THE EVOLUTION OF SURGERY:
A journey of opportunity, invention and quality!

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Objectives
A “whirlwind” tour of major historical events that shaped surgery as we know it!

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Evolution of Surgery

Fundamental prerequisites:

1) Anatomy
2) Hemostasis
3) Anesthesia/analgesia
4) Antisepsis and aseptic technique
5) “Instrumentation”
Neanderthal cave drawings, stone figures of the human body

40,000 BC

37,000 BC 1st depiction of female genitalia

3500 BC The wheel: Mesopotamia (Iraq)

2560 BC The Great Pyramid at Giza completed

1800 BC

Kahun Papyrus: Women’s diseases

1800 BC

Bronze metalworking: Europe (Middle East -3000 B.C.)

1750 BC Code of Hammurabi: Medical rules of operation (Babylon)

1700 BC

Kahun Gynecological Papyrus

Egypt 1800 BC
Discovered 1889

• Oldest known medical text.
• 34 sections, addressing specific problems.
• Addressed women’s health: fertility, pregnancy, contraception.
• Diagnosis and non-surgical treatment.
• Symptoms/Diagnosis/Treatment approach
• PROGNOSIS was not addressed!
• Egyptian written level of knowledge of medicine surpassed that of Hippocrates (1,400 years later).
Code of Hammurabi
Medical laws and ethics of Babylon (1700 BC)

• 282 laws, dealing with all aspect of public life, citizen's rights and limits, and the Babylon Kingdome's justice system.
• Represents the initial \textit{interface between medicine and law}.
• In principle, the human body represents a forbidden existence in nature, saved and protected against violation which may endanger life.
• Allows violating the body integrity in treatment and surgery by \textit{consent}, on condition that this interference in the human body is limited specifically to those cases that would benefit health.

Code of Hammurabi
Medical laws and ethics of Babylon (1700 BC)

• 282 laws, dealing with all aspect of public life, citizen's rights and limits, and the Babylon Kingdome's justice system.

Described a \textit{scaled fee schedule} for surgical services, \textit{linked to the outcome} of the surgery with severe penalties if expectations not met!
• Required documentation of diseases and therapies, including \textit{prescription benefits}.
• The code fully explained \textit{patient rights}.
• Surgical care was authoritarian; there were possibility of \textit{legal actions} to insure justice and equity particular to each social class.

*3700 years prior to NSQIP

1700 BC
1650 BC
First “skin” staples: Decapitated Ants!
(2st century AD)

1500 BC
15th reference to “adhesive” tape
(Egypt) [1960 1st micropore tape]

1000 BC
First “skin” staples: Decapitated Ants!
(2st century AD)

900 BC
Albucasis used hot iron to stop bleeding
(1654: Middeldorpf describes galvanocautery)

753 BC
Rome founded

80 BC
1st recorded reference to nursing as a profession (India)

1st reference to suture material; Edwin Smith Papyrus (Egypt)

3700 BC
Albucasis used hot iron to stop bleeding
(1654: Middeldorpf describes galvanocautery)

50 BC
Phoebe, Romans 16:1, 1st “Christian” nurse
Hippocrates (460-375 BC) *

- “Father of Western Medicine”
- Under his influence medicine became a “profession”!
- 1st to believe that diseases were caused naturally, not related to superstition and gods.
- Hippocratic medicine was humble and passive and the therapeutic approach was based in “the healing power” of nature.
- CRISIS, a point in the progression of disease at which either the illness would progress and the patient would succumb to death, or the opposite would occur and natural processes would allow the patient to recover.

1st reference to vessel ligation: Soft and not over twisted (Aulus Cornelius Celsus: Rome)

Aulus Cornelius Celsus* (25 BC – 50 AD)

- *Treatise On Medicine (De Medicina).
- 1 – The History of Medicine (references 80 medical authors)
- 2 – General Pathology
- 3 – Specific Diseases
- 4 – Parts of the Body
- 5 & 6 – Pharmacology
- 7 – Surgery
- 8 – Orthopedics
- Theory to medical practice and pros and cons of animal & human experimentation.
- Credited with recording the cardinal signs of inflammation:
  - “Celsus tetrad”: calor (warmth), dolor (pain), tumor (swelling) and rubor (redness and hyperemia).
- Celsus who translated the Greek term CARCINOS (used by Hippocrates meaning crab or crayfish, to refer to malignant tumors) into the Latin cancer, also meaning crab.

*Roman encyclopedist physician
1 AD
- 1st reference to vessel ligation: Soft and not over twisted (Aulus Cornelius Celsus: Rome)

150
- Anatomic detail vessel origin, incision placement
- Galen (Greek in Rome) "AD" 

175
- Tendon repair with silk (Soranus: 1st reference to catgut: Galen)

200 AD
- Surgery separates from medicine

200 AD
- 1-500 AD: Nursing care palliative needs of persons and families. Religious organizations were the care providers!

910
- Rhazes (Persia)
- Urine analysis
- Identifies smallpox,
- Suggests blood as the cause of infectious disease

1175
- Intestinal suturing over a hollow tube
- Warmed exposed intestine: covered with the viscera of a dying animal.
- Primitive Murphy Button (Roger of Palermo)

1200 AD

Murphy's Anastomosis Button: 1903
- Two bowls inserted into the lumen of the intestine and clipped together, making an inverted anastomosis.

End to End Anastomosis, EEA 1978
Jehan Yperman (1260-1331 AD)

- Flemish surgeon and the first Dutch medical writer.
- Realized the "lowly" status of surgery during late medieval time.
- Advocated that surgeons know nature, philosophy and ethics and have "good behavior". (Origin of Disruptive behavior)
- Raised the level of surgery based on reason and experience in an effort to take medicine out of the hands of barbers and "ignorant practitioners".
Andreas Vesalius (1514-1564)*
Father of human anatomy (Dutch)

- 1543: *De humani corporis fabrica*, a fully illustrated book on human anatomy body, based on observations from dissections (many animal), overturning misconceptions that had persisted for > 1000 years (Galen).

- Book 1: The Bones and Cartilages*
  2: The Ligaments and Muscles
  3: The Veins and Arteries
  4: The Nerves*
  5: The Organs of Nutrition and Generation
  6: The Heart and Associated Organs*
  7: The Brain*

- 1540
  John Knox leads Reformation in Scotland

- 1545
  Paré: "clean" care of traumatic wounds

- 1546
  Verona theorized that small germs cause contagious diseases (500 years prior to Semmelweis, Lister and Pasteur)

- 1588
  Defeat of the Spanish Armada

- 1592
  Galileo: 1st thermometer

- 1597
  A Discourse of the Whole Art of Chirurgery
  1st English Surgical text (Parr Lows)

- 1600
  William Harvey: Circulatory system
  An Anatomical Study of the Motion of the Heart and of the Blood in Animals

- 1607
  Jamestown settlement

- 1628
  Daughters of Charity of Saint Vincent de Paul: Servants of the Sick Poor

- 1633
  French nurse Jeanne Mance established North America's 1st hospital Hôtel-Dieu de Montréal.

- 1645
  U.S. Population: 474,000

- 1650
  U.S. Population: 5,700

- 1670
  1st small bowel resection for gangrenous bowel (Randohr: 2 year survivor!!)

- 1687
  1st appendectomy: (Amyand's hernia [R inguinal hernia])

- 1730
  Jefferson's birthday

- 1750
Ephraim McDowell (1771-1830)

- **Father of abdominal surgery!**
- Studied in Scotland and Virginia: never received a degree.
- **1809**: 1st successful removal of an ovarian tumor (Danville, Ky)
- Performed without anesthetic or antisepsis.
- Tumor weighed 22.5 pounds (10.2 kg).
- Operative time 25 mins!
- His report: “scrupulously clean” technique, removal of blood from the peritoneal cavity and “bathing” the intestines with warm water.
- Uncomplicated recovery …….Mrs. Crawford lived another 32 years.
Crawford Long (1815 – 1878)

- Cousin of famed gambler John Henry “Doc” Holliday!
- Performed his first surgical procedure using SULFURIC ETHER on March 30, 1842, removing a neck tumor from a young man. Later used it in his obstetrical practice.
  - *Never published his findings!!!*
- Six years later (1846), William Morton, unaware of Long’s prior work, administered ether anesthesia before a medical audience at MGH.
Ignaz Semmelweis (1818-1865)

- Hungarian physician: “SAVIOR OF MOTHERS”.
- As an assistant (“Chief resident”) in the maternity clinic in Vienna, he introduced **HAND WASHING** with chlorinated lime solutions for interns who had performed autopsies.
- **Immediate reduction of the incidence of fatal puerperal fever from ~10% (range 5–30%) to <2%**.
- The concept of “**cleanliness**” was considered extreme and was ignored, rejected and ridiculed, dismissed and harassed by the medical community in Vienna, which eventually forced him to move to Budapest. **LATER COMMITTED!**
J Marion Sims (1813 – 1883)

- "Father of modern gynecology"
- Repair of "catastrophic complication of childbirth!"
- Silver-wire sutures led to successful repair of a fistula, after multiple procedures (30)!!!
- He founded the Woman's Hospital (1855), later to be named St. Luke's-Roosevelt Hospital Center and established America's first cancer institute, New York Cancer Hospital in 1871 (MSKCC).
- Hero or Villain?

U.S. Women in Medicine

- 1849: Elizabeth Blackwell: 1st woman to obtain a medical degree in the U.S.  
  (Geneva Medical College)
- 1855: Mary Edwards Walker: 1st U.S. female surgeon: Civil War,  
  Medal of Honor.  (Syracuse Medical College)
- 1863: Mary Harris Thompson: 1st American woman to specialize in pelvic surgery.  
  Chicago Hospital for Women and Children!  
  (New England Female Medical College/Chicago)
1864: Rebecca Lee Crumpler: 1st black woman to earn a medical degree (New England Female Medical College)

54,543 physicians in the United States, 300 of whom were women. None of them were African American women!!

1889: Susan La Flesche Picotte MD: 1st Native American woman to become a physician in the U.S. (Women's Medical College of Pennsylvania)

1947: Gerti Cori MD: 1st woman to win Nobel peace prize in physiology and medicine.
Joseph Lister: (1827 – 1912)

- British surgeon: *Father of antiseptic surgery*
- Applied Pasteur’s principles in microbiology, introducing carbolic acid (phenol) to sterilize surgical instruments and clean wounds, reducing post-operative infections.
- Lister promoted the antiseptic system by stressing ‘principles’ and ‘professionalism’ and ‘performance’
  - soaking surgical sponges and bandages in a solution of carbolic acid, spraying a wound with an antiseptic solution during surgery, washing surgical instruments, rinsing hands before beginning an operation, and wearing appropriate surgical gowns.
- Procedural changes confusing, use of carbolic area was unpleasant, not easily reproduced and “germ theory” was certainly not accepted by all!

1st American woman to specialize in pelvic surgery (Mary Harris Thompson)

Lister: Carbolic acid antisepsis

Mary Mahoney: 1st African American nurse in the U.S.

Cesarean Hysterectomy: 3 day survival!! (Horatio Storer)

Gastroctomy for cancer (Billroth)

1st successful gastrectomy for cancer (Billroth I)
Hysterectomy: Historical "Highlights"

- **1881**: Koch postulates "microorganisms cause disease"
- **1883**: 1st successful operation for ectopic pregnancy: mortality rate 90% to 4% (Tait)
- **1888**: EDISON INVENTS LIGHTBULB
- **1889**: 1st HYSTERECTOMY FOR FIBROID (Mary Jane Dixon)
- **1888**: Statue of Liberty is dedicated
- **1882**: Koch’s postulates "microorganisms cause disease"
- **1884**: 1st HYSTERECTOMY FOR FIBROIDS (Mary Jane Dixon)
- **1886**: Statue of Liberty is dedicated
- **1888**: EDISON INVENTS LIGHTBULB

**HYSTERECTOMIES WERE PERFORMED SPORADICALLY AND ONLY FOR UTERINE PROLAPSE OR UTERINE INVERSION. HOWEVER, URINARY INJURY WAS COMMON & PATIENTS RARELY SURVIVED.**

**Hysterectomy: Historical "Highlights"**

- **50 BC**: 1st reference to vaginal hysterectomy Themison of Athens.
- **128 AD**: Soranus (Greece) removed an inverted gangrenous uterus.
- **1889**: 1st authenticated vaginal hysterectomy performed by the Italian anatomist Berengario da Carpi of Bologna.

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**Hysterectomy: Historical "Highlights"**

- **1670**: One of the first reported successful vaginal hysterectomies was self-performed.

  Faith Haworth, a 46-year-old peasant suffered a complete uterine prolapse while carrying a heavy load.
  Frustrated by this frequent occurrence, she grabbed her uterus and amputated it with a short knife.
  She survived for a decade, with a persistent vesico-vaginal fistula.
Hysterectomy: Historical “Highlights”


1813: Conrad Lagenbeck of Gottingen performed the 1st planned vaginal hysterectomy reported 1817.

1843: Charles Clay performed the 1st recorded abdominal (subtotal) hysterectomy in Manchester, England. (postoperative hemorrhage and death)

Hysterectomy: Historical “highlights”

1853: Walter Burnham performed the 1st successful abdominal hysterectomy, in Lowell, Mass, by accident! (12/15 (80%) subsequent patients died)

1868: 1st Cesarean hysterectomy in US (Storer, Boston for “perfectly frightful” hemorrhage)

1872: Due to high mortality rate Abdominal hysterectomy was “formally condemned” by the Academy of Medicine in Paris.

1895: Clark and Rumpf performed “extended hysterectomy” and pelvic lymphadenectomy (Hopkins).

1898: Wertheim devised extended hysterectomy and lymphadenectomy

1929: Richardson (U.S.) performed the 1st total abdominal hysterectomy, recommended cervix excision, to avoid cervical stump carcinoma.

1902: Schauta performed radical vaginal hysterectomy

1948: Brunschenig reports “ultra radical” salvage surgery
"In the winter of 1889 and 1890—I cannot recall the month—the nurse in charge of my operating-room (Caroline Hampton) complained that the solutions of mercuric chloride produced a dermatitis of her arms and hands. As she was an unusually efficient woman, I gave the matter my consideration and one day in New York requested the Goodyear Rubber Company to make as an experiment two pair of thin rubber gloves with gauntlets.

On trial these proved to be so satisfactory that additional gloves were ordered. In the autumn, on my return to town, an assistant who passed the instruments and threaded the needles was also provided with rubber gloves to wear at the operations. At first the operator wore them only when exploratory incisions into joints were made.

After a time the assistants became so accustomed to working in gloves that they also wore them as operators and would remark that they seemed to be less expert with the bare hands than with the gloved hands".
We have come a long way......

1901: Dimitri Ott, wore head mirrors to reflect light and augment visualization and used a speculum in the a posterior fornix incision as access in a pregnant woman (Petrograd gynecologist)

1901: Kelling, described “coelioscopy,” filling the abdomen of a living dog with air and inserted a Nitze cystoscope to inspect the viscera using high pressure insufflation (German surgeon)

Laparoscopy: we have come a long way......

1910: H.C. Jacobaeus: published description of peritoneal, pleural and pericardial cavity!

1911: Bertram M. Bernheim (John Hopkins Hospital) introduced diagnostic laparoscopic surgery in US

1918: O. Goetz: pneumoperitoneum needle

1920: Zollinger (replaced CO2)

1934: John C. Reddock (Toronto): DIAGNOSTIC LAPAROSCOPY SUPERIOR TO LAPAROTOMY

1938: James Veress (Hungary)

1944: Randall Palmer, first gynecologic laparoscopy, Trendelenburg position

1953: Rigid rod lens system: Hopkins et al. perform; Strong acquires patient

1960: Semm, (German gynecologist): automatic insufflator

1982: Clarke: laparoscopic suturing technique.

1982: 1st computer chip camera - Circon
1969 ARPAnet

1972 Gynecologic Oncology

1973 Computed Tomography (Calneck & Hounsfild)

1974 Polyglycolic Acid suture (Vicryl)

1976 Polyester suture (Ethibon)

1977 Sentinel Node 1st reported (Penis)

1978 1st Whole body MRI (Damadian)

1979 1st Nursing PhD (Case Western)

1980 Bayh-Dole Act or Patent and Trademark Law Amendments Act

- Ownership of inventions supported with federal funding
- Business interests influence the direction of cancer research and the adoption of new practices in therapy (Guidelines, CME)
- University projects which receive industry funding are more likely to produce research outcomes which favor their funders
- Pharmaceutical and medical device industry sponsored studies are more often favorable to the sponsor’s product compared with studies with other sources of sponsorship
- “Funders” seek and court scientists to author papers and lend their person reputations to add credibility to research findings
- $13-18 meals influence prescribing habits

1982 PET scan

1983 - Polytetrafluoroethylene (PTFE suture)

1985 - Polydioxanone Sulfate (PDS) suture

1986 - 1st LSC cholecystectomy

1987 - 1st LSC hysterectomy (Reich)

1988 - 1st LSC Radical hysterectomy - SNL vulva (Martin)

1990 BRCA 1 - Mary Claire King

1993 Poliglecaprone 25 (Monocryl)

1994 Poliglactate (Maxon)

1995 1st use of Morcellator! (FDA Advisory 2014)
Where are we going????

Scope vs Robot?

Cost?

Quality?

Role of Mesh?

Debulking vs Neoadjuvant therapy?

Sentinel node vs. Lymphadenectomy?

Energy source?

Harmonic/LigaSure/Gyrus

Molecular/Immune/Vaccine?

Knowledge

Doubled from 100 B.C. to 1700
Doubled from 1700-1900
Doubled from 1900-1950
Doubled from 1950-1970
Doubled from 1970-1980
Doubled from 1980-1988

Now doubles every 12 months.
Soon it will double every 12 hours.
“I think the biggest problem with healthcare today is not its cost or technology— which is a big problem— but for all that money, it’s not an expression of our humanity.”

Jonathan Bush – CEO, athena health