Feasibility of real-time MRI of true vocal fold paralysis

Tanner Sorensen MS[1], Alison Yu[2], Asterios Toutios PhD[1], Brenda Villegas, SLP-CCC[2], Melody Ouyoung, SLP-CCC[2], Shrikanth S Narayanan PhD[1], Uttam K Sinha MD, MS, FACS[2]

[1]Signal Analysis and Interpretation Laboratory, University of Southern California
[2]Keck School of Medicine, University of Southern California

Summary

- Vocal fold adduction and abduction are disrupted in true vocal cord paralysis due to recurrent laryngeal nerve injury [2].
- Real-time magnetic resonance imaging (MRI) dynamically resolves vocal fold adduction and abduction as it occurs in real time.
- **Objective:** Evaluate the technical performance of real-time MRI for visualizing and quantifying vocal fold movements in speech.

Magnetic resonance imaging

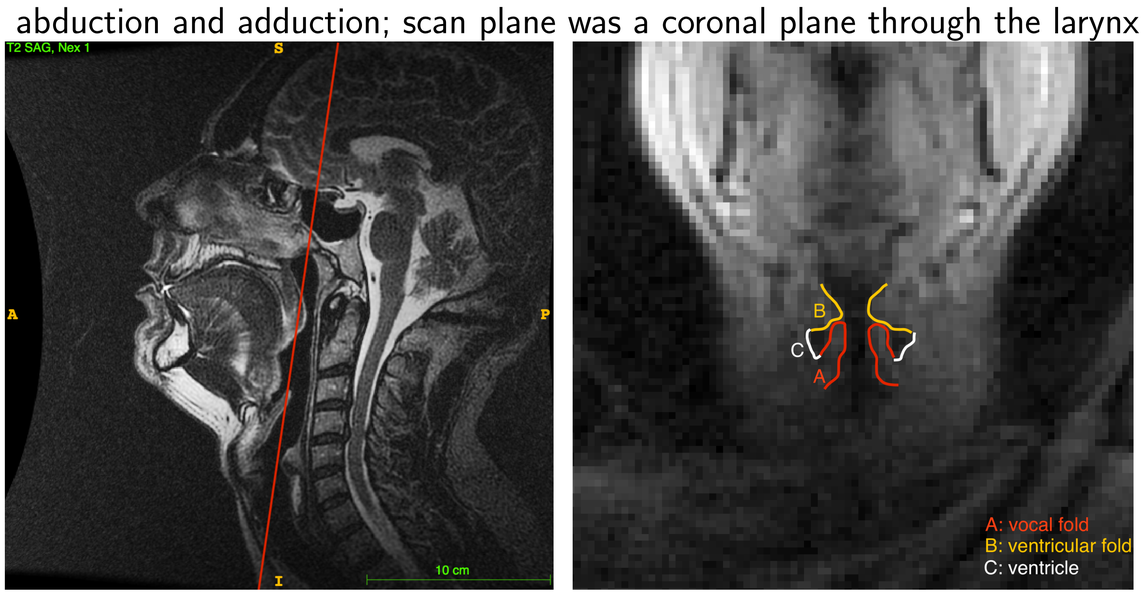
Scanner hardware: 1.5 T scanner; custom 8 −channel coil

Scanner pulse sequence: real-time spiral sequence; 200 mm × 200 mm field of view; 6 mm slice thickness; 15° flip angle; 2.5 ms readout time; 6.004 ms repetition time (TR)

On-the-fly reconstruction: gridding reconstruction algorithm with 78 ms temporal resolution and <100 ms latency

Retrospective reconstruction: sparse-SENSE constrained reconstruction algorithm; 12 ms temporal resolution; 2.4 mm × 2.4 mm in-plane spatial resolution

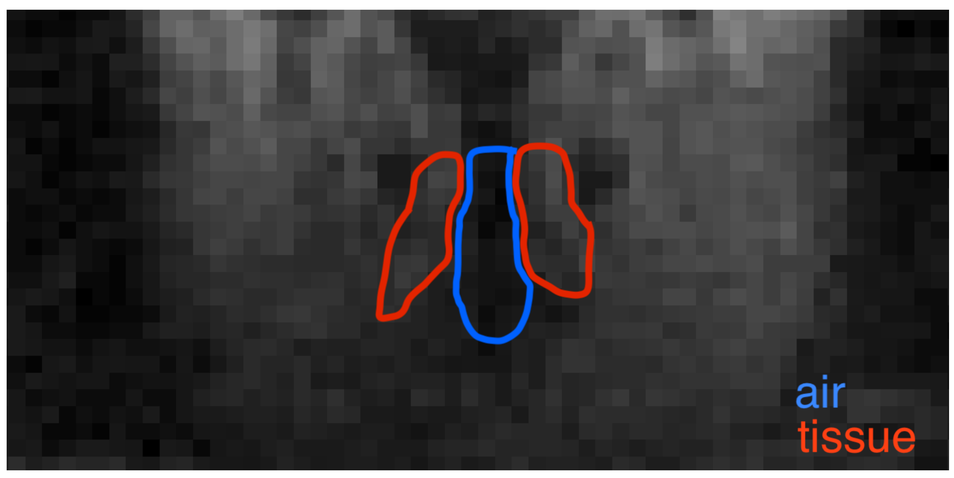
Protocol: Healthy volunteer reads aloud set of phrases that elicited vocal fold abduction and adduction; scan plane was a coronal plane through the larynx



Contrast-to-noise ratio

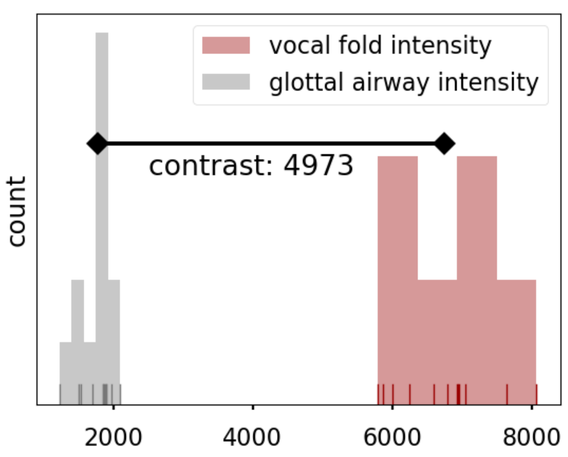
Segmentation

Glottal airway and vocal fold tissue were manually segmented in a random subset of real-time images ($n = 12$).



Result

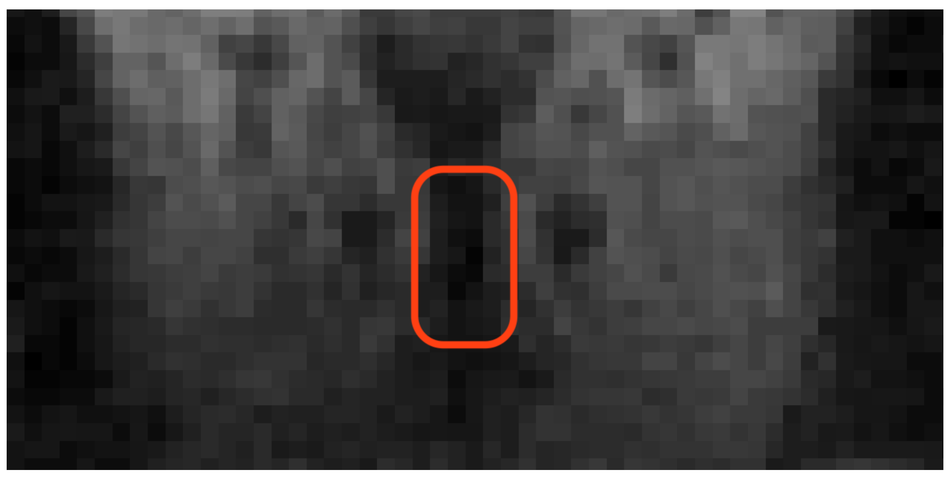
Average contrast-to-noise ratio was 5.62±1.75 (n=8).
Tissue-air contrast was consistently larger than noise level.



Range of motion for glottal adduction

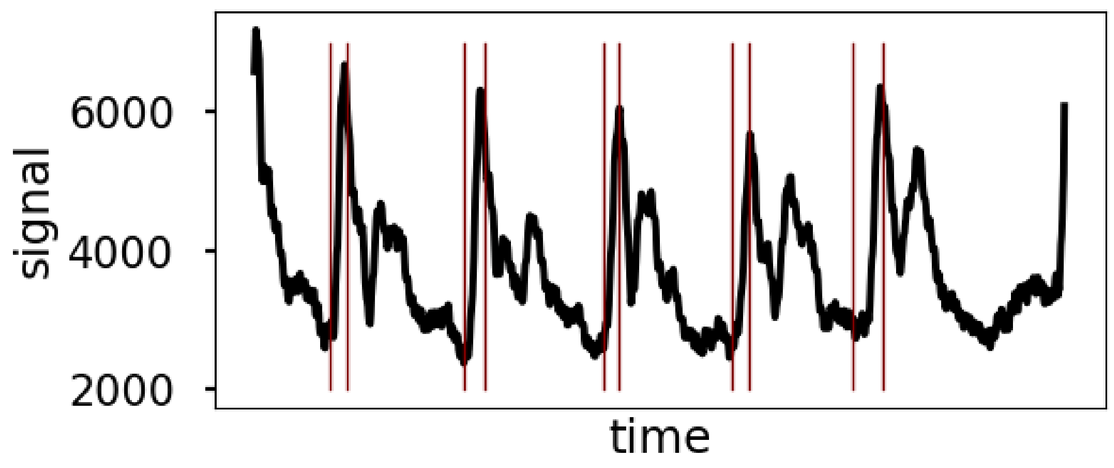
Region of interest

Region of interest was manually placed at the glottal midline.



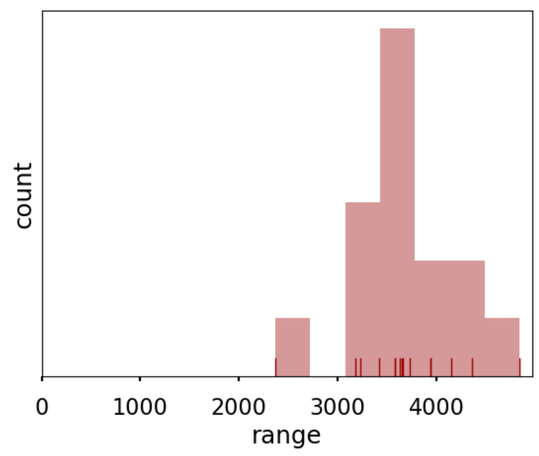
Timecourse of motion

Variation in MR signal intensity within the region of interest indicates vocal fold adduction (increasing signal) and abduction (decreasing signal).



Result

MR signal increases during adduction and decreased during abduction.
Analysis reliably tracks the vocal folds as they enter and exit region of interest.



Conclusions

- Visualizing and quantifying vocal fold adduction and abduction is feasible with real-time MRI due to high contrast between the vocal fold and airway.
- Real-time MRI may provide quantitative outcome measures for clinical research on vocal cord paralysis treatment and rehabilitation.

Future research

- Quantify MR signal difference between healthy volunteers and patients
- Compare MRI to endoscopy results
- Develop method for computer-assisted scan plane localization

References

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