semi-random fMRI encoding paradigm shows lateralized anterior mesiotemporal lobe activation in TLE patients

K. Deblaere[1], W. H. Backes[2], A. Tieleman[1], P. Vandemaele[1], K. Vonck[3], P. Hofman[2], P. Boon[4], J. Vermeulen[5], J. Wilmink[2], A. Aldenkamp[6], P. A. Boon[3], G. Vingerhoets[7], E. Achten[1]

[1]MR Department, Ghent University Hospital, Ghent, Belgium, [2]Radiology Department, Maastricht University Hospital, Maastricht, Netherlands, [3]Department of Neurology, Ghent University Hospital, Ghent, Belgium, [4]Medical Psychology, Maastricht University Hospital, Maastricht, Netherlands, [5]SEIN, Heemstede, Netherlands, [6]Epilepsy Centre 'Kempenhaeghe', Heeze, Netherlands, [7]Labaratory for Neuropsychology, Ghent University Hospital, Ghent, Belgium

Purpose

A functional magnetic resonance imaging (fMRI) study was carried out to validate a semi-random memory encoding paradigm, and to compare the results obtained in pre-surgical temporal lobe epilepsy (TLE) patients with the intracarotid amytal procedure (IAP).

Methods

Eight healthy volunteers and 12 presurgical TLE patients were included in the fMRI study using a memory encoding paradigm with a semi-random design. Subjects were instructed to memorize new images mixed with images seen before. Data analysis comprised the computation of the activation contrast between new and old images and the lateralization index (LI), defined as the relative difference of the number of activated voxels between left and right mesio-temporal lobe (mTL). The LI was compared between patients and volunteers, and statistically related with the memory results of the patients' IAP.

Results

The memory paradigm consistently activated the posterior and anterior mTL structures in both healthy volunteers and patients. Regression analysis revealed that the fMRI activation was stronger lateralised to the contralateral hemisphere than the IAP results. Further analysis showed that the LI of the right, but not the left, TLE patients showed a significant relation with the IAP.

Conclusions

A fMRI memory encoding paradigm was developed yielding consistent mTL activation in volunteers and TLE patients. Lateralization of fMRI activation was in concordance with the IAP results for right TLE patients only. The disagreement between the fMRI and IAP results in left TLE patients can be explained by essential differences in brain states during the fMRI and IAP settings, and the favored role of the left mTL for more verbally encodable items which are more used during the IAP than in the fMRI exam.

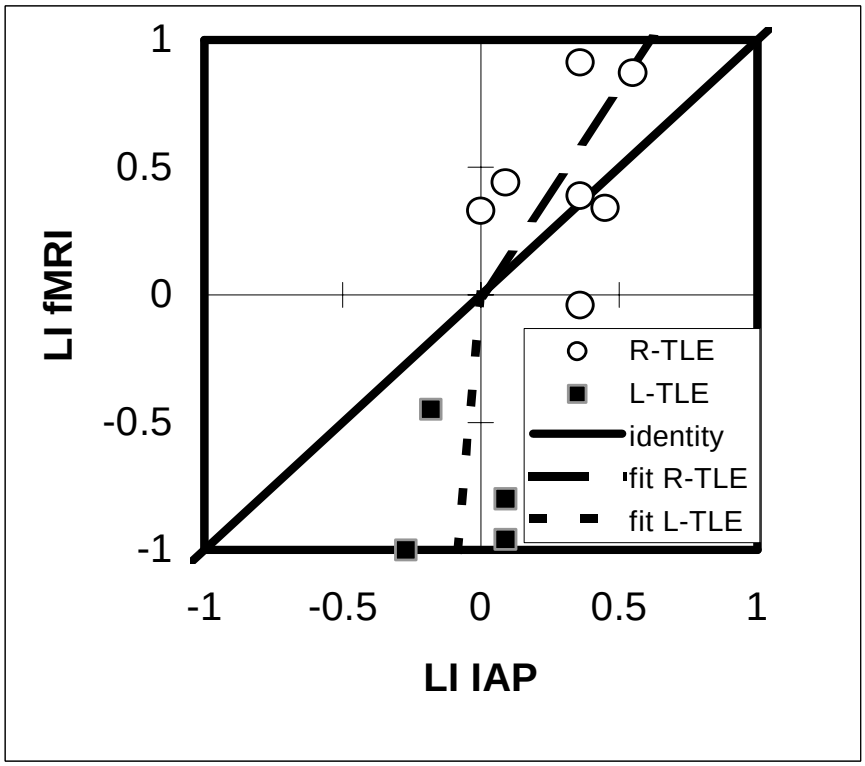

Fig.1
The lateralization index (LI) obtained by fMRI and IAP. RTL= right TLE group, LTL= left TLE group. The identity relation is represented by the (solid) line through the origin with slope 1. The regression lines for the right- and left-sided TLE patients are indicated by the dotted and broken lines, respectively.

References

1. Deblaere K, Backes WH, Hofman P, Vandemaele P, Boon PA, Vonck K et al. Developing a comprehensive presurgical functional MRI protocol for patients with intractable temporal lobe epilepsy: a pilot study. Neuroradiology 2002; 44(8):667-673