ABSTRACT

Objectives The purpose of this study was to determine the incidence of balloon dilation-induced cricoid ring fractures in adult larynx ex-vivo model using micro Computed Tomography scanning and any relation to demographics or balloon type.

Study Design Cadaveric study

Methods 14 fresh frozen human larynges were evaluated using micro-tomography before and after balloon dilation with an Acclarent tracheal balloon dilator or a Boston Scientific esophageal balloon dilator. Scans were compared to identify any cricoid fractures and results were analyzed by logistic regression analysis for variables of balloon type, average diameter of each larynx, gender, and age group

Results Cricoid fracture incidence was 14%, all located at the anterior lamina. There were no statistically significant correlations on logistic regression analysis between presence of cricoid fracture and age group ($\chi^2=0.5379$), balloon type ($\chi^2=0.1266$), or average diameter ($\chi^2=0.5123$). There was a statistically significant correlation between fracture and female gender ($\chi^2=0.0404$). Further analysis showed no correlation with gender and balloon type.

Conclusion Adult cadaveric cricoid cartilage fracture after balloon dilation is low, with an incidence of 14% in this study. Fractures were only observed in female larynges, which was a significant correlation although the power of the study is low. Micro CT is a useful method to evaluate ex vivo specimens for both bony and soft tissue specimens that may be useful in future studies. However, future study of in vivo cricoid cartilage fracture after balloon dilation in adult subjects is needed.

CONTACT
Micaela Dagucon MD
San Antonio Uniformed Services Health Education Consortium
Email: micaela.dagucon.mil@mail.mil
Phone: 505-280-1984

INTRODUCTION

Laryngotracheal and tracheobronchial stenosis (LTS) can be a challenging congenital or acquired condition. Balloon dilation results in decreased trauma and shearing of healthy tracheal mucosa, as well as minimizing trauma to deeper mucosal layers with equal concentric or radial outward pressure created by the balloon. There is debate in the literature whether a dilation of developing scar tissue occurs or if there is a cartilage cartilage fracture created. An animal model has suggested that a cricoid fracture to the anterior cricoid ring may be the mechanism, yet this has not been shown in humans. The purpose of our study was to determine the incidence of balloon dilation-induced cricoid ring fractures in adult cadaveric larynges using micro-computed tomography (CT) scanning.

METHODS AND MATERIALS

- Fourteen fresh frozen cadaveric larynges were dissected (Figure 1). - MicroCT was performed pre and post dilation to assess full thickness cricoid fracture, and average airway diameter (Figure 2, Figure 3) - Specimens were randomized for dilation between Acclarent tracheal balloon dilator 16mm and Boston Scientific esophageal balloon dilator 20mm - Logistical regression compared: - age group (55-75 and >75), - gender, - balloon type, - average diameter of the airway

RESULTS

-Anterior cricoid fractures were found in 14% (2/14) - Both observed cricoid fractures were from the 20mm Boston Scientific esophageal balloon dilator - Acclarent 16mm tracheal balloon dilator did not cause a cricoid fracture in any specimen - No statistically significant correlations on logistic regression analysis between presence of cricoid fracture and age group ($\chi^2=0.2166$), or average diameter ($\chi^2=0.5123$) (CI: 95%, alpha=0.05). - There was a statistically significant correlation between fracture and female gender ($\chi^2=0.0040$)

CONCLUSIONS

- Adult cadaveric cricoid cartilage fracture after balloon dilation is uncommon - The anterior cricoid ring was identified as the only site of fracture - Fractures were only observed in female larynges with dilations using the Boston Scientific 20mm esophageal balloon dilator at 6atm of pressure - Micro CT is a useful method to evaluate both bony and soft tissue ex vivo specimens. - Future study of in vivo cricoid cartilage fracture after balloon dilation in adult subjects is needed.

REFERENCES


Figure 1. Dissected specimen with specimen cup and impression molding Figure 2. MicroCT chamber Figure 3. post-dilation MicroCT with fracture