



Historical Article

Al Zahrawi: The Father of Modern Surgery

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When reviewing most contemporary article on medicine; it becomes noticeable that the period that extends from Greco-Roman times and the modern era are commonly over-looked, giving the appearance that during this period nothing worthy of mention happened in medicine.^{1,2} In Europe, this period is usually referred to as the Dark Ages, in which the great era of the Greco-Roman medicine came to an end and no progress in medical science was made until the Renaissance.²⁻⁴ However, in the East, the firm establishment of the Moslem supremacy coincided with the development of botany, pharmacy and chemistry, branches of science that the Moslem world is given credit for having established.^{3,5,6} Between the ninth and the sixteenth centuries, the study of medicine and other branches of science revived and acquired a scientific basis.^{3,5,7,8}

Among many Moslem scholars who shared in enlightening the path of medical human knowledge is "Alzahrawi" (Fig 1) who is regarded as the father of modern surgery, and rightfully so. He was a great surgeon, a pioneer in surgical innovation and a great teacher whose comprehensive medical texts had shaped the European surgical procedures up until the renaissance and later. He devoted his life and lifework to his patients and students. None of his contemporary medieval surgeons could be compared to him and the entire famous renaissance surgeon had quoted him. No doubt he was the chief of all surgeons.^{9,10}

To appreciate more the value of Alzahrawi it is worth noticing that surgery at that time in Europe was belittled and practiced by barbers and butchers

and the Council of Tours declared the following resolution: "*Surgery is to be abandoned by the schools of medicine and by all decent physicians*".



Fig 1. Abu al-Qasim Khalaf bin Abbas Al-Zahrawi (A.D. 936-1013)

"Without doubt, the chief of all surgeons"
(Pietro Argallata)

This article shed a light about the place he was born in the city where he lived, the hospitals where he practiced his most useful contributions to the art of surgery.

Place of Birth: Abulqasim Khalaf Ibn Al-Abbas Al-Zahrawi, lived between 328- 404 H (936-1013 AD). He was born and raised in Alzahraa, a suburb of the famous city of Qurttoaba (Cordova) in Andalusia (Spain) (Fig2) which was the torch bearer of knowledge, wisdom and civilization when the rest of what is known today as Europe lived in the darkness of medieval era. It is narrated that his family descended from Al-Ansar (the supporters of Prophet Mohammad peace be upon him) of Al Madina Al Monawara in Saudi Arabia who settled earlier in Spain.

Few details of the life of this great surgeon remained, apart from his published work, after the destruction of Alzahraa during the later Spanish - Moorish conflicts. He was first mentioned in the writings of Ibn Hazm [993 - 1064 AD] who listed him among the greatest physicians of Moorish Spain. But the first detailed biography of him appeared in the work of Al humaydi: Jadwat Almugtabis [on Andalusian savants], completed 6 decades after Alzahrawi's death

Names in Latin literature: Alzahrawi is known in western literature as Albucasis, Abulcasis, Bucasis (all being distortions of his Arabic "koniah" (nickname) Abul-Qasim and as Zahravius; the Latin rendering of his Arabic birth-place name Alzahrawi.

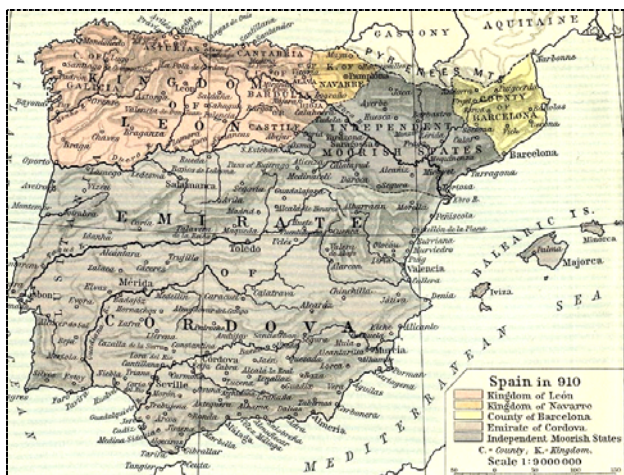


Fig 2. Extent of Emirate of Cordova in 910 AD

Cordova was the magnificent capital of Andalusia. Named the flowering Cordoba, it was one of the wonders of the world. At the zenith of its flowering, Cordova had total population of 1 million living in 200,000 houses. It housed 600 Mosques, 900 public paths, 80 Schools and 27 High schools, and 300 libraries encompassing 1 million books. The status of a person at that time was gauged by how much he had read and the wealth was measured by how many books he owned. It was known that the Caliph Al Nasser had 30,000 books at his palace, many of which had his comments as footnotes. This was the time when the population of Rome did not exceed 50,000 and that of London 18,000. It was the time when the largest library in Europe (The library of the monastery St. Gall in Switzerland) had a total of 35 books only!!! Cordoba was the centre of learning in Europe. Lane - Poole the Italian Poet wrote in the 13th. century:

*“To Cordoba belong all the beauty and ornament
That delights the eye, or dazzles the sight.
The dress is of banners of learning, well knit together
By the men of science and the masters of every art”*

Before embarking into the contribution of that great surgeon “Alzahrawi” to the science of medicine and art of surgery, it is worthwhile to highlight the status of hospitals during that time. The development of efficient hospitals was an outstanding contribution of Islamic civilization to humanity. Hospitals in the 11th century were constructed as masterpieces of beauty or else grand palaces were converted into hospitals. Each hospital had separate wards for male and female patients. Different diseases such as fever, infections, mania, eye conditions, diarrhea, and female disorders; were treated at separate wards.

Each hospital had:

- A pharmacy dispensing free drugs to patients,
- A mosque for Muslim as well as a chapel for Christian patients.
- A conference room
- A library.

Hospitals were institutions for educating medical students. Only qualified and licensed physicians were allowed by law to practice medicine. Licensing Boards were set up under a government official called “**Muhtasib**”. Pharmacists were

employed as inspectors to inspect drugs and maintain quality control of drugs sold.

Hospital policies were as follows:

1. The hospital shall keep all patients, men and women until they are completely recovered.
2. All costs are to be borne by the hospital whether the people come from a far or near, whether they are residents or foreigners, strong or weak, of high or low class, rich or poor, employed or unemployed, blind or not, physically or mentally ill, learned or illiterate. The entire service is through the magnificence of Allah. No wonder that healthy individuals faked illness to be admitted and enjoy such royal treat.

Physicians were highly valued during that time. The annual income of a physician would reach as high as 4.9 million Dhs' at a time when the annual costs of living were 1000 Dhs per person per year. Under these excellent circumstances Al Zahrawi had practiced medicine.

In Alzahraa he lived most of his life. It was where he studied, taught, and practiced medicine and surgery till shortly before his death in 1013, 2 years after the sacking of Alzahraa.

Work: He was the personal physician to the Andalusian Caliph Abdul Rahman the Third (also called Abdul Rahman Al-Nasser i.e. the victorious). He attended the University of Cordova, which had been established for one and a half century.

Al-Zahrawi was an innovative surgeon who added many original contributions, to surgery and medicine, not known to his predecessors. During his life time doctors used to travel from far away in order to learn from him. Later on, in Europe, during the middle ages and renaissance he remained the famous teacher of surgery through his well known encyclopedic work (Fig 3) "*Al-Tasreef Liman Ajez Aan Al-Taareef*" (The disposal of medical knowledge to those unable to get it from the other compilations), a 30 volume medical treatise which covered surgery, medicine, orthopedics, obstetric and gynecology, ophthalmology, pharmacology, nutrition, etc.⁷

That work was a landmark in the history of surgery being the first rational and complete illustrated text of the subject. Many of the surgical procedures and instruments described and illustrated in it do not appear in any other work of his time or before. The book was completed by the year 1000 AD.

It was the outcome of almost fifty years of learning practicing and teaching the art medicine. Al Zahrawi wrote: [What ever I know, I owe solely to my assiduous reading of books of the ancients, and to my desire to understand and appropriate this science. To this I have added the observations and experience of my whole life.]



Fig 3. A page from Chapter 60 of "*Al-Tasreef*"

In 1150 AD, Gerard of Crimona had completed the translation of "*Al-Tasreef*" into Latin thus contributing to its spread all over Europe where it remained the most important reference book on surgery until the end of Eighteenth century. With the reawakening of European interest in medical science, *At-Tasrif* quickly became a standard reference and was translated into Latin five times. The arrangement of the work, its clear diction, and its lucid explanations all contributed to its popularity and great success.

William Hunter (1717-1783) used Arabic manuscripts of Al-Zahrawi for his study on Aneurysm in the University of Glasgow:

The thirtieth volume of his work on surgery contained: 3 sections (BAB) and 19 chapters (FASL). It was the first independent surgical treatise ever written. The famous French surgeon Guy de Chauliac wrote: (*it was nothing less than the greatest achievement of medieval surgery*), he quoted *Al-Tasreef* over 200 times.

Al-Tasreef book contains the description and illustrations of numerous surgical instruments, many of which devised by Zahrawi himself.

Al Zahrawi was the first to stress the importance of basic sciences: *"Before practicing, one should be familiar with the science of anatomy and the functions of organs so that he will understand them, recognize their shape, understand their connections, and know their borders. Also he should know the bones, nerves, and muscles, their numbers, their origin and insertions, the arteries and the veins, their start and end. These anatomical and physiological bases are important, and as said by Hippocrates: 'there are many physicians by title and a few by practice'. If one does not comprehend the anatomy and physiology, he may commit a mistake that can kill the patient. I have seen someone, who pretended to be a surgeon, incised an aneurysm in the neck of a woman, mistaking it for an abscess. The woman bled to death"*.

He stressed on the importance of a positive doctor-patient relationship, and wrote affectionately of his students, whom he referred to as [my children].

Al- Zahrawi stressed the importance of specialization. *"too much branching and specialization in many fields before perfecting one of them causes frustration and mental fatigue"*.

He promoted bedside clinical medicine: *"Only by repeated visits to the patient's bedside can the physician follow the progress of the medical treatment"*

Al-Zahrawi was the first to:

1- Use *cotton* (in surgical dressings, in the control of hemorrhage and as padding in the splinting of fractures).

2- Describe in details the unusual disease, hemophilia.

3- Use cautery, wax and alcohol to control bleeding from the skull during cranial surgery and described the ligature of arteries long before Ambrose Pare.

4- Teach the lithotomy position for vaginal operations. He was the first surgeon to describe ectopic pregnancy

5- Describe the tracheotomy operation and performed it as an emergency on one of his servants.

6- Write on orthodontic and described how to treat misaligned teeth

Al- Zahrawi description of varicose veins stripping, even after ten centuries, is almost like modern surgery

"... Have the leg shaved if it is much hairy. The patient gets a bath and his leg is kept in hot water until it becomes red and the veins dilate; or he exercises vigorously. Incise the skin opposite the varicose vein longitudinally either at the ankle or at the knee. Keep the skin opened by hooks. Expose, dissect, and separate the vein. Introduce a spatula underneath it. When the vein is elevated above the skin level, hang it with a blunt rounded hook. Repeat the procedure about three fingers from the previous site and hang the vein with another hook as previously done. Repeat the procedure at as many sites along the varicose vein as necessary. At the ankle, ligate and strip it by pulling it from the incision just above. When it reaches there, repeat at the higher incision until all of it is stripped. Ligate the vein and then excise it. If difficulty is encountered in pulling it, ligate its terminal part with a string and pass it under the spatula and dissect it further. Pull gently and avoid its tearing because if it does, it becomes difficult to strip all of it and can cause harm to the patient. When you have stripped it all, put alcohol sponges at the sites of the skin incisions and take care of the incisions until they heal. If the varicose vein is tortuous, you have to incise the skin more frequently, at each change of direction. Dissect it and hang it with the hooks and strip it as previously described. Do not tear the vein or injure it. If this happens, it becomes difficult to strip it. The hooks used should be blunt, eyeless, and rounded; otherwise it can injure the vein".

Al Zahrawi contribution on bladder stone was remarkable. Extraction of stones from the urinary bladder is one of the oldest surgical operations in history. The operation was done through a perineal incision down to, then through, the bladder neck to reach the stone and extract it. Al Zahrawi remarkably improved the technique of this operation and reduced its risks. He invented Al-Mirwed, which is a metal probe or a sound to confirm the presence of the stone before proceeding with the perineal cystolithotomy operation. As a resident I used to practice this procedure at Cairo University pediatric hospital (Abouelrish hospital) in early 1970s.

Alzahrawi was the first to use a forceps to extract a bladder stone¹. Before him, extraction of the stone was by an instrument similar to a small spoon that goes around the stone and scoops it out. But Alzahrawi introduced, for that purpose, a new instrument with a better grasp on the stone. Accurate description of that new instrument and its use was

mentioned in the text. The use of Alzahrawi's stone forceps spread to Europe during the middle Ages and Renaissance (Fig 4).



Fig 4. Alzahrawi's stone forceps

Al-Zahrawi also designed a special forceps (lithotrite) named Kalalib^{5, 8} (Fig 5) which he used for crushing a large vesical stone through a perineal cystotomy. He was also the first to invent a fine pointed instrument (a drill) to pierce impacted urethral stone.

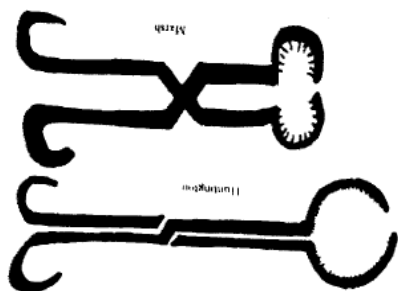


Fig 5. Alzahrawi's lithotrite

His chapter on bladder irrigation with its numerous illustrations of syringes is of utmost originality. (Fig 6)

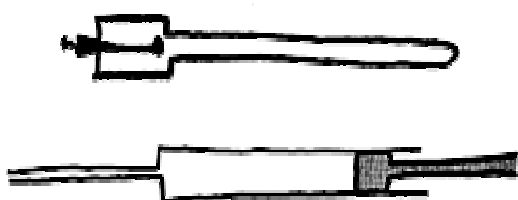


Fig 6. Syringes used for bladder irrigation

Alzahrawi converted the ritual circumcision⁹ to an art of surgical dissection using a scissors that he designed especially for it.

His contribution in Orthopedics is unprecedented. He described the reduction of dislocated shoulder [known today as Kocher's Method] long before Kocher was born

He described pateleectomy. 1000 years before Brooke reintroduced it in 1937.

In the managements of fractures he advocated manipulative reduction with external immobilization if the bones were parted, he said, "reduction was to be effected by traction and counter-traction, using diligent manipulation in order to secure exact reposition of the bones and avoiding violent compression."

His remarkable conclusion that cranial and extremity bones healed differently is in concurrence with our understanding of cartilaginous and membranous bone healing.

After reduction, He cautioned against the presence of pain that signified an increase in the swelling of the extremity, appearance of swelling distal to the bandage as it suggested too tight a splintage, any loosening of the bandage as it indicated the subsidence of the swelling and the relative inefficacy of the immobilization.

He was considered one of the early leading "plastic surgeon" as he performed many plastic surgery procedures. In the 11th chapter of volume 30 of his book he put many principles in that surgical field. He used ink to mark the incisions in his patients preoperatively, which became now as a routine standard procedure. In (chapter 26) he explained the differences between primary and secondary wound closure and also the importance of wound Debridement before closure.

In (chapter 47) he described the surgical options to treat Gynecomastia as he recommended removal of the glandular tissue by a C-shaped incision. For large breasts with excess skin that cannot be corrected with glandular excision alone, "...make two incisions so that the edges join each other, then remove the skin and glandular tissue in between and suture the edges of the defect..." This technique is still considered for such condition nowadays.

Al-Zahrawi had a special interest in eyelid surgery. He gave sensible suggestions on the use of fine instruments, of which he had a wide variety. He described surgical management of different pathologies such as entropion, ectropion, trichiasis and symblepharon.

In the treatment of entropion, Al Zahrawi advised eversion of the eyelid with fingers or with a traction suture. *“An incision under the eyelashes from medial to lateral is then carried out so that the skin is separated from the lid margin. A leaf-shaped piece of eyelid skin is excised, and lash eversion is achieved as the defect is sutured primarily”*.

He also classified ectropion as congenital and acquired and he advised eversion and resection of a base-down triangular segment from the inner layers for lower lid laxity to treat to cases of eye ectropion.

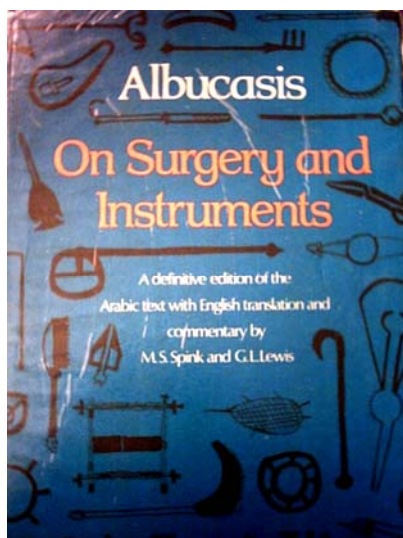


Fig 7. One of the published books that described the contribution of Al- Zahrawi (Albucasis)

Al-Zahrawi's influence on the course of European surgical development was deep and long lasting,¹⁴ (Fig 7). There came the greatest surgeon of modern times. To Al Zahrawi we are all indebted to our modern practice of surgery. I strongly believe that

his contribution should be an integral part of any medical education.

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