BRAINSTEM ACTIVATION AFTER INJECTION LARYNGOPLASTY FOR UNILATERAL VOCAL FOLD PARALYSIS (UVFP) – LIMRI STUDY

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BACKGROUND

A perfect closure of both vocal folds is essential to allow phonation. A unilateral vocal fold paralysis (UVFP) in abduction causes a glottis leakage responsible for dysphonia, dysphagia and phonatory dyspnea.

The injection of **a temporary filling material** within the vocal fold restores the voice by closing the glottis leak. This procedure is called an **Injection Laryngoplasty (IL).**

A previous study by Dedry et al. (1) showed -*for the first time ever*- **a brainstem mediated neuroplasticity activation after Injection Laryngoplasty (IL)** for Unilateral Vocal Fold Paralysis.

This observation supports the hypothesis that **promoting the restoration of proprioceptive feedback enhances the neural recovery process**.

OBJECTIVES

Although the previous study marked a breakthrough in showing how a short-term vocal fold filler injection could induce lasting voice benefits via brainstem-mediated neuroplasticity, it was only demonstrated in a single patient.

This finding raises several questions:

1. **Does this neuroplasticity response always occur** at the brainstem level following IL for UVFP?
2. Is the occurence of this brainstem response **associated with the severity of nerve damage?**

METHODS

- Prospective study
- 5-10 patients (18-65 y old), no control subject
- Randomized in 2 groups based on the severity of their nerve damage: idiopathic VS post-surgery

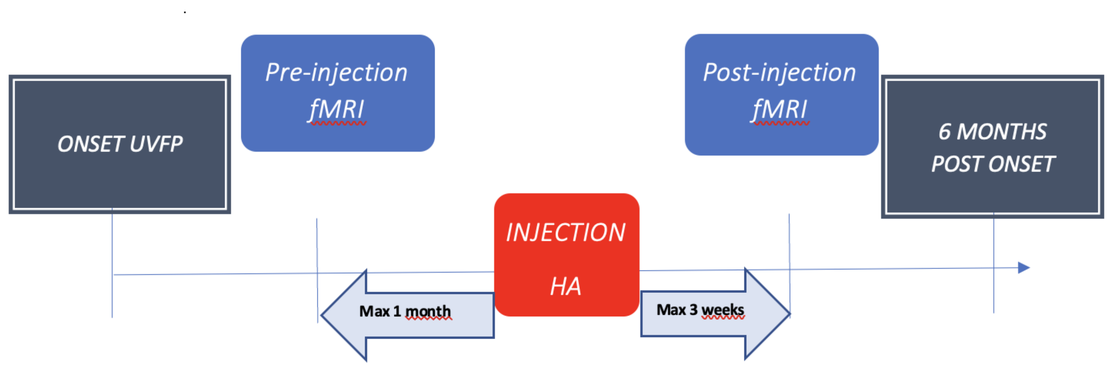

Fig. 1. Timeline of study.
a. Pre-injection functional MRI (fMRI)
b. Hyaluronic acid injection into the paralyzed vocal cord (within one month of fMRI)
c. Post-injection fMRI (within three weeks of injection)

FUNCTIONAL MAGNETIC RESONANCE IMAGING (fMRI)

- fMRI is a specialized MRI technique that visualizes brain activity using computer-generated three-dimensional images
- Anatomical and functional (resting-state and task) sequences will be acquired
- **Task sequences:** brain activity while performing phonatory tasks
- **Resting-state sequences:** brain activity at rest is measured

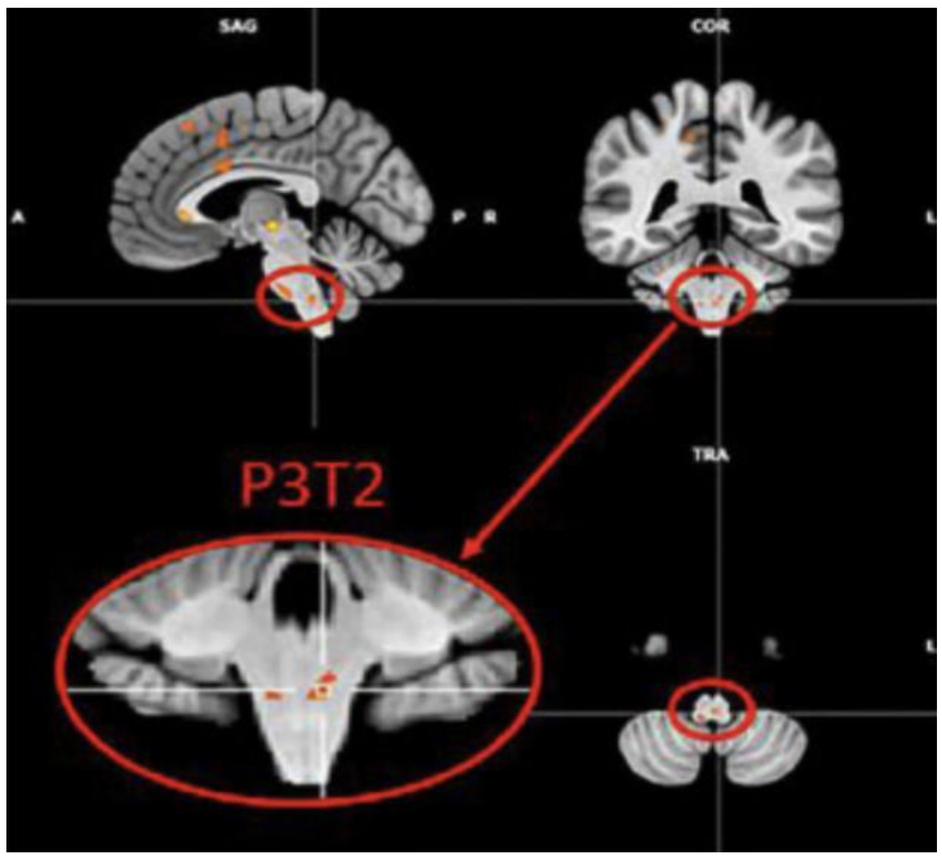

Fig. 2. Activation in the region of ambiguus and solitary tract nuclei at the level of the brainstem after injection laryngoplasty. (1)

DATA PROCESSING AND ANALYSIS

Resting-state fMRI study: Pre-processing analysis to remove artefacts and sources of variance will be performed, followed by co-registration and spatial normalization using BrainVoyager and customized Matlab code (The Mathworks). Cross-correlations between the average time-course signals, extracted from 55 regions of interest that were pre-established by a previous literature review, will be calculated. ANOVA will be used to investigate differences between the MOBILE and PARALYZED maps.

Task-based fMRI study: Functional data will be analyzed using a multiple regression model (general linear model; GLM) consisting of predictors corresponding to the particular experimental conditions: i.e., PHONATION_AUDITION, AUDITION and REST. The used predictor time courses are obtained by convolution of a condition box-car time course with a standard hemodynamic response function (two-gamma HRF). Whole brain analysis for each participant and for each assessment time point, to determine, without a priori functional localization, the involved regions for the PHONATION contrast.

WE ARE LOOKING FOR…

We are seeking **two enthusiastic students** for collecting, cleaning, analyzing, and interpreting the fMRI data sets:

1. Examining changes in brain activity during the resting state before and after IL.
2. Investigating if a brainstem-mediated neuroplasticity response occurs after IL in each patient and whether this response relates to the severity of nerve damage.
3. Knowledge of English/French would be an asset as collaboration with other universities might be sought.

References
1. Dedry M, Dricot L, Van Parys V, Boucquey D, Delinte N, van Lith-Bijl J, Szmalec A, Maryn Y, Desuter G. Brain adaptation following various unilateral vocal fold paralysis treatments: A magnetic resonance imaging based longitudinal case series. Front Neurosci. 2022 Oct 5;16:947390. doi: 10.3389/fnins.2022.947390. PMID: 36278014; PMCID: PMC9580273.