Tonsillectomy, past, future and present

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Tonsillectomy is one of the oldest surgical methods practiced to the present day. This operation has been performed for more than 2,500 years, and, over the years, it has undergone many changes and has been practiced with varying popularity. The first records date back to the Hindus. Tonsils are strategic lymphoid organs located at the entrance between the digestive and the respiratory tracts. From a medical point of view, it is interesting to trace the evolution and development of the methods and surgical techniques used.

Surgeries of the tonsils have been carried out since the earliest times; in the first century BC, Cornelius Celsus was the first to perform a tonsillectomy using his index finger as a dissector. Celsus used a solution of vinegar and milk for hemostasis in the surgical site, but also he pointed out that the lack of adequate anesthesia was a hindrance for implementing this procedure. For that reason tonsillectomy was the last method to treat tonsil infections back then. Some indications for tonsillectomy at that time included nocturnal enuresis, convulsions, laryngeal stridor, chronic bronchitis and asthma.

Another technique for removing tonsils in the Middle Ages was using cotton snares which were tightened daily until the tonsils fell. This procedure was abandoned in the 16th century. Paré, in 1564, and Scultetus, in 1655, invented an oval-shaped instrument which was placed around the uvula, and which removed it by strangulation. Hildanus, in 1646, and Heister, in 1763, presented tools for uvulotomy resembling a guillotine cutter. These

instruments were modified by Physick, who, in 1828, in the USA, invented the tonsilotome, which was used successfully for tonsillectomy. All of these tools were designed to perform surgery as fast as possible, especially in children, because of the lack of anesthesia.

Since 1909 tonsillectomy became a common and safe procedure, after Cohen introduced ligation of bleeding vessels as a perioperative technique. The routine use of Sluder's guillotine started in 1909 in the USA, in 1910 in Austria, and in 1912 in Belgium.

Practice and Instruments

In 1928, Philip Physick from Philadelphia announced improvements in the method using a cotton wire. The pain and discomfort in patients caused by this method lasted for 12 hours, so Physick tried another quicker method to perform tonsillectomy. He carried out research and found other old instruments, encountering a device called uvulotome, which was originally invented in the 16th century.

Uvulotome was used to remove the uvula. An essential part of this instrument was a circular opening in which the uvula was placed. Once placed there, the uvula was cut off by a retractable blade. In order to use the uvulotome for tonsillectomy, Physick needed to make some improvements. Firstly, he extended the circular opening. Secondly, he placed a piece of hemp wire in the posterior part of the instrument to support the tonsil and to make a cut.

This instrument was called tonsilotome, and it was modified over the years.

Gregg Dillinger believed that the tonsilotome caused bleeding and he developed a method called diathermy. Diathermy is an electric method using high frequency electromagnetic currents intended to raise tissue temperature. This technique involved insertion of a metallic needle-like hook, connected to an electric source, into the tonsil. The electric current applied resulted in burning the tissue which subsequently fell. The performance of this procedure required a longer time, but it was related to less bleeding and fewer infections.

Despite introducing this technique, the tonsilotome was still used instead of diathermy.

Techniques and Technologies

Tonsillectomy techniques can be divided into two major groups:

Extracapsular total tonsillectomy and intracapsular (partial) tonsillectomy, also called tonsillotomy. Extracapsular tonsillectomy involves dissection laterally to the tonsil, at the level between the tonsillar capsule and the pharyngeal muscles, and removal of the tonsil en bloc. Partial tonsillectomy, or tonsillotomy, involves removal of most of the tonsil, while preserving some of the lymphoid tissue and the tonsillar capsule. Preservation of this marginal tissue may promote faster recovery, with lower hemorrhage rate and faster return to normal diet. The most commonly used techniques for extracapsular tonsillectomy are traditional dissection, monopolar electrocautery, bipolar electrocautery, and harmonic scalpel. As techniques for intracapsular tonsillectomy, a microdebrider, bipolar radiofrequency ablation (which can also be used to remove the whole tonsil), and a carbon dioxide laser can be used. Either intracapsular or extracapsular tonsillectomy can be used in pediatric patients with obstructive sleep apnea, but only extracapsular tonsillectomy should be applied in patients with chronic tonsillitis or peritonsillar abscesses.

Conventional method

A commonly used method for total tonsillectomy is dissection. In this technique, the tonsillar capsule is dissected from the surrounding tissue by the means of scissors, a blade (scalpel), or a dissector, and the inferior pole is cut off by the use of a tonsil snare. Bleeding is controlled during the operation. The smaller blood vessels in the operative field coagu-

late by natural physiological mechanisms. The larger vessels are clipped with hemostats, ligated with wire or sutured. Bipolar cautery has been established as a safe and effective method - the current flows only in the area of clamping, but there is some burning of the surrounding tissues as well.

Harmonic scalpel

A harmonic scalpel can be used in tonsillectomy (Ethicon Endo-Surgery Inc, Cincinnati, OH). Ultrasonic energy makes its blade to vibrate at 55,000 revolutions per second. The vibrations transfer energy to the tissue, ensuring simultaneous cutting and coagulation, so that no other instrument is needed for haemostasis. The components of the device include: a generator, a handpiece, and a disposable blade. A high-frequency supply provides energy to the handpiece. The blade oscillates and intracellular cavities are formed as waves are conducted through the tissue, which results in tissue dissection. The expansion and contraction of these cavities leads to the lysis of intercellular connections and dissection of tissues.

Microdebrider tonsillectomy

This is another method for intracapsular tonsillectomy. The microdebrider is an electrically driven rotary cutting device with continuous aspiration, comprising a tube connected to a handpiece, which, in turn, is connected to a motor with foot control and aspiration device. In partial tonsillectomy, about 90% to 95% of the tonsil is removed, but the tonsillar capsule is preserved.

Laser ablation

High-energy coherent radiation (CO₂ or KTP laser) is applied, and as a result of that very high temperature in a limited area is achieved. In fact, hypertrophic tonsillar tissue is evaporated layer by layer, and the manipulation is considered to not involve severe pain, but the incidence of postoperative bleeding reaches 5%.

Argon plasma coagulation

This principle is used for more than 20 years in medicine, including in otorhinolaryngology. A constant stream of the relatively inexpensive gas argon is fed to the handpiece. The ceramic tip of the handpiece houses an electrode connected to a source of high-frequency current. The other electrode is fixed

to the patient and when the tip of the instrument gets close to the tissue at field strength of about 500 V/mm, argon converts into conductive, luminous plasma jet, destroying the tissue. Then plasma self-directs to areas with high electrical conductivity, i. e. to hemorrhagic zones, and it has a coagulating effect at a depth of 1-2 mm only.

Bipolar system LigaSure

This method does not have an accurate name, the device is relatively new and we use the name of the commercial product. Again, this is a case of topical application of a high frequency current, but unlike coblation, the two electrodes, shaped as tips of a clipping tool, directly contact with the tissue to be cut. The characteristics of the current flowing through the compressed tissue change constantly depending on the impedance, which allows to achieve strictly controlled melting at 70-95°C. Under the influence of the temperature, localized conversion of collagen and elastin into a gelatinous substance, blocking the vessels, is achieved. The process of adhesion is accelerated by the tips of the instrument which remain relatively cold and mechanically tighten the tissue until the "adhesive" hardens, and when released, these tips do not stick to the tissue. The tissue may be cut in the zone of melting by the use of the same instrument.

Welding

Again, a clipping instrument and controlled melting are used, but the principle is based on fast-heating element with low-voltage direct current, located in one branch of the instrument, which ensures direct heating of the tissues of the patient. The other branch of the instrument has a specially

shaped symmetrical silicone profile. Thus, in the central zone of the clipped tissue a temperature of 300-400°C develops and cutting occurs, and at 0.5 mm on both sides of the incision zone, the temperature drops to 100°C and thermal hemostasis is achieved.

Coblation tonsillectomy

Bipolar radiofrequency ablation can be used for extra- and intracapsular tonsillectomy. The equipment includes: a radiofrequency generator, a coblation wand (electrode), a foot control, saline irrigation regulator, PlasmaCare (Corp, Sunnyvale, CA).

During bipolar radiofrequency ablation tonsillectomy, the conductive saline solution turns into an ionized plasma layer, which results in molecular dissection, with minimal transfer of thermal energy. Haemostasis can be usually achieved by the use of the electrode alone.

The plasma has enough energy to break the molecular bonds of the tissue and create an ablation path. Thermal effect in this process is about 40-70°C, which is a much lower temperature compared to conventional radio frequency techniques. This method was invented by Philip E. Eggers and Hira V. Thapliyal in 1999, and was approved in 2001.

Advancement in anesthesia, particularly general anesthesia, has an important role in the development of all methods and surgical techniques. It allows the operation to be performed more safely and with greater precision. As well as in other surgical procedures, best results are achieved when tonsillectomy is performed in patients with appropriate indications, and also when the benefits and risks in the preoperative, intraoperative and postoperative periods are assessed and considered.

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