

Bone Fractures as Viewed by Ibn Sīnā

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Abstract

Ibn Sīnā, or Avicenna as known in the West, was a well known Islamic philosopher and physician. He composed 276 works, the most famous of which is "al-Qānūn fit-Tibb." This paper highlights the bone fractures that may occur, described in Ibn Sīnā's "al-Qānūn," and reveals his accomplishments and contributions to this field of medicine.

Key words: Ibn Sīnā, Avicenna, Al-Qānūn fit-Tibb, History of Traumatology.

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Ibn Sīnā, or Avicenna as known in the West, was born in 980 A.D. in Afshana near Bukhārā in Turkistan, which is now Uzbekistan. He left Bukhārā when he was 21 years old to spend the rest of his life in various Persian towns. Ibn Sīnā

composed 276 works, all written in Arabic except a few small books written in his mother tongue, Persian. "Al-Qānūn fit-Tibb," which is written in Arabic, represents Ibn Sīnā's most important work. Osler described it as the most famous medical textbook ever written.¹

Ibn Sina devoted two treatises in the fourth book of his medical encyclopedia, "al-Qānūn," to fractures. The first treatise is entitled: "Fractures as a Whole," and the second is "Fractures of Every Bone Separately."

In the first treatise, he described the causes, types, forms, methods of treatment, and complications of fractures. While in the second treatise, he determined the special characteristics of fractures of each bone. Ibn Sina, by this way of explanations, was very close to following the format of modern medical textbooks.

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The first treatise – Fractures as a Whole

Ibn-Sīnā defined a fracture as a loss of continuation in the bone.² Then, he determined the types of fractures such as transverse, longitudinal, or comminuted. When he talked about symptoms and signs of a fracture, he considered the pain, swelling, and deformity of the limb to be of great importance to the diagnosis.

In this chapter, Ibn-Sīnā distinguishes the fractures that reach the joint line. "If the fracture was at the joint line and healed, the movement of the joint could be difficult as the rigidity of the callus needs more time to become soft,"³ he said. It is well known now that fractures that occupy the joint line cause stiffness of that joint after they heal, unless convenient physiotherapy is applied to the limb.

Factors that stimulate and inhibit bone healing

Ibn Sīnā mentions that fractures of children heal more rapidly than those of adults. He determined the time span necessary for every bone to heal.

He said, for example, a nose bone fracture needs 10 days to heal, a rib needs 20 days, a forearm needs 30 to 40 days, and a femur need 50 to 120 days. It is clear that these figures are similar to those written in modern medical textbooks.

At the end of this chapter, he pointed out the factors that affect negatively bone healing, such as the lack of a splint at the site of the fracture, quickness in moving the affected limb, loss of blood (anemia), and the existence of a disease in the body.⁴ These factors, and others, are now considered to have a considerable role in delaying bone healing.

Principles of splinting the bone

In this chapter, Ibn-Sīnā talked about treating a bone fracture by splinting it. He warned the physician against overlightening the affected limb, which could cause gangrene.

In respect to what is called now open fracture, he pointed out the importance of taking care of the wound more than the fracture. If the fracture was complicated by hematoma formation, Ibn Sīnā advises the bone setter to make an incision at the site of swelling to allow the blood to get out.

In this chapter, Ibn Sīnā also focuses on a very important issue in the treatment of comminuted fractures. He said: if the fracture is associated with a sequester and is painful, it has to be mended and reduced into its position. If this is impossible, the sequestrum has to be excised using a thin saw or by drilling many holes at the base. Whatever the method, the doctor has to be very careful not to injure an important structure. Sometimes the sequestrum is not visible; its position can be identified by remarking the discharge from the wound. In such cases, the wound must be enlarged to allow the removal of the sequestrum.⁵

Recommendations to the bone setter

Before treating any fracture, Ibn Sīnā advised, the phy-

sician should inspect and examine the fracture accurately and splint it quickly because fracture reduction will be more difficult and complications may develop if there is a delay.

At the same time, Ibn Sīnā drew attention to the necessity of not splinting the fracture immediately. He advised postponing it beyond the fifth day or more, until the swelling disappeared. This is called now the theory of delayed splintage, and professor George Perkins is considered the pioneer of this theory today.⁶

Fractures associated with a wound (open fractures)

In this chapter, Ibn Sīnā talked about treating fractures associated with a wound. He stressed the necessity of not applying a splint to the wound; ointment should be put on first, then the wound may be covered by a special dressing that would let out the wound discharge, and allow the physician to apply medicine.

This method of treating open fractures as described by Ibn-Sīnā is similar, in many aspects, to that used today, except the use of antiseptic procedures during the course of treatment.

Malunion fractures

What Ibn Sīnā meant by malunion fracture was a fracture that is joined in a nonsuitable position, allowing the limb to become deformed. To treat this case, he suggested breaking the bone again at the site of old fracture and splinting it properly. If the callus is hard, this method should be avoided, otherwise a fracture may occur elsewhere. In such cases, Ibn Sīnā advised the bone setter to apply material that softens the callus until the limb can be splinted in the correct position.

Today, all types of malunion are treated surgically.

The second treatise – Fractures of every bone separately

Skull fractures

Ibn Sīnā clarified that a skull fracture may happen even if the skin above it is still intact. In such cases, a hematoma may develop under the skin. The physician should not omit fracture treatment because this may lead to bone decay. The patient may complain of tremors and mind loss. In such cases, Ibn Sīnā advised the operator to make an incision at the site of fracture to treat it. Next, he described the signs of skull fracture such as unconsciousness, dizziness, and speech loss.

At the end of this chapter, Ibn Sīnā said. "If the fracture is severely comminuted it should be completely excised, but if it is linear and distended you should not widen the incision, as no damage could result from the fracture."⁷

Mandible fractures

The method Ibn Sīnā describes for treating these fractures resembles what is used today, except in some modern special surgical techniques. In this respect, he said that if the fracture is in the right side and displaced internally, the

physician must insert his left index and middle fingers into the patient's mouth to elevate the fracture edge outward. The complete reduction could be identified by a good occlusion of teeth.

If the fracture is comminuted or associated with a wound, Ibn Sina said to make an incision at the fracture site, and remove any sequestrum that may be present. He advises the physician to suture the teeth using a gold wire in order to stabilize the correct position of the mandible. The patient is asked to remain at rest and avoid speaking. His diet should be liquids. The mandibular bone needs three weeks to heal; it is filled with bone marrow.

Nose-bone fractures

Ibn Sina stated that a delay in treating a nose-bone fracture may lead to tilting of this bone, and anosmia may develop. So, he insisted on treating this fracture during the first 10 days. If the fracture is comminuted, and the reduction is impossible, the bone setter should incise the skin and remove all the comminuted bone.

Clavicle fractures

Ibn Sina's treatment of clavicle fractures is extremely different from those known today. He considered clavicle fractures difficult to splint. He described a long method to achieve a complete reduction. Today, this fracture is considered easy to treat, and complete reduction is not required to achieve healing.

Shoulder fractures (fracture of scapula)

Ibn Sina said: "The shoulder is rarely fractured in its broadest part, but its borders and sides are commonly affected. . . . The most common signs are pain and crepitation on palpation, and the patient may complain of anesthesia in the hand. . . . This fracture is treated by pushing the shoulder from the anterior aspect as a trial to reduce it; otherwise, the physician has to use cupping glasses in order to tract the fractured part posteriorly. . . . In cases of existence of some painful bone fragments, they should be excised. . . . After the treatment the patient is asked to sleep on the intact side."⁸

All types of scapular fractures need no more treatment than rest until the pain subsides.

Fractures of the sternum

Ibn Sina classified this fracture into types:

1. an isolated splitting fracture, which is diagnosed by the existence of crepitation on palpation and
2. a fracture that is displaced anteriorly and may cause bad symptoms such as difficulty in breathing, dry cough, and, sometimes, hemoptysis.

The treatment of this fracture is similar to that of the shoulder.

Rib fractures

In this chapter, Ibn Sina stated that the seven true ribs are fractured at their lateral sides, while the false ribs are fractured at their medial sides. The diagnosis of a rib fracture is very easy to determine by palpation, which allows the physician to feel abnormal movement at the fracture site. The patient may complain of pleurisy and hemoptysis. The treatment is accomplished by using cupping glassing to tract the fractured rib. If the bone is compressing the diaphragm, the skin must be incised to excise carefully that bone.

Vertebral fractures

Ibn Sina talked about vertebral fractures very briefly, perhaps because of the rarity of information about these fractures at that time. He attributed all this information to Paulus Eginus (who is a famous surgeon from the Alexandria school who lived in the 7th century and wrote a medical book containing seven treatises in surgery and obstetrics, translated into Arabic by Hunin Ibn Ishaq)⁹

Ibn Sina drew the physician's attention to the danger of this type of fracture that could cause death if the cervical vertebrae were involved.

Finally, he described the method for reducing coccygeal fractures by inserting the left index finger into the patient's rectum.

Humeral fractures

Ibn Sina elucidated that this fracture often tilts outside, so the physician must reduce it according to this tilting. It should be stabilized by using three bandages; the first one is ascending while the second is descending and the third is ascending. The upper limb must be stabilized in an angular shape with a sling. It is better to stabilize it to the chest to prevent movement.

After seven to 10 days, the bandages should be released and replaced by applying suitable splints for another 40 days.

Forearm fractures

Ibn Sina said: "Both of ulnas or one of them may be fractured. The fracture of the inferior one is more bad, while the fracture of the superior one is more easy to treat."¹⁰ At that time, the bones of the forearm were called the superior ulna (radius) and the inferior ulna (ulna).

Ibn Sina explained the method for stabilizing the fractured forearm. He said not to tighten the bandage too much, otherwise severe swelling of the fingers may develop, and not to loosen it, so no swelling at all may appear. After that, he explained a very important item that still occupies a considerable role in the field of treatment of forearm fractures: the necessity of not applying the splints so they extend beyond the base of the fingers, which may cause these fingers to become stiff.

After accurate reduction and complete stabilization are achieved, Ibn Sina advised the physician to sling the af-

ected forearm to the neck in an angular shape by using a wide rag so that it covers the whole length of the forearm. Forearm fractures heal quickly (within 28 days).

Wrist fractures

Ibn Sīnā said: "These bones rarely fracture, as they are very hard. And if they are severely injured, dislocation may result, which could be treated as we had said in the dislocations section."¹¹

It is well known today that wrist fractures are extremely rare, except for scaphoid fractures, which cannot be diagnosed without performing an X-ray on the wrist joint.

Finger bone fractures

In this chapter, Ibn Sīnā said that finger bones are affected more by dislocations than by fractures. To treat finger fractures, the patient is seated on a high chair and is told to put his hand on a flat chair, an assistant extends the fracture bones, and the physician reduced them with his thumb and index fingers.

Ibn Sīnā pointed to what is called now "Bennet's fracture 1982"¹² when he said, "If the fracture was in the thumb and was displaced inferiorly, then you have to use the broad bandage from above to prevent the occurrence of the host tumor."¹³

Ibn Sīnā said if the fracture is in the thumb, it should be bound to the hand; if it is in the index or small finger, it should be binded to the nearest finger.

Broad bone and hip fractures

This chapter represents the cases of central hip fracture-dislocation and fracture of the sacrum, which was called the broad bone at that time.

Ibn Sīnā said a central hip fracture-dislocation rarely occurs. The injured patient may complain of severe pain and anesthesia in his leg and thigh, resembling that of an arm or shoulder fracture.

In order to achieve a good reduction in broad bone fractures, he said the physician should put the patient in a prone position, and two strong people should tract the patient's two thighs while two people use splints to try to reduce the fracture and put on the bandages.

Femur fractures

Ibn Sīnā said: "If the femur fracture needs severe traction to reduce it to the normal position, which is convex in its lateral side and concave in its medial side, the traction should be upward to be more effective."¹⁴

He said that when this fracture occurs, the distal fragments displace anteriorly and outside because the femur is broader at that side.

After the reduction is achieved by applying severe traction, a bandage should be applied above the fracture and another one below it if the fracture is in the middle of the femur.

Femur fractures heal within 50 days. The most common complication is deviation at the fracture site.

Patella fractures

Ibn Sīnā said: "The patella is rarely fractured, but it is sprained frequently. The fracture is diagnosed by the presence of crepitation which can be palpated or heard. In respect to treatment, the leg should be extended, then the patella be reduced. But if the fracture was comminuted, the fragments should be gathered first then reduced."¹⁵

Al-Razī (who lived before Ibn Sīnā) may be the first who pointed to excision of the patella before Brooke (1930).¹⁶

Leg Fractures

Ibn Sīnā stated that fractures of the small bone of a leg (which is now called the fibula) are better than fractures of the big bone (tibia). If the fracture is in the upper part of the fibula, the deformity is outside and anterior, and walking is possible. If the fracture is in its lower part of the tibia, the deformity is posterior and outside. If the fracture is in both bones, and situation is bad and the deformity may be at any direction.

He said the physician should apply a traction to reduce the fracture in the same method used for forearm fractures.

Talus fractures

In this chapter, Ibn Sīnā said the talus is protected against fracture because it is solid and surrounded by structures that guard it. This bone may be dislocated.

Today, this fracture may happen rarely; its diagnosis is difficult unless an X-ray is performed.

Calcaneus fractures

Ibn Sīnā said: "Calcaneus fracture is a bad case as its treatment is difficult. It occurs when a person falls down on his feet from a high place It may cause severe signs like fever, confusion, tremor, and spasm After calcaneus fracture unites walking becomes difficult."¹⁷

This fracture now is called now parachutists's fracture. The most important complication of this fracture is difficulty it causes in walking, due to the development of osteoarthritis in the talo-calcaneal joint after the union of this fracture.

Toe fractures

This is the last chapter on fractures. In this chapter, Ibn Sīnā pointed out that the treatment of toe fractures is like that of the fingers.

Conclusion

A survey was conducted to find out the most important points related to fractures as described by Ibn Sīnā in his medical book, "al-Qānūn-fit-Tibb."

From this survey we can conclude:

1. Ibn Sīnā played an important role in keeping the

medical heritage that developed over thousands of years. His medical book, "al-Qānūn," represents a unique reference document containing medical knowledge in general and traumatology in particular as it accumulated through many civilizations until the age of Ibn Sīnā.

2. In his way of explanation, Ibn Sīnā was very close to the way modern medical textbooks follow. At the beginning, he talked about fractures in general. He described their causes, types, forms, methods of treatment, and complications. Then he described the fractures that occur in every bone.

In this respect, one can say that the excellence in its arrangement and comprehensiveness made "al-Qānūn" the most widely used medical text book in Islamic and European countries until the 17th century.

3. Ibn Sīnā drew attention to the necessity of not splinting the fracture immediately, advising postponing it beyond the fifth day. Today, this is called the theory of delayed splintage; professor George Perkins is considered the pioneer of this theory.

4. Ibn Sīnā talked about what is called now "Bennet fracture 1882." We know that neither al-Rāzī before him, nor Ibn-Aljuk after him, had described this type of fracture.

In the West, it had been said: "Anyone who wants to be a good doctor must be an Avicennist." A word of truth was written by the European physician De Poure who declared: Medicine was absent until Hippocrates created it, dead un-

til Galen revived it, dispersed until Rhases collected it, and deficient until Avicenna completed it.

References

1. Al-Baba MZ: Some of medical books edited by Ibn Sīnā. Aleppo: Institute for the History of Arabic Sciences - Aleppo University, 1984.
2. Ibn Sīnā: "Al-Qanūn fit-Tibb. vol. 3, Dar Sader, Lebanon, 1980, 197.
3. Ibn Sīnā, vol. 3, p. 197.
4. Ibn Sīnā, vol. 3, p.198.
5. Ibn Sīnā, vol.3, p.199-200.
6. Apley AG, Solomon L: Apley's system of orthopedic fractures. London: Butterworth & Co., Ltd. 1982, 6th ed., 344.
7. Ibn Sīnā, vol.3, p.210
8. Ibn Sīnā, vol.3, p. 213
9. Al-Baba MZ: History and legislation of pharmacy. Damascus: Damascus University, 1986. 132.
10. Ibn Sīnā, vol.3, p.215.
11. Ibn Sīnā, vol. 3, p. 215.
12. Rockwood CA, Green DP: Fractures. vol.1 London: H. K. Lewis and Co. Ltd., 1975, 305.
13. Ibn Sīnā, vol. 3, p. 215-6.
14. Ibn Sīnā, vol.3, p. 216.
15. Ibn Sīnā, vol.3, p. 217.
16. Rockwood CA, Green DP: Fractures. vol. 2. London: HK Lewis and Co. Ltd., 1975. 1153.
17. Ibn Sīnā, vol. 3, p.217.