

Impact of the Percutaneous Tracheostomy on the Human Trachea *in vivo*

Ivan Valkadinov¹, Desislava Cherneva¹, Nikolay Sapundzhiev¹, Lora Nikiforova¹, Viliyan Platikanov²

¹Division of Otorhinolaryngology, Department of Neurosurgery and ENT Diseases, Medical University of Varna, Bulgaria

²Department of Anesthesiology, Emergency, Intensive and Maritime Medicine, Medical University of Varna, Bulgaria

Introduction

Percutaneous dilatational tracheostomy (PDT) has gained increasing popularity among intensive care units, since its introduction by Ciaglia et al in 1985. [1] Despite the clear advantages, it does have limitations and risks. Most of the disadvantages stem from the decreased control over the technical aspects of the procedure, mainly due to limited exposure and decreased visualization of the trachea. [2]

Materials and Methods

The aim of this study is to quantitatively and qualitatively describe the effect of PDT on the trachea *in vivo*. Retrospective study of endoscopic video material from the clinic's archive was performed. The impact on the trachea was visually interpreted and summarized. Account was taken for the degree of narrowing of the tracheal lumen on pressure application, proximity and contact of the used instrument with the posterior tracheal wall and any visible traumatic consequences on the tracheal mucosa and cartilaginous skeleton.

Three sets of instruments were examined, namely PercuTwist (PT), Ciaglia and Griggs.

References: [1] Ciaglia P, Firsching R, Syniec C. Elective percutaneous dilatational tracheostomy. A new simple bedside procedure; preliminary report. *Chest*. 1985 Jun. 87(6):715-9. [2] Kost KM. Endoscopic percutaneous dilatational tracheostomy: a prospective evaluation of 500 consecutive cases. *Laryngoscope*. 2005 Oct. 115(10 Pt 2):1-30.

Results

An average of 70% luminal narrowing was observed for the Ciaglia, 67% for the Griggs and 25% for the PercuTwist with 77, 25 and 0% rate of contact with the posterior wall, respectively. These indices were further differentially calculated for the stages of the procedure, relatively to the appearance of the instrument in the lumen: on pressure application, on first penetration and full penetration of the dilatator in the tracheal lumen. The degree of luminal narrowing for the three instruments on each step is presented on **Table 1**. We also observed whether the instrument itself comes into contact with the posterior tracheal wall, when pressure was introduced and the tip of the dilatator is already in the tracheal lumen – these are shown in **Table 2**. Injury of the trachea was observed in the Ciaglia and Griggs groups, e.g. laceration of the mucosa, fracture of tracheal cartilages and mucosal irritation by the guiding wire.

	Pressure application	Fist penetration	Full penetration
PT	25%	25%	25%
Ciaglia	63%	83%	75%
Griggs	85%	50%	38%

Table 1 Degree of luminal narrowing of the tracheal lumen in percentages of the total diameter at the different stages of the intervention.

	Away	In proximity	Contact
PT	100%	None	None
Ciaglia	8%	15%	77%
Griggs	25%	50%	25%

Table 2 Rate of relative position of the instrument in the tracheal lumen to the posterior tracheal wall on pressure application by the operator. Rate of contact of the instrument to the posterior tracheal wall.

Note that in one case there was contact with the lateral walls as well. Since before penetration the instrument is not inside the lumen, these results are calculated relative to the total number of pressure applications at first and full penetration of the instruments.

Fig. 1 clearly demonstrates the effect of pressure exertion on the lumen dimensions (A – normal, B,C). Also a mucosal laceration (C) and tracheal cartilage fracture (D) is visible.

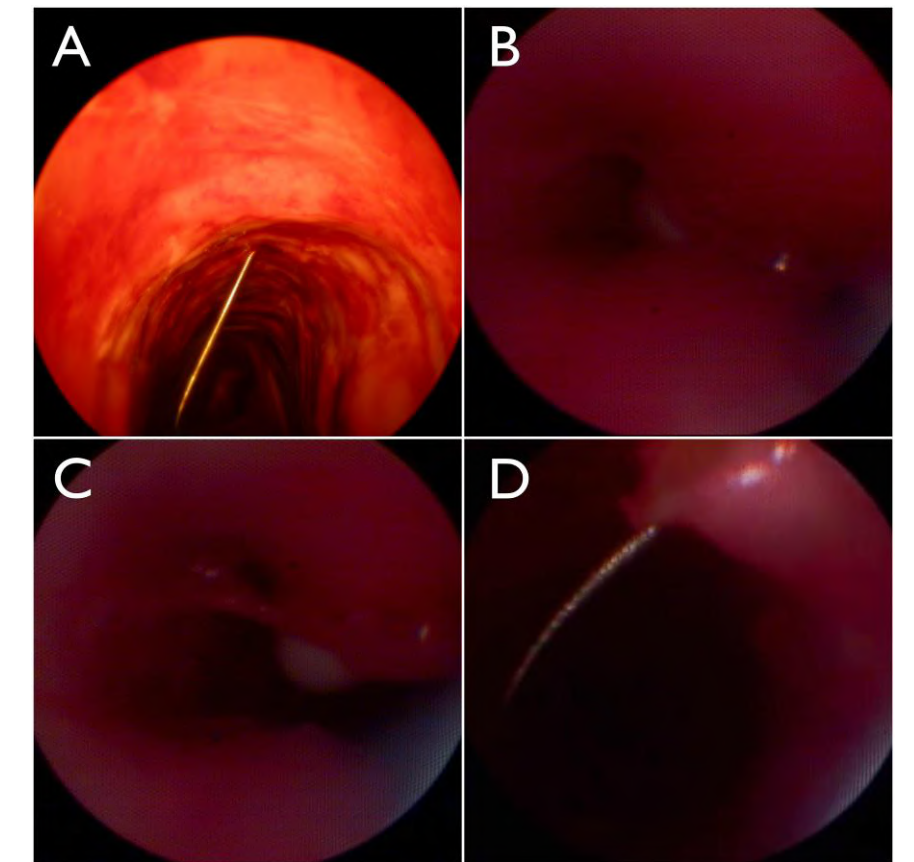


Fig. 1 Impact of PDT on the human trachea *in vivo*.

Conclusion

The study results show significant luminal narrowing when applying pressure with the dilatator, significant amount of contact between the dilatator of tracheal wall and visible injury. It suggests that PDT is a relatively traumatic procedure.

