

Greek and Arab Advances in the Anatomy of the Spine (Tashrīḥ Amūd al-Fiqār): A Comprehensive Review

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Abstract: The vertebral column begins at the occipital bone and concludes with the coccyx, collectively forming the structure referred to as the *Ṣulb*, or spine. The vertebrae are relatively small in size and extend from the cervical region down to the coccyx, with the spinal cord being distinct from the brain. The cervical vertebrae are essential for facilitating a range of movements while maintaining stability, and their cavities are designed to be spacious, allowing the spinal cord to reside within them comfortably. The vertebrae have a distinctive thorn-like form, with each featuring two foramina located on its right and left sides. From each foramen, two processes extend; one connects to the upper vertebral foramen, while the other connects to the lower vertebral foramen. The closure of these foramina has enhanced stability and strength within the vertebral structure. Each vertebra is characterized by three analogous processes: one that extends upward and two that project laterally. A vertebra typically features four processes, with two located on the right and two on the left of the foramen. The processes serve the essential function of establishing articular connection between adjacent vertebrae, utilizing the cavities of some processes and the condyloid projections of others. They also provide protection, support, and resistance to impact, as well as facilitate the attachment of ligaments. The structures located at the posterior aspect of the vertebrae are referred to as spinous processes, while those situated laterally on the right and left are known as transverse processes. These processes serve to safeguard the nerves, blood vessels, and muscles that are situated deeper within the body along its length. The spinal cord's gradual reduction in thickness from top to bottom mirrors natural patterns found in rivers and trees, allowing for the emergence of nerve pairs from the intervertebral foramen. The cervical region comprises five cervical vertebrae, each characterized by four processes that extend both upward and downward. The twelve vertebrae of the spine are arranged such that each joint produces two upwardly extending processes, while two additional processes descend into corresponding pits that interlock with adjacent vertebrae. The research aims to conduct a comprehensive analysis of the complex anatomical framework of the vertebral column, as described by various esteemed scholars and notable philosophers from both Greek and Arab civilizations.

Keywords: Amūd Al-Fiqār, Nukhā, Aẓm Al- 'Ajuz, Vertebral Column, Spinal Cord.

INTRODUCTION

Buqrāt (Hippocrates) studied the structure of the spine and spinal cord, recognizing its importance and suggesting that it was the site of sperm creation. He hypothesized that the spine was made up of vertebrae connected by anterior and posterior nerves, known as mucous connections. *Buqrāt (Hippocrates)* divided the spine into three parts: cervical, thoracic, and lumbar, and identified a muscle related to the spine and a dense venous plexus around the spinal cord [1]. He discovered that the spine is held together by intervertebral discs, ligaments, and muscles, allowing him to define its typical curvature [1].

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Jalinūs (Galen), a Roman philosopher, identified twenty-four vertebrae, including the sacrum, in the vertebral column, categorized them into cervical, thoracic, and lumbar sections [2]. *'Alī Ibn Al-'Abbās Al-Majūsī* identifies the spine as composed of *Faqarāt al-Unuq* (cervical vertebrae), *Faqarāt al-Şadr* (thoracic vertebrae), *Faqarāt al-Qaţan* (lumbar vertebrae), and *Aţm al-Ajuz* (sacrum) [3]. *Abū Al-Qāsim Khalaf Ibn 'Abbās Al-Zahrāwī*, a prominent figure in spine anatomy, extensively researched spinal injury, particularly spinal dislocations, and contributed significantly to surgical techniques [4].

Ibn Sīnā, a key figure in the Canon of Medicine, introduced methods for stabilizing the spine and treating spinal deformities like kyphosis and vertebrae fractures, demonstrating a rational explanation for anatomy [5]. *Ibn Hubal Baghdādī* and *Ibn Sīnā* suggest that the third and fourth vertebrae, separated into two parts, are where the fourth pair of spinal nerve originates. The thinner segment joins the fifth pair or extends over *Uruq Subati*, the diaphragm, and mediastinum. The majority is located deep within the back muscles, then emerges from *Shawk al-Fiqār* and branches off to affect the head and neck muscles [5].

MATERIAL AND METHODS

This study centres on the examination and synthesis of knowledge regarding *Tashrīh Amūd al-Fiqār* (Anatomy of the Spine) as presented in historical Unani texts. Key works referenced include *Kitāb al-Hāwī*, *Kitāb ul Mukhtarāt fī Tib*, *Kitāb al-'Umda fī Jarahat*, *Kitāb al-Tasrīf*, *Dhakhīra Khwarizm Shāhī*, *Firdaus-al-Hikmat*, *Kitāb-al-Mansūrī*, *Al-Qanūn fī tib*, *Kitāb al-Kulliyāt*, *Kitāb al-Miāt*, *Iksīr al-Qulūb*, and *Kāmil-al-Sanā*, among others.

In addition to these classical sources, the research broadens its scope by integrating insights from contemporary academic literature. This involves a detailed examination of scholarly journals, research articles, and modern publications, which collectively contribute to the development of a robust framework. This framework not only incorporates historical perspectives but also effectively bridges them with current academic discussions and innovative concepts.

By employing this dual methodology, the analysis is significantly enhanced, situating the Unani system of Medicine within the wider context of *Tashrīh 'Amūd al-Fiqār* (Anatomy of the Spine). This comprehensive approach not only deepens the understanding of the subject but also highlights its relevance in today's medical discourse.

Objectives

The objective of this research paper is to connect the insights derived from classical Unani literature with contemporary scientific discussions, thereby enhancing the knowledge about *Tashrīh Amūd al-Fiqār* (Anatomy of the Spine).

1. To integrate perspectives from classical Unani texts with modern scientific discourse, thereby deepening the understanding of *Tashrīh Amūd al-Fiqār* (Anatomy of the Spine).
2. To provide a comprehensive perspective on *Tashrīh Amūd al-Fiqār* (Anatomy of the Spine), highlighting the historical significance and contributions of Greek and Arab Scholars in the context of contemporary medical research and practice.

LITERATURE REVIEW

Anatomy of Spine

The vertebral column begins at the *'Aţm Mu'akhhkar al-Rās*, commonly known as the occipital bone located at the back of the head, and concludes with the last bone of *'Aţm al-Uşuş*, or the coccyx. Collectively, these vertebrae form the structure referred to as the *Şulb*, or spine [3-6]. While the term "vertebra" denotes a single unit, "vertebrae" refers to the plural form. These bones are relatively small in size and extend from the cervical region down to the coccyx, with the spinal cord being distinct from the brain, analogous to a veil [7].

The cervical vertebrae originate from a prominent opening at the back of the head known as the foramen magnum. This region is characterized by vertebrae that possess foramina on both sides, allowing for the passage of nerves and blood vessels [8]. The arrangement of these vertebrae is crucial for the support and mobility of the head and neck.

The intricate design of the spine not only provides structural integrity but also protects the spinal cord, which plays a vital role in transmitting signals between the brain and the rest of the body. The cervical vertebrae, in particular, are essential for facilitating a range of movements while maintaining stability, underscoring the importance of this anatomical feature in overall human function.

The first cervical vertebra connected to the skull is notably smaller than all other vertebrae, characterized by a greater width in depth and a reduced height [3]. The vertebral canal's spaciousness accommodates the spinal cord, which is still encased within the brain and has not yet descended to the cervical region, resulting in the nerves remaining

undeveloped. Consequently, the quantity of these vertebrae is not a significant factor, and their reduced height contributes to their overall fragility.

These cervical vertebrae exhibit a degree of weakness due to the forward and backward bending of the neck, which influences their structural integrity. Their cavities are designed to be spacious, allowing the spinal cord to reside within them comfortably [3]. The thickness of these vertebrae is appropriate for ensuring that they can adequately support the spinal cord while accommodating the necessary flexibility required for neck movement.

The second category of vertebrae located in the back is characterized by a high quantity and a constricted opening. In contrast, the third type of vertebra found along the spine is both low in height and has a narrow cavity [3]. As one progresses down the vertebral column, there is a noticeable increase in the height of each vertebra, accompanied by a corresponding reduction in the width of the cavity. This reduction in cavity size occurs because a pair of nerves emerges from the central spinal cord at each vertebra, positioned symmetrically on either side.

Consequently, each vertebra features a foramen on both the right and left sides, allowing for the exit of one spinal nerve. As the vertebrae descend, the spinal cord itself becomes increasingly slender [3]. This anatomical arrangement highlights the relationship between vertebral structure and the emerging spinal nerves, illustrating how the configuration of the vertebrae adapts as one moves down the spine.

A foramen exists along the length of these vertebrae, creating a canal through which the *Nukhā*, or spinal cord, travels, while nerves emerge from both sides of the foramen. Additionally, foramina are present on both the right and left sides, allowing for the passage of arteries and veins, as well as the exit of nerves. The vertebrae located in the lower section of the spine are larger in size, whereas those in the upper section are comparatively smaller [5-9].

The cervical vertebrae are comparatively broad, as they serve as the primary pathway for the spinal cord, which is notably thicker in this region than in other areas. Despite their width, these vertebrae are smaller in size compared to those found in other sections of the spine. This size difference is due to their positioning atop other vertebrae, necessitating that the structures they support be lighter than the supporting vertebrae, given their broader surface area [4-10].

The cavity of this structure is twice as large due to its composition and positioning. Its body has been reinforced to enhance its strength, resulting in a hardness that surpasses that of vertebrae. Additionally, the neck exhibits a narrow breadth in terms of rigidity. The first cervical vertebra is distinguished from the others as it serves as the initial conduit for the spinal cord. This vertebra features two depressions on either side, which are designed to be thicker than those of the other vertebrae, allowing them to withstand the presence of a foramen [4].

The vertebrae within the spinal column exhibit two distinct shapes: some are circular, known as facets, while others are semi-circular, referred to as demi-facets [5]. When viewed from the inferior perspective, the vertebral bodies appear large, accompanied by a narrow vertebral canal. Conversely, from a superior viewpoint, the bodies appear smaller, and the canal associated with the spinal cord appears larger [5].

Among the various organs, bones are recognized as the most rigid structures, primarily due to their role as foundational elements. The hardness of bones is essential, particularly for larger vertebrae that serve as a supportive framework. These vertebrae must possess greater strength and durability than the structures they support, such as the vertebrae in the back [4]. Additionally, certain bones function as pillars during movement, necessitating a high degree of strength to fulfil this supportive role effectively.

Jalinūs (Galen), asserts that the human spine consists of twenty-four vertebrae, with seven located in the cervical region, twelve situated between the shoulders, and five in the lumbar area. He notes that there are twelve ribs, each of which is connected to a corresponding thoracic vertebra [6-11]. Additionally, the chest contains seven unique ribs that align with specific vertebrae. *Jalinūs (Galen)* chooses to distinguish the sacrum from the rest of the spinal column, highlighting that it is composed of vertebrae. While the occurrence of extra vertebrae is possible, it is relatively rare. Between the bodies of the vertebrae, there exists a "mucous and ligamentous connection" that serves to link the vertebrae together.⁶ This connection plays a crucial role in allowing the spine to flex and bend, thereby preventing fractures, particularly in instances where the anterior longitudinal ligament is compromised. *Jalinūs (Galen)* developed an innovative approach to the examination of the human spine. His investigations resulted in an accurate characterization of both the vertebral column and the spinal cord. Additionally, he identified the trajectory and distribution of the nerves that originate from the spinal structure [12].

During early development, the human body contains a total of thirty-three vertebrae. As a child matures, the sacral and coccygeal vertebrae undergo fusion; leading to an adult vertebral column that typically comprises twenty-six vertebrae

[13]. The cervical region contains seven vertebrae, which connect to the thoracic vertebrae, totalling seventeen, with twelve specifically identified as thoracic vertebrae. Following the thoracic vertebrae, there are five lumbar vertebrae, resulting in a cumulative count of twenty-four vertebrae extending from the brain to the sacrum. It is noteworthy that variations exist among individuals, with some possessing either an additional vertebra or one less than the standard count [8].

The increase in size of the vertebrae is a response to the demands of supporting the weight transmitted to the neck from the surrounding vertebrae. Their vertical thickening results from the limited space within their cavities. Even at the lower end of the spinal column, the opening remains quite constricted, leading to a slender spinal cord that exits through it. This particular vertebra is the largest among all vertebrae, and there are a total of twenty-four vertebrae in the human spine [3].

The human spine is categorized into four distinct sections [3-14]. The cervical vertebrae, known as *Faqarāt al-Unuq*, are located in the neck region. The thoracic vertebrae, referred to as *Faqarāt al-Şadr*, constitute the upper back. The lumbar vertebrae, or *Faqarāt al-Qaṭan*, are situated in the lower back, commonly associated with the waist area. Lastly, the sacrum, termed *ʿAzm al-ʿAjuz*, is a wide bone positioned adjacent to the lumbar vertebrae.

The human spine is composed of thirty-one individual bones, organized into five distinct segments [4-16]. The first segment, known as the cervical vertebrae, consists of seven vertebrae. The second segment, referred to as the thoracic vertebrae, includes twelve vertebrae located in the upper back. The third segment is the lumbar vertebrae, which comprises five vertebrae situated in the lower back. The fourth segment is the sacrum, also known as *Gunchā*, which is made up of three fused bones. Finally, the fifth segment is the coccyx, commonly referred to as the tailbone, which also consists of three bones. Each of these segments plays a crucial role in providing structure and support to the human body.

The human body is supported by a series of vertebrae [15]. A limited number of these vertebrae is maintained to prevent them from forming an ineffective chain [4]. The benefits of the vertebrae, particularly during the process of birth, are significant. Among these advantages, the most crucial is the ability to maintain an upright posture, which serves as a protective mechanism for vital organs and safeguards the integrity of the spinal cord and nerves [7].

The human spine consists of a total of two hundred eleven spinal processes. Each vertebra is composed of the *Shawk al-Fiqār*, or spinous process, and the *Ajniḥa al-Fiqār*, known as the transverse process. Serving as the foundation of the body, the vertebrae are structurally reinforced and segmented, reflecting their role in providing stability and support [3]. With the exception of the cervical and thoracic regions, the vertebrae are positioned adjacent to the lumbar vertebrae. Each lumbar vertebra features two horizontal processes on either side, referred to as *Ajniḥa al-Fiqār* or transverse processes [7]. These structures enhance the vertebra's strength and play a crucial role in safeguarding the internal organs.

The *Ajniḥa al-Fiqār*, or transverse processes, along with the *Shawk al-Fiqār*, known as spinous processes, serve a crucial role in safeguarding essential organs within the thoracic region of the vertebral column. The spinous process is characterized by its thorn-like appearance. Notably, the diameter of the spinal cord diminishes progressively from the upper to the lower regions, resembling the tapering of rivers and their tributaries, as well as the branching of trees [6, 7]. Additionally, a pair of nerves emerges from the intervertebral foramen [7].

The structural design of the thoracic vertebrae, including the transverse and spinous processes, is integral to the protection of vital anatomical structures. The spinous process, with its distinctive thorn-like form, contributes to this protective function. Furthermore, the spinal cord's gradual reduction in thickness from top to bottom mirrors natural patterns found in rivers and trees. This anatomical arrangement allows for the emergence of nerve pairs from the intervertebral foramen, facilitating communication between the central nervous system and the rest of the body.

Ghulam Husain Kantoori, in his translation, elaborates on the phrase by clarifying that each vertebra features two foramina located on its right and left sides. From each foramen, two processes extend; one process connects to the upper vertebral foramen, while the other connects to the lower vertebral foramen. This description pertains specifically to the right foramen, which should be interpreted as the central foramen. The closure of these foramina has significantly enhanced stability and strength within the vertebral structure [3].

The cervical region comprises five cervical vertebrae, each characterized by four processes that extend both upward and downward. These processes engage with the depressions formed by the closure of the second vertebra, facilitating a binding effect through various ligaments associated with these vertebrae [3]. This anatomical arrangement contributes to the overall integrity and functionality of the cervical spine. In the four vertebrae, there exist four distinct processes essential for both protection and reinforcement. Within the spinal vertebrae, the formation of these two processes is not feasible; instead, the protrusions that emerge from the spine resemble twisted and rotating forks, referred to as *Shawk al-Fiqār* (spinous processes) [3].

Each vertebra is characterized by three analogous processes: one that extends upward and two that project laterally. The twisting and turning of these processes contribute to the intricate structure of the vertebrae. The twelve vertebrae of the spine are arranged such that each joint produces two upwardly extending processes, while two additional processes descend into corresponding pits that interlock with adjacent vertebrae [3]. A vertebra features four processes, with two located on the right and two on the left of the foramen. The upper pair is referred to as upward processes, while the lower pair is known as downward processes, or inverted processes. In certain instances, a vertebra may possess six processes, with four on one side and two on the opposite side, and occasionally, there may be as many as eight processes. These processes serve the essential function of establishing *Ittiṣāl Maḥṣili* (articular connection) between adjacent vertebrae, utilizing the cavities of some processes and the condyloid projections of others [8].

The vertebrae possess processes not only to fulfil their primary functions but also to provide protection, support, and resistance to impact, as well as to facilitate the attachment of ligaments. These robust and elongated bones are aligned longitudinally along the vertebrae. The structures located at the posterior aspect of the vertebrae are referred to as *Shawk al-Fiqār* (spinous processes), while those situated laterally on the right and left are known as *Ajniha al-Fiqār* (transverse processes). These processes serve to safeguard the nerves, blood vessels, and muscles that are situated deeper within the body along its length [8].

CONCLUSION

The study highlights the importance of understanding the complex anatomical framework of the vertebral column, which has implications for various medical disciplines. The study also suggests that a collaborative approach can lead to a deeper understanding of spinal anatomy and its relevance in today's medical discourse. The practical applications of the study include a better understanding of the anatomical structure of the human spine, which can inform the development of treatments and therapies for spinal injuries and disorders.

The study concludes that historical insights are essential in shaping modern anatomical understanding, and that a collaborative approach is necessary to bridge various disciplines. The study also highlights the importance of understanding the complex anatomical framework of the vertebral column.

The conclusions of the study are that the complex anatomical arrangement of the vertebrae provides protection, support, and facilitates communication between the central nervous system and the rest of the body.

Future Perspectives

The study encourages future researchers to draw inspiration from the rich intellectual legacy of historical Unani texts and to further develop the field. The study also suggests the need for further research on the interdisciplinary aspects of ocular studies. The future work that can be done in this area includes a more detailed analysis of the functional aspects of the spine, and the relationship between the anatomical structure and the overall health of the individual.

Conflict of Interest: No

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REFERENCES

1. Vasiliadis, E.S., Grivas, T.B. and Kaspiris, A., 2009. Historical overview of spinal deformities in ancient Greece. *Scoliosis*, 4, pp.1-13.
2. Tareekh e Tib wa Akhlaqiyat, 3rd edition, Faculty of Unani Medicine, Jamia Hamdard, New Delhi (110062), pg-73,80,86.
3. Majūsi A, 2010, *Kamil-us-Sanaa*, Trans. Kantoori GH, CCRUM New Delhi, pp. 134-140, 157-159, 221.
4. Masihi IQ, 1986, *Kitab Al-Umda Fil Jarahat*, vol. 1, trans. CCRUM, Ministry of Health and Family Welfare, govt. of India, New Delhi, pp. 30,36-39,52,53,57-60,80-83,86-89,106,107.
5. Hubal Baghdadi AA, 2005, *Kitab ul Mukhtart fi Tib*, vol.1, trans. CCRUM, Ministry of Health and Family Welfare, govt. of India, New Delhi, pp 32,37,38,43,45-50.
6. Ṭabarī AH. 2010, *Firdaws al-Ḥikma fi'l Ṭibb*, trans. Awwal Shah HM, Idara Kitab al-Shifa, Darya Ganj, New Delhi, pp. 184, 185, 187, 188, 293, 303-305.
7. Rushd I, 1980, *Kitab Al-Kulliyat*. Translate by CCRUM.1st edn. CCRUM, Ministry of Health and Family Welfare, govt. of India, New Delhi, pp. 6, 7, 13-17, 21.

8. Sina.I, 1993, *Al-Qanun fi al-Tibb*, Book-I, trans. Jamia Hamdard, New Delhi, pp. 46-53, 81, 82, 92-95.
9. Husain HSG, 1904, *Tashrīḥ-o-Afaal-e-Aaza-e-Insani Ba Usool Tibb-e-Unani*, Matba Akbari, Agra, pp. 18-21, 48-49, 63, 79-83,118,119.
10. Marketos, S.G. and Skiadas, P.K., 1999. Galen: a pioneer of spine research. *Spine*, 24(22), p.2358.
11. Ajita, R., 2015. *Galen and his contribution to anatomy: a review*. *Journal of Evolution of Medical and Dental Sciences*, 4(26), pp.4509-4517.
12. Gerard J. Tortora, 2017, *Principles of Anatomy and Physiology*, 15th edn. Printed at Shree Maitrey Pvt. Ltd, Noida, pp. 217,229.
13. Kabiruddin HM, 1920, *Tarjuma Kamil-us-Sana*, Major Tibbi Kutub Khana, New Delhi, India, pp. 12-14.
14. Masihi AS, 2008, *Kitab al-Miat*, Vol. 1, CCRUM, New Delhi, pp., 57-71.
15. Jurjānī AH, 2010, *Dhakhīra Khwarizm Shāhī*, Idara Kitab-us-Shifa, Darya Gunj, New Delhi, pp. 37-41.
16. Arzani A, 2010, *Iksīr al-Qulūb* trans. CCRUM, Ministry of Health and Family Welfare, govt. of India, New Delhi, pp 104-108,114.