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TITLE: PEDIATRIC AIRWAY DEVICE SELECTION WITH A BODY LENGTH TAPE MEASURE

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Introduction The superiority of using body length as a predictor for endotracheal tube size in children has been previously demonstrated by us and by Keep and Manford.[1,2] Since many airway dimensions in children have been shown to correlate with body length/height, we report here the utilization of a tape measure system that predicts airway device sizes for children based on their body length.[3]

Methods This study was approved by the Dartmouth-Hitchcock Medical Center's Committee for the Protection of Human Subjects. Two hundred (200) ASA I children under the age of 13 years presenting for elective surgery were studied. The Pedi-Tech™ airway tape measure was used to make the airway device selections. The tape measure predicted face mask (FM), oral airway (OA), and laryngoscope blade (LB) sizes, as well as endotracheal tube internal diameter (ETT-ID), mid-trachea to incisor distance (MT-I) for the ETT, and estimated airway leak pressure (ALP). All predicted equipment sizes and distances were used first and, if judged incorrect, the next size larger or smaller was chosen. Each patient's body length and final equipment sizes used were recorded. Table 1 shows the range of sizes for each airway device that was available for selection.

Results The accuracy of the tape measure system in predicting airway device selection in children varied according to the particular airway device (Table 2). Success in predicting correct airway device size on first selection was highest for LB size (98%) and lowest for MT-I distance (86%). Predicting ALP was the most difficult; in 34% of the cases, real ALP exceeded predicted ALP by an average of 8.5 cm H_2O (range 0.5 - 31.2 cm H_2O). In 66% of the cases real ALP was less than predicted ALP by an average of 11.1 cm H_2O (range 0.7 - 23.8 cm H_2O). However, no real ALP was less than 5 cm H_2O or greater than 45 cm H_2O.

Discussion As shown in Table 2 an airway device selection system using a tape measure based on body length can accurately help the clinician select airway devices in children. Use of such a tape measure can be beneficial in clinical situations when age and body weight are unknown. We are currently developing a color-coded system in conjunction with this airway tape measure to improve the speed and safety of airway device selection in children.

References

1. Hinkle AJ: A rapid and reliable method for selecting endotracheal tube size in children. Anes Analg 67:92, 1988.
2. Keep PJ, Manford ML: Endotracheal tube sizes for children. Anaesthesia 29:181-185, 1974.
3. Morgan GA, Steward DJ: Linear airway dimensions in children: including those from cleft palate. Can Anaesth Soc J 29:1-8, 1982.

TABLE 1: Airway Device Sizes

Airway Device	Size Selection
FM	0, 1, 2, 3, Small Adult
OA	000, 00, 0, 1, 2, 3, 4
LB	0-Miller, 1-Miller, 2-Miller
ETT-ID* (mm)	2.5, 3.0, 3.5, 4.0, 4.5, 5.0, 5.5, 6.0, 6.5, 7.0
MT-I (cm)	10.5, 11, 12, 12.5, 14.5, 16.5, 17, 17.5, 18, 18.5

* uncuffed FM = face mask; OA = oral airway; LB = laryngoscope blade; ETT-ID = endotracheal tube internal diameter; MT-I = mid-trachea to incisor distance

TABLE 2: Results

Airway Device	% Accuracy on 1st Selection	% Requiring Larger Size	% Requiring Smaller Size
FM	91	6	3
OA	94	3	3
LB	98	2	0
ETT-ID	94	3[a]	3[b]
MT-I	86	5[c]	9[d]

[a] (avg. ALP = 42.5 cm H_2O)
[b] (avg. ALP = 16.5 cm H_2O)
[c] (avg. 0.83 cm Ø)
[d] (avg. 1.0 cm ≠)

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TITLE: EVALUATION OF SIX VENTILATORS WITHIN THE MRI ENVIRONMENT

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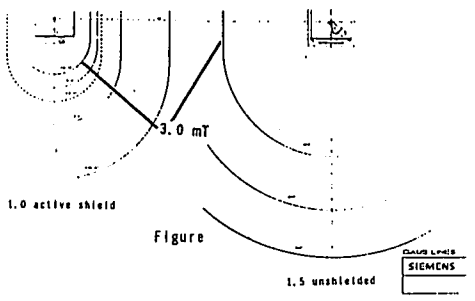
The ideal anesthesia ventilator will function as designed within the magnetic field and not distort the MR image. This study evaluates whether currently available mechanical ventilators function properly in the MRI environment, without failure and without distorting the MR image.

The Ohmeda (7000), Omni-vent (series-D/MRI), Monahagan (225/SIMV), AirShields (VV), Siemens (9000), and Blanch MRI ventilators were studied in the imaging room of a 1-tesla (T), actively shielded Siemens MRI. An actively shielded MRI machine effectively attenuates the magnetic field strength, which brings the 3-mT line to within 8 ft of the center of a 1-T magnet, versus 18 ft for a 1-T non-shielded magnet (Figure). Each ventilator was disassembled and tested for the presence of ferromagnetic components with a 0.2-T magnet. After reassembly, ventilator function was tested inside the imaging room with a Vent-Aid training/ test lung and a Novametrix Pneumogard airway pressure analyzer and strip recorder for a period of 20 min. During testing the ventilator was positioned 2 ft from the patient gantry, approximately 10 ft from the magnet core and within the 3-mT magnetic field. The following functions were tested: delivered tidal volume, ventilator rate, maximum and minimum inspiratory time, pressure limits, and CPAP. All results were compared to manufacturer's published specifications. Images were obtained during ventilator function to observe any image interference.

Three of the four fluidic/pneumatic ventilators contained small ferromagnetic parts, and both electronic ventilators were largely ferromagnetic. Despite this fact, all ventilators functioned appropriately within our 1-T shielded MRI room, even when placed as close as possible to the scanner, within the 3-mT area. None of the ventilators distorted the MR image.

The Omni-vent, AirShields, Monahagan, and Blanch ventilators are fluidic or pneumatic ventilators and have been specifically promoted for use in the MRI environment. The use of the Siemens ventilator with non-shielded MRI has been reported. Concerns have been raised about the effects of the magnetic field on its solenoid-type PEEP valve. The Ohmeda 7000 has not been recommended for use with MRI because its flow output is dependent on magnetic solenoids that may cause unpredictable tidal volumes in the MRI environment. Despite these concerns, each of the 6 units tested could be used within our 1-tesla actively shielded MRI room.



Figure