

[NM-186] In vitro and in vivo validation of a novel syringe device with a digital readout for measuring the intracuff pressure in cuffed endotracheal tubes

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Introduction

With the recent change in the practice of pediatric anesthesia towards the use of cuffed endotracheal tubes (cETTs), it has been recommended that the cuff pressure (CP) be monitored in order to prevent potential airway complications. However, most of the current methods available to measure the CP seem too cumbersome or expensive to be used for routine clinical practice. A portable, less expensive and much simpler syringe-like manometer (SM) (AG Cuffill, Hospitech Respiratron, Kiryat Matalon Petach-Tikva) has been recently devised to give a direct measurement of the CP. In this study, we evaluated the accuracy of this SM to measure the CP.

Methods

For the in vitro portion of the study, cETTs of sizes 4.0, 5.0 and 6.0 mm ID were placed into PVC tubes and the cuffs were inflated using the SM to create a seal. The CP was then measured simultaneously from the SM and a standard manometer (MM) (Fig.1). A total of 100 readings were obtained from each of the 3 sizes of cETTs and the results were compared.

After obtaining IRB approval, an in vivo study was conducted in pediatric patients who required general anesthesia and placement of cETTs. Following endotracheal intubation, the cuff was inflated by the air-leak CPAP method and the CP was measured simultaneously using the SM and MM and the results were compared.

Statistical analysis included a linear regression analysis and Bland-Altman test to determine the bias, precision, and 95% levels of agreement (LOA).

Results

Statistical analysis of the in vitro measurements is presented in Table 1.

For the in vivo study, the cohort included 31 pediatric patients, ranging in age from 1.2-15 years and in weight from 9.2-71 kgs. There were 20 boys and 11 girls. The size of the cETT ranged from 3.5 mm to 7.0 mm ID. Statistical analysis of the in vivo measurements is also presented in Table 1.

Discussion

There are a number of benefits in using cETTs including decreased incidence of reintubation, improved ventilation dynamics, lower cost related to decreased wastage of inhalational agents and better ETCO₂ tracing. Though the introduction of newer generation cETTs with a bigger safety margin has made it popular for pediatric use, accidental hyperinflation is always possible. Avoiding hyperinflation of the cuff is important especially in the pediatric population, as the mean arterial pressure is lower. This study demonstrated a clinically acceptable correlation between the CP readings obtained from the SM and MM both in vitro and in vivo. This novel device appears to be a reliable, simple, portable and cheap alternative to ensure the CP is within the acceptable range.

	Parameter	In vitro			In vivo
		4.0mm ID cETT	5.0mm ID cETT	6.0mm ID cETT	
Linear Regression Analysis	R ² Value	0.9993	0.9991	0.9986	0.9939
Bland-Altman analysis	Bias ± precision (cm H ₂ O)	-1.83 ± 0.59	-1.88 ± 0.59	-2.06 ± 0.65	-1.29 ± 0.74
	Level of Agreement (cmH ₂ O)	-2.98 to -0.68	-3.04 to -0.72	-3.33 to -0.79	-2.73 to 0.16

