

Temperature measurement routs

Lect. 2

By

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Assessment of Vital Signs

Assessment of vital signs is one of the most important milestones of general examination. They are “vital” because they give a rapid and good general impression about the patient’s health status (When these values are not zero, they indicate that a person is alive)

The main vital signs are:

- Body Temperature
- Blood Pressure
- Pulse Rate
- Rate of Breathing (Respiration Rate)
- Recently, many studies have designated the pain as a fifth vital sign.

Body Temperature

- **Temperature** is the degree of sensible heat or cold, expressed in terms of a specific scale (Celsius, Fahrenheit, and Kelvin).
- **Body temperature** is the balance between the heat production due to chemical activities by the body and heat lost by the body through radiation, conduction, convection, and vaporization (evaporation).
- It is considered as a marker of endocrine, metabolic, or muscle activity; the response of the body to heat or cold in the environment ; or the presence of infection or inflammation.
- **Remember that** : While heat production in the body is called thermogenesis , heat loss to the environment is called thermolysis.

Types of Body Temperature:

- 1- Core Temperature
- 2- Surface Temperature

Core Temperature

- Is the temperature of deep tissues of the body (e.g. cranium, thorax and abdominal cavity) • It remains relatively constant (37°C) with range of $36.5\text{-}37.5^{\circ}\text{C}$.
- True core temperature can only be measured invasively , such as placing a temperature probe into the esophagus, pulmonary artery or urinary bladder. (المرئ , الشريان الرئوي, او المثانة)
- Non-invasive sites such as the rectum, oral cavity, axilla and external auditory canal are accessible and are believed to provide the best estimation of the core temperature.
(المواقع غير الغازية مثل المستقيم وتجويف الفم والإبط والقناة السمعية الخارجية)

Surface Temperature

- Is the temperature of the skin & the subcutaneous tissue.
- It rises and falls in response to the environmental changes.

Body Temperature Regulation

Why regulation of body temperature is required ?

- 1) The enzymes of the body work in optimal temperature.
- 2) Speed of chemical reaction varies with temperature.
- 3) Very low temperature leads to cardiac fibrillation and failure (Lower lethal core temperature is 26°C).
- 4) Very high temperature leads to heat stroke (Upper lethal core temperature is 43.5°C)

Variations in Body Temperature

Diurnal variation (circadian variation) of about 0.5°C :

Body temperature is lowest at about (6 a.m.) and highest in the evening.

Age:

Infants and children have a wider range of body temperature than adults, and elderly have a lower body temperature than others.

Monthly cycle in women:

during menstruation the average body temperature is at minimum, but during ovulation there is a rise in temperature.

Exercise: increases body temperature.

Emotional stress: increases body temperature.

Body Temperature

The average normal body temperature is 37°C with range of (36.6-37.2°C, or 97.8-99°F).

Hypothermia	< 35 °C
Subnormal	35-36.6°C
Normal	36.6-37.2°C (mouth)
Febrile	37.2-41.6° C
Hyperpyrexia	> 41.6° C

Condition with body temperature more than 37.2°C (100°F) is called **fever or pyrexia** and that with a temperature of less than 35°C is called **hypothermia**.

Hyperpyrexia is an extreme elevation of body temperature

Routes for Measuring Body Temperature

Body temperature can be measured from the mouth (Oral), axilla, rectum, groin, and tympanic membrane.

Oral Route

- It is the most convenient route for measuring body temperature, used for conscious adult patients.

Normally, it is 0.5°C lower than rectal temperature. It is affected by some factors as ingestion of hot/cold fluids and mouth breathing.

Axillary Route

- It is also convenient and used in practice usually for unconscious patients and for children. Normally, it is 0.5°C lower than oral body temperature and can be affected by environmental temperature changes.

Ear (Tympanic) Route

- Temperatures can be taken in the ear. A special thermometer can quickly measure the temperature of the ear drum, which reflects the body's core temperature (the temperature of the internal organs). Normal ranges: $36.8\text{-}37.3^{\circ}\text{C}$.



Rectal Route

- It is inconvenient route for measuring body temperature, but the most reliable route. The rectal temperature represents the temperature of the body core and is the least affected by environmental temperature . It is used in unconscious patients and in infants. Rectal temperature is normally 0.5°C higher than that of the oral route.



Groin Route

- It is convenient and usually used for children. It can be affected by environmental temperature and usually done by placing the bulb of the thermometer in the fold of the groin with the thigh held flexed on the abdomen. Groin temperature is 0.5° C lower than that of the oral route.

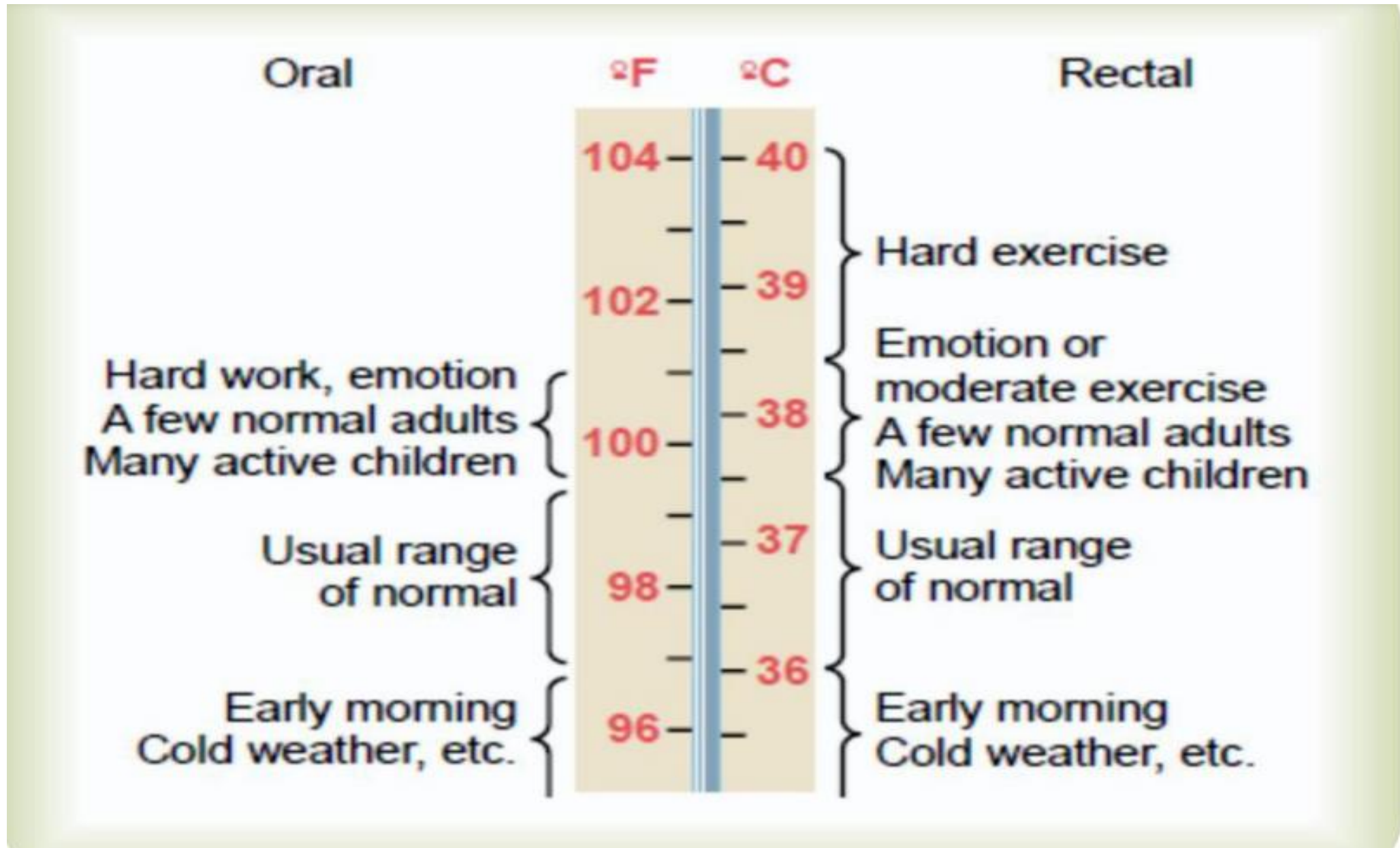


Forehead Route

- By skin. A special thermometer can quickly measure the temperature of the skin on the forehead. Range: 36.4-36.7°C.



Estimated Range of Body “Core” Temperature in Normal People



Fever

William Osler



Humanity has but three great enemies: fever, famine, and war; of these by far the greatest, by far the most terrible, is fever.

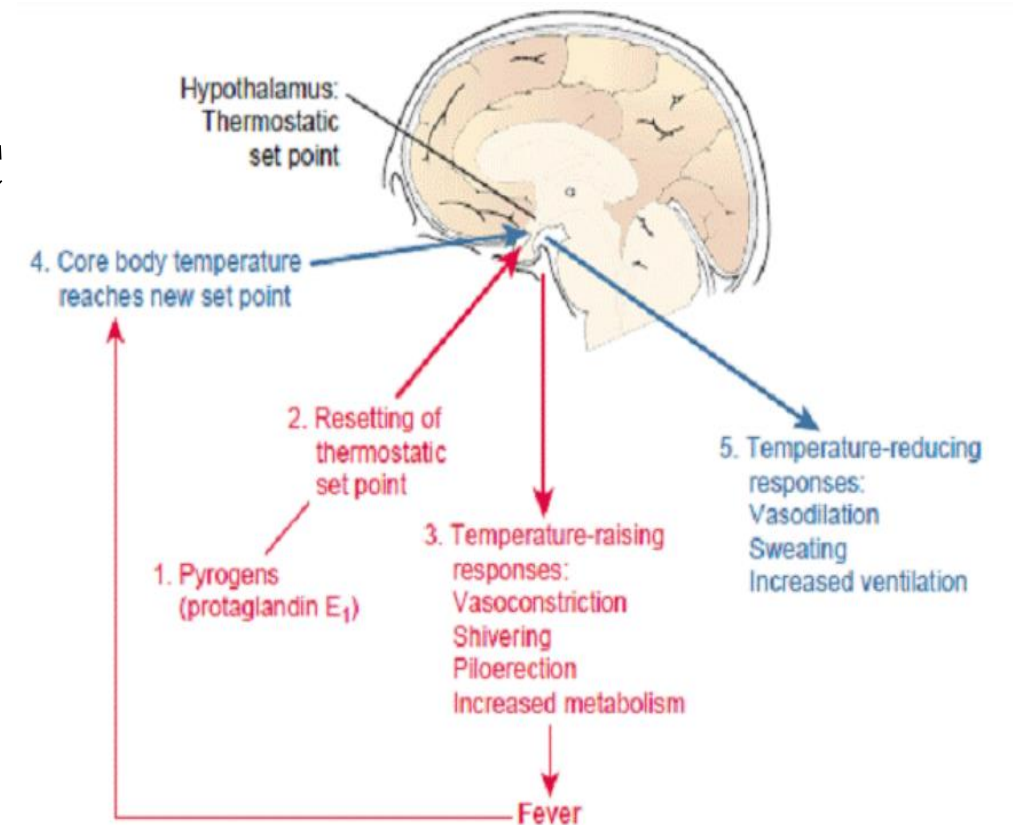
AZ QUOTES

Fever is an elevation of body temperature that exceeds the normal daily variation and occurs in conjunction with an increase in the hypothalamic set point (e.g., from 37°C to 39°C). [an A.M. temperature of >37.2°C (>98.9°F) or A P.M. temperature of >37.7°C (>99.9°F)]

The person who is having fever is indicated as **febrile**.

Fever can be categorized in different ways

- a. **Low grade fever** : above 37.1°C but below 38.2°C
- b. **High grade fever** : above 38.2°C.
- c. **Hyperpyrexia** : higher than 41.6°C



Causes of fever can be classified as followings :

Infections

A. Bacterial : typhoid fever , T.B. , pneumonia , brucellosis , meningitis , pyelonephritis

B. Viral : hepatitis A & B , measles , rubella , COVID-19etc

C. Parasitic : malaria , toxoplasmosis etc

D. Fungal.

Malignancies

• Leukemia , lymphoma , hepatoma , nephroblastoma etc .

Autoimmune

• SLE , rheumatoid arthritis , rheumatic fever , vasculitis Etc

الذئبة الحمراء والتهاب المفاصل الروماتويدي والحمى الروماتيزمية والتهاب الأوعية الدموية

Others

• Drug-induced fever , factitious fever

Hyperpyrexia

Hyperpyrexia is a fever with an extreme elevation of body temperature greater than or equal to 41.6 °C . Such a high temperature is considered a medical emergency as it may indicate a serious underlying condition or lead to significant side effects.

Causes :

1. Severe infection
2. CNS hemorrhage particularly pontine hemorrhage (most common cause) .
3. Lobar pneumonia
4. Thyroid crisis

Heat Stroke

Serious Condition, high environmental temperature , Overheating of body, impaired sweating, Hyperpyrexia (41°C or 106°F)

Symptoms:

- Headache
- Restlessness
- Mental confusion /Delirium
- Convulsions,
- CV collapse &
- COMA
- Death results if untreated
- Temperature to be brought down to 102°F with ice packs

Hypothermia

Hypothermia occurs when the body's core temp falls below 35°C. The very young are susceptible because they have poor thermoregulation and a high body surface area to weight ratio, but the elderly are at highest risk.

Hypothermia classified into: *Mild hypothermia* (35-32°C), *Moderate hypothermia* (32-28°C), and *Severe hypothermia* below 28°C.

Causes:

- a. Severe sepsis
- b. Cold injury
- c. Hypothyroidism

Hyperthermia

Hyperthermia is an example of high temperature that is not a fever. It characterized by unchanged (normothermic) setting of the thermoregulatory center in conjunction with an uncontrolled increase in body temperature that exceeds the body's ability to loss heat .

Causes:

1. Heatstroke, : exercise in high than normal heat and/or humidity.
2. Central nervous system stimulants such as amphetamines , cocaine , anticholonegic ... etc
3. Malignant hyperthermia .

Frostbite

Have you heard about frostbite?

- When the body is exposed to extremely low temperatures, surface areas can freeze; the freezing is called frostbite.
- It mostly occurs in the lobes of ears and in the digits of hands and feet.



Temperature With Consequences

- ▶ 40-44°C -- Heat stroke with multiple organ failure and brain lesions
- ▶ 38-40°C -- Hyperthermia (as a result of fever or exercise)
- ▶ 36-38°C -- Normal range
- ▶ 34-36°C -- Mild hypothermia
- ▶ 30-34°C -- Impairment of temperature regulation
- ▶ 27-29°C -- Cardiac fibrillation