Imaging the Dynamic Airway in Professional and Amateur Wind Musicians Using Cine MR Techniques

Tiffany Peng, BA, 1, 2 C. Douglas Phillips, MD, 3 Jonathan P. Dyke, PhD, 4 Michael G. Stewart, MD, MPH
1 Department of Otolaryngology-Head and Neck Surgery, Weill Cornell Medical College, New York, New York, U.S.A.
2 Department of Radiology, Weill Cornell Medical College, New York, New York, U.S.A.

INTRODUCTION

Playing a wind instrument is known to increase risk for certain oropharyngeal disorders, such as laryngooceles, embouchure dystonia, and velopharyngeal stress incompetence.1-5 However, there is limited evidence of modified risk for other medical conditions. The purpose of this study was to use cine MRI (CMR) to first assess the feasibility of dynamic assessment of the upper airway during instrument playing, and then to evaluate for anatomical differences in the upper airway between professional and amateur wind musicians.

METHODS

Each subject was given MRI-compatible equipment, and asked to perform a series of tasks while being studied with an 8-channel head coil in a Siemens Trio® 3T MRI. Both dynamic and static images were recorded in the mid-sagittal plane using T1-weighted CMR. The tasks included vocal phonation, tone production in 3 octaves, and performing a scale. Our study population was 15 professional and 15 amateur musicians, including 10 each saxophonists, trombonists, and trumpeters. Professionals were defined as full-time musicians whose sole source of income is instrument performance. Amateurs were defined as musicians who receive no payment for performance. The mean age of participants was 28.8 years (range = 20-61 years). Dynamic images were reviewed, and qualitative comparisons were made. Representative still images were captured, and anatomic measurements were made at five consistent locations in the oral cavity and oropharynx for statistical comparisons [Fig. 1]. Data were analyzed for displacement, percentage change from baseline, and consistency across trials. Comparisons were made between amateur and professional musicians, and between instrument types. Statistical significance was calculated with the Mann-Whitney U Test.

RESULTS

There was no difference between amateurs and professionals in vowel phonation; however, professionals utilized a narrower oropharyngeal airway during performance [Fig 2]. Analysis showed shorter mid-tongue-to-palatal height in professional brass players (p=0.01-0.05 across all trials), decreased narrowest point among all professionals (p=0.01-0.08), and decreased airway area among all professionals (p=0.07-0.4) [Fig 3-5].

DISCUSSION

Sound generation in wind instrument performance is dependent upon vibrations produced when air passes across a material, such as the lips or a reed.6 Prior studies have demonstrated that peak expiratory flow is no higher among wind musicians compared to non-musicians.3 In this study, we utilize an innovative CMR sequence in the oral cavity to demonstrate that professional wind musicians produce air speed for performance by raising the tongue against the hard palate, narrowing the airway and compressing the air stream. Though further studies are required to better understand oropharyngeal conditions among wind musicians, our findings reveal mechanisms that may prove useful in the evaluation of these potentially career-ending conditions.7-10 Limitations of this study include small sample size, few instruments studied, supine position during scan, and potential geographical training bias.

CONCLUSION

Professionals performed with a narrower airway than amateurs, accomplished by elevating the tongue against the hard palate. The differences between professionals and amateur musicians are visible on video imaging to the trained observer. Cine MR is a useful tool for assessment of dynamic motion in the oral airway.

REFERENCES