Retrospective Application of a Novel *Tracheal Access Roughness* Classification System to Randomly Selected Video Laryngoscopy Intubations
A Tracheal Access Roughness Grading System

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Introduction

Recent studies demonstrate the main intubation failure mode using Video Laryngoscopes (VL) is failure to access the trachea despite adequate visualization. [1,2] Glottic harm is well known after intubation.[3] Systematic study of tracheal access (Endotracheal tube placement (ETT)) during intubation with VL is lacking. We apply a novel ***Tracheal Access Roughness*** (TAR) grading system to understand roughness of tracheal access during VL intubations.

Methods

The study was approved by the University of Utah IRB.
Recordings of randomly selected VL intubations from a database of automatically collected random operating room VL intubations were reviewed to determine if an intubation attempt was made in the recording; resulting in 94 VL intubations included for review by two trained anesthesiologists.

Endpoints: 1) CL grade; 2) Total Attempt Time (Insertion of VL to ETT cuff through glottis); 3) Total Tracheal Access Time: (Appearance of tracheal access equipment in the field of view to balloon through glottis); 4) Total Tracheal Access Time: (Appearance of tracheal access equipment in the field of view to balloon through glottis); 5) Visual Trauma: (new blood or ecchymosis). A TAR grade was applied to each intuabtion. (See table 1.)

	Redirection of Tracheal Access Equipment	Rotation of endotracheal tube	Displacement of glottic structures	Visible Trauma
TAR Grade 1 Smooth	Single smooth forward motion	None	None	None
TAR Grade 2 Moderately Rough	1-3 reversals or redirections	Spinning of ETT	Moderate	None
TAR Grade 3 Rough	>3 reversals or redirections	Spinning of ETT	Severe	New blood or ecchymosis
TAR Grade 4 Failed Tracheal Access	Failed intubation	Failed intubation	Failed intubation	Failed intubation

Table 1. Tracheal access roughness (TAR) grading criteria

Results

TAR Grade (Tracheal Access Roughness)	CL Grade 1 or 2 View	Incidence of TAR Grades	Total Attempt Time Avg (SD) Seconds	Tracheal Access Time Avg (SD) Seconds
Grade 1 Smooth	100%	41/94 (43%)	20.0 (11.5)	12.3 (7.9)
Grade 2 Moderately Rough	100%	**36/94 (38%)**	28.6 (13.4)	19.7 (9.5)
Grade 3 Rough	100%	**17/94 (18%)**	42.3 (16.8)	29.6 (16.4)
Grade 4 Failed	100%	1/94 (.01%)	98	63

Table 2. Results

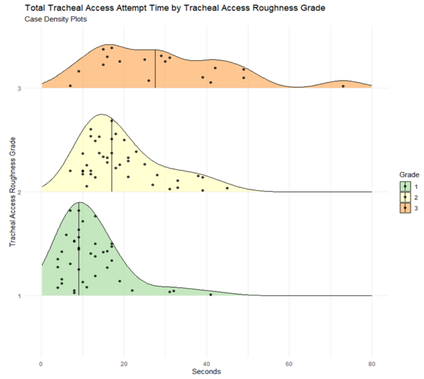

Figure 1. Tracheal Attempt Access Rime Case Density Plots by TAR Grade.

Conclusions

Conclusions: Little is systematically known about tracheal access in VL intubation. The glottis is a delicate structure at risk of harm during intubation. The TAR classification system may be a useful tool in studying, understanding, and reducing tracheal access trauma during VL intubations.
Less than half of attempts were TAR Grade 1; smooth tracheal access.
Increasing TAR grade was associated with longer *total intubation attempt times* and longer *tracheal access times* raising the question, *'Should tracheal access attempt times be limited to reduce patient harm?'*. (See figure 1.)
Establishing base lines for TAR grades may be an important risk management tool for VL intubations.
Currently, TAR grades are not linked to actual patient harm. The next step is to link roughness of tracheal access to the incidence of hoarseness and loss of voice after VL intubation to understand any correlation to real harm.

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Disclosures

SR is a share holder in TTCmed.com.

References

1.Phelan HM, Stobbs SL, Sorbello M, Ward PA, McNarry AF. A prospective cohort evaluation of the McGrath™ MAC videolaryngoscope in a series of 979 cases. *Trends in Anaesthesia and Critical Care*. 2023;48. doi:10.1016/j.tacc.2022.101209
2.Prekker ME, Driver BE, Trent SA, et al. Video versus Direct Laryngoscopy for Tracheal Intubation of Critically Ill Adults. *New England Journal of Medicine*. 2023;389(5):418-429. doi:10.1056/nejmoa2301601
3.Homsi JT, Brovman EY, Greenberg P, Urman RD. A closed claims analysis of vocal cord injuries related to endotracheal intubation between 2004 and 2015. *J Clin Anesth*. 2020;61. doi:10.1016/j.jclinane.2019.109687