Forgotten Pioneers of Plastic and Reconstructive Surgery During the Medieval Period

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Abstract: Sushruta who lived in India sometime between 1000 and 800 BC is traditionally recognized for being the "Father of Plastic Surgery." However, "plastic surgery" has been performed much earlier in antiquity, with the earliest origins of primitive procedures dating back to 1600 BC in Ancient Egypt on the southeastern shores of the Mediterranean. Some centuries later, simple plastic cosmetic surgeries were performed, as well on the Northern Mediterranean shores in ancient Greece and Rome to repair damaged parts caused by war mutilation, punishment, or humiliation. Afterward, there has been a historical gap moving rapidly from the Greco-Roman period to the European Renaissance. Ignoring valuable contributions made by surgeons of the Medieval period, like Albucasis and Avicenna, has denied scholars of the Arabic Golden Age that bridged the eastern and western cultures recognition. In fact, all Mediterranean populations, albeit not together or simultaneously, have participated in the development of plastic and reconstructive surgery art and science. All have made valuable innovations, together with others, which cumulatively have resulted in progressive buildup of knowledge and technical skills.

Key Words: Albucasis, Avicenna, Arabic golden age; plastic and reconstructive surgery; medieval period

Plastic surgery has been for centuries driven by medical necessity, mainly to reconstruct body parts amputated for punishment or mutilated because of injury. Sushruta who lived in India sometime between 1000 and 800 BC, notably famous for reconstruction of amputated noses initially with the cheek flap then using tissues from the forehead, is considered to be the "Father of Plastic Surgery" and is responsible for the advancement of medicine in ancient India.[1] By the sixth-century BC, surgeons in India were performing procedures not dissimilar to modern-day cosmetic rhinoplasty. Elsewhere, the first known cleft lip repair is believed to have been performed in the fourth century in China.[2] However, "plastic surgery" has been performed much earlier in antiquity, with the earliest origins of primitive procedures dating back to 1600 BC in Ancient Egypt on the southeastern shores of the Mediterranean.[3] The oldest-known "plastic surgery" procedures appear in the Egyptian "Edwin Smith Papyrus," an early trauma surgery textbook containing detailed case studies for a variety of injuries with descriptions for the treatment of wounds and bone fractures. The papyrus describes ways to treat nasal fractures by manipulating the nose into the desired position before using wooden splints, lint, swabs, and linen plugs to hold it in place. In 2000, an ancient mummy was found to have a prosthetic toe that may have aided the woman's walking, indicating that ancient Egyptians occasionally used prostheses.[2] Moreover, extending surgical practice, ancient Egyptians surgically inserted bone and seeds into the nose of deceased Ramses II who had a large and long nose to make sure he would be recognized and received as a king in the afterlife.[3] On the northern Mediterranean shores in ancient Greece and Rome, simple plastic cosmetic surgeries were performed as well to repair damaged parts caused by war mutilation, punishment, or humiliation.[4] In ancient Rome, the encyclopedist Aulus Cornelius Celsus documented what we would call today blepharoplasty.[2]

The traditional 19th-century view about the "Middle Ages" in Europe was that this period between the demise of Rome and the Renaissance lacked innovation.[5] Developments made during the Medieval period by the Arabs who have spread their domination from Baghdad to Andalusia across North Africa have received relatively limited acknowledgment. Although Arab scholars have been credited for preserving ancient Greek and Roman texts pertaining to medicine through translation, their sizable contributions to medical and surgical fields have been almost forgotten. Nevertheless, these scholars during this period were at the forefront of medical and surgical advancements and went to challenge Galen traditional teachings; they had the intellectual leadership from the 8th to 13th centuries.[5] Al-Baghdadi, for example, challenged Galen's claims that the mandible is comprised of 2 bones and Al-Razi opposed Galen's concept that the brain, spinal cord, and ventricles comprise a single structure and distinguished nerves from tendons.[5,6]

ABU ALKASEM AL-ZAHRAWI (ALBUCASIS), A REAL PLASTIC SURGERY PIONEER

Born in a nearby village a few miles from Córdoba, one of the world's most populous 10th-century cities and an international center of art, science, culture, and economic growth at a time when the rest of Europe was struggling through the Dark Ages, Albucasis (Fig. 1A) spent his entire life from 936 to 1013 in the region and was the court physician to the Andalusian ruler Al-Hakam II at a period considered to be the "Golden Age" of Arab Spain when natural and mathematical sciences reached their peak. He is credited with the performance of the first thyroidectomy and he certainly defined surgical practice at that time. Albucasis' great legacy, however, was his 30-volume remarkable medical textbook *Kitab al-Tasrif* replete with illustrations of surgical procedures, tools, and over 200 surgical instruments. He included his book with detailed descriptions of using probes, surgical knives, scalpels, and hooks, as well as details about surgical scissors, grasping forceps, and obstetrical forceps. His illustrations of surgical instruments were the earliest intended for teaching and for manufacturing. Albucasis also wrote about the importance of positive doctor-patient relationships and emphasized the importance of treating patients irrespective of social status.[6–8]

Albucasis' textbook proved to be a critical reference for physicians and surgeons for the next 500 years and beyond. The last volume was reserved for surgery describing a wide range of techniques and procedures encompassing several subspecialties

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FIGURE 1. (A) Albucasis blistering a patient in the hospital at Cordova. Oil painting by Ernest Board. Reproduced with permission of Wellcome Library UK. Credit: Wellcome Collection. Public Domain Mark. (B) An Arabic man of learning (Avicenna). Oil painting by a Neapolitan painter, 17th century. Reproduced with permission of Wellcome Library UK. Credit: Wellcome Collection. Public Domain Mark. (C) Nervous system, Avicenna, Canon of Medicine. Reproduced with permission of Wellcome Library UK. Credit: Wellcome Collection. Attribution 4.0 International (CC BY 4.0).

among which plastic surgery. The book that was the summation of about 50 years of medical education, training, practice, and experience, served as a bridge between the ancient and modern and advanced the knowledge from the past into an educated foundation for the future. It was translated by Gerard of Cremona, Rogerius Frugardi, Ronaldus Parmensis, as well as by others and remained an essential component of the medical curriculum in European countries for many centuries. The famous French surgeon Guy de Chauliac (1300–1368) quoted Albucasis over 200 times praising the power of his guidance and the influence he had on European surgeons of the Middle Ages. Several editions of Albucasis' book and chapters were published including 1 in Venice (1497), Basel (1541), and Oxford (1778).[6,7]

Albucasis was a pioneer of surgery and education of his time, and his contributions to the field of plastic surgery deserve mention. He recommended incisions be marked with ink preoperatively and advocated important principles of surgery: primary closure and debridement and closure; he promoted as well the use of antiseptics in wounds.[9] Albucasis recommendations for primary suturing of fresh wounds and excising healed margins before attempting surgical closure were remarkable for his time: "…If the wound be fresh and bleeding, bring the edges of the wound together with a suture, and dress them till they are healed. If the discontinuity has separated the edges, and both edges have healed, it is necessary to scrape both edges on the external skin till they bleed; then bring the edges together with a suture…. and put over the powder a plaster of palm ointment… and leave bandaged for two or three days…"

Quoting Asaad et al[4,6] who themselves quoted Albucasis on the description and treatment of male gynecomatia "…the breasts of some males may swell on attaining puberty so as to resemble the female breast…a semicircular incision should be made on the breast… then dissect away all the fatty tissue…" seems to be a quote from a modern plastic surgery textbook. "…But if the breast is pendulous and flabby on account of its size, as happens with women, you should make two semicircular incisions on the upper side…. then dissect away the skin between the two incisions and remove the fat and sew up…"[6]

Regarding syndactyly and polydactyly, Albucasis wrote: "… You have to cut the web away until the fingers are brought back to their original form; then interpose between them a pad or piece of material soaked in oil of roses to prevent them from rapidly joining together and to keep them apart…"; "…A superfluous finger… sometimes is all flesh, sometimes contains a bone, sometimes has a nail… That which is purely flesh is easily removed; you cut it off at the root with a broad scalpel. But the treatment of that which arises at the root of a finger is difficult; you should avoid amputating. In the case of one growing from the finger at a phalangeal joint, you should first cut through the flesh down to the bone with a circular incision; then saw the bone through, with one of the saws that suit the purpose; then dress it until it heals…"[6]

ABD ALLAH IBN SINA (AVICENNA) AND REPAIR OF PERIPHERAL NERVE INJURIES

The great Middle-Eastern Arab physician Abd Allah ibn Sina (980–1037 AD), also known as Avicenna (Fig. 1B), was born in Afshana, Uzbekistan, and died in Hamadan, Iran. He had an important contribution in the repair of peripheral nerve injuries. His great work, "al-Qanun fi al-Tibb" (Canon of Medicine), is an encyclopedic work about medicine and comprises 5 books that were translated into Latin and remained the reference text for European medical schools for centuries to follow.[6,10] The "Canon" was translated into Latin for the first time in the 12th century by Gerard of Cremona. It was published in 1473 in Milan, 1476 in Padua, and 1482 in Venice. The Hebrew version was translated in 1279 in Rome and was published in 1491 in Naples.[10]

Avicenna was the first author to discuss peripheral nerve disorders. He pointed that nerve injury is a serious condition and symptoms may sometimes be severe. He described the surgical management of peripheral nerve injury in the fourth book and was the first to recommend suturing transected nerves. Although some descriptions and theories presented by Avicenna are nowadays obsolete and are regarded from a historical humoral perspective, some of his observations were innovative at that time and represented a real progress over the prevalent notion then that a divided nerve could not be united.[10] Furthermore, the medieval Arabic physician changed Galen's dictum that surgery was an inferior branch of medicine. With him, surgery became an important medical branch, and purely surgical therapeutic interventions expanded. Guy de Chauliac made extensive use of Avicenna's writings; furthermore, surgical teaching in Italian universities also drew upon practically oriented teachings of the Canon.[10]

Although Avicenna did not describe in detail the procedure of nerve repair, restoring the anatomic continuity of the nerve for proper healing after a transection injury was an innovative approach at that time and is still valid at present. One century later, Roger of Salerno (12th century), widely recognized as the pioneer of peripheral nerve injuries management, recommended anastomosis of the interrupted nerves, with particular emphasis on anatomic continuity obviously influenced by Avicenna[10,11] (Fig. 1C). Interestingly, Avicenna noted that injuries to nerves may occur after penetrating "pinprick" wounds by a sharp object or a cleft-type (splitting and fissuring) wound. He went on to note that longitudinal-type injuries are more benign than transverse lacerations because the longitudinal cut commonly occurs parallel to the "capillary" (possibly used for "nerve fascicle" in those times) so that the majority of the nerve fascicles remain undamaged. Avicenna also described that nerves may be confused with other tissues and described the differential diagnosis between nerves and those other tissues. He also noted that crushed or partial transverse-cut injury of nerves is more tormenting than complete transection injury, although the extremity can be paralyzed in the latter condition. Remarkably, he also recommended drainage of inflammatory substances that have collected inside the wound, cleaning of the contaminated wound, and treating the nerve after the management of inflammation. Furthermore, his recommendations for bandaging and wound dressing care are not so unfamiliar to current medical practice. Moreover, although Avicenna's descriptions are not detailed, he discusses nerve entrapment syndromes and, notably, describes Tinel's sign: "Twisting and hardening of a nerve more than usual frequently occurs from falling down or receiving a blow on the nerve. The sign of twisting and hardening of the nerve is numbness when compressing it with a finger."[10]

CONCLUSIONS

Moving rapidly from the Greco-Roman period to the European Renaissance has created a gap and ignored the valuable scientific contribution made by scholars of the Arabic Golden Age that have bridged the eastern and western cultures. It must be recognized that all Mediterranean populations, albeit not together or simultaneously, have participated in the development of plastic and reconstructive surgery art and science. All have made valuable innovations, together with others, which cumulatively have resulted in progressive buildup of knowledge and technical skills.

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