Updates in Management of New Fever in ICU Patients

Essay

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By

Mohamed Said Mohamed Badr
M.B.B.Ch. (Ain-Shams University)

Under Supervision of

Prof. Dr. Galal Abd El-Reheem El-Kady
Professor of Anesthesiology, Intensive Care and Pain Management
Faculty of Medicine - Ain-Shams University

Dr. Gehan Abd El-Halim Ali Gomaa
Assistant Professor of Anesthesiology, Intensive Care and Pain Management
Faculty of Medicine - Ain-Shams University

Dr. Azza Mohamed Lotfy
Lecturer of Anesthesiology, Intensive Care and Pain Management
Faculty of Medicine - Ain-Shams University

Faculty of Medicine
Ain-Shams University
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Abstract

Introduction: Fever frequently occurs in critically ill patients. Although fever is primarily a symptom of infection, it also occurs as a host's response to non-infectious inflammatory stimulus. It complicates up to 70% of all intensive care unit (ICU) admissions and is often due to an infection or another serious condition.

For all patients, all ICU temperature values during the entire ICU admissions were available. Measurement methods included pulmonary artery thermistor, tympanic, axillary, per rectum, esophageal and bladder temperature probes. Fever was defined as a body temperature >38.0°C.

Aims: The aim of this work is to study different causes of new fevers in intensive care unit (ICU) and to discuss the management of infectious and non-infectious cases of it in the ICU.

Summary: Fever is a characteristic feature of most infections but is also found in a number of noninfectious diseases such as autoimmune and autoinflammatory diseases.

Also there is methods available to induce therapeutic hypothermia in a variety of clinical settings: (1) surface cooling d (2) core cooling. The corner stone in management of fever is accurate diagnosis and treatment of underlying etiologies.

Keywords: Updates in Management, Infectious and non-infectious, New Fever ICU

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بسم الله الرحمن الرحيم

قالوا

سبحانك لا علم لنا إلا ما علمتنا إنك أنت العليم الحكيم

صدق الله العظيم

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List of Abbreviations

BALF	: Bronchoalveolar lavage fluid
CCUs	: Critical care units
CF	: Central fever
CLABSI	: Central line-associated bloodstream infections
CO	: Carbon monoxide
Cox-2	: Cyclooxygenase 2
CRP	: C-reactive protein
CT	: Computed tomography
CVCs	: Central venous catheters
GNB	: Gram-negative bacteria
HAP	: Hospital-acquired pneumonia
ICU	: Intensive Care Unit
LFT	: Liver function test
MDR	: Multidrug-resistant
MRSA	: Methicillin-resistant *Staphylococcus aureus*
NS	: Nosocomial sinusitis
PCT	: Procalcitonin
PE	: Pulmonary embolism
TSH	: Thyroid stimulating hormone
VAP	: Ventilator-associated pneumonia

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INTRODUCTION

Fever frequently occurs in critically ill patients. Although fever is primarily a symptom of infection, it also occurs as a host's response to non-infectious inflammatory stimulus **(Lee et al., 2012)**. It complicates up to 70% of all intensive care unit (ICU) admissions and is often due to an infection or another serious condition **(Walter et al., 2016)**.

Fever is a common feature of infection, and the febrile response exerts a number of beneficial effects by fighting sepsis and enhancing chemotaxis, neutrophil migration, phagocytosis, antibody production, and T-cell proliferation **(Yamamoto et al., 2016)**.

Sepsis accounts for up to 74% of fever in hospitalized patients and of the remainder, malignancy, tissue ischemia, and drug reactions account for the majority. Neurogenic fever, and fevers associated with endocrinopathy are rarer **(Walter et al., 2016)**.

For all patients, all ICU temperature values during the entire ICU admissions were available. Measurement methods included pulmonary artery thermistor **(Lee et al.,**

2012), tympanic, axillary, per rectum, esophageal and bladder temperature probes. Fever was defined as a body temperature >38.0°C **(Suzuki et al., 2015)**.

The common practice of treating fever in patients with infection is challenged by studies showing that fever may enhance immune-cell function, inhibit pathogen growth, and increase the activity of antimicrobial drugs **(Young et al., 2015)** and by observational studies showing that higher early fever is associated with a lower risk of death among patients with an ICU admission diagnosis of infection **(Young et al., 2012; Saxena et al., 2015)**.

AIM OF THE WORK

The aim of this work is to study different causes of new fevers in intensive care unit (ICU) and to discuss the management of infectious and non-infectious cases of it in the ICU.

BODY TEMPERATURE REGULATION

1-Heat loss:

Body Temperature is controlled by balancing heat production against heat loss. When the rate of heat production is greater than the rate at which heat is being lost, heat builds up in the body & the body temperature rises. Conversely, when heat loss is greater, both body heat & body temperature decrease **(Marieb, 2009).**

Most of the heat produced in the body is generated in the deep organs, especially in the liver, brain, heart & skeletal muscles during exercise, then this heat is transferred from deeper organs & tissues to the skin, where it is lost to air & other surroundings. Therefore, the rate at which heat is lost is determined almost entirely by two factors; rate of conduction of heat from the core to the skin and rate of transferring of heat from the skin to the surroundings **(Guyton, 2006)**.

The rate of blood flow into the skin venous plexus can vary tremendously from barely above zero to as great as 30% of total cardiac output. A high rate of skin flow causes heat to be conducted from the core of the body to the skin with great efficacy. Whereas reduction in the rate of skin flow can decrease the heat production from the core to very little **(Costanzo, 2006).**

The skin is an effective controlled "heat radiator system" & the flow of blood to the skin is the most effective mechanism for heat transfer from the body core to the skin. **(Costanzo, 2006).**

Mechanisms of Heat Loss:

Heat is lost from the skin to the surroundings by radiation (60%), conduction (15%) & evaporation (22%) as shown in figure (1). **(Guyton, 2006)**

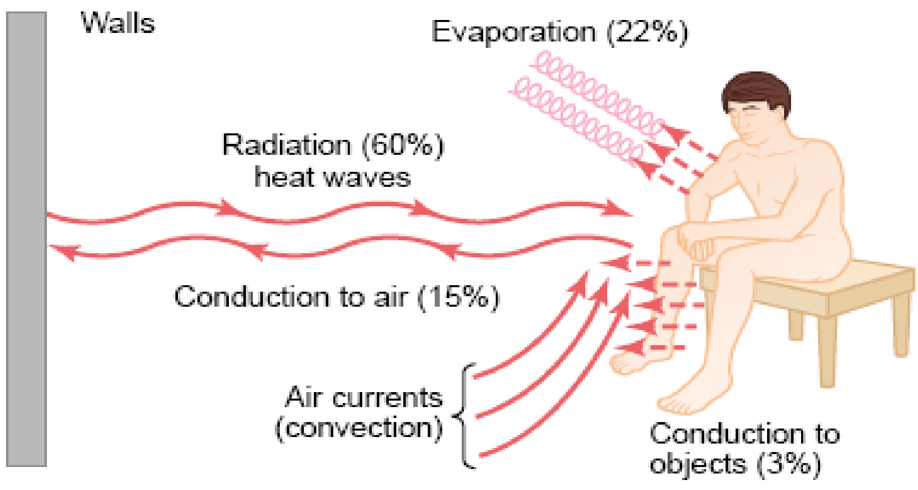

Figure (1): Mechanisms of heat loss from the body (Guyton, 2006).

1-Radiation: All objects that are not at absolute zero temperature radiate infra-red rays. The human body radiates heat rays in all directions, heat rays are also being radiated from the walls of the rooms & other objects towards the body. If the temperature of the body is greater than the temperature of the surroundings, a greater quantity of heat is radiated from the body than is radiated to the body **(Costanzo, 2006).**

2-Conduction: Only minute quantities of heat, (about 3%), are normally lost from the body by direct conduction from the surface of the body to solid objects, such as a chair or a bed. Loss of heat by conduction to air, however, represents a sizable proportion of the body's heat loss (a bout 15%) even under normal conditions **(Wenger, 2003).**

Heat is actually the kinetic energy of molecular motion & the molecules of the skin are continually undergoing vibratory motion. Much of the energy of this motion can be transferred to the air, if the air is colder than the skin, thus increasing the velocity of air molecules. Once the temperature of the air adjacent to the skin equals the temperature of the skin, no further loss of heat occurs in this way, because now an equal amount of heat is conducted from the air to the body. Therefore, conduction of heat from the body to the air is self-limited, unless the heated air moves away from the skin, so that, new unheated air is continually brought in contact with the skin, a phenomenon called "air convection" (**Raff ,2007).**

3-Convection: It is the transfer of heat resulting from the movement of a fluid, either liquid or gas. In thermal physiology, the fluid is usually air or water in the environment or blood in case of heat transfer in the body. Although conduction plays a role in this process, convection so dominates the overall heat transfer as that we refer to the heat transfer as if it is entirely convection. Therefore, the conduction term is restricted to heat flow between the body & other solid objects, & it usually represents only a small part of the total heat exchange with the environment **(Marieb, 2009).**

4-Evaporation: When 1 gram of water is converted into vapor at 30^{o}c absorbs (0.58 Kcal.). The latent heat of evaporation is thus an efficient way of losing heat & it is the body's only mean of losing heat when the environment is warmer than 36^{o}c **(Wenger, 2003)**