



# Sepsis Part 2: Recognition

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Mortality from sepsis decreases with early recognition and treatment. It is vital that recognising, screening for and treating sepsis is done rapidly to increase the chance of survival (Guirgis, 2017; UK Sepsis Trust, 2017). In the UK, the focus is now on the use of the National Early Warning Score (NEWS) 2 and identification of high-risk criteria ("red flags") (RCP, 2017; NICE, 2017a).

Taking observations such as respiratory rate, pulse, blood pressure and temperature, is critical in the detection of sepsis in all healthcare settings (NHS, 2015). Detecting sepsis in primary care can be difficult due to the lack of a laboratory service. The Royal College of General Practitioners (RCGP) has produced a sepsis toolkit, which includes a screening tool to help healthcare professionals in primary care identify and manage the condition (RCGP, 2016). In hospital, healthcare professionals use the NEWS 2 to identify and assess patients who may be deteriorating. National guidance (NCEPOD, 2015) recommends that, in addition, all hospital trusts have a sepsis screening tool in place for the consistent early identification and management of sepsis.

Symptoms present differently in adults and children. There is no single sign for sepsis; symptoms may resemble influenza, gastroenteritis or lower respiratory tract infection (UK Sepsis Trust, 2019). Patients who have received anti-cancer therapy in the past 6 weeks and who present feeling unwell or have a suspected source of infection, even in the absence of other clinical signs, should be treated for suspected sepsis. Any patient presenting with any one of the red flags shown in the table below should be suspected of having sepsis, triggering the Sepsis Six care bundle (UK Sepsis Trust, 2017), as outlined in Part 3 of this series. This procedure outlines the red flags in detail, following the ABCDE structure of assessment as in the NEWS 2 chart (RCP, 2017). It should be read in conjunction with part 1 of this series on possible causes and high-risk groups, and part 3 on sepsis management.

The absence of red flags does not mean that a patient is well. The amber flags (moderate- to high-risk criteria) shown below will identify those patients at moderate risk of deterioration. If present, healthcare professionals should consider further assessment and closer monitoring, or transfer to hospital if patients are being cared for in the community (NICE, 2017a). In the hospital setting, NICE (2017b) recommends that with any two or more amber flags, staff should send blood tests for analysis and ask a senior clinician to review the patient.

Perform a structured set of observations and a physical examination if sepsis is suspected. Base the criteria and risk on the patient's age, and consider the use of an early warning score. It is important to monitor patients suspected of having sepsis continuously or at least every 30 minutes (NICE, 2017a).

## Sepsis red flags

- Patients who respond only to voice or pain or are unresponsive;
- Patients who present in an acutely confused state;
- Systolic blood pressure  $\leq 90$  mmHg (or  $>40$  mmHg below normal);
- Heart rate  $>130$  beats per minute;
- Respiratory rate  $\geq 25$  breaths per minute;
- Oxygen required to keep  $\text{SpO}_2 \geq 92$  per cent ( $>88$  per cent in COPD);
- A non-blanching rash, mottled/ashen/cyanotic;
- No urine passed in the past 18 hours or a urine output  $<0.5$  mL/kg/h;
- Blood lactate level  $\geq 2$  mmol/L;
- Recent chemotherapy.

## Perform observations and physical examination

NEWS key		FULL NAME: Jill Payne												
		DATE OF BIRTH: 21/05/1989										DATE OF ADMISSION:		
		DATE	TIME										DATE	TIME
<b>A+B</b>														
Respirations														
Breathless														
	a≥25	3												
	21-24	2												
	18-20	20												
	15-17													
	12-14													
	9-11													
	s≤8	3												
<b>A+B+C</b>														
SpO <sub>2</sub> Scale 1														
Gauge saturation (%)														
	≥96	3												
	94-95	1												
	92-93	2												
	s≤91	3												
SpO <sub>2</sub> Scale 2														
Gauge saturation (%)														
	≥97 on O <sub>2</sub>	3												
	95-96 on O <sub>2</sub>	2												
	93-94 on O <sub>2</sub>	1												
	≤92 on O <sub>2</sub>													
	SpO <sub>2</sub> <92% and respiratory failure													
	ONLY use Scale 2 unless directed by a qualified clinician													
Air or oxygen?														
Air	A-Air	3												
O <sub>2</sub> /min	O <sub>2</sub> /min	2												
Device	Device													
<b>C</b>														
Blood pressure														
measured using a sphygmomanometer														
	a≥220	3												
	201-219													
	181-200													
	161-180													
	141-160													
	121-140													
	111-120													
	101-110	1												
	91-100	2												
	81-90	3												
	71-80													
	61-70													
	51-60													
	s≤50													
<b>C</b>														
Pulse														
Breathless														
	a≥131	3												
	121-140	2												
	111-120	1												
	101-110	2/3												
	91-100	1												
	81-90													
	71-80													
	61-70													
	51-60													
	41-50	1												
	31-40	3												
	s≤30													
<b>D</b>														
Alert	A													
Confusion	V													
Consciousness	P													
loss of contact (no awake in device)	U													
	≥39.1°													
	38-39.0°	2												
	37-38.0°	1												
	36-37.0°													
	35.1-36.0°	1												
	<35.1°	3												
<b>NEWS TOTAL</b>		5												
Monitoring frequency	1 <sup>st</sup>													
Escalation of care Y/N	Y													
Initials	W													
	Monitoring													
	Escalation													
	Initials													

National Early Warning Score 2 (NEWS2) ©Royal College of Physicians

The NEWS 2 helps to identify patients at risk of deterioration: a score of 5 or above should always prompt a sepsis screen and an immediate check for any red flags; check local guidelines which may specify a lower score (RCP, 2017; UK Sepsis Trust, 2017). See clinicalskills.net procedure, "A–G assessment".

## Sepsis amber flags

- Relatives concerned about mental status;
- Acute deterioration in functional ability;
- Immunosuppressed;
- Trauma/ surgery/ procedure in last 6 weeks;
- Respiratory rate 21–24 or breathing hard;
- Heart rate 91–130 or new arrhythmia;
- Systolic blood pressure 91–100 mmHg;
- Not passed urine in past 12–18 hours;
- Temperature  $<36^\circ\text{C}$ ;
- Clinical signs of wound, device or skin infection.

## Sepsis Part 2: Recognition Page 2

### Recognising sepsis: (a)

#### RED FLAG Respiratory rate of 25 or more per minute

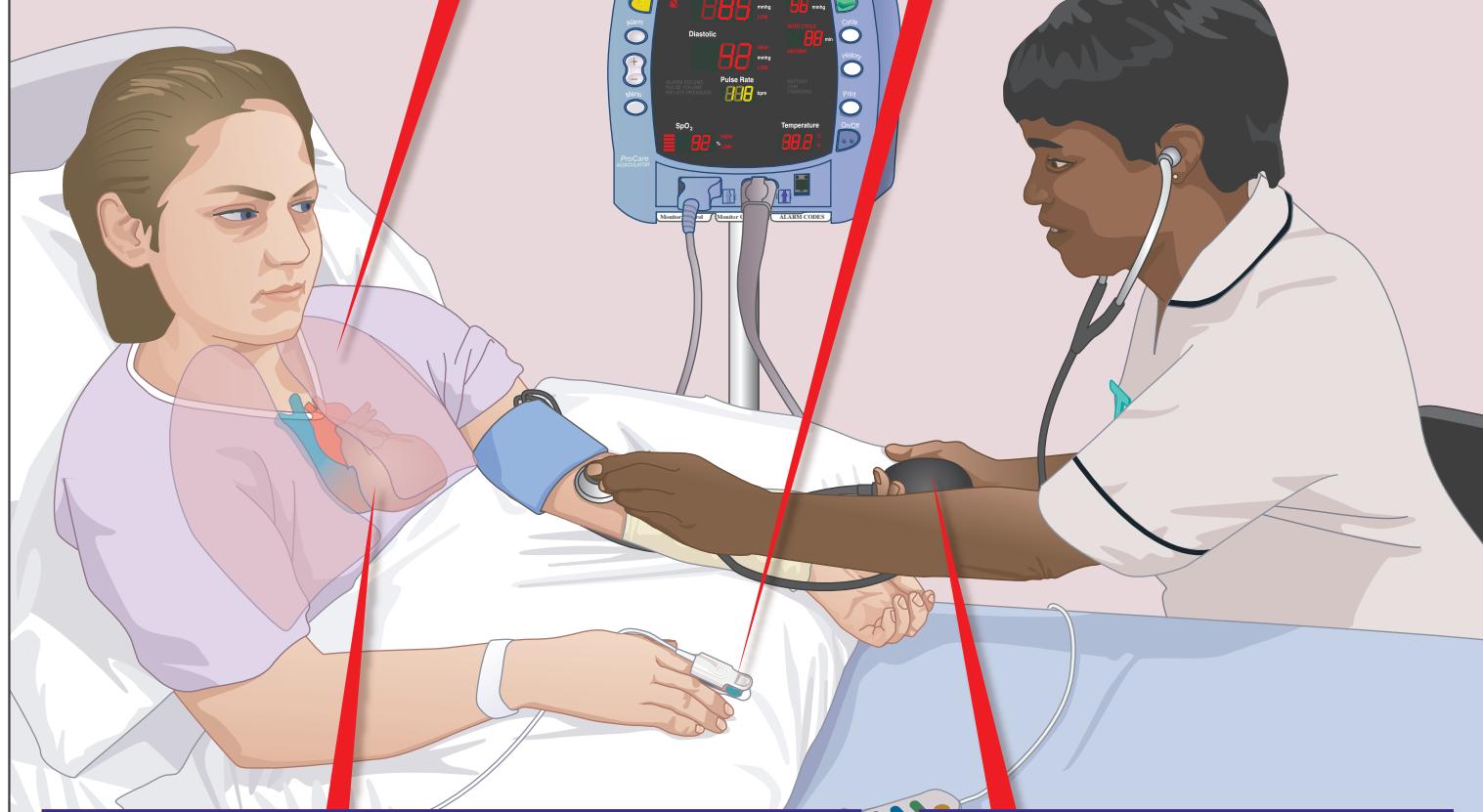
##### Increased respiratory rate

Tachypnoea (abnormally rapid breathing) occurs in sepsis as the body tries to resolve hypoxia and expel carbon dioxide in order to normalise blood pH following the development of lactic acidosis due to tissue ischaemia (McClelland & Moxon, 2014; McGloin & McLeod, 2010). A rise in respiratory rate is a comparatively early and significant sign of critical illness/deterioration, but it can be difficult to assess correctly, so is sometimes neglected. Consider a chest X-ray if the suspected source of sepsis is the respiratory tract (NICE, 2017a).

#### RED FLAG Needs oxygen to keep $\text{SpO}_2 \geq 92$ per cent

##### Oxygen saturation

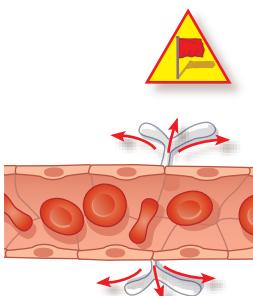
Sepsis causes hypoxia, so measure peripheral oxygen saturation levels using pulse oximetry (Vaughan & Parry, 2016). It may be difficult to obtain a peripheral oxygen saturation recording if the patient's peripheral circulation is poor (NICE, 2017a). If you are unable to obtain a peripheral oxygen saturation reading, you will need to take an arterial blood gas sample in order to accurately assess respiratory and metabolic functions; refer to procedures on arterial blood gas measurement.



#### RED FLAG Heart rate >130 per minute

##### Heart rate

The vasodilation and capillary leakage that occurs during sepsis causes hypovolaemia which triggers the sympathetic nervous system to increase the heart rate in an attempt to maintain perfusion to the vital organs (Morelli *et al.*, 2015). Always take the baseline pulse of the patient into account when assessing the heart rate of a patient with suspected sepsis. Patients who are very fit may have a lower heart rate, and during pregnancy the pulse can be 10–15 bpm more. The pulse of older patients may not increase but a new arrhythmia can develop as a response to the infection. Medications such as digoxin or beta-blockers may affect the heart rate and contribute to a falsely low reading (NICE, 2017a).



#### RED FLAG Systolic BP $\leq 90$ mmHg (or decrease of >40 mmHg from normal)

##### Blood pressure

Initially the patient may present with a normal or slight increase in systolic pressure but a decrease in diastolic pressure. This reflects the vasodilation occurring during sepsis. However, the patient's ability to maintain this is limited and soon the systolic pressure will drop as well (Vaughan & Parry, 2016). Compare the patient's blood pressure with their previous recordings and their normal baseline. Always assess whether your patient's blood pressure is adequate to perfuse vital organs such as the brain and kidneys.

## Sepsis Part 2: Recognition Page 3

### Recognising sepsis: (b)

#### Temperature

Fever is the innate immune system's response to infection (Weinkove *et al.*, 2015). However, a patient's temperature should not be the sole predictor of sepsis, as fever or hypothermia are not always present. Patients who are elderly, the young or those receiving chemotherapy may not develop a raised temperature. A rise in temperature can also occur post-surgery or be the result of trauma. Ask the patient or their family/carers about recent rigors or fevers (NICE, 2017a).

#### Assess the patient's mental state

Assess the patient's mental state in comparison with their normal function, and treat any changes as significant. These changes can be subtle, so taking a history from carers or family may be helpful.

"She's not normally confused like this, no."



#### RED FLAG Responds only to voice or pain/unresponsive

##### Reduced level of consciousness

A reduced level of consciousness is potentially life-threatening as the patient is at risk of airway obstruction, hypoxia and aspiration (Cooper *et al.*, 2006). Use a quick bedside assessment using the AVPU (Alert, Voice, Pain, Unresponsive) scale to check the patient's conscious level. If the patient is unresponsive, you should place them in the lateral recovery position, see clinicalskills.net procedure, "Placing a patient in the recovery position" (Resuscitation Council [UK], 2015).



#### RED FLAG Acute confusional state

##### Confusion

Inadequate blood flow to the brain as the result of vasodilation and falling blood pressure leads to hypoxaemia and hypoperfusion, affecting the patient's cognitive and mental state (Vaughan & Parry, 2016). Patients with sepsis may present with new confusion. Older patients with dementia may show increased irritability (NICE, 2017a).



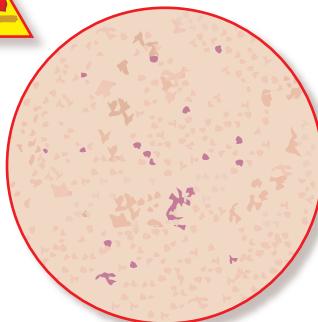
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### Recognising sepsis: (c)

#### RED FLAG Non-blanching rash, mottled/ashen/cyanotic skin

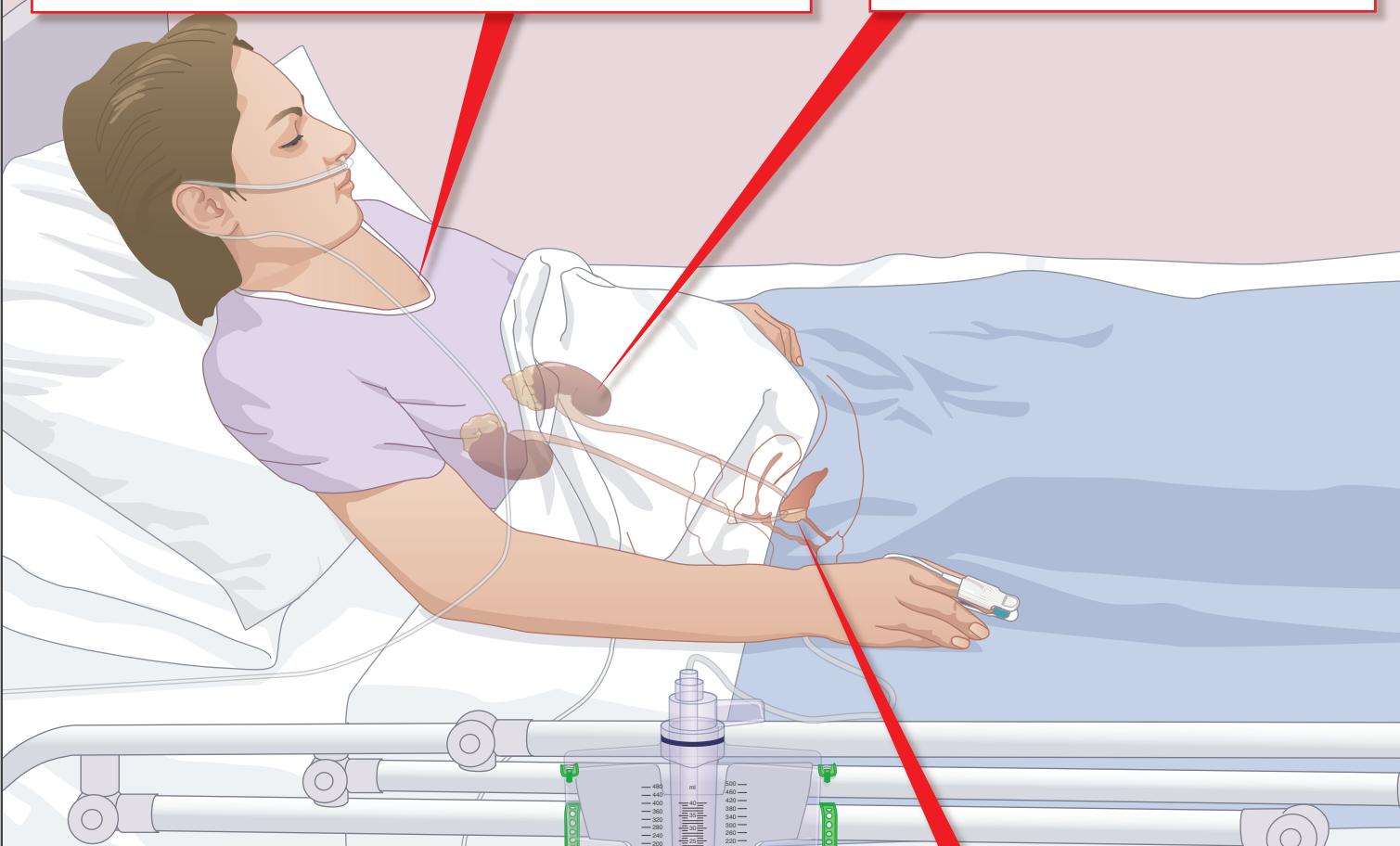
##### Changes to skin

Bleeding from small blood vessels or poor perfusion can cause changes to the skin. A purpuric rash that does not blanch is a sign of sepsis and requires urgent attention. Examine patients with suspected sepsis for any changes to the skin including cyanosis or a mottled appearance. Carry out a thorough clinical examination to help identify any wounds or abscesses that may require surgical drainage or other intervention, or any other sources of infection, such as cellulitis (NICE, 2017a).



#### Acute kidney injury

Acute kidney injury (AKI) is a sudden reduction in renal function that disrupts fluid balance, electrolytes and acid–base balance (Think Kidneys, 2016). AKI affects 13–18 per cent of all people admitted to hospital (NICE, 2013), and is associated with a significant increase in morbidity and mortality (Karthikeyan & Sharma, 2016). It has been estimated that sepsis causes between 13 and 64 per cent of AKI cases, with delayed administration of prescribed antibiotics being the biggest cause of sepsis-related AKI (Case et al., 2013). Consider and identify AKI in all patients who present with suspected sepsis (NICE, 2013).



#### RED FLAG Not passed urine in last 18 hours/urine output <0.5 mL/kg/h

##### Urine output decreases

Patients who have not passed urine in the previous 18 hours and catheterised patients who have passed less than 0.5 mL/kg per hour are at risk of severe illness or death. Consider urinalysis if you suspect the source of sepsis to be the urinary tract (NICE, 2017a).

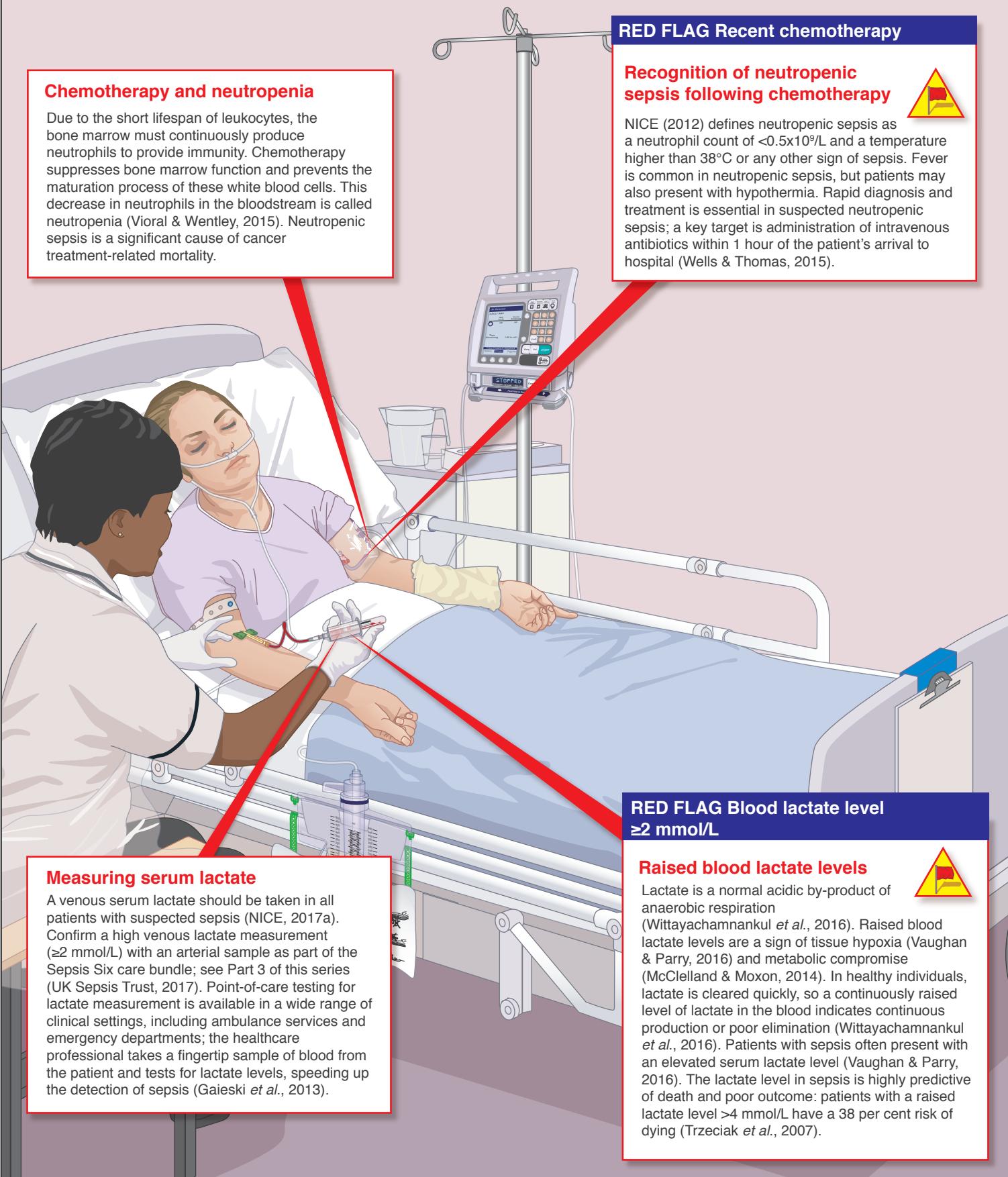


#### Kidneys reabsorb water into circulation

The kidneys rely on adequate blood pressure and volume to produce urine, receiving about 25 per cent of cardiac output. A fall in either or both of these will cause water to be reabsorbed into the circulation in order to increase pressure and volume, resulting in reduced urine output (Vaughan & Parry, 2016). If urine output falls, it is likely that cardiac output has also fallen and urgent action is required (UK Sepsis Trust, 2017).

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## Recognising sepsis: (d)



**Chemotherapy and neutropenia**

Due to the short lifespan of leukocytes, the bone marrow must continuously produce neutrophils to provide immunity. Chemotherapy suppresses bone marrow function and prevents the maturation process of these white blood cells. This decrease in neutrophils in the bloodstream is called neutropenia (Vioral & Wentley, 2015). Neutropenic sepsis is a significant cause of cancer treatment-related mortality.

**RED FLAG Recent chemotherapy**

**Recognition of neutropenic sepsis following chemotherapy**

NICE (2012) defines neutropenic sepsis as a neutrophil count of  $<0.5 \times 10^9/L$  and a temperature higher than  $38^\circ\text{C}$  or any other sign of sepsis. Fever is common in neutropenic sepsis, but patients may also present with hypothermia. Rapid diagnosis and treatment is essential in suspected neutropenic sepsis; a key target is administration of intravenous antibiotics within 1 hour of the patient's arrival to hospital (Wells & Thomas, 2015).

**Measuring serum lactate**

A venous serum lactate should be taken in all patients with suspected sepsis (NICE, 2017a). Confirm a high venous lactate measurement ( $\geq 2 \text{ mmol/L}$ ) with an arterial sample as part of the Sepsis Six care bundle; see Part 3 of this series (UK Sepsis Trust, 2017). Point-of-care testing for lactate measurement is available in a wide range of clinical settings, including ambulance services and emergency departments; the healthcare professional takes a fingertip sample of blood from the patient and tests for lactate levels, speeding up the detection of sepsis (Gaineski *et al.*, 2013).

**RED FLAG Blood lactate level  $\geq 2 \text{ mmol/L}$**

**Raised blood lactate levels**

Lactate is a normal acidic by-product of anaerobic respiration (Wittayachamnankul *et al.*, 2016). Raised blood lactate levels are a sign of tissue hypoxia (Vaughan & Parry, 2016) and metabolic compromise (McClelland & Moxon, 2014). In healthy individuals, lactate is cleared quickly, so a continuously raised level of lactate in the blood indicates continuous production or poor elimination (Wittayachamnankul *et al.*, 2016). Patients with sepsis often present with an elevated serum lactate level (Vaughan & Parry, 2016). The lactate level in sepsis is highly predictive of death and poor outcome: patients with a raised lactate level  $>4 \text{ mmol/L}$  have a 38 per cent risk of dying (Trzeciak *et al.*, 2007).