



## Innovations and discoveries of Jorjani in medicine

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Received: 04 Jul 2009

Accepted: 15 Aug 2009

Published: 20 Aug 2009

J Med Ethics Hist Med. 2009; 2:16.

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### Abstract

Theologian Seyed Esmaeel Jorjani (1041-1136), titled Zeinoddin and known as Jorjani, is one of the most famous Iranian physicians. Almost one thousand years ago, he did valuable compilations in the history of medicine and many of his medical views are, to a great extent, in line with the recent views. His most famous work is *Zakhire Kharazmshahi*. His innovations and practices in various branches of medical sciences are quite new and unique. Jorjani was very efficient in surgery and, in his main book *Zakhire*, he introduced different methods and instruments of surgery in a way that it shows his dexterity and depth of experience. He explained methods of stopping severe hemorrhage by casting them with plaster, treating the obstruction of air canals by tracheotomy, curing the difficulty in urination by catheterization, the exact method of removing apophysis and stitching the spot after cutting and paring in polyp surgery in full details.

Jorjani also wrote about cancer, its difficulty of treatment, the necessity to avoid inciting it, and the impact of early treatment. In *Zakhire*, he pointed to the relationship between exophthalmos and goiter, and the relationship between outgrowth of thyroid and increase in heart rate; this way, he came to understand about the pathologic toxic reactions of thyrotoxicosis.

**Keywords:** Thyrotoxicosis, Surgery, *Zakhire Kharazmshahi*, Jorjani.

### Introduction

Seyed Esmaeel Jorjani, one of the most outstanding Iranian physicians in the history of Islamic medicine, was born in Gorgan in 434, A.H (1042, A.D.) and died in Marve in 531, A.H (1136, A.D) during Kharazmshahi dynasty. He was claimed to belong to the second generation of physicians like

Avicenna, having an important role in the preservation and transmission of Greco-Roman medical heritage (1).

*Zakhireye Kharazmshahi* is one of the most complete, significant and comprehensive Persian medical texts that truly must be recognized as an

integrated medical encyclopedia which covers all aspects of medical subjects and branches, including general medicine, anatomy and physiology, etiology of disease, description of health, hygiene, nutrition, health care duties of everyday life, medical procedures such as blood sampling etc, disease symptoms and their treatments, surgical procedures, pharmacology and pharmaceuticals. He wrote this book in nine volumes plus a chapter exclusively about herbs; so, altogether, they amounted to ten volumes (1, 2). With almost 700,000 words, Zakhireh has made an astonishing summary of the world of medicine. In his book, Jorjani has combined repeated experimental methods of Rhazes, scattered ways in Al-Havi, Avicenna's classic and logical (and sometimes difficult) descriptions and his own logical, theoretical, and applied approach to medicine to create a relatively easy and clear medical source. In other words, he standardized the medical terms in the Zakhireh Kharazmshahi. Jorjani's works are complete examples of medicine (3).

Edward Brown has talked about Zakhireh and its significance in Arabian medicine and in Persian medical history (4). The French's Crussol, in his medical thesis discusses Jorjani's views on physiology and ophthalmology given in the Zakhireh and Al-Aghraz. In this thesis, Crussol writes: "*Jorjani collected and combined the main and specialized points in the medical books of his predecessors, added his own experiences and made a complete medical book*" (2).

Jorjani used Avicenna's Canon and referred to it as one of the most important sources, but Zakhireh is not merely a translation of Canon, rather, it is a complementary to Canon and other medical works of the time. Jorjani criticized certain details offered by Galen and Avicenna (5). In the fifth book, Jorjani elegantly described three body fluid compartments: intravascular, interstitial and a third compartment within the material of the tissues (intracorporeal). Also he was the first to mention the association between goiter and exophthalmia (1). He wrote several works in which he dealt with medicine and natural sciences. Jorjani believes on the science of medicine: "*Medicine is an art that a physician relies on to understand the status of health and disease in man, to keep the healthy condition and restore the health of the sick*" (1). According to Jorjani, each organ has a special balance and any imbalance in organs would cause disease (2).

### **Discoveries of Jorjani**

As we know the diaphragm is a dome-shaped musculofibrous septum which separates the thoracic from the abdominal cavity. It is crucial for breathing and respiration. The two phrenic nerves are made up mostly of motor nerve fibers for

producing contractions of the diaphragm during respiration (6). In the physiological study, he described, for the first time, that diaphragm is a unique muscle in an anatomical site but, functionally, it acts like two separate muscles, because when one of the two phrenic nerves is severed, the related muscle part is paralyzed, but the other part works correctly (1). We know that intercostal muscles are several groups of muscles that run between the ribs, and contribute to the formation and movement of the chest wall (6). The observation of Jorjani showed for the first time that there are two principal layers; the external intercostal muscles, which aid in quiet and forced inhalation and the internal intercostal muscles, which aid in forced expiration (1). On the anatomy of the optic nerve, Jorjani, unlike Avicenna, agreed with Galen that this nerve at its periphery goes to the ipsilateral rather than the contralateral eye. In Zakhireh, after mentioning the main theories of the great former scientists, he comes to conclusions and he does this in the clearest and the most appropriate manner and wherever he feels he adds his comments and this makes his work even more specific. His innovations and practices in various branches of medical sciences are quite new and unique.

Jorjani was fully efficient in surgery for which he used a nice Persian term meaning manipulation. In Zakhireh, he elaborated on different methods of surgery and the related tools in a way that is quite expressive of the dexterity and the depth of his experience. He also wrote about the needed medications and the types of medical care before and after surgery in the best possible way. It can be claimed that Zakhireh is the best surgical document of the time after Zahravi's *Al-Tarif* and Razi's *Al-Havi* (1); here we point to some of the surgeries which had been recommended by Jorjani:

In the case of surgery, other than the usual operations, Jorjani also prescribed different kinds of cauterization. Based on his experience and practice, he even wrote about its application in tightening and epilating the slots made by different types of hernia. For complete treatment of pustule apothems, at first, he prescribed pharmacotherapy, and, if not being successful, gave appropriate instructions for surgery and operation (2).

For stopping severe hemorrhage of wounds, he suggested using plaster casts several centuries before European scientists. In urology, he proposed catheterization for the treatment of patients with difficulty in urination. However, he indicates that if, due to swelling, injury or bladder stone, using catheter is not possible, there will be no way other than ripping up and discharging the obstructive agent (2, 7).

In case of the polyp existence, Jorjani explained how to use a thin sharp semicircular knife for cutting and paring and a curved needle made of metal with a piece of silk string or the hair of horse

for stitching and repairing the wound. It is also interesting to know that Jorjani indicated that, if the resulted apophysis was hard, distorted in color and accompanied by edema of mortise area, this could be regarded as a possibility for malignancy and cancer (7).

Jorjani discussed cancer for the difficulty of its treatment, the necessity to avoid inciting it and the relative effectiveness of early treatment. This, somehow, connotes modern chemical treatment as it insists on taking care of the patient's body. He also referred to high degree of occurrence of breast and uterus cancer among women and throat and bowel cancer among men (7).

In a wonderful discussion about tumors, Jorjani divided these lesions into soft and hard and called them "Saghirus" and "Saratan" (= Crab / Cancer), respectively. He believed that cancers are more common in females, and stated correctly that *"the diagnosis of cancer in early stages is not simple and by the time you can diagnose a cancer, it is usually when you cannot treat it."* Then he added that if a cancer is far from the vital organs, you should excise it completely with all of its roots, and he explained, in detail, how he resected the breast of a woman with breast cancer (8).

Jorjani is one of the pioneers in finding an early chemotherapy treatment for cancer in the form of medication which was used as a lotion for covering the cancerous tissue and there have been positive reports declaring its efficacy. Jorjani talked about cancers, effectiveness of curing cancer from the very beginning, operating cancerous tumors, and spreading cancer to other organs (Metastasis). On cancer and its treatment he wrote *"The best method in treating this disease is to avoid operation or cut the tumor and it should be kept intact. Cancer may be cured in its early stages, but a deeply rooted cancer is impossible to cure. In many occasions a cancerous tumor appears and grows slowly in body, and the best thing to do is not to remove the cancerous tumor, then it may live in the patient for longer time, otherwise it will kill the patient. Some cancerous tumors are small in size and they may not affect body organs. These tumors plus a part of flesh surrounding it can be removed by surgical operations. In this case let the blood bleed, apply ointment and then dress the wound cleanly. In many occasions, cauterization and cutting the cancerous tumor proved to be deadly. It is said that some previous physicians used to cut the cancerous breast of women, but after a while the disease returned to other breast"* (2).

Jorjani pointed out clinical symptoms and methods of treatment which himself had observed and cured. For instance, in the chapter dedicated to throat diseases, he explained the relationship between protrusion of eyeball (exophthalmos) and

goiter. This is what Parry came to discover several centuries later in 1825 (9). He also pointed to the relationship between the outgrowth of thyroid glands and the increase in the heart rate. This is how he understood about the toxic reactions of these glands (thyrotoxicosis). This is one of his most fascinating observations in the discussions of endocrinology. In endocrinology, in particular, Jorjani was one of the first to associate exophthalmos with goiter, which was not repeated until Parry C, and later Robert Graves and Carl von Basedow. Ljunggren JG, in 1983 suggested that Jorjani should be credited with recognizing Graves-Basedow disease having noted the association of goiter and exophthalmos (10).

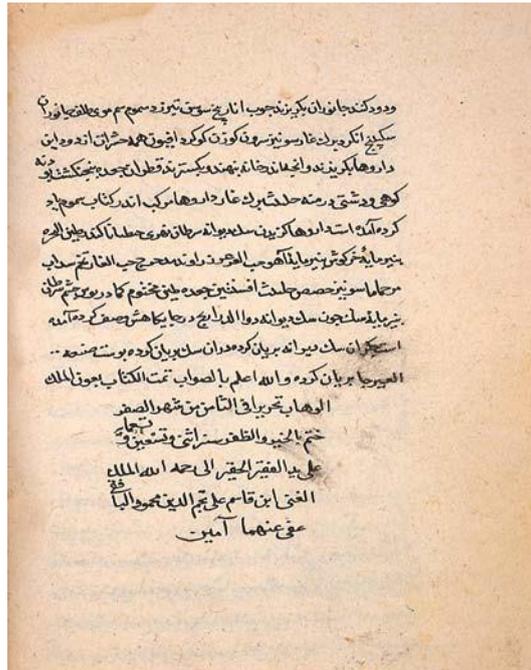
Jorjani also established an association between goiter and palpitation in the Zakhire (11).

In the case of severe diphtheria and the obstruction of air canals, for the continuation of air flow and breathing, he proposed the incision of a glass pipe into the throat. And, in case of asphyxia caused by displacement of a cervical vertebra, he prescribed the insertion of hand or a metal device into the throat (Laryngoscope) for fixing the vertebra (2, 11).

In eye surgery, he discussed different types of operation among which the treatment of cataract can be mentioned. In the surgery stages, at first he explained situating the patient in a lighted place, holding his head backward, turning his upper eyelid upward, keeping the eye wide open and then using a rod called "Meheh" which is made of copper with which incision through iris takes place and the water is drained (2).

### Conclusion

Nowadays medicine has to be considered as a complex system based on the interaction of formation, research, medical and social facilities, law and ethics. The specific field of the history of science is the study and explanation of the origin and transformation of the structures of scientific knowledge. What is of interest here is the combination of approaches used by philosophers and historians in studying medical thinking and their joint relevance for a better understanding of contemporary medical problems. The study of Jorjani's works shows his depth of knowledge and great expertise on diseases and their treatments. Similar to Avicenna and many other scientists' works, his compilations need careful revisions and preparation of grounds for new research due to the existence of various problems in curing diseases especially in modern medicine.



**Fig 1:** The colophon to a copy of the final book of *The Treasure of Khvarazm 'Shah* by Jurjani. It states that the copying of the first section (on materia medica) was completed on 8 Safar 992 [= 20 February 1584] by Qasim 'Ali Tajm al-Din Mahmud al-Yafaqi. (12)



**Fig 2:** Treatment of a patient by the physician. (8)

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