

## ORIGINAL ARTICLE

### Historical Review: Skin and Subcutaneous Abscess Management by *Ibn al-Quff* in the Islamic Era (1233-1286)

#### Abstract

We review abscess management by *Ibn al-Quff* in the 12 century, described in his book *al Omdaa* (Arabic version). He explained in detail how an abscess presents, access for drainage, the proper preparation by the surgeon and patient for a procedure, and technical guidelines. It is considered advanced in ensuring the best results of managing this pathology. Much of his advice is already in use, and the rest has either never been considered or has not been studied well.

A comprehensive literature review was conducted using PubMed and Google Scholar. Articles were sought about *Ibn al-Quff* and his contribution to medical knowledge, medical education and quality control for surgical practice. Included were studies of abscess management, options for drainage after maturation, methods of incision and packing after drainage, and preparations to be made by the patient and surgeon for a procedure to be completed correctly.

Chapter 10 of the original manuscript of *Ibn al-Quff* (in Arabic) describes in detail how to manage an abscess, which was compared to current practice.

*Ibn al-Quff* gave clear practice guidelines for abscess management and discussed abscess maturation and the timing of incisions, which are poorly addressed in the current literature. The role of eruptive medicine in helping spontaneous abscess rupture was addressed in the book. The direction of incisions in relation to the location and involvement of

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organs for all abscess are not explored in detail. These are considered common sense in the preparation by a surgeon and patients for surgery in modern health care, and they are well explained by *Ibn al-Quff*.

Conclusion: *Ibn al-Quff* addressed abscess management in an unmatched manner for his time. Some points that he addressed, like abscess maturation, use of eruptive medicine through local skin applications to help an abscess erupt spontaneously, pus smell in relation to the causative organism, and the direction of incisions based on abscess location, are still areas of active research.

**Keywords:** *Ibn al-Quff*, Abscess, Pus, *Staphylococcus aureus*, Ichthammol, Ichthyol, Incision, Drainage, Packing, Practice guidelines, Historical, Quality control

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- 1- Hassan, 2009: 99-127.
- 2- Muazzam, 1989: 64-70.
- 3- Elgohary, 2006: 82-7.
- 4- Saad, 2014: 249-58.
- 5- Nagamia, 2003:19-30.
- 6- Omayesh, 2009.
- 7- Abi usaabye ah, 600 AH.
- 8- Hamarneh, 1971: 1088.
- 9- Hamarneh, 1974: 1138.

### Islamic medicine

Islamic medicine is a body of knowledge inherited by Muslims in the early phase of Islamic history, from the mid-sixth century till the mid-seventh century. Greek knowledge was combined with other sources from around the world. There was active translation and high financial benefits for those who shared in such activities. Physicians, Muslims or not, were well compensated. Experimentation and observation supported the practical guidelines of those times. The standard of care was known to be important and stressed during physician training<sup>1,2</sup>.

The activities of Islamic physicians and their innovations supported better results and lead to the spread of their medical knowledge to other parts of the world<sup>3-5</sup>.

### *Ibn al-Quff*

*Ibn Al-Quff* was born in Jordan 1233 and moved to Syria, where he practised medicine. He published many works, the most important being his book, *Al Omdaa Fi Sinaat al jerahaa*, which has 20 chapters in Arabic and was completed in 1281. Chapter 10 is on the knowledge of surgery that should be known by all surgeons (at that time). It was first published and edited in Arabic in Hyderabad, India, in 1937. Other original manuscripts by him are also available, like *alshafi fi altibb* 1272, *jaamee alaaraadh fi hifdh alsehaa wa almaraadh* 1274, and *alkoleeyat min kitaab alkaanoon le ibn sinaa* 1278<sup>6-9</sup>.

### Quality control and physician education standards

Quality control during the Islamic era was called from the



start *hisbah*. It was well developed, and took its main shape in the ninth century. It advanced by being dictated and written down, which was cheap in those days. *Hisbah* took care of many aspects of life, including services accuracy, goods, scaling and accounting<sup>10</sup>.

In the eleventh century, standards were very high for physician education, e.g., for how to take a medical history properly, physical examinations and supporting tests like a urine evaluation, documentation and counselling with colleagues<sup>11</sup>. Ethical standards were important too, for the patient, families and his colleagues. Hospital infrastructure too supported this training of physicians<sup>12</sup>, which formed the root of the current European medical system.

#### **Abscesses: physical and anatomical location**

The distribution of abscesses in the body varies: 70% of cases are on the face, scalp, neck, chest, pelvis/genitals, back, buttocks, hand, upper arm, or lower arm, 15% on the lower leg or foot, 9.5% on the upper leg and 6.1% on the abdomen.

The depth of involvement is 13.6% to the epidermis/dermis, 68.7% to subcutaneous tissue, 12.2% to the fascial planes and 5.4% to the muscles. Physical symptoms like erythema and induration are mostly moderate in nature (51.7% and 49.7%, respectively) or absent (5.4% and 13.6%, respectively). Pain is felt as almost severe in 44.9% of cases and is absent in 3.4%<sup>13</sup>.

#### **Abscess formation**

An abscess is defined as a drainable infected fluid<sup>14</sup>, or can be defined as inflammatory lesions releasing purulent materials<sup>15</sup>. *Staphylococcus aureus* is the most common bacterium responsible for cutaneous abscesses. Skin trauma, mainly because of needle stick injuries, is considered the main cause for MRSA infection.

Recurrent abscess may occur in patients with diabetes mellitus, who are obese or who are undergoing steroid therapy<sup>16</sup>.

*Staphylococcus aureus* is usually implanted in the soft tissue either from bloodstream dissemination or from a nearby skin carrier break, which initiates an inflammatory response. Neutrophils, macrophages and other cells will be attracted. The response of the host immune system is liquefaction necrosis. The usual response is accumulation of fibrin to separate the infected liquefied tissue from healthy tissue. Such phenomena happen by default in the immune for most tissue

- 10- Ajlouni, 2003: 820-6.
- 11- Abouleish, 1993:15-43.
- 12- Majeed, 2005: 1486-7.
- 13- Lipsky, 2012: 227.
- 14- Samett, 2012.
- 15- Cheng, 2011: 225-32.
- 16- Rogers, 2006: 697-710.





injuries.

*Staphylococcus aureus* uses these phenomena for its own benefit to form a well-formed fibrin pseudo capsule in a few days.

The formation of an abscess passes through two phases in general. There is an acute phase, usually between day 1 and day 6, and then there is a recovery phase between day 7 and day 14, from the perspective of abscess size. Some small abscess can disappear by an unknown mechanism<sup>17</sup>.

The pus produced due to this process has many dead neutrophils, which were recruited to the site of infection. They release calprotectin, a member of the S100 family of pro-inflammatory proteins, which acts through chelating of manganese from the surrounding environment. This reduction in available manganese diminishes the presence of *Staphylococcus aureus* through a variety of possible routes linked to nutrition and the capability of the bacterium to mount an effective response to the reactive oxygen species generated by the neutrophils<sup>18</sup>.

### **Pus**

Pus is a yellowish, green-white, opaque, somewhat viscid matter. In a pus-forming disease, the pus can be seen macroscopically. Pus-forming bacteria are those that normally, frequently or usually cause suppuration.

The separation of bacteria into pyogenic and non-pyogenic groups is not precisely correct all the time, for example, the reaction to the mycobacterium *Bacillus* produces pyogenic fluid in the pleural cavity, bladder or meninges, but classically it cause non-suppurative granuloma<sup>19</sup>.

Nonbacterial causes for skin abscesses have been described, and include fungal, viral, physical, systemic drugs, topical applications and other causes<sup>20</sup>.

It has been reported that that the pH of neutrophils and monocyte phagosomes drops to 3.5–4.5 within 7–15 min of ingestion of micro-organisms. This initiates acid hydrolysis and the degradation of dead micro-organisms. At the same time, polymorphs that die or are injured will release acidic material into the extracellular space. The dead organisms and polymorphs form a thick opaque pus, usually yellow to green. It includes leucocytes, exudates, bacteria, dead cells and tissue debris. It has been suggested that the acidic environment inside a cell could destroy bacteria.

The acid space usually disturbs and limits the function of

17- Malachowa, 2012: 1185-93.

18- Russell, 2008: 115-6.

19- Jensen, 1973: 379–88.

20-Jackson, 1974: 801.



local anaesthesia. Although a combination of regional anaesthesia (nerve block) and local infiltration may provide a good alternative to analgesia<sup>21</sup>.

Pus has antimicrobial powers through the activity of calprotectin, which is a pro-inflammatory protein that acts through chelation of manganese. Neutrophils usually destroy both the pathogens and host tissue. It is regulated by the developing acquired immune response, which combats infection and limits tissue damage. Any pathogen capable of surviving this frontal assault will be met by a less frenetic, but more focused attack mediated by antibodies, lymphocytes and macrophages.

Sometimes, a physician may need other methods to diagnose an abscess in soft tissue. Needle aspiration can help to diagnose an abscess through aspiration of purulent fluid. It is not uncommon that an abscess cavity, a deep abscess or very thick pus will give a negative aspiration test result. Sonographic studies can help to identify and locate an abscess in soft tissue, if used properly. Abscess maturation and the contents of an abscess can be identified by ultrasound, which varies from classic hypo echoic complex fluid collection, to hyper echoic views. Other views include sedimentation, loculation and septation. Any swirling of a suspected abscess can help to identify and confirm the diagnosis. Ultrasound can show abscess wall hyperaemia and surrounding inflammatory fluid collection<sup>22</sup>.

## **Timing and preparation for drainage**

### **1-Timing of Drainage**

Where the indications and contraindications of drainage are well established, the timing of drainage is realistically open to personal discretion. There is little in the medical literature on this subject. Although the clinical benefit of timely drainage cannot be debated, the question is whether or not the procedure can be deemed an emergency. "*signs of abscess maturation : relenting abscess position, calming of pain and fever, increase in abscess weight*"<sup>23</sup> Where central accumulation of the pathogen is surrounded by pseudo capsule of fibrin deposits ,zone of necrotic and healthy polymorphonuclear neutrophils, and a rim of eosinophilic material consisting of collagens and fibroblast.<sup>24-26</sup>

- 21- Meechan, 1999: 15-20.
- 22- Adhikari, 2012: 1509-12.
- 23- Alharbi, 2014.
- 24- Flaris, 1992: 1299.
- 25- Lam, 1963: 611-5.
- 26- Freedlander, 1928: 663-75.



## 2-Assessment for Drainage

### 2-1-Spontaneous rupture

Often there is spontaneous oozing of an abscess. The diagnosis of a cutaneous abscess is usually not difficult, and often the patient may complain of spontaneous drainage. The treatment of such abscesses frequently involves incision and drainage. Because it is considered a minor surgical procedure, some primary-care physicians will choose to refer for definitive management. In addition, procedures such as these may not be possible in an outpatient setting due to time constraints.

### 2-2-Facilitated spontaneous rupture by local medication

Local medication, like “*eruptive medicine*”, and ichthammol, can be used to help an abscess spontaneously rupture. In Germany, 20% ichthammol ointment is an approved treatment for abscesses. In comparison, ichthammol glycerine is a registered product for use in humans in Australia, although no specific indication is documented for its use (Therapeutic Goods Administration, pers. comm.).

**2-2-1-Anti-inflammatory effect:** The effect of ichthyol on the migration of human neutrophilic granulocytes was studied by the Boyden chamber technique<sup>27</sup>. This was thought to explain the accumulation of cells and the formation of an abscess observed with the use of ichthyol on inflammatory skin lesions and the resultant anti-inflammatory properties of the compound. Ichthyol also inhibits the chemotactic response of neutrophils and cell migration. Ichthammol has no effect on the release of inflammatory mediators in cells in a normal condition. It also speeds up the maturation of an abscess, giving the patient faster relief.

**2-2-2-Antibacterial properties:** Ahmed et al. and Nelseen et al. tested the antibacterial effect of ichthammol glycerine on common bacteria that cause otitis externa using an agar solution. Their results showed an inhibitory effect against the gram-positive bacteria *Staphylococcus aureus*, *Staphylococcus epidermidis* and *Streptococcus pyogenes*. There was less inhibition of the gram-negative organisms *Pseudomonas aeruginosa* and *Escherichia coli*. They also found weak inhibition of *Candida albicans*. The antibacterial effects were more obvious with ichthammol alone, which led the authors to conclude that the main antibacterial substance in ichthammol glycerine is ichthammol<sup>28,29</sup>.

**2-2-3-Risk and side effects:** It has been shown that ich-

27- Kownatzki, 1986: 190-3.

28- Ahmed, 1995: 201-3.

29- Nilssen, 1996: 319-21.





thylol is safe in general. It does not cause mutations, it is not carcinogenic and there is no teratogenic effect either with local or oral use. However, there may be minor skin reactions, and if mixed with a dressing, it may be flammable<sup>30</sup>.

### **2-3-Indented rupture by surgical instruments on bedside**

*“the location of incision should be chosen carefully: it should be look for the thinnest place, the bottom of the abscess is better than the top (to allow better drainage of hidden cavities)”*. The initial step in performing an incision and drainage is to prepare the site for incision and remove any dirt or debris. Then, the area is cleaned with anti-infective agents (e.g., chlorhexidine, povidone iodine or isopropyl alcohol).

After using local anaesthesia, a straight incision is made over the maximal fluctuance area. The length of the incision will depend on the size of the abscess; however, in general, the incision should be large enough to promote adequate drainage. Decompression of purulent material should be performed. The abscess cavity is probed, which further releases any hidden purulent material. All necrotic and devitalised tissue should be debrided.

After thorough drainage and removal of purulent material and any dead tissue, the abscess cavity is loosely packed using 1/4- or 1/2-inch plain packing strips. To ensure that the incision site remains open and to allow for continued drainage, 1 cm to 2 cm of the packing material is left extending outside the wound<sup>31</sup>.

### **2-4-Ultrasound-guided percutaneous drainage**

Some abscesses require to be drained using a more effective, safe procedure. Ultrasound-guided drainage through the skin gives significant cost savings to the health-care system. It is used for deep neck abscess<sup>32,33</sup>.

### **2-5-Abscess drained in operating theatre**

*“abscess can be drained by metal instrument ,as primary (situation varies based on size of abscess ,fiber packing, position, which organ is involved). Or in case of failure of eruptive medicine ,due to :thick pus .weak inflammation.patient being unable to tolerate the painful effect of the eruptive medicine. the abscess being located near a joint or a major organ”*.*“The incision should be at the bottom of the abscess, if possible, as mentioned above, to facilitate pus drainage”*. (Figure 1).

30- Rowe, 2007: 29-32.

31- Abrahamian, 2008: 89-116.

32- Biron, 2013: 18.

33- Hussain, 2008: 21.



Abscesses in close proximity to or involving important neurovascular structures (e.g., axillae or antecubital fossa), large and/or deep abscesses that will require a prolonged period of time to drain, abscesses that, owing to size or location, will require a degree of patient cooperation best achieved using general anaesthesia, and deep space abscesses of the hands and feet, or perirectal abscesses<sup>34</sup> are drained in an operating theatre.

- 34- Chudnofsky, 2008: 195-205.
- 35- Singh, 2014: 4735.
- 36- de Vries, 2010: 1928-37.
- 37- Lewis, 2001: 1-131.

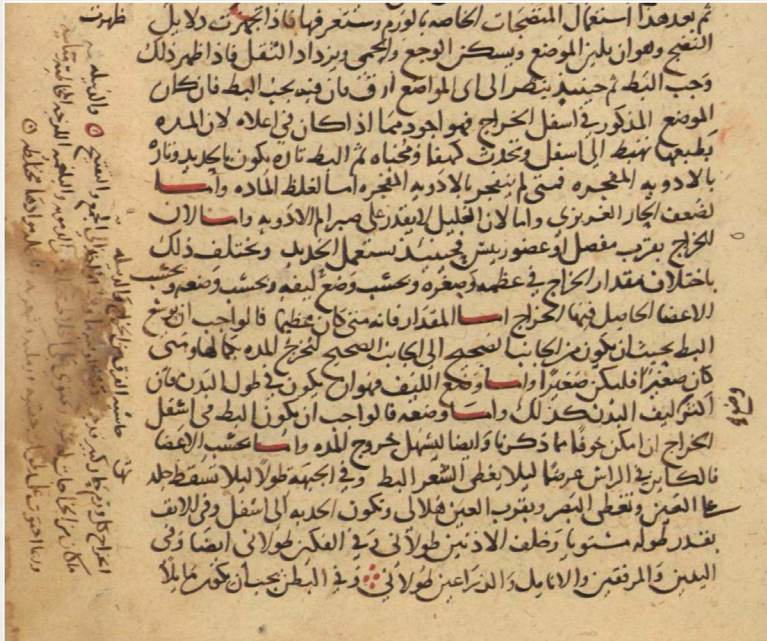


Figure 1. Abscess cavity packing and pus maturation

**2-6-perioperative conditions and protocols of abscess management**

The importance of surgeon knowledge of anatomy is well known<sup>35</sup>, preoperative check list for patient safety in perioperative period<sup>36</sup>, current practice describe in details how to manage abscess, although *Ibn Al-Quff*, handled that issue to ensure surgeon competence ,patient selections and timing of the procedure, and optimisation of surgical safety to reduce morbidity (Figure 2).

**2-7-Special concerns about abscess cavity packing and pus amount and maturation**

Drained abscess volume was not a major concern in current available researches, although its volume was important to justify ultrasound use for detection in case of critical zones with abscess, like the neck,or impairment of wound healing<sup>37</sup>.





Packing changes varies from 24 hours till 7 days, as there is no consensus about it, but the general trend is accepting one day or less for changing the dressing for an abscess<sup>38</sup>. Pus smell and colour are not widely addressed in literature, this could be due to the accepted universal treatment to most of them, and minimal clinical implications doing so<sup>39</sup>.

*Ibn Al-Quff*, discussed the importance of pus drained volume, need for packing, and physical characters of pus, like smell, colour and maturity of pus.

38- Korownyk, 2007: 1680-4.

39- Chapman, 2007: 1-40.



Figure 2. Abscess drainage preparation

### Conclusion

*Ibn Al-Quff* described in unique details the clinical implications, the possibility of using eruptive medicine, the direction of incisions made for pus release, and pus physical characters of abscess management. His contributions in abscess management may help in making different view of practice guidelines, and may open new windows in clinical research.

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