

Cuff Pressure Effects on Signal Amplitude Using the Teves Phonocardiographic Recording Endotracheal Tube: An In-Vitro Laboratory Study

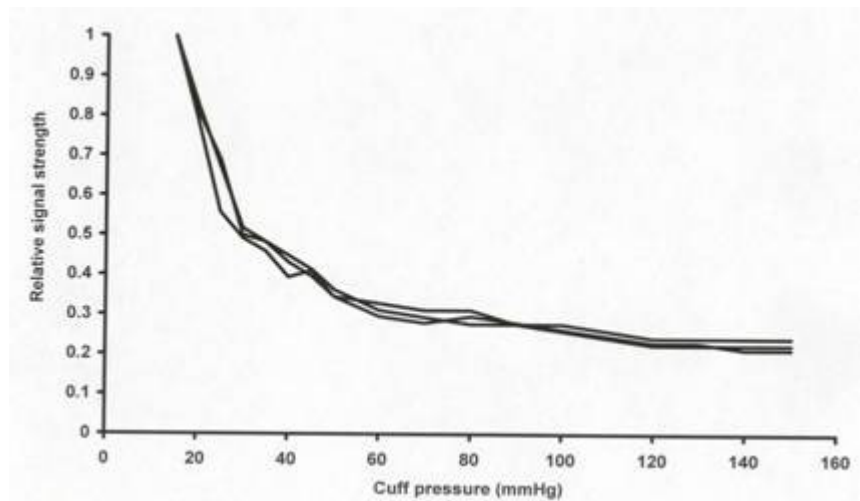
D. John Doyle MD PhD, Department of General Anesthesiology, Cleveland Clinic, USA

Introduction In a previous report (Anesth Analg. 2004;98:1192) we described a novel method of phonocardiographic recording based on heart sound capture from the cuff of a special endotracheal tube (“Teves ETT”, U.S. Patents 5,029,591 and 5,315,991) constructed using a cuff large bore inflation line (ID 4.2 mm vs. 0.90 mm).



Methods In this study we were interested in the effect of ETT cuff pressure on the relative amplitude of obtained acoustical recordings. To study this in an in-vitro setting, a 300 Hz acoustical source was applied to a 20 ml syringe barrel (as shown on the left) and the acoustical signal amplitude obtained from the Teves ETT cuff was measured for varying cuff pressures using a special leak-free microphone described previously. Because it is ordinarily not clinically appropriate to employ cuff pressures under 15 mm Hg, this was the lowest value studied.

Results The graph on the right shows the relative signal intensity obtained for varying cuff pressures (range 15 mm Hg to 160 mm Hg) for three trials. Similar results were obtained for other frequencies. As can be readily seen, stronger acoustical signals are obtained when ETT cuff pressures are lower.



Discussion The main design alteration in the Teves ETT consists in connecting the ETT cuff via a larger bore line than is used conventionally, using 4.2 mm inner diameter tubing vs. 0.90 mm diameter tubing typically used. Thus, the diameter of the cuff inflation line is 5.2 times larger in the new design, corresponding to a cross sectional area 27 times larger. This is the acoustical basis for the excellent phonocardiographic recordings obtained using this design. However, the results obtained here indicate that ETT cuff pressure impacts strongly on the intensity of the obtained acoustical signal, and this fact should be specifically born in mind when using the Teves ETT in phonocardiographic research studies.