

## **Marvels, myths and misses – The story of paediatric tracheal intubation**

**Rod Westhorpe OAM FRCA FANZCA**

**Melbourne, Australia**

Endotracheal intubation in children preceded anaesthesia by about 50 years and came as a result of attempts at neonatal resuscitation. The first paediatric airway was Benjamin Pugh's "air-pipe", and it was not uncommon for a lifeless newborn to be administered air by means of the fireside bellows. In 1780, the French obstetrician, Francois Chaussier, designed an inflatable air bag that could be used with a mask or nostril tube, thus eliminating the soot and dust of the bellows method. In 1807, he added a curved cannula that could be passed into the infant's larynx. Others modified Chaussier's cannula, including Depaul (1845), Ribemont (1878) and Gairal (1879).

Unaware of earlier work by Bouchut in 1858, Joseph O'Dwyer was confronted with a serious outbreak of diphtheria in New York in 1872. He developed short laryngeal tubes that were inserted while the child was awake, thus saving countless lives. His work was not published until 1885, but served as an alternative to emergency tracheostomy, and was ultimately developed into an anaesthesia breathing system, as the Fell-O'Dwyer Apparatus.

The advent of laryngoscopy led to the introduction of endotracheal intubation for anaesthesia. Chevalier Jackson developed his laryngoscope in 1906, and described his technique of laryngoscopy in 1909, enabling the passage of gum elastic catheters for insufflation anaesthesia.

The earliest endotracheal tubes were made of spiral wire coated with latex, and they were manufactured in sizes suitable for children. When Sir Ivan Magill introduced the "wide-bore" rubber endotracheal tube for use in adults in the 1930s, he obtained his supply from a local rubber shop. Once the medical manufacturer Charles King began supplying the tubes, it was not long before smaller sizes were manufactured.

With rubber endotracheal tubes of fixed shape, variations in attachment to the anaesthesia breathing system could only be achieved by a large variety of connectors, many boasting the names of their inventors. The Oxford tube was the first pre-formed tube designed for use during oral and nasal surgery. The fine taper and sharp tip was prone to cause impaction and tracheal irritation, later to be superseded by the polyvinyl chloride designed by Ring, Adair and Elwyn.

Concern regarding resistance to airflow in narrow paediatric endotracheal tubes, led to development of the Cole tube. The tube had a shortened narrow segment for passage through the larynx, while the remainder of the tube was of a wider bore. While the design

had little benefit in lowered resistance, the principle fault was the ease with which the shoulder impacted on the larynx.

Long-term intubation in children was pioneered by Bernard Brandstater at the American Hospital in Beirut in 1962. In 1963, Tom Allen and Ian Steven in Adelaide began using a similar technique, reporting a series of 61 cases of successful prolonged nasotracheal intubation in 1965. One case of subglottic stenosis was the only serious complication that occurred.

Cuffed paediatric endotracheal tubes have been available from the earliest designs. Chaussier's cannula included a sponge cuff, and rubber tubes were available with inflatable cuffs in the 1940s and 1950s. Various designs for cuffed paediatric tubes have been introduced, from a solid bulb to a series of concentric flanges. The recent introduction of cuffed PVC paediatric tubes follows many years of standard practice where uncuffed tubes were the "norm". Brandstater and the Adelaide group used PVC tubes for prolonged intubation, with few complications, and there is little evidence that routine use of PVC tubes causes tracheal damage. Are cuffed paediatric endotracheal tubes a solution to a problem that didn't exist?