AUSTRALIAN COMMISSION
ON SAFETY AND QUALITY IN HEALTH CARE

Clinical Care Standards

FACT SHEET
for clinicians

Sepsis Clinical Care Standard

Lactate in the deteriorating patient and sepsis

Key messages

1. **Measure blood lactate in all patients with a potential or suspected serious infection**
2. **Lactate can be a marker of emerging or actual critical illness, and increased levels are associated with elevated morbidity and mortality**
3. **Escalate care for all patients with a lactate of 2.0 mmol/L or more and treat promptly where indicated**
4. **Treat any patient with a lactate of 4.0 mmol/L or more as a medical emergency**
5. **Lactate levels below 2.0 mmol/L do not exclude sepsis in patients with other signs**

Who this resource is for

This resource informs clinicians about the significance of elevated serum lactate levels in both adults and children. Recognition of elevated lactate and rapid escalation of care can avoid patient harm and potentially death.

What is lactate?

Lactate is a non-specific marker of illness severity in acutely ill patients.[1] Lactate is usually present in low levels in the blood, and elevated levels can indicate either a protective or a maladaptive response to shock.

Elevated lactate levels and failure to clear lactate can help identify patients who are in early stages of deterioration, with reduced organ perfusion, but who are maintaining their blood pressure and whose vital signs and behaviour may otherwise be deceptively reassuring.[2]

Elevated lactate levels have been shown to predict outcomes following sepsis in deteriorating adult patients.[1]

Lactate may also be affected by other causes of shock (for example, cardiogenic or haemorrhagic shock), or other catecholamine responses such as hyperthermia and seizures. Medications such as adrenaline infusions, salbutamol, metformin and antiretroviral (HIV) therapies can also increase lactate.[3]

Point-of-care devices

Point-of-care lactate devices enable rapid assessment and should be used whenever possible. The device needs to be readily available for clinicians to use when and where a patient deteriorates.

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Lactate level thresholds

- Normal lactate levels are less than 1.0 mmol/L in all age groups.
- Lactate levels greater than 2.0 mmol/L represent hyperlactataemia and should be reviewed by a clinician with experience in managing deteriorating patients, and treatment started as advised.[3,4]
- A lactate of 4.0 mmol/L significantly increases the risk for both morbidity and mortality, and requires urgent treatment and escalation through the health service organisation's rapid response system.[1,5]
- A lactate less than 2 mmol/L does not preclude a diagnosis of sepsis, especially in a paediatric patient and/or when low systolic blood pressure or signs of organ dysfunction are present.

Lactate in sepsis

Sepsis is a time-critical medical emergency, and prompt recognition and treatment are essential in improving survival rates[3,6,7,8]:

- Consider a diagnosis of sepsis in any patient with an acute illness or clinical deterioration that may be due to infection
- Measure blood lactate levels in all patients with suspected serious infection or sepsis, irrespective of their perfusion status, including when the patient has normal blood pressure or a normal appearance[9]
- If lactate is increased in a patient with a suspected serious infection or possible sepsis, commence them on the locally approved sepsis pathway.

Lactate levels should be interpreted as part of a more comprehensive assessment of clinical status and perfusion. Lactate measurement should not delay management of sepsis.

Blood lactate monitoring can help assess response to treatment in sepsis patients with initially elevated levels, including children.[3]

Lactate measurement is incorporated in state and territory sepsis pathways and recommended in the *Sepsis Clinical Care Standard*.

Sampling errors and false positives

In the past, some clinicians have been reluctant to act on lactate due to concerns about sampling and false positives. However, lessons from serious adverse event reviews show that when clinicians attribute an elevated lactate to bad sampling technique and ignore potential clinical causes, it can lead to adverse outcomes including impairment and death.

Assume the lactate is correct and escalate to a clinician with experience in managing sepsis and treat the patient accordingly.

Questions?

Find out more about the *Sepsis Clinical Care Standard* and other resources. Scan the QR code or use the link **safetyandquality.gov.au/sepsis-ccs**.

References

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Adapted with permission from the NSW Clinical Excellence Commission information sheet *Lactate in the Deteriorating Patient* 2021.

Frequently asked questions

Do I need a venous or arterial blood sample?

Obtaining a venous blood sample is often easier and less painful for the patient. Studies show that both venous and arterial blood can be used for lactate testing.[10]

Do I need to take the tourniquet off before drawing a venous sample?

No. The blood should be drawn within two minutes of the tourniquet being applied, as lactate levels can be elevated with prolonged application. If the blood is not drawn within two minutes, remove the tourniquet and wait for at least two minutes to allow the blood supply to recirculate, and then reapply the tourniquet and take the sample.

Once the blood is drawn, do I need to take any measures to preserve the sample?

Ideally, a sample for point-of-care testing needs to be tested immediately on the blood gas analyser. If the test is delayed longer than 15 minutes, collect a fresh sample for testing. If this is not possible, a grey-top tube (fluoride oxalate) can stabilise the sample for later point-of-care testing.

Immersing a sample in an ice slurry is not recommended because it can affect other critical results.

Is point-of-care testing accurate?

Point-of-care testing is accurate provided validated equipment is used, users are trained and a quality control system is in place. Your local pathology laboratory can advise on this.

Point-of-care lactate measurement is particularly useful in rural and remote settings to enable urgent escalation.

Do all patients with an elevated lactate level have sepsis?

No. Elevated blood lactate levels are a sign of deterioration and can be due to multiple causes.

What causes an elevated lactate level?

Increased lactate levels and failure to clear lactate are associated with all stages of shock.

Blood lactate levels may be elevated due to:

- Sepsis
- Any cause of shock (for example, cardiogenic or haemorrhagic shock)
- Hyperthermia
- Seizures
- Intestinal ischaemia
- Extreme exercise
- Medications such as adrenaline infusions, salbutamol, metformin and antiretroviral (HIV) therapies that contain lactate.

Patients with hepatic failure can have elevated lactate from decreased clearance; however, these patients are also prone to sepsis and hypotension.

Lactate levels ≥4 mmol/L have been associated with poor patient outcomes regardless of whether the cause is sepsis or not.

What should I do if I think the lactate result is falsely elevated?

Repeat the blood test in 30 minutes to confirm the result, but do not delay treatment of a deteriorating patient. If the patient is unwell and has a known or suspected infection, consult a clinician with expertise in recognising and managing sepsis and start sepsis treatment as per the relevant sepsis pathway, without waiting for the result.

Lessons from serious adverse event reviews show that ignoring the potential clinical causes of increased lactate can lead to adverse outcomes, such as an increased chance of morbidity (including amputations and neurological impairment) and death.

Factors that lead to falsely elevated lactate results on blood gas analysers include:

- Contamination of the sample with intravenous fluids (for example, Hartmann's solution)
- Prolonged tourniquet use or delay in testing (>15 minutes).