

## Letter to the Editor

# A Miniature From the 15<sup>th</sup> Century That Narrates Shoulder Reduction

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Serefeddin Sabuncuoglu (1385–1470 A.D.) was a surgeon who lived in Amasya, which is in the northern part of middle Anatolia, in the 15th century during the period of the Ottoman Empire. During his lifetime, he wrote detailed explanations of surgical methods and used miniatures to demonstrate these methods. He made a significant contribution to the field of medical sciences, which included the fields of obstetrics, gynecology, vascular surgery, nerve surgery, ophthalmology, oncology, dentistry, and plastic surgery.<sup>[1, 2]</sup>

His main book, *Cerrahiyet'ul Haniyye (Imperial Surgery)*, has three volumes: treatment by cauterization, surgical interventions, and fractures and dislocations. This manuscript consists of 193 chapters and 412 pages. In addition, it contains pictures of 134 surgical interventions and 156 surgical instruments. The book was written in 1465, and the main point making this book unique is the inclusion of miniature illustrations that explain these treatment methods in detail in Turkish in the Anatolian medical literature<sup>[3, 4]</sup>. There are three original handwritten copies: two in Istanbul in the Fatih Millet Library and the Library of Medical History at the Department of Istanbul University and one in the Bibliothèque Nationale in Paris.<sup>[2]</sup>

*Cerrahiyet'ul Haniyye* was written by Sabuncuoglu and was translated from Albucasis's Textbook of Surgery as a resource book. Moreover, surgical techniques and colored pictures or miniatures containing the position of patients and physicians were added by Sabuncuoglu himself.<sup>[5]</sup> Further, his book was the first illustrated, Turkish-written, sur-

gical textbook in Anatolian medicine.<sup>[2]</sup>

Sabuncuoglu was a master of Turkish, his mother language. Although he knew Arabic, Greek, and Persian, he consciously wrote his book in Turkish because most physicians and majority of the Anatolian public spoke Turkish at that time. The other reason was that medical books were commonly written in other languages; thus, the public of Anatolia was deprived of this knowledge in his era.<sup>[2]</sup>

The 3rd volume of Sabuncuoglu's manuscript's, which deals with fractures and dislocations, includes a very detailed classification, definition, and treatment methods for shoulder dislocation with the inclusion of individual miniature illustrations.<sup>[1]</sup> As already observed, he wrote the manuscript in Turkish; during that time, the commonly used scientific language was Arabic. Further, it was written in the period for public works. Therefore, Sabuncuoglu was sufficiently unrecognized. Our main objective in this study is to examine, detail, and interpret the miniatures found in this 550-year-old book.

## Discussion

Descriptions from Ancient Egypt (3000 B.C. to 2500 B.C.) to Sabuncuoglu's time (1465):

Shoulder dislocation was first described in Edwin Smith papyrus rolls from 3000 B.C. to 2500 B.C. which is one of the oldest written documents.<sup>[7]</sup> These papyrus rolls gave descriptions of surgical interventions and treatments and prognosis of those cases.<sup>[7]</sup> They constitute a written source

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for the time period in which they were written; however, they did not include any illustrations or pictures that explain that information in detail.

A tomb from 1200 B.C. found on the eastern side of the Nile in the city of Thebes contains murals with human figures. One of the murals shows a patient lying and a physician holding the patient's elbow and wrist with both hands.<sup>[6,7]</sup> This is thought to describe shoulder reduction using lateral rotation in the treatment of shoulder dislocations. In this technique, dislocated shoulder is reduced into the joint space directly by lateral rotation.<sup>[7]</sup>

Hippocrates, the father of modern medicine who lived between 460 B.C. and 377 B.C., also described shoulder dislocation and suggested some techniques for treating the condition. In those techniques, he used either a wooden stick supported by a pillow or his heel, which was placed in the axillary region of the patient.<sup>[9]</sup> In the first technique, a strong person holds the other side of the dislocated part of the shoulder. The elbow of the patient on the dislocated side is held and tied above to detect the dislocated spot, and the doctor begins to pull upward. After this, the doctor reduces the dislocated shoulder using either a towel or a hanger to pull an upward motion toward him.<sup>[9]</sup>

Another classical method since the times of Hippocratic is to reduce the shoulder by placing the heel in the axillary region of the patient while the patient lies supine and is supported by pad or cotton.<sup>[9]</sup> Serefeddin Sabuncuoglu also described similar techniques for shoulder dislocation in the 26th chapter of the 3rd volume of his manuscript *Cerrahiyyet'ul Haniyye* with or without using tools. One of the techniques he described was to pull the hand of the patient in a downward motion while the surgeon pushes toward the joint by placing both thumbs in the axillary region of the patient.<sup>[2]</sup>

Another technique described by Hippocrates is using the body weight of the patient to reduce the shoulder. In this technique, the dislocated part is relocated by piggybacking a tall and strong person using the patient's body weight. Despite the apparent simplicity of this technique, its usage is difficult in a person who might carry taller and heavier patients. In Sabuncuoglu's manuscript, there are also attempts to reduce the shoulder using plants with known muscle relaxant properties and the muscle relaxant effect of heat. In one of these techniques, a knob or ball is placed in the axillary region of the patient while the patient lies in the supine position. Then, as an assistant pulls down the hand of the dislocated side, the surgeon pushes the ball upward using the palm. This has been reported to be successful in reducing the dislocated shoulder.<sup>[2]</sup>

Hippocrates also described tools to facilitate reduction. One of the tools is a 2-inch thick and 6-foot tall wooden stick with

a knob that is inserted into the axillary region of the patient in the middle and 2 ears on both sides of the knob.<sup>[9]</sup> The "ears" act as supports for the shoulder to not slip from the knob. The dislocated shoulder is positioned over that knob and two people raise the stick. After that, the surgeon pulls down the patient to reduce the shoulder.<sup>[9]</sup> A similar method is described in Sabuncuoglu's manuscript. Another similar method described by Sabuncuoglu is the three-person intervention. In this description, two people should be taller than the patient and one should be of a similar build. A cloth is tied to the shoulder head and the wrist of the patient on the affected side. A stick is passed under the tied cloth, and the patient's armpit is positioned on a wooden stick between the two knobs. Then, the stick is raised by two people above the patient to reduce the shoulder.<sup>[2]</sup> It is not including to this processing illustration.<sup>[2]</sup>

### Interpretation of the Miniature

In this report subjected to our title, the miniature shows the cloth to be placed on the arm and forearm region to stabilize the upper extremity. Even though the wooden stick is shown to be located on the elbow, it is probably used to keep the shoulder in the abduction position (Fig. 1). Sabuncuoglu stated that this technique could also be used in patients who do not respond to other shoulder reduction techniques or where reduction failed.<sup>[2]</sup> The patient is elevated from the ground with a wooden stick inserted into the axillary region of the upper extremity with cloth bandage and longitudinal traction until it is reduced. This technique can seem brutal and hard in reduction to difficult dislocation. However, the procedure used to intractable ones. Because a general anesthesia procedure was unavailable, Sabuncuoglu used some oil and herbal oil as a fenugreek and *Althaea officinalis*, mandrake, and almond oil based on conventional herbal medicine therapies in Anatolia. The necessity for a wooden stick and the need for more than one person appear to be the disadvantages of this technique. Moreover, it has risks of fracture or breakdown of the wooden stick or wooden stick mechanism, causing additional trauma and injury. The main advantage is using the body weight of the patient to reduce the shoulder. Further, by placing the wooden stick in the armpit, the reduction of the joint is facilitated by keeping the shoulder in abduction. The action of raising the wooden stick by two people reduces the risk of additional trauma, even when the patient falls from the wooden stick or the breakdown of wooden support because of the short distance to the floor. Even though similar methods have been previously described, Sabuncuoglu's manuscript is one of the first to show this in an illustration (Fig. 1).

Galen described general body injuries seen in gymnasiums and wrestling matches. Shoulder dislocations and their

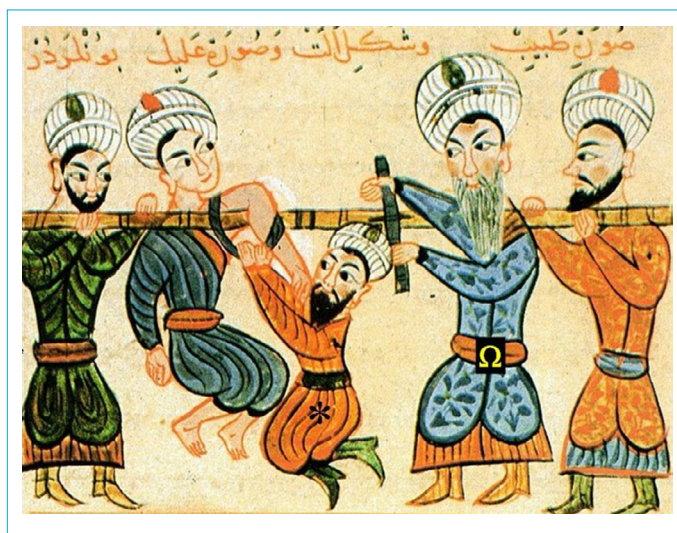
treatments were also described in his writings. In today's literature, there are no illustrated manuscripts from this period. However, there are some illustrated issues from the 16th to the 17th century with the increase in illustrations and paintings directly related to the European Renaissance movement in the Western literature.<sup>[11]</sup>

Albucalsis, who lived between 936 A.D. and 1013 A.D., is described by medical historians as the "father of surgery." Under this title, he wrote his manuscript titled *Al-Tasrif* during the Medieval Ages. In his manuscript, he described surgical techniques and illustrated the tools he used in surgery.<sup>[12]</sup> He also defined a shoulder reduction technique in the treatment of shoulder dislocations, very much similar to Kocher's technique used today.<sup>[12]</sup> However, there are no illustrations of the shoulder reduction technique in his book.

The manuscripts of Serefeddin Sabuncuoglu, Hippocrates, *al-Qanun fi't Tibb*, and *Al-Tasrif* are classified as basic medical manuscripts. All these manuscripts include the classification, definition, and treatment of various diseases.<sup>[11, 12]</sup> As mentioned above, Sabuncuoglu's manuscript is included among them.<sup>[11]</sup> What sets this manuscript apart from other manuscripts is the use of miniatures to illustrate the disease stages and treatment methods in addition to the instruments he used in surgery.<sup>[2]</sup> Most of the described maneuvers resemble classic Hippocrates' techniques. As with most physicians, Sabuncuoglu followed Ibn-i Sina (Avicenna)'s medicine as influenced by Hippocrates. Sabuncuoglu's book includes colorful illustrations and detailed descriptions on how to make reduction of the shoulder if some simple maneuvers fail.<sup>[12]</sup>

### Interpret, Pathophysiology, Reduction Techniques from Hippocrates to Our Subjected Miniature

The first definitions of shoulder dislocation directions and their treatment methods were found in Hippocrates' manuscripts. The most common dislocation type is anterior dislocation, which comprises approximately 95% of shoulder dislocations. To relocate the humerus, its head has to be positioned either in the anterior and lateral or superolateral position.<sup>[9, 13]</sup> Further, external rotation has to be applied to place this shoulder joint into the joint fossa.<sup>[13]</sup> However, the muscles in the shoulder line, such as the long head of biceps and subscapularis muscle, contract as a reflex in shoulder dislocations, effectively blocking the anterior reduction of the joint.<sup>[13]</sup> The pathophysiology of shoulder dislocation should be clearly defined to reduce the dislocation. In wall paintings in Ancient Egypt, the biceps muscle is shown to be relaxed by elbow flexion and then the shoulder is shown to be externally rotated and adducted. The shoulder is thought to be reduced by a sharp reduction maneuver, which is very similar to Kocher's method used today.<sup>[7]</sup>



**Figure 1.** This method, described by Serefeddin Sabuncuoglu in the miniature; the following is shown; the senior surgeon (Omega-Serefeddin Sabuncuoglu) and three additional contributors (assistants) carrying the long wooden stick that was placed in the axial region of the patient, thereby forcing the shoulder to an abduction. The "assistant", marked with asterisk, applied longitudinal traction for reduction (Reprinted with permission from Prof. Dr. Ilter Uzel. Copyright T.C. Ataturk Kultur, Dil ve Tarih Yuksek Kurumu. Turk Tarih Kurumu Baskanlığı Ankara, Turkey).

In Hippocrates, there is longitudinal traction during abduction. The muscles in the shoulder line had to be pulled against contraction with force. For this reason, a force exceeding the contraction force of the muscles has to be applied in reduction techniques with or without instruments. Sabuncuoglu and Hippocrates used similar methods. Both of them used a lever-wooden stick inserted into the axillary region of the patient and traction force.

In this figure, even though the wooden stick looks as though it is located on the elbow, it is actually inserted in the axillary region, which forces shoulder abduction, very much similar to Hippocrates' technique. The "assistant" marked with an asterisk applies longitudinal traction. The illustration of this technique with miniatures and the explanation of the technique in writing were representative of forward thinking and didactic contributions during that period.

In the traction method, many techniques are described according to the traction position of the arm. These techniques were defined by the positions of the arm to the body: abduction, anterior flexion, lateral flexion, and upper (overhead) traction.<sup>[14]</sup> The arm abduction technique is the oldest technique and was first described by Hippocrates.<sup>[13]</sup> As the patient lies down in the supine position, the surgeon's foot is placed on the axillary region of the patient and the patient's arm is pulled. To successfully perform this reduction,

the surgeon must be taller and stronger than the patient. A possible complication of this technique is injury to axillary nerves. This technique is still used today and is described in various forms.<sup>[9]</sup>

## Conclusion

One of the most important aspects in the manuscripts of Serefeddin Sabuncuoglu is the detailed explanations of surgeries and interventions in writing and the illustrations of those with miniatures. Most of these illustrations show the position of the surgeon and the patient and also include the instruments or tools and methods used during surgery in detail. Currently, in the written scientific article to explain description has pictures and drawing. In this sense, one can say that it has a similar approach to modern medical writings in terms of the detailed writing, classification, and illustration of the techniques. Moreover, a combination of all Greek, Roman, and Arabic medical knowledge and Turkish surgery techniques is important for contribute and original remarks in his book. Therefore, it could be one of the earliest written scientific content.

Another interesting point in Sabuncuoglu's manuscript is the inclusion of human pictures and figures, which were not found in previous Islamic medical manuscripts during that era. This absence of illustrations in previous manuscripts can be explained by the Islamic ban on paintings human figures and illustrations.

The oldest information classified as orthopedic literature is papyrus rolls, describing shoulder dislocation and its treatment in Ancient Egypt. This is also seen in temple murals. Hippocrates also gave information about the definition, classification, and treatment of shoulder dislocations and put them in writing. Illustrations of miniatures or drawings were used in the medical literature until the Renaissance period. Along with the Renaissance period, detailed pictures, illustrations, and drawing instead of miniatures. Serefeddin Sabuncuoglu described diseases and their treatments in detail, illustrated with miniatures. This approach is revolutionary, considering the Islamic ban on painting human figures in the region in which he lived during that era. In addition, he made a trailblazing contribution to the medical field at that time, influencing the resurgence of paintings and illustrations in medical manuscripts and articles in Europe that began with the Renaissance period and continued throughout the Age of Enlightenment.

## Disclosures

**Conflict of Interest:** None declared.

**Authorship contributions:** Concept – E.K.; Design – E.K.; Supervision – E.K.; Materials – E.K.; Data collection &/or processing – E.K.; Literature search – E.K.; Writing – E.K.

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