Medical Journal of the
Islamic Republic of Iran

Volume 18
Number 1
Spring 1383
May 2004

Medicine in Islamic Culture

AVICENNA'S VIEWPOINTS ON FEVER AND IT'S COMPARISON TO MODERN MEDICINE

S.Z. TABEI,* M.B. MASOUMPOUR, R. ASADOLLAHI, N. SOBHANI AND S. SAJJADI

From Shiraz University of Medical Sciences, Shiraz, Iran.

ABSTRACT

In his book "Canon in Medicine (Al-Ghanoon)", Avicenna has specified a chapter containing two sections pertaining to fever. After defining fever and explaining it's different stages, he divides it into three types: hectic fever, infection-induced fever and daily fever. After accurate attention to the patient's history and key-points in examination, he focuses on fever signs and its treatment regarding each type of the three. In this article, we intend to discuss Avicenna's views on fever in comparison to those of modern medicine.

MJIRI, Vol. 18, No. 1, 79-84, 2004.

Keywords: Fever, Avicenna, hectic fever, infection-induced fever, daily fever.

INTRODUCTION

Despite inappropriate conditions such as numerous difficulties in exchanging information through mass media, limitations in scientific and educational facilities and, in a word, with very few facilities available, a thousand years ago a highly talented man with philosophical, scientific and mystical experience, named Avicenna, introduced his invaluable book, called "Canon in Medicine(Al-Ghanoon)".

Avicenna, nicknamed "Sheikh-or-Raees", in his book Canon in Medicine, describes different types of fever along with their underlying causes.

He continues to explain causes, manner, signs, and finally treatment of each type of fever. In this article, we intend to compare Avicenna's views on fever against those of modern medicine to find out novel relations governing his doctrines of fever and those of the modern world. It is hoped that the reader could be appropriately informed of the classical works of science on the one hand and the scientific character of this distinguished Moslem scientist on the other.

What is fever?

Avicenna views fever as an alien heat radiated in the heart which is then transferred to arteries and veins via the individual's blood and soul, hence inflaming the whole body in a way that its natural functioning is hampered, so that it loses the ability to perform its necessary and natural duties properly. Having attributed the cause of this alien heat to infections generally rooted in inflammation or non-inflammatory sources, Avicenna says, "..the heat from any organs affected first, and prior to all other organs, is transferred to different other organs...."[1]

Nowadays fever is defined as elevation of the body's temperature to an extent greater than normal caused by changes occurring at a heat-regulating center, situated at the anterior part of the hypothalamus. Factors inducing fever may be of external or internal sources. Examples of the former include microorganisms or their byproducts and those of the latter comprise ILs (IL6 and IL10) and TNFα. Internal elements causing fever, whether local or systemic, first enter the circulation, and then are carried to the hypothalamus, and induce the fever.[2-4,6]

Having attributed fever in different people to various

[Downloaded from mjiri.iums.ac.ir on 2024-03-28]

temperaments, Avicenna believes that hot-tempered and rheumatic people are more susceptible to fever than others. Of course, each individual possesses the greatest level of hot temperance and rheumatic state at his early childhood. Similar to many other diseases fever passes through a number of stages as follows:

A) The introductory (initial) phase: At this stage, the substance causing the fever would spread all through the body of the feveree, overcoming and suppressing the natural heat of a particular organ. This stage can be referred to as "colonization" and "adhesion" stage.

B)Enhancement and elevation stage: This stage during which natural and instinctive heat of the body starts to defend itself, is referred to as setting of the body's immunity (overcome of body defense).

C)The final stage when the disease stops: At this stage two forces of instinctive heat and alien heat are involved in a battle; this stage is roughly simultaneous with (the same as) infection stage.

D) The phase when the intensity of fever subsides: At this stage when natural and instinctive fever wins the battle by forcing the occupiers to leave the field, the fever drops. This stage is similar to a "repair " process.[1,2,4]

Having emphasized the significance of identifying the type of illness Avicenna draws the reader's attention to a number of points such as the patient's complexion, age and stamina and the particular season, patient's environment and his pulse rate. For example, fast, repeated and intense pulse indicates the intensity of the disease; it is also necessary to identify the bout of each stage along with the number of fluctuations in fever.[1]

Reasons underlying a longer bout of fever are enumerated as follows:

1)The element inducing the disease may be plentiful.
2)The element causing the disease may be thick and dense.
3) The element causing the disease may be cold (and the person may be) cold tempered.
These reasons could be considered as virulent features of microbes.
4) Time, cold season, and cold environment could contribute to the prolongation of the disease. This issue also shows the impact of environmental factors on the relationship between the host and disease-inducing elements.
5) Weakening of instinctive heat in the patient's body may also prolong the bout of illness.
6) Dryness and hardness of the patient's skin (can also worsen the problem).

The last two factors show the role of the patient, particularly weakness of his immune system in combating infection, resulting in the prolongation of the fever.[1,4]

Avicenna has divided fever into three types:

Hectic fever: in which the main bodily organs are invaded by an alien heat.
Infection-induced fever: in which alien heat involves the body's humors, resulting in the warmness of other bodily organs.
Daily fever: In which the alien heat first influences the soul and steams inside the body by making them warm; then the warmth developed would spread to involve other bodily organs.[1]

General aspects of daily fever

Daily fever is not so worrying unless it lasts for more than three to six days, developing into a kind of infection-induced fever. In this fever, the patient's urine will not change considerably, nor will his pulse. Also, while recovering, the patient sweats. Avicenna enumerates the signs of daily fever in detail; then he continues further to introduce symptoms indicating the conversion of daily fever into other types of fever.

As to the treatment of daily fever Avicenna maintains: "Those suffering from daily fever should consider diet as a significant part of their treatment. They have to adopt a diet which is rich but, at the same, easy to digest. It is important to remember that the feverish is sick and a sick person is afflicted with a disease, requiring food and has to be nourished well as far as possible..."[1]

Avecenna also considers a number of exceptions regarding the patient's nutrition, (we known that) fever enhances the body's metabolic rate by 7% against every one degree increase in body temperature exceeding 98.6° Farenheit or by 13% against each one degree increase exceeding 37° Centigrade; this significant issue has been duly observed by Avicenna.[1,9]

At the onset of fever, drinking cold water would cause no trouble; besides, in most patients taking a bath would also be all right. If the patient is to use ointment, he should apply massage to the site sufficiently in order to leave the skin holes open, and then spread the ointment over the area.

Avicenna's emphasis on the significance of openness of the skin holes is rooted in the role of perspiration on keeping the skin cool, as sweat appearing on the surface of the body, during the heat-reducing reactions, would evaporate, giving rise to the cooling of the skin.

Avicenna divides "daily fevers" in to three basic groups:

1) Those dealing with psychological states and internal reactions of the patient, as follows:

Contemplation fever, panic-stricken fever, fever of delight and ecstasy, fever of grief and sorrow, fever of sleep-

[Downloaded from mjiri.iums.ac.ir on 2024-03-28]

lessness, fever of sleep, fever of tiredness.

2) Some fevers deal with the state of the patient's body and are directly related to the patient's body, such as fevers caused by obstructions in the body, inflammations and abscesses on the surface of the body, fever due to the body's tiredness, fever due to collapse, resulting from starvation or severe thirst.

3) Fevers rooted in external sources include sunstricken fevers, those resulting from washing of the body by waters which dry up the skin and fevers caused by severe cold.

In each of these fevers, Avicenna first introduces the pathogenic features of the fever; then talks about the signs of fever, including a brief account of the history of the disease, the examination of the patient, urine check (urine study) and eventually carries on to introduce procedures involved in the treatment of the disease. As an example, we would like to draw your attention to Avicenna's account of the fever caused by obstructions in the body:

Obstructions, according to Avicenna could be divided into two major groups: (1) Those blocking skin holes, such as cold, intense radiation of the sun, dust particles, and refraining from washing up of the skin resulting in the accumulation of dirt on its surface; and (2) those blocking capillaries, and the opening of the veins. The term "obstruction fever" to Avicenna, refers to obstructions happening through the body's veins. Avicenna continues further to describe the pathology of this fever as follows:

"... in such a condition elimination of materials which should have to be consumed or exhausted is low. Obstruction of vessels in the body and, as a result, obstruction of the body (as a whole) would speed up in an unnatural manner. dischargable substances are trapped inside the body, without being discharged; breathing pathways to bodily organs are blocked and obstructions accompanied by impediments would develop. A sizable amount of heat and vapour congregates inside the body. This vapour which is warm will not be absorbed or eliminated resulting in the elevation of heat in the patients body."[1]

Theses steps are, to some extent comparable to the procedures involved in necrotic clotting in which oxygen fails to reach the tissue, resulting in hypoxia. After the development of necrosis, distention and pus would follow, resulting in the onset of fever.[5] Then Avicenna continues to describe the manner of obstruction development as follows:

1-Sputum and blood have to be more than usual.

2- Sputum and blood may not be too much, but could be thick, dense and viscoid, obstructing the passage.

3-Internal elements (internal tissues and organs) might have been harmed; for example, they could have been contracted or distented due to cold, exerting extra pressure over their neighbouring tissues or organs; also an alien growth, such as extra flesh, might have developed, resulting in the obstruction of the passage.[1]

Nowadays also disruptions in the clotting system, including platelets and clotting proteins, and damage to endothelial cells and stasis are claimed to account for formation of clot.[5]

In treating obstruction fever, if the physician was forced to resort to blood letting procedures, he had to clean up the obstructed part before adopting phlebotomy.[1]

General Aspects of Infection-induced fever

To Avicenna, obstructions (in the body) and types of food (as a channel of transmission) together with some minor factors such as insanitary, incompatible gases, e.g. gases emitted from marshes or swamps can account for infection-induced fevers. Nowadays also, the intestinal and respiratory tracts are shown to be major sources of disease transmission. Then, based on the site where they develop, infections are divided in to two groups: one of them spreads all through the body whereas the other is confined to one particular organ.[1,8]

Avicenna introduces four different types of infection-induced fevers, depending on which of the four humors, i.e. black bile, phlegm, blood or yellow bile, is infected. Apart from blood, the other three humors might be present outside the veins; and (accordingly) Avicenna views fever useful for the elimination of infection-induced substances when the substance is situated outside the veins, by maintaining that:

"...the heat causing fever could remove, break apart, ingest and discharge the infected substance, as the infected matter is not trapped in the veins, with no outlet through which the infection could be released."

Various studies have indicated that, despite its harmful effects elevation of heat in the body could contribute to the individual's survival. Elevated heat could block multiplication and growth of certain bacteria; this indicates why treatment via fever was common for elimination of neurosyphilis before the discovery of antibiotics. Elevated heat would enhance phagocytic and bactericidal properties of neutrophils and cytotoxic lymphocytes. This might be the reason that, in treating intermittant fever, Avecina says: "... if the fever is shown to follow its natural trend and the rest of the task is left to the nature to be carried out, do not employ any medicine; however, if you noticed that you have to assist the nature in the final stage of the treatment, do whatever you could do. Nevertheless, in such cases try not to exercise against the usual trend of nature...."

Avicenna has enumerated signs of infection-induced fevers. He introduces etiology of fever, patient's history

[Downloaded from mjiri.iums.ac.ir on 2024-03-28]

before the onset of fever, pulse and breathing manner of the patient. He continues to say that in most cases of infection fevers Malile precedes fever; feeling of tiredness, pain over the bones, lack of sleep, heavy breathing, nasal discharge, etc. would appear. To detect the cause of fever, Avicenna recommends a full examination of the patient, by referring to a number of manifestations, some of which would be worth mentioning here: patient's food and his self-observance; his natural habitat; the season of the year; the study of patient's age, temper, pulse, urine and feces; history of his nasal bleeding; previous records of his perspiration, lack of appetite, headache, and sleeplessness; his nonsensical expressions; the history of frequency, manner and intensity of the fever and the patient's occupation.[1,4]

In investigating the signs of fever, Avicenna attributes muscular trembling to the muscle's defense against the infected substance whereas nowadays spontaneous contraction of muscles is attributed to the body's need for the elevation of heat so that the body's temperature reaches the elevated set point of the hypothalamus.[1,6]

Avicenna delicately maintains that the elderly may contract latent fever, whose duration may be accounted for by a kind of inflammation inside the body. In such cases, the patient has to be forced to lie down on his back and stretch his legs; then the physician can examine the patient by touching the area of his abdomen; this could help the physician to diagnose the cause of the problem.

In treating infection-induced fever, Avicenna sometimes gives priority to the treatment of the fever and sometimes refers to the significance of treating the substance giving rise to the fever. In this connection, he says,"...pay attention and see which of these two is more urgent and significant to be exercised first; then adopt the treatment of one which is more significant...."

In treating infection-induced fevers, diarrhea, sweating, urination and vomiting of the patient are significant to Avicenna, as these are means of removing infected sputum from the patient's body. According to Avicenna, drinking beer, oxymel and poppy syrup are useful for the patient. The wetness of the patient's throat plays a significant role in healing of fever as this will not stir up areas of underlying mucus, ultimately blocking mucus secretion. Then having enumerated the unpleasant complications of fever, Avicenna continues to present a particular treatment for each one. The complications include spontaneous shivering of the body, nasal bleeding, intense vomiting, diarrhea, sleepiness, a coarse tongue, a dry mouth, sneezing, hunger, depression, etc. Then Avicenna continues further to provide a detailed account of black and yellow bile fevers, phlegm fever and blood fever, together with measures to be adopted for their treatment.

Now we would like to draw your attention to one of the infection-induced fever's from Avicenna's viewpoint: To Avicenna, fever of "one-in-four" is rooted in a humour substance which gets infected. He describes this humour substance as follows: "blood deposits and sediments may form black bile. Blood may have burned and transformed into black bile; and maybe the ash of humour-any kind of humour-turn out to become black bile".

" The fevers called one-in-four mostly do not last for more than one year, although some may last for 12 years."

He also continues to claim that "in a cold rooted in one-in-four fever, the body feels a sort of pain in which the patient, feeling as if his bone is broken, presses his teeth against each other. If the patient has the fever, it is possible to identify whether he suffers from one-in-four fever by examining his spleen for signs of distention. Avicenna also maintains that splenic pain even without distention can indicate one-in-four fever. He also says when fever is passing through its fourth phase, i.e. the fever is to be over, the patient's urine tend to become black in color.[1]

In all these cases, we see that Avicenna tries to explain infection-induced fever via *Plasmodium malariae,* which is actually the only type of plasmodium causing one-in-four fever.

By referring to blood sedimentation, maybe Avicenna intended to indicate to lysis of red blood cells; also when he discusses the spleen disruption by referring to its distention, he is actually referring to one of the signs of chronic malaria; by comparing the body's pain to that of a broken bone, he is indeed referring to the nature of muscular pain; he prudently attributes the darkening of urine to the beginning of end of fever, which is rooted in the release of red blood cells from the site of fever, resulting in the presence of these cells in the urine, referred to as hematuria.[1,3]

Hectic fever in general

Avicenna describes hectic fever as follows:

"...some of the moisture inside the organs are used to provide moisture and nutrition for the joints; from this part of the moisture some stay in the veins while some spread through them, functioning as dew keeping the grass fresh and live. The first part of the moisture contributing to nutrition may get infected. From the moisture available in organs, particular parts are used to bind together very tiny particles and organs right from the beginning of creation. If this moisture is destroyed, the relevant organs would disintegrate and die out. Such assertions are in harmony with the existence of cells on the one hand and the role of interstitial fluids on the other."

[Downloaded from mjiri.iums.ac.ir on 2024-03-28]

If the heat elevates in intensity so that it could influence the flesh of the body, it would be very difficult to save the patient.

Regarding the common features of infection-induced fever and hectic fever, Avicenna says, due to the fever, the patient gets weak, thin and withered, which are (some of) the signs of hectic fever.[1]

Nowadays, in discussions dealing with pathogenesis of fever, the role of cytokines has been clearly demonstrated. In defending (the body) against invaders, such as constituents of various microorganisms or certain chemical substances, the cells of our immune system would produce particular proteins which function as thermogenic elements related to the family of cytokines. So far eleven proteins with pyrogenic activities have been identified, while it is likely to identify many more of such proteins. It is implied that pyrogenic cytokines are attached to endothelial cells at the hypothalamus, adjusting the heat-regulation center at the hypothalamus with heat fluctuations of the body. This change depends on endothelial cells producing prostaglandins. TNFα or Cachectin, TNFβ, IL1α, IL1β, IFNγ, IFNβ, IFNα, IL6,MIP-1α, MIP-1β and ILβ form proteins with pyrogenic activities. The link between elevation of IL10 and death in patients with fever has been introduced.[10,6,7,2]

For the treatment of hectic fever, two basic principles have been introduced:

1-Keeping the patient's body cold.

2-Keeping the patient's body moist.

Avicenna maintains that "if distention has caused the hectic fever or damage to one of the patient's organs has resulted in the fever, before treating the fever, the infection or the damaged organs, serving as the main cause of fever, has to be treated".

He also regards milk useful for the treatment and talks about the significance of food as well. He introduces a number of signs for the diagnosis of hectic fever as follows: the study of pulse, type of heat, urine and feces, patient's complexion (sunken eyes and fitting of the skin to the temporal bone) and unusual change of nails.

In investigating the type of heat in hectic patients, Avicenna maintains that the heat in such patients is always of the same nature and does not drop. However, whenever the patient with hectic fever eats food, his temperature elevates and intensifies, and his heart beat gets faster and stronger. He continues to say that in such a condition, if the patient is refrained from taking food, the ground for his death would be prepared.[1]

In describing cholera fevers, though to him they are mainly rooted in the air, he sometimes refers to the role of water in contaminating the air and the role of the earth in contaminating water as follows: it is likely that some infections are emitted from inside the earth, whose details are not clear to us. The infectious state, rooted in inside the earth, could affect water and air, by polluting both with cholera. To him, people swimming frequently are more susceptible to contracting cholera fevers. To avoid cholera, he recommends the cooking of the meat and souring of the food with vinegar, sumac ,juice of unripe grape, juice of sour lemon and juice of pomegranate. He refers to the role of underground waters as sources of transmitting cholera, and draws our attention to the effectiveness of acids in eliminating *Vibrio cholera*.[8]

In two separate sections, Avicenna investigates small pox and typhoid fever, their signs, and their treatment.

Inflammation-related fevers, from Avicenna's viewpoint

Such fevers are accounted for by inflammations appearing on the surface of the body; for example, there can be some fillings in the body, appearing as inflammations on the body, or a wound might have happened, accumulating nasty and disease-causing particles, negatively influencing the (surrounding) flesh and, hence, resulting in fever. In all these cases, it is observed that Avicenna pays attention to inflammation and, at the same time, refers to obstruction of ducts and accumulation of disease-causing substances. "Fever due to internal inflammations would be the worst type of fever, whose complications include acute pain, intense thirst and high temperature. Internal inflammations causing such fevers include inflammation of the brain, the ears, the throat possibly, the diaphragm, the liver, the kidneys, the bladder, the uterus, the intestine, and other similar organs.

Such kinds of inflammatory fevers happen at particular times, depending on the substance inducing the fever. Whenever the disease-causing humour substance enters the distended area, fever would start, or whenever the humour substance is developed in the distended area itself and gets activated at a rate which absorbs heat and pain toward the inflated area, fever also starts at the same rate. By the term" substance "Avicenna could mean chemotoxic substances that develop at the site of inflammation and after entering the veins, depending on the type of inflammation, would absorb lymphocytes, PMNs and monocytes, which give rise to pain by secreting substances, causing lysis of cells, and other substances such as bradykinin.[1,7]

In the last two chapters of his work on fever, Avicenna discusses compound fevers and Shatrolghab fever. By defining compound fevers, Avicenna says:"it happens that various states of fever would occur simultaneously so that they overlap; for example, two states of fever which are not of the same nature and have to be independent of each other happen simultaneously, such as a person contracting both hectic fever and infection-induced fever at the same time."

He continues to enumerate other factors accounting

[Downloaded from mjiri.iums.ac.ir on 2024-03-28]

for compound fevers and maintains that it is absolutely essential to identify different types of compound fevers. Shatrolghab fever is one kind of compound fever in which two types of fever would occur over a single day; then he continues to introduce the causes of such fever, with reference to the type and manner of humour involvement.

Then discussing signs of fever, he draws one's attention to the patient's pulse, urine, vomiting and stool. This fever, to him, could be effectively treated by removing the humour causing the fever.[1]

REFERENCES

1. Avicenna: Canon in Medicine; Persian translation by Sharafkandi A., Volume 4, Tehran, Soroush, 1991.
2. Betler B, Beutler SM: The Pathogenesis of Fever, In: Cecil Textbook of Medicine. Volume 3, W. B. Saunders Company, 21st ed, 2000.
3. Markell EK, John DT, Krotoski WA: Medical Parasitology. W.B. Saunders Company, 8th ed., 1999.
4. Charles AD, Sheldon MW: Pathogenesis of Fever and The Acute Response, In: Mandell, Douglas and Bennett's Principles and Practice of Infectious Disease. Volume 1, Churchill-Livingstone, 4th ed., 1995.
5. Cotran RS, Kumar V, Robbins SL, Schoen FG: Robbins Pathologic Basis of Disease. W.B. Saunders Company, 6th ed., 1999.
6. Gelhand JA, Dinarello CA: Fever and Hyperthermia. In: Harrison's Principles of Internal Medicine. Volume 1, McGraw Hill, 14th ed., 1998.
7. Abbas AK, Lichtman AH, Pober JS: Cellular and Molecular Immunology. W.B. Saunders Company, 4th ed., 2000.
8. Brooks G.F, Butel JS, Morse SA: Jawetz, Melnick and Adelberg's Medical Microbiology. Appleton and Lange, 21st ed., 1998.
9. Johnson RK, Energy, In: Krause's Food, Nutrition and Diet Therapy. W.B. Saunders Company, 10th ed., 2000.
10. Van Dissel JT, et al : Anti-inflammatory cytokines profile mortality in febrile patietns; Lancet, Mar 28: 351 (9107): 950-3, 1998.

[Downloaded from mjiri.iums.ac.ir on 2024-03-28]