Roberts DJ, Hughes E, Tainturier MJ. 2012. Lexico-Semantic Impairment in a Case of HSVE to the Left Anterior Temporal Lobe. Procedia Social and Behavioral Sciences, in press.

Background

This study investigates the role of the left anterior temporal lobe (aTL) in semantics. Clinical and neuroscientific investigations propose the aTL bilaterally (BaTL), are implicated in semantics, based on findings that: (1) disruption to BaTL results in a multimodal semantic impairment, observed in semantic dementia (SD) and herpes-simplex-viral-encephalitis (HSVE); (2) impairment can be mimicked by inducing a "virtual lesion" (repetitive-transcranial-magnetic-stimulation) to BaTL in neurologically intact participants; (3) neuroimaging studies identify BaTL activation for semantic tasks (Fig 1, Lambon Ralph et al., 2012, for points 1-3). Anchored in this evidence is the assumption that semantic impairment will result from BaTL damage only. Recently, investigators have suggested a loss of semantic knowledge can result from LaTL damage. Using sensitive tests, this can be observed in chronic stroke (Schwartz et al., 2009) and temporal lobe resection for epilepsy patients (rTLE: Antonucci et al., 2008; Lambon Ralph et al., 2012). Of interest is the striking similarity of rTLE and very early stages of SD (when atrophy is left sided and overlaps with resection) – impairment is mild and the primary symptom is anomia and/or forgetfulness. This builds upon the possibility that a semantic weakness may result from a LaTL lesion. Whilst rTLE studies have provided insight into this notion, one must be cautious – pre-surgical seizures may initiate changes in brain organisation/normal development, and reorganisation of function could occur post-surgery. Chronic stroke studies are problematic since lesions are large and encompass other areas that may contribute to the impairment. Consequently, whether LaTL lesions results in semantic impairment is not entirely understood. The goal of the present case study was to initiate an investigation to determine whether semantic impairment is in fact present following LaTL lesion.

Method

WRP, a 49 year old right-handed male, one year post-HSVE has a LaTL lesion with extensive destruction of temporal pole, extending to medial temporal, amygdala and hippocampus. No involvement of right hemisphere. MMSE revealed no dementia. A comprehensive test battery proved successful in detection of mild semantic impairment in other patient groups (SD, HSVE, rTLE) was administered.

Results & Discussion

Results are summarised below in Table 1. Evidence of semantic impairment was obtained, independent of input and output modality – abnormal performance in oral/written naming, semantic association, naming-definition, word-picture comprehension, synonym judgement, verbal fluency. Particularly, living<nonliving category effect emerged in both oral ($\chi2(1)=10.26,P<.005$) and written ($\chi2(1)=6.56,P<.05$) naming accuracy on 64-item naming-to-confrontation set, and in semantic errors for living>nonliving (e.g., kangaroo>crocodile) in oral ($\chi2(1)=6.62,P<.05$) and written ($\chi2(1)=5.24,P<.05$) naming. He also showed visual<functional effect ($t(63)=3.37,P<.001$) for naming-to-definition. For synonym judgement control level was reached for easiest items only (high frequency, high imageability) and effects of imageability ($\chi2(1)=4.36,P<.05$) and frequency ($\chi2(2)=14.06,P<.005$) were present. These results suggest that aTL lesions to the left hemisphere can lead to lexico-semantic impairment.

Table 1. WRPs accuracy performance on semantic tasks

Task	Sub-test	*Item N*	Mean	Cut-off	WRP	Semantic error rate*
Cambridge semantic battery (uses identical stimulus items (N=64) for each test)**	*Oral naming*	*64*	62	59	**53**	82%
	Written naming	*64*	62	59	**58**	67%
	Word-picture matching	*64*	63	63	**58**	-
	CCT~ picture	*64*	59	53	**57 (in RT)**	-
	CCT~ word	*64*	61	57	**48**	-
	Naming to functional definitions	*64*	57	57	**51**	-
	Naming to perceptual definitions	*64*	54	54	**36**	-
	Verbal fluency	-	115	70	**64**	-
Naming to confrontation	*Oral+*	*64*	62	60	**54**	60%
	Written+	*64*	62	60	**54**	50%
	Oral retest+	*64*	62	60	**54**	50%
	Written retest+	*64*	62	60	**52**	33%
	*Graded naming^*	*30*	22	14	**6**	-
Synonym judgements* **	*Total*	*96*	94	92	**83**	-
	High Frequency	*48*	47	45	**44**	-
	Low Frequency	*48*	47	45	**39**	-
	High Imageability	*32*	32	31	32	-
	Medium Imageability	*32*	32	31	**29**	-
	Low Imageability	*32*	31	28	**22**	-

Note. **Bold** denotes abnormal performance. *Non-semantic errors were no response; **Tests from Bozeat et al. (2000); ~CCT: Camel and Cactus test (designed along the principles of the PPT); +Tests from Lambon Ralph et al. (1998b); ^Warrington (1997); ***Jefferies et al. (2009).

References

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