1 Measuring body temperature

Introduction

- Normal body temperature ranges between 35.8 °C and 37.2 °C (depending on circadian variation and from which part of the body it is measured)
- Core temperature represents the balance between the heat generated by body tissues during metabolic activity, especially of the liver and muscles, and heat lost during various mechanisms
- Taken orally, temperature has been found to be 0.5–1 °C lower than when measured from the rectum
- The most widely used device to measure temperature is the infrared tympanic thermometer (Figure 1.1). This is inserted into the external acoustic meatus and measures the infrared radiation emitted from the tympanic membrane
- Temperature is regulated by the thermoregulatory centre in the hypothalamus through various physiological mechanisms, e.g. sweating, dilation/constriction of peripheral blood vessels and shivering

Figure 1.1 Electronic tympanic thermometer.

Medical Student Survival Skills: Procedural Skills, First Edition. Philip Jevon and Ruchi Joshi.

Companion website: www.wiley.com/go/jevon/medicalstudent

Indications

- Acute illness – part of the ABCDE approach
- Routine observations

Methods for measuring body temperature

- Tympanic thermometer (most commonly used method)
- Rectal thermometer (particularly in hypothermia)
- Oesophageal/nasopharangeal probes
- Bladder probe
- Pulmonary artery catheter

NB Important definitions:
- *Hypothermia*: <35 °C
- *Hyperthemia*: >37.5 °C

Procedure using an electronic tympanic thermometer

- Assemble equipment: electronic tympanic thermometer, new hygiene probe, and waste bag
- Identify correct patient
- Introduce yourself to the patient
- Explain procedure to the patient and gain consent
- Ascertain which ear was used for previous readings
- Wash hands
- Turn on electronic thermometer and attach new hygienic probe cover following manufacturer's recommendations
- Gently pull back the pinna upwards and backwards and insert the thermometer in the external acoustic meatus (Figure 1.2)
- Press the button on the device to measure the temperature and a reading should appear
- Remove the thermometer from the ear canal and then dispose of the hygiene probe into the waste bag
- Wash hands
- Document information on temperature chart of correctly identified patient including time and date taken

- Clear away equipment and ensure that the electronic tympanic thermometer is stored following the manufacturer's guidelines

Figure 1.2 Inserting an electronic tympanic thermometer.

OSCE Key Learning Points

Good practice

- ✔ Wash and dry hands
- ✔ Use the same ear for consecutive measurements
- ✔ Install a new disposable probe cover for each measurement
- ✔ Ensure thermometer probe is positioned snugly in the external auditory meatus
- ✔ Aim thermometer towards the tympanic membrane
- ✔ Measure the patient's temperature following manufacturer's instructions
- ✔ Consider the temperature reading alongside other systemic observations and overall condition of the patient
- ✔ Store the thermometer following manufacturer's instructions

Mechanisms of heat loss

- *Radiation*: flow of heat from a higher temperature (the body) to a lower temperature (environment surrounding the body)
- *Convection*: heat transfer by flow or movement of air
- *Conduction*: heat transfer due to direct contact with cooler surfaces
- *Evaporation*: perspiration, respiration, and breaks in skin integrity

Factors that can cause a fluctuation in body temperature

- The body's *circadian rhythms*: temperature is higher in the evening than the morning; the difference can be as much as 1.5 °C. If temperature is being recorded every 4–6 hours, the optimum time for detecting a pyrexia is probably between 7 and 8 p.m.
- *Ovulation*
- *Exercise* and *eating* can cause a rise in temperature
- *Old age*: there is an increased sensitivity to cold and there is generally a lower body temperature
- *Illness*, e.g. sepsis

NB The tympanic membrane shares the same carotid blood supply as the hypothalamus; measurement of the tympanic membrane temperature therefore reflects core temperature.

Common misinterpretations and pitfalls

Care should be taken when using the tympanic thermometer as poor technique can render the measurement inaccurate. Temperature differences between the opening of the ear canal and the tympanic membrane can be as much as 2.8 °C.

NB Ear canal size, wax, operator technique, and the patient's position can affect the accuracy of the measurements.

Causes of pyrexia

- Infection
- Hyperthyroidism
- Malignancy
- Drug allergy
- Surgery – tissue damage
- Damage to the central nervous system
- Allergic reaction to blood transfusion
- Heat stroke

Common misinterpretations and pitfalls

- Pyrexia in response to infection is a protective mechanism. It inhibits bacterial and viral growth, promotes immunity and phagocytosis, and through hypermetabolism promotes tissue repair. Mild pyrexia is generally not treated
- Care should be taken to ensure the same method/site for recording temperature is used to help ensure the recordings are reliable