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Original Article

Neuroanatomy in Tesrih-i Ebdan: a study on a book which is written in Ottoman era*

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ABSTRACT

The writer of the first pictorial Turkish Anatomy handwritten book (Tesrih-i ebdan ve Tercuman-i kibale-i feylesufan) is Sirvanlı Semseddin Itaki. In our study, we aimed to review the neuroanatomy topics in his book, and to show the relationship between the book and the current anatomy knowledge that we have today.

One of the main characteristic of the book is the availability of numerous illustrated explanations. Itaki studied neuroanatomy in two parts in his book. He considered peripheral and cranial nerves in the common structure of organ related structures in the book. He considered the topic, cerebrum in internal organs. He combined the illustrations and schemes he used for considering the neuroanatomy topics with pretty good and explanatory notes. Different sides were seen in addition to similarities to nowadays knowledge. ***Neuroanatomy; 2005; 4: 31–34.***

Key words [anatomy] [neuroanatomy] [Ottoman] [medical history] [Semseddin Itaki]

Introduction

The writer of the first pictorial Turkish Anatomy handwritten book "Tesrih-i ebdan ve Tercuman-i kibale-i feylesufan" that was written during the period of Murat the IVth was Sirvanlı Semseddin Itaki. This book must have been written between the years 1623-1632. The most important characteristic of the book whose seven copies are available today is that it has so many defining pictures and explanations in it. It is thought that some of the pictures were drawn by the writer himself and the others with the help of the pictures in "De Humani Corporis Fabrica" of Andreas Vesalius [1-4].

In this study, we aimed to review the neuroanatomy subject in the anatomy book of Itaki and show the relations between that book and the anatomy knowledge that we have today. In his book, Itaki had analysed the neuroanatomy subject in two parts. Although in today's anatomy books, the peripheral and central nervous systems are hold and studied together within the human nervous system, in Itaki, the peripheral and cranial nerves were analysed in the part of the general structure of the organs. The peripheral nerves were described like the distribution of the skeleton and the muscles. Besides, the subject of central nervous system was described with internal organs. So he studied these two subjects separately [1].

* This study was presented as a poster presentation in VII. National Anatomy Congress (2003, Diyarbakir–Turkey).

Material and Methods

We mainly studied the book which is written by Prof Dr Esin Kahya named "Şemseddin-i İtaki'nin Resimli Anatomi Kitabı". We worked on the Ottoman text of "Teşrih-i ebdan ve tercüman-ı kibale-i feylesufan" given at the end of this book. The translation text in the book was not used, it was retranslated to current Turkish by the researchers. The text consists of 241 pages. The nervous system is between pages 78–97. The subjects in the text were compared with two anatomy books that instructed in medical faculties today.

Results

The anatomy of peripheral nerves

He studied this subject in the section "the anatomy of nerves". First he mentioned the cranial nerves and then the spinal nerves. He started the topic with some general information about nerves. According to Itaki, the nerves were sending sensation and motion to the organs. He said that some of the nerves came out of the brain and some came out of spinal cord which is called "nuha" in Arabic. He mentioned the spinal cord as the *caliph* of the brain [1].

Just as we do today, Itaki also divided the nerves into two parts as sensitive and motor fibers. He stated that all the nerves were paired except the one that came out of the tip of "kavimec" (coccyx).

The anatomy of the cranial nerves

As Galen and Ibni Sina had done, Itaki gave the number of the cranial nerves as seven pairs.

The explanations of Itaki about the cranial nerves which he called head pairs are as stated below.

The first cranial nerve. While explaining this nerve, Itaki mentioned two nipples like prolongations in front of the brain. He stated that this place was called "halamet-u's-sudi" (olfactory tract) in Arabic and was also the reason for the human to smell but Itaki did not realize that it was a different cranial nerve. Then he explained that from each of those prolongations a single nerve came out and in a place near to the eye it made a crosswise. He said that this crosswise was called "mecma'en-nur" (optic chiasm). And he also wrote that after those nerves got into a crosswise, they came to the eye and got into the circumference of lens and enabled the eye to see. He reported that inside of the nerve was perforated so it was called "mucevvef" which means "nerve with holes". Itaki thought that optic nerve was a part of prolongation of the olfactory nerve and he explained those two as a single nerve. He also gave some information about the useful features of the optic chiasma. First of all, when damage occurred in one of the eyes, it increased the power of the healthy one by enabling all the light to go into it. Secondly, optic chiasma prevented diplopia. Thirdly, by the help of that crosswise, the nerves were becoming stronger and stronger [1].

The second cranial nerve. He said that this cranial nerve went out of the front part of the first one and started from the hole in the eyelid and then came to the muscles of the apple of the eye and divided into six branches. He also told that eye movements were enabled by those nerves which were thick [1]. Here we can see that those nerves are occulomotor nerve, trochlear nerve and abducent nerve. Itaki explained those three as a single nerve.

The third cranial nerve. He said that it started in the middle of the brain and then was mixed with the fourth pair and then again separated into four branches. He also reported that one of the branches spread to the interior organs through the neck and diaphragm by going out of the hole (carotid canal) where "uruk-u sibati" (internal carotid artery) went in. He wrote that the second branch mixed with the branches of the fifth pair by going out of the temple bone's hole. The third branch went out through the hole of the second cranial nerve and again divided into three branches. The first of those branches spread through the auricular, temporal, frontal and orbital regions. The second branch spread inside the nasal cavity. The third branch innervated the upper part of mental and oral regions; the fourth branch went to the tongue and the lower part of mental and oral regions. And he also added that the tongue could feel bitter and sweet objects with the help of that branch [1]. As understood from these explanations, the first branch of the nerve that is mentioned as the third cranial is vagus nerve, the second branch is facial nerve, the third branch is ophthalmic and maxillary branches of trigeminal nerve, and the fourth branch is mandibular nerve.

The fourth cranial nerve. He gave less information about this cranial nerve. He said that this one came out from the behind of the third cranial nerve and mixed with the third pair and reached the nasal fossa [1]. This nerve is mandibular nerve which is the motor branch of trigeminal nerve.

The fifth cranial nerve. He wrote that this nerve which came out of the two sides of the brain was composed of two branches. One of the branches spread in the ear and went into the tympanic membrane. He added that the ability of hearing was held with that nerve. The other branch came out of the hole called as "a-ver" or "a'ma" and mixed with the third pair and innervated the face and the flat muscle on the face [1]. It can be understood that the structures that Itaki mentioned here are facial and vestibulocochlear nerves.

The sixth cranial nerve. Itaki said that this nerve was originated from the backside of the brain, and then divided into three branches and these three came out of the hole at the end of lomboid suture in the neck. The first branch reached the pharyngeal muscles and the root of the tongue. The second branch went to the shoulder girdle muscles and to the flat muscle behind them (trapezius). He added that the third branch was bigger than the other two. It innervated the organs in abdomen and chest, and at the same time it reached the carotid artery and the laryngeal muscles. Itaki described recurrent laryngeal nerve here. While third branch went to the organs of chest, a subbranch of it returned and went to "tircihali" cartilage (arytenoid cartilage). He defined that branch as "asab-i ric" (recurrent laryngeal nerve). He wrote that the rest of the nerve went to heart, lung and liver, then spread into the internal organs in abdomen by passing through the diaphragm and conjoined with the third pair [1]. As understood, the first branch of the nerve that Itaki mentioned as the sixth cranial nerve is glossopharyngeal nerve. The second branch is accessory nerve. The third branch he mentioned is vagus nerve. It is interesting that he mentioned vagus nerve both in the third and in the sixth head pairs.

The seventh cranial nerve. As for that nerve, he said that it came out of the top of the spinal cord and went to the tongue muscles, neck muscles which were between hyoid bone and thyroid cartilage [1].

The anatomy of the spinal nerves

Itaki stated that the number of the spinal nerve pairs arising from the cervical part of the spinal cord was eight. He added that these nerves generally spread to the head muscles and enabled head to sense. The explanations of Itaki about the cervical spinal nerves were as follows:

The first cervical spinal nerve. It was thinner than the others and it was not able to reach the head completely.

The second cervical spinal nerve. It reached the outer skin behind the ear, the muscles behind the neck.

The third cervical spinal nerve. It divided into two branches. The branch going forwards spread to the ear region and to the neck muscles. He added that this branch was responsible for ear movements in animals.

The second branch went to the cheek and the flat muscle located there.

The fourth cervical spinal nerve. It divided into two branches. The branch going forwards went to the muscles between head and neck after uniting with the fifth cervical spinal nerve. The second branch reached the muscles of the face.

The fifth cervical spinal nerve. It divided into two parts. The branch on the front side went to the shoulder muscles, the flat muscle in the face, and to the muscle that bends the head and the neck forward. Some of its branches reached the diaphragma by uniting with the sixth and seventh cervical spinal nerves.

The sixth cervical spinal nerve. It divided into two parts. Some of its branches spread to the head muscles, lumbar muscles and at the lumbar bone, some of the fibres came to the top of the shoulder.

The seventh cervical spinal nerve. It divided into two branches. Some of them reached until the head muscles and lumbar muscles and diaphragma after uniting with the fifth and the sixth cervical spinal nerves and also some of them reached the arms.

The eighth cervical spinal nerve. It divided into two branches. The first branch went to the head and neck muscles and the second branch to the arm, wrist and to the palm of the hand [1].

Thoracal spinal nerves. Itaki told that the number of the thoracal spinal nerves was twelve in number. While talking about those nerves, he analysed the first two pairs separately, and after explaining the outlets of the others, he accepted that their destinations were the same. According to him, after the first two parts divided into two branches, the branch at the front side spread in rib muscles and back muscles. The branch on the backside reached the wrist after uniting with the eighth pair of the neck nerves. The second pair went to the skin of the arm and the palm of the hand. Then the ten pairs of back nerve went to the inside of the hand, muscles in wrist, girdle muscles and rib muscles respectively. The bottom back nerve lines also gave branches that go to the abdomen muscles [1].

Lumbar spinal nerves. According to Itaki, the nerves in the "katan" (lumbar) section were in five pairs. The branches coming out of those nerves went to the abdomen muscles. Itaki said that the first three lumbar nerves unite with the nerves coming from the brain. He also added that some branches of the third, fourth and fifth lumbar nerves unite in each other and mix with the nerves of "aciz" section (sacrum, rump bone) and reach the coccyx, the groin section and also the calf and the knee [1].

Sacral spinal nerves. Itaki said that the number of the nerves coming out of "aciz" (sacrum) and "usus" (coccyx) was six. Three pairs were separated from the sacral and three pairs were separated from coccyx. The branches coming out of those nerves united with the nerves that were going down to calf, end went to the muscles there and to the leg muscles. The second sacral and the third sacral reached the penis, urinary bladder and anus muscles and the muscles starting from the sacrum [1].

When Itaki counted the nerves coming out between vertebras, he found 32 pairs but he said that the nerve coming out of coccyx was a single nerve. Today the number of spinal nerves is stated as 31 pairs [5, 6]. When Itaki said that all the nerves that come out divided into two branches, he makes us consider that he was talking about ramus anterior and ramus posterior. Here the nerve that he said which came out of coccyx as a single should probably be filum terminale. Itaki didn't mention the plexus concept but he said that some branches united with each other [1].

Brain anatomy

Firstly, Itaki gave some information about the structure of the brain and then he explained the brain-membranes, ventricles, and the canals of the ventricles respectively. He didn't give any information about the brainstem, cerebellum and the spinal cord. According to him, brain had the capacity for the power of spirits of the thinking power that human beings need. It provided the way for the vapours in the stomachs of the human to go out. The nerves whose duties were to make the human stand up in a controlled way came out of the brain. Some important activities like hearing, memory, seeing took place here. The human brain was in front of the head, and was divided into two parts. Those two parts were united with membranes and spaces [1].

After that introduction, Itaki gave some information about the temperament of the brain. According to him, brain was cold. The movements of the nerves and souls coming out of it were cold in order to modify that movement. The brain is humid. A part of the brain is soft, and it has to be soft so as to provide the ability of understanding. The brain is oily. The muscles that are responsible to sense began from the front of the brain, because the front side is soft. The behind of the brain is harder and the muscles responsible for the movement began from there. There was a thin membrane between the soft part of the brain and the hard part of it. Here Itaki talked about a soft and a hard part of the brain. That soft part is cerebrum and the hard one is cerebellum. But Itaki didn't mention cerebellum separately [1].

Itaki said that there were two types of brain membranes. He wrote that the one which is thin and adhered to the brain was called as "ummu'l-rakik" (pia mater) and the hard and thick one was called as "ummu'l-cafiye" (dura mater). Itaki didn't mention arachnoidea mater [1].

Itaki emphasized the ventricles of the brain. According to him, there were three spaces in brain. He added that the doctors were calling those as "batn-i dimag". The one on the front side was called as "batn-i mukaddes" (lateral ventricle), and the one on the backside was called as "batni muahhar" (the fourth ventricle). And the one between those was called as "batn-i evsat" (the third ventricle). The first ventricle is big, the second is smaller than the first one, and the one between these two is riddled. The three spaces were connected to each other with the one in the middle which functioned as a tunnel. He said that between the ventricles there were three canals. Two of those were between the front space and the backspace. As the endings of those canals were

like a funnel, they were called as “kam” (infundibulum). He said that after that funnel there was a gland and this gland is probably the hypophysis. Itaki especially gave his attention to the middle space. He said that inside of the space was a lining of the brain membranes and added that it continued to the back ventricle [1].

Discussion

Itaki was influenced by the doctors of his time and the past in subjects about nervous system. He was especially influenced by Ibn–i Sina and Ali bin Abbas. He also made use of the ideas of Galen and Vesalius. Itaki especially mentioned the peripheral nervous system in a more detailed way. Even though he said that the number of the cranial nerves was seven pairs, he explained the twelve pairs of cranial nerves we know today [1, 5, 6]. The fact that he mentioned the existing points of the nerves in a very detailed way shows that he probably made dissection. Considering that dissection was forbidden in those times, it is understood that he knew the anatomy writers before him really well. It is also possible to think that he understood the spinal nerves very well. But it is also obvious that Itaki did not have enough information about brain. And the information that was provided by the doctors of those times was not enough either; however, it may makes us think that it was enough because of the fact that some examinations which were being done on animals in those times were applied to human. Itaki did not talk about the concept of the brain. But he mentioned the membranes of the brain, optic chiasm and the ventricles elaborately. He showed optic chiasm in his schema. His schema about nervous system are relatively good and explanatory.

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