



10 Historic Events That Shaped the Face of Modern Surgery “The Craft of Surgery is as old as Mankind”

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Abstract

Evidence of the practice of surgical procedures has been found in ancient civilizations. Various books have documented surgeries being done in ancient Egypt, India and Greece. Modern practices of anaesthesia, blood transfusion, antisepsis and nursing have helped to improve the outcomes and comfort of Surgery. The two World Wars played an important role in creating condition which were conducive to the rapid development of modern technology and improvement in Surgical techniques. In this article, we examine the various milestone events that have led to the development of modern Surgical practice.

Keywords: History, Surgery, Ancient Civilizations, Barber surgeons, World wars.

History of Surgery

“The Craft of Surgery is as old as Mankind”

The term Surgery is derived from the Greek word ‘Chier’- hand and ‘Ergon’- to work and also from the Latin word ‘Chirurgia’. It is the treatment of disease, injury or deformity by manual or instrumental operations as removal of diseased part of tissue by cutting.

Development of Surgery in Ancient Civilizations

Earliest trepanation of skull was found in Peru around the year 10,000 BC.^[1,2,3,4] This was done by taking a series of perpendicular incisions on the

skull. Odyssey that of all the branches of Science pursued in ancient Egypt, none achieved such popularity as medicine. Surgeons were a separate group in Egypt. Edwin Smith Papyrus (17th century BC) and Ebers Papyrus (16th century BC) mention the following therapeutic accessories- 1. Dressing for wounds- including lint of vegetable origin and linen, 2. Sutures, 3. Splints and 4. Cautery. The medical papyri contain many references to instruments and tools that included knives, drills, saws etc. Egyptians also knew the art of reducing mandibular dislocations.^[5,6,7,8] Imhotep, one of the first known physicians from Egypt also performed surgery. His medical

practices deviated from the use of magic and prayers.

1. Code of Hammurabi

Code of Hammurabi- is a Babylonian legal text.^[9] It specified that – “If a Surgeon performs a major operation on a Nobleman with lancet and causes the death of that man, they shall cut off his hands”. It also specified the fees for life saving operations- 10 shekels of silver for Noblemen, 5 shekels for the poor and 2 shekels for the slave. Surgical care was thus authoritarian during this era.^[10,11,12,13,]

2. Rigveda and Ayurveda

In India, the ancient surgical science was known as Shalya Tantra.^[14,15] Rigveda, the earliest account of ancient Indian civilization mentions Ashwini Kumars known as Dev Vaidya. They were the Chief Surgeons of the Vedic period. The 4 Vedas laid down the foundation of Ayurveda-classical medical system of India. There are many Granthas and Samhitas dealing with Ayurveda. Sushruta Samhita deals mainly with Surgical knowledge. Some treatments written in Sushruta Samhita, which is considered a part of Atharva Veda, are applicable even in the present times. British Surgeons used the ancient Indian concepts in the surgeries for Rhinoplasty and Cataract. Many of the instruments used by Sushruta are very similar to the instruments used in modern Surgery.^[16]

3. Work of Greek physician Hippocrates

Greek Physician Hippocrates believed that physicians should study anatomy.^[17,18,19,20,21] He focuses on the integrity of professional benevolence and human dignity in practice of medicine. Hippocrates devised a technique for shoulder reduction, which is still in use. Prometheus was punished by Zeus because he stole fire to give back to mankind.^[22,23,24,25] He was chained to a rock in Caucasus Mountain and everyday an eagle came and ate a part of his liver.

Each night, his liver would regrow. This gives rise to an important question- Did the ancient Greeks already have the knowledge of liver’s ability to restore itself and of the fact that this capacity is inexhaustible?

4. Advent of Barber-surgeons

Barber Surgeons were medical practitioners in medieval Europe who, unlike many doctors of the time, performed surgery, often on the war wounded. Barber-surgeons would normally learn their trade as an apprentice to a more experienced colleague. Many would have no formal learning, and were often illiterate.^[26]

The red and white pole which is still used to identify a barber’s shop was originally intended to reflect the blood and napkins used to clean up during bloodletting.^[27] This treatment was one of the main tasks of the barber-surgeon, as well as extracting teeth, performing enemas, selling medicines, performing surgery and, of course, cutting hair.

5. Advent of anesthesia- On October 16, 1846, Boston dentist William T.G. Morton used sulfuric ether to anesthetize a man who needed surgery to remove a vascular tumor from his neck. William T.G. Morton called his creation Letheon, named after the Lethe River of Greek mythology, noted for its waters that helped erase “painful memories.”^[28] Dr. William S. Halsted used cocaine for the first regional (mandibular or jaw) nerve block with cocaine.^[29,30,31,32] He was, however, unawares of the addictive effects of cocaine, which took a toll on his and his colleagues health. Advent of anesthesia helped the patients to have a pain free surgery. This made way for safe conduct of major and supra major surgeries.

6. Antisepsis- The microbiological discoveries of Louis Pasteur were the inspiration for Joseph Lister’s use of carbolic acid as an antiseptic on surgical wounds.^[33] German and Swiss surgeons

invented aseptic surgical practice based on the studies of Robert Koch (1843-1910), a life-saving revolution in medicine as profound as anaesthesia.^[34,35,36] Together they changed human history, sparing millions the horrors of hospital gangrene and making the entire body accessible to surgical intervention.

7. Nursing- Florence Nightingale was a nurse who tended to injured soldiers in the Crimean War in the 1850s and played a significant role in changing the nature of the nursing profession in the 19th century.^[37] Nightingale campaigned for improved hygienic standards in the hospital attending the wounded soldiers, which drastically reduced the number of deaths from infections. Florence Nightingale thus improved nursing care and the survival of patients. She was also an expert in statistical evaluation of patient outcomes.

8. Blood Transfusion- The first blood transfusions were also attempted around 17th century, although these were often unsuccessful and proved fatal in humans.^[38,39,40,41] In 1667, Jean-Baptiste Denis who was physician to King Louis XIV, performed the transfusion of blood from an animal to a human.^[41] In 1818, British obstetrician James Blundell successfully transfused human blood to a patient who had haemorrhaged during childbirth. In 1901, Karl Landsteiner, an Austrian physician discovered the first human blood groups, which helped transfusion to become a safer practice.

Technology and Diagnostic boom – the advent of radiology diagnostics such as Ultrasonography, CT scan, MRI and other imaging techniques, helped surgeons to do more precise and safer surgery with better outcomes.

Wars that lead to development of Surgery

9. World War I-

X-rays machines were set up in hospitals, and radiology has since been used for the benefit of

millions. During the war, French surgeon Alexis Carrel and English chemist Henry Drysdale Dakin developed the Carrel-Dakin chlorine-based antiseptic.^[42,43,44] It was effective in disinfecting traumatic wounds, as was “verdunization,” a simple technique using diluted bleach (sodium hypochlorite).

Army doctors developed simple but effective devices to carry out transfusions at the front, considerably augmenting the chances of survival and recovery of seriously wounded soldiers and bringing about a major advance in first-aid and emergency care. Use of citrate as anticoagulant was also developed during the first world war.^[45]

In reconstructive surgery, the first grafts were carried out to help the large number of soldiers whose faces were mutilated in trench warfare. Parallel to the progress in reconstructive surgery were improvements in prosthetic devices. There was also considerable improvement in anaesthesia techniques.

10. World War II-

At the beginning, only plasma was available as a substitute for the loss of blood. By 1945, serum albumin had been developed, which is whole blood that is rich in the red blood cells that carry oxygen and is considerably more effective than plasma alone. During the war, surgery techniques such as removing dead tissue resulted in fewer amputations than at any time. To treat bacterial infections, penicillin or streptomycin were administered for the first time in large-scale combat.^[46]

Other improvements during World War II included improved crash helmets, safety belts, flak jackets and other preventive measures.

History of development of Specialized Procedures

Development of Endoscopy- Phillip Bozzini, a German army surgeon, invented the first instrument to visualize the inside of a human body in 1806.^[47] He named this device the Lichtleiter.

Maximilian Carl-Friedrich Nitze and Joseph Leiter developed the first true working cystoscope in 1878. From that point on, there has been constant innovation and development that has led to the instruments urologists use today.

Cystourethroscopy is one of the most common procedures performed by a urologic surgeon. Cystoscopy is mostly a diagnostic procedure, but there are a limited number of therapeutic procedures that can also be performed.

Development of Laparoscopy

A German gastroenterologist, Heinz Kalk, developed a superior laparoscope with improved lenses and the first forward-viewing scope in 1929, earning him the title “Father of Modern Laparoscopy.”^[48]

In 1983, Kurt Semm performed the first laparoscopic appendectomy, bringing him criticism and censure rather than accolades. The German Board of Surgery condemned him. The first surgeon to perform a laparoscopic cholecystectomy met with a similar fate. German surgeon Erich Muhe used his “galloscope,” a 3-cm, direct-vision laparoscope of his own design to remove a gallbladder. He presented his work at the 1986 Congress of the German Surgical Society. He, too, suffered skepticism and criticism and was ultimately censored by the courts.

Development of Organ Transplant-

Around 600 BC, the Indian surgeon Sushruta, known as the father of surgery, is credited with performing the first plastic surgery operations, including full-thickness skin grafts. In 1954, kidney was the first human organ to be transplanted successfully.^[49] Liver, heart and pancreas transplants were successfully performed by the late 1960s, while lung and intestinal organ transplant procedures were begun in the 1980s. Initial results were dismal but improved after availability of cycloserine and other drugs for immunosuppression.

Some Notable Surgeons & Their Contributions to the development of Surgery

Anatomist Surgeons-

Andreas Vesalius was a 16th-century anatomist, physician, and author of one of the most influential books on human anatomy, *De Humani Corporis Fabrica Libri Septem* (*On the fabric of the human body in seven books*). Vesalius is often referred to as the founder of modern human anatomy.^[50]

Ambroise Paré (c. 1510 – 20 December 1590) was a French barber surgeon who served in that role for kings Henry II, Francis II, Charles IX and Henry III. He is considered one of the fathers of surgery and modern forensic pathology and a pioneer in surgical techniques and battlefield medicine, especially in the treatment of wounds. He was also an anatomist, invented several surgical instruments, and was a member of the Parisian barber surgeon guild.^[51]

He improved the methods of wound management by using ointment instead of boiling oil. He also re introduced the concept of ligation of blood vessels. He also popularised the use of tourniquet.

William Stewart Halsted, was an American surgeon who emphasized strict aseptic technique during surgical procedures, was an early champion of newly discovered anaesthetics, and introduced several new operations, including the radical mastectomy for breast cancer.^[52]

Along with William Osler (Professor of Medicine), Howard Atwood Kelly (Professor of Gynecology) and William H. Welch (Professor of Pathology), Halsted was one of the "Big Four" founding professors at the Johns Hopkins Hospital.

Christian Albert Theodor Billroth was a German and Austrian Surgeon. As a surgeon, he is generally regarded as the founding father of modern abdominal surgery. He introduced the concept of audits, publishing all results, good and bad, which automatically resulted in honest discussion on morbidity, mortality, and

techniques – with resultant improvements in patient selection.^[53]

Harvey Williams Cushing was an American neurosurgeon, pathologist and a writer.^[54] A pioneer of brain surgery, he was the first exclusive neurosurgeon and the first person to describe Cushing's disease. He considerably improved the survival of patients after difficult brain operations for intracranial tumors. He used X-rays to diagnose brain tumors. He used electrical stimuli for study of the human sensory cortex. He played a pivotal role in development of the Bovie electrocautery tool with William T. Bovie, a physicist.

Sir John Charnley was an English orthopaedic surgeon. He pioneered the hip replacement operation. He also demonstrated the fundamental importance of bony compression in operations to arthrodesis (fuse) joints, in particular the knee, ankle and shoulder.

Emil Theodor Kocher was a Swiss physician and medical researcher who received the 1909 Nobel Prize for Medicine for his work in the physiology, pathology and surgery of the thyroid. Among his many accomplishments are the introduction and promotion of aseptic surgery and scientific methods in surgery, specifically reducing the mortality of thyroidectomies below 1% in his operations.

Allen Whipple was an American surgeon who is known for the pancreatic cancer operation which bears his name (the Whipple procedure) as well as Whipple's triad.

Alexis Carrel was a French surgeon and biologist who was awarded the Nobel Prize in Physiology or Medicine in 1912 for pioneering vascular suturing techniques. He invented the first perfusion pump with Charles A. Lindbergh opening the way to organ transplantation.

Future Developments

We have now entered the era of Modular Operation theatres which boast of the state of art

technology for Surgery. Use of Surgical robots has increased precision and decreased the chances of errors. Robots are also being modified and newer leaner robots are making their way into the modern Operation theatres. We have now entered an era of minimal access surgery. Conventional laparoscopy is giving way to Single Incision Laparoscopic Surgery (SILS) and Natural Orifice Transluminal Endoscopic Surgery (NOTES). 3D printing of human tissues, Simulation and navigation and Mixed reality along with Artificial Intelligence is the future of surgery. We have thus come a long way from the ancient Egyptian, Roman, Greek and Indian methods of Surgery to the modern day modular OT concept.

Through history, we can learn how past surgeons, systems, ideas, cultures and technologies were built, how they operated patients, and how they have changed over years. The rich history of the surgery helps us to paint a detailed picture of where we stand today and makes us think about future.

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