest. There they are listening to music. They have come by a car and car is parked in the guest house. Near by there is sea or river. There one boat is there. Near by some people are washing their cloths and doing some work.)

APPENDIX- E

Sample of a TBI participant following the second instruction where there is a delay in giving the gist of the information.

P: ii citra... ii citra nooDidare ondu haLLiyalli jana jiivan naDesuta iirodu. (This picture.. This picture depicts a village scene where people are leading their life.)
I: nooDi… yaava samayadalli iige kuutakotaare?Ellige hoodaaga iige kuutukotiivi (See… When do they sit like this? Where do we go and sit like this?)
P: ondu mane ide, samudrada pakka ide. ondu huDuga, hengasu, ganDasu, naayi, kaaru ede. ivaru avara kelasadalli toDagiddare. elaaru vishranti togotaa iiddare. pravasakke bandiddare. (One house is there. It is next to the ocean, one boy, women, men, dog, car is there. These people are involved in their work. All are taking rest. They have come for a picnic.)