

NARRATIVE SKILLS IN CHILDREN WITH SPINA BIFIDA AND
HYDROCEPHALUS

by

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ABSTRACT

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This study examined how 22 children with spina bifida and hydrocephalus (SBH) and 22 matched control children with the same vocabulary age (VA) performed on story retelling and story generation tasks. The children were asked to retell two stories of different lengths (Stein and Glenn's *Melvin, the Skinny Mouse* and *The Tiger's Whisker*) and generate two stories from different stimuli (wordless picture book and verbal story starter). Analyses were conducted in terms of global narrative organization (story structure), local connection of ideas (cohesion), and productivity (number of words and utterances). Two-way ANOVAs were conducted to analyze how the stories and story tasks (retell versus generation) influenced the two groups' narrative performance. When comparisons were made between the two groups' performances on the individual stories, the children with SBH generally produced shorter and less complex stories than their VA peers. Story-by-group interaction effects showed that the children with SBH produced fewer story grammar elements than their VA peers on the retell stories but not on the generated ones.

When comparisons were made between the two groups' performances on the type of task (story retell versus generation), results showed that for story retelling, the children with SBH produced stories that contained fewer words and utterances than their VA peers, significantly fewer story grammar components, and more correct cohesive ties. For the story generation task, the children with SBH produced significantly fewer reactions and total story grammar components. Story-by-group interaction effects showed that the children with SBH produced fewer reactions and total different words than the VA group on the story retell task but not the generation task.

The results suggest that children with SBH function differently from their vocabulary age peers in some dimensions of narrative production. When the children with SBH encountered the retelling tasks or the more structured generation story, they tended to produce stories that were shorter than those of their VA peers.

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Introduction

Children who are born with *spina bifida*—the failure of the spinal column to fuse—most often lose motor control at or below the level of the spinal lesion. This physical defect causes a malformation of the spinal cord and a consequent disruption in the flow of cerebral spinal fluid (CSF). This disruption often causes hydrocephalus and subsequent enlarged ventricles in the brain and a malformation of the brainstem, known as the Arnold Chiari malformation.

Although the hydrocephalus is arrested soon after birth, affected children often continue to have enlarged ventricles in the brain and subsequent neurological deficits, which commonly manifest themselves in the areas of cognition and language. Particularly, children with spina bifida and hydrocephalus show cognitive deficits in attention and in organization or executive control functions. In the area of language, children with spina bifida and hydrocephalus have been found to produce discourse that is considered to be less complex, more ambiguous, and more implausible than those of their peers. The language deficits appear to be in higher text-level narrative skills of story structure and cohesion rather than lower text-level skills of sentence length and vocabulary. The purpose of this study was to determine if children with spina bifida and hydrocephalus exhibit deficits in narrative production when compared to children of similar vocabulary age without spina bifida and hydrocephalus.

Literature Review

Children born with spina bifida and hydrocephalus present many complex medical and educational challenges. To understand the array of issues and the complexity of the problems caused by this birth defect, this literature review will describe the physical as well as the cognitive and linguistic nature of spina bifida.

The Nature of Spina Bifida

Definition

Spina bifida, classified as one of the most commonly occurring birth defects, is a disorder resulting from the neural tube in the spinal cord not closing during the fourth week of gestation. As a result, the vertebrae of the spinal column fail to fuse together and the spine remains in two separate parts (Anderson & Spain, 1977). While the separated spine can occur anywhere along the length of the spinal cord, it is most likely to occur along the lower thoracic, lumbar, and sacral regions (Murdoch, Ozanne, & Smyth, 1990). In the United States, spina bifida occurs at a rate of 0.41 to 1.43 per 1000 births (Elwood, Little, & Elwood, 1992), with females being affected more than males (Anderson & Spain, 1977).

Types of Spina Bifida

There are three main types or levels of severity of spina bifida. Two of the three types of spina bifida will only be described briefly, as they are not considered to be very serious and do not result in hydrocephalus. The third type of spina bifida, spina bifida myelomeningocele, is considered to be severe and often results in hydrocephalus. This type is the focus of our study.

Spina bifida occulta and spina bifida meningocele. These two types of spina bifida occur when the spine does not close completely, but the spinal cord does not push

through the open spine. Rather, the spinal cord remains in its normal undamaged position (Murdoch, Ozanne, & Smyth, 1990). The third type of spina bifida occurs more often than any other type and is considered to be the most severe (Charney, 1992).

Spina bifida myelomeningocele. *Myelomeningocele* is “an open spinal cord defect, protruding dorsally, not skin covered, and usually associated with spinal nerve paralysis” (Shurtleff & Lemire, 1995, p. 183). Because the vertebrae fail to fuse together, the spinal cord and meninges push between the vertebrae, forming a sac outside of the vertebrae while the nerves of the spinal cord are damaged anywhere above, at, or below the sac (Landry, Jordan, & Fletcher, 1994).

Myelomeningocele often causes a wide array of complications and abnormalities of the central nervous system. One of the most common abnormalities is the *Arnold-Chiari II malformation* found at the base of the brain. The Arnold-Chiari II malformation is defined as “a herniation or protrusion of the lower brain downwards through the foramen magnum and a general disarrangement of the lower brain structures” (Anderson & Spain, 1977, p. 220). The lower brain structures that are involved include the medulla oblongata, cerebellum, choroid plexus, and fourth ventricle. Because the lower brain protrudes through the foramen magnum, the circulation of cerebral spinal fluid (CSF) is blocked at the opening of the fourth ventricle causing an accumulation of fluid in the ventricular system of the brain which leads to the development of hydrocephalus (Murdoch, Ozanne, & Smyth, 1990). Approximately four out of five babies born with myelomeningocele develop hydrocephalus (Anderson & Spain, 1977). Often a shunt is inserted into the lateral ventricle to drain the excess CSF into another body space, usually the heart or the peritoneal cavity in the abdomen. This relieves the pressure on the brain

which can increase brain function and prevent further damage to the brain (Del Bigio, 1993). Despite the insertion of a shunt, children with hydrocephalus often continue to have enlarged ventricles in the brain, which can cause pressure and damage to the brain. Though the hydrocephalus may be arrested when the shunt is inserted, the ventricles in the brain may remain enlarged and continue to intrude on the processes of the brain, causing continual damage. Some of the damage may be manifest as physical deformities.

Concomitant Deficits

Physical

The damage that is caused to the spinal cord as a result of myelomeningocele often causes a wide variety of physical handicaps. The range and severity of the physical handicaps is directly related to the location of the lesion on the spinal cord. Most children with myelomeningocele and hydrocephalus have paralysis of the body and limbs usually occurring at or below the level of the lesion. They need assistance with ambulation and are at risk for an increased rate of fractures of the lower limbs and skeletal deformations of varying severity, including scoliosis and kyphosis, abnormalities of the rib cage, dislocation of one or both hips, or other fixed limb deformities of the ankles or knees (Anderson & Spain, 1977; Del Bigio, 1993). These children are also unlikely to independently have control of their bladder and bowels. In fact, fewer than 10% of children with myelomeningocele have the ability to control their bladder and bowels. This incontinence is due to damage to the nerves controlling the sphincter at the neck of the bladder (Yeates, Enrile, & Loss, 1998; Coffey & Brumback, 1998). Skin lesions are also common due to the sensory loss below the lesion. Oculomotor and other visual difficulties are another common physical impairment that occurs in children with myelomeningocele. In addition, children with myelomeningocele have difficulty with

both visual acuity and motility. As with other physical impairments of this disorder, the degree of abnormality and damage to the central nervous system affects the severity of the visual disorder. Though physical manifestations are more readily recognized, cognitive deficits become increasingly apparent as children grow older.

Cognitive

The damage to the brain that occurs as a result of spina bifida and hydrocephalus often has far-reaching cognitive effects. Children with spina bifida and hydrocephalus have a wide array of intellectual and language deficits. As a group, they often exhibit many similar characteristics, though at varying levels of severity. Many children with spina bifida and hydrocephalus have cognitive difficulties in the areas of memory and retrieval, attention, and overall decreased general intellectual functioning. Soare and Raimondi (1977) found the following:

The presence of hydrocephalus in a child with myelomeningocele decreases his chances for normal intelligence. Though surgical treatment of the hydrocephalus increases the chances for normal intelligence, myelomeningocele children with hydrocephalus, as a group, are still significantly less intelligent than their normal siblings and also less intelligent than myelomeningocele children without hydrocephalus. (p. 202)

In addition, Tew and Laurence (1975) as well as Shaffer, Friedrich, Shurtleff, and Wolf (1985) found that children with myelomeningocele who did not have any other confounding disabilities or disorders had lowered cognitive abilities and academic achievement than their normal peers. Affected children also had difficulty keeping up with their peers as they grow older. Tew and Laurence (1983) discovered that children with spina bifida had unchanged IQ scores between the ages of five and 10; between the

ages of 10 and 16, their IQ scores dropped between four and six IQ points. Dennis, Hendrick, Hoffman, and Humphreys (1987) found that while children with hydrocephalus did make improvements in their academic performance, they did so at a lesser rate than their peers and with increasing age, they were less able to perform at age level.

Performance versus verbal IQ. In addition to the overall decreased intellectual functioning of children with spina bifida and hydrocephalus, these children often exhibit a large discrepancy between their performance IQ and their verbal IQ. As a group, children with hydrocephalus have a significantly lower performance on nonverbal IQ than their verbal IQ (Fletcher et al., 1992; Shaffer, Friedrich, Shurtleff, & Wolf, 1985; Wills, Holmbeck, & McLone, 1990; Yeates, Loss, Colvin, & Enrile, 2003; Zeiner, Prigatano, Pollay, Biscoe, & Smith, 1985). Because of this discrepancy, they often have seemingly normal IQs because of their ability to be “chatty” in a conversation but they lack the ability to fully comprehend what is being said in the conversation. Part of the problem with this kind of comprehension may be related to deficits in remembering past conversations with and prior exposure to the conversational subjects.

Memory. Children with spina bifida and hydrocephalus exhibit deficits in the area of memory. Specifically, the memory of these children is affected in the area of rote recall. Cull and Wyke (1984) found that when children without handicap were compared to children with spina bifida and hydrocephalus in a task of learning, storing, and retrieving information, children with spina bifida and hydrocephalus showed deficits, specifically in the area of recalling lists of unrelated words. In addition, children with spina bifida and hydrocephalus were found to have a slower memory recall than their normal peers.

Yeates, Enrile, Loss, Blumenstein, & Delis (1995) found the following:

Children with myelomeningocele recalled as many words as controls on the first learning trial, but learned words more slowly across trials, so that their overall recall was lower. They demonstrated more pronounced regency effects on learning trials, although they did not differ in recall consistency, semantic or serial clustering, or in recall errors. They did not display more interference after presentation of a second word list, but their delayed recall of the original list was worse than controls, both absolutely and compared to initial learning. (p. 810)

Children with myelomeningocele do display some strength in the area of memory, however. Some have been found capable of learning and retaining relevant verbal and nonverbal information, such as recalling a short story after a brief delay (Cull & Wyke, 1984). In addition, they demonstrate recognition abilities that could not be differentiated from their controls. These data findings suggest that children with myelomeningocele encode and store the words adequately, but that they have difficulty retrieving them spontaneously (Yeates et al., 1995). This ability to retrieve may be due to the reduced attention and distractibility these children frequently exhibit.

Attention and distractibility. Compromised attention and distractibility is another common characteristic of children with spina bifida and hydrocephalus. Multiple studies suggest that children with spina bifida and hydrocephalus have significantly shortened attention spans and are more distractible than control children. Tew and Laurence (1979) found in their study that children with hydrocephalus had a mean attention span of nine minutes, while their normal controls had a mean attention span of 18 minutes. Loss, Yeates, and Enrile (1998) showed in their study that children with myelomeningocele

performed at a lower attention level than their siblings in the areas of encoding, sustaining, focus/execution, and shifting attention from one topic to the next.

Clinicians who have experience working with children with spina bifida and hydrocephalus often say that these childrens' behavior during testing and social interactions is frequently inappropriate, over-familiar, impulsive, and distractible (Vachha & Adams, 2002; Wills, 1993). Parents and teachers of children with hydrocephalus typically report similar behavior problems, including difficulties focusing and sustaining attention, for which the child often receives stimulant medications (Brewer, Fletcher, Hiscock, & Davidson, 2001).

Perception. The ability to focus on relevant while ignoring irrelevant stimuli is another area of deficit. Culatta (1980) found that children with spina bifida and hydrocephalus had difficulty focusing and ignoring irrelevant stimuli. They were also very distractible and constantly needed to be redirected to focus on the activity presented. In addition, they showed difficulties separating irrelevant stimuli from relevant stimuli (Culatta & Young, 1992; Miller & Sethi, 1971). Children with spina bifida and hydrocephalus try to focus on all of the stimuli presented at a given time, whether it is relevant or irrelevant; they are unable to focus exclusively on the relevant stimuli.

The inability of children with spina bifida and hydrocephalus to separate irrelevant from relevant stimuli may be due to difficulties in problem-solving and vocabulary comprehension. Horn, Lorch, Lorch Jr., and Culatta (1985) found that children with spina bifida and hydrocephalus showed decreased comprehension of vocabulary compared to normal children when irrelevant information and background were presented simultaneously. This study suggests that if irrelevant stimuli could be reduced in these childrens' environments, their performance would likely increase substantially

(Horn et al., 1985). In addition, decreased problem-solving of children with hydrocephalus may have been a product of difficulty in sustaining attention (Fletcher et al., 1996). Poor attention and distractibility appear to be major components in the compromised language functioning of children with spina bifida and hydrocephalus.

Linguistic

Language contains different elements, including lower sentence levels and higher discourse levels. The lower sentence level deals with comprehension and production of words and sentences, while higher discourse levels deal with understanding narratives and participating in topically-related conversations (i.e. connecting ideas across sentences). Children with spina bifida and hydrocephalus have difficulty with both the discourse and narrative levels of language. Not only do these children have problems producing comprehensible sentences, but they also have difficulties producing discourse and narratives that are complete and complex. While these deficits are often evident when listening to the speech and conversations of children with spina bifida and hydrocephalus, these children do demonstrate the ability to use correct prosody and articulation.

Prosody and articulation. The prosody and articulation of children with spina bifida and hydrocephalus remain unaffected. Dennis, Jacennic, and Barnes (1994) and Brookshire and colleagues (1995) found the speech of children with spina bifida and hydrocephalus to be fluent and articulated, but also reported that it contained perseveration of responses, excessive use of social phrases, inappropriate familiarity, unspecified referents, and inappropriate substance and content (Brookshire et al., 1995; Dennis, Jacennik, & Barnes, 1994). This unusual manner of speech of children with spina bifida and hydrocephalus is referred to as hyperverbal speech.

Hyperverbal speech. The speech of children with spina bifida and hydrocephalus often has many distinctive characteristics that set these children apart from their peers. Characteristically, their speech is often considered to be hyperverbal. Hyperverbal speech has also been called “cocktail party speech” because it sounds smooth and chatty, but is superficial in content (Hagberg, 1962; Hagberg & Sjorgen, 1966; Ingram & Naughton, 1962; Schwartz, 1974). In addition, Schwartz (1974) defined cocktail party speech in the following manner:

Characteristic inflectional contours and stress patterns often resemble mature adult speech. Resonance patterns are characteristic as well, although examination of oral peripheral mechanisms indicates no contributing structural deficiencies. The children’s spontaneous utterances are often out of context. The child uses automatic phrases and clichés; at times, he even quotes directly from television commercials or slang he has heard adults use. He uses words from other contexts that almost, but do not quite, fit his conversation. Utterances are often in the form of verbal commands or inappropriate questions. This manner of delivery, especially when accompanied by stereotyped inflections, results in a “chatter” which appears to be imprudent and impertinent at its worst, or “cute” at its best. Yet the children’s articulation is mature and precise. Even difficult polysyllabic words are well articulated. (p. 466)

Additionally, children with spina bifida and hydrocephalus often like to use large inappropriate words out of context. Tew and Laurence (1979) said “they revel in the opportunity to use large words in conversation and display their memorizing ability” (p. 361). Fleming (1968) and Horn, Lorch, Lorch, and Culatta (1985) found that children characterized as having cocktail party speech had a high percentage of inappropriate

remarks and spoke out of context and without appropriate referents as compared to control children. Swisher and Pinsker (1971) also found that their speech was more inappropriate and bizarre than the speech of the controls. Lastly, children with hydrocephalus used many more words and initiated more speeches than the control group (Swisher & Pinsker, 1971). This unusual way that children with spina bifida and hydrocephalus speak is often associated with their inability to fully understand what they are both hearing and saying.

Comprehension. For these children, their own comprehension of what they are saying is often low. Spain (1974) found that children who display hypervocal speech are often children with lower than average verbal comprehension and content test scores. Additionally, Tew (1979) found that the children with cocktail party speech had an expressive vocabulary score more than one-half of a year below their language comprehension scores, with some of the children more than two and one-half years below. Recent research suggests that the level of comprehension or the severity of the deficits that children with spina bifida and hydrocephalus display varies depending on the language demands found within various social and academic settings (Vachha, 2003; Vachha & Adams, 2002; Vachha & Adams, 2003a; Vachha & Adams, 2003b; Vachha & Adams, 2003c). Narrative discourse is one such language demand that is difficult for children with spina bifida and hydrocephalus.

Narrative discourse. Although children with spina bifida and hydrocephalus display adequate use of vocabulary (Culatta, 1980), they demonstrate many deficits in narrative discourse. Children with spina bifida and hydrocephalus use language that lacks content (Barnes & Dennis, 1996). They have difficulties assessing information from the discourse content as well as from previous experience (Barnes & Dennis, 1998). In

addition, they also have difficulty staying on topic and contributing to a narrative discourse in a meaningful manner (Fleming, 1968). While their utterance lengths are longer than those of their peers, they lack important semantic content. These children also have difficulties with inferring or understanding ambiguous sentences and figurative language (Dennis & Barnes, 1993; Landry, Jordan, & Fletcher, 1994). Culatta and Young (1992) found similar findings in that children with spina bifida and hydrocephalus have a high frequency of irrelevant utterances and have difficulty with abstract language. Not only do children with spina bifida and hydrocephalus have trouble understanding and using narrative discourse, they also experience difficulties at the basic sentence level. Dennis, Jacennik, and Barnes (1994) found that the sentences within the stories that children with hydrocephalus produced were less productive in terms of number of clauses, had reduced syntactic complexity, were more verbose and less concise, and contained fewer mental verbs during a story narration. In addition, their sentence structures also lacked completeness and meaningfulness (Dennis et al., 1987). These narrative deficits of children with spina bifida and hydrocephalus are the focus of this study.

Purpose of the Study

Since it has been found that children with spina bifida and hydrocephalus demonstrate reduced semantic content in their ability to narrate a story and that their sentence structure is less complex, the purpose of this study was to compare how children with spina bifida and hydrocephalus perform on various narrative tasks versus children without spina bifida and hydrocephalus. Further, the purpose of this study was to compare children with spina bifida and hydrocephalus to children without spina bifida and hydrocephalus on narrative story retelling and story generation skills.

It was hypothesized that children with spina bifida and hydrocephalus will produce stories with fewer informational and story grammar components and more limited internal cohesion than their peers of similar vocabulary age. Because of the suspected higher level language deficits, it is also hypothesized that children with spina bifida and hydrocephalus will perform more poorly than vocabulary age controls in production of story grammar components. It is hypothesized that because of the suspected higher level deficits, children with spina bifida and hydrocephalus will exhibit a more limited understanding of the story grammar components and of cohesive devices which serve to tie the elements together.

Method

Subjects

Twenty-two children with spina bifida and hydrocephalus (SBH), chronological ages between 5 years 6 months and 13 years 9 months, (*M*, 8 years 2 months; *SD*, 4 years 11 months) and twenty-two vocabulary language-aged matched control children, chronological ages between 5 years 9 months and 13 years 4 months, (*M*, 8 years 2 months; *SD* 3 years 4 months) participated in the study. The children with SBH and the control children were matched within four months on receptive vocabulary recognition, as measured by the *Peabody Picture Vocabulary Test-Revised* (PPVT-R); Dunn & Dunn, 1981. Since children with SBH have been found to have vocabularies comparable to their peers (Parsons, 1968), matching on vocabulary, a smaller or lower-level language skill than telling a story, will permit assessment of differential linguistic performance on text or discourse level narrative skills. The children with SBH had standard scores on the PPVT-R that ranged between 77 and 123, which was within one and one-half standard deviations of the mean. The vocabulary age matched control children had standard scores on the PPVT-R that ranged between 77 and 121, which was also within one and one-half standard deviations of the mean.

Children with scaled scores below 77 SD on the PPVT-R were excluded from the study in order to eliminate children with significant developmental delays or mental retardation.

The children with SBH were drawn from regular public school settings, the Rehabilitation Institute of Pittsburgh, and the Massachusetts Hospital School. These children had arrested hydrocephalus and had shunts inserted soon after birth. All of the children with SBH had some degree of paralysis, with sites of lesions ranging from S1 to

T10 on the spinal column. Permission to participate in the study was solicited from parents of all eligible children with SBH; all children whose parents provided consent were included in the study.

The vocabulary age matched control children were drawn from local school districts in Rhode Island. The children who were selected were those who demonstrated average test scores in the classroom. They were selected to be a specific match to a child with SBH by entering all available subjects into a computer program designed to assign matches by finding the best fit. The program took all children with spina bifida and hydrocephalus and all available children without spina bifida and hydrocephalus and found the best matches, based on similar receptive vocabulary scores on the PPVT-R.

Stimuli

Four tasks were used to collect narrative samples, two story retelling tasks and two story generation tasks. The retelling tasks will be discussed first followed by the generation tasks.

Story Retelling Tasks

The two stories used for retelling were entitled *Melvin, the Skinny Mouse* and *The Tiger's Whisker*, both taken from Stein and Glenn (1979). Appendix A contains the two stories used as measures of retelling, with story grammar elements indicated. The two stories differed in number of *story grammar components* and in length. Story grammar components are structural elements within a story or narrative that describe prototypical structural elements that reflect the different parts of the plot or organization of a story. The shorter of the two stories, *Melvin, the Skinny Mouse*, contained 14 events, with two per story structure grammar components (setting, initiating event, internal response, internal plan, attempt, direct consequence, and reaction). *The Tiger's Whisker* contained

26 events, with at least two per story grammar components.

For both *Melvin, the Skinny Mouse* and *The Tiger's Whisker*, subjects were told that they were to listen to a story and then to tell as much as they could about what they remembered about the story. If the subject had difficulty getting started, the examiner asked the subject, "What was the name of the [character]?" or "Who was the story about?" The examiner then followed that question with a second question, "What can you tell me about him?" If during the testing the subject needed prompting to continue the story, the examiner would pause and use general prompts such as, "Tell me more.", "What was happening?", "Can you tell me anything else?", and "What else happened?". If this did not prompt the subject to continue the story or if the subject seemed to pause in the middle of the story, the examiner asked a specific question about the story to activate the subject's memory and encourage him or her to get back to the task of telling the story (e.g. "How did the character feel?"). This practice was used to see if the specific question would stimulate the retelling of the story. All responses to this specific question were excluded from the analysis in terms of story grammar, number of words, and number of utterances. If the child continued on, the examiner would continue to listen to the story telling until the child was finished telling the story.

Story Generation Tasks

The two story generation tasks differed in complexity as well. The simpler or structured story generation task was a request to tell a story about a wordless picture book taken from Mercer Mayer's book entitled *Frog on His Own* (Mayer, 1973). This task is simpler than the second story generation task because the pictures from the story help guide the telling. Appendix B contains the text describing the pictures used from the story. In this task, subjects were shown a five picture sequence taken from the book.

The five picture sequence represented a story about a boy taking both his dog and frog to the park and how the frog runs off and has a series of adventures before the boy finds the frog again. Subjects were then asked to tell a story about the sequence. The retelling of adults (Ripich & Griffith, 1986) constituted the event prototype used to assist in scoring the retellings.

The other generation task was a request to tell a story from a story starter. The story starter task gave the subjects the chance to make up a story about children being home alone with a dog. The subjects were given figurines of a boy, a girl, and a dog and were told that the Mom and Dad were going out for dinner while the boy and the girl had to stay home to take care of the dog. Like the story retelling tasks, the examiner asked the same general and specific questions if the subject needed help getting started or continuing the task.

Procedures

Each child was seen in an individual session of approximately 30 minutes. The PPVT-R was presented first and then the four narrative tasks were presented in rotating or balanced order to control for order effect. The tasks were counterbalanced by determining all order possibilities and assigning each subject to the next possible order. All stories were audio recorded and transcribed in full from the audiotapes.

Reliability was obtained for both the transcriptions and the coding. For the transcriptions, a graduate student listened to the tapes while looking at the written transcription that was previously written by the examiner to ensure that what was written was exactly what was said on the tape.

For the coding, two graduate students in the speech-language pathology graduate program independently coded, scored, and rated ten randomly selected subjects'

narratives. Reliability was obtained for each of the following variables: number of story grammar components (setting, initiating event, etc.), presence of complete and incomplete cohesive devices (correct and incorrect uses of pronouns and conjunctions), and productivity measures (number of words, different words, *T-Units* and Type Token Ratio or TTR). Reliability agreements were 93% for story grammar components, 97% for cohesive devices, and 95% for productivity measures. A T-Unit is defined as one main clause and all subordinate clausal and nonclausal elements attached to or embedded in it. T-Units are “the shortest grammatically complete sentences that a passage can be cut into without creating fragments” (Hunt, 1965, p. 93).

Data Analysis

All stories were transcribed with utterances separated into T-Units. Transcripts of the story retelling tasks and story generation tasks were analyzed for global narrative organization (number of different story grammar components, complete and incomplete episodes, and story type), connections of ideas across sentences (cohesion or correct and incorrect use of pronouns and conjunctions), and productivity (number of T-Units, number of words and different words). Responses to all general question prompts were bracketed. Ellipsis responses, or those responses that are not considered to be a complete utterance, were not included as part of the analysis and neither were the responses to specific questions asked during the session.

Story organization and complexity was analyzed using the story grammar analysis developed by Stein and Glenn (1979). This analysis is based on the notion that narratives revolve around the same basic structural content—the characters, their goals, and their attempts to achieve their goals. Components of the narrative, referred to as story grammar elements, are organized into the setting, initiating event, internal response, plan,

attempt, consequence, and reaction. The frequency with which these components appeared in the story generation and story retelling stories and tasks was recorded for each subject. A complete episode consisted of at least three story grammar components— initiating event, action or attempt, and consequence. If one of these three components was missing, it was considered to be an incomplete episode. The number of both complete and incomplete episodes was recorded for each subject for each of the four stories.

Cohesion was measured using the cohesion analysis system devised by Halliday and Hasan (1976) and the cohesion disruptions used by Ripich, Terrell, and Spinelli (1983). Cohesion is defined as the degree to which different parts of a narrative (words, sentences, paragraphs, etc.) are connected to one another. The cohesion analysis system depends on a cohesive tie, which is a device to link sentences. There are five different types of cohesion ties, but only two of the five were used in this study—*conjunctive* and *referential* ties. The numbers of appropriate conjunctive and referential ties were determined for each story production. Conjunctive ties connect the narrative elements using conjunction words such as *and* and *but*. Referential ties use pronouns to refer to previously stated nouns. In addition, any disruptions in cohesion, as defined by Ripich and colleagues (1983), were used to measure cohesive errors.

Productivity was measured by counting the number of T-Units and number of words in each narrative for each subject. Total number of different words was also counted.

In addition to looking at narrative performance, the children's story productions were also analyzed for words used (vocabulary diversity), sentence structure complexity, and number of utterances (length). Vocabulary diversity was measured by counting the

total number of different words in each narrative for each subject. Sentence structure complexity was measured by counting the mean words per T-Unit. T-Units without fragments (complete T-Units) and total number of fragments was also counted. These variables were included to contrast discourse or narrative performance with word and sentence construction, those aspects of language production that occur at the sentence rather than discourse level. These variables were the T-Unit analysis and Type Token Ratio (TTR). The T-Unit analysis was selected to measure sentence complexity and the TTR was selected to measure vocabulary diversity.

Although children with SBH have previously been found to have comparable sentence level abilities (TTR and mean length of utterance or MLU; Byrne, Abbeduto, & Brooks, 1990), it was felt that the T-Unit of analysis may reveal differences that have not been detected using MLU as the analysis measure. While children with spina bifida and hydrocephalus did not differ significantly from their similarly matched chronological age peers with similar IQ scores in terms of their MLU in one study (Byrne, Abbeduto, & Brooks, 1990), it is hypothesized that these children's use of meaningful language will be less than their vocabulary age peers. The T-Unit was used because it is believed to be a better measure of complexity for children over five years of age as it is less influenced by the length of conjoined sentences. If sentence level skills are comparable, they can be used to contrast performance at the discourse level.

Results

As a multi-group comparison design, analyses were conducted to compare performance of the two groups—children with spina bifida and hydrocephalus (SBH) and their matched vocabulary age (VA) peers—on narrative production. Analyses were conducted to determine the presence of story and group main effects and story-by-group interactions for all dependent variables. In addition, a main independent variable titled *type of task* was created by combining the two retelling tasks to form a retell condition and the two generation tasks to form a generation condition. The dependent variables reflected various aspects of narrative performance: global narrative organization (episodes and story grammar components), local connection of ideas (correct and incorrect use of cohesive ties), and word and sentence productivity (number and length of T-Units, total number of words, and total number of different words). Results are reported in terms of these performance requirements and different task demands with analyses conducted both on individual stories and task types.

Global Narrative Organization

Individual Story Tasks

A series of repeated measures 2 (group) x 4 (story) ANOVAs were performed on each of the story grammar components entered singly as dependent variables (setting, initiating event, internal plan, attempt, consequence, and reaction). Means and standard deviations for story grammar components for the four stories are summarized on Table 1.

Some significant group differences were obtained for a number of the story grammar components produced in the four stories. In the *Melvin, the Skinny Mouse* story, the children with SBH produced significantly fewer initiating event components,

Table 1

Means and Standard Deviations for Story Grammar Components by Story

Story		Melvin		Tiger		Frog		<i>Family</i>	
Subjects		SBH	VA	SBH	VA	SBH	VA	SBH	VA
Setting	<i>M</i>	0.90	1.25	0.65	0.95	2.50	2.40	2.15	3.45
	<i>SD</i>	0.64	0.78	0.48	0.51	1.35	0.94	1.72	4.32
Initiating Event	<i>M</i>	0.50***	1.35	0.45	0.50	1.00	0.75	1.65*	2.80
	<i>SD</i>	0.51	0.98	0.51	0.51	1.12	0.85	1.13	1.82
Internal Plan	<i>M</i>	0.95	1.25	2.00	3.15	0.15	0.20	0.40	2.20
	<i>SD</i>	0.99	1.25	1.60	2.20	0.36	0.69	0.75	4.18
Attempt	<i>M</i>	0.65	1.05	1.70*	2.75	0.60	0.70	2.40	2.45
	<i>SD</i>	0.81	0.68	1.41	1.88	0.75	0.73	3.33	2.03
Consequence	<i>M</i>	1.30	1.45	1.60**	2.65	1.20	1.75	2.25	3.70
	<i>SD</i>	0.80	0.68	1.04	1.49	1.50	0.78	1.83	3.82
Reaction	<i>M</i>	0.30*	0.75	0.40	0.45	0.60***	2.20	0.40	0.25
	<i>SD</i>	0.57	0.78	0.50	0.51	1.04	1.70	0.59	0.63
Combined	<i>M</i>	4.60**	7.10	6.80*	10.40	6.00*	8.00	9.30	14.80
	<i>SD</i>	2.60	3.50	4.10	5.50	3.30	2.30	6.20	14.20

* $p < .05$; ** $p < .01$; *** $p < .001$

$F(1, 36) = 4.53, p < .001$, and reaction components, $F(1, 36) = 2.01, p < .05$, than their VA peers. In *The Tiger's Whisker* story, the children with SBH produced significantly fewer attempts, $F(1, 36) = 1.39, p < .05$, and consequences, $F(1, 36) = 3.38, p < .01$, than their vocabulary age peers. In the *Frog on His Own* story, the children with SBH produced significantly fewer reactions than their VA peers, $F(1, 36) = 2.01, p < .001$. In the *Family* story, significantly fewer initiating events were produced by the children with SBH than their VA peers, $F(1, 36) = 4.53, p < .05$. The story grammar components *consequences* and *reactions* are considered to be the more complex than story grammar components *settings* and *initiating events* (Mandler & Johnson, 1977). There were no significant differences in the frequency with which the SBH and VA groups signaled settings and internal plans for any of the four stories.

In addition to assessing group differences on frequency of individual components, a repeated measure 2 (group) x 4 (story) ANOVA was also performed for total story grammar components combined. The children with SBH generated significantly fewer total story grammar components than the VA controls for the *Melvin, the Skinny Mouse* story, $F(1, 36) = 2.78, p < .01$, *The Tiger's Whisker* story, $F(1, 36) = 2.78, p < .05$, and the *Frog on His Own* story, $F(1, 36) = 2.78, p < .05$. These results show that the children with SBH had more difficulty generating as many story grammar components when they were combined as their VA peers on the three structured story tasks. Significant differences between subject groups for total story grammar components combined were not obtained for the *Family* story. The *Family* story was very loosely structured, which allowed the children to tell a story with fewer task constraints.

Analyses were conducted for complete and incomplete episodes between subject

groups for the four stories. Means and standard deviations for complete and incomplete episodes for the four stories are summarized on Table 2. No significant differences were found between the children with SBH and their VA peers for numbers of complete and incomplete episodes for any of the stories.

Significant story differences were obtained among the stories for all six of the individual story grammar components, each with $p < .001$. Story differences would be expected because the stories varied in length, presence of stimuli, and task demands. For group differences, the two subject groups produced significantly different numbers of initiating events, $p < .01$, internal plans, $p < .05$, consequences, $p < .01$, and reactions, $p < .01$, as well as total story grammar components combined, $p < .01$. Story-by-group interactions showed that the children with SBH produced fewer initiating events, $p < .01$, for the story *Melvin, the Skinny Mouse*, and reactions, $p < .001$, for the story *Frog on His Own* while their VA peers produced significantly more of these dependent variables for each respective story.

Task Types

A repeated measures 2 (group: SBH, VA) x 2 (task type: retell, generation) ANOVA was also performed with individual story grammar components. Means and standard deviations for story grammar components by task are summarized on Table 3. For the story retell task, the children with SBH produced significantly fewer settings, $F(1, 36) = 3.86, p < .05$, initiating events, $F(1, 36) = 4.53, p < .01$, attempts, $F(1, 36) = 1.39, p < .05$, and consequences, $F(1, 36) = 3.38, p < .05$, than their VA peers. For the story generation task, the children with SBH produced significantly fewer reaction components than their VA peers, $F(1, 36) = 2.01, p < .01$. Again, reactions are

Table 2

Means and Standard Deviations for Complete and Incomplete Episodes by Story

Story		Melvin		Tiger		Frog		<i>Family</i>	
Subjects		SBH	VA	SBH	VA	SBH	VA	SBH	VA
Complete Episodes	<i>M</i>	0.30	0.75	0.55	0.80	0.35	0.35	0.75	1.20
	<i>SD</i>	0.47	0.44	0.51	0.41	0.48	0.48	0.44	0.95
Incomplete Episodes	<i>M</i>	0.50	0.20	0.35	0.20	0.60	0.65	0.55	0.45
	<i>SD</i>	0.51	0.41	0.49	0.41	0.50	0.49	0.68	0.68

Table 3

Means and Standard Deviations for Story Grammar Components by Task—Story Retell versus Generation

Task	Story Generation				Retell			
	SBH		VA		SBH		VA	
Subjects								
Condition	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Setting	4.65	2.03	5.85	4.68	1.55*	0.88	2.20	1.10
Initiating Event	2.65	1.56	3.55	1.96	0.95*	0.75	1.85	1.26
Internal Plan	0.55	0.82	2.40	4.41	2.95	2.25	4.40	2.93
Attempt	3.00	3.46	3.15	2.30	2.35*	1.46	3.80	2.21
Consequence	3.45	2.62	5.45	4.08	2.90*	1.55	4.10	1.89
Reaction	1.00**	0.70	2.45	1.90	0.70	0.73	1.20	1.15
Combined	15.30*	8.15	22.85	14.86	11.40**	5.74	17.50	8.73

* $p < .05$; ** $p < .01$

a higher level story grammar component and are seen more often in the stories of older children (Mandler & Johnson, 1977). When total story grammar components were combined, the children with SBH produced significantly fewer total story grammar components combined for the both the story generation task, $F(1, 36) = 2.78, p < .01$, and the story retell task, $F(1, 36) = 2.78, p < .05$ than their VA peers. These results show that the children with SBH produced significantly fewer total story grammar components for both tasks.

Analyses were also conducted for task effects as well as for group-by-task interactions. Task effects showed significant differences between the two tasks for settings, $p < .001$, initiating events, $p < .001$, internal plans, $p < .001$, and reactions, $p < .001$, as well as total story grammar components combined, $p < .01$. Group-by-task effects showed that for the story retell task, the children with SBH producing significantly fewer reactions, $p < .05$, and total story grammar components combined, $p < .01$, while their VA peers produced significantly more of these variables for the story retell task.

Local Connection of Ideas

Individual Story Tasks

A series of 2 (group) x 4 (story) ANOVAs were also conducted for complete and incomplete referential and conjunctive ties. Means and standard deviations are summarized on Table 4. Two of the stories, *Melvin, the Skinny Mouse* and *Frog on His Own*, showed significant differences between the two groups for some of the dependent variables. For the *Melvin, the Skinny Mouse* story, the children with SBH produced significantly fewer correct referential ties, $F(1, 36) = 4.61, p < .01$, correct conjunctive

Table 4

Means and Standard Deviations for Correct and Incorrect Cohesive Ties by Story

Story		Melvin		Tiger		Frog		<i>Family</i>	
Subjects		SBH	VA	SBH	VA	SBH	VA	SBH	VA
Correct Ties	<i>M</i>	7.45**	15.45	11.05	15.50	15.75*	23.00	33.25	30.25
	<i>SD</i>	6.15	11.31	7.72	11.05	8.77	10.40	30.67	29.40
Correct Referential	<i>M</i>	5.20**	10.70	7.45	10.90	10.60*	15.80	22.55	21.15
	<i>SD</i>	3.98	7.08	5.50	7.79	6.45	7.26	17.99	19.40
Correct Conjunctive	<i>M</i>	3.60*	4.75	2.25	4.60	5.15	7.20	10.70	9.10
	<i>SD</i>	2.94	4.63	2.31	3.73	3.01	4.28	13.28	10.58
Incorrect Referential	<i>M</i>	0.60	0.75	1.40	1.15	0.15	1.10	0.80	1.15
	<i>SD</i>	0.82	0.96	1.09	0.93	0.67	4.22	1.05	2.45
Incorrect Conjunctive	<i>M</i>	0.10	0.00	0.10	0.00	0.10	0.10	0.10	0.10
	<i>SD</i>	0.44	0.00	0.44	0.00	0.44	0.31	0.44	0.47

* $p < .05$; ** $p < .01$

ties, $F(1, 36) = 2.50, p < .05$, and total correct cohesive ties, $F(1, 36) = 3.56, p < .01$, than their VA peers. This showed that the children with SBH used fewer conjunctive words such as “and” and “but,” as well as fewer referential words such as pronouns. For the *Frog on His Own* story, the children with SBH produced significantly fewer correct referential ties, $F(1, 36) = 4.61, p < .05$, and total correct cohesive ties, $F(1, 36) = 3.56, p < .05$, than their VA peers. This showed that for both the shorter retell story and the shorter generation story, the two subject groups performed significantly different on the use of these cohesive ties. No significant differences were obtained between the subject groups for the other two stories. In addition, there were no significant differences between the two subject groups for use of incorrect referential and conjunctive ties for any of the four stories. Both the children with SBH and their VA peers produced similar numbers of incorrect cohesive ties.

Significant differences were obtained among the stories in terms of combined correct cohesive ties only, $p < .001$, for story differences. There were no significant group differences or story-by-group interactions.

Task Types

A repeated measures 2 (group: SBH, VA) x 2 (task type: retell, generation) ANOVA was also performed for the referential and cohesive ties. Means and standard deviations are summarized on Table 5. Significant differences were obtained for several of the dependent variables for only the story retell task. The children with SBH produced significantly fewer correct referential ties, $F(1, 36) = 4.61, p < .01$, and total correct cohesive ties, $F(1, 36) = 3.56, p < .05$, but significantly more incorrect conjunctive ties, $F(1, 36) = 3.55, p < .05$, than their VA peers. There were no significant differences

Table 5

Means and Standard Deviations for Correct and Incorrect Cohesive Ties by Task—Story Retell versus Generation

Task	Story Generation				Retell			
	SBH		VA		SBH		VA	
Condition	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Correct Ties	49.0	32.68	53.25	33.89	18.5*	12.47	30.95	20.37
Correct Referential	33.15	19.48	36.95	21.85	12.65**	8.45	21.60	13.64
Correct Conjunctive	15.85	14.36	16.30	13.24	5.85	4.52	9.35	7.59
Incorrect Referential	0.95	1.14	2.25	4.62	2.00	1.55	1.90	1.29
Incorrect Conjunctive	0.20	0.89	0.20	0.52	0.45*	0.99	0.00	0.00

* $p < .05$; ** $p < .01$

between the two subject groups for use of correct conjunctive and incorrect referential ties. The story generation task showed no significant differences for any of the dependent variables between the two subject groups. This showed that both groups used similar numbers of both correct and incorrect referential and cohesive ties, or conjunctions and pronouns, within the stories.

Significant task differences were obtained for total correct cohesive ties only, $p < .001$. There were no group-by-task interactions.

Productivity

Individual Story Tasks

Measures reflecting productivity (number of T-Units and number of words), sentence structure complexity (mean words per T-Unit), and vocabulary diversity (number of different words) were also assessed using 2 (group) x 4 (story) repeated measures ANOVAs. Means and standard deviations are summarized on Table 6. Significant story differences were obtained for several of the dependent variables for the *Melvin, the Skinny Mouse* story, *The Tiger's Whisker* story, and the *Frog on His Own* story. No significant differences were obtained for any of the dependent variables for the *Family* story. For the *Melvin, the Skinny Mouse* story, the children with SBH produced significantly fewer total words, $F(1, 36) = 2.28, p < .05$, different words, $F(1, 36) = 4.96, p < .01$, T-Units without fragments, $F(1, 36) = 4.32, p < .01$, and T-Units, $F(1, 36) = 7.79, p < .01$, than their VA peers. For *The Tiger's Whisker* story, the children with SBH produced significantly fewer total words, $F(1, 36) = 2.28, p < .05$, different words, $F(1, 36) = 4.96, p < .05$, T-Units without fragments, $F(1, 36) = 4.32, p < .05$, and T-Units, $F(1, 36) = 7.79, p < .05$, than their VA peers. For the *Frog on His*

Table 6

Means and Standard Deviations for Productivity by Story

Story	Melvin		Tiger		Frog		<i>Family</i>		
	SBH	VA	SBH	VA	SBH	VA	SBH	VA	
Total Words	<i>M</i>	40.65*	64.60	50.30*	77.95	53.40**	80.95	115.05	127.70
	<i>SD</i>	35.07	38.90	31.11	48.98	26.57	35.98	98.05	126.03
Total Different Words	<i>M</i>	22.75**	37.30	30.70*	41.15	34.90	43.40	53.00	52.70
	<i>SD</i>	13.00	16.45	15.15	15.81	13.86	14.51	24.70	36.38
T-Units without Fragments	<i>M</i>	33.20**	61.55	48.55*	76.50	51.05**	74.95	116.45	123.90
	<i>SD</i>	21.34	40.07	30.61	49.59	23.87	30.18	98.67	126.543
Total T-Units	<i>M</i>	4.10**	7.50	5.10*	7.77	7.3**	10.20	14.80	14.25
	<i>SD</i>	2.40	4.22	3.19	4.33	3.90	3.22	13.41	13.08
Words per T-Unit	<i>M</i>	8.53	7.89	9.60	9.91	7.50	7.25	8.75	7.98
	<i>SD</i>	3.57	1.89	2.52	2.92	2.18	1.57	3.67	2.82
Total Fragments	<i>M</i>	0.20	0.35	0.20	0.25	0.35	0.35	0.60	0.55
	<i>SD</i>	0.41	0.81	0.41	0.55	0.58	0.67	1.39	0.82

* $p < .05$; ** $p < .01$

Own Story, the children with SBH produced significantly fewer total words, $F(1, 36) = 2.28, p < .01$, T-Units without fragments, $F(1, 36) = 4.32, p < .01$, and T-Units, $F(1, 36) = 7.79, p < .01$, than their VA peers. This resulted in the narratives of the children with SBH to be shorter and less varied overall for these three stories. There were no significant difference between the two subject groups for the dependent variables of total number of fragments and words per T-Unit for any of the four stories.

For story differences, there were significant differences among the four stories for words per T-Unit only, $F(1, 36) = 0.05, p < .001$. No significant group differences were obtained, and there were no significant story-by-group interactions.

Task Types

A repeated measures 2 (group: SBH, VA) x 2 (task: retell, generation) ANOVA was also performed for productivity components. Means and standard deviations are summarized on Table 7. For the story retell task, the children with SBH produced significantly fewer total words, $F(1, 36) = 2.28, p < .05$, different words, $F(1, 36) = 4.96, p < .01$, words without fragments, $F = 4.32, p < .01$, and T-Units, $F = 7.79, p < .01$, than their VA peers. Again, this showed that the stories of the children with SBH were shorter and less varied than their VA peers for the retell task. A follow-up one-way analysis showed that no significant differences were obtained between the two subject groups for the dependent variables of words per T-Unit and total number of fragments for the story retell task. The story generation task showed no significant differences for any of the dependent variables between the two subject groups. Both groups performed similarly in terms of productivity components for the story generation task.

Table 7

Means and Standard Deviations for Productivity by Task—Story Retell versus Generation

Task	Story Generation				Retell			
	SBH		VA		SBH		VA	
Condition	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Total Words	168.45	102.95	208.65	139.02	90.95*	55.09	142.55	84.28
Total Different Words	87.90	31.68	90.10	43.30	53.45**	25.41	78.45	30.26
T-Units without Fragments	87.90	31.68	198.85	134.59	53.45**	25.41	138.05	86.58
Total T-Units	22.10	14.64	24.45	14.04	9.20**	4.80	15.05	8.08
Words per T-Unit	8.03	2.06	7.73	1.81	9.07	2.51	8.85	2.16
Total Fragments	x	x	0.90	1.16	x	x	0.60	0.99

* $p < .05$, ** $p < .01$

There was a significant overall task effect for total words, $p < .01$, and words per T-Unit, $p < .01$. A task-by-group interaction showed that the children with SBH produced significantly fewer total different words than the VA peers on the retell but not the generation task.

Discussion

The aim of this study was to determine if children with spina bifida and hydrocephalus (SBH) would perform differently than children with comparable vocabulary age (VA) abilities on story generation and story retelling tasks in the areas of global narrative organization (story grammar components), local connection of ideas (cohesive ties), and productivity (number of words and T-Units). Specifically, this study tried to determine if children with SBH and their VA peers would perform differently on global or local organization while performing comparably on story length. Results showed that while the children with SBH and their VA peers performed comparably on some aspects of narrative production skills, they performed differently on others. The discussion and interpretation of the results are reported in terms of the nature of narrative deficits in children with SBH and the assessment and treatment methods that can be used to help children with SBH produce well-structured narratives.

Nature of Narrative Performance in Children with SBH

The purpose of this study was to learn more about how children with SBH perform on discourse-level language tasks. Specifically, we wanted to determine if children with SBH would produce stories that were less complex than those of their mental age peers. One way to determine this was to contrast global and local organization with measures of story length.

When the performance of children with SBH was compared to the performance of children with similar vocabulary age abilities on the four individual story tasks, the children with SBH produced retell and structured generation narratives that contained fewer story grammar components, were generally shorter and less complex, and tended to

be less cohesive than their VA peers. The performance of the children SBH and VA peers on retelling and generation tasks is discussed in terms of the global narrative organization (story grammar components), local connection of ideas (cohesion), and productivity (generation of words and sentences).

Global Narrative Components

When the four individual stories were analyzed for global story organization, analyses included the extent to which the groups produced the story grammar components (setting, initiating event, internal plan, attempt, consequence, and reaction), as well as how the subject groups performed when production of all story grammar components was combined. We wanted to see how the demands of each story task impacted performance of the children with SBH and their VA peers.

When the story grammar components were combined for each individual story, the children with SBH produced significantly fewer total story grammar components than their VA peers for the two retell stories, *Melvin, the Skinny Mouse* and *The Tiger's Whisker*, as well as the more structured generation story, *Frog on His Own*. While the *Family* story did not yield significant differences between the subject groups on total story grammar components, results showed that the children with SBH did produce fewer story grammar components than their VA peers. These results suggest that the children with SBH had more difficulty than their VA peers producing well developed stories, at least for the more structured story tasks.

When the four stories were analyzed for use of individual story grammar components, the children with SBH produced fewer of each story grammar component than their VA peers for the two retell stories, *Melvin, the Skinny Mouse* and *The Tiger's*

Whisker. When compared to the VA group, the children with SBH produced significantly fewer initiating events in *Melvin, the Skinny Mouse*, and attempts and consequences in *The Tiger's Whisker*.

The generation stories yielded mixed results. For the *Frog on His Own* story, the children with SBH actually produced more settings and initiating events than their VA peers, though not significantly more. For the *Family* story, the children with SBH produced more reactions than their VA peers, but again, not significantly more. However, some significant differences between the subject groups were obtained. The children with SBH produced significantly fewer reactions in *Frog on His Own* and fewer initiating events in the *Family* story. These results appeared to be the result of the different task demands of the four stories.

A comparison between children's performance on the retelling and generation stories suggests that differences in story task demands influenced the number of story grammar components the children with SBH produced. The children with SBH had more difficulty producing as many story grammar components as their VA peers on the two retelling stories, but not on the freely generated or unstructured *Family* generation story. Because of these task differences, both subject groups tended to produce longer generation stories than retell stories, especially for the *Family* story.

For the retell stories, the children were required to listen to stories and retell them. Essentially, they had to paraphrase the story or convey the story content and organization in their own words. The children were constrained by a model that they had to replicate.

For the generation stories, children were not as constrained. The two generation

stories were different from each other in terms of story structure. The more structured story, *Frog on His Own*, was a wordless picture book task where children generated a story to a sequence of pictures. It was a cross between a retelling task and an unstructured generation task. It was less structured than a story retell, but more structured than a generated story that contained little structure, as in the *Family* story. Because the *Frog on His Own* story allowed the children to generate a story and not retell one, the results of this story showed that both subject groups generated narratives that were longer than the two retell stories.

The *Family* story had even fewer constraints. It was a story task that was largely unstructured. This story allowed the children to freely produce a story related to a very broad topic. Because the children could generate their own story, there was great variability among the children in the kind of narrative they produced. Most of the *Family* story narratives that the children produced were longer than the other three narratives. What is interesting is that the loosely structured *Family* story did not yield significant differences between the children with SBH and their VA peers in terms of overall length, while the other three stories did. It appeared that all of the children produced narratives of similar lengths for the *Family* story.

While the children with SBH produced longer *Family* stories and comparable number of story grammar elements as their VA peers, not all of the children's story generations for this story were well-organized. Story length and number of story grammar elements do not necessarily reflect a story's complexity or its level of organization. From observations of many of the generated stories, it appears that many of the children with SBH had a greater tendency to produce longer stories that contained

an unfocused chaining of events, rather than stories that contained overarching goals, plans, or motives to drive the story and keep the story centered around a particular theme.

Appendix C contains some examples of such stories.

Because many of the stories seemed to be long but not necessarily complex, future research should control for length, since it is reasonable to assume that a longer story would likely contain more story grammar components than a shorter story. If we controlled the length, we could analyze the proportion of story grammar components to numbers of T-Units to see if this would provide more specific information on story complexity. In addition, the number of utterances that were extraneous or irrelevant (those that could not be coded as fitting a story grammar component) could be counted to see if that also affected the story complexity.

Local Connection of Ideas

The use of correct and incorrect cohesive ties, both referential and conjunctive, was analyzed for both subject groups for each of the individual stories. In addition, both subject groups' use of combined correct cohesive ties was analyzed across stories. When the use of cohesive ties was analyzed for the two subject groups, some significant results were obtained. For the shorter retell story, *Melvin, the Skinny Mouse*, the children with SBH produced significantly fewer correct referential and conjunctive ties, as well as combined correct cohesive ties, than their VA peers. For the shorter generation story, *Frog on His Own*, the children with SBH produced significantly fewer correct referential ties, as well as combined correct cohesive ties, than their VA peers. The longer retell story, *The Tiger's Whisker*, and the longer generation *Family* story did not significantly differentiate between the two groups for any of the variables.

It appears that the children with SBH had more difficulty producing narratives that were tied together than their VA peers when they were required to produce the shorter retell story and the shorter generation story. The inclusion of cohesive ties cannot always be viewed alone as a reflection of coherence in a story. Coherence, the logical connections in a story, is influenced by the capacity to connect ideas across sentences. It is also influenced by a child's ability to relate story ideas to a central theme or to a character's goal in a story. Again, the longer *Family* story often had more frequent ties, but the overall stories generated by some children with SBH were often not coherent because they chained events together rather than connecting events to a central theme. In the future, the stories could be analyzed using Applebee's chaining and centering notions (Applebee, 1978), which are more appropriate for analysis of children with language learning disorders.

Productivity

When the productivity components were analyzed for the four individual stories for the two subject groups, the children with SBH showed multiple deficits in terms of vocabulary diversity and sentence structure complexity. For both of the two retell stories, the children with SBH produced significantly fewer total words, different words, and complete grammatical units than their VA peers. For the more structured generation story, *Frog on His Own*, the children with SBH produced significantly fewer total words and complete grammatical units than their VA peers. These results show that the children with SBH produced narratives that contained sentences that were less complex, contained a more limited used of vocabulary, and were shorter than their VA peers for the three more structured stories. The *Family* story did not significantly differentiate

between the two subject groups, as was again expected, given how it was structured differently from the other three stories.

The results of this study show that the children with SBH most often produced narratives that contained fewer story grammar components, used fewer correct cohesive ties, and contained less complex sentences than children of a comparable vocabulary age for the two generation and the two retell stories that were used in this study. It appeared that the structure of the stories affected how well children with SBH performed in relation to their peers of a comparable vocabulary age.

Assessment and Treatment for Children with Spina Bifida and Hydrocephalus

Since this study seemed to show that children with SBH had difficulty producing narratives that were as complex as their VA peers' narratives, especially when the task was more structured, it is important that these children be assessed on how well they perform with structured tasks. Using both story retell and generation task demands would be helpful because they would reveal how the children with SBH perform in relation to the different types of story tasks. Providing retell and generation stories with some structure will help children with SBH stay with a main theme and relate events to it, rather than producing a series of unrelated and unfocused chains. Analysis of the stories should include both the use of global narrative components as well use of cohesive ties and productivity.

Treatment can focus on those aspects of narrative performance that are most difficult for children with SBH. Speech-language pathologists need to support children with SBH to stay with a central theme and to relate events in a well-organized story scheme for story generations. Paying attention to whether the story is a retell or a

generation task is also important, since the focus of intervention would be different depending on the task demands. In addition, speech-language pathologists must keep in mind that many children with SBH have the tendency to produce long narratives in a generation task, but not fully organized narratives. They must be careful not to assume that the length mirrors complexity. The results of this study provide important information to the growing amount of current research that is available about children with spina bifida and hydrocephalus; particularly, how they understand and produce narratives based on the type of story they are required to produce.

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Appendix A

STORY RETELLING TEXT TRANSCRIPTS

The Tiger's Whisker

Category Type	Type of Information	Statement
Major Setting	State	Once there was a woman
Internal Response	Goal	who needed a tiger's whisker
Internal Response	Affect	She was afraid of tigers
Internal Response	Goal	but she needed a whisker
Internal Response	Goal	to make medicine for her husband
Initiating Event	Natural Occurrence	who had gotten very sick
Internal Response	Cognition	She thought and thought
Internal Response	Goal	about how to get a tiger's whisker
Internal Plan	Goal	She decided to use a trick
Internal Plan	Cognition	She knew that tigers loved food and music
Internal Plan	Cognition	She thought that if she brought food to a lonely
tiger		
Internal Plan	Cognition	and played soft music
Internal Plan	Cognition	the tiger would be nice to her
Internal Plan	Cognition	and she could get the whisker
Attempt	Action	So she did just that
Attempt	Action	She went to a tiger's cave
Minor Setting	State	where a lonely tiger lived
Attempt	Action	She put a bowl of food in front of the opening of the cave
Attempt	Action	Then she sang soft music
Attempt	Action	The tiger came out
Direct Consequence	Action	and ate the food
Attempt	Action	He then walked over to the lady
Direct Consequence	Action	and thanked her for the delicious food and lovely music
Direct Consequence	Action	The lady then cut off one of his whiskers
Direct Consequence	Action	and ran down the hill very quickly
Reaction	Affect	The tiger felt lonely and sad again

Melvin, the Skinny Mouse

<u>Category Type</u>	<u>Type of Information</u>	<u>Statement</u>
Major Setting	State	Once upon a time there was a skinny little mouse named Melvin who lived in a big barn.
red		
Initiating Event	Natural Occurrence	One day, Melvin found a box of Rice Krispies underneath a stack of hay.
Initiating Event	Natural Occurrence	Then he saw a small hole in the side of the box.
Internal Response	Goal	Melvin knew how good the cereal tasted and wanted to eat just a little bit of cereal.
Attempt	Action	He decided to get some sugar first so that he could sweeten his cereal.
Attempt	Action	Then Melvin slipped through the hole in the box and quickly filled his cereal bowl.
Direct Consequence	Action	Soon Melvin had eaten every bit of the Rice Krispies and had become very fat.
Reaction	Affect	Melvin knew he had eaten too much and felt very sad.

Appendix B

STORY GENERATION PICTURE SEQUENCE TEXT

Frog on His Own

1. Once there was a man and a woman
2. who were on a picnic
3. and there was a frog who was watching them from behind a tree
4. When the frog saw their picnic basket
5. It made him feel very hungry
6. he decided to go look inside
7. While the people were talking and drinking
8. the frog snuck into the basket.
9. Soon the woman put her hand into the basket
10. to get out some sandwiches
11. and the frog grab bed her arm
12. When the woman saw the frog, she was very frightened
13. and she screamed.
14. The man was so surprised
15. That he dropped his coffee cup.
16. And while the frog just hopped away.
17. The man fell on the ground laughing.

Appendix C

SOME EXAMPLES OF GENERATION STORIES BY CHILDREN WITH SBH

*Frog on His Own:*Example One:

A guy and his wife are having a picnic.

He's pouring something into a glass of water.

A thermos.

Coffee, tea.

In this picture he has his hand in his pocket.

And he's drinking coffee.

And she's looking at him.

And she has her hand in the picnic basket.

Flies are flying above.

No.

In this picture, she still has her hand in the picnic basket.

This time a frog leg is on it.

And she's looking crosseyes at the basket.

And he has his hands folded with the cup of coffee in his hand looking at it.

In the next picture, she brings her hand out of the picnic basket.

And she finds a frog on it.

She screams.

He spills his coffee.

His glasses fall off.

And in the next picture he fell down.

The lady threw a cup of coffee.

And the frog is running.

Example Two:

He came up to her and asked her for a glass of water.

He's giving her water.

And she's reaching into the picnic basket.

And there's a frog climbing out.

And the frog escaped in this one.

And in this one the frog's out.

And he's dropping the glass.

And his glasses.

And in the next one the frog's hopping away.

*Family:*Example One:

The dad's going to work.

The mom was going to work.

The older sister had to watch the baby brother.

They had one car so they went in the car. (continued)

The cat jumped on the little girl and the little girl screamed and screamed.
 And then the cat said, "I'm sorry I just jumped on you."
 And the little girl gives the cat a lickin'.
 So pretty soon the mom and dad are coming home.
 The sister was holding the baby.
 The baby couldn't walk, that good cause her legs swelled up cause she fall down in the house.
 Mommy and daddy's coming home.
 They're walking in the house.
 Mommy gave the cat a lickin'.
 Dad kicked the cat.
 He just went like this:
 He yelled and went, "I'll give you a horsey ride."
 Now dad is riding the cat.
 Mom got on the cat.
 And they all got back up.
 And pretty soon the kids wanted to get on.
 "Oh, no," said Mom.
 There's no room for you.
 You wait til we get off.
 Take us to Pittsburgh.
 And then we'll come back.

Example Two:

Once upon a time there was a little baby.
 The Mommy had to take care of the baby all the time.
 And the sister was so jealous that she thought she would cry.
 She sat down on the couch and laid down.
 The mommy and the daddy took care of the baby all the time.
 He's skating in the snow.
 And then he got a little bigger.
 He used to wake up his sister.
 He used to wake up his daddy.
 "Mommy, mommy wake up."
 He used to wake up his mommy.
 And he got bigger.
 He can't do that stuff.
 And then the mommy can't have a baby.
 And the daddy went on a ride on the kitten.
 And the momma said, "Honey, you should be careful."
 Mommy's having a baby.
 So he got off and laid down and got the baby off.
 And they lived happily.
 And then they all went, outside when it was snowing.
 And they skated all day.
 And the mommy skated. (continued)

She crossed her legs.
But then she felt the baby coming out.
They watched the xxx into the house.
But the daddy was still skating outside.
And then the sister did something for mommy.
She called the doctor.
“Hello doctor, can you come cause my mommy’s having a baby?”
“Yes, I’ll be there right away.”
“Mommy, he said that he’ll be right away.”
And the doctor came.
“Yes, I got it out.”
“Can you hold him please?”
And they lived happily ever after.