

THE USE OF ARTIFICIAL INTELLIGENCE FOR CORRECT SIZING OF ENDOTRACHEAL TUBES

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Introduction

- The correct sizing of paediatric endotracheal tubes (ETTs) can be difficult.
- Too large a size can result in an inability to intubate the airway, subglottic pressure necrosis and airway oedema.
- Too small a size can result in difficult ventilation with a leak.
- Traditional methods of sizing ETTs are based on age derived formulas (Khine, Motoyama, Cole) that are known to be imprecise.
- Artificial intelligence (AI) is a novel tool that is increasingly used in anaesthesia.

Traditional ETT sizing formula

Cuffed ETT size:

Khine: age (years)/ 4 + 3

Motoyama: age (years)/ 4 + 3.5

Uncuffed ETT size:

Cole: age (years)/ 4 + 4

Methods

- A baseline data set of 508 intubations was created.
- Data collected included final size ETT used, number of attempts, size change, associated predictive variables of weight and height.
- AI software Alteryx™ performed data validation removing 11 outliers.
- DataRobot™ processed the data set with prediction modelling.
- Several AI models used with Nystroem Kernel SVM Regressor model being the most accurate.

AI ETT sizing derivation

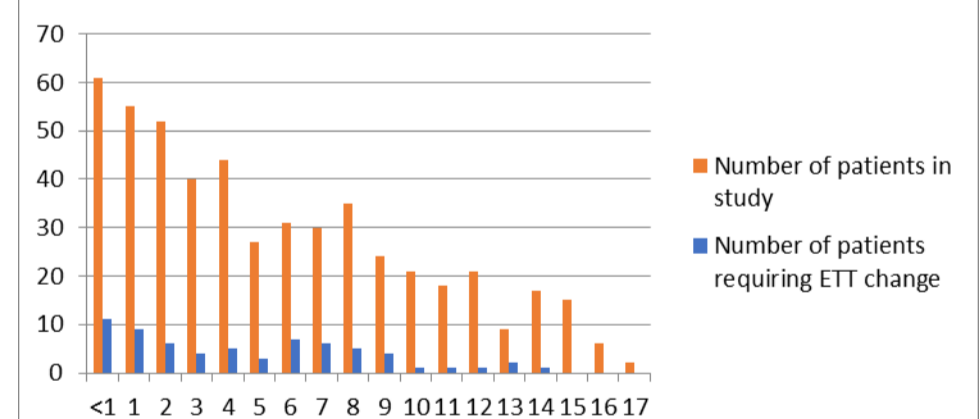


Results

Formula used	Khine	Motoyama	Cole	Data-Robot™ (uncuffed)	Data-Robot™ (cuffed)
Correct size ETT prediction	22%	38%	42%	55%	53%

- 18.2% (57/277) uncuffed ETT required a change
- 3.9% (9/229) cuffed ETT required a change

Patients requiring a change of Endotracheal Tube by age



Discussion

- The need for successful first time intubation has increased given the risk of SARS-CoV-2 transmission¹.
- The rate of first time successful ETT size selection was increased by AI prediction whether it be cuffed or uncuffed.
- The rate of our cuffed ETT exchange was lower than reported (18.2% vs 30.8) but higher for cuff ETT (3.9% vs 2.1%)².
- The AI continuously reviews new data so increased use may further improve success rate.
- The AI algorithm allows for a bespoke model for individual hospitals and their respective patient cohorts.

Sláinte Leanaí Éireann



Children's Health Ireland

References

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2. Weiss M, Dullenkopf A, Fischer JE, Keller C, Gerber AC. Prospective randomized controlled multi-centre trial of cuffed or uncuffed endotracheal tubes in small children#. *Br J Anaesth*. 2009 Dec 1;103(6):867–73.