Assessment of language disorders after right hemisphere damage

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ABSTRACT

A set of tests was developed to examine areas of language previously described as involving right hemisphere processing. These tests were constructed to be simple to administer and clinically useful. The tests included metaphorical comprehension, the understanding of inferred meaning and humour. A discourse analysis was also performed to investigate whether any language deficits were evident in more functional communication. Testing for aphasia was carried out using the Western Aphasia Battery. Groups of subjects with left or right cerebral hemisphere damage and a group of normal subjects were assessed.

The results showed that the right hemisphere damaged subjects were impaired as compared to the control subjects on all of the language tests. However, they were not significantly different on the aphasia test.

These results indicate that subtle language problems can occur after right hemisphere damage and these are apparent in functional communication (as assessed by discourse analysis). It is suggested that these language problems particularly concern inability to utilise linguistic information in context. It is further suggested that these language difficulties may account for some of the apparent social and emotional problems following right hemisphere damage.

Key words: right hemisphere damage, language assessment.

INTRODUCTION

In recent years the assumption that language is processed solely in the left hemisphere has been challenged. Recent theories of language lateralisation suggest that this is individually varying and relative rather than absolute.

Many studies have examined the variables contributing to language laterality (e.g. Bradshaw, 1980; Hecaen, De Agostini & Monzon-Montes, 1981). They suggest that familial sinistrality and sex are important in determining bilateral representation of language. Joannette, Lecours, Lepage and Lamoureux (1983) concluded that functional lateralisation of the brain is relative rather than absolute and that the

degree of lateralisation for any individual will depend upon several inter-related genetic and environmental factors. This would imply a continuum of language laterality. How such a continuum would function in terms of the organisation of the two hemispheres can be considered by examining theories of hemisphere organisation which stress the interdependency of processing between the two hemispheres, even though the left hemisphere may still be considered as dominant for language processing (Goldberg & Costa, 1981; Bever, 1983; Moscovitch, 1983).

Thus, the position now reached with regard to language laterality is that it is a dynamic system which depends first upon a gradient of individual laterality factors and then upon a complex system of inter-intrahemispheric factors that relate to the demands of the task (e.g. Brown, 1983; Levy, 1983). The knowledge that the right hemisphere does possess some language abilities is crucial to these theories of language lateralisation. Suggestions for the nature of the language processing in the right hemisphere have come from many types of studies, e.g. hemispherectomy studies (Dennis, 1980) and studies on split brain patients (Gazzaniga & Smylie, 1984). However, of more relevance to the present study is the work done with unilaterally brain-damaged subjects. These studies make an underlying assumption that normal functioning can be inferred from the impact of localised damage. However, some tachistoscopic studies with normal subjects support these assumptions (Chiarello, 1985).

The right hemisphere has been suggested as having a supportive role in verbal memory (Moscovitch, 1983). Coltheart (1980) argued that the right hemisphere has a role in reading although this has been challenged by more recent reviews (Rabinowicz & Moscovitch, 1984).

However, it is in the area of lexical-semantic and high level language processing that the role of the right hemisphere is more evident. A number of studies have examined lexical-semantic and high level language deficits, such as those involving implicature and inference, following right hemisphere damage. These studies are reviewed in detail by Code (1987).

What is evident from these studies is that lexical, semantic and high level language skills are affected by right hemisphere damage. It is possible that spatial, perceptual and emotional problems contribute to some extent to the right hemisphere language deficit, but they cannot account for it. This could be equivalent to perceptual problems and emotional lability which can contribute to an aphasic's speech and language problems, but cannot entirely account for them. It may be that, in the past, right hemisphere damaged patients were observed to be anomalous in their speech, but as they were patently not aphasic and as it was thought to be well proven that language was associated with the left hemisphere, these problems were attributed to other right hemisphere deficits.

Recent studies of language in terms of discourse functions clearly show that language problems following right hemisphere damage can affect communicative abilities. A study of speech act comprehension by Hirst, LeDoux and Stein (1984) showed that the right hemisphere damaged subjects were able to comprehend the literal or conventional meanings, but were unable to determine when this conventional meaning did not apply. The authors therefore suggested that the right hemisphere is involved in the pragmatic aspects of language.

A study by Brookshire and Nicholas (1984) showed that right hemisphere

damaged subjects processed narrational material on the basis of direct linguistic information only.

Weintraub and Mesulam (1983) suggested that early damage to the right hemisphere causes profound impairment in the development of skills normally associated with the right hemisphere.

Taken together, the results of the work on right hemisphere language processing, particularly at the semantic and discourse levels of language, provide evidence for the clinical observations of failure of certain right hemisphere damaged subjects to appreciate humour, connotative aspects of meaning and paralinguistic cues. Their overall impairment in comprehending and using contextual information to derive meaning may partly explain their insensitivity to the pragmatic aspects of communication. They seem unable to extract and isolate key elements, to see the relationships among them, to integrate them into an overall structure and to draw inferences based on these relationships, both in complex linguistic tasks and in discourse.

In the study that follows, subjects with right hemisphere damage were examined on an aphasia test and on a series of language tests designed to evaluate the right hemisphere's contribution to language. In addition, a discourse analysis was used to examine whether clinical observations of communication deficits are evident in discourse processing.

METHODOLOGY

A set of tests was designed to assess right hemisphere language functions. The tests were designed to be clinically useful and quick and easy to administer with simple instructions. In addition they were planned to avoid performance dependency on memory or visual perception. Pilot studies were undertaken with normal subjects to verify acceptability of all test materials and comprehension of instructions etc. The Western Aphasia Battery (WAB; Kertesz, 1982) was also administered to test for aphasia. The WAB was selected for speed of administration and because it has a designated cut-off point for the diagnosis of aphasia.

Subjects

The two experimental groups were right hemisphere vascular damaged and aphasic left hemisphere vascular damaged. There were 30 subjects per group. Subjects were assigned to the groups on the basis of neurological examination, CT (computerised tomographic) scan results where possible and a brief neuropsychological examination.

Further criteria for selection of subjects were that they had no previous history of neurological dysfunction and no evidence of general cognitive deterioration. Subjects also had no history of hearing loss. Subjects were aged from 20 to 80. A third group of non-neurologically damaged control subjects was also tested. The three groups were matched exactly for sex (18 male and 12 female), and as far as possible for age and education. The Mann-Whitney U test was used to test the differences between the groups for age and education. No significant differences were found at $P=0.01$. All subjects were right handed.

A simple template mapping procedure was used to localise lesions on the CT scans

into frontal, parietal, temporal and occipital lesions of either the right or left hemisphere.

The brain-damaged subjects were tested at 0–6 weeks post-onset and re-tested at 14–20 weeks post-onset. Control subjects were tested once only in identical circumstances, i.e. a noisy hospital ward.

A brief description of the tests is given below.

Metaphor test – picture choice

This test was based on a study reported by Winner and Gardner (1977). A list of 12 sentences each containing a common metaphor was prepared, e.g. 'She left the scene of the accident with a heavy heart'.

A set of four pictures was drawn for each sentence; these represented:

- (1) The correct metaphorical meaning.
- (2) The literal meaning.
- (3) Two control pictures which depicted one aspect of the sentence.

The subject was told to listen carefully to the sentence and to think what it meant, then to point to the picture which showed this. The sentence could be repeated once if the subject wished. No time limit was imposed and two practice items were given.

Metaphor test – written choice

This test was developed to ensure that any deficits found on the previous test were not due to the pictorial nature of the task, and to compare performance using written material. It was based on a report by Winner, Rosenstiel and Gardner (1976) on the development of the comprehension of metaphor in children. A list of 12 common metaphors of the form 'an X is a Y' was prepared, and each was incorporated into a short contextual sentence, e.g. 'After many years of working at the jail the prison guard had become a hard rock'. Each sentence was printed on a card, and was followed by three sentences which represented possible meanings of the target. These were:

- (1) Genuine metaphorical meaning, e.g. in the above example, the guard was mean and did not care about the feelings of the prisoners.
- (2) Primitive metaphorical meaning – this focused on an incidental aspect of the metaphor without actually appreciating the metaphorical meaning, e.g. the guard had hard tough muscles.
- (3) Metonymic meaning – the sentence was re-phrased so that the two aspects of the metaphor were interpreted literally without defying realism, e.g. the guard worked in a prison that had hard rock walls.

The order of the three sentences was randomized. The card was placed before the subject and the examiner read out both the metaphorical sentence and the alternative meanings. The subject was told to listen to the target sentence and then to point to the alternative that explained it correctly. One repetition was permitted and two practice items were given.

Comprehension of inferred meaning

This test was developed to assess the ability to comprehend aspects of inferential

meaning in short paragraphs which describe a situation or event. This test was based on work reported by Gardner (1975), Rivers and Love (1980), Wapner, Hamby and Gardner (1981) and Delis, Wapner, Gardner and Moses (1983) which suggested that some right hemisphere damaged subjects were unable to integrate aspects of narrative materials.

Five paragraphs were adapted from *Reading and Thinking*, Book 3 (Evans, 1968). The material was altered to make it suitable for adults, the length was restricted to 65–67 words, and only simple syntactic structures without embedding were used. The content of each passage was controlled giving conversational, narrative and emotional passages.

Four questions were devised for each passage. The answers to the questions were not directly stated in the paragraphs but were clearly implied by its contents.

Each paragraph was printed on a card in enlarged type. The card was placed in front of the subject and was read aloud twice by the examiner. The subject was then asked each question in turn and could refer to the card. Two practice items were given.

Appreciation of humour

This test was based on results reported by Gardner, Ling, Flamm and Silverman (1975) and Brownell, Michel, Powelson and Gardner (1983).

Twelve jokes with a clear punchline were selected from a book of jokes (Goldstein-Jackson, 1973). The content of the jokes was selected to be non-offensive. It was not possible to control the length of the items, but the words used were of high frequency. The jokes were printed on cards in enlarged type, and a choice of four punchlines was offered:

- (1) The actual punchline.
- (2) A straightforward ending of neutral content.
- (3) A straightforward ending of emotional content.
- (4) An ending that was a surprise but was unrelated to the body of the joke.

An example item was:

A man goes to a restaurant and says to the waiter 'Can I have some soggy chips, some cold beans and a greasy egg'. 'I'm sorry sir', said the waiter, 'but we couldn't possibly give you anything like that.' The man replied . . .

- (1) 'Why not? I had that yesterday.'
- (2) 'Oh well, I'll have to choose something else.'
- (3) 'Oh dear, I was looking forward to that.'
- (4) 'Do you have a cook?'

The card was put in front of the subject and the examiner read out the joke and the endings twice. The subject was told that the joke needed finishing and was asked to point to the ending that would make it funny. Two practice items were given.

Semantic test

The test constructed here was based on a procedure devised by Goodglass and Baker (1976).

A series of 23 high frequency nouns was selected from a range of semantic categories. For each word five associated items were selected:

- (1) Two semantic coordinates.
- (2) A functional associate.
- (3) A phonological control (a rhyming word).
- (4) A visual control.

The visual control was included because pictures of objects close in meaning are often also similar in appearance. Visual perceptual problems are associated with right hemisphere damage, and it could be that errors made by such patients on the 'semantic' test are perceptual rather than linguistic (Bishop & Byng, 1984). If a patient consistently selected the visual distracter this would suggest a perceptual basis to his problems.

The items were selected with reference to word association lists (Battig & Montague, 1969; Rosch, 1975; Ashcroft, 1978). An example item would be, 'chair' as the target, with the five associates being 'table,' 'bed', 'sitting', 'hair' and 'steps'.

For each item the six words were depicted in clear line drawings. The subject was shown the picture sheet and the examiner said the name of the target item twice. Subjects were told to look at all of the pictures and then to point to the correct one. Three practice items were done prior to the trials.

Discourse analysis

This analysis aimed to evaluate discourse, i.e. a two-way interaction or conversation. This would be evaluated in terms of: content, e.g. greetings, instructions, narrative; style, e.g. the type of information conveyed and the level of formality; interaction, e.g. turn-taking behaviour and comprehension including abstract and inferred meanings, and overall coherence of the discourse.

Construction of the analysis was based on justification for discourse being assessed as a separate level of language (Coulthard & Montgomery, 1981). Trower, Bryant and Argyle (1978) developed a social interaction analysis that rates natural conversation in terms of what is expected in the given situation and how the rater feels about the subject's interaction. Application of such procedures to the study of brain-damaged subjects was explored, by taping conversations with such subjects and attempting to analyse their discourse. A series of rating scales was therefore developed. Scoring was arranged on an inverted scale of 0-4, with 0 indicating normal and 4 indicating extremely abnormal. This would give an indication of the level of error. Ratings were completed for each subject by the examiner and an independent observer. The ratings and the guidelines for the observer are given in Appendix 1.

RESULTS

The mean and standard deviation scores for the right hemisphere language and the aphasia test are shown in Table 1.

The right and left hemisphere damaged groups were compared to the control group using ANOVA with multiple comparison Scheffe tests to determine significant differences between the groups. These results are shown in Table 2.

Table 1: Mean and standard deviation values for the three groups on language tests.

Errors in test	Maximum value	Right hemisphere damage		Left hemisphere damage		Control	
		Mean	s.d.	Mean	s.d.	Mean	s.d.
Metaphor picture	10	4.20	2.54	2.2	1.9	0.5	0.6
Metaphor written	10	3.6	2.9	1.9	2.1	0.3	0.8
Inference test	12	5.44	2.26	1.4	1.1	0.4	0.6
Humour test	10	3.8	2.8	2.9	1.6	0.3	0.5
Semantic test	20	4.3	3.5	2.7	3.9	0.1	0.2
Discourse analysis	40	20.24	6.12	9.3	3.0	0.4	1.0
WAB quotient	100	95.62	3.46	63.8	19.7	99.3	0.6

Table 2: ANOVA and multiple comparison Scheffe test results comparing the performance of the three groups on the language tests.

Test	F Value	F Probability (P)	Significant Scheffe Tests (P=0.01)		
Metaphor picture	29.56	0.0001	RHD/Control	RHD/LHD	LHD/Control
Metaphor Written	13.03	0.0001	RHD/Control		
Humour	29.40	0.0001	RHD/Control		LHD/Control
Inference	62.46	0.0001	RHD/Control	RHD/LHD	
Semantic	11.82	0.0001	RHD/Control		
Discourse analysis	185.1	0.0001	RHD/Control	RHD/LHD	LHD/Control

RHD = right hemisphere damage.

LHD = left hemisphere damage.

n = 30. Critical value of F at P = 0.01 is 4.15.

The results show that the right hemisphere damaged subjects made significantly more errors than the control subjects on all of the language tests. In addition the right hemisphere damaged subjects made more errors than the left hemisphere damaged subjects on the metaphor picture test, the inferential meaning test and the discourse test. On the WAB aphasia test, the right hemisphere damaged subjects were not significantly different from the control subjects. However, the left hemisphere damaged subjects were significantly impaired as compared to the controls and the right hemisphere damaged subjects. This was expected as the subjects in the left hemisphere damaged group were all aphasic.

Two-tailed T tests were used to compare the types of errors made by each group. These results are shown in Table 3. The right hemisphere damaged subjects made significantly more errors by choosing the literal items rather than the control items on the metaphor picture test. They also made significantly more errors of inference rather than direct errors on the inferential meaning test, and significantly more

semantic errors than either visual or phonological errors on the semantic test. These results are illustrated in Figures 1 and 2.

Table 3: Paired *T*-test comparisons of error types within each test for the three groups.

Error comparison	RHD	LHD	Control
Metaphor picture, literal errors/control errors	5.79*	2.8 *	0.53
Metaphor written, metonymic errors/primitive errors	2.2	-2.49	-1.16
Inferential meaning, inference errors/direct errors	5.28	1.7	-1.14
Humour test			
unrelated/straightforward	-0.07	-3.45*	-1.72
unrelated/straightforward sad	2.38	-0.77	1.44
straightforward/straightforward sad	2.35	2.65	2.97
Semantic test, semantic/visual	4.63*	3.58*	0.0
Semantic/phonological	4.75*	3.32	0.0
Semantic/verb	1.6	0.7	-1.0

Critical value for $t=2.75$ for a two-tailed test at $P=0.01$.

* = significant at $P=0.01$.

Figure 1: Histograms to show error scores on the metaphor tests. (a) Metaphor picture test: □ literal errors; ▨ control errors. (b) Metaphor written test: □ metonymic errors; ▨ primitive errors. RHD = right hemisphere damage; LHD = left hemisphere damage.

Figure 2: Histograms to show error scores on the inferential meaning, humour and semantic tests. (a) Inferential meaning test: □ inference errors; ▨ direct errors. (b) Humour test: ▨ unrelated; ▨ straightforward neutral; ▨ straightforward sad. (c) Semantic test: ▨ semantic errors; ▨ visual errors; ▨ phonological errors; ▨ functional associate errors.

The discourse analysis was rated by both the examiner and an independent observer. Pearson coefficients were calculated to examine the correlation between the two judges' scores. A high correlation between the two sets of scores was found ($R=0.89$, significant at $P=0.0001$).

The independent judges' scores were used in the analysis. Figure 3 shows the discourse ratings for the three groups. The ANOVA results (see Table 1) showed that the right hemisphere damaged subjects had a significantly higher discourse error rating than either the left hemisphere damaged or the control groups.

Paired T-test results showed that there were no significant differences on the language tests, between the initial testing and the re-test after 3 months, for either of the experimental groups (Table 4). However the left hemisphere damaged group had improved their performance (although this did not reach significance) on the metaphor picture and humour tests.

Table 4: Paired T-test results for comparison of test one and test two results.

Test	RHD T value	LHD T value
Metaphor picture	1.5	1.42
Metaphor written	-0.1	2.09
Inference	1.74	1.0
Humour	1.0	1.0
Semantic	2.18	2.11
Discourse analysis	1.06	2.02
WAB quotient	-0.43	-6.44*

T=2.75 is the critical value at $P=0.01$ for a two-tailed test.

*Significant at $P=0.01$.

Figure 3: Box and whisker plot to show the median and range of scores on the discourse rating.

On the WAB, the left hemisphere damaged subjects made a significant improvement on all of the tests. However, they remained significantly impaired as compared to the control subjects on all of the tests. On the WAB comprehension measure, the left hemisphere damaged subjects were not significantly different from the right hemisphere damaged subjects on test 2.

DISCUSSION

The right hemisphere damaged subjects made significantly more errors than the controls on all of the language tests. They also made significantly more errors than the left hemisphere damaged subjects on the metaphor picture test, the inferential meaning test and on the discourse rating despite the fact that there was no evidence for the right hemisphere damaged subjects having any aphasic language disturbances. This would indicate that more detailed tests are required to identify certain specific language disturbances after right hemisphere damage.

On the lexical-semantic test the right hemisphere damaged subjects tended to make errors by choice of semantic coordinates and functional associates indicating some disruption in the comprehension of single words. The errors could not be accounted for by visual difficulties or left-sided neglect.

Other aspects of lexical-semantic problems in right hemisphere damaged subjects have been illustrated, for example Gardner, Silverman, Wapner and Zurif (1978) showed that these subjects have difficulty in both selecting and supplying word antonyms. The results in this study would support the suggestion that the right hemisphere has a role in processing of semantic properties of words, and that the coordinated functioning of both hemispheres is necessary in order to appreciate the full meaning of individual words.

The right hemisphere damaged subjects also had a deficit in the understanding of metaphor. This deficit was evident in both pictorial and auditory-written tests, and Winner and Gardner (1977) attributed such problems to a disruption in aspects of connotative meaning. In addition, the right hemisphere damaged subjects appeared unable to judge whether the response they chose was plausible. It was also noted that the control and left hemisphere damaged subjects found many of the alternative explanations and pictures very amusing, but many of the right hemisphere damaged subjects did not show any humour. Their performance on the humour test verified this observation. The right hemisphere damaged subjects made most errors through choosing the unrelated items which implies a preserved sensitivity to surprise, but inability to integrate the joke with its punchline marked the performance of the right hemisphere damaged subjects. This is consistent with other evidence for right hemisphere damaged subjects being unable to integrate linguistic material or to use contextual cues to judge an appropriate response.

On the inferential meaning test errors were evident on all three passages; therefore, the difficulty was not confined to emotional material. The right hemisphere damaged subjects made significantly more errors of inference, i.e. they made an inference but this was not the correct one. They had failed to appreciate the implication because they were unable to use semantic information that extended beyond individual word meanings linked to form sentences.

The type of incorrect inferences made showed that, in this test, the replies were usually plausible, i.e. not impossible or outrageous, but not in accordance with the information given in the paragraph. This would suggest that right hemisphere damaged subjects are not completely insensitive to contextual information, but that they are specifically unable to utilise the information provided to make an inference within the correct context. This effect was also apparent in the metaphor tests. Here the context was specified and the correct answer was dependent on comprehending the metaphor within the correct context. The right hemisphere damaged subjects were unable to use this contextual information and thus chose the implausible literal explanations. This suggests that the right hemisphere damaged subjects can judge plausibility but that they cannot make this judgement when the context is specified. It is therefore suggested that the plausibility hypothesis suggested by Wapner *et al.* (1981) to explain these high-level language deficits after right hemisphere damage should be modified. The problem appears to be one of an inability to make judgements about language in a specific context and an inability to use linguistic information within a particular context.

The right hemisphere damaged subjects were given a significantly higher discourse error rating than normal subjects. These ratings reflected problems such as discussing highly personal or emotional issues at an inappropriate time and failing to change the subject despite efforts from the listener to indicate that this was desired.

This indicates that the linguistic impairments seen in the language tests were evident in functional communication and supports the position suggested by Weintraub and Mesulam (1983) that subtle language problems may account for some of the social and behavioural anomalies seen in patients who have sustained right hemisphere damage.

These problems of inference and the use of language in context may partially explain the 'emotional problems' that these patients seem to display. Emotional information is often not directly conveyed, and is dependent on inferences. The right hemisphere damaged subjects have difficulty in making these inferences, in using the information within a given context and in discriminating emotional information conveyed by prosodic cues (Heilman, Scholes and Watson, 1975). Thus, the language deficit could be a significant part of the lack of emotional response shown by right hemisphere damaged patients.

These language problems may partially account for some of the social and behavioural anomalies in right hemisphere damaged patients which have been previously attributed to changes in personality and emotional disorders. This has probably arisen because such patients do not have the overt difficulties of aphasia. In fact, if questioned about speech or 'understanding' these patients will frequently vigorously deny any deficit. Some spouses commented on communication difficulties but many of the right hemisphere damaged subjects seemed to be completely unaware of the listener's difficulty in communicating with them.

This lack of awareness of language problems in right hemisphere damaged subjects would presumably be a barrier to any form of rehabilitation. However, Burns, Halper and Mogil (1985) suggested that once the patient is confronted with these problems they can be discussed much more effectively. It could be suggested on the basis of the results of this study that relatives or carers would benefit from some insight into these language problems, particularly where they cause the patient to make inappropriate or perhaps offensive remarks.

This study did not include a functional assessment of the subjects, but in certain right hemisphere damaged subjects it was obvious when they were seen for the re-test, after 3 months, that they were not able to communicate normally with their families. The re-test visits took place at home and it was noted that some subjects were quite withdrawn and rarely contributed spontaneously. Others had offended various family members or friends because of offensive comments or inappropriate conversations.

Consideration of individual error profiles in the right hemisphere damaged subjects showed that the exact nature of the language disorder can vary across individuals in the same way as language disturbances can vary in aphasic subjects (and indeed not all left hemisphere damaged patients necessarily have aphasia). There is therefore a need for careful assessment of language skills in these patients. An attempt was made to map the CT scans of the right hemisphere damaged subjects. The group was then divided into subgroups with lesions in the same area. The resulting groups were very small and the scan mapping was not entirely satisfactory; however, the results did indicate that lesions in the right parietotemporal region are particularly associated with the right hemisphere language disorders shown by the tests used in this study. Improved scan analysis and larger groups of subjects with localised lesions would be needed in order to verify these results.

In addition, the evidence given above indicates that the disorders of lexical, semantic and high level comprehension skills are part of a language disorder. Undoubtedly, to some extent spatial, perceptual and emotional problems contribute to the right hemisphere language deficit, but they do not totally account for it.

The left hemisphere damaged subjects performed surprisingly well on these tests despite their aphasia, although they were significantly impaired on all of the tests when compared to the control subjects. This could be due to the fact that these left hemisphere damaged subjects had an intact right hemisphere; also the tests were not timed, the need for verbal responses was minimised and the majority of the aphasics had fairly good comprehension (as measured by the WAB). But these findings would indicate that language tasks which involve right hemisphere language processing may be useful approaches to aphasia therapy for certain types of language disturbance. This is beyond the scope of the present study, but the results would suggest that the application of discourse-orientated language processing to the treatment of aphasia could be usefully explored in future research.

The results were essentially unchanged when the subjects were re-tested after 3 months, with no significant differences between the two performances for the right hemisphere damaged subjects. This would indicate that the language disorder was specifically due to right hemisphere damage, rather than just an initial effect of brain damage generally and that the disorder does not spontaneously resolve.

This study therefore confirms previous reports of language deficits after right hemisphere damage, and shows that these deficits are evident in discourse processing. The tests used were quick and easy to administer and could perhaps form the basis for a future test battery. What is clear is that right hemisphere damaged subjects require specific and detailed assessment of their communication skills. Whereas the aphasia test did not reveal any deficits, the discourse analysis showed a number of particular areas of difficulty. However, individual profiles were varied which again suggests that detailed language assessment is required after right hemisphere damage. In addition, the language problems were still evident after 3 months suggesting that they did not spontaneously resolve. Clinical trials are therefore needed to assess the value of counselling and communication therapy for right hemisphere damaged patients.

APPENDIX: DETAILS OF DISCOURSE ANALYSIS

Discourse ratings were for:

- (1) Supportive routines – those concerned with politeness and affiliation.
- (2) Humour – including specific humour such as jokes as well as a humorous tone to conversation on appropriate subjects.
- (3) Questioning.
- (4) Assertive routines – those concerned with exerting rights and taking initiative.
- (5) Narrative – this includes length of utterances as well as level of detail.
- (6) Variety of topic content and types of utterance.
- (7) Formality – level of formality between the participants and the nature of the information disclosed.
- (8) Turn-taking – the balance of the conversation between the participants.
- (9) Meshing – the timing of the utterance.
- (10) Discourse comprehension.

The following points were to be considered when using the rating scales:

- (1) The appropriateness of the communication should be evaluated in terms of the interaction taking place, e.g. formal interview or informal discussion of general topics.
- (2) The ratings should be made in relation to normal interaction rather than pathological interaction.
- (3) The judge should take into account both what the subject says and the effect of this on the listener.
- (4) In judging whether or not a limitation was due to aphasia the judge should carefully consider the nature of the speech difficulties. For example, if a subject can produce short phrases then his ability to comment on a particular point is not directly compromised by this. In view of the difficulty of this judgement the independent judge was a speech therapist.

The judge heard four samples of the subject's speech. These were the WAB picture description and question and answer section, a recording of the subject greeting and the examiner and a conversation that arose entirely spontaneously.

ACKNOWLEDGEMENTS

I would like to thank Dr R. Lesser and Dr D. Bates of the University of Newcastle upon Tyne for their invaluable assistance with this project and also Mrs S. Clark for rating the discourse tapes. The work was funded by a grant from the Medical Research Council.

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Received 1 July 1987; revised version received 19 April 1988.