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Title : TRACHEAL AND CRICOID DIAMETERS IN THE PREMATURE INFANT

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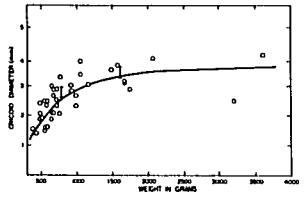
Introduction. Interest in the treatment and prevention of acquired subglottic stenosis has increased with recent advances in neonatology that have prolonged the survival of very small premature infants, many of whom require prolonged airway intubation. Knowledge of the airway dimensions may be important in planning the size of endotracheal tube and the route of intubation. Whereas other studies[1,2] have attempted to determine the airway size in children and adults, there are few reports of the size of the airway in preterm infants. We therefore measured the airway diameters in a group of autopsy specimens of premature neonates.

Method. Thirty-nine specimens were obtained from neonates whose gestational age ranged from 21 weeks through 40 weeks, and whose weights ranged from 390 gms to 3,600 gms. The specimens were preserved in 10% formalin before excision of the larynx, trachea and main bronchi in one block. The upper airway was incised at two levels for measurement of the internal diameter of the cricoid and the third tracheal ring. Each diameter was measured three times with a vernier calliper both in the sagittal and the coronal planes. The mean diameter at each level was compared with gestational age, birth weight, and lung weight. A computerized curve plotting routine was used to determine which mathematical expression best represented the relations between these parameters, and to calculate regression coefficients.

Results. The illustrations show the relations between airway diameters, birth weight, gestational age and lung weight.



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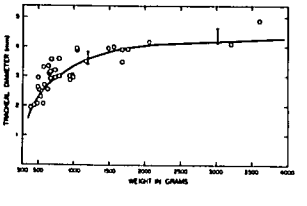

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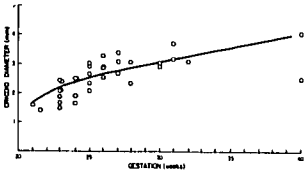

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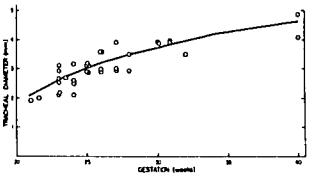

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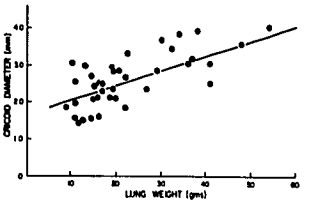

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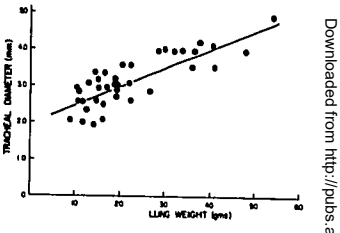

(r=0.83)

Allowing 10% for post-mortem shrinkage of the tissues, the internal diameter of the cricoid may be estimated from the formula:

$$\frac{\text{Gestational Age (weeks)}}{10} + 0.5 \text{ mm}$$

Discussion. These measurements emphasize the small caliber of the airway in very small premature neonates. The straight line relation between lung weight and diameter of the cricoid and trachea suggests that bronchopulmonary hypoplasia, a common problem in such infants, is also associated with laryngotracheal hypoplasia. Whereas previous studies[1] have suggested a straight line relation between birth weight and diameter of the cricoid or trachea, we found that relation hyperbolic. In neonates who weighed less than 1500 gm, the diameter of the cricoid and trachea were less than expected from extrapolation of data from larger infants. Even with allowance of up to 10% for post-mortem shrinkage, we found the diameter of the cricoid of the smallest specimens to be less than the 3.8 mm (11 Fg) external diameter of the smallest (2.5 mm) endotracheal tubes in use. In view of the significant morbidity of subglottic stenosis from prolonged intubation of neonates weighing less than 1500 gms, consideration of such aggressive measures as tracheostomy or anterior cricoid splitting procedures may well be justified.

References.

1. Butz RO: Length and Cross-Section Growth Patterns in the Human Trachea. Pediatrics 44:336-341, 1968.

2. Chodoff P, Helrich M: Factors Affecting Pediatric Endotracheal Tube Size: A Statistical Analysis. Anesthesiol 28:779-784, 1974.