**Cognitive-Linguistic Processing in Conduction Aphasia-A cases study**

**Abstract**

*This case study describes the language processing difficulties exhibited by the case with conduction aphasia with respect to the deficits in working memory capacity and discourse ability. The case presented here is the 33-year old right-handed female, who started exhibiting aphasic features following craniotomy for the anaplastic oligodendroglioma. In this case study, the medical report is presented first followed by the description of cognitive-linguistic deficits. The tasks used in this case study were narrative discourse task and working memory tasks such as, forward span task, backward span task and N-back tasks. These tasks were used to assess the cognitive-linguistic ability of the case presented here. The deficit exhibited by the case at the level of working memory was explained with the help of Allan Baddley’s Working Memory Model. Where, this case demonstrated impairment at phonological storage or articulatory rehearsal with reference to the cognitive ability. The discourse deficits were observed only at propositional aspect with poor local coherence and good global coherence when compared to the non-propositional aspects of narrative discourse. The contributing factor for these cognitive communicative deficits would be the aphasic errors like perseveration and phonemic paraphasias. The coherence violation observed could be attributed to the patient’s overt and covert attempt to use certain adaptive strategy to compensate for micro and macro-structural deficits. The same is discussed in this case study in detail*.

**Keywords**: *Phonological loop, working memory, narrative discourse, coherence, N back task*

**Background:**

Aphasia has been traditionally defined as a language based impairment (Benson, 1973; Grodzinsky, 1990) typically resulting from a lesion in the perisylvian region of the left hemisphere. The Speech and language deficits vary depending on site of the lesion. Aphasia is also viewed as an upshot of reduced efficiency in cognitive processes which are thought to support language behavior (Luria, 1966; Martin 1987). These cognitive processes may include attention, memory, perception, and problem-solving. One cognitive system believed to be involved with language processing in aphasia includes working memory (WM). Working memory capacity has been conceptualized as a single “resource” pool for attention, linguistic, and other executive processing (Just & Carpenter, 1992). A number of researchers (Wright, Newhoff, Downey & Austermann, 2003) have reported that deficits in memory capacity add to language processing difficulties in individuals with conduction aphasia. Among all the varieties of aphasia, for example, conduction aphasia is marked by the cardinal feature of repetition impairment of spoken language; phonemic paraphasic errors; good comprehension of spoken language and a certain degree of circumlocution (Benson et al., 1973). The relative preservation of comprehension often engenders a self-critical attitude toward paraphasic output and, consequently, a halting quality in spontaneous speech.

Several explanations for the repetition impairment in conduction aphasia has been highlighted in aphasia literature. According to Wernicke and Lichtheim model, the clinical features of conduction aphasia is presented with the explanation that “*sound images*” or language components are organized in cortical centers. Centers for *articulatory gestures* and *sound images* are connected with one another. Any disconnection in this can result in the dissociation of two components of a word (named as disconnection syndrome); hence the patient will have word finding and repetition difficulty in spontaneous speech. Since there is no damage to Broca’s and Wernicke’s area, the patient is presumed to have normal comprehension and expression (Benson & Ardila, 1996).

 This disconnection model was criticised by Goldstein and he attributed the repetition impairment to the disruption of *inner speech* or *word concept* (Geschwind, 1965; Benson et al., 1973). Repetition impairment in conduction aphasia is due to the lesion in the arcuate fasciculus, the fibers which are responsible for transmission of information from auditory perception area to motor speech apparatus. This is in support of the evidence of impairment of phonological component of speech production (Dubois et al., 1964; Luria et al., 1967). The presence of auditory-verbal short-term memory impairment in aphasic subjects with preserved perceptual and output mechanisms as the basis for repetition impairment was claimed by Warrington and her colleagues (Warrington, Logue & Pratt, 1971; Warrington & Shallice, 1969). Thus, they introduced the new concept in aphasiology literature that, repetition deficit in aphasia could be attributed to working memory disorder rather than attributing to linguistic processes alone.

One of the important models of WM was proposed by Baddeley and Hitch (1974), this model consists of three subsystems for WM. The first component is the phonological loop, which is responsible for storing verbal and acoustic information, the visuospatial sketchpad is the second component, and the third component is the central executive which is attentionally limited control system. The first two components are dependent on this system. In original WM model, as there were limited capacities in phonological and visuospatial sketchpad subsystem the model failed to explain the results of various experiments. Hence, Baddeley (2000) added a fourth component called “episodic buffer” which acts as a backup storage and thus interacts with short-term memory, long-term memory, and working memory. This model has got a great application for both normal and disordered language processing. Most of the studies in aphasia literature has explained the language and repetition impairment in conduction aphasia with reference to the underlying impairment at the cognitive process.

The relationship between working memory capacity and comprehension was studied by Caspari, Parkinson LaPointe, and Katz (1998).The study consisted of 22 participants with aphasia. To measure the working memory capacity, they used a modified version of Daneman and Carpenter's (1980) Reading Span Task. The stimuli consisted of sentences increasing its words length from one to six, the task of the aphasic participants were to remember the terminal words following each sentence for subsequent recognition. The index of WM capacity was calculated based on the maximum number of words retrieved. The study demonstrated a strong correlation between memory capacity, reading comprehension and language function. This finding evidences the notion that the language comprehension in aphasic individuals is dependent on the WM capacities.

Thus, a consensus has been that individuals with aphasia exhibits impaired working memory capacities compared to neurologically healthy controls (Wright & Shishler, 2005) but only a few studies have assessed working memory capacity explicitly in people with conduction aphasia. Working memory assessments may be a practical means for identifying conduction aphasia. Hence, as a clinical implication, there is a need to replicate similar studies in conduction aphasia and to develop a reliable working memory assessment tool to use in any clinical setup. The outcomes of such studies discuss the association and the correlation between linguistic processing deficits and the cognitive deficits in individuals with conduction aphasia.

With reference to the above mentioned objective, a smaller but nonetheless rapidly growing body of research has been done to understand the impact of cognitive deficit on communication and its role in language processing deficits in aphasia (Erickson, Goldinger & LaPointe, 1996; Murray, Holland, & Beeson, 1997; Wright, Newhoff, Downey & Austerman, 2003). Conversely, many tasks of attention and memory on individuals with aphasia have been created with high linguistic load, posing greater contribution of lexical, semantic, and/or phonological processing to follow the task instructions and/or give a response. Consequently, result interpretation for the same is restricted. However, prior studies have failed to attribute the cause of poorer performance by individuals with aphasia on a cognitive task, whether the observed deficit is due to linguistic processing deficit or cognitive domain deficit is still questionable. The present case study is planned to evaluate the cognitive- linguistic deficits in isolation using discourse and n-back task respectively and discuss the association between the two processes in relation to the aphasia symptoms (Conduction Aphasia).

*Aphasia symptoms in relation to working memory*

A study attempted to investigate the working memory in participants with aphasia for processing different types of linguistic information and examine whether a relationship exists between working memory and auditory comprehension measures (Wright, Downey, Gravier, Love & Shapiro, 2007). This study consisted of nine individuals with aphasia, they administered 2 level n-back tasks (level 1 & 2), each tapping different types of linguistic information, such as PhonoBack (phonological level), SemBack (semantic level), and SynBack (syntactic level). Each level consisted of 20 target items; the accuracy of the response was recorded by stimulus presentation software. For syntactic sentence comprehension task, they administered Subject relative, Object-relative, Active, and Passive Test of Syntactic Complexity (SOAP). Results of the study revealed that, with the increase of n-back task difficulty, participants’ performance declined significantly. Participants’ performance was better on SemBack task compared to PhonoBack and SynBack task; however, differences were not statistically significant. In this study, they highlight that there exist separate working memory ability for different types of linguistic information; therefore the clinical features of language deficit exhibited by the patients will depend upon the underlying impairment in the working memory ability. Hence their findings strengthen the evidence that a working memory deficit may contribute to the language-processing difficulties in aphasia.

With reference to a specific example, studies have reported an association between repetition and Auditory-verbal STM and others have reported dissociation between both. The latter one was studied by Attout, Van der Kaa, George, and Majeru (2011) who accomplished the task for language and STM processing through retention of the item versus order information task in the immediate serial recall. Here, language processing is linked with retention of items and STM is linked with order information. They reported two case studies with a conflicting pattern of performance in the given task. One case with a mild phonological impairment performed poorly on item recall and the other case with no residual language impairment exhibited the opposite pattern. Their study strengthens the importance and the challenge in teasing out verbal and STM component in a verbal STM task.

In the present case study, the linguistic encoding task would be the narrative discourse task and recall of information on STM would be the N-back task. Here an attempt is made to study and highlight the correlation between the WM performance and discourse in patients with conduction aphasia following diffused lesion. This study also discusses and highlights the point, whether the repetition error in conduction aphasia is due to the linguistic deficit or working memory impairment. For the same, the relatively pure case of conduction aphasia is presented in the following section in the form of a case report study. These include a brief presentation of the patient’s history, performance on working memory and discourse task and discuss their performance in WM task in relation to their narrative discourse task using discourse analysis scale.

**Materials and Methods**

**Participant**

Ms. A was a 33-year old right-handed female, a bilingual speaker with the graduation in Biotechnology. She worked as a system engineer for over two years. Ms. A reported on 17th of Jan 2017 with complaints of left temporal headache, left temporal eyelid sharp pain with burning sensation, progressive memory disturbance, headache, vomiting and double vision.

*Clinical Examination:*

Ms. A was moderately built, nourished. No neurocutaneous markers, vitals were stable. MMSE administered, obtained a score of 26/30. Ms. A was conscious, alert and oriented on examination of higher mental function. Cranial Nerve examination revealed functions within normal limits. Motor-Bulk and tone were normal. A score of 5/5 was obtained for Power in all sensory groups. Touch, pain, and temperature were normal. Posterior column, deep tendon reflexes were normal. Superficial reflexes were present, plantar reflexes were bilaterally down going. Cerebellar signs were absent. Gait was normal.

*Clinical neuroimaging findings:*

As per the recommendation of a neurologist, the patient underwent MRI investigation on 20th of Jan 2017. *A large heterogeneously enhancing solid lesion noted in the left anterior frontotemporal region* was the findings. The lesions show heterogeneous signal intensity on T2 with hyperintensity on Fluid Attenuated Inversion Recovery Image (FLAIR). Multiple foci of blooming on Susceptibility Weighted Imaging (SWI) were seen in the lesion without any appreciable foci of Diffusion Weighted Imaging (DWI) restriction. MR Spectroscopy from the lesion reveals a large choline peak with reduced N-acetyl-aspartate (NAA). The Choline (Cho)/Creatinine (Cr) and choline/N-acetyl aspartate (Cho/NAA) ratios were elevated. T2 perfusion revealed significantly elevated perfusion within the lesion (Relative Cerebral Blood Volume-rCBV was approx. 3-5 times as compared to the contralateral normal appearing white matter).

 Adjacent T2/FLAIR hyperintensity was noted, extending to involve the left perisylvian region. A small cystic cavity was seen in the left lentiform nucleus and the left anterior periventricular region. The left temporal horn was not visualized. Mild mass effect on the uncus and left cerebral peduncle was seen. The impression made was **Left frontal-temporal anaplastic oligodendroglioma.**

*Medical Treatment:*

Ms. A underwent left Frontotemporal craniotomy and near total decompression of high-grade glioma. The tumor was solid cystic, yellowish grey and moderately vascular, diffusely infiltrating. Following the surgical treatment, the patient was under medication-Antibiotics, antiedema, antiepileptics and other supportive measures.

*Post-Operative Course and Speech & Language Assessment:*

The surgery rendered her aphasic, seizures and memory difficulties with reference to the informal profiling of language and cognitive abilities by a neurosurgeon. The same neurosurgeon after 6 months of the postoperative period, referred the client to a speech-language pathologist at AIISH for a detailed investigation. Western Aphasia Battery (WAB) was administered on 6th July 2017, obtained an AQ score of 0.5 and the impression made was global aphasia. Ms. A attended her speech therapy sessions at her native place, after 8 months she was reported back to AIISH. At the time of the investigation, her speech was fluent and occasionally interrupted with word-finding pauses, literal or verbal paraphasias, and circumlocutions. WAB was administered on 7th March 2018; she obtained an AQ score of 42.4 and was diagnosed with conduction aphasia. These were the linguistic deficits observed in Ms. A- Grammatical errors were sometimes present. Her comprehension of conversation, including discussion of relatively complex ideas, was good, though she made occasional errors with words in isolation, particularly numbers, body parts, and colors. Reading was very laborious with many paralexic errors. Spontaneous writing showed paraphasic substitutions and many spelling errors. Furthermore, her repetition was marked by an overt rehearsal which was audible & filled with literal paraphasias; she could repeat monosyllabic high-frequency words correctly, the frequency of paraphasic errors increased with increase in syllable length. Similar errors were seen in confrontation naming as well, she displayed occasional phonemic and semantic substitutions (paraphasias) and circumlocutions. Arithmetic skills on Simple additions, subtractions, multiplications, and divisions of was carried out. Ms. A was able to do simple additions and subtractions and refused to do the rest. When shifting from one task to the next, Ms. A exhibited perseveratory behaviors such as doing additions when she is supposed to divide the digits.

**Stimulus and Materials:**

**1. Working Memory assessment**

The Software used in the study was “Cognitive Module” (Kumar & Sandeep, 2012) to assess WM in individuals with and without aphasia. Tasks used for the WM assessment includes *N-Back task, Forward Span Task (FST) and Backward Span Task (BST).*

**2. Discourse Assessment**

The discourse was assessed using “Discourse Analysis Scale” (DAS) (Hema & Shyamala, 2013). This is standardized on Kannada language speaking neuro-typical individuals in the age range of 20 to 60 and above years under All India Institute of Speech and Hearing (AIISH) research funded project. This qualitative analysis scale is developed for three types of discourse genres conversation, narration and picture description. Among these three genres, the present case study considered the Narrative Discourse Analysis Scale. To obtain discourse samples of narration, a neutral topic like “Journey to a place” was given to the participant and was instructed ‘to imagine his/her past/future journey to a place and narrate the same in past or future tense’.

**Procedure**

*1. Working Memory assessment*

In *N-back task*, current stimulus should be judged whether it was matched with one that presented ‘n’ places previously in a sequence. The participant was asked to complete the task, for example, three n-back tasks: which has 3 levels of WM load (0, 1, and 2) and having the linguistic complexity of high-frequency words per load. For example in the 0-back condition, the target was considered as any stimulus that has to be matched with a pre-specified stimulus. In the 1-back condition, the target was any stimulus that has to be matched with one stimulus which was preceded immediately (i.e., one trial back). In the 2-back condition, the target might be of any stimulus and the individual has to identify the stimulus presented two trials back (Illustrated in Fig. 1). Prior to the experimental n-back tasks, in order to ensure that instructions are comprehensible to the individual, the participant had to attempt trials for 0-, 1-, and 2-back conditions initially and this would facilitate them to perform with reference to the actual instruction and not on speculation in the actual task. For every subtest, participant’s user ID was created in a .note file format. Task instructions emphasized both accuracy and speed and included both pictured examples and demonstration was given to minimize the possible effects of auditory comprehension deficits in the participant.

The N-back task was presented on a laptop using “Cognitive Module” software. Each stimulus in the N-back task was displayed for 900 ms and an inter-stimulus interval of 1600ms. This relatively rapid presentation rate was chosen to discourage attempts to covertly verbalize the linguistic stimuli (note that it was expected that participants would covertly verbalize the nameable stimuli). The participant was seated at a comfortable distance from the screen with their dominant hand resting on the keyboard and instructed to click left on the mouse whenever the target stimulus is seen.

The length of each n-back sequence was varied automatically by the software according to WM load, there was ‘n’ of trials specified and when individuals perform well in the task, level of stimulus presented was increased. For the 0-back tasks and 1-back tasks, the participant had to match with a pre-specified target when shown and for the 2-back tasks, some target stimuli were repeated. Across n-back tasks, non-target stimuli were contributing simultaneously and were distributed across the set of stimulus by the same number of times in a similar manner. For every attempt of the task, the software provided a feedback.

The N-back task was administered in a partially fixed order to reduce confusion within a set of stimulus. That is, the participant would complete all three 0-back tasks before completing the 1-back and then the 2-back tasks, respectively. For every trial, the order of tasks along with the complexity (within high-frequency stimuli) was considered as randomized and a break was given after every set of stimulus as preferred by the participant. The results were saved in the .notepad file within the software. The data of the participant were then examined manually to record the reaction times (RT) associated with correct and wrong responses so that the mean RT and accuracy of one participant representing correct responses were considered for comparison amongst the two patients.

*2. Narrative Discourse Assessment*

The narrative discourse sample of the participant was video recorded and later was transcribed using verbatim transcription. Discourse involving both the speaker (participants) and listener (investigator) was transcribed. Discourse Analysis Scale analyzed the discourse samples qualitatively using a perceptual rating scale. It consists of a set of parameters and a list of skills under each parameter. Each skill was rated separately and a final index was obtained for them. In the present case study, Discourse Analysis Scale for narrative discourse (Hema & Shyamala, 2008) was used. It measures the propositional and non-propositional aspects of narration. The propositional aspects of discourse include discourse structure, communication intent, coherence, information adequacy, information content, message accuracy, temporal and causal relationship, topic management, vocabulary specificity, linguistic fluency, speech styles, intonation, gaze efficiency and response time. The non-propositional (interactional) aspect of communication includes turn taking, revision behaviors and conversational repair/repair strategy. These parameters have been described and statements are framed to rate them. The (three-point perceptual) rating scale consisted of uniform rating of 0, 1 and 2 where '0' represented the behaviors that were poor, '1' represented behaviors that were fair (at least 50% of the time there is a positive response) and ‘2’ when the behaviours were good. The rating scale was used for scoring. Thus, total scores of the Discourse Analysis Scale (DAS) for narration could be obtained. These total scores of DAS for this task have been further divided into two sub-levels, the propositional and non-propositional total. The same DAS was administrated for Ms. A in her native language and thus, the scores were obtained for narration task.

**Analysis**

*1. Performance of Ms. A in WM task*

From Table 1, it is clear that the ability to retain more than two items (level) correctly was impaired grossly. Ms. A exhibited accurate response at a lower level and inaccurate response at a higher level with greater reaction time in both forward and backward span task. The above observations with reference to the levels and reaction time could be attributed to the phonological storage or articulatory rehearsal being impaired in an individual with aphasia. This reduced score in Ms. A suggests that reduced working memory capacity is likely to have central executive and attentional component in addition to impairments in the phonological loop.

*2. Performance of Ms. A in narrative discourse*

Ms. A obtained a score of 16 out of 42 under propositional aspects and 6 out of 10 under non-propositional aspects of narrative discourse with the discourse quotient of 42 as seen in Table 2.

**Results**

The present study is a case report of client with the diagnoses of conduction aphasia. The working memory assessment and the narrative discourse assessment are carried out for this single subject. As per the aim of this case study, an attempt is made to present a brief presentation of the patient’s history, performance on working memory and discourse task and discuss their performance in WM task in relation to their narrative discourse task using discourse analysis scale.

**Discussion**

**1. Performance on working memory task**

To explain in detail about the performance of Ms. A in WM task, Ms. A had a pronounced difficulty in performing working memory task. Ms. A was overtly rehearsing the names of items presented on the screen, which was audible to the examiner in spite of relative rapid presentation rate chosen to discourage this attempt to covertly verbalize the linguistic stimuli. Her overt rehearsal of names of visual stimuli was filled with literal paraphasias and perseveration. The consequence of this erroneous rehearsal was reflected in the selection of items in the response window as well, during which she was not able to recall or select the items in both forward and backward span task. This deficit exhibited by Ms. A can be explained with the help of Allan Baddeley’s Working Memory Model (Baddeley & Hitch, 1974) at the level of phonological storage or articulatory rehearsal.

Therefore, impairment exhibited by Ms. A could be allocated to the phonological loop. It was proposed that the phonological loop could be divided into two subcomponents, a temporary storage system, and a subvocal rehearsal. The temporary storage system is responsible for retaining memory traces for over a matter of seconds; the traces could be decayed unless rehearsed by the second component. Hence the subvocal rehearsal is very much important to retain information within the store and also they are responsible for registering visual information within the store. Ms. A exhibited marked impairment in recalling the names of visually presented items during the WM task because of literal paraphasias and repetition impairment. Since the articulatory rehearsal itself was impaired, the subvocal rehearsal system could not retain the information within the temporary storage system which caused decay of visual images in the system. Hence, the corresponding result of WM performance is also poor on forward, backward and n-back visual span task. Though this task requires the subject to retain the sequences of images for immediate recall either in forward or backward depending on the task, despite their visual presentation, subjects often subvocalize them and hence their retention had to depend crucially on their acoustic or phonological characteristics. The visual images in the task consisted of a peacock, cake, fan, glasses, octopus, palm, star, sun and the letter Y. Neither of these words is phonologically or semantically related to each other, hence we can rule out the influence of semantic or phonological similarity effect.

To support these findings, the patients with left hemisphere lesions were studied in comparison with the neuro-typical individuals. The former group performed significantly poorer on verbal memory and spatial memory tasks (Burgio & Basso, 1997; Caspari et al. 1998). Similar results which support the differences in working memory capacity between individuals with aphasia and neuro-typical individuals using tasks like forward and backward digit span, word span, the N-back task and judgement task is also reported (Mayer & Murray 2012; Wright & Shishler, 2005). In the present case study, the *first* contributing factor for the poor performance of Ms. A could be the differences in the strategies used to orally rehearse the name of the visual image and keep a count of the same in the correct sequence at subconscious level. Thus, she could not organize the responses in backward or forward order. Overall, the participant was better in terms of lesser reaction time on forward order compared to backward order. This particular result of the present case study is in support with the Lezak (1995) study on working memory. Where it is reported that patient with brain dysfunction performed better in digit forward task than digit backward task which infer that digit forward task stores information in short-term memory whereas digit backward task has highest demands on working memory where manipulation is required to identify the information.

The *second* contributing factor is the language impairment in Ms. A causing the deficit in the phonological loop and hence performed poor on the FST and BST. The past research has demonstrated that IWA exhibit deficit in the phonological loop (Heilman et al., 1976; Martin, 1987; Rothi & Hutchinson, 1981). This phonological deficit is related to the comprehension deficits (Caramazza, Basili, Koller, & Berndt, 1981; Ostrin & Schwartz, 1986; Saffran & Martin, 1975; Vallar & Baddeley, 1984). The language learning is facilitated by the working memory capacity and this working memory is reported to be affected in IWA (Baddeley, 2003; Murray, 2004). But, in the previous studies, it is unclear that poor performance by IWA is indeed because of the deficient phonological loop or rather there could be another possibility of the paradigm used to assess working memory. Hence, in the present case study an attempt was made to assess both the linguistic aspects and the working memory capacity using the visual span forward, backward task, N back task and discourse assessment to check the individuals cognitive communicative aspects. Thus, the paradigm (FST & BST) used to assess working memory capacity is very effective in assessing the cognitive aspects alone and should not be influenced by the impaired linguistic aspects of any individuals with aphasia. Hence, this could be an initial attempt used to differentiate or study the association between cognition and language in the clinical group.

**2. Performance on narrative discourse task**

On observation, Ms. A obtained a score of 1 for the sub-parameter ‘discourse structure’ of propositional aspects. The discourse of Ms. A was partially organized with respect to the overall plan and it was confusing because of the repetition errors and phonemic paraphasias. However, she had maintained the contextual theme of the narration by obtaining good scores for the parameter ‘global coherence’. However, coherence measures were not satisfactory at ‘local coherence’, where she demonstrated few information gaps, excessive repetition and more irrelevant propositions which accounted for her coherence violation. The contributing factor could be the syntactic and lexical deficits in discourse resulting in the production of paragrammatical structure which altogether resulted in impairment at the microlinguistic structures of discourse. Though the case was able to access the lexico-semantic and syntactic information, they were often substituted and distorted giving the listener an impression of incoherent utterance thus making the narrative confusing. Ms. A exhibited very good ‘communication intent’ by asking for assistance whenever required without hesitation, initiating her narration without any prompts and obtained a score of 4 in this parameter.

Other discourse parameters like ‘Information adequacy’, ‘Information content’ and ‘Message accuracy’ and ‘Temporal-causal relation’ were observed to be partially adequate. Ms. A did not exhibit empty phrases. Speech related parameters like’ vocabulary specificity’ and ‘linguistic fluency’ were greatly affected because of repetition of proposition, hesitations, literal paraphasias and stuck in type of perseveratory behavior. In addition, Ms. A seemed to have preserved self - monitoring skills, as evidenced by her overt self-corrective behavior through multiple repetitions of propositions to correct her grammatical and lexical errors. However, these adaptive strategies did not improve or correct her utterance. Ms. A obtained a better score on the parameter topic management of propositional aspect through the correct introduction of the topic, proper topic shift and change.

 Non-propositional measures were observed to be adequate as she was able to monitor errors in her discourse. These abilities reflect the reciprocal nature of the conversation and the joint co-operation required for a participant. Thus, maintaining a good relationship between the meaning and context of verbalization resulted in a better score for ‘global coherence’. Whereas the impaired microlinguistic structure resulted in poor ‘local coherence’ (obtained zero scores). The coherence violation observed could be attributed to the patient’s overt and covert attempt to use certain adaptive strategy to compensate for micro and macro-structural deficits, similar observations were reported by Christiansen (1995) on subjects with conduction, anomic and Wernicke’s aphasia.

To summarize, according to McCabe & Peterson (1991), narrative discourse involves recalling a series of events in a sequential manner. In order to narrate, an individual must possess the ability to understand and produce large chunks of text/verbal utterance well organized according to listener perception, topic and also convey meaning (Ewing-Cobbs, Brookshire, Scott, & Fletcher, 1998). Therefore, for better narration skills, there is a need for strong correlation between higher linguistic comprehension level and cognitive capacity. This knowledge facilitates memory and understanding through organizing and relating events in the utterance of a narrative discourse task. Thus, in any narrative task, in order to produce a coherent narrative, an individual speaker must plan and generate the linguistic content into an acceptable form while identifying the social rules that are built-in into the narratives. Thus, narrative discourse needs more advanced linguistic knowledge when compared to other discourse tasks. Thus to conclude, for example, any conduction aphasia case should undergo their cognitive-linguistic assessment in terms of WM assessment, discourse assessment along with a conventional language assessment.

**Conclusion**

From this case study, we conclude that the linguistic deficit exhibited by Ms. A is due to the underlying cognitive processing deficit. The cognitive process which is evidenced to be affected in this case is the phonological loop of the working memory system because of the erroneous articulatory rehearsal at microlinguistic level. Though the case was able to access the lexico-semantic and syntactic information, they were often substituted and distorted giving the listener an impression of incoherent utterance thus making the narrative confusing. The coherence violation observed could be attributed to the patient’s overt and covert attempt to use certain adaptive strategy to compensate for micro and macro-structural abilities of discourse task and the memory task.