

## A review of cuffed vs uncuffed endotracheal tubes in children

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### Key points

If a paediatric patient was to be intubated, current practice would see an uncuffed endotracheal tube placed in the majority of patients.

However with the development of new cuffed endotracheal tubes it is important that this practice is reviewed. Cuffed endotracheal tubes have been proven to be effective in a variety of circumstances.

### Abstract

#### Background

The use of cuffed endotracheal tubes in paediatric patients is still a controversial topic. This paper aims to investigate whether cuffed or uncuffed tubes should be used in children under the age of 8 based on the literature that is currently available on this topic. Currently there are no guidelines on this topic.

#### Methods

The literature review has been taken in consideration

#### Results

The results of the first four studies all show significant results in favour of the use of cuffed endotracheal tubes. Cuffed endotracheal tubes were no more likely to cause injury.

#### Conclusions

In conclusion cuffed tubes are shown to decrease the need for multiple intubations, reduce costs and are not shown to increase adverse effects in children of all ages.

**Keywords:** uncuffed, cuffed, endotracheal tubes, paediatric, children,

#### Introduction

Traditional paediatric anaesthetic teaching is that the cricoid cartilage is the narrowest part of the airway, and that the utilisation of an uncuffed endotracheal tube that fits and seals within the cricoid makes a cuffed tube unnecessary.<sup>1,2</sup> Recently UK practice has changed however with cuffed tubes becoming more accepted for use in children, particularly older children<sup>3,4</sup>

A registry of intubations in 15 North American Paediatric Intensive Care Units shows that more than 90% of PICU intubations were with a cuffed endotracheal tube.<sup>5</sup>

It is generally accepted that it is difficult to be certain of the correct size of uncuffed tube for each patient. Evidence suggests that this can lead to an excessive exchange rate of tubes, approaching 30%.<sup>6</sup> Too large a tube is known to risk damage to the larynx<sup>7</sup>; too small a tube risks air leaks, poor efficiency of ventilation, wastage of anaesthetic volatile agent and environmental pollution.<sup>3</sup> Using a smaller tube also carries the risk of pulmonary aspiration; this is a rare complica-

tion, but carries with it extremely serious consequences<sup>1</sup>.

Cuffed tubes have traditionally been avoided in young children for fear of damaging the airway mucosa. The risk of damage can be increased in a number of ways:

- Oversized outer tube diameters
- Poorly designed cuffs
- Wrongly positioned tubes
- Overinflating of the cuff,

All resulting in post-extubation stridor<sup>1,3</sup>

Newly designed cuffed tubes are now available which aim to combat some of the problems noted above. Close attention during use to: sizing; careful length adjustment and appropriate cuff inflation pressures are still necessary. These tubes are more expensive than uncuffed alternatives.<sup>4</sup> It is however possible that by using these cuffed tubes, indirect savings can be made (ie decreasing oxygen and anaesthetic gases used during surgery) and decrease environmental pollution.<sup>1,4</sup>

A systematic review was carried out of the current evidence base for the use of both cuffed and uncuffed endotracheal tubes in young children.

### **Methods**

An initial search was conducted using Medline (Ovid), Web of Science and PubMed. This identified 43 potential papers in the English language; and a subsequent review of each, to establish that the subjects studied were under the age of ten, enabled selection of 5 papers for detailed review. They can be seen in table 1.

The studies reviewed were a mix of randomised control trial, non-randomised control trials and cohort studies, in a variety of clinical settings, with a variety of outcome measures.

### **Results**

The results of the first four studies reviewed all show significant results in favour of use of a cuffed endotracheal tube and a change in current practice. None of the studies reviewed showed that patients were mo-

re likely to suffer injury as a result of using a cuffed tube. This is important as the review covers a variety of patients including those undergoing elective operations, burn patients and those who are critically ill. All of the studies reviewed demonstrated potential benefits of introducing cuffed tubes into practice as they reduced exchange rate, air leaks and the costs associated with the anaesthetic gases used; without a significant increase in the rates of post-extubation stridor or failed extubation.

TABLE 1	Author	Summary					Date
H.Kihne et al <sup>6</sup>	RCT of 488 patients 0-8yrs requiring GA.					1997	
			Cuffed	Uncuffed		P-value	
	Patients	251	237				
	Tube changes	3 (1.2%)	54 (23%)			<0.001	
	Gas need >2lpm	3 (1.2%)	26 (11%)			<0.001	
	Post extubation stridor	7 (2.8%)	6 (2.5%)			NS	
M.Weiss et al <sup>3</sup>	Prospective multi-centred RCT. 0-5 yrs. Standardised cuffed tubes / non-standardised uncuffed tubes.					2009	
			Cuffed	Uncuffed		P-value	
	Patients	1119	1127				
	Tube changes	2.1%	30.8%			<0.0001	
	Post extubation stridor	4.4%	4.7%			NS	
C.J.L Newth et al <sup>8</sup>	PICU patients – prospective cohort study. Not randomised. Physician choice of tube type. Standard tube size calculations.					2004	
		<	1	2	5	>	Total
	Type of tube						
	Uncuffed	1	2	6	2	8	422
	Cuffed	2	1	5	4	1	438
	Intubation duration (d)						
	Uncuffed	5	1	1	1	0	1.9
	Cuffed	6	4	1	1	0	1.8
	Racemic adrenaline use						
	Uncuffed	7	1	6	1	1	29
	Cuffed	2	1	5	0	2	21
	Failed Extubations						
	Uncuffed	1	1	4	2	0	29
	Cuffed	2	1	6	4	6	34
	D.P Dorsey et al <sup>9</sup>	Retrospective study of cuffed vs. uncuffed tubes in burns patients 0-10yrs.					2009
			Cuffed	Uncuffed		P-value	
Female			24.3%	37.6%		0.03	
Mean Age (y)			4.6	2.7		<0.001	
<1			3.6%	23.1%			
1-4			53.2%	53.0%			
5-10			43.2%	23.9%			
Mean TBSA			22.1	14.4		<0.001	
TBSA <20%			48.7%	75.2%			
TBSA 20-50%			35.1%	18.8%			
TBSA >50%			16.2%	6.0%			
Facial burns			35.1%	25.0%		NS	
Smoke inhalation			5.4%	3.5%		NS	
Immediate reintubation needed			7.2%	37.6%		<0.001	
Air leak			1.8%	23.1%		<0.001	
Post extubation stridor		7.2%	4.3%		NS		
Failed extubation		1.8%	3.4%		NS		
S. Eschertzhuber et al <sup>4</sup>	RCT comparing cost of sevoflurane in use of cuffed and uncuffed ET tubes in 70 children 0 to 5years (>3kg).					2010	
			Uncuffed	Cuffed		p-Value	
	No. Patients	35	35			-	
	Age (yrs)	1.75	1.65				
	Weight	9.8	12				
	Fresh gas flow (l/min)	2.0	1.0			<0.001	
	Sevo use /patient (l)	16.1	6.2			0.003	
	Gas consumed /patient (l)	129	46			<0.001	
	Sevo cost /patient (€)	12.9	5			<0.001	

## Discussion

The reduction of incidence of multiple intubations and the environmental advantage without any suggestion of an increased risk of complications support the introduction of cuffed tubes. However, clinical experience suggests that it is not just a case of choosing one tube over another. Paediatric cuffed tubes may not be readily available. Cuffed tubes within the above studies were over five times more expensive than uncuffed ones. This cost is offset with any surgery lasting 49 minutes as gas flow delivery can be easily reduced with a cuffed tube<sup>4</sup>. Although no direct figures can be shown, it can be assumed that with a much lower tube exchange rate, as shown in the early studies, that this would also reduce the cost associated with the cuff tube. More conclusive evidence is needed in certain areas, with a need for more randomised control trials with larger sample sizes.

## Conclusions

In conclusion cuffed tubes are shown to decrease the need for multiple intubations, reduce costs and are not shown to increase adverse effects in children of all ages.

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