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Fever in Intensive Care Unit patients

An essay submitted for the partial fulfillment of the master degree in intensive care

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Ahmed Tolba,

Contents

Pages

List of Abbreviations

Abbreviation	Meaning
APR	Acute phase reaction.
ARDS	Acute Respiratory Distress Syndrome.
ATP	Adenosine Triphosphate.
BBB	Blood Brain Barrier.
°C	Celsius.
CAP	Community-acquired pneumonia.
CCU	Cardiac care unit.
CFU	Colony forming units.
CHCT	Caffeine halothane contracture test .
CM	Candida mannan.
CMV	Cytomegalo virus.
CNS	Central nervous system.
COX	Cyclooxygenase.
CPK	Creatinine Phosphokinase.
CRBSI	Catheter related blood stream infections.
CRP	C reactive protein.
CSF	Cerebrospinal fluid.
CT	Computerized tomography.
DNA	Deoxyribonucleic acid.
EIA	Enzyme immunoassay.

Abbreviation	Meaning
ELISA	Enzyme-linked immunosorbent assay.
EtCO2	End tidal carbon dioxide.
°F	Fahrenheit.
FC	Fragment, crystallizable.
GM	Galactomannan.
GIT	Gastrointestinal Tract.
HEV	High endothelial venules.
HS	Heat stroke.
HSF1	Heat shock factor-1.
HSPs	Heat shock proteins.
ICP	Intracranial pressure.
IL	Interleukin.
INF	Interferon.
Kcal.	Kilo calory.
LPS	Lipopolysaccharide.
MAO	Monoamine oxidase,
MDMA	3, 4-Methylendioxymeth- amphetamines.
MH	Malignant hyperthermia.
MRSA	Methicillin resistant staphylococcus aureus.
NK	Natural killer cell.
NO	Nitric Oxide.

Abbreviation	Meaning
NMS	Neuroleptic malignant syndrome.
NSAIDS	Non-steroidal anti-inflammatory drugs.
NST	Nucleus of tractus solitarius .
PAMPS	Pathogen associated molecular patterns
PCP	Pentachlorophenol.
PCT	Procalcitonin.
PFPF	Preformed pyrogenic factors .
PG	Prostaglandins.
PTH	Post traumatic hyperthermia.
SAH	Subarachnoid hemorrhage .
SIRS	Systemic inflammatory response syndrome.
SPP	Species.
SS	Serotonin Syndrome.
SSRIs	Selective serotonin re-uptake inhibitors.
STICU	Surgical and trauma intensive care unit.
TBI	Traumatic brain injury.
Tc	Core temperature.
Th	T helper cell.
TNF	Tumor necrosis factor.
TLR-4	Toll like receptors 4
TPN	Total parenteral nutrition.

Abbreviation	**Meaning**
TRP	Transient receptor potential.
Tset	Set point temperature.
VAP	Ventilator associated pneumonia.
WCC	White cell count.

List of tables

List of figures

Introduction

Fever is common in intensive care unit (ICU). Its incidence ranges from 28 – 70 % of patients in general ICU and from 23 – 47 % in neurosurgical and neurological ICU **(Kiekkas et al., 2008).** In many ICUs, patients with temperature of 38.3 ^{0}C or more are considered to be febrile and special attention is warranted if infection is present **(O'grady et al., 1998).**

The definition of fever is arbitrary and depends on the purpose for which it is defined. Some literature defines fever as a core temperature of 38.0°C, whereas other sources define fever as two consecutive elevations of 38.3°C. In patients who are neutropenic, fever has been defined as a single oral temperature of 38.3°C in the absence of an obvious environmental cause, or a temperature elevation of 38.0°C for 1 hr. A variety of definitions of fever are acceptable, depending on how sensitive an indicator of thermal abnormality an ICU practitioner wants to utilize. Because fever can have many infectious and non infectious etiologies, a new fever in a patient in the ICU should trigger a careful clinical assessment rather than automatic orders for laboratory and radiologic tests. A cost conscious approach for obtaining cultures and imaging studies should be undertaken if indicated after a clinical evaluation **(O'grady et al., 2008).**

Evaluating a new fever in a patient in the ICU should begin with thorough history and physical examination. The main objective of management of a febrile patient is to identify the cause and eliminate it **(Tabah et al., 2010).** Fever is a common response to sepsis in critically ill patients. It occurs when either exogenous or endogenous pyrogen affect prostaglandin E2 synthesis **(Ryan and Levy, 2003).**

In about half the ICU patients, fever is secondary to a developing infection, in which case, bacteriologic samples are obtained and empiric antimicrobial therapy is initiated. The antimicrobial treatment must be continuously assessed even when treatment appears successful. Medications should be reevaluated when the laboratory results become available **(Tabah et al., 2010).** Efforts must be made to identify the source of infection and the causative organism, which may be a resistant hospital pathogen Fever in the critically ill patient, is a marker of an underlying problem which needs to be unearthed and suitably dealt with, rather than reacting to an elevated body temperature in a knee jerk fashion **(Kothari and karnad, 2005)**.

An elevated body temperature may, however, be associated with a number of deleterious effects, most notably an increase in cardiac output, oxygen consumption, carbon dioxide production, and increase in BMR(basal metabolic rate). oxygen consumption increases by approximately 10% per degree Celsius. These changes may be poorly tolerated in patients with limited cardiorespiratory reserve. In patients who have suffered a cerebrovascular accident or traumatic head injury, moderate elevations of brain temperature may markedly worsen the resulting injury. Maternal fever has been suggested to be a cause of fetal malformations or spontaneous abortion **(Kothari and karnad, 2005)**.

Although nurses employ various techniques in attempting to cool critically ill patients, no guidelines have been established for the pharmacologic and physical treatment of fever. Although two newer physical antipyretic methods appear to be more effective at lowering temperature than conventional methods, they have significant drawbacks: one is highly invasive (endovascular cooling) and the other is associated with shivering (water circulating pads) **(Kiekkas et al., 2008).**

Temperature is the thermal state of an object **(Rajan and Rao, 2008)**. Normal body temperature is generally considered to be 37.0°C (98.6°F) with a circadian variation of 0.5°C to 1.0°C **(Marik, 2000).**

The definition of fever is arbitrary and depends on the purpose for which it is defined. The Society of Critical Care Medicine practice parameters define fever in the ICU as a temperature **>**38.3°C (≥101°F). Unless the patient has other features of an infectious process, only a temperature**>**38.3°C (≥101°F) warrants further investigation **(Marik, 2000).**

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 and body temperature decrease**(Marieb, 2009).**

Heat loss mechanisms:

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

Radiation is the transfer of heat by infrared electromagnetic radiation from one object to another at a different temperature with which it is not in contact. Because of radiation, an individual can feel chilly in a room with cold walls even though the room is relatively warm **(Barrett et al., 2010).**

Conduction is heat exchange between objects or substances at different temperatures that are in contact with one another. The rate at which heat is transferred from the deep tissues to the skin is called the tissue conductance**.** Conduction is aided by convection **(Barrett et al., 2010).**

Convection: 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 and other solid objects and it usually represents only a small part of the total heat exchange with the environment **(Marieb, 2009).**

Vaporization of water on the skin and mucous membranes of the mouth and respiratory passages. Vaporization of 1 g of water removes about 0.6 kcal of heat. A certain amount of water is vaporized at all times. This insensible water loss amounts to 50 ml/ h in humans. When sweat secretion is increased, the degree to