

“BRAIN LESIONS IN IBN SINA’S “CANON OF MEDICINE”: ANCIENT THEORIES AND CURRENT MEDICAL CONCEPTS”

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ABSTRACT

The brain and its lesions have interested many physicians and scientists throughout history. Since Hippocrates, they have been extensively studied by many physicians and surgeons, each adding new insights to previous knowledge. In his Canon of Medicine, Ibn Sina, gave outstanding descriptions of several neurological conditions along with their symptoms, complications and treatments. Some of his clinical approaches and therapeutic guidelines still concur with current medical knowledge. In this article, we investigate Ibn Sina’s writings and knowledge about three different conditions causing brain injury, which are stroke, traumatic head injury and Meningitis.

Key words: Canon of medicine, Head injury, Meningitis, Ibn Sina, Stroke

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INTRODUCTION

Brain lesions affect cognition, emotions, behavior and somatic function, changing the patients as individuals, and impacting their interactions with the environment. Their devastating clinical as well as psychological consequences aroused physicians’ interest throughout history starting with Hippocrates (470-360BC) who wrote about a number of neurological conditions [1]. In the golden age of Islamic civilization, Ibn Sina (980-1037) stood out as the foremost pioneer in neurology [2]. His major medical book ‘The Canon of medicine’ (*Al Qanun fi al Tibb*), includes a complete treatise about affections of the brain and the nervous system, where he provided extremely valuable guidelines on their assessment and treatment according to both his personal experience, and previous medical knowledge [3]. In this article, we propose a critical reappraisal of Ibn Sina’s writings and knowledge about three different conditions causing brain injury, which are stroke, traumatic

head injury and Meningitis. Although most of Ibn Sina’s explanations were founded on the humoral theories [3] -fallen out of favor at present days-, he reported a number of interesting neurological findings proved accurate when examined in the light of current medical knowledge.

WHO IS IBN SINA?

Ibn Sina whose full name was ‘Abu Ali al-Hussain ibn Abdullah ibn Sina’ [4, 5], also known by his Latin name ‘Avicenna’ in the west, was born in 980 in Bukhara and died in 1037 in Hamadan [6]. A child prodigy, he memorized Quran by the age of 10 and surpassed his teachers in various fields of knowledge. A precocious physician at only 16 years old [2], he cured Noah II, the ruler of Samanids at 18 [6]. As a reward, he chose to be granted access to the King’s stocked library, what sharpened his intellect. At 21 years of age, he had gained the reputation of an outstanding doctor [7], and was referred to as ‘*The prince of physicians*’ [8]. He was a polymath, with a wide ranging brilliance, who

made accountable contributions in the fields of medicine, philosophy, astronomy, chemistry, physics and literature [6] and wrote over 400 books and writings [2]. The Canon of Medicine is one of Ibn Sina's most important and famous books, which became the standard textbook of medical education in Asia and Europe for six centuries [7]. Consisting of almost a million Arabic words, it was elaborately divided into 5 books dealing with different affections and treatments [3].

STROKE IN IBN SINA'S CANON

The first documented definition of stroke dates back to Hippocrates [9] who referred to it as apoplexy, meaning 'struck down with violence' and described it as a sudden collapse, with unconsciousness and paralysis [10]. To this description, Ibn Sina added extensive details concerning etiologies, risk factors, clinical manifestations, prognosis and management. Definition wise, he called stroke '*sekteh*', a word standing for the loss of organs movement and sensation [2,3], which is still in line with the World Health Organization's definition of cerebrovascular accidents ('rapidly developing clinical signs of focal (or global) disturbance of cerebral function, with symptoms lasting 24 hours or longer or leading to death, with no apparent cause other than of vascular origin')[11]. Ibn Sina distinguished two etiologies of stroke that he accurately related to currently acknowledged risk factors. On one hand, the blockage of humors circulation by agents derived from the phlegm humor [2, 3]- among which fat and atherosclerosis -,responsible for ischemic stroke[12]. And on the other hand, high blood pressure resulting in hemorrhagic stroke [2, 3]; a phenomenon Ibn Sina described in the language of his era- stating that persons with high blood humor nature had an increased risk of bleeding in the brain [2, 3].

Ibn Sina pointed out asphyxia, hemiplegia, headache, vertigo, anxiety, darkened vision and weakness as clinical manifestations of stroke [2, 3]. For poor prognosis determinants, he highlighted the absence of respiration as well as the swallowing reflex [2, 3]. Nowadays, dysphagia that affects more than 50% of stroke survivors [13] is recognized as a factor that increases morbidity and mortality, leading to malnutrition, dehydration and amplifying the susceptibility to aspiration pneumonia [14] whereas respiratory function abnormalities are known to lead to hypoxia and aggravate neuronal damage[15].

Ibn Sina recognized that the treatment of stroke was difficult and often ineffective[3]. However, some of

the remedies he recommended (like Chamomile and Ginger) have been recently recognized for their possible therapeutic effects [2]. Indeed, a recent study revealed the neuro-protective effect of Chamomile in ischemic rats [16]. Moreover, Ginger's properties as a blood pressure lowering, cognitive enhancing and oxidative stress decreasing drug have been verified [17,18].

TRAUMATIC HEAD INJURIES IN IBN SINA'S CANON

Before any attempt to treat, Ibn Sina places great emphasis on the importance of a detailed and thorough clinical examination of patients who have suffered head trauma, and highlights the importance of taking with extreme details the story of the causal event (fall, assault, fight, sports...) and the injury mechanism [3, 6]. The shape of the traumatic object, its weight and size, its orientation with respect to the impact point could provide an idea on the location and severity of underlying lesions [3]. According to Ibn Sina, observing symptoms is crucial to assess the clinical state of head injured patients and their outcome. He believed that a fall resulting in abundant otorrhagia and swelling of the ear was certainly lethal [3]. Besides, speechlessness, stroke and confusion would also stand for poor prognosis [3,6].While assessing the neurological status of patients sustaining head injury is considered, nowadays, as a systematic and common practice to identify victims with brain injuries, requiring emergency management, Ibn Sina was one of the first to underline the importance of such assessment[6]. He pointed out that some neurological symptoms (aphasia, confusion, apoplexia) revealed an overpressure or penetration of the brain cover "the dura mater", requiring an urgent surgery [3, 6].

Examination of the injury site results in determining the type of the skull fracture, which Ibn Sina classified into four categories; 1) Fractures of the bone, 2) Contusions of the bone, 3) Fractures extending to the scalp and 4) Fractures forming a curvature [3,6]. This ancient classification is not very different from current skull fractures' classifications, which are categorized either by appearance (linear or comminuted), location (cranial vault or basilar skull), degree of depression or communication with sinuses and skin (closed or open) [1].Moreover, Ibn Sina pointed out that clinical examination might not be sufficient to perform an exhaustive assessment of damage, and that some invisible lesions might require further surgical exploration[3]. He stated that a merely

swollen but not lacerated scalp might hide a more serious skull fracture with possible underlying brain lesions [3,6]. In this case, Ibn Sina recommended extending the scalp lesion, removing the bone fragments and checking the cover of the brain's state, relating its integrity to less damage, and therefore no great danger [3, 6]. Otherwise, if the cut reached the brain and the ventricles, the patient's case was more serious [3].

Ibn Sina described detailed guidelines and recommendations in the treatment of head injuries, pointing out the dramatic consequences of neglecting them, such as fever, tremor, and unconsciousness [3]. He also stated that inflammation could spread from a head wound to the brain's water membrane [3], in an early attempt to define post-traumatic meningitis. Ibn Sina was the first to describe the procedure of elevating a depressed skull bone in order to relieve the "dura mater" from overpressure [3,6]. He recognized that the bone of the skull was different from the bone in other parts of the skeleton, as it was less prone to spontaneous healing with simple bandaging [3]. So, he recommended the cut and extraction of the bone fragments when the fracture was complete, in order to clean the area and prevent tissues corruption [3]. He also recommended lifting the swollen scalp and well opening of the breaches, to drain pus and filth [3, 6]. Ethics and morality wise, Ibn Sina paid great attention to patients' comfort and suffering. He usually recommended relieving the pain before any examination or intervention [3], and insisted on closing patients' ears with cotton or wool during surgery, in order not to be disturbed by the noise of the saw [6].

MENINGITIS IN IBN SINA'S CANON

Ibn Sina began this chapter criticizing a common idea in his era, according to which solid tissues (bones) and soft ones (brain) could not be subject to inflammation [3]. He fully described a dangerous condition he called '*Serssam*'; a Persian compound word with '*Ser*' meaning head and '*sam*' standing for inflammation. He defined it as an inflammation of the membranes covering the brain (meninges), with the possibility of extension to the brain's parenchyma (meningo-encephalitis) resulting in the patient's death within four days [3]. Meningitis symptoms he cited included: Fever, headache, photophobia and vomiting [3]. According to Ibn Sina, the presence of sensory impairments, confusion, behavioral change, dysphasia, bradycardia and respiratory abnormalities was a sign of severity [3] and these lasts were associated

to the inflammation's site. For example, Ibn Sina precised that if the front of the brain was inflamed, the patient would present delirium and behavioral changes; consistent with the actual well defined frontal syndrome. Additionally, these severity determinants can be categorized as focal neurological symptoms, cognitive impairments, and neuro-vegetative disorders that usually reflect severe meningitis complications such as encephalitis or septic shock.

Among the treatments Ibn Sina proposed was bloodletting, applying roses with vinegar on the forehead as coolers and using restraints to prevent the agitated patients from harming themselves [3]. He was also aware of the importance of using psychological means to positively influence the healing process, as he clearly recommended that meningitis patients should be surrounded by kind, caring friends to cheer them up [3].

CONCLUSION

Ibn Sina was one of the brightest stars that shone during the Golden Age of Islamic Medicine. His work led to a significant advance in medical sciences, especially in the neurological field. Although his fruitful life ended a thousand years ago, the enduring legacy Ibn Sina left to the world continues to survive the test of time; a testimony of real genius!

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