

# Two Different Approaches Regarding Hydrocephalus Treatment in the Islamic World During the Middle Ages

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## ABSTRACT

**AIM:** To present the sections allocated to hydrocephalus in the works of Ibn Hubal al-Baghdādī and Ibn al-Quff, to include them and determine their position in the history of medicine by discussing relevant literature.

**MATERIAL and METHODS:** A printed copy and a manuscript in İstanbul Süleymaniye Manuscript Library, Fatih Collection, nr. 3632 of Ibn Hubal's *Kitāb al-Mukhtārāt fī al-Ṭibb*, and a facsimile of a printed copy and a manuscript in Istanbul University Rare Works Library, Arabic Manuscripts, A 4749 of Ibn al-Quff's *Kitāb al-'Umda fī Ṣinā'a al-Jirāḥa*, were used. The chapters on hydrocephalus in both works have been translated to English and obtained knowledge was determined based on relevant literature.

**RESULTS:** Hydrocephalus was discussed under the title "On swellings and water occurring outside the skull and on the 'uṭāsh of the child and on water collection in the skull" in the third volume of Ibn Hubal's work and "The sixth chapter on the treatment of water which collects in the heads of children" in the 19th article of Ibn al-Quff's work. Ibn Hubal's and Ibn al-Quff's knowledge and approach to hydrocephalus match the knowledge and approaches of their predecessors. Compared with Ibn Hubal, Ibn al-Quff provided more systematic and detailed information on hydrocephalus.

**CONCLUSION:** Like other writers of the Islamic world in the medieval times, Ibn Hubal and Ibn al-Quff accept definitions and classifications of hydrocephalus by Greco-Roman writers.

**KEYWORDS:** Hydrocephalus, Ibn Hubal al-Baghdādī, Ibn al-Quff, History of medicine

*"If I have seen further, it is by standing upon the shoulders of giants"*

Isaac Newton

## INTRODUCTION

Hydrocephalus often manifests itself with head enlargement in children and has been known since prehistoric times. Skeletal remains from different times, including findings related to hydrocephalus, are frequently reported in the literature (10,11,17,42,43,46). Although information regarding the definition, treatment, and use of the term "hydrocephalus" for the first time in the *Hippocratic Corpus* is

repeated in the literature (11,16,33,40,46), it was first recorded in Celsus's *De re medica* (18,32). Celsus (14) gives the following brief information about hydrocephalus and its treatment:

*"Besides the foregoing there is a class which may become chronic, in which a humour inflates the scalp, so that it swells up and yields to the pressure of the fingers. The Greeks call it hydrocephalus (14,p.365)."*

*"The class in which humour collects upon the head is different. In that case it is necessary to shave the head to the scalp; then to apply mustard until it causes ulcers; if this is of little avail, recourse must be had to the scalpel. The following measures are the same as for dropsical patients: exercise, sweating, smart rubbing, and such food and drink as will specially promote urination (14,p.369)."*

Galen of Pergamon (129–200 AD), in *Introductio seu medicus*, reports that there are four types of hydrocephalus: (1) between the brain and meninges, (2) between the meninges and the bone, (3) between the bone and the pericranium, and (4) between the bone and the skin. Galen recommends that fluids under the skin and the pericranium are evacuated with two or three incisions and those under the bone are chiseled out, but he does not recommend treatment for those between the meninges and the brain (18-20,35).

Oribasius of Pergamon (325–403 AD), quoting Antyllus, states that hydrocephalus occurs because midwives press the newborn's head inappropriately and describes hydrocephalus as the collection of fluid in the following three locations: (1) between the skin and the pericranium, (2) between the pericranium and the bone, and (3) between the bone and meninges. He also reports that it is impossible to collect fluid between the meninges and bone because the patient will die before hydrocephalus develops. For the fluid that collects between the skin and the pericranium, in the case of mild swelling, he recommends making one incision in the middle and the case of larger swelling, two or more incisions and draining the fluid. Oribasius proposes the same treatment method if the fluid has accumulated between the pericranium and the bone; however, if the fluid has accumulated under the bone, he prohibits surgical treatment regardless of whether the sutures have been separated (20,32,34,38).

Aetius of Amida (502–575 AD) classifies hydrocephalus similarly to Oribasius, but determines its causes as visible and unknown. The apparent reason for this is that blood flows, stops, and turns into a dark-colored liquid owing to the rupture of the vessels following a fall or injury. The violent maneuver that midwives use on the baby's head is also a cause of injury. In those with unknown reasons, the vessels become loose spontaneously, and the watery substance that is mixed with blood passes through the walls and accumulates in one site, which remains watery. During treatment, if the swelling is small, he recommends making one incision at the top and if it is large, two, three, or more incisions compatible with the size of the swelling with the most fluid discharge should be made. For the fluid that collects under the bone, he reports waiting until the amount of fluids has increased and sutures have separated, after which the incision is made between the sutures, where the fluid can be drained easily (13,20,32).

Paul of Aegina (625–690 AD) follows Oribasius's and Aetius's approaches on hydrocephalus. During treatment, he recommends making an oblique incision in the middle of the swelling if it is small in the first type of hydrocephalus. In the second type, he recommends making two crossing incisions, and if it is large, three incisions in H shape can be made. Paul prohibits surgery in the third type, where fluid collects under the bone (32,36,39).

Abū Bakr Muḥammad ibn Zakariyyā al-Rāzī (Rhazes), 'Alī ibn al-'Abbās al-Majūsī (Haly Abbas), Abū al-Qāsim Khalaf ibn 'Abbās al-Zahrāwī (Albucasis), and Abū 'Alī Husayn ibn Sīnā (Avicenna) also included hydrocephalus in their works during the period called the golden age of Islamic civilization and science in the Middle Ages.

Rhazes (865–925 AD) handles head enlargement in children as a separate topic in *Practica puerorum*, reports the reason for this as ventosity in the skull bones or water accumulation trapped in the skull, and reports the drugs applicable for its treatment. Rhazes does not define the site where the liquid accumulates in the head (6,12,41). In his encyclopedic work, *Kitāb al-Hāwī fī al-Ṭibb (Liber Continens)*, he quotes the drugs to be used in the treatment of head growth from al-Kindī's *Ikhtiyārāt* and suggests that a plaster prescription should be used in the collection of fluid outside the skull under the skin, placing retaining drugs on the head, and tight bandaging in cases of suture separation. In cases of excessive suture separation, he recommends cauterization and scraping the bone to remove vapors and venesection from the forehead, temporal, or jugular vein if there is no suture separation. However, the reason for suture separation is not fully explained (2,6).

In the chapter describing hydrocephalus in the *Kāmil al-Šinā' al-Ṭibbiyya/Kitāb al-Malikī (Liber Regius)*, Haly Abbas (930?–994 AD) says that this disease occurs because midwives are pressing the head hard to correct the baby's head, coagulation of the blood flowing after the vessel rupture, or an internal disease. He reports three types of this disease in which the fluid collects (1) between the pericranium and the skin, (2) between the pericranium and the bone, (3) between the bone and the dura mater. He recommends a single transverse incision in the first type and if the accumulating fluid is small, two intersecting incisions in the middle of the swelling in the second type and if the swelling is large, and a T-shaped incision to drain the fluid if the swelling is too large. Haly Abbas does not recommend treatment in patients whose sutures have been separated because of fluid collection in the skull. It is seen that what Haly Abbas wrote mostly overlaps with Paul of Aegina's writings (4,8).

In *al-Taṣrīf*, Albucasis (936–1013 AD) reports that in children's heads, water collects either between the skin and the bone or on the membrane (the dura mater) under the bone. This is either because the midwife was holding the baby's head roughly during birth or due to an unknown reason. Albucasis makes no distinction between the skin and the pericranium and the pericranium and the bone, as the location of water that collects between the skin and the bone. In cases where a small amount of fluid has accumulated between the skin and the bone, Albucasis recommends making a transverse incision; if more fluids, two intersecting incisions are made; if the fluid collects under the bone, which Albucasis indicates a sign of separation of sutures, a T-shaped incision is made in the middle of the head and the liquid drained. The incision should be made in the part of the head where the swelling is more prominent. This information provided by Albucasis appears to be more compatible with the information given by one of his predecessors Aetius of Amida, except for the details of the site where water collects outside the skull (3,7,9,20).

Avicenna (980–1037 AD) discusses this issue under two titles in the *Kitāb al-Qānūn fī al-Ṭibb (The Canon of Medicine)*, stating that water would collect between the dura mater and the bone in the skull. In this case, the patient may constantly

cry and experience heaviness of the head, partial or complete inability to close the eyes, and sliding of the eyes. Avicenna said that this situation is incurable. Although the collection of water outside the skull is seen in adults, it is a disease of children. This occurs because of a ruptured vessel at the site of pressure and leakage of watery blood resulting from the midwife's exerted pressure on the baby's head. Water collects either between the bone and the skin or two outer membranes (probably, the pericranium and the galea aponeurotica). He recommends making a transverse incision if a small amount of fluid, two intersecting incisions if more, and three intersecting incisions if large amounts of fluid have accumulated. The information provided by Avicenna is mostly compatible with the information provided by Paul of Aegina (1,5,20).

In the 12<sup>th</sup> and 13<sup>th</sup> centuries, two distinguished writers of Islamic geography, Ibn Hubal al-Baghdādī and Ibn al-Quff, discussed and analyzed the issue of hydrocephalus in their works. This study aimed to translate the sections allocated to hydrocephalus in the works of Ibn Hubal al-Baghdādī and Ibn al-Quff into English, to include them in the history of medicine literature, and to determine their position in the history of medicine by discussing relevant literature.

## ■ MATERIAL and METHODS

In this study, a printed copy (29) and a manuscript in İstanbul Süleymaniye Manuscript Library, Fatih Collection, nr. 3632 and (30) of Ibn Hubal al-Baghdādī's *Kitāb al-Mukhtārāt fī al-Ṭibb*, and a facsimile of a printed copy (27) and a manuscript in İstanbul University Rare Works Library, Arabic Manuscripts, A 4749 (28) of Ibn al-Quff's *Kitāb al-'Umda fī Şinā'a al-Jirāha* were used. The chapters on hydrocephalus in both works have been studied and translated into English.

The Results section, after giving brief information about both authors and their works, presents the translations of the chapters related to hydrocephalus. In the Discussion section, in addition to the relevant literature, we tried to determine the value of the information in these chapters in the history of medicine.

## ■ RESULTS

### Muhadhdhab al-dīn Ibn Hubal al-Baghdādī and *Kitāb al-Mukhtārāt fī al-Ṭibb*

According to Ibn Abī Uşaybī'a (26), Muhadhdhab al-dīn Ibn Hubal al-Baghdādī, also known as al-Khilāṭī, was born in 1122 AD in Baghdad. He studied literature and medicine from Abū al-Qāsim Ismā'īl b. Aḥmad al-Samarqandī. Ibn Hubal, who came from Baghdad to Mosul and from there to Khilāṭ (Ahlat in modern Turkey) and made a great fortune by serving as a physician at the court of the Shāh-Arman (Akhlāt-Shahs). Then, Ibn Hubal came to Mārdīn from Khilāṭ and served Badr al-dīn Lū'lū' and al-Niẓām, who were killed by Naşīr al-dīn b. Artuq, the ruler of Mārdīn. After which, Ibn Hubal returned to Mosul. He lost his sight at age 75 years and spent his remaining life in his home because of a chronic illness, and died in 1213 AD in Mosul. According to Vernet (45), Ibn Hubal had a son named Shams al-dīn Abū al-'Abbās Aḥmad, who practiced as a physician in the Seljuk Palace during the Kaykāwus period.

*Kitāb al-Mukhtārāt fī al-Ṭibb*, which was written in 560 AH/1164–1165 AD and had not been translated into Latin throughout the Middle Ages, contains theoretical and practical medical knowledge. In this work, every subject is shown under the title of "faşl" (24,31). Hydrocephalus is discussed under the title "faşl fī al-awrām al-ḥāditha khārij al-qihf wa l-mā' wa fī 'uṭāsh al-şibyān wa fī ijtimā' al-mā' dākhil al-qihf" in the third volume of the work (Figure 1). *The 'uṭāsh of the child* [Siriasis] was excluded from translation since it was defined as mild warm swelling of the membranes outside and inside the skull.

### "On swellings and water occurring outside the skull and on the 'uṭāsh of the child and on water collection in the skull"

*As for the swellings outside of the skull, their types are looked at [or considered], the humor is determined, and each swelling is treated in its section. As for water, it often befalls children, the aqueous moisture that collects in them is trapped between the cranium and the skin or between [the cranium and] the two outer membranes and sticks to the ground inside this area. Insomnia and weeping befall them. The color and consistency indicate that the humor collection may not be aqueous. If the aquosity is abundant and repellent, when pressed on the outside of the skull, it cannot be treated. If the retained [humor] is little, then it is incised and emptied, and this area is treated with treatment of ulcers. It [this disease] can also occur to people other than children. The sign of water is that the skin is in its own color, when it is pressed [with the finger], it plunges and the skin appears elevated (29, pp.30,31; 30, f.15v)."*

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*"As for the water collection in the skull, its symptom is that the sutures may separate, closing the eyes becomes difficult, and the eyes remain wide open with excessive water and matter discharge. There is no cure for it (29, p.31; 30, f.16r)."*

### Ibn al-Quff and *Kitāb al-'Umda fī Şinā'a al-Jirāha*

According to Ibn Abī Uşaybī'a (26), Ibn al-Quff was a Christian of Karak, and he was born in 1233 AD. His first teacher in medicine was Ibn Abī Usaybia (d. 1270 AD) in Sarkhad, who taught him the *Questions* of Ḥunayn b. Isḥāq (809–879 AD), *Aphorisms* and *Prognostic* of Hippocrates (460–370 BC), and treatments from books by Rhazes. Then, Ibn al-Quff went to Damascus with his father, where he studied 'Ulūm al-Ḥikamiyya and Ajzā al-Falsafiyā from al-Shaikh Shams al-Dīn 'Abd al-Ḥamīd al-Khusrawshāhī (d. 1254 AD) and 'Izz al-Dīn al-Ḥasan al-Ghanwī al-Ḍarīr (1190/1 AH–1261 AD), medicine from Ḥakīm Najm al-Dīn b. Minfākh (1196/7 AH–1254 AD) and Muwaffaq al-Dīn Ya'qūb al-Sāmīrī (d. 1282 AD), and *Kitāb Uqlidis* from al-Shaikh Mu'ayyad al-Dīn al-'Araḍī (1200/1 AH–1273 AD). Thereafter, Ibn al-Quff worked as a physician in the castle of Ajlūn for several years, returned to Damascus, and served in the castle of the city to treat patients. He died in 1286 AD (15,21–23,26).

According to Ibn Abī Uşaybī'a (26), *Kitāb al-'Umda fī Şinā'a al-Jirāha* consists of 20 maqāla, theoretical and practical, which include everything a surgeon needed. Hydrocephalus is discussed under the title "al-faşl al-sādis fī 'ilāj al-mā' alladhī



**Figure 1:** Pages containing the section with explanations regarding hydrocephalus in Ibn Hubal al-Baghdādī's *Kitāb al-Mukhtārāt fī al-Ṭibb* in İstanbul Süleymaniye Manuscript Library, Fatih Collection, nr. 3632 (30, ff.15v,16r) (Courtesy of Türkiye Yazma Eserler Kurumu Başkanlığı, İstanbul, Türkiye).

yajtamī'u fī ru'ūs al-ṣibyān” in the 19<sup>th</sup> article of the work (Figure 2 and 3).

**“The sixth chapter on the treatment of water, which collects in the heads of children**

This disease is classified into three types. First, the collected water is between the skin (al-jild) and the pericranium (al-simḥāq). Second, the water is between the pericranium and the bone (al-‘azm). Third, the collected water is between the bone and the dura mater (umm al-jāfiyya). The reason for this collection is either the violent pressure exerted by the midwife while trying to smooth and straighten the head, or the child falling headfirst during birth, which leads the moisture in the child’s body to the head due to the weakness and acceptance of the head, or because of the blow to the head, one of its vessels bursts and the blood collects in aforementioned place, where it turns into immature matter.

You should know that those who hoped to be cured by iron work [surgery] are the first and second types. As for the third type, the surgeon should not engage in the treatment. The softness of the place when touched with the hand, how easily the finger can press the area, the less amount of pain, and the change in the color of the skin on the head from its usual color are the signs of the first type. These are also the signs for the second type; however, the area is comparatively harder to press with a finger, the pain is stronger, and the skin color is little bit changed. The symptoms of the third type are severe pain when pressing [with finger], the area is comparatively much harder to press since the substance returns inward when pressed with force, the swelling returns, the forehead protrudes out, the eyes constantly tear up and remain wide open, and the color of the skin remains unchanged.

As for the treatment of this [disease] of the first type, the skin of the head is cut transversely with a single incision, which is

applied to the lumps so that all the moisture is removed. This is done carefully, so that it does not come out all at once. Then the incision is filled with linen and wrapped well with a bandage for up to 3 days. Then the bandages are untied on the third day and the area is squeezed to remove the remaining moisture. It is then filled with another cloth and then wrapped for another 3 days, then the bandages are dissolved and treated with a wound medicine. You should know it.

As for the treatment for the second type, the head is cut with two longitudinal and transverse incisions, and then what we mentioned about it are used.

As for the third type, you should not approach it with any of surgical treatment, unless the strength is strong and the substance has come out and it is really obvious, and use the treatment of the second type along with providing food and drink to the patient to increase their strength, and follow what we have mentioned for the wound treatment. God reveals what is hidden and gives the truth in exchange for nothing (27, pp.188,189).”

**■ DISCUSSION**

From ancient times until the 16th century, the definition and treatment approaches of hydrocephalus were not the same as today. In the beginning, the term hydrocephalus was used to define the collection of any kind of liquid substance on and in the head. In the Antiquity and the Middle Ages, physicians were mostly concerned with subgaleal or subperiosteal hematomas and fluid collections under the bone, such as epidural or subdural hematomas and hygroma under the title of hydrocephalus. According to written sources, in such cases where most of the lesions are under the cranial bone, some authors suggest that such lesions should not be touched, while some physicians stated that it is possible to intervene under the bone (11,16-20,25,32-37,44).

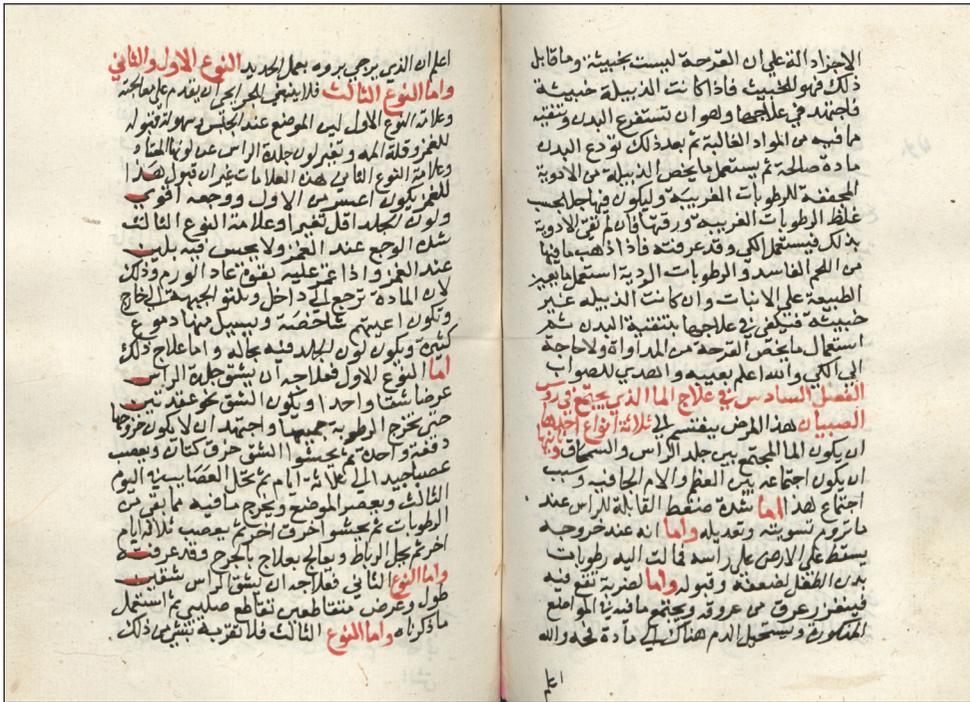


Figure 2: Pages containing the section on hydrocephalus in Ibn al-Quff's *Kitāb al-'Umda fī 'Ilm al-Jirāha* in İstanbul University Rare Works Library, Arabic Manuscripts, A 4749 (28) (Courtesy of İstanbul University Rare Works Library, İstanbul, Türkiye).

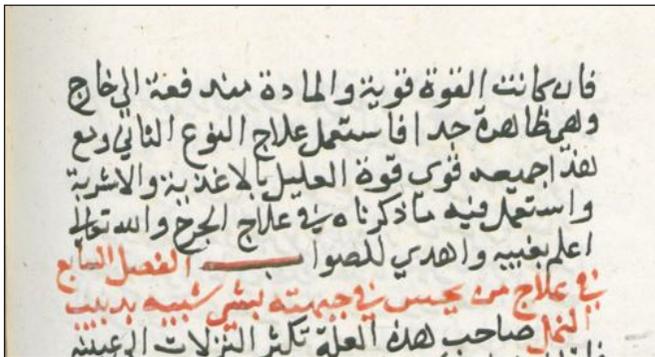


Figure 3: End of the chapter on hydrocephalus in Ibn al-Quff's *Kitāb al-'Umda fī 'Ilm al-Jirāha* İstanbul University Rare Works Library, Arabic Manuscripts, A 4749 (28) (Courtesy of İstanbul University Rare Works Library, İstanbul, Türkiye).

The writings of Ibn Hubal about hydrocephalus are compatible with those of Haly Abbas (4,8) and Avicenna (1,5,20). While the description of the location of the fluid collected outside the skull is compatible with the narration of Avicenna rather than that of Haly Abbas, he does not go into detail about the number and shape of the incision to be made in his proposal to drain the collected fluids. The same information is shared with Haly Abbas and Avicenna about the site where water was collected in the skull. While Ibn Hubal's information that the fluid collected in the skull causes separation of the sutures is not included in the writings of Avicenna, it is among the writings of Haly Abbas. Ibn Hubal's approach that these patients are incurable is very similar to the approach of both authors. In general, it appears possible to say that Ibn Hubal's knowledge and approach to hydrocephalus is parallel to the knowledge and approaches of Haly Abbas and Avicenna.

Ibn al-Quff gives more systematic and detailed information on hydrocephalus than Ibn Hubal. Its causes include pressure on the baby's head when the midwife corrects the head, body fluids collecting on the child's head after a child fall, and collection and transformation of the blood coming out of a ruptured vessel following an impact, which are compatible with the reasons given by Haly Abbas (4,8) and Avicenna (1,5,20). The finding about the three types of fluid collected in the head and their location is compatible with the information provided by Haly Abbas. Ibn al-Quff's suggestion of making a single incision in the first type, and two crossing incisions in the second type in which the fluid collects outside the skull, is very similar to the suggestions of Haly Abbas and Avicenna. On the contrary, if the fluid collects in the skull, Ibn al-Quff does not recommend surgical treatment in accordance with the recommendations of Haly Abbas and Avicenna at the beginning, but when the disease becomes prominent and the substance protrudes out and if the patient becomes stable, he recommends surgical intervention, such as incisions for other types. Ibn al-Quff's proposal for the third type overlaps with that of Albucasis (3,7,9). However, interestingly, Ibn al-Quff never mentioned suture separation in the third type.

All these explanations indicate that two surgical approaches to hydrocephalus, which could perhaps be recognized as schools, emerged in Greco-Roman medicine in the Antiquity and the Middle Ages. In the first school, incisions are used as a treatment method for the fluids collected outside the skull, and surgical intervention is performed by making incisions or scraping the bone for the fluids that accumulated in the skull. In the second school, incisions are used as a treatment method for the fluids that accumulated outside the skull, but surgical intervention is not performed for the fluids that accumulated in the skull. These schools continued to exist in

Islamic medicine during the Middle Ages. Islamic physicians followed their predecessors in this regard in the Eastern and Western caliphate.

## CONCLUSION

Ibn Hubal al-Baghdādī and Ibn al-Quff were two influential physicians of the Golden Age of Islam who dealt with hydrocephalus. Generally, similar definitions and classifications were made for hydrocephalus starting from ancient times until the ages of these Islamic writers. Like other writers of the Islamic world in medieval times, these authors appear to accept the classification of Greco-Roman writers. Moreover, in the Middle Ages, we can conclude that two separate schools prevailed in the approach to the surgical treatment of hydrocephalus: those that interfere with fluid collections under the bone and those that do not. Galen, Aetius of Amida, Rhazes, and Albucasis are in favor of the first school, while Antyllus, Oribasius, Paul of Aegina, Haly Abbas, and Avicenna are in favor of the second school. In conclusion, it seems possible to say that while Ibn al-Quff was a follower of the first school, Ibn Hubal was a follower of the second.

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## AUTHORSHIP CONTRIBUTION

**Study conception and design:** AA, OK, DB

**Data collection:** AA, OK, DB

**Analysis and interpretation of results:** AA, OK, DB

**Draft manuscript preparation:** AA, OK, DB

**Critical revision of the article:** AA, OK, DB

**Other (study supervision, fundings, materials, etc...):** AA, OK, DB

All authors (AA, OK, DB) reviewed the results and approved the final version of the manuscript.

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