How to measure capillary refill time in patients who are acutely ill

Capillary refill time (CRT) is a measure of the time it takes for a distal capillary bed, such as those found in the fingers, to regain colour after pressure has been applied to cause blanching. A prolonged CRT may indicate the presence of circulatory shock.

Tissue perfusion is dependent on an adequate blood pressure in the aorta which, in turn, is determined by the product of two factors:

- Cardiac output – the amount of blood ejected from the left ventricle in one minute;
- Peripheral resistance.

Cardiac output is determined by the heart rate and stroke volume.

Normal and prolonged CRT

CRT is part of the circulation (C) component of the ABCDE approach (Bit.ly/RCUKABCDEApproach), which is used to assess and treat patients who are acutely ill. However, its reliability has been questioned as there is very little research data to confirm validity (Shinzaki et al, 2019; Lewin and Maconochie, 2008).

The normal CRT is <2 seconds; a CRT of >2 seconds suggests poor peripheral perfusion and may be an early sign of shock (Hernández et al, 2020; Bit.ly/RCUKABCDEApproach). However, several other factors can cause a prolonged CRT, including:

- Peripheral vascular disease;
- Hypothermia;
- Cold ambient temperature;
- Poor lighting;
- Old age (Bit.ly/RCUKABCDEApproach).

Accurate timing of CRT is difficult: Fleming et al (2016) advised using a watch or clock to help measure CRT, but this can be difficult in practice as CRT is measured over a very short period of time. Some nurses count in thousands with each number (1,000, 2,000, 3,000) equating to a second but this approach may not be performed consistently between staff.

It is important to interpret CRT in the context of a comprehensive assessment of circulation, which should include:

- Pulse rate;
- Pulse volume;
- Blood pressure;
- Level of consciousness;
- Skin colour/temperature/texture;
- Urine output;
- Other clinical findings from the ABCDE assessment.

Shock

Shock is defined as life-threatening, generalised form of acute circulatory failure with inadequate oxygen delivery to the cells (Rhodes et al, 2016; Cecconi et al, 2014); this results in impaired basic metabolic functions of cells and organs (Bit.ly/BMJBPShock). Hypoperfusion of the tissues triggers a systemic stress response, including tachycardia and peripheral vasoconstriction; once these physiological compensation mechanisms are overwhelmed, organ dysfunction, organ failure, irreversible organ damage and death may ensue (Bit.ly/BMJBPShock).

Shock classifications are outlined in Box 1, with clinical features given in Box 2.

It is important to remember that hypotension is not a prerequisite for diagnosing shock because compensatory mechanisms such as vasoconstriction – which diverts blood from the peripheral circulation to the vital organs – can preserve blood pressure in the short term (Van Genderen et al, 2013). As a consequence, patients in shock may exhibit adverse changes in CRT before a fall in blood pressure is detected.

CRT is a marker of peripheral perfusion and an abnormal CRT in patients with septic

Box 1. Classifications of shock

- Hypovolaemic shock – loss of circulating volume due to, for example, severe haemorrhage
- Cardiogenic shock – caused by pump failure, usually secondary to an acute myocardial infarction. Other causes include cardiac arrhythmias, such as fast atrial fibrillation and complete heart block
- Distributive shock – there are three types of distributive shock:
  - Neurogenic – causes include damage to the spinal cord or the brain stem
  - Anaphylactic – caused by an allergic reaction to a drug or substance
  - Septic – caused by an infection
- Obstructive shock – caused by a circulatory obstruction, such as pulmonary embolism, tension pneumothorax and cardiac tamponade

Sources: Cecconi et al (2014); Soni and Watson (2011)

Box 2. Shock: clinical features

- Tachypnoea
- Tachycardia
- Hypotension
- Pallor
- Cool peripherals
- Mottled skin
- Peripheral cyanosis
- Delayed capillary refill time
- Oliguria
- Altered level of consciousness and confusion

Sources: Ceccconi et al (2014); Jevon et al (2012)
Fig 1. **Positioning the patient**

Position the patient’s hand to the level of the heart

Fig 2. **Application of cutaneous pressure**

Apply pressure to the patient’s fingertip for five seconds

Fig 3. **The sternum: an alternative site to check CRT**

An alternative site for measuring the CRT is the sternum (Fig 3). This site is frequently used in emergency departments, especially in winter when patients may come from a cold environment, which affects the accuracy of CRT.

Procedure for measuring CRT

This procedure is usually undertaken alongside other systemic observations.

1. Explain the procedure to the patient and obtain informed consent.
2. If required, screen the bed to maintain the patient’s privacy and dignity.
3. Decontaminate your hands according to local policy.
4. Position the patient comfortably and elevate their hand to the level of their heart (or slightly higher) (Fig 1). This will ensure that perfusion of the arteriolar capillaries carrying oxygenated blood, rather than venous stasis, is being assessed.
5. Apply cutaneous pressure to the fingertip for five seconds (Fig 2). The pressure applied should be enough to cause blanching as the blood is dispelled from the tissue.
6. Release the pressure.
7. Time how long it takes for the skin to return to the same colour as the surrounding tissues.
8. Consider any of the factors mentioned earlier in the article that may influence CRT.
9. Decontaminate your hands.
10. Document the CRT measurement in seconds, the site where it was undertaken and any factors that may have influenced the reading. This will help to ensure standardisation and interpretation of repeated measurements.

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**References**


