Abstract

Discourse analyses have demonstrated utility for delineating subtle, non-aphasic communication deficits following diffuse axonal damage secondary to closed head injuries (CHI). The present investigation utilized discourse analyses for individuals with multi-focal cortical, subcortical, and white matter lesions resulting from penetrating head injuries (PHI). Story narratives were analyzed from two groups of participants, 167 survivors of PHIs and 46 non-injured individuals. Three measures distinguished the groups: narrative length, story grammar, and completeness. Results are consistent with previous findings for CHI participants, specifically that macro-structural/organizational measures best characterize discourse deficits following PHI.

Numerous studies have documented the clinical utility of discourse analyses for examining cognitive-communication impairments following traumatic brain injuries (TBI; e.g., see Biddle, McCabe, & Bliss, 1996; Coelho, 2007; Coelho, Ylvisaker, & Turkstra, 2005; for reviews). Discourse may be thought of as continuous strings of language which convey a message (Cherney, 1998). There are several genres of discourse, for example descriptive, narrative, procedural, and conversational. These studies have consistently documented that the vast majority of TBI survivors do not present with aphasia, yet demonstrate difficulty with complex language tasks such as discourse production. Although there is general agreement among these studies regarding the sensitivity of discourse analyses for detecting the often subtle communicative impairments following TBI, there is little consensus regarding discourse elicitation or analysis procedures. Consequently it has been difficult to compare findings across studies.

Ylvisaker, Szekeres, and Feeney (2008) have suggested that discourse proficiency involves an interaction of cognitive and linguistic organizational processes. Story narratives have been the focus of a number of recent studies because they provide the opportunity for the analysis of multiple sources of information related to cognitive and linguistic levels of narrative organization. One level, macro-organization, relates to story grammar. At this level information is organized in terms of how intentions and events logically relate in time through cause-effect relations (Liles, Duffy, Merritt, & Purcell., 1995). Because the interpretation of content is facilitated by the speaker or listener's access to general cognitive schemata, this level of narrative organization is hypothesized to go beyond the content of a specific text (Mandler, 1982; Rumelhart, 1975). A second

level, micro-organization, involves linguistic organization of the text both within and across sentences. At this level the information is processed locally (Liles et al.).

In one of the largest studies to date (Coelho, 2002), story narratives were elicited from two groups of participants, 55 with closed head injury (CHI) and non-aphasic and 47 non-brain-injured (NBI). Performance on analyses of sentence production, cohesive adequacy and story grammar were compared across two tasks, story generation and story retelling. Results indicated that two measures distinguished the groups. The CHI group produced significantly fewer 1) words per T-unit and 2) T-units within episode structure than the NBI group. In addition all participants produced longer more grammatically complex T-units in the story generation task than in story retelling. Overall, the participants with CHI demonstrated relatively intact micro-organization both within and across sentences but demonstrated particular difficulty with story grammar or macro-organization of story narratives.

The present study employed analyses of story narratives to characterize the cognitive-communication deficits of a large group of survivors of penetrating head wounds. Unlike the CHI group from Coelho (2002), which consisted primarily of individuals with diffuse axonal injury, the participants with PHI all had combinations of multi-focal cortical, sub-cortical and white matter lesions.   Therefore it was unclear whether they would present with the same general pattern of discourse deficits in a story retelling task.   The following questions were addressed:

1. Is the discourse performance of the participants with PHI comparable to that of a non-injured comparison group?

2. Is the discourse performance of the PHI group comparable to that reported in the literature for individuals with CHI?

Methods

Participants

Participants were drawn from Phase III of the Vietnam Head Injury Study and underwent five days of neuropsychological testing and CT scans at the National Naval Medical Center in Bethesda, Maryland. Discourse samples were elicited during this time. All were native English speaker.

PHI group. All 167 participants survived severe head wounds, primarily from shrapnel, during the Vietnam War. They were 52-70 years of age, with 8-22 years of education (see Table 1). Scores ranged from 1-99 on the Armed Forces Qualification Test (AFQT) , 25-60 on the Boston Naming Test (BNT) , and 87-100 on the Token Test (TT). None were considered to have a frank aphasia.

Comparison group. Forty-six male Vietnam veterans with no history of neurological disease or injury served as the comparison group. , They were 55-76 years of age, with 12-20 years of education (see Table 1). Scores ranged from 14-85 on the AFQT , 46-60 on the BNT , and 94-100 on the TT.

Independent samples t-tests, using a Bonferroni-adjusted alpha level of .01 to account for multiple comparisons, indicated no significant differences between groups on any of the demographic characteristics.

Discourse Analysis Procedures

Task. Participants were shown a picture story on a computer screen with no sound track. Upon completion of the story participants were instructed to "tell me that story you just watched". Each story retelling was digitally video-recorded. Recordings were transcribed verbatim, segmented into T-units and analyzed at multiple levels.

Sentence production. A T-unit is defined as an independent clause plus any attached subordinate clauses. The primary measure of sentence production was the number of subordinate clauses per T-unit and referred to as grammatical complexity.

Cohesive adequacy. Cohesion pertains to how meaning is linked across utterances. In the analysis of cohesion, cohesive ties are judged to be complete or incomplete. Cohesive adequacy was the percent complete ties of total ties.

Coherence. Coherence ratings reveal how well an individual maintains and conveys the overall theme of a narrative. Each T-unit is rated for local (how an utterance links back to previous utterance) and global (how an utterance links to the overall theme of story) coherence (Van Leer & Turkstra, 1999).

Story grammar. Story grammar pertains to temporal and logical relationships between people and events in a story. The story grammar measure used is the proportion of T-units within episode structure. An episode consists of three components, an initiating event, an attempt or action, and a direct consequence marking attainment or failure to reach a goal. The proportion measure reflects how much of the story is organized in an episodic framework..

Story completeness. Each narrative is surveyed for the presence of five critical components, derived from the stories of the comparison group. The completeness score is the total number of components present in the story.

Data Analysis

A MANOVA was performed with seven discourse measures as the dependent variables and group as the independent variable (see Table 2). Individual ANOVAs were then examined to determine which measures differentiated the groups.

Results/Discussion

1. Pillai's trace indicated a significant effect of group on the discourse measures, $V = .085$, $F(7, 204) = 2.72$, $p = .01$. The ANOVAs indicated that three discourse measures distinguished the participant groups: number of T-units (story length or productivity), proportion of T-units within episode structure structure (story grammar), and completeness (number of critical story components). In all

instances, the comparison group had higher mean scores for these measures than the PHI group (see Table 2).

2. Results are consistent with previous findings for CHI , specifically that macro-structural/organizational measures best characterize discourse deficits following PHI .

3. The PHI participants were all 30-35 years post injury and continued to demonstrate measurable cognitive-communication impairments. None received intervention focused on their discourse deficits. Findings are in agreement with those of previous studies, documented the chronicity of discourse impairments in children (Brookshire, Chapman, Song, & Levin, 2000; Chapman, McKinnon, Levin et al., 2001).

4. Research needs include development of a clinician-friendly tool for sampling discourse and discourse treatment studies.

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Table 1

Demographic Data for Matched Groups

	Comparison			PHI				
Measure	*M*	*SD*	Range	*M*	*SD*	Range	*df*	*p*
Age (Years)	59.07	3.52	55-76	58.11	2.63	52-70	211	.04
Education (Years)	15.09	2.39	12-20	14.91	2.44	8-22	200	.65
AFQT	67.17	22.17	14-85	60.51	25.21	1-99	185	.19
BNT	55.67	3.70	46-60	54.31	5.69	25-60	210	.13
Token Test	98.74	1.57	94-100	98.30	2.43	87-100	206	.25

Table 2.

Means and Standard Deviations of Discourse Measures for Group Comparisons.

Measure	Comparison		PHI			
	M	*SD*	*M*	*SD*	*p*	*Cohen's d*
Number T-units	26.20	15.30	21.00	14.52	.03	.35
Subordinate clauses/T-unit	.24	.16	.24	.20	.99	
Cohesive adequacy	.68	.17	.66	.16	.35	
Local coherence	4.40	.61	4.40	.86	.98	
Global coherence	4.70	.46	4.50	.64	.07	
Proportion T-units in episodes	.70	.21	.61	.24	.03	.40
Completeness	4.41	1.10	3.63	1.52	.001	.60