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Factors associated with blocked tracheal tubes

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Sir: I thank Dr. Defouilloy for the interest shown in our paper [1]. We specifically commented that the study was a not head-to-head comparison of tube blockage rate when filters were used for 24 or 48 h.

We have looked at the factors associated with blocked tracheal tubes in more details elsewhere [2]. Table 1 lists the various factors associated with the 13 episodes of blocked tracheal tubes. The conclusions of our detailed analysis were as follows. Tracheal tube blockage was relatively rare, occurring in 11 of 7,978 patients (0.14%) with a frequency of 13 episodes in over 15,628 tracheal tube days (0.08%). It occurred less frequently with endotracheal tubes (ETT) than with tracheostomy tubes (TT; 9/7973 vs. 4/416, $p = 0.00006$ per patient; 9/13755 vs. 4/1873, $p = 0.003$, per tube day). It occurred more frequently when heat and moisture exchanger-filters (HMEF) were

used for 48 h than when they were used for 24 h (0/6641 vs. 13/8987, $p = 0.001$). It occurred equally frequently in pediatric and adult patients (1/310 vs. 10/7686, NS, per patient; 2/650 vs. 11/15032, NS, per tube day). ETTs were more likely to be blocked by secretions, and the tube was more likely to require replacement, while TTs were more likely to be blocked by blood, and the episode was more likely to be managed without the need to change the tube.

It is therefore apparent that blockage of these tubes is multifactorial. I agree with Dr. Defouilloy's contention that the quality and efficiency of the HMEF may have a bearing as to the incidence of blocked tracheal tubes, but much more data are needed before this can be accepted as scientifically confirmed. At present Dr. Defouilloy's statement can only be viewed as anecdotal, or at best as expert opinion. We have also used both the Pall and the Intersurgical HMEFs, but unfortunately we do not have the individual data to compare the difference in tube blockage rates. Interestingly, two studies [2, 3] which compared different HMEFs found that both the Pall and the Intersurgical filter performed worse than other brands.

How does one actually evaluate the role of an HMEF in the genesis of tube blockage? Most studies measure humidity, which is a surrogate marker in the genesis of a

blocked tracheal tube. We looked directly at episodes of blocked tracheal tubes, which is clinically more meaningful. Use of surrogate markers must always be viewed with caution [4]. Most studies measure absolute humidity, but a thoughtful study has pointed out that, for the same absolute humidity, a lower relative humidity may predispose to tracheal tube blockage [5]. It is also worth noting that a complete monogram on humidification fails to even mention the problem of blocked tracheal tubes as a consequence of inadequate humidification [6].

We noted in our paper that small studies have shown safety with prolonged use of HMEFs. Combining all our cited papers [2], there were a total of 324 patients. Considering that the incidence of blocked tracheal tube was 13 episodes in 7,978 patients over 15,628 days, one wonders as to the relevance of these small studies.

Lastly we would like to point out that blocked tracheal tubes are life-threatening complications. In our data 7 of these 13 episodes required a short duration of cardiopulmonary resuscitation although there were no associated deaths. Clearly, avoiding these episodes is highly desirable.

Table 1 Factors associated with blocked tracheal tubes. HMEF duration does not refer to the duration of use of the particular HMEF, but the protocol that was followed when the accident took place. (ETT endotracheal tube, TT tracheostomy tube, total days the duration of intubation until the episode occurred, tube days the duration of the particular tracheal tube when the tube had been changed)

No. of blocked tubes	No. of patients	ETT or TT	Blood or secretions	Total days	Tube days	HMEF duration (h)	Tube changed	CPR required	Death at time of episode	Year
1	1 (child)	ETT	Secretions	22	10	48	Yes	No	No	1997
2	1 (child)	TT	Secretions	45	20	48	Yes	Yes	No	1997
3	2	ETT	Secretions	1	–	“48”	Yes	No	No	1997
4	3	TT	Blood	65	7	48	No	Yes	No	1997
5	4	TT	Blood	48	19	48	Yes (to ETT)	Yes	No	1998
6	5	ETT	Secretions	3	–	48	No	Yes	No	1998
7	5	ETT	Secretions	5	–	48	No	No ^a	No	1998
8	6	ETT	Blood	7	–	48	No	Yes	No	1998
9	7	ETT	Secretions	3	–	48	Yes	No	No	1998
10	8	ETT	Secretions	6	–	48	Yes	No	No	1998
11	9	ETT	Both	12	–	48	Yes	Yes	No	1999
12	10	TT	Blood	113	35	48	No	Yes	No	1999
13	11	ETT	Both	2	–	48	Yes	No	No	1999

^a Received atropine and adrenaline

References

1. Kapadia FN, Bajan KB, Singh S, Mathew B, Nath A, Wadkar S (2001) Changing patterns of airway accidents in intubated ICU patients. *Intensive Care Mod* 27: 296–300
2. Kapadia FN, Nath AS, Tekawade P, et al (2001) Analysis of blocked tracheal tubes in ventilated ICU patients. *Indian J Crit Care Med* (in press)
3. Jackson C, Webb AR (1992) An evaluation of the heat & exchange moisture performance of four ventilator circuit filters. *Intensive Care Medicine*. 18: 264–268
4. Doig GS (2001) Measuring change with surrogate outcomes. In: Squires B (ed) *Fluid management in the critically ill*. Core Health Services, Concord, Ontario, Canada pp 67–72
5. Miyao H, Hirokawa T, Miyasaka K, Kawazoe T (1992) Relative humidity, not absolute humidity, is of great importance when using a humidifier with a heating wire. *Crit Care Med* 20: 674–679
6. Shelly MP (ed) (1991) Recent advances in humidification. *Problems in respiratory care*, vol 4. no 4

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