

WHERE CLASSICAL WISDOM MEETS INTELLIGENT LEARNING

# 1.2. Chronological development of surgery from ancient to present era

## **Chronological Development of Surgery - From Pre-history to the Present**

Era	Landmarks & Innovators	Knowledge/Technique Gained	Why it Mattered
Pre-historic ( ≈ 10 000 - 3000 BCE )	Trepanation holes in Neolithic skulls on every continent	Earliest proof that humans could open bone, recognise survival signs, and control bleeding	Demonstrates innate surgical impulse; survival rates ≈ 40 %
Early Civilisations (c. 2600 - 600 BCE)	• Edwin-Smith Papyrus, Egypt (≈ 1600 BCE) - 48 case-notes on head & spine trauma • इह खलु शल्यं प्रथमम् — Suśruta (~600 BCE) - 125 <b>śastra</b> , 120 <b>yantra</b> , detailed rhinoplasty flap: २०२०२००० (Su. Su. 26), six-fold wound classification (Su. Sū. 1/12)	Systematic operative science; anaesthetic wine-henbane mix; aseptic wound care	Becomes the classical bedrock of <b>Śalya Tantra</b> and plastic surgery
Greco-Roman ( 400 BCE - 500 CE )	Hippocrates on fracture traction; Celsus' ligatures & trepan; Galen's vascular dogma	Anatomy from animal dissection, arterial vs. venous bleeding control	Medical language of Europe; preserved by Arabs
Islamic Golden Age (7-11 th c.)	Abū al-Qāsim al-Zahrāwī (Al-Zahrawi): <b>Kitāb al-Taṣrīf</b> - 200+ instruments, obstetric forceps, dental drills	Illustrated operative manual; silk- thread ligatures	Filters Greek-Indian surgery to medieval Europe
European Renaissance (14-18 th c.)	Ambroise Paré (1510-90): gentle <i>ligature</i> replaces cautery     Andreas Vesalius (1543): <i>De Humani Corporis Fabrica</i> – human dissection atlas	Scientific anatomy; battlefield haemostasis	Lays foundation for rational, anatomy-based surgery
19 th-century Revolutions	Pain → Infection → Imaging triad • Ether anaesthesia (16 Oct 1846, Boston) • Carbolic-acid antisepsis (Lister, 1867) • X-rays discovered by Röntgen (1895)	Painless, infection-controlled, image-guided operations	Drops mortality, permits deep cavity & bone surgery
Early 20 th century	<ul> <li>ABO blood-groups (Landsteiner, 1901)</li> <li>Antibiotics (Penicillin 1928)</li> <li>First heart-lung machines &amp; tumour resections</li> </ul>	Safe transfusion, infection control, major resections	Enables lengthy, complex operations
Transplant & Tech Era (1950-80s)	<ul> <li>First kidney transplant (Boston, 1954)</li> <li>Microsurgery &amp; operating microscopes (1960s)</li> <li>CT imaging (1971)</li> <li>First laparoscopic cholecystectomy (Mühe, 1985)</li> </ul>	Organ replacement, minimally invasive optics	Surgery shifts from "large incision, large cure" to keyhole precision
Robotic & Digital Age (2000 →)	<ul> <li>da Vinci system FDA-cleared (2000)</li> <li>First complete tele-surgery "Lindbergh Operation" (2001)</li> <li>5G ultra-remote telesurgery feats (Rome-Beijing prostatectomy 2024)</li> </ul>	Enhanced dexterity, tremor-filter, distance-nullifying care	Opens door to Al-assisted, mixed-reality and nano- robotic interventions
Frontiers (2020s- present)	Xenotransplantation (pig-to- human heart, 2022); bioprinted tissues; autonomous suturing algorithms	Regenerative, personalised, data- driven surgery	Aims for scar-less, complication-free, globally accessible operations

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## **Key Themes across the Timeline**

#### 1. Control of Three Core Problems

 $Pain \rightarrow Bleeding \rightarrow Infection$  have sequentially been conquered (anaesthesia, ligature/blood-banks, antisepsis/antibiotics).

## 2. Miniaturisation & Visualisation

From Sushruta's fine-pointed vrihimukha śastra to fibre-optics, laparoscopy, and 8 K 3-D robotic consoles.

## 3. Integration of Technology

## Mnemonic - "S-C-A-L-P-E-L" to remember the march of surgery

Letter	Epoch
S	Stone-Age trepanation
C	Classical Suśruta & Celsus
A	Arabic Al-Zahrawi
L	Ligature Paré & Lister antisepsis
P	Pain-free ether anaesthesia
E	<b>Electro-imaging</b> (X-ray → CT)
L	<b>Laparoscopy</b> → <b>da Vinci</b> & beyond

## Take-Away

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