STAGES IN THE DEVELOPMENT OF TRACHEOTOMY

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ABSTRACT

Tracheostomy refers to a surgical procedure of distinguished historical evolution. It spans various periods, each having specific contributions to what obtains presently. Every resident doctor is encouraged to acquire the skill required for this live-saving procedure.

INTRODUCTION

Tracheostomy is one of the oldest operations, whose indications and methods of the operative technique have been reported since ancient times. The word 'tracheostomy' is derived from two Greek words, tracheo and oma meaning 'I cut trachea'. It refers to a surgical procedure which involves an opening between the trachea and the skin surface of the neck in the midline, with the creation of a stoma[1]. The word tracheostomy 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 [2]. The procedure has been given several different names, including pharyngotomy, laryngotomy, bronchotomy and tracheotomy. In Greek and Roman medicine, the operation was initially called laryngotomy or bronchotomy.

The evolution and adaptation of tracheostomy, can be divided into 5 periods, according to McCIelland[3] .**The period of the Legend** (2000BC to AD 1546); **the period of Fear** (1546 to 1833) when the operation was performed only by a brave few, often at the risk of their reputation; the **period of Drama** (1833 to 1932) during which the procedure was generally performed only in emergency

situations on acutely obstructed patients; **the period of enthusiasm** (1932 to 1965) when the dictum, 'if you think tracheostomy, then do it,'became popular; **the period of rationalization,** (1965 to the present) when the relative merits of intubation versus tracheostomy were debated.

THE PERIOD OF THE LEGEND (2000BC TO AD 1546)

Even though the first instance of tracheostomy was portrayed way back in 3600 BC on Egyptian artifacts by engravings in Abydos and Sakkara regions of Egypt depicting tracheostomy, the Rig-Veda, a Hindu text circa 2000 BC which describes spontaneous healing of a tracheostomy incision, is believed to be the first documented report on tracheostomy.[2] 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.[4][If true, this must have been reported by "Homer the Younger" (Homerus of Byzantium) who lived in the 3rd century BC, because Homer lived about 850 BC, - 500 years before Alexander the Great was born in 356 BC.][5] Hippocrates (460-377 BC) condemned tracheostomy 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. The first tracheostomy is said to have been performed by Asclepiades of Bythinien, who lived in Rome during the last century before the Christian era (100 BC).[6]Antyllus, in second century AD, advocated tracheostomy 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 tracheostomy in severe laryngotracheobronchitis saying that the operation was not effective because the disease was below the operative site. This was first modern tracheostomy. Galen about 20 years later (AD 131) described the anatomy of larynx in detail.[2] Antonio Musa Brasavola, an Italian

physician, (Pix 1) performed the first documented case of a successful tracheostomy. He published his account in 1546. The patient suffered from a laryngeal abscess and recovered from the procedure

The Period of Fear (1546 to 1833)

The question whether tracheostomy 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, Avicenna). Aretaeus of Cappadocia in the first century AD did not advocate tracheostomy 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. Moreover therefore, it was in Arabian medicine finally, that tracheostomy had an important rank in theory, but probably was never performed in humans.

Despite many ethical reservations, it became generally accepted as the last live-saving method in certain syndromes. Amongst the protagonists of this method included Ambroise Pare, Thomas Fienus, Hieronymus Fabricius ab Aquapendente, Julius Casserius, and Johannes Scultetus. Sanctorius (1561-1636) first described a new method of performing tracheostomy, the opening of the trachea with the use of a trocar and cannula. In the 16th century, Guidi invented an original method for tracheostomy.[2] In 1620, Habicot performed the first pediatric tracheostomy.[8] 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 tracheostorny, he manipulated the bag of gold so that it would pass. It was eventually recovered per rectum. George

Martin (1702-1743) developed the double lumen tracheostomy tube. The inner lumen was to be removed for cleansing and outer cannula is left in place.

Afterwards, Trousseau whose work made tracheostomy a legitimate procedure reported performing tracheostomies on more than 200 children with diphtheria. Only 50 of these survived. He also stressed the importance of post-operative care. It was also during the same period that in 1799, George Washington (Pix 2) died of an upper airway obstruction, probably due to acute epiglottitis or an abscess. Washington's physician was reported to have been familiar with the tracheostomy procedure, but had not actually performed one himself. He apparently failed to perform this on his patient. It was probably because of the status of his patient as the president of the United States that he was not willing to carry out his first tracheostomy on a person of Washington's stature. It was not until 1805, that Viq d'Azur became the first to describe the procedure of Cricothyrotomy.

The Period of Drama (1833 to 1932)

The beginning of this 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. Tracheostomies were used in the early 1800's for airway inflammation in children due to Diphtheria. This trend reduced with the advent of intubations (O'Dwyer tube) and diphtheria antitoxin.[6] William Macewan in 1880 was first to recommended the insertion of tracheal tubes, by mouth instead of tracheostomy and laryngotomy.[10]

In 1909, a lower tracheostomy 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

tracheostomy in second and third tracheal rings as opposed to a high tracheostomv (cricothyrotomy). Galloway further expanded the uses for the tracheotomy from airway obstruction to the treatment of paralysis requiring artificial ventilation and management of secretions.

The Period of Enthusiasm (1932 to 1965)

In 1932 Wilson suggested its prophylactic and therapeutic use in poliomyelitis and tracheostomy was then recommended for a large variety of assorted maladies. This started a tremendous period of enthusiasm. Chevalier Jackson bettered the procedure by emphasizing post-operative care and dramatically reduced the death rate. The use of tracheostomy for tracheobronchial toileting was encouraged by the epidemics of Polio in the early 1950s. Similar indications were used in cases of Tetanus, Cardiac surgery, severe burns and most recently, the care of preterm infants.

The Period of Rationalization, (1965 to the present)

Finally, the present era starting in 1965 comes as a period of rationalization. Complications. indications and interrelation with endotracheal intubation are clearly outlined. Tracheostorny has thus found its place. In 1965, the use of intubation and respiratory support for neonatal patients was described by McDonald and Stocks.[11] This revolutionized neonatal care;but at the same time it has lead to many more children surviving with tracheotomies due to subglottic stenosis.

Recently, the development of synthetic materials(Shirley, portex) 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). This replaced the use of metallic tracheostomy tubes which had the complications of rusting, nonsuitability for radiotherapy. At present the

mortality rates in tracheotomy is between 0.5 to 3%.[2] With the development of percutaneous tracheostomy, the procedure has become simpler and less complicated, such that even treating physician and anaesthesiologists can do it with expertise.

CONCLUSION

Looking at the various stages tracheostomy has evolved from, one thing remains constant. That is the fact that tracheostomy remains a live saving procedure. Hence every resident doctor needs to acquire the required skill to carry out this procedure.

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Pix 1: Culled from www.tracheostomy.com [9]

Antonio Musa Brasavola (1490-1554)
The National Library of Medicine

Pix 2: George Washington (1732 - 1799), 1st President of the US (1789 - 1797). Culled from www.tracheostomy.com [9]

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