

## The anatomy of spinal nerves in the “Teşrihü’l-Ebdan Min e’t-Tıb” written in the fourteenth century\*

XIV. yüzyılda yazılmış olan “Teşrihü’l-Ebdan min e’t-Tıb” adlı eserde spinal sinirlerin anatomisi

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### ABSTRACT

Considering that the visual dimension of anatomy cannot be ignored and an anatomy education without the visual part will make a doctor imperfect in their profession, it may be seen that pictorial anatomy books written in previous periods are highly valuable.

The purpose of this study is to investigate the spinal nerve anatomy included in the work titled *Teşrihü’l-Ebdan min e’t-Tıb* written in the XIVth century and compare the information at that period to the information of our time.

The nervous system was analyzed under a separate title in the book. Firstly, general information was provided about nerves, and then cranial and spinal nerves were described. The author stated in his work that there are two differences between humans and animals as feeling and movement. He stated that the center for feeling and movement is the brain and all nerves converge in the brain.

Although there are insufficient or incorrect information in historical books of medicine, such books are highly valuable as they show the scientific progress. It is apparent that Mansur’s work titled *Teşrihü’l-Ebdan min e’t-Tıb* has a significant place in the history of anatomy, and its influence was reflected in the following periods. Despite the occasions of insufficient or incorrect information in the piece, we think it contributed to the historical development of anatomy.

**Keyword:** *Teşrihü’l-Ebdan min e’t-Tıb*, Spinal nerve, Medical history

### ÖZ

Anatominin görsel boyutunun ihmal edilemeyeceği, görsellikten yoksun bir anatomi eğitiminin hekimin iyi yetişmesini noksan bırakabileceği düşünüldüğünde geçmiş dönemlerdeki resimli anatomi kitaplarının oldukça kıymetli olduğu anlaşılacaktır.

Bu çalışmanın amacı XIV. Yüzyılda yazılmış olan *Teşrihü’l-Ebdan min e’t-Tıb* adlı eserde bahsedilen spinal sinir anatomisinin incelenmesi ve o dönemdeki bilgilerin günümüz bilgileri ile karşılaştırılmasıdır.

Kitapta, sinir sistemi ayrı bir başlık altında incelenmiştir. İlk olarak sinirler hakkında genel bilgiler verilmiş ardından kranial ve spinal sinirler anlatılmıştır. Yazar, eserinde insanlar ile hayvanlar arasında his ve hareket olmak üzere iki fark olduğunu ifade etmiştir. His ve hareketin merkezinin beyin olduğunu ve bütün sinirlerin beyne ulaştığını söylemiştir.

Tarihi tıp kitaplarında eksik ve yanlış bilgiler olsa da bu kitapların bilimsel gelişimi göstermesi açısından değeri yüksektir. Mansur’un *Teşrihü’l-Ebdan min e’t-Tıb* isimli eserinin anatomi tarihi açısından önemli bir yerinin olduğu, etkisinin kendinden sonraki dönemlere de yansıdığı görülmektedir. Eserde verilen bilgilerin eksiklikleri ve yanlışlıklarına rağmen bu eserin anatominin tarihsel gelişimine katkı sağladığını düşünmekteyiz.

**Anahtar Kelimeler:** *Teşrihü’l-Ebdan min e’t-Tıb*, Spinal sinirler, Tıp tarihi

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## INTRODUCTION

Considering that the visual dimension of anatomy cannot be ignored and an anatomy education without the visual part will make a doctor imperfect in their profession, it may be seen that pictorial anatomy books written in previous periods are highly valuable.<sup>1</sup> It is known that anatomy information is included to some extent in medicine books written in the Islamic world. However, pictorial anatomy books are very rare. The work titled *Teşrihü'l-Ebdan min e't-Tıb* written by the physician *Mansur ibn Muhammed ibn Ahmed ibn Yusuf ibn Ilyas* in the XIVth century in Farsi is a pictorial anatomy book.<sup>2, 3</sup> The pictures in this book have been used in many medicine and science history books, often uncited. Mansur, who lived in Shiraz, wrote this piece in the year 1386. It is known that the work has forty copies, and two of these copies are at Washington National Library of Medicine, while İstanbul Süleymaniye Library holds one copy.<sup>3, 4</sup>

Mansur described anatomical structures systematically, and then provided information about the formation and development of the embryo. It is known that he utilized the knowledge of individuals like Aristoteles, Galen and Avicenna, additionally providing his own ideas.<sup>3, 5-9</sup>

The purpose of this study is to investigate the spinal nerve anatomy included in the work titled *Teşrihü'l-Ebdan min e't-Tıb* written in the XIVth century and compare the information at that period to the information of our time.

## METHODS

In this study the translation of the work *Teşrihü'l-Ebdan min e't-Tıb* from Farsi into Turkish, *Kitab-ı Teşrihü'l-Ebdan min e't-Tıb*<sup>3</sup> was examined. The sections of the work related to spinal nerves were analyzed in detail. The information in the book was compared to the current information. Correct, incorrect and missing information was determined.

## RESULTS

### **Anatomy of the Nerves**

The nervous system was analyzed under a separate title in the book. Firstly, general information was provided about nerves, and then cranial and spinal nerves were described. The author stated in his work that there are two differences between humans and animals as feeling and movement. He stated that the center for feeling and movement is the brain and all nerves converge in the brain. He categorized nerves in four ways. In the first group, he analyzed nerves based on their softness and gave the olfactory nerve as an example. He stated that soft nerves would conduct the sensation faster. In the second group, he categorized the nerves based on whether they are hollow (e.g. optic nerve) or not. In the third group, he described nerves based on their functions as sensory (e.g. sense of taste), motor or both. In the fourth group, he categorized nerves based on the location they leave the brain or the spinal cord. He stated that nerves could be flexible but it would be hard to cut them. He stated that besides providing feelings and movements, nerves also strengthen and harden the muscles. Another function of nerves is to receive sensation via the tissues covering internal organs like liver and spleen when they receive damage.<sup>3</sup>

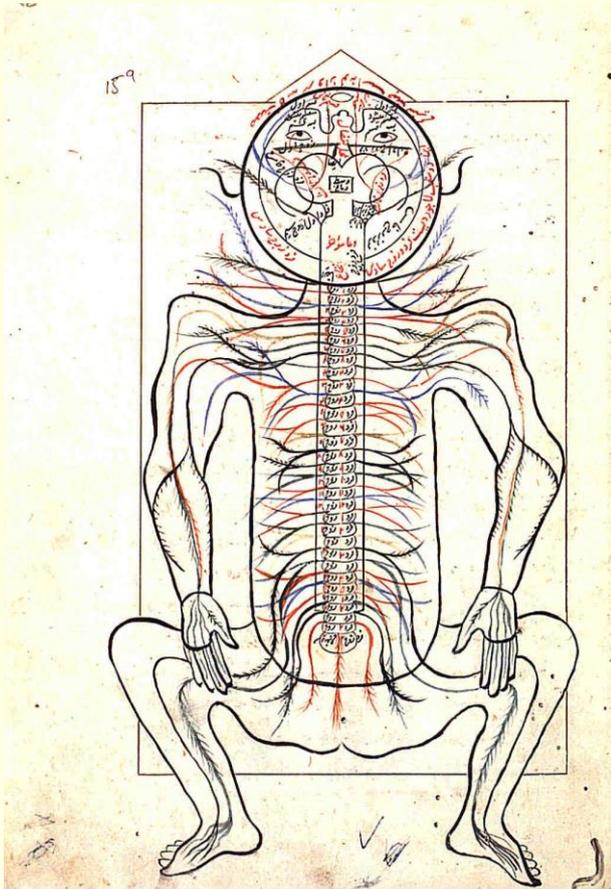
When this section is analyzed, it is seen that he correctly identified nerves as cranial and spinal nerves. He did not mention the spinal cord while identifying the brain as the center of feeling and movement, he was correct in his statements to a great extent. While categorizing the nerves, he identified the first two groups incorrectly, correctly identify the third and the fourth. While stating correctly that nerves are flexible, he incorrectly stated that it is hard to cut them. Mansur correctly stated that nerves receive visceral sensation from the fascia surrounding the organs.

### **Spinal Nerves**

He reported that thirty-one pairs of spinal nerves and an additional single one leave from the spinal cord which is the extension of the brain. He categorized the spinal nerves based on where they exit as nerves stemming from the neck, the back, the sacrum and the coccyx.<sup>3</sup>

When this section is analyzed, it is seen that he correctly identified the numbers and sections of the spinal nerves to a great extent. We think that the single spinal nerve mentioned to be leaving the spinal cord may

be the filum terminale containing the rudimentary coccygeal nerve roots. He made the visual dimension clearer and easier to understand by assigning different to nerves. Mansur, explicitly drew the spinal nerves coded with different colors (*Fig.1*). He indicated their color in the figure while providing information about the nerves in the text.



**Figure 1.** The drawing of the spinal nerves in hand written textbook (Ayasofya 3598, from the Collection of the Suleymaniye Library Istanbul, Turkey)

### **Cervical spinal nerves**

Mansur stated that eight pairs of spinal nerves leave the neck and described each of them separately. *The first cervical spinal nerve* reaches the muscles in the head. *The second cervical spinal nerve* exits between the first and second cervical vertebrae, receives sensation from the skin over the head and moves the muscles behind the head. *The third cervical spinal nerve* exits between the second and third cervical vertebrae, diverges into two branches, one branch reaching the front, the other reaching the back. *The fourth cervical spinal nerve* exits between the third and fourth cervical vertebrae, diverges into two branches. One of the branches converges with the fifth cervical spinal nerve. The fifth cervical spinal nerve is too small and exits between the fourth and fifth cervical vertebrae and diverges into two branches. It rises to the vertebrae and spreads between the head and the neck. *The sixth cervical spinal nerve* exits under the fifth cervical vertebra and diverges into two branches. One reaches the muscles in the head, neck and waist area. The other branch reaches the shoulder. *The seventh cervical spinal nerve* exits under the sixth cervical vertebra and diverges into two branches. Differently from other nerves, one branch reaches the arm and spreads in this area. *The eighth cervical spinal nerve* exits under the seventh cervical vertebra and diverges into two branches.<sup>3</sup>

When this section is analyzed, it is seen that he correctly described the emergence of eight pairs of nerves from the cervical area. The emergence sites of spinal nerves from the vertebral canal are described correctly. While there were deficiencies and incorrect information, his report on joining of the branches of the 5th and 6th cervical spinal nerves and reaching of the 7th cervical spinal nerve to the upper extremity

resembles the development of brachial plexus. The information about the muscles innervated by the cervical spinal nerves is mostly incorrect. The information that 2nd cervical nerve receives sensation from the head is given correctly.

### **Thoracal spinal nerves**

He indicated that there were twelve nerves leaving the spinal cord between thoracic vertebrae. *The first thoracal spinal nerve* exits between the first and second thoracic vertebrae. It diverges into two branches and the big one resides between the sternum and the scapula. This nerve resides between the eighth costal cartilage and the neck, reaching the lung. It also diverges into branches at the shoulder. *The second thoracal spinal nerve* is a nerve of the chest area and originated between the second and third vertebrae. A branch leaving this nerve reaches the arm and receives sensation. The other branch diverges into multiple sub-branches. One of these sub-branches reaches the muscle on the scapula and provides the shoulder ability to move. *The third thoracal spinal nerve* originates between the third and fourth thoracic vertebrae. Some of the branches leaving this nerve reach the muscles on bones on the back and help the movement of the shoulder. Some branches reach the palm while some others reach the area of the chest bones. *The fourth thoracal spinal nerve* diverges into ventral and dorsal branches like the third thoracic spinal nerve. Some of these branches reach to chest bones. *The fifth thoracal spinal nerve* reaches the chest area. *The sixth thoracal spinal nerve* reaches the area under the chest bones. The seventh *thoracal spinal nerve* reaches the ninth vertebra and a muscle in the abdominal cavity. *The eighth thoracal spinal nerve* reaches to a muscle in the abdominal cavity. *The ninth thoracal spinal nerve* reaches a muscle in costal cartilages and the abdomen. *The tenth thoracal spinal nerve* reaches towards the back. *The eleventh and twelfth thoracal spinal nerves* disperse between costal cartilages and the muscles in the abdomen.<sup>3</sup>

When this section is analyzed, it is seen that the originating points of thoracic spinal nerves from the vertebral canal was described correctly, and generally reaching of the thoracic spinal nerves towards areas between the ribs, to abdominal muscles and back muscles were described correctly with its main aspects. It was incorrectly stated that these nerves reach structures such as the palm and the lung. We think the branch originating from the thoracic spinal nerve and receiving sensation from the arm is the intercostobrachial nerve.

### **Lumbar spinal nerves**

Mansur reported the origination of five nerve pairs from the lumbar region. *The first lumbar spinal nerve* exits from the first foramen in this region. This nerve is described with the word *müteneyyin*, which means "back nerve". A part of this nerve converges with a few nerves originating from the brain. *The second lumbar spinal nerve* originates from the below of the second lumbar vertebra. This nerve reaches a muscle in the posterior region. A part of this nerve also converges with a few nerves originating from the brain. *The third and fourth lumbar spinal nerves* diverge into two branches. While one branch reaches a muscle in the posterior region, the other reaches abdominal muscles. *The fifth lumbar spinal nerve* diverges into two branches. One branch reaches the muscles in the posterior region, while the other reaches the foot.<sup>3</sup>

When this section is analyzed, it is seen that the exciting levels of the lumbar spinal nerves from the vertebral canal were described correctly. We think Mansur did not describe the connections of lumbar 1st and 2nd spinal nerves with the nerves originating from the brain appropriately. The information that lumbar spinal nerves innervate the abdominal region was incorrect. The information that they innervate the back was correct. While the information that 5th lumbar spinal nerve reaches the foot is partly correct, it is seen that there was no information about lumbosacral plexus.

### **Sacral and coccygeal spinal nerves**

Three pairs of nerves leave the sacral area. *The first sacral spinal nerve* reaches the sacral bone, while *the second sacral spinal nerve* reaches the hip bone. *The third sacral spinal nerve* reaches the muscles in the anal region, the penis, the bladder, the uterus and the peritoneum. *Coccygeal spinal nerves* are three pairs of nerves and one single nerve originating from the coccygeal area. These nerves reach penis, muscles attaching to sacrum, muscles in the groin area and muscles outside the uterus. The single nerve reaches the sacrum, the groin, the penis and muscles outside the uterus.<sup>3</sup>

When this section is analyzed, it is seen that the number of nerves originating from the sacral and coccygeal areas is not in compliance with the current information. The information that a total of six pairs of nerves originate from the sacral and coccygeal areas is correct. It was correctly stated that sacral and coccygeal spinal nerves innervate the anal muscles, penis and muscles connected to the sacrum. There was not a knowledge about the structure of the sacral plexus.

## DISCUSSION

In the figure (Fig.1) depicting the spinal nerves described in different colors show that the author paid attention to the visual aspects of anatomy. Mansur, who cited Aristoteles, Galen and Avicenna, also provided his own interpretation in his work. It is seen that he described human anatomy without going into details.<sup>3</sup> The information provided in the piece was used by other authors for a long time.<sup>3, 5-9</sup> The most significant example of this is the similarities found in the work titled *Teşrih-ül Ebdan ve Tercümânı Kibale-i Feylesûfan* written by Şemseddîn-i İtâkî in the 17th century.<sup>5,6</sup>

## CONCLUSION

While there are insufficient or incorrect information in historical books of medicine, such books are highly valuable as they show the scientific progress. It is apparent that Mansur's work titled *Teşrih-ül-Ebdan min e't-Tıb* has a significant place in the history of anatomy, and its influence was reflected in the following periods. Despite the occasions of insufficient or incorrect information in the piece, we think it contributed to the historical development of anatomy.

## CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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