VITAL SIGNS

Introduction

Vital signs (from Latin *signa vitae*) are measurements of the body's most basic functions. The four main vital signs routinely monitored are:

1. Body temperature
2. Pulse
3. Respiration
4. Blood pressure

These measurements are taken to help assess the general physical health of a person, give clues to possible diseases and show progress toward recovery.

Vital signs can be measured in a medical setting, at home, at the site of a medical emergency or elsewhere. Measurement of vital signs is a routine part of any physical examination.

Body temperature

The temperature should always be recorded as part of the initial clinical examination of the patient. The normal body temperature ranges from 36.6°C to 37.2°C. In very hot weather the temperature may rise up to 0.5°C higher. Fever is defined as a morning oral temperature of >37.2°C (>98.9 °F) or an afternoon oral temperature of >37.7°C (>99.9°F). A temperature between 37.3°C and 38°C is classified as a 'low-grade fever', between 38.1°C and 39°C a moderate-grade fever and between 39.1 and 41°C a 'high- grade fever'. Temperatures above 41°C are referred to as hyperthermia or hyperpyrexia and are very serious, i.e., may result in death. Causes include: heat stroke from exposure or excessive exertion, for example in marathon runners; intracranial haemorrhage; malignant hyperthermia (a group of genetically determined disorders in which hyperpyrexia occurs in response to various anaesthetic agents or muscle relaxants); neuroleptic malignant syndrome; infections and hypothalamic disease.

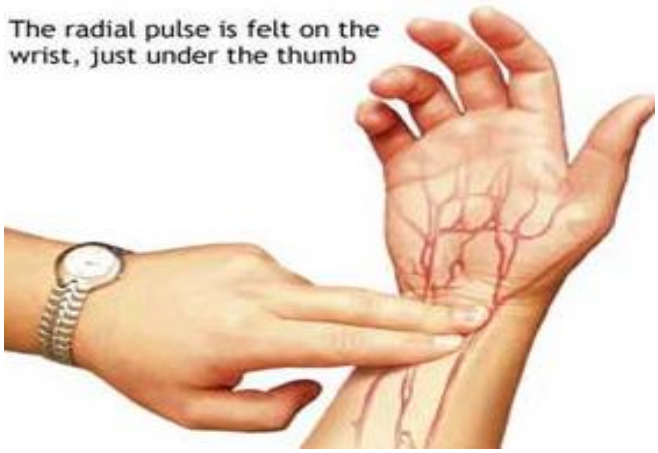
Body temperature is measured using temperature devices inserted on or into the rectum, mouth, axilla, skin, or ear. Some devices (laryngoscopes, bronchoscopes, rectal probes) may have temperature-sensing probes that can record temperature continually. The most common way to measure body temperature was (and still is in many countries) with a mercury thermometer; because of glass breakage and the possibility of subsequent mercury contamination, many developed countries use digital thermometers with disposable probe covers to measure temperature from all of the body sites listed above. Disposable temperature-sensitive strips that measure skin temperature are also used.

Oral temperatures are most commonly measured in adults, but rectal temperatures are the most accurate because environmental factors that increase or decrease temperature measurements have the least effect on the rectal area. The oral temperature is normally lower than the rectal temperature by 0.5°C to 0.7°C. Axillary temperature may be 0.5°C lower than the oral reading. There is a diurnal variation; body temperature is lowest in the morning and reaches a peak between 6:00 and 10:00pm. The pattern of the fever may be helpful in diagnosis.

Hypothermia is defined as a temperature less than 35°C. Normal thermometers do not record below 35°C and therefore special low- reading thermometers must be used where hypothermia is suspected. Causes of hypothermia include: prolonged exposure to cold and hypothyroidism.

Pulse

Pulse rate refers to the number of heart beats per minute. It can be measured centrally or peripherally. When palpated, the pulse is felt best where the artery can be compressed against bone: inside of neck (carotid artery), inside of elbow (brachial artery), inside or wrist (radial artery), behind the knee (popliteal artery), behind the ankle (posterior tibial artery) and top of the foot (dorsal foot artery). The radial artery is most commonly palpated and is felt just medial to the radius using the forefinger and middle finger pulps of the examining hand (Figure 1). The following observations should be made: 1) rhythm of the pulse; 2) rate of the pulse and 3) character of the pulse. The character and volume of the pulse are better assessed from palpation of the brachial or carotid arteries. The brachial pulse is palpated in the antecubital fossa, medial to the biceps tendon. The biceps tendon is best located with the elbow slightly flexed. The carotid pulse is palpated medial to the sternomastoid muscles. Both carotid arteries should never be palpated together since they provide much of the blood supply to the brain.



The normal resting heart rate in adults is between 60 and 100 beats per minute. Formal counting over 30 seconds, multiplied by two, is an accurate way of determining the heart rate. *Bradycardia* (Greek *bradus* slow, *kardia* heart) is defined as a heart rate less than 60 beats per minute and is due to a variety of causes including physiological, drugs, hypothyroidism, hypothermia, arrhythmia. *Tachycardia* (Greek *tachus* swift, *kardia* heart) is defined as a heart rate over 100 beats per minute and can be cause by a hyperdynamic circulation, drugs, arrhythmias etc.

The rhythm of the pulse can be regular or irregular. An irregular rhythm can be completely irregular with no pattern or it can be regularly irregular.

Respiration

The respiration rate is the number of breaths a person takes per minute. The rate is usually measured when a person is at rest and simply involves counting the number of breaths for one minute by counting how many times the chest rises. Normal respiration rates for an adult person at rest range from 12-16 breaths per minute. Respiration rates may increase with fever, illness, exercise, etc. When checking respiration, it is important to also note whether a person has any difficulty breathing. *Dyspnoea* (Greek *dys*, bad and *pnoia*, breathing), or shortness of breath, is often defined as an unexpected awareness of breathing. *Tachypnoea* refers to a rapid respiratory rate. Look to see whether the accessory muscles of respiration are being used. These muscles include the sternomastoids, the platysma, intercostal muscles and the strap muscles of the neck. Characteristically the accessory muscles cause elevation of the shoulders with inspiration and aid respiration by increasing chest expansion.

Blood pressure

Measurement of the arterial blood pressure is essential. Usually indirect measurements are obtained with a sphygmomanometer (Greek *sphygmos*, pulsing and *manos*, thin). The systolic blood pressure is the peak pressure that occurs in the artery following ventricular systole and diastolic blood pressure is the level to which the arterial blood pressure falls during ventricular diastole. It is expressed in millimetres of mercury (mmHg) or kilopascals (kPa). Normal blood pressure is at or below 120/80mmHg. It may normally vary between arms by up to 10mmHg. It should be taken in a lying and standing position. A fall in blood pressure or more than 15mmHg (systolic) or 10mmHg (diastolic) on standing is abnormal (postural hypotension).

The usual blood pressure cuff width is 12.5cm. This is suitable for a normal-sized adult forearm. However, in obese patients, the normal -sized cuff will overestimate the blood pressure and therefore a large cuff must be used. Smaller sizes are available for children.

When measuring a patient's blood pressure ensure the patient is relaxed and has been seated for at least 5 minutes. Explain the procedure to the patient. Check that the patient is not wearing any tight clothing on their arm. Ask the patient to be still and quiet while you are measuring their blood pressure. The patient's arm should be supported at the level of the heart. The cuff is wrapped around the upper arm (snugly, while still allowing enough room for one fingertip to slip under it) with the bladder centred over the brachial artery. The bottom edge of the cuff should be at least 2 cm above the crease in the elbow. Ensure that at least 80% of the upper arm is encircled with the indicator mark on the cuff over the brachial artery. Inflate the bladder whilst palpating the radial or brachial pulse to estimate the systolic (when the pulse disappears) blood pressure. Then for a more accurate measurement of the blood pressure, inflate to 30mmHg above the estimated systolic whilst listening to the brachial pulse using the diaphragm of the stethoscope, deflating by 2-3 mmHg/sec until

pulsation is audible (systolic) then disappears (diastolic). Record your findings. Don’t forget to disinfect the stethoscope diaphragm before and after use.

Literature

- Clinical Examination: *A Systematic Guide to Physical Diagnosis*, 7th Edition, Talley & O'Connor (available from the Book Depository)
- Šimunović V.J. (ed.): *Basic & General Clinical Skills*. Charlestone, SC, USA; CreateSpace Independent Publishing Platform: 2013
- Power Point presentations
- Departmental script (available on website)