



# Acute care toolkit 9: Sepsis September 2014

Staff working in acute medical units (AMUs) should be familiar with the significant morbidity and mortality associated with sepsis. The AMU should provide a key role in identifying patients with sepsis, stratifying risk, determining appropriate levels of care, and continuing the resuscitation of patients identified with sepsis prior to AMU admission. Sepsis responds well to early intervention and, if required, rapid escalation of therapy. All staff working in AMUs need to possess the knowledge and skills to identify sepsis and initiate resuscitation if appropriate.

## Background

The overall mortality rate for patients admitted with severe sepsis is 35% – approximately five times higher than for ST elevation myocardial infarction and stroke – and sepsis is responsible for approximately 37,000 UK deaths and 100,000 hospital admissions per year.<sup>1,2</sup> The incidence of sepsis as a cause of hospital admission has more than doubled over the last 10 years.<sup>3</sup>

Sepsis arises when the body's response to infection causes systemic effects – manifested as two or more SIRS criteria (see Box 1).<sup>4</sup> In the absence of organ dysfunction, this is termed 'uncomplicated sepsis'. Severe sepsis occurs when it is accompanied by organ dysfunction (see Box 2), with septic shock identified by sepsis with hypoperfusion resistant to fluid therapy (see Box 2 and Fig 1).

The lactate level in sepsis is highly predictive of death (see Box 3).<sup>5</sup> When initially elevated, the degree of reduction following resuscitation predicts survival.

Severe sepsis is a highly time-sensitive condition. In the most severe cases (septic shock), for every hour, appropriate antibiotic administration is delayed, there is an 8% increase in mortality.<sup>6</sup> The Sepsis Six is an initial resuscitation bundle designed to offer basic intervention within the first hour: in a prospective observational study it was independently associated with survival, suggesting that if it alone were responsible for outcome differences, the number needed to treat (NNT) to prevent one death is 4.6.<sup>7</sup> This compares

### Box 1 Systemic inflammatory response syndrome (SIRS)

SIRS is confirmed if ANY TWO of the following are present:

#### Immediate

New onset of confusion or altered mental state

Temperature >38.3 or <36 °C

Heart rate >90 beats per minute

Respiratory rate (counted over 60 seconds)

>20 breaths per minute

#### Point of care testing (commonly available)

Blood glucose >7.7mmol/l in the absence of known diabetes

#### Laboratory (unless point of care testing available)

WCC >12 or <4×10<sup>9</sup>/l

## Box 2 Definitions of sepsis

- > Sepsis = SIRS\* + presumed or confirmed infection = 10% mortality.
- > Severe sepsis = SIRS + presumed or confirmed infection + end organ dysfunction = 35% mortality.
- > Septic shock = SIRS + presumed or confirmed infection + hypoperfusion\*\* = 50% mortality.

Criteria for end organ dysfunction are as follows:

- > Systolic blood pressure <90 mmHg or >40 mmHg fall from baseline, or mean arterial pressure <65 mmHg.
- > Bilateral pulmonary infiltrates with new need for oxygen to maintain saturations >90%, or with PaO<sub>2</sub>/FiO<sub>2</sub> ratio <300 (mmHg) or 39.9 (kPa).
- > Lactate >2.0 mmol/l.
- > Serum creatinine >176.8 µmol/l or urine output <0.5 ml/kg/hr for 2 successive hours.
- > INR (international normalisation ratio) >1.5 or aPTT (activated partial thromboplastin time) >60 s.
- > Platelet count <100×10<sup>9</sup>/l.
- > Bilirubin >34.2 µmol/l.

\*SIRS = systemic inflammatory response syndrome (see Box 1).

\*\*Where hypoperfusion is defined as systolic blood pressure <90 mmHg, mean blood pressure <65 mmHg, a fall of >40 mmHg from the patient's usual systolic blood pressure persisting after delivery of at least 30 ml/kg body weight intravenous fluids; or a lactate >4 mmol/l.

with an NNT of 42 for aspirin in major heart attack or of 45–90 for percutaneous coronary intervention (PCI) in ST elevation myocardial infarction.

The high mortality rate seen in patients with severe sepsis demands that their care is immediately prioritised. Patients should be assessed, and their care led, by the most senior healthcare professional available. We recommend that all patients with severe sepsis be discussed at the earliest opportunity with the responsible consultant.

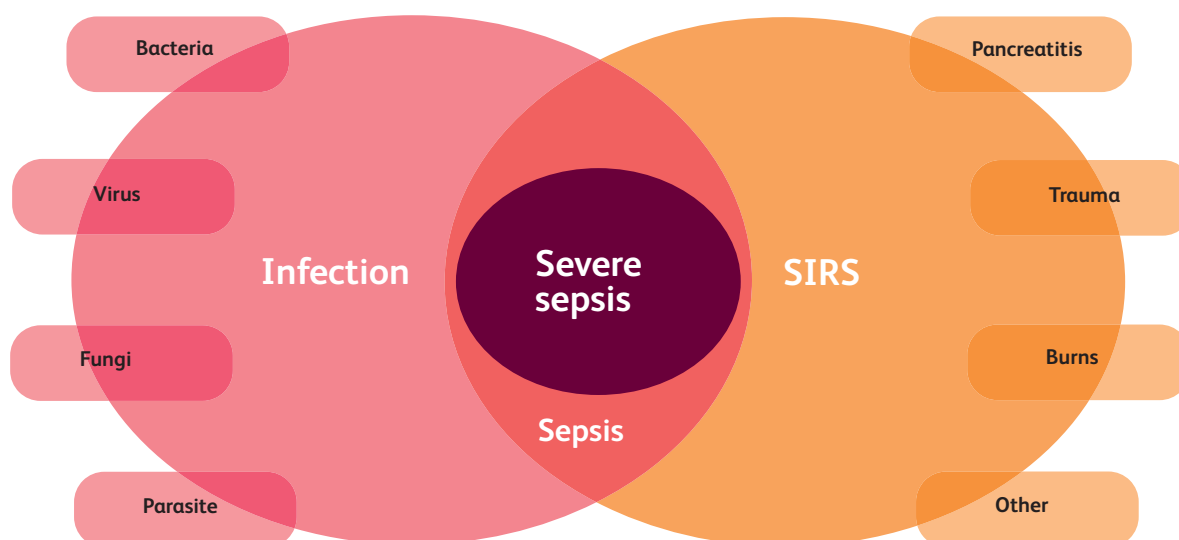
Sepsis is poorly recognised and treated. A 24-month improvement programme across 30 countries measuring the delivery of the severe sepsis resuscitation bundle was unreliable, with compliance rising from 10% to 21% in self-selected centres.<sup>8</sup> More recently, the College of Emergency Medicine audited performance against sepsis standards and identified similarly concerning results, with

first-hour antibiotics being administered in only 33% of patients with severe sepsis and septic shock. NHS England has now established sepsis as a future indicator in both domains 1 and 5 of the national outcomes framework.

## Acuity of sepsis

Organisations should be explicit about whether the intent is to initiate standardised care in patients once severe sepsis (including septic shock) has developed, or in all patients including those with uncomplicated sepsis (who still represent a high-risk population). International guidelines recommend the application of standards of care, including first-hour antibiotics to patients with severe sepsis and septic shock. Whichever strategy an organisation adopts, it is key that the decision is clear and communicated to all staff.

**Figure 1:** Relationship between SIRS, infection, sepsis and severe sepsis/ septic shock



### Box 3 The relationship of lactate level in sepsis to mortality

Lactate (mmol/l)	Mortality
<2	15%
2–4	25%
>4	38%

From: Trzeciak S, Dellinger RP, Chansky ME, *et al.* Serum lactate as a predictor of mortality in patients with infection. *Intensive Care Med* 2007;33:970–7.

## When severe sepsis is recognised

The factors that increase survival are as follows.

### 1) Early recognition

A high degree of vigilance is required for early identification of the patient with sepsis – this demands cultural change to one of awareness and suspicion of sepsis. A binary decision should be reached at the end of each interaction with an acutely unwell patient: does this patient have sepsis? Yes/No.

Sepsis screening should be linked to track-and-trigger scoring as a part of all initial and routine observations (eg National Early Warning Score, NEWS). All patients with pyrexia, elevated serum lactate, organ dysfunction or a raised white cell count (WCC), a clinical suspicion of sepsis or unexplained deterioration should also be screened.

Organisations should allocate resources to measurement of the reliability of screening, the denominator being the number of patients eligible for screening (eg number of patients triggering NEWS) and the numerator being the number screened.

### 2) Rapid intervention

There are a number of basic care bundles in use for the immediate management of patients with sepsis, of which the most widely used (now standard across Scotland and Wales) is the Sepsis Six (see Box 4). This bundle has been shown to be associated with significant mortality reductions when applied within the first hour.

Sepsis screening should be done as a two-part process: screening for SIRS (see Box 1) and screening for the severity of sepsis (Sepsis Risk Stratification – see Box 5). As soon as

sepsis is confirmed, Sepsis Risk Stratification should be performed. If severe sepsis or septic shock is confirmed, the Sepsis Six bundle (or a suitable alternative) should be started without waiting for the results of any further tests.

In some cases, the exclusion or diagnosis of SIRS and/or sepsis will only be possible with blood test results from the laboratory or after 2 hours of urine output monitoring. A pragmatic solution, designed to avoid delays in patients who are clearly unwell and recommended by the UK Sepsis Trust, is to use criteria from NEWS to highlight 'Red Flag Sepsis' (see Box 5).

Clinical pathways should include 'variance' boxes permitting documentation of reasons for deviating from elements of care: for example, it might be legitimate to omit high-flow oxygen in a patient with severe chest disease and this should not be taken as a failure to deliver the Sepsis Six if correctly documented.

Following delivery of the Sepsis Six, patients should be placed on a standardised pathway of care to ensure optimal sepsis management regardless of the time of day or experience of the staff. Attention should be focused on urgent ongoing resuscitation and wider management, including control of any source amenable to drainage or removal within 12 hours.

There are two distinct streams of admissions in most AMUs: direct arrivals from the community and emergency department transfers. Units with mixed entry points should undertake process mapping exercises for each stream, in order to identify and resolve potential areas for diagnostic delay. Such systems delays, and handover and transfer points, are common causes of unrecognised deterioration.

### 3) Timely escalation

Care pathways should include an observation, review schedule and guidance as to which parameters imply treatment success or failure, with an easy-to-follow directive informing when senior and critical care review is required. It is vital that patients with sepsis should be reviewed at the earliest opportunity by the most senior available doctor, with the expectation that pathways will demand a telephone conversation with the responsible consultant as a minimum for all patients identified with severe sepsis or septic shock.

Many patients with sepsis will have multiple comorbidities, and may be elderly or frail. For such patients, decisions should be taken at senior level (in consultation with the patient and their family as appropriate) regarding the appropriateness of escalation of care to level 2 ('high dependency', where a single organ system requires support excluding a need for invasive ventilation) or level 3 ('intensive care', where invasive respiratory support or more than one organ system support is required). Where possible, these decisions should be made and documented prior to the point at which the acuity of the patient's condition has deteriorated – this will not always be feasible.

## Box 4 The Sepsis Six

- 1 High-flow oxygen.
- 2 Blood cultures and consider source control.
- 3 Intravenous antibiotics.
- 4 Intravenous fluid resuscitation.
- 5 Check haemoglobin and serial lactates.
- 6 Hourly urine output measurement.

## Box 5 Sepsis Risk Stratification

Immediate treatment is indicated if ANY ONE of the following is present:

### Immediate

Systolic blood pressure <90 mmHg or >40 mmHg fall from baseline

Mean arterial pressure <65mmHg

Heart rate >131 beats per minute\*

New need for supplemental oxygen to maintain saturations >90% should prompt emergent chest radiograph

Respiratory rate >25 breaths per minute\*

AVPU = V, P or U\*

### POCT (commonly available)

PaO<sub>2</sub>/FiO<sub>2</sub> ratio <300 (mmHg) or <39.9 (kPa)

Lactate >2.0 mmol/l

### Radiology (only if clinically indicated, eg SpO<sub>2</sub> <90%)

Bilateral pulmonary infiltrates AND new need for supplemental oxygen to maintain oxygen saturations >90%

### Laboratory (unless POCT available)

Creatinine >176.8 µmol/L

INR >1.5

aPTT >60 s

Platelet count <100×10<sup>9</sup>/l

Bilirubin >34.2 µmol/l

### Urine output monitoring

Urine output <0.5 ml/kg for 2 consecutive hours

\*The Sepsis Risk Stratification tool detailed above is modified from the Surviving Sepsis Campaign's Evaluation for Severe Sepsis Screening Tool.<sup>9</sup> It adds a heart rate of >131 beats per minute, an AVPU score less than 'Alert' and a respiratory rate of >25 breaths per minute. These three parameters are individually allocated a score of 3 in the National Early Warning Score, and will help to identify patients with severe sepsis who are awaiting confirmatory laboratory or radiographic tests. Their inclusion in Sepsis Risk Stratification is recommended in order to avoid unnecessary delay in initiating life-saving therapy in patients with sepsis with threatened cardiovascular or respiratory compromise.

For 'red flag sepsis' patients, ie those who qualify as having severe sepsis via only one of the three surrogate criteria described above: if subsequent blood results are not confirmatory for severe sepsis, then it is recommended that a senior competent decision-maker considers alternative diagnoses and reviews the need for ongoing antimicrobial therapy and other aspects of the severe sepsis pathway.

## Suggested clinical guidelines for the management of patients admitted to or developing sepsis in an AMU

### Sepsis (uncomplicated):

- > A documented decision as to whether or not to initiate the Sepsis Six.
- > Discussion with a competent decision-maker, such as a doctor grade ST3 or above, within 60 minutes following recognition.
- > Review by consultant within 14 hours (see *Acute care toolkit 4: delivering a 12-hour, 7-day consultant presence*

*on the acute medical unit).*

- > Hourly observations until track-and-trigger score is below trigger threshold for 4 successive hours.
- > Repeat lactate measurement within 2 hours in order to identify deterioration.
- > Escalate immediately if severe sepsis or septic shock (including patients with normal blood pressure but elevated lactate, known as 'cryptic shock') develops.

### Severe sepsis (where critical care input is not immediately required):

- > Sepsis Six to be completed as soon as possible, but always within 60 minutes.

- > Review by competent decision-maker, such as a doctor grade ST3 or above, within 60 minutes.
- > Review by consultant within 14 hours (see *Acute care toolkit 4: delivering a 12-hour, 7-day consultant presence on the acute medical unit*).
- > Observations every 30 minutes until track-and-trigger score is below trigger threshold for 4 successive hours.
- > Repeat lactate measurement within 2 hours.
- > Repeat laboratory blood tests within 14 hours, unless observations indicate earlier need (eg reducing urine output, jaundice, bleeding).
- > Escalate immediately if septic shock (including cryptic shock) develops or if organ dysfunction requires reconsideration of need for critical care (eg acute kidney injury).

#### Severe sepsis (for critical care referral) or septic shock:

- > Initiation of the Sepsis Six to be completed as soon as possible, but always within 60 minutes.
- > Review by competent decision-maker, such as a doctor grade ST3 or above, immediately.
- > Telephone conversation with consultant immediately following initial review.
- > Immediate referral to critical care outreach (or equivalent team).
- > If there is any delay in medical review, nurses should contact the critical care outreach team (CCOT) or consultant directly.

Pathways should also describe where patients with sepsis should be nursed and clearly state the escalation status and any ceilings of care for each patient. It should be stressed that although patients may not be determined suitable for full resuscitation or invasive ventilation, treatment limits of non-invasive ventilation, inotropes, vasopressors, or intensive fluid management may be set.

Whenever there has been physician review of patients with sepsis, there should be a documented schedule for when repeat lactate measurement and medical review are planned, and what the criteria for calling the medical team or de-escalating level of monitoring are.

## References

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## Exemplar standards for the acute management of sepsis

The AMU has a key role to play in early sepsis management. Rapid decisions must be made about the appropriate destination for ongoing care, referral to other services (eg to critical care, or to radiology or surgery for drainage of collections), as well as establishing any treatment limitations. The delivery of excellent sepsis care demands that pathways applicable to a clinical environment consider how patients arrive to that clinical area (for example, ED triage), where they are discharged to (critical care or the ward) and what support services are required. In designing a clinical pathway, construction of both high-level and low-level process maps is a helpful starting point.

The standards below have been identified by the UK Sepsis Trust and the All-Party Parliamentary Group (APPG) Sepsis as important in the management of sepsis. They are 'exemplar standards', which are intended as standards at which organisations should intend to deliver care within the near future. Achieving these standards will place an AMU well on the road to providing excellent sepsis care.

- 1** All AMU patients with physiological derangement to be screened for sepsis and have a serum lactate result within 30 minutes.
- 2** Clear clinical pathways should be in place for the management of sepsis, severe sepsis and septic shock. This must include standards for recognition, intervention and escalation (see above).
- 3** A nominated acute medical and nursing lead, contributing to the organisation's sepsis group.

**4** Sepsis should be placed on the organisation's risk register, with an identified board-level person with responsibility for sepsis. The mortality from sepsis and pneumonia should be on the monthly quality dashboard.

**5** The Sepsis Six (or robust equivalent) to be used as a delivery method for early sepsis care.

**6** The Sepsis Six (or robust equivalent) delivered within 1 hour post-diagnosis on  $\geq 95\%$  of episodes of severe sepsis (excluding patients with limitations of treatment).

**7** Definitive, documented decision made about the presence/absence of sepsis on arrival in the AMU (this may be prior to medical clerking), at each medical assessment and prior to transfer to another ward/specialty.

**8** On diagnosis of sepsis, the patient should not be transported to a different clinical area prior to completion of the Sepsis Six (or robust equivalent), unless emergency surgery, specialist intervention or escalation of treatment is required.

**9** Discussion between admitting team and microbiology/infectious diseases team to confirm optimal antimicrobial selection and consider de-escalation or escalation of antimicrobial spectrum at 48 hours, or earlier as results become available.

**10** Mandatory prospective data collection and continuous audit on patients with sepsis, measuring the delay to intervention, treatment and outcomes.

**11** Voluntary reporting of performance data into the public domain.

**12** Annual sepsis training available to all clinical members of staff.

**13** A minimum of 60% of permanent staff to have received appropriate training on sepsis at any one time point, audited at least biannually.

**14** Clinical pathway to include initiation of all investigations necessary to confirm or exclude organ dysfunction (see Box 2) and to include criteria for escalation/de-escalation of care.

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