

THE WESTERN SURGICAL APPROACH: A BRIEF HISTORY

VLAD PRELUCĂ¹, ALEXANDRU SABĂU², ANCA DUMITRA³, DELIA ALEXANDRA PETRIA⁴,
IRINA PALADA⁵, ALBERTINA STĂNILĂ⁶, DAN SABĂU⁷

^{1,2,3,4,5,6,7} “Lucian Blaga” University of Sibiu, ^{1,2,3,4,7} Clinical County Emergency Hospital Sibiu

Keywords: surgery, Western approach
Abstract: The beginning of surgery predates the earliest written records. Initial healing strategies involved a mix of surgery, pharmacy and magic. During antiquity, surgical theory was based on the humoralist view, while practice was largely empiric. In the dark and middle ages, surgery regressed under the dogmatization of ancient texts, which ended when the renaissance started a new wave of empiricism. Surgery was seen as inherently painful and high-risky until the advent of anesthesia and antisepsis. These breakthroughs led to an age of increasing invasiveness of surgical procedures, the time of “great surgeon – great incision”. Since the second half of the XXth century, the focus has shifted to minimally invasive and fast-track surgery. Current developments suggest that this approach will endure, with a constantly improving pharmacological and technical support.

The invasive nature of surgical procedures must have been obvious since the first human, or hominid, used a sharp tool to open an abscess or remove a foreign body, long before the appearance of the written word.

While the acknowledgment of pain as a price for surgical healing is present as a continuous thread throughout history, the evolution and revolutions of what is considered a proper surgical approach come together as a tumultuous and fascinating tale.

The tale of the surgeon and his attitude towards the patient’s body and disease spans millennia, from the ritualistic or empiric beginning, through ancient glory, dogmatization and dark ages, revolutions and relapses, to the present age of microinvasive, scar-free, one day surgeries. As an exhaustive presentation is well beyond the scope and possibilities of this article, we will offer a brief history of the surgical approach, grouped by historical periods.

Antiquity

The oldest known texts pertaining to surgical practice originate from ancient Mesopotamia, in the form of (mainly) Assyrian clay tablets and the Babylonian Code of Hammurabi. The clay tablets give a picture of a mixed medical art, both physical and spiritual. Physical healing, by pharmacological and surgical means, was conducted by the *azu*, while magical healing, by identifying and exorcizing the causative demons through rituals and incantations, was the specialty of the *asipu*. These two systems were seen as complementary and occasionally overlapped, with the *azu* using incantations as adjuvants and the *asipu* offering pharmacological advice.(1) Hammurabi’s Code is possibly the first official acknowledgement of the risks of surgical healing, which is separated from medical healing in terms of both remuneration (ten shekels for a successful surgery versus five for “curing diseased bowels”, laws 215 and 221) and malpraxis liability (no mention of medical malpraxis, while surgical malpraxis could have cost the physician his fingers, law 218).(2) Regarding surgical technique and care, surviving texts mention a variety of procedures and post-operative

wound care in the form of oil-soaked linen bandages.(3) While raw opium was known and extracted by the Assyrians (4) and, possibly, the Sumerians (5), there are no clear indications to its use as a surgical analgesic.

Ancient Egyptian sources reveal a similar approach to healing, often prescribing surgery, unguents, talismans and incantations as a unitary therapeutic scheme. The Ebers papyrus, one of the most extensive medical texts of its time (XV century B.C.), abounds with prescriptions of healing incantations and esoteric poultice ingredients such as cat’s dung, tail of a mouse, crocodile eggshell or dust of a statue. While some of the recipes have been deemed to have reasonable antiseptic, astringent or desiccant properties, the majority are clearly based on magical thinking. However, in the same text we find the first sprouts of systematic medical thinking (particularly the classification and diagnosis of tumors), first assimilation of post-operative and traumatic wound care and the first explicit warning against careless incision (“treat it with the knife, but plan to avoid the blood vessels”).(6) The Edwin-Smith papyrus is an outstanding example of this emergent systematization, with an almost Hippocratic logic, clarity and lack of magical solutions. It is also notable for the indication of therapeutic abstinence in incurable conditions (case 45 – “Practices for ball-like tumors on his chest”).(7)

The first schools of medical thinking wholly anchored in the physical world, to our current knowledge, were the Hippocratics. The collection of their works is characterized by a high degree of systematization, coherence and practical diagnosis and advice. Although based on erroneous premises and observations, the humoralist theory is the first attempt of physiopathology. While the Hippocratic Oath prohibits lithotomy, the corpus does deal with traumatic surgery. Among the surgical related premieres, there is included the observation on the relationship between age, wound healing speed and scar formation (On wounds in the head, XV, XVIII), which will later lead to over a thousand years of “pus bonum et laudabile” dogma due to misinterpretation.(8) In spite of its long dated

¹Corresponding author: Vlad Prelucă, Str. Lucian Blaga, Nr 2A, Sibiu, România, E-mail: vlad.preluca@yahoo.com, Tel: +400721285862
Article received on 12.07.2015 and accepted for publication on 25.11.2015
ACTA MEDICA TRANSILVANICA December 2015;20(4):86-89

CLINICAL ASPECTS

practices and faulty theories, the Hippocratic corpus represents the philosophical foundation of modern western medicine.

The next big step was the institutionalization of medical learning and research in Ptolemaic Alexandria. The center of knowledge fostered in Alexandria gathered scholars and ideas from all over the Mediterranean world, leading to an unprecedented advance in surgery and pharmacy.(9) The constant exchange of ideas and academic debates led to a diversification in medical thinking currents. Most were adherents to the Hippocratic humoralist theories, but one group, the Empiricists, stood out as the first recorded advocates of a statistical approach and evidence based medicine.(10) While little survived of the primary sources dealing with Alexandrine medical thought, their knowledge passed on through Celsus and Galen.(11)

As stated above, Roman medicine was a direct continuation of hellenistic medicine (and, for a considerable part, hellenistic itself).(12) Celsus' Book VII of *De Medicina* describes a fairly advanced surgical art, comparable in terms of concepts, technique and variety to that of early XIXth century. The proemina recommends the surgeon an attitude of compassion, thoroughness and detachment, and, by listing the patient's cries as a perturbing factor, confesses the lack of proper analgesia (VII.0.4), although the pharmacopoeia (book V) describes opium, Mandragora and Hyosciamus. Notable concepts mentioned include elderly frailty (VII.7.14.B), comorbidities (VII.14.8) and preoperative preparation of the patient by diet, hydration and exercise (VII.26.2.B).(13) Probably the most renowned product of the Alexandrine school of medicine, and definitely the most important in terms of historical impact, was Galen of Pergamon. Conceptually, Galen's writings are consistent with those of Celsus, with a heavy emphasis on detail and the theoretical and methodological basis of the healing art. His titanic corpus, unparalleled in terms of length, scope, detail and argumentation, has been turned into the dogma of mainstream western medicine for approximately a millennium and a half, to the point where novel techniques or contradictory findings (such as inconsistencies between dissections and his animal-based anatomy) were instantly dismissed as quackery or irrelevant anomalies.(12,14) As it happens when appeal to authority dominates scientific thought, "Galenic" medicine became corrupted through translation errors and misinterpretation. A great example in this sense was the omnipresence of the "laudable pus" doctrine, centered on the idea that to achieve proper wound healing, the physician had to encourage suppuration (sometimes through barbaric interventions), although Galen himself explicitly stated otherwise (*Method of Medicine* V.1.).(15)

Dark and Middle Ages

The crisis and fall of the Western Roman Empire led to a massive regression of medical knowledge and practice throughout its territory. Until the beginning of the second millennium A.D., no significant literature has been produced, and much has been lost. Technique also devolved, from the use of resorbable stitches and complex maxillary resections of Heliodorus and Antyllus (reported by Oribasius) (8), Galen's contemporaries, to an indiscriminate use of the cautery and the consolidation of "laudable pus". In opposition to the abrupt collapse of Rome, Byzantium experienced a gradual decline, which allowed the preservation of Greco-roman medicine. This knowledge was passed to the Arab world through the Nestorian exile in the Vth century.(14,16) The writings of Rhazes, Albucasis and Avicenna preserved Galenic medicine and added some improvement, particularly in pharmacy and the importance of scientific methodology. While progressive in comparison to contemporary Christian surgery, Arab surgery was still inferior

to the ancient Greco-roman standard in terms of technique. This situation was common in all cultures with Abrahamic religions, which deemed surgery as a somewhat dishonorable practice.(16)

The rebirth of European surgery was fostered in the first medieval medical schools, during the X-XIIIth centuries: Salerno, Bologna, Montpellier and Paris. Based on Arab versions of Galenic medicine (14), these institutions were the birthplace of several innovations. The Bamberg Surgery manuscript (a product of Salerno) carries the first mention of the "soporific sponge", a crude method of anesthesia.(16) In Montpellier, Henri de Mondeville stressed the importance of clean utensils in preventing post-operative infections. In Bologna, William of Salicet advocated for the use of knives instead of cauterization.(17) Hugh and Theodoric de Lucca (Bologna) are noteworthy for their vehement opposition to the "laudable pus" concept, promotion of dry wound healing, and other innovations, including drainage and limiting interaction with post-operative wounds and preserving the peritoneal microenvironment by placing a freshly eviscerated dog on the patient's intestines.(16,18)

However, these ideas had little impact in general surgical practice, which was still dominated by aggressive use of cauterization and wound irritation as the golden standard.

Renaissance and Enlightenment

The first significant progress from ancient times began in the early XVIth century, when a new wave of empiricism, which included Vesalius, Ambroise Pare and Paracelsus, rebelled against the dogmatic view of Galenic infallibility and preached for a modern medicine.(14)

Ambroise Pare advocated for a gentle surgical approach, and against the use of cauterization and wound irritants, a view based on his personal experience, which contradicted the usual methods of his time.(19) Opposite to Pare's humble demeanor ("I dressed, God healed"), Paracelsus launched vitriolic attacks against mainstream medicine ("my shoe buckles are more learned than your Avicenna and your Galen").(16) While Paracelsus' alchemy-based medicine was just as arcane as the Galenic theories he denounced, he did stress the importance of proper training for surgeons (which were still a lower class profession), acknowledged the body's natural healing ability and connected medicine to alchemy, which allowed for a primitive chemical and quantitative perspective of disease and therapeutics. Other contributions include the invention of the opium-based analgesic laudanum and the discovery of medicinal ether. It appears he was oblivious to the potential of ether anesthesia for surgery.(20)

At the same time, the Germanic surgical tradition, mainly derived from the practical experience of war surgeons instead of the Galenic schools, was developing. A noticeable manuscript from this source, by Heinrich von Pflorspeundt, is stressing the importance of keeping instruments, bandages and wounds clean to prevent infections.(14)

During the XVIIth and XVIIIth centuries, surgery experiences a slow progress. It was still seen as an inherently painful and high risk therapy, and the solution was to increase the surgeon's speed and dexterity as much as possible.(21)

XIXth century and modern surgery

The XIXth century brought about the greatest changes in surgery since its beginning, through a series of enabling technologies and concepts, such as anesthesia, Pasteur's microbiological etiology of infection and Lister's antisepsis, Schwann and Virchow's cellular basis of pathology and tissue regeneration, or Claude Bernard's concept of homeostasis.(22) Through these groundbreaking discoveries we see a greater difference between surgery in 1800 and 1899 than between ancient Greco-roman surgery and the one in 1800.

CLINICAL ASPECTS

The first and probably most important breakthrough took place in 1846, when Henry Jacob Bigelow published an article regarding the use of ether as an anesthetic for a dental extraction by William Morton. Anesthesia was quickly embraced by surgeons and their patients, as a dramatic improvement in the surgical act. However, the consequences have been a lot more important. Anesthesia granted surgeons time to be thorough and, for the first time, made visceral surgery feasible. In the following decades, the variety of interventions exploded, each more daring, complex and invasive than the last. The age of "great surgeon – great incision" had begun.(23)

The next big issue, post-operative infections, was tackled in the second half of the XIXth century. Based on Pasteur's theory of microbiological etiology of disease, Lister developed and strongly stressed the importance of antisepsis. Initially attacked as overly complicated and useless, antisepsis became the standard procedure, greatly diminishing post-operative mortality.(24)

After the explosion of techniques and ever-increasing indications of surgery started by anesthesia and antisepsis, the focus shifted to improving healing speed and reducing late post-operative complications. One of the pioneers of this approach was William Halsted, whose contributions include the introduction of rubber gloves and the principles of gentle tissue handling, careful haemostasis and accurate tissue apposition, still in use today.(25) This philosophy coincided with the increase in research infrastructure and specialists of the XXth century, which gave birth to innumerable strategies developing at an amazing pace.

Developments in wound healing strategies in the second half of the last century include (1) preservation of wound microenvironment by moist wound healing (26), followed by dressing with impermeable foils, hydrogels and alginates (27); (2) targeting signaling pathways with growth factors, cytokines or pharmaceutical agents; (3) biophysical stimulation by vacuum (28) or electrical current.(29)

One of the latest revolutions in surgery, accepted by surgeons and demanded by patients with an enthusiasm that parallels the introduction of anesthesia, is the minimally invasive approach (figures no. 1-3).

Figure no. 1. Patient treated with minimally invasive approach for acute pancreatitis and postoperative scan after classic open surgery (Prof Dr. Dan Sabău, personal case)



Figure no. 2. Patient treated with a minimally invasive approach for perforated gastric ulcer, compared with the classic incision required in the same condition (Prof. Dr. Dan Sabău, personal case)



Figure no. 3. Patient treated with a minimally invasive approach for a hepatic hydatid cyst penetrating the diaphragm (Prof. Dr. Dan Sabău, personal case)



Catalyzed by Moutret's video-laparoscopic cholecystectomy in 1987, a burst of innovations led to a great expansion of laparoscopic, thoracoscopic and arthroscopic procedures, whose advantages include significant reduced healing time, functional and aesthetic preservation of the overlying tegument and reduced incidence of postoperative complications (figure no. 4).(30,31)

Figure no. 4. Giant eventration after a classic surgical intervention, and laparoscopic treatment of an eventration (Prof Dr. Dan Sabău, personal cases)



CLINICAL ASPECTS

Recent developments include the introduction of robotic, flexible, single incision (multiport) and no incision (transluminal) laparoscopic or thoracoscopic surgery.(32,33)

The ever-increasing body of knowledge in the physiology and pharmacologic modulation of the surgical stress response prompted the recent emergence of fast-track surgery protocols that include reduction of anesthesia side-effects, thromboembolic and antimicrobial prophylaxis, postoperative ileus prevention, metabolic and fluid management (34), and neuroendocrine and immunological modulation.(35) This has led to an ever increasing polarization of surgical techniques. While transplant and radical oncologic surgery remain highly invasive due to their nature and increased available supportive measures, most surgical fields show an increasing tendency towards the minimally invasive approach.

Perspectives

The minimally invasive approach is here to stay and will undoubtedly be refined and adapted to a growing palette of indications in the following years. Although currently prohibitive in terms of cost, speed and efficiency, robotic surgery will probably offer a precision, stability and maneuverability hard to overlook. Finally, new insights in the molecular mechanisms of wound healing and cellular responses to surgery will make precise pharmacological interventions an inseparable component of cutting edge surgical management.

REFERENCES

1. Biggs RD. Medicine, Surgery and Public Health in Ancient Mesopotamia. In: Sasson JM (Editor). The Civilizations of the Ancient Near East. Vol III. New York: Charles Scribner's Sons; 1995. p. 1911-1924.
2. Harper RF. The code of Hammurabi King of Babylon, about 2250 BC. 2nd Edition. Chicago: The University of Chicago Press; 1904. p. 77-79.
3. Majno G. The healing hand: Man and wound in the ancient world. Cambridge: Harvard university press; 1975. p. 52.
4. Thompson RC. The Assyrian Herbal: a monograph on the Assyrian vegetable drugs. London: Luzac and Company; 1924. p. 251-269.
5. Kramer SN. First pharmacopeia in man's recorded history. Am J Pharm Sci Support Public Health. 1954;126(3):76-84.)
6. Bryan CP. The papyrus Ebers. Letchworth: Garden City Press; 1930. p. 54-66,142-150.
7. The US National Library of Medicine Turning the Pages Information System (TTPI). Available at <http://archive.nlm.nih.gov/proj/ttp/flash/smith/smith.html>, Accessed 20 Oct 2014.
8. Withington ET. Hippocrates. vol 3. Cambridge: Harvard University Press; 1959. p. 37-43.
9. Nutton V. Medicine in the Greek world, 800-50 BC. IN: The Western medical tradition: 800 B.C.-1800 A.D. Cambridge: Cambridge University Press; 1995. p. 33-38.
10. von Staden H. Herophilus: the art of medicine in early Alexandria. Cambridge: Cambridge University Press; 1989. p. 512-513.
11. Serageldin I. Ancient Alexandria and the dawn of medical science. Glob Cardiol Sci Pract. 2013;4:395-404.
12. Nutton V. Roman Medicine 250 BC to AD 200. IN: The Western medical tradition: 800 B.C.-1800 A.D. Cambridge: Cambridge University Press; 1995. p. 40-42.
13. Spencer WG. Celsus: De Medicina: With an English Translation by WG Spencer. Vol 3. Cambridge: Harvard University Press; 1938. p. 299,351,383,429.
14. DeBaakey ME. A surgical perspective. Ann Surg 1991;213(6):499-531.
15. Johnston I, Horsley GHR. Galen: Method of Medicine. Vol II. Harvard University Press; 2011. p. 3-7.
16. Zimmerman LM, Veith I. Great Ideas in the History of Surgery. Norman Publishing; 1993. p. 74.
17. Mackenzie D. The history of sutures. Med Hist. 1973;17(2):158-168.
18. Forrest RD. Early history of wound treatment. J R Soc Med. 1982;75(3):198-205.
19. Shah M. Premier Chirurgien du Roi: the life of Ambroise Pare (1510-1590). J R Soc Med. 1992;85(5):292-294.
20. Davis A. Paracelsus: a quincennial assessment. J R Soc Med. 1993;86(11):653-656.
21. Guest J. William Cheselden (1688-1752): humane anatomist and master surgeon. Aust N Z J Surg. 1997;67(8):542-7.
22. Connor JTH. Beyond the Ivory Tower: The Victorian Revolution. Science. 2004;304(5667):54-55.
23. Gawande A. Two Hundred Years of Surgery. N Engl J Med. 2012;366:1716-1723.
24. Kavic MS. In the fullness of time. JSLS. 2000;4(2):87-89
25. Cameron JL. William Stewart Halsted. Our surgical heritage. Ann Surg. May. 1997;225(5):445-458.
26. Hinman CD, Maibach H. Effect of air exposure and occlusion on experimental human skin wounds. Nature. 1963;200(10):377-378.
27. Moues CM, Heule F, Legerstee R, Hovius SER. Five millennia of wound care products – what is new? A literature review. Ostomy Wound Manage. 2009;55(3):16-22.
28. Morykwas MJ, Argenta LC, Shelton-Brown EI, McGuirt W. Vacuum-assisted closure: a new method for wound control and treatment: animal studies and basic foundation. Ann Plast Surg. 1997;38(6):553-562
29. Weiss DS, Kirsner R, Eaglstein WH. Electrical stimulation and wound healing. Arch Dermatol. 1990;126(2):222-225.
30. Sabău D, Dumitra A, Grosu F, Bratu D. Herniile abdominale anterolaterale. In: Popescu I (Editor). Tratat de chirurgie. Vol VIIIA. București: Editura Academiei Române; 2008. p. 883-932.
31. Sabău D. Chistul hidatic hepatic. In: Popescu I (Editor). Chirurgia ficatului. Vol. I. București: Editura universitară "Carol Davila"; 2004:319-355.
32. Yoshida M, Furukawa T, Morikawa Y, Kitagawa Y, Kitajima M. The developments and achievements of endoscopic surgery, robotic surgery and function-preserving surgery. Jpn J Clin Oncol. 2010 Sep;40(9):863-9.
33. Sihoe ADL. The evolution of minimally invasive thoracic surgery: implications for the practice of uniportal thoracoscopic surgery. J Thorac Dis. Oct 2014;6(Suppl 6):S604-S617.
34. Hoffmann H, Kettelhack C. Fast-Track Surgery – Conditions and Challenges in Postsurgical Treatment: A Review of Elements of Translational Research in Enhanced Recovery after Surgery. Eur Surg Res. 2012;49:24-34.
35. Desborough JP. The stress response to trauma and surgery. Br J Anaesth. 2000 Jul;85(1):109-17.