A Comparative Study of Bone Fractures Treatments by Both Albucasis (324-404 AH/936-1013AD) and Sabuncuoğlu (787-874AH/1385-1470AD)

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Abstract
Albucasis “Abul-Qasim al-Zahrawi” was the first Arab surgeon acknowledged by his contemporaries and by great surgeons who followed him, he was born in 324 AH/936 AD and died in 404 AH/1013 AD in Madina al-Zhara west of Córdoba. Sabuncuoğlu Şerefeddin also was a distinguished Ottoman physician interested in surgery, he was educated at Dar Al Shifa in Amasya then worked as a surgeon for many years. He was Born in 787 AH/1385 AD and died in 874 AH/1470 AD in Amasya. Both of the physicians made a great progress in surgery during their periods. Albucasis had a great book in medical book called “Al- Tasrif li-man ajaz an al- taalif” which considered as a medical encyclopedia. Sabuncuoğlu also had a medical book called “Cerrahiyetü’l Haniye” which considered a special scientific medical work. Although there was a long time between Albucasis and Sabuncuoğlu’s periods, mistakenly, Sabuncuoğlu’s book was considered as a translation of Al- Zahrawi’s book. Both books dealt with Orthopaedics and bone fractures’ treatment. So, this study focuses on analyzing the differences and similarities between the two works of both physicians. The main purpose of this work is to highlight the knowledge, concerning the orthopaedics and bone treatments as explained by Sabuncuoğlu and Albucasis. This study also relied on the analytical method to find out these differences and similarities. According to the analysis findings, the research found some differences and a lot of similarities in bone
treatments between both books. Also, the research analyzed that the differences were only in the instruments they used.

**Introduction**

Bones are the main components of the skeletal system, consider the mechanical support of the body. Doctors classify the fractures according to shape or pattern\(^1\). Although there was a long time between Albucasis and Sabuncuoğlu’s periods, mistakenly, Sabuncuoğlu’s book “Cerrahiyet’ül Haniye” or (Imperial Surgery) was considered as a translation of Albucasis’ book “Al- Tasrif li-man ajaz an al-taalif”. He affected a lot by Albucasis’ book and the main skeleton of his book came from al-Zahrawi’s book\(^2\).

Albucasis, the pioneer of surgery affected in all Arabic and European physicians\(^3\). Sabuncuoğlu, the Turkish physician also influenced by al-Zahrawi and that appeared in his medical work, the manuscript of Cerrahiyet’ül Haniye and his treatment of fractures and orthopaedics\(^4\).

This topic is important and serves several scientific disciplines such as: history, because it discusses the history of certain periods and makes a comparison in the history of medicine in both periods. It is also important to the science of medicine, as it discusses the history of two famous physicians and sheds light on their medical contributions. As well as, its importance in manuscript science, because it discusses two important medical manuscripts.

Accordingly, the main focus of this work is to highlight the knowledge concerning the bone fractures and their treatments as explained by Sabuncuoğlu Şerefeddin and Albucasis al-Zahrawi. The main purpose of the research is to answer the questions, “What are the similarities between the two books in orthopaedics and bone fracture treatments, that made scholars thought the two works are the same?. If there were differences between the books of both physicians in the treatment of fractures and orthopaedical diagnosis?. What are the similarities and differences in surgical instruments they used?” that was discussed for the first time. This study also relied on the analytical method to find out these differences and similarities.

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1. Albucasis al-Zahrawi (324-404 AH/ 936-1013 AD)

His name was Abul Qasim Khalaf Ibn al- Abbas al-Zahrawi, was born in 324 AH/936 AD and died in 404 AH/1013 AD in Madina al-Zahara in west of Cordoba, his period was flourished and advanced in scientific fields, especially in medicine. He is famous in Latin by several names, the most famous is Abulcasis. He was the personal physician of the Caliph Abd Rahman III. He wrote two books; Al-Tasrif li-man ajaz an al-taalif and Kitab fi-l-tibb li-‘amal aljarrahin.

2. The Book of Al-Tasrif li-man ajaz an al-taalif

He had a great medical treatise on surgery, which is Al-Tasrif li-man ajaz an al-taalif. This manuscript is considered as a medical Encyclopedia consisting of thirty volumes talking about surgery, medicine, pharmacology, therapeutics and chemistry. He invented many surgical instruments were used for many centuries. For the first time the surgical instruments were illustrated and described and that influenced in all later Arab physicians.

As well as, many surgeries were mentioned in his book for examples; ophthalmic surgery, surgery for thyroid cystectomy and arrow extracting. Emergency medicine also was mentioned in this book and how to use the suture materials made of silk and wool. In Europe, he was considered as the famous pioneer surgeon and no one of his contemporary could be compared with them. At the same period, surgeries in Europe were performed by butchers and barbers.

He interested also with bone fractures and their treatments, like skull fractures and discussed how to treat this kind of fractures with different instruments such as...

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9 Abdel Rahman III: He was the Umayyad Caliphate who ruled from 912 to 961 AD. His reign was considered as the golden age for Islam in Spain. He was the constructor of Madina al-Zahra. See, Michael Goodyear, Abd al- Rahman III, (World History Encyclopedia), 11 February 2019, https://www.worldhistory.org/Abd_al-Rahman_III/, Last access. 25/11/2021, 1:00 AM.
11 Cambra, Abucasis, p. 241
13 Vaskeh, Mostafavi, Alizadeh, Kazemi, Albucasis, p. 435
16 Cambra, Abucasis, p. 244
17 Vaskeh, Mostafavi, Alizadeh, Kazemi, Albucasis, p. 435
18 Abdel-Halim, Elfaqqi, Extraction, p. 1284
19 Elgohary, Al Zahrawi, p. 82
Misqab and Mikta20-21. Furthermore, clavicle fracture22, humeral fracture23, orthopaedic surgeon and spinal dislocations were discussed in his book24.

3. Sabuncuoğlu Şerefeddin (787-874 AH / 1385-1470 AD)

He was a distinguished Ottoman physician interested in surgery25, he was educated at Dar Al Shifa in Amasya26 then worked as a surgeon for many years27. Born in 787AH/1385 AD and died in 874AH/1470 AD, lived in Amasya, wrote many medical books influenced in Ottoman medical and covered about 40 illness. Sabuncuğlu Şerefeddin worked as a chief of physicians for 14 years28. At first, his scientific work was considered as a translation of the book “al-Tasrif li-man ajaz an al-taalif” of Al-Buscacis29.

4. The Book of Cerrahiyetü’l Haniye “Imperial Surgery”

In 869AH/1465AD, Sabuncuğlu introduced his famous book Cerrahiyetü’l Haniye to sultan Muhammed al-Fatih30 as a gift, who appreciated this scientific work31. Although the importance of this book in medical treatments, especially surgery32, it was ignored until 1930AD, because it wasn’t written in Arabic or Persian like the other books during this era33. This book includes 163 surgical instruments’ images and explained 163 surgical procedures. Sabuncuğlu explained these surgical procedures with miniatures34. Considers the oldest

21Mikta: is a medical instrument with a one face of the knife and the other like the back of the knife, see Turgut, History Pediatric, p. 1086
22The Clavicle Fracture: The clavicle is the bone that connect the arm and shoulder with the trunk. The fracture of clavicle is one of the most common bones fractures. See, Filippo Familiari, MD, Gazi Huri, MD2, Olimpio Galasso, MD1, Giorgio Gasparini, MD1, Mahmut Nedim Doral, MD2, The Shoulder, Springer, 2017, p. 91
23The Humeral Fracture: That done near the shoulder in the arm bone. See, Frank Norberg, MD, Proximal Humerus Fracture Book, Twin Cites Orthopedics, without date, p. 2
25Neset Koksal, History of Surgery in Turkey, UEMS Surgery Section Meeting, 5-6 April, Istanbul, without date, p. 13
26Amasya: located in Northern Turkey, this province encompasses 55,199ha. Amasya is famous as agricultural province and there are approximately 35,000 farms middle. It is a small province. See, Vedat Ceyhan and Kerem Hazneci, Economic Efficiency of Cattle-Fattening Farms in Amasya Province, Turkey, Journal of Animal and Veterinary Advances, (2010), Vol. 9, Issue. 1, p. 60
27Madah, Atib, p. 549
29Madah, Atib, p. 549
30Muhammed al -Fatih: He was the son of sultan Murad II, born in 1432 and died in 1481. He was the seventh Ottoman sultans. He was the great sultan who conquered Constantinople in 1453. See, Gábor Ágoston, Bruce Masters, Encyclopedia of the Ottoman Empire, Facts On File, 2009, pp. 364:366
31Gulsat Aygen, PhD, Aykut Karasu, MD, FACS, Ali Ender Ofluoglu, MD, Glenn Pait, MD, Halil Toplamaoglu, MD, The first Anatolian contribution to treatment of sciatica by Serefeddin Sabuncuoglu in the 15th century, (Surgical Neurology), 2009, NO. 71, p. 131
32Ng’n alyndn ‘ly bn ‘mr bn ‘ly álkbth álqwvn, gám ’ álldh, dár álbyáñ ál’rby, 2002, p. 532
33Verti, Aksoy, Kafali and Ferda Verit, Urologic Techniques, p. 778
34Koksal, History, p. 13
illustrated surgical Ottoman textbook that wrote in Turkish language. The book is divided into three chapters (fractures and dislocations, treatment with cauterization, and surgical procedures) including various specialties like: general surgery, pediatric, obstetrics, and gynecology, thoracic surgery, urology and neurosurgery. The book is considered cauterization as a main treatment for a lot of diseases.

5. The Orthopaedics and Treatment of Bone Fractures:
Al-Zahrawi, in the volume 30 of his book al-Tasrif mentioned how to treat the fractures and breaks of bones and joints. He was a famous orthopaedic surgeon; he was the first physician treated the pelvis fracture. In addition, he described orthopaedic in bones dislocation and fracture, as well as describing of different types of fractures. Albucasis defined the fractures as kinds of separation in bones.

In chapter 3 of his book, Sabuncuoğlu also discussed in 22 sections the fractures treatments, and rest of the 36-section related to dislocations. In section 5, he discussed the treatment of clavicle fracture, in section 11, he discussed the treatment of humeral fracture, in section 23, he talked about treatment of dislocations, and in section 30 he talked about the treatment of spinal dislocations.

Sabuncuoğlu, in a part of his book recommended some advice to the physicians. First, in the case of total vertebral dislocation of spinal that can’t be treated and causes death. Another case is sliding of the vertebral dislocation towards any side. If it happens to the kids, there is no treatment, but with adults it can be treated, especially when the vertebra rises to the back causing hunchback.

Moreover, al-Zahrawi used a special table for dealing with vertebral dislocation, this table helped in extending limbs and that affected in reducing the displaced fractures (fig. 1).

35 Aygen, Karasu, Ofluoglu, Pait, Toplamaoglu, *The first Anatolian*, p. 130
36 Sarban, Aksoy, Uzel, DDS, Is, Atik, *Orthopaedic Techniques*, p. 257
37 Verti, Aksoy, Kafali and Ferda Verit, *Urologic Techniques*, p. 776
38 Aygen, Karasu, Ofluoglu, Pait, Toplamaoglu, *The first Anatolian*, p. 130
39 Uygur, Pamir, Ottoman, p. 166
40 Cambra, *Abulcasis*, p. 245
44 Turgut, *History Pediatric*, p. 1087
45 Booz, *Bone Surgery*, p. 75
Figure 1: Reducing table used by al-Zahrawi as a treatment for bone dislocations.


Similarly, *Sabuncuoğlu* described in detail the technique of the axial traction of dislocation and fracture spinal. As the patient is placed on a soft bed near to the wall facing upside down, the healers wrapped the knees and the ankles of the patient carefully with a smooth rope. Then they should collect both ends of the rope and tie them to the wheel of the stake found at the patient feet. Likewise, they put the rope under the patient armpits and tie it to the wheel of the stake at the patient head (fig. 2). If the treatment didn’t work, the healers stood by their feet upon piece of wood onto the dislocation vertebra of the patient until the joint returns back to its place\(^46\). *Al-Zahrawi* also dealt with the different types of fractures like head fracture, recurrent dislocation and even for wiring teeth with gold and silver wires by cauterization\(^47\).

Plate 2: The technique of an axial traction for therapy of dislocation vertebra, done by *Sabuncuoğlu*.

After: Imperial Surgery, in 2 Volumes [in Turkish]. Ankara: Turkish Historical Institute Publishing; 1992; Chapter 3, Section 30 [32]. Used with permission from Turkish Historical Society by 04 Sep 2012.

Sometimes, physician couldn’t know if there is fracture or not, so al-zahrawi recommended advice in his book *al-Tasrif* to enable physicians knowing that. He described the signs of fracture as crack sound, protrusion and distortion, the physician could realize that by pressing the hurt bone with his hand\(^48\).

6. Bone Surgical Instruments:

\(^{46}\) Turgut, *History Pediatric*, p. 1087

\(^{47}\) Booz, *Bone Surgery*, p. 74

\(^{48}\) Shuriye, Othman, *Contributions*, p. 137
Albucasis, the pioneer of surgery, invented many instruments for using them in his treatment of bones fracture and in his orthopaedic such as; scalpel “mibdla’ that used for cutting or removing tumours, saw “minshar” for cutting bones (fig. 3), osteotome “mikta” for cutting dead bones, drill “miskab” for making holes in bones, bone lever which is used to reduce fracture (fig. 4)\(^49\). and splint “Jabira” for fractures (fig. 5) which he cut bandages and cut them to different layers and then wrapped the fractures with those layers\(^50\).

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\(^{49}\) Booiz, Bone Surgery, p. 76

\(^{50}\) Ahmer, S.M., Ali, Contribution, p.31
According to Sabuncuoğlu, there are different methods used for removing the broken bones: one of them is cutting bones by using a cutting instrument which called Mikta ending with a thin edge, and if the area of the fracture is wide, he recommended making a hole using a drill with a button on its neck prevents overpenetration of the drill inside the brain tissues. There are 3 kinds of drills he used51.

He introduced some advice to the physicians during fracture procedures. First, they should turn the Miskab ‘the drill instrument’ (fig. 6) after they put it in the center of the broken bone until making a hole and the edge of the drill comes out from the other side of the skull. Then they should open another hole in another section of the wound and cut the bones between the two holes by Mikta. They should be careful of the tissues of the brain52.

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51 Turgut, History Pediatric, p. 1086
52 Turgut, History Pediatric, p. 1086
Figure 6: surgical devices used by Sabuncuoğlu for cutting and drilling bones of the kids ‘skull, Miskab in the right and Mikta in the left, reprinted with permission of the Ataturk Institute of Culture, Language and History, Institute of Turkish History.


Figure 7: Photo of some tools used by Sabuncuoğlu, from the Museum


Conclusion:

- According to analysis findings, Sabuncuoğlu the Turkish physicians from the fifteenth century followed the same medical methods of Albucasis in orthopaedic and the different treatments of bone fractures. As, both of them described the different types of dislocations and their treatments, but he added his own details.

- Because of the large number of similarities in both physicians’ treatments of bone fractures, mistakenly, Sabuncuoğlu’s book “Cerrahiyetü’l Haniye” was considered as a translation of Albucasis’ book “Al- Tasrif li-man ajaz an al- taalif”. Although there are many similarities between the two books, there are some differences.

- The differences were in the drawing of surgical instruments in two books of al-Zahrawi and Sabuncuoğlu. According to Albucasis, he drew the instruments only, such as drawing reducing table without presence of patients, while Sabuncuoğlu in his book, drew the patients operated on, in addition to the reducing table, and that was appeared for the first time in the Islamic world.

- Both of the physicians reflect how was the progress in orthopaedical surgeries and bone fractures during those periods.
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