



Spinal Traumas and their Treatments According to Avicenna's *Canon of Medicine*

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- Persian medicine
- Spinal traumas

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INTRODUCTION

In the past, spinal traumas had a high rate of incidence, and many patients are still affected by them today. Despite the development and expansion of medicine, a number of issues regarding the treatment of spinal traumas remain unsolved (12). The first report of paraplegia caused by spinal injury is in an ancient Egyptian papyrus, the Edwin Smith surgical papyrus, dating back to 3000 BC (20). In Homer's *Iliad* (ca 8th century BC), brief but clear descriptions of neurologic complications attributable to spinal traumas are presented (6). The first reported comprehensive scientific description of spinal trauma, and secondary complications and treatment approaches, such as traction methods (succession on a ladder), go back to Hippocrates (460–370 BC) (7). After him, some other great scholars such as Aulus Cornelius Celsus (1st century AD), Galen (131–201 AD), as well as Paul of Aegina (625–690 AD), Rhazes (865–925 AD), and Haly Abbas

Spinal Traumas have been categorized as disabling diseases that cause irretrievable personal and social problems. Having conducted a rather comprehensive diagnosis of the anatomy of the backbone and spinal cord as well as their functions, Avicenna (Ibn Sina, 980–1037) stated the levels and kinds of spinal impairments that are caused by spinal traumas in his great masterpiece *Al-Qanun fi al-Tibb (The Canon of Medicine)*. He also based his treatment process on his etiological diagnosis of such impairments. Avicenna had used the following methods to treat spinal traumas: food and drug therapy and regimental therapies such as massage, phlebotomy, cupping, dry sauna, and surgery. The authors of the present article review the bases of Avicenna's viewpoints regarding spinal traumas and their treatment.

(died 982–994) improved on that knowledge (1, 6, 7, 23).

Avicenna was another great scientist in the early 11th century who advanced neurologic concepts, including those regarding spinal trauma (22). Although some of his contributions in describing and treating spinal traumas have been investigated recently (2), most of his findings and treatment approaches are still unclear. Here we attempt to clarify Avicenna's points of view and descriptions of the spinal cord, spinal trauma, and also his treatment approaches, including food and drug therapy, as well as manipulation methods, such as surgery and exercise, in his large medical encyclopedia, *The Canon of Medicine*.

AVICENNA AND THE CANNON OF MEDICINE

Ibn Sina, who is known in western countries as Avicenna (Figure 1), was a great Persian medicine and philosophy scholar. He was born in Afshaneh, a village near Bokhara (a city in the north-east of old Persia) in 980 AD (22). He finished learning Persian literature, as well as religious texts such as the Quran (24), when he was only 10 years old. Then, he began learning medicine and philosophy. Avicenna was a famous physician by the time he was just 18 years old. He had more than 200 records in the various science branches in Persia. His most valuable work in the

field of medicine, *The Canon of Medicine*, is a large and comprehensive encyclopedia. In the 12th century AD, this manuscript was translated into Latin by Gerard of Cremona and was one of the main medical textbooks taught in western universities until the 16th century AD. The third volume of this book begins with neuroscience topics, including chapters regarding spinal traumas and its relevant treatment approaches (Figure 2) (4, 22).

DESCRIBING VERTEBRAE AND SPINAL NERVES

Eight chapters of *The Canon of Medicine* explore functional spinal neuroanatomy. Avicenna tried to find explanations for the anatomic features of the vertebrae and the spinal region. He emphasized that the shape and the size of any vertebra are determined by its regional function. Therefore, he classified the spine into the following segments, which is similar to the currently used classification system: cervical, thoracic, lumbar, sacral, and coccygeal. Then, he described the anatomic features of the vertebrae in each region. Avicenna described the biomechanical features of the vertebrae and the spine almost perfectly correct. He described the flexion, extension, and lateral bending aspects of the moving segments (Chapters 8 and 9), as well as the coupling phenomenon of the thoracolumbar spine (2, 5).



Figure 1. Avicenna's statue in Hamadan, the city in which he died and was buried.

The most interesting of Avicenna's points of view concerns the biomechanics of the craniovertebral junction. Avicenna described the different characteristics of the atlas and the axis vertebrae. He reported that the head-atlas moving segment is responsible for lateral bending, whereas the C1–C2 segment makes anteroposterior

motion possible. One condyle elevates the head and the other bends it (5). Furthermore, Avicenna observed that “the odontoid process has two functions: it protects and prevents displacing the thinner first cervical vertebra. During the anteroposterior and lateral head movements C1 and C2 vertebrae act as a single bone and move together” (5). The similarities between some parts of Avicenna's Canon and our current biomechanical knowledge are surprising. In addition, the chapters of the Canon mentioned previously reveal that an understanding of spinal biomechanics was a necessity, even 1000 years ago (17):

The neck includes seven vertebrae [C1–C7 in current classification]. Each cervical vertebra has one edge, two wings, four upward articular apophyses and each wing has two branches. In addition to these eleven apophyses, each vertebra has a common place with its adjacent vertebrae for nerves to exit the structure. The first and second vertebrae have some features that other vertebrae do not (5).

Avicenna described spinal-cervical, thoracic, lumbar, sacral, and coccygeal nerves, as well as the sensual and the motor functions of each aforementioned nerve system based on his recognized anatomy (5). Avicenna believed that the spinal cord contains 2 parts, in the same as the brain, although one cannot feel it (Figure 3) (5).

TRAUMATOLOGY OF SPINAL TRAUMAS

Avicenna produced a great amount of comprehensive information about spinal traumas and their treatments in The Canon under the title of “nerve [asab in original text] diseases, orthopedics and medicinal simple drugs.” He considered various parameters as signs and symptoms, including location, kind, and paroxysm of trauma. They will be discussed in the sections to follow.

Location of Trauma

If trauma is located where the spinal cord passes, Avicenna believes that the whole body, except the head and face, will be paralyzed. Also, he stated that “If one half



Figure 2. A handwritten copy of *The Canon of Medicine*, written in 1066AD, the first page of the book 1 of the Canon (left), the first page of the chapter about vertebral dislocation (right).

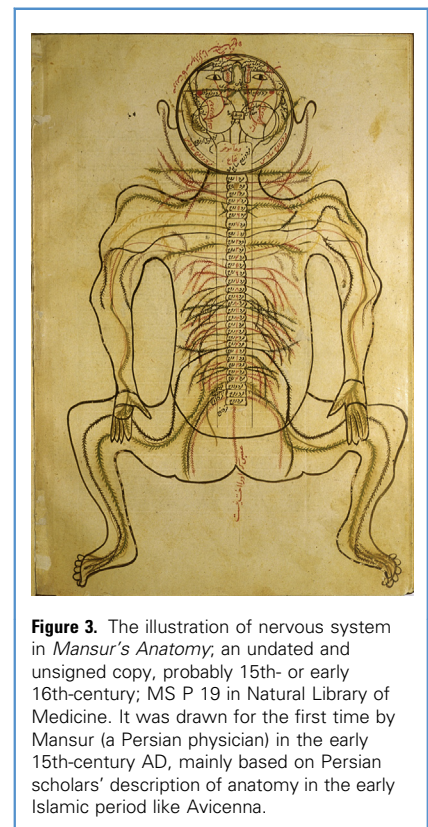


Figure 3. The illustration of nervous system in *Mansur's Anatomy*, an undated and unsigned copy, probably 15th- or early 16th-century; MS P 19 in Natural Library of Medicine. It was drawn for the first time by Mansur (a Persian physician) in the early 15th-century AD, mainly based on Persian scholars' description of anatomy in the early Islamic period like Avicenna.

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