

History of Endotracheal Tubes

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Being anaesthesiologists, we all are using endotracheal tube in our day to day practice. We all have some idea of endotracheal tube evolution, but here I am attempting to write a complete history of its evolution. In history, first known brief description of intubation to facilitate breathing was given in the A.D. 1020 by Avicenna in his 14-volume medical encyclopaedia *The Canon of Medicine*.^[1] The first detailed report on endotracheal intubation and subsequent artificial respiration of animals was given by Andreas Vesalius in 1543. He pointed out that this technique could be life-saving, but it went unnoticed. First successful intubation in humans was done by German surgeon Friedrich Trendelenburg in 1869. This tube was introduced through a temporary tracheotomy. In 1878, the Scottish surgeon William MacEwen performed the first oral intubation. Tube used for intubation was of metal and the purpose was to administer chloroform during anaesthesia. On July 5, 1878, Macewen performed a blind oral intubation on an awake patient with an ulcerating epithelioma of the tongue. An extensive operation was performed, and the results were excellent. Subsequently, Macewen tracheally intubated three other patients - two for edema of the larynx, and third one for another surgical procedure in the mouth. In the last case, the pulse was suddenly lost after administering chloroform and the patient died on the table. Franz Kuhn (1866-1929) used a flexible metallic tube for blind oral and nasal intubation during operations in mouth. Kuhn published his report on tracheal intubation in 1905 and included an extensive description of a technique using carbon dioxide absorption cartridges. In his report he proposed use of inflatable pharyngeal cuffs to prevent air leaks, though he did not use them.

Endotracheal tube got its recognition during World War I. Born in Larne, Northern Ireland, Sir Ivan Whiteside Magill (1888-1986), obtained his medical degree from Queen's University, Belfast in 1913 and accepted post of anaesthetist at Queen's Hospital, Sidcup in 1919. This hospital was established for the treatment of facial injuries

of World War I victims. While working in the hospital, he faced difficulty in administering ether or chloroform using only face masks. He then used a tube cut from roll of rubber industrial tubing (mineralised) as single lumen endotracheal tube. This tube had the natural curve of present day endotracheal tube and was named as Magill tubes. Blind nasal intubation was done by making patients position as if they were “sniffing the morning air”. Failures of blind intubation were solved with a special instrument designed by Magill (Magill forceps). It lifts the tube off the posterior wall of the pharynx into the glottic opening. A curved metal adaptor was designed (Magill oral & nasal connectors) and a 4" black rubber connecting hose to fit to the anaesthetic circuit (adapted from an MG brake hose) and was named 'the catheter mount' by Magill's theatre technician at Westminster Hospital. As, there were no inflatable cuff, the tube was secured by placing two green anaesthetic swabs on either side of the sub-glottis, and ribbon gauze was sewn on by hand to aid extraction at extubation of the ETT. Anaesthetic gel or ointment was used to lubricate the tube to provide some relief for the patients sore throat post operatively. Later, Magill developed many pieces of equipments for anaesthesiologists. Cuffed endotracheal tube was promoted by Arthur Guedel (1883-1956) and Ralph M. Waters (1883-1979) in 1928, hence allowing use of intermittent, controlled, positive-pressure ventilation. Magill received many awards, including a knighthood awarded personally by the Queen of England in 1960 and the Henry Hill Hickman Award.

Portex Medical (England and France) produced the first cuffless plastic 'Ivory' ET tubes, in conjunction with Dr Magill's design. Later a cuff was added making the tube more viable and these tubes were glued on by hand to make the famous Blue-line tube copied by many other manufacturers.

In 1941, 'Murphy Eye' was added by Mallincrodt GmbH to their disposable ETT tubes to avoid right bronchial occlusion in case of 'accidental' placement of the tube into the right bronchus and as an alternative air passage in the event of distal tip occlusion. Red rubber tubes were developed by Rusch-Germany which could be sterilized

and re-used with a small a risk of infection. Present day "disposable" plastic endotracheal tube were manufactured in America by David S. Sheridan..

Concept of one lung ventilation was introduced by Gale and Waters in 1932. Magill introduced the bronchial blocker to confine the secretions of an infected lung to one side. Double-lumen tubes for bronchspirometry were introduced by Carlens in 1949, and remodelled by Robertshaw thus allowing single-lung ventilation whilst the other lung is collapsed to make surgery easier. The deflated lung is re-inflated as surgery finishes to check for fistulas (tears).

References

1. Patricia Skinner (2001), Unani-tibbi, *Encyclopedia of Alternative Medicine*
2. History of Anaesthesia Practice, Miller's Anaesthesia-7th edition