Assessing the pulse rate in adult patients

Learning points...
› Finding the main pulse sites in adults
› Accurately assessing the different pulses
› Factors that can affect pulse rate

Cells require a constant supply of oxygen and nutrients, and must continuously remove waste products such as carbon dioxide. It is the function of the circulatory system to transport nutrients, oxygen, carbon dioxide, waste metabolites and hormones throughout the body.

The circulatory system consists of the heart, blood vessels and blood. The heart acts as a pump to generate blood pressure, which drives blood through the vessels. Arteries - thick-walled vessels - carry blood away from the heart at high pressure. The larger arteries have elastic fibres within their walls that enable them to stretch momentarily as they fill with blood when the heart contracts and pumps blood around the body. These elastic arteries then recoil as the heart relaxes.

What is the pulse?
The momentary stretching and relaxing of the arteries occurs with each heartbeat – this is what is felt as the pulse, and should have regular and consistent rhythm. The pulse starts in the aorta (for the systemic system) and spreads as a “pulse wave”, which travels through all the arteries. The farther away from the heart the artery is located, the fainter the pulse, because the energy of the pulse becomes dissipated as it moves through the arteries. By the time blood reaches the capillaries, there is no longer a pulse, and pulses cannot be felt in the veins that return blood to the heart.

The pulse is a pressure wave in the arterial wall. If an artery wall is pressed at a pulse point, the pulse of pressure in the arterial wall can be felt as blood is squeezed along with each contraction of the heart. The pulse, therefore, occurs with each heartbeat; the frequency, or rate, at which it is felt indicates the rate at which the heart is beating (the heart rate).

The strength (or amplitude) of the pulse depends on the volume of blood squeezed out of the heart with each beat; this is called the stroke volume. The strength of the pulse is also influenced by the extent of elasticity of the artery wall. The arteries become stiffer with age – this is called atherosclerosis – and the extent to which they can stretch with each pulse reduces.

Heart anatomy and function
The heart rate and stroke volume determine the cardiac output – the volume of blood pumped out of the heart each minute. As may be expected, cardiac...
output must be maintained at all times for the circulation to continue. Heart rate, and therefore pulse rate, depends on a number of physiological factors.

Muscle tissue requires an electrical signal to contract. For the skeletal muscles, which are used to move limbs and to alter posture, this electrical signal comes from peripheral nerves; however, the myocardium – which is the muscle that makes up most of the heart – can generate its own signal.

This signal comes from the sinoatrial node (more commonly called the pacemaker), which is a patch of specialised tissue in the right atrium. It constitutes a wave of electrical activity and spreads across the atria and then, after a short delay at the atrioventricular node, travels down the bundle of His (specialised heart muscle cells that transmit electrical impulses) and across the ventricles. This causes the atria to contract together to pump blood into the ventricles. The ventricles then contract, producing the pressure to squeeze blood from the heart. The electrical signal is carried through the heart muscle by the heart’s conduction system. The energy is known as synergy because each action results in another, like a line of dominoes. The electrical activity of the heart can be picked up on an electrocardiogram and displayed as an electrocardiograph.

The pacemaker has a natural rate, which is around 90 beats per minute. This natural pacemaker-generated heart rate is faster than the normal resting heart rate. At rest, something slows the heart rate down; to understand this, the other factors that affect heart rate must be considered.

The heart is supplied with nerve fibres from the autonomic nervous system, which has two divisions:
- The sympathetic nervous system;
- The parasympathetic nervous system.

In general, the actions of these two divisions oppose each other. The sympathetic nervous system causes the heart rate to increase and increases the force at which the heart contracts, while the parasympathetic system causes the heart rate to decrease. This dual nerve supply enables the heart rate to be carefully regulated. At rest, the parasympathetic nerve stimulation predominates and acts to slow the heart rate from its natural pacemaker rate. Many factors will activate the sympathetic nervous system to cause an increase in heart rate (and therefore pulse rate), including:
- Exercise;
- Pain;
- Infection;
- Anxiety and other forms of stress (exams, interviews);
- Excitement.

Several hormones also affect the heart rate; one of these is adrenalin, which is commonly recognised. This is produced from the adrenal glands after sympathetic nerve stimulation. Adrenalin acts in the same way as the sympathetic nervous system and will speed up the heart rate, increasing the force of contraction. This may produce a rapid, bounding pulse.

**Assessing the pulses: what to look for**

A normal adult pulse will beat regularly between 60 and 100 times each minute at rest; in babies and children they are much faster. Pulses are usually easily palpable; patients with a weak or unstable pulse should be assessed further; weak pulses indicate reduced cardiac output and can progress to deterioration, for example fainting, or perhaps a more serious problem.

The rhythm of the pulses should be regular and consistent; unstable or irregular pulses indicate irregular contractions of the heart and should be referred to a senior clinician. A strong, bounding pulse indicates high blood pressure.

It is important that any deviations from the norm can be easily explained. As mentioned, pain, stress or exertion will increase the pulse rate, but it should return to normal when the underlying trigger is abated. A slower-than-normal pulse can result from some medications, for example digoxin and beta-blockers, and may also be present in people who are accustomed to strenuous activity. In the case of very fit people, a slower pulse results from their heart capacity being enlarged, and therefore needing to beat fewer times to circulate the blood adequately. Required competencies and documentation are listed in Box 1.

**Main pulses**

There are many pulses in the body but the main ones are:
- Carotid;
- Brachial;
- Radial;
- Femoral;
- Posterior tibial;
- Dorsal pedal.

When assessing any pulse, the site being assessed should ideally be level with, or below, the level of the heart. If the site is above the heart, blood is travelling upwards and so the pulse might be less easy to palpate. Some people have stronger palpable pulses on one side than the other so if you experience difficulty feeling a pulse, try the opposite side.

Pulse assessments must always be accurately documented, and any deviations from the norm reported. Providing they are conscious and competent, a patient’s consent must be gained before a pulse assessment is undertaken.

**Carotid pulse**

The landmark for this pulse is the anterior triangle. This is formed by the mandible, trachea and muscle. The carotid pulse is located in front of the sternocleidomastoid (Fig 1) and is sometimes deeper than anticipated. When locating this pulse, the

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**Box 1. Required competencies and documentation**

Nurses must be able to:
- Identify key anatomical sites – this makes it easier to access sites and maximises the potential for a safe assessment
- Obtain informed consent
- Ensure the patient is relaxed and the relative position of the chosen site is equal to, or lower than, the level of the heart

When assessing a patient’s pulse, the following must always be documented:
- Time
- Pulse rate
- Pulse quality

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patient's head should be in a comfortable position that requires no hyperextension. It is important to assess this pulse on one side only and move the fingertips progressively towards the anticipated site of palpation. Caution must be exercised when assessing the carotid pulse due to the proximity of the carotid sinus – stimulation of the carotid sinus can result in a reduced pulse rate, which will be undesirable for a patient with bradycardia, for example.

Brachial pulse
This pulse is commonly used when manually assessing blood pressure. The main site is at the brachial plexus, in line with the biceps tendon. The patient's arm should be extended, with the palm facing upwards. Find the medial aspect of the volar forearm, close to the elbow joint and ulnar styloid (Fig 2).

Radial pulse
To find the radial pulse, trace the thumb to its base and to where the radial bone begins at the wrist. On the volar/palmar aspect is the radial styloid – the thickened bone at the distal end of the radius. Applying excess or insufficient pressure will make it difficult to feel the pulse; the ideal pressure is equal to the weight of the hand and wrist, which will happen automatically when the correct position is adopted and the pulse felt for.

To achieve the correct position, place two fingertips directly alongside the radial styloid, just to the inside (Fig 3). Turn the patient's hand over to allow it to hang from your fingertips. Ensure the patient's arm is relaxed, so you are supporting the weight of hand and wrist on your fingertips. If the patient has cold hands a radial pulse may be difficult to palpate because of reduced peripheral circulation. Similarly, if blood pressure is very low, the peripheral circulation will be compromised.

Femoral pulse
The femoral artery lies midway between the pubic symphysis and the anterior superior iliac spine (Fig 4). Maximal pulsation of the femoral artery occurs immediately below the level of the inguinal ligament. Use the pads of your fingertips to press on this area. If there is a lot of subcutaneous fat you will need to press more firmly, however take care not to compress the artery too much or the pulse will not be felt.

Posterior tibial pulse
Locate the inner ankle (medial malleolus) and feel 2-3cm behind and below it (Fig 5). The posterior tibial pulse is deeper than the dorsal pedal pulse and requires more concentration to locate and assess.

Dorsal pedal pulse
To find the dorsal pedal pulse, trace a line between the medial and lateral malleoli towards the first toe. The pulse is located between the malleoli and can be found about a third of the distance from there and towards the first toe (Fig 6).

Conclusion
Pulse assessment is a key element of healthcare and is used to indicate a patient’s health status. It is, therefore, vital that nurses feel confident in their ability to accurately locate and measure the pulses. There are many pulses throughout the body and as well as being able to locate them, nurses must be aware of the factors that can affect pulse rate so these can be taken into consideration.

Once the selected pulse sites have been located and the pulse rate taken, it must be documented accurately. The patient must always be referred to another healthcare practitioner if any abnormality is detected.

For more on this topic go online...
- Effect of recording site on pulse oximetry readings
- Bit.ly/NTPulseOximetry

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FIG 2. BRACHIAL PULSE
FIG 3. RADIAL PULSE
FIG 4. FEMORAL PULSE
FIG 5. POSTERIOR TIBIAL PULSE
FIG 6. DORSAL PEDAL PULSE