
Historical Review Of Tracheostomy

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Abstract

Tracheostomy is a life saving procedure done to establish airway in-patients with upper respiratory tract obstruction. It requires an opening to be made in anterior wall of trachea and a tube is inserted through the opening to allow passage of air and removal of secretions. Instead of breathing through the nose and mouth, the patient now breathes through the tracheostomy tube. If we look into history, the tracheotomy is one of the oldest surgical procedures, which was dreaded with complications until 19th century when procedure was understood clearly and indications properly defined. Authors review the history of tracheostomy from ancient period to the present era of surgical advancement.

THE ORIGIN OF THE TERM TRACHEOSTOMY

The word tracheostomy is derived from two words meaning I cut trachea in Greek. The procedure has been given several different names, including pharyngotomy, laryngotomy, bronchotomy, tracheostomy and tracheotomy. In Greek and Roman medicine, the operation was initially called laryngotomy or bronchotomy. The word tracheotomy first appeared in print in 1649, but was not commonly used until a century later when it was introduced by the German surgeon Lorenz Heister in 1718.

Other similar terms used before included bronchotomy and tracheostomy proposed by Negus in 1938. Tracheostomy refers to the opening created by the tracheotomy procedure. Sometimes this term is used interchangeably, but tracheotomy usually refers to the operation itself.

Tracheotomy is one of the oldest operations. Indications and methods of the operative technique were reported already in the ancient times. The following outline - subdivided into three parts - tries to give a comprehensive survey of the development of tracheotomy along the centuries. The first part is concerned with the role of tracheotomy in antiquity, i.e. in Greek, Roman and Arabians at the turn of the millennium. The second part deals with the establishment of tracheotomy in the medicine of the European Middle Ages and third part which was period of rationalization in which clear indications and complications were established.

THE ANCIENT PERIOD

The first and longest period (covering roughly 3,000 years

from 1500 BC to 1500 AD) begins with references to incisions into the "wind pipe" in the Ebers Papyrus. The Rig-Veda a Hindu text circa 2000 BC describes spontaneous healing of a tracheotomy incision. The first instance of tracheotomy was portrayed way back in 3600 BC on Egyptian artifacts by engravings in Abydos and Sakkara regions of Egypt depicting tracheostomy. Homer around 1000 BC reported that Alexander the Great saved the life of a soldier from suffocation, by making an opening in the trachea using the tip of his sword. The first tracheotomy is said to have been performed by Asclepiades of Bythinien, who lived in Rome during the last century before the Christian era (100 BC). Hippocrates (460-377 BC) condemned tracheotomy because of fear of carotid artery damage. He knew that laceration or ligation of carotid vessels would cause death and advocated intubations in such cases. Antyllus, in second century AD, advocated tracheotomy in obstructive adenoidal-tonsillar and oral diseases. He further refined the technique by suggesting that the trachea be divided at the third and fourth tracheal rings using a transverse incision to avoid cartilage damage. He disapproved tracheotomy in severe laryngotracheobronchitis saying that the operation was not effective because of the disease was below the operative site. This was first modern tracheotomy. Galen about 20 years later (AD 131) described the anatomy of larynx in detail. The Hebrew Babylonian Talmud in the fourth and fifth centuries AD advocated a longitudinal incision. By the end of fifth century AD tracheotomies were well recognized in India (e.g. The Hindu text Sushruta). The question whether tracheotomy would be of use or not was highly controversial in the following

centuries. There were advocates of the operation (for example Antyllus, Paulus von Aegina), but there were strict antagonists, too (for example Aretaeus). Aretaeus of Cappadocia in the first century AD did not advocate tracheotomy to avoid suffocation caused by infection. He noted that secondary wound infections at the operative site produced complications, increased dyspnoea, cough and death. Similarly Avicenna reserved this procedure for hopeless cases. In Arabian medicine finally, tracheotomy had an important rank in theory, but probably it had never been performed in humans.

THE PERIOD OF ACCEPTANCE

Despite many ethical reservations, it became generally accepted as the last live-saving method in certain syndromes. Protagonists of the method included Ambroise Pare, Thomas Fienus, Hieronymus Fabricius ab Aquapendente, Julius Casserius, and Johannes Scultetus. Antonio Musa Brasavola, an Italian physician, performed the first documented case of a successful tracheotomy in a patient, who suffered from a tonsillar obstruction and recovered from the procedure. He published his account in 1546. Sanctorius (1561-1636) first described a new method of performing tracheotomy, the opening of the trachea with the use of a trocar and cannula. In the 16th century, Guidi invented an original method for tracheotomy.

In 1620, Habicot performed the first pediatric tracheotomy. The procedure was performed on a sixteen-year-old boy who had swallowed a bag of gold in an attempt to keep the gold from being stolen. The bag became lodged in the boy's esophagus and obstructed his trachea. After Habicot performed the tracheotomy, he manipulated the bag of gold so that it would pass. It was eventually recovered per rectum. George Martin (1702-1743) developed the double cannula tracheotomy tube. The inner cannula was to be removed for cleansing and outer cannula is left in place. In 1825, Bretonneau reported a successful tracheotomy on a five-year-old girl with diphtheria. Afterwards, Trousseau reported performing tracheotomies on over 200 children with diphtheria, though only 50 patients survived it made the tracheotomy a legitimate procedure. He also stressed the importance of post-operative care. Throughout the 1800's, tracheotomies became increasingly popular but the mortality and morbidity of the procedure remained high. In the early 1900's, Chevalier Jackson standardized the procedure and demonstrated that the mortality rate was significantly reduced if the procedure was performed properly and careful attention was paid to post-operative care.

Tracheotomies were originally used for emergency treatment of upper airway obstruction, but with little success. Upper airway obstruction in children was first discussed as a clinical entity in 1765. It was suggested that a tracheotomy be performed as an emergency treatment to prevent children from suffocating due to throat inflammation. Between 1546 with the writings of Brassarolo until 1883, the procedure was considered futile and irresponsible and few surgeons had the courage to perform it. Reports of tracheotomies can be found in medical literature sporadically from the second to the eighteenth centuries. However, well-documented studies do not appear until the early 1900's.

The third period starts with Trousseau's report of 200 cases in the therapy of diphtheria in 1833. Tracheostomy became a highly dramatized operation for asphyxia and acute respiratory obstruction. Tracheotomies were used in the early 1800's for airway inflammation in children due to Diphtheria. The first documented successful tracheotomy performed on a child was reported in 1808.

In 1909, a lower tracheotomy technique was introduced in which the tracheal incision extends to the 4th or 5th tracheal ring. This operative technique was refined and further standardized by Chevalier Jackson who advocated a low tracheotomy in second and third tracheal rings as opposed to a high tracheotomy (cricothyrotomy). Galloway further expanded the uses for the tracheotomy from airway obstruction to the treatment of paralysis requiring artificial ventilation and management of secretions.

In 1932 Wilson suggested its prophylactic and therapeutic use in poliomyelitis. Tracheotomy was then recommended for a large variety of assorted maladies. This started a tremendous period of enthusiasm.

THE PERIOD OF RATIONALIZATION

Finally, the present era starting in 1965 comes as a period of rationalization. Complications, indications and interrelation with endotracheal intubation are clearly outlined. Tracheotomy has thus found its place.

Recently, the development of synthetic materials and low pressure/high volume cuffs have improved the tracheostomy tubes and reduced the complication rate of the tracheotomy procedure (e.g. stenosis and erosion of large blood vessels). At present the mortality rates in tracheotomy is between 0.5 to 3%. With the development of percutaneous tracheotomy sets this procedure has become simpler and less complicated, such that even treating physician and ICU specialists doing it

with expertise.

In 1965, the use of intubation and respiratory support for neonatal patients was described by McDonald and Stocks. This revolutionized neonatal care; but at the same time it has lead to many more children surviving with tracheotomies due to subglottic stenosis.

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