Characterization of brain language area during awake surgery using speckle laser imaging

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Introduction

The laser speckle imaging is based on the analysis of speckle patterns produced by the reflection of a laser light on a surface. In a previous study, *Klijn et al.* used speckle laser imaging to monitor changes in motor cortex blood flow during motor tasks performed in awake patients by surgery, finding an activation pattern similar blood-oxygen-level dependent studied in functional MRI (fMRI).

We report in this clinical case the study and detection of brain areas involved in language using laser speckle imaging in a 30 years old patient during awake surgery.

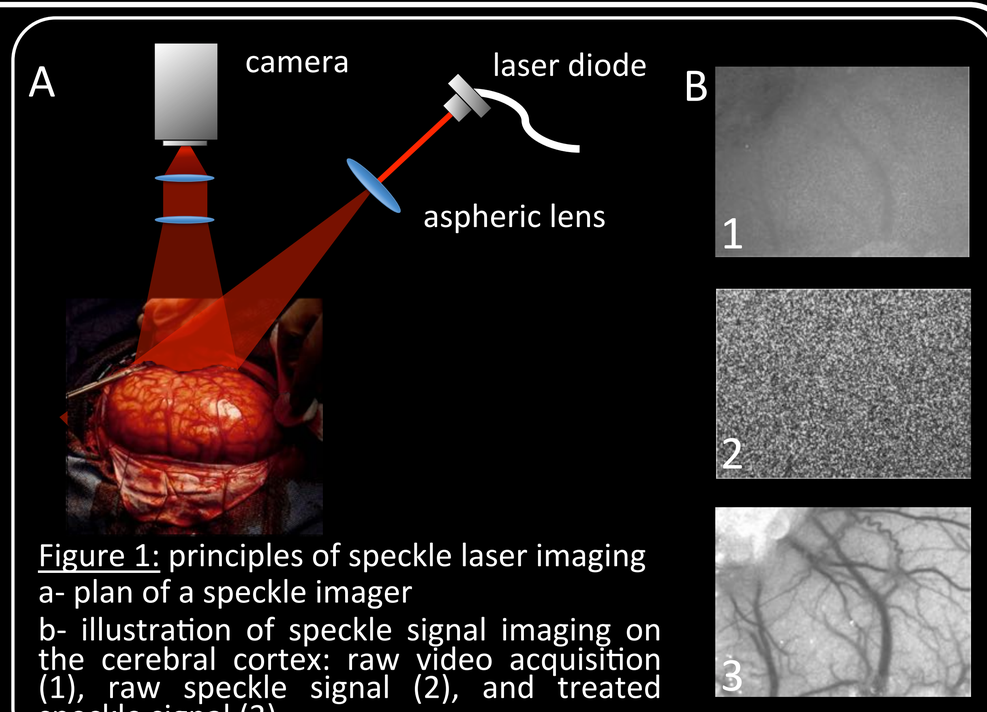

Figure 1: principles of speckle laser imaging
a- plan of a speckle imager
b- illustration of speckle signal imaging on the cerebral cortex: raw video acquisition (1), raw speckle signal (2), and treated speckle signal (3)

Material

Mr J. was hospitalized in the Department of Neurosurgery of the University Hospital of Angers for a posterior temporal glial tumor. Brain areas involved in language were identified preoperatively using fMRI and during the surgery with cortical stimulation mapping.

We studied during surgery the changes in cortical blood flow using a laser speckle Pericam PSI (Perimed) when the patient was performing naming tasks in a block paradigm, identical to the one used during fMRI sequences. The acquired images were then realigned to remove motion artifacts.

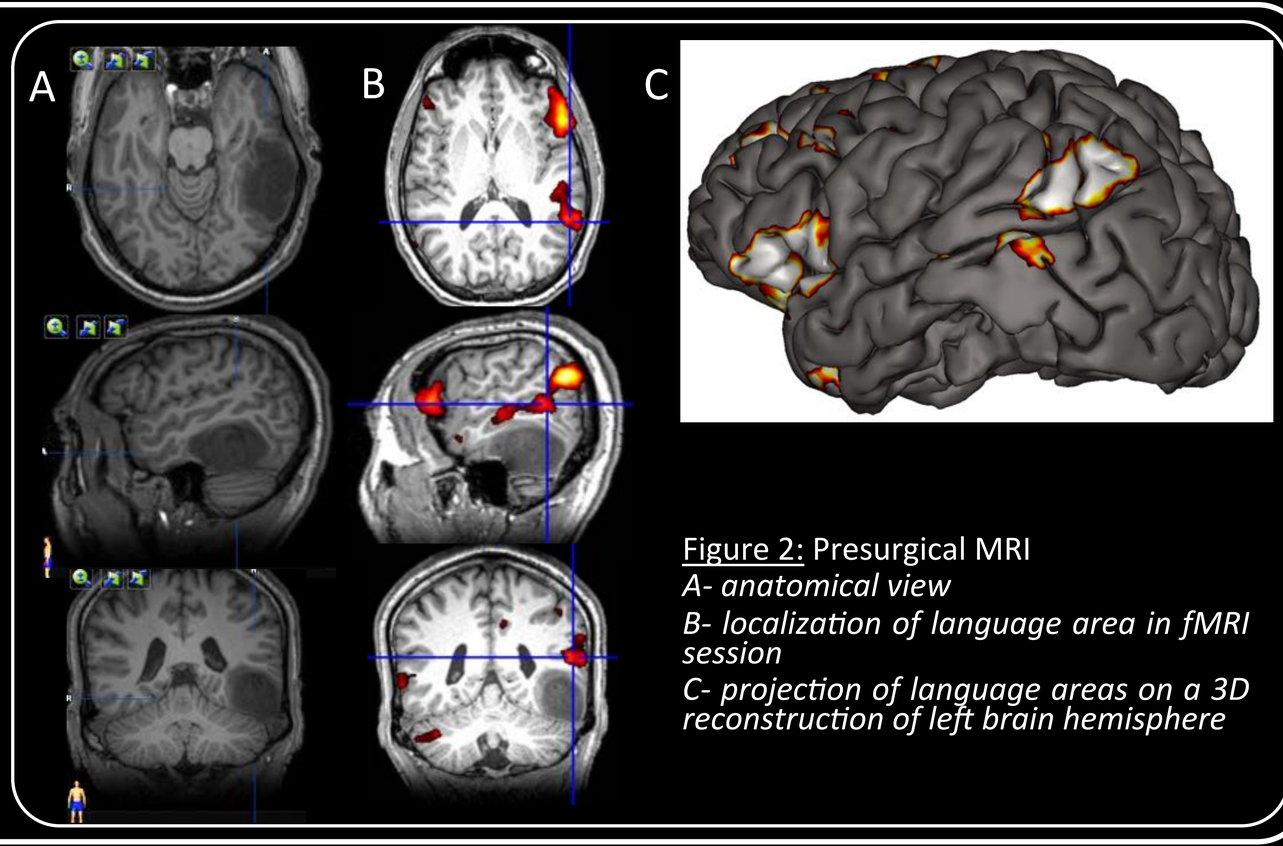

Figure 2: Presurgical MRI
A- anatomical view
B- localization of language area in fMRI session
C- projection of language areas on a 3D reconstruction of left brain hemisphere

Results

During surgery, stimulation of the posterior part of the supramarginal gyrus resulted in a reproducible suspension of language, corresponding to an identified langage area in fMRI (Fig.4, landmark n°1 and 2).

The laser speckle study identified in this particular area a cyclic variation of the local blood flow, increasing during the naming tests and returning to baseline levels during the rest sessions, evoking an activation of this brain area during naming tasks.

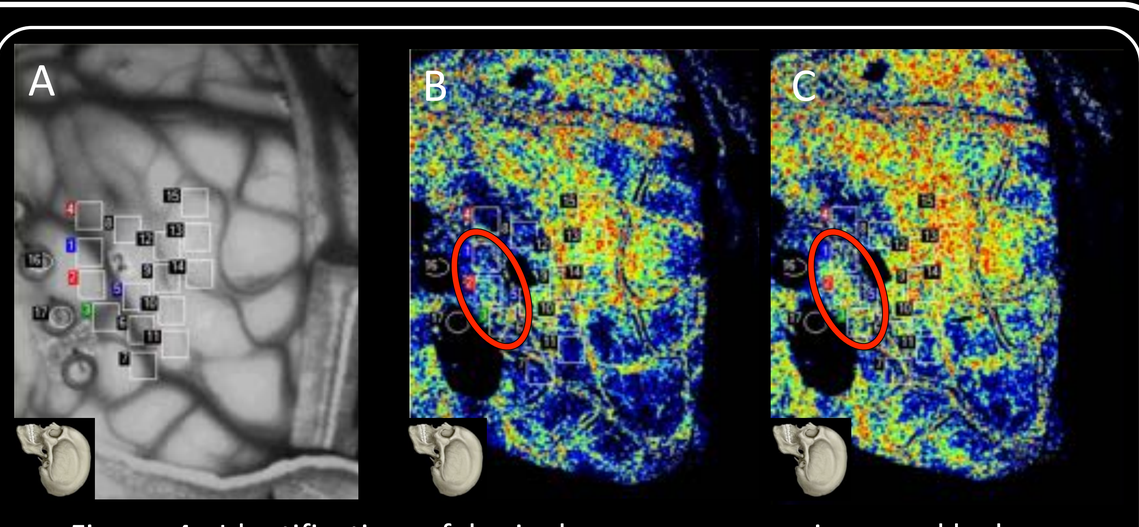

Figure 4: Identification of brain language area using speckle laser imaging. Cortical surface with landmark and voxels for speckle laser analysis (A). Speckle signal acquisition during rest session (B) and during naming test (C).

This case emphasizes the potential implications of laser speckle imaging in the intraoperative analysis of in cortical blood flow variations . A study is currently ongoing in our service to validate the relevance of laser speckle as a means of identifying functional brain areas during awake surgery.