

Lung: Upper Airway

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- Advanced MRI techniques can offer insights into the function and dysfunction of the upper airway which include speech, swallowing and airway narrowing as seen with obstructive sleep apnea (OSA)
- OSA is the most common form of sleep apnea which is characterized by fragmented sleep caused by recurring arousals from episodes of sleep-induced airway collapse
- “Sleep MRI” is a non-invasive technique which can localize and characterize airway collapse without the use of a medication-induced sleep.
- The potential for “Sleep MRI” includes gaining a greater understanding of the pathophysiology of OSA and problem solving for why and how alternative OSA therapies fail.

Title: MRI of the Upper Airway

Target audience: Radiologists, MRI researchers, and clinicians interested in MRI of the upper airway with specific focus on “Sleep MRI” in the context of OSA.

OUTCOME/Objectives: Participants will gain greater insight into the clinical background and problems associated with OSA, as well as understand the challenges of establishing a “Sleep MRI” protocol.

PURPOSE: Obstructive sleep apnea is a common sleep disorder. The gold standard treatment is positive airway pressure (PAP) therapy, which does not require knowledge of the site(s) and severity of upper airway collapse because all site(s) are treated with this method. PAP therapy requires OSA patients to wear a mask-tubing apparatus that “splints” the airway open during sleep. PAP therapy is often poorly tolerated with high non-compliance rates of over 50% while non-CPAP alternative therapies suffers from poor efficacy rates (up to ~60%)¹; the latter of which has been attributed to inaccurate localization and estimation of airway collapse.

METHODS/RESULTS/DISCUSSION: OSA upper airway imaging has generally entailed “static” imaging with cephalography, CT and MRI while the patient is awake; in efforts to more accurately duplicate sleep-induced airway collapse, more recently sleep nasoendoscopy (i.e. direct visualization via a fiberoptic camera) and many dynamic sleep MRI protocols have utilized medication-induced sleep for collapse evaluation. As medications can variable depress airway tone and respiratory drive, “Natural-Sleep” real-time MRI offers unique advantages that can increase our understanding of OSA and non-CPAP failures. Various MRI approaches will be reviewed that include dynamic single-plane, multi-planar² and 3D imaging³; advantages and disadvantages will be discussed. Major challenges of establishing a robust sleep MRI protocol and strategies how to address MRI acoustic noise, patient setup (e.g. comfort, etc), and physiologic-data monitoring will be reviewed. The potential utility of “Sleep MRI” will be illustrated via clinical cases of the various types of airway collapse.

CONCLUSION:

Sleep MRI of the upper airway offers great potential in deepening our understanding of the airway collapse in OSA that may lead to better clinical outcomes by improving the selection of non-PAP therapies as well as understanding/visualizing why existing non-PAP therapies fail.

REFERENCES:

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