Toolkit: Prehospital management of sepsis

This clinical toolkit has been developed in partnership with the College of Paramedics. It is designed to provide operational solutions to the complexities challenging the reliable identification and management of sepsis, and complements clinical toolkits designed for other clinical areas.

*We acknowledge use of some content from the Acute Medicine Toolkit developed by the UK Sepsis Trust & Royal College of Physicians

Staff working in the prehospital environment should be familiar with the significant morbidity and mortality associated with sepsis. The prehospital practitioner may be the first point of contact for patients with sepsis. This contact represents an opportunity to screen, identify, risk-stratify and deliver immediate life-saving treatment for these patients. Concurrent to these processes, appropriate transportation, destination selection and communication will enable seamless care and further reduce morbidity and mortality associated with sepsis.

Evidence from Europe and the USA shows that prehospital recognition of sepsis with appropriate destination selection and handover leads to a shorter delay to administration of antibiotics and early fluid therapy. These steps are independently associated with improved outcome.

Background:

The overall mortality rate for patients severe sepsis is 35% - approximately 5 times higher than for ST elevation myocardial infarction and stroke. Sepsis is responsible for at least 37,000 deaths and 100,000 hospital admissions in the United Kingdom (UK) per year¹.

Severe sepsis is a time-critical condition. At the most severe end of the spectrum, septic shock, for every hour that appropriate antibiotic administration is delayed, there is an 8% increase in mortality². 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 4.6³. This compares to an NNT of 42 for Aspirin in major heart attack and 45-90 for PCI in ST elevation myocardial infarction.
Sepsis is common in the prehospital environment. In the United States:

- The number of patients transported by Emergency Medical Services (EMS) with sepsis now outnumbers those with heart attack or stroke\(^4\)
- More than 40% of all severe sepsis hospitalizations arrived at the emergency department after EMS transport
- Prehospital care intervals, on average, exceed 45 minutes for those hospitalized with severe sepsis: a significant proportion of the one hour in which the Sepsis Six should be delivered

In Scotland in a recent study, over 85% of patients diagnosed with severe sepsis or septic shock in Emergency Departments were transported to hospital by ambulance\(^5\).

The prehospital phase represents both opportunity and risk. By recognizing sepsis early, life-saving elements of the Sepsis Six can be delivered and ongoing care (e.g. in the Emergency Department resuscitation area) can be facilitated. Failure to recognize Sepsis in the prehospital environment will lead to excess deaths.

**Professional responsibility & accountability**

NHS England has established sepsis as a future indicator in both Domains 1 and 5 of the National Outcomes Framework, and issued a stage 2 alert on sepsis in September 2015. It signposts to clinical toolkits such as this, to education programmes, examples of good practice, and other available resources. NHS England is working with the UK Sepsis Trust and professional body stakeholders to identify and accredit exemplar centres from which others can learn. In her report of September 2013 entitled ‘A Time to Act’, the Parliamentary and Health Service Ombudsman called upon the NHS and the Department of Health to act rapidly to reduce unnecessary deaths from sepsis. As a direct result of this work, it is anticipated that NICE will produce a clinical guideline and Quality Standard for Sepsis.

We will learn valuable lessons from the report arising from the recent survey on sepsis conducted by the National Confidential Enquiry into Patient Outcome and Death (NCEPOD). Until that time, it is the responsibility of those commissioning services from, designing clinical systems for, and working within the prehospital environment that their efforts focus on early recognition, urgent intervention using existing consensus guidelines from the UK Sepsis Trust and Surviving Sepsis Campaign, and timely escalation for patients with sepsis.
Delivering Excellent Sepsis Care:

Determining actions specific to severity of condition

Sepsis arises when the body’s response to infection causes systemic effects that manifest as two or more of the Systemic Inflammatory Response Syndrome (SIRS) criteria (Box 1) triggered by a new infection\textsuperscript{6}. Some patients will develop end-organ dysfunction, denoting severe sepsis (Box 2). Septic shock is a subset of severe sepsis, identified by sepsis with hypoperfusion resistant to fluid therapy (Box 2).

Box 1: Systemic Inflammatory Response Syndrome (SIRS):

SIRS is present if there are at least 2 of:

| Temperature $> 38.3 \, \text{or} \, < 36.0^\circ C$ | New confusion/drowsiness |
| Pulse $> 90 / min$ | WBC $> 12 \, \text{or} \, < 4.0 \times 10^9/ L$ |
| RR $> 20 / min$ | Blood glucose $> 7.7 \, \text{mmol/L (not if diabetic)}$ |

Ambulance services should be explicit about whether the intent is to initiate standardized transfer and pre-alert protocols only in patients in whom severe sepsis (including septic shock) is identified, or in all patients including those with uncomplicated sepsis who may still represent a high risk population. Decisions will be governed by local geography, transit times and availability of medical personnel in the community and prehospital environments.

International guidelines recommend the application of standards of care including first-hour antibiotics to patients with severe sepsis and septic shock. Whilst evidence to support early intervention in uncomplicated sepsis is scant, some would view it as artificial to delay therapy until an arbitrary threshold of organ dysfunction is reached, particularly in the context of interventions being relatively non-invasive and highly cost-effective. Recognition and communication during the prehospital phase is key in preventing unnecessary delays in key interventions.
**Box 2 : Defining the severity of Sepsis**

<table>
<thead>
<tr>
<th>Severity</th>
<th>Definition</th>
<th>Group mortality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uncomplicated sepsis</td>
<td>SIRS + presumed or confirmed infection</td>
<td>10%</td>
</tr>
<tr>
<td>Severe sepsis</td>
<td>Sepsis + one or more organ dysfunction criteria (other than shock)*</td>
<td>35%</td>
</tr>
<tr>
<td>Septic shock</td>
<td>Sepsis + shock**</td>
<td>50%</td>
</tr>
</tbody>
</table>

*Organ dysfunction criteria:*
- Bilateral lung infiltrates + new need for oxygen to maintain saturations $>90\%$, or
- Bilateral lung infiltrates with PaO$_2$/FiO$_2$ ratio $<300$ (mmHg) or 39.9 (kPa)
- Lactate $\geq 2.0$ mmol/L
- Serum creatinine $>176.8 \mu$mol/L or urine output $<0.5$ mL/kg/hr for 2 successive hours
- INR $>1.5$ or aPTT $>60$ s
- Platelet count $<100 \times 10^9$/L
- Bilirubin $>34.2 \mu$mol/L

**Shock criteria:**
- Lactate $>4$ mmol/l at any time point
- Hypotension persisting after 30ml/kg intravenous fluid, defined as Systolic Blood Pressure $<90$mmHg, Mean Blood Pressure $<65$mmHg, or a fall of $>40$mmHg from the patient’s usual Systolic Blood Pressure

Key: (Box 1 + 2)
- **Red** = identifiable by most prehospital resources
- **Blue** = identifiable by some prehospital resources
- **Black** = identifiable by very few/zero prehospital resources

In the prehospital environment, the lack of laboratory services or point of care tests limit ability to distinguish between sepsis, severe sepsis and septic shock in many cases. It is important to note that the consensus definitions for severe sepsis were designed for use within hospitals. Conscious of the challenges this presents in operationalizing care pathways outside hospitals and while laboratory results are pending, the UK Sepsis Trust has developed the concept of ‘Red Flag Sepsis’, based upon criteria within the National Early Warning Score (NEWS).
Describing the solutions – how can we be good at treating sepsis?

1) Early Recognition:

Sepsis is identified through the presence of SIRS (Box 1). SIRS in the presence of infection is sepsis. Sepsis can be sub-classified according to severity: uncomplicated sepsis, severe sepsis or septic shock (Box 2). For the prehospital environment a Sepsis Screening and Action Tool has been devised which combines the above to assist in early recognition and guide early intervention.

A high degree of vigilance is required for early identification of the septic patient. All prehospital clinical personnel should be trained in sepsis recognition. All patients presenting with physiological disturbances that could meet the SIRS criteria, or with signs and symptoms compatible with an infective illness, should be formally screened for sepsis. A binary decision should be reached for all patients screened: this patient could have sepsis, or this patient does not have sepsis. This binary decision should be clearly recorded on the patient report form (PRF). Those involved in the design of prehospital systems should modify their PRF design to allow for this.

Suspicion of an infective cause is all that is required to initiate screening. The most common causes are respiratory, abdominal, skin and urinary but staff must also be aware that there are other causes. A comprehensive list is beyond the scope of this document but must be included in training.

1.i) Recognition strategies

This toolkit will complement other toolkits for Emergency Medicine, NHS Pathways/111, and primary and community care.

We recommend that Paramedics and Community First Responders be trained to screen for sepsis in conjunction with the NEWS track-and-trigger scoring system. Supported by guidance from the Joint Royal Colleges Ambulance Liaison Committee (JRCALC) and by the Sepsis Screening and Action Tool, practitioners may pre-alert receiving Emergency Departments (EDs). Pathways should be developed through collaborative workshops involving ED staff, ambulance service staff, patient representatives, managers and commissioners.

Patients identified as Red Flag Sepsis (see below) should be pre-alerted and routed directly to the Emergency Department for immediate assessment. The toolkit for Emergency Departments recommends that patients with Red Flag Sepsis are seen immediately in the Resuscitation Area. A Sepsis Team may be available to see these patients. An example of a Sepsis Team and their roles within the ED is given in the UK Sepsis Trust resources’ Appendix 3.
I.ii) The use of a two-part screening process to determine severity

Sepsis screening should be done as a two-part process; screening for SIRS (prompted either by NEWS or by clinical suspicion of infection) and screening for the level of severity of sepsis, or Sepsis Risk Stratification. As soon as sepsis is confirmed, the Sepsis Risk Stratification should be performed. This two-part process can be easily visualized as actions 1 and 3 on the Sepsis Screening and Action Tool (with validation by suspicion of infection as action 2). During Sepsis Risk Stratification, as soon as Red Flag Sepsis is identified, treatment should be started immediately including early communication/ pre-alert to the receiving ED.

<table>
<thead>
<tr>
<th>a. Screening for SIRS</th>
</tr>
</thead>
<tbody>
<tr>
<td>SIRS is confirmed if ANY TWO of the following are present:</td>
</tr>
<tr>
<td>Immediate</td>
</tr>
<tr>
<td>➢ New onset of Confusion or Altered Mental State</td>
</tr>
<tr>
<td>➢ Temperature &gt;38.3 or &lt;36 degrees</td>
</tr>
<tr>
<td>➢ Heart Rate &gt;90 beats per minute</td>
</tr>
<tr>
<td>➢ Respiratory Rate (counted over 60 seconds) &gt;20 breaths per minute</td>
</tr>
<tr>
<td>POCT (commonly available)</td>
</tr>
<tr>
<td>➢ Blood Glucose &gt;7.7mmol/L in the absence of known diabetes</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>b. Sepsis Risk Stratification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red flag sepsis is identified if ANY ONE of the following are present:</td>
</tr>
<tr>
<td>Systolic B.P &lt; 90 mmHg</td>
</tr>
<tr>
<td>Lactate &gt; 2 mmol/l (where available)</td>
</tr>
<tr>
<td>Heart rate &gt; 130 per minute</td>
</tr>
<tr>
<td>Respiratory rate &gt; 25 per minute</td>
</tr>
<tr>
<td>Oxygen saturations &lt; 91%</td>
</tr>
<tr>
<td>Responds only to voice or pain/ unresponsive</td>
</tr>
<tr>
<td>Purpuric rash</td>
</tr>
</tbody>
</table>
Red Flag Sepsis

*The Sepsis Risk Stratification tool detailed above is modified from the Surviving Sepsis Campaign’s Evaluation for Severe Sepsis Screening Tool (2005). It adds a heart rate of >131, and a respiratory rate of >25, oxygen saturations < 91% and an AVPU score less than ‘Alert’. 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 will need confirmatory laboratory or radiographic tests in hospital. 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. The inclusions correspond with ‘Red Flag Sepsis’ criteria in the Emergency Department Sepsis Screening and Action Tool.

### Case Study 1

The partner of a 30 year old woman calls 999 as she is in excruciating pain with dysuria and loin pain for three days. She has a temperature of 38.8 degrees, a tachycardia of 105 beats per minutes and a BP of 80 systolic. The paramedic is concerned by these observations and refers to the sepsis screening toolkit.

The Paramedics confirms the presence of Red Flag Sepsis and suspects that she has severe sepsis due to pyelonephritis. He gains IV access and starts with fluid challenges according to screening tool recommendations and oxygen at 15l/min. The paramedic sends a pre-alert to the hospital with the situation “Red Flag Sepsis” followed by the observations and intervention.

Patient is transferred on “blues” and greeted in Resusc by the Sepsis Team. Diagnosis is confirmed rapidly with point of care testing - the first dose of antibiotics are given within minutes of arrival.

### 2. Urgent Intervention

The key immediate interventions that increase survival are described in a bundle termed the Sepsis Six (Box 3). This bundle has been shown to be associated with significant mortality reductions when applied within the first hour.

UKST PH TOOLKIT 2015 | 7
Box 3: The Sepsis Six (Source: http://sepsistrust.org)

1. Administer high-flow oxygen  
2. Take blood cultures and consider infective source  
3. Administer intravenous antibiotics  
4. Give intravenous fluid resuscitation  
5. Check haemoglobin and serial lactates  
6. Commence hourly urine output measurement

This bundle should be initiated immediately on diagnosis or suspicion of Red Flag Sepsis. Not all prehospital teams will be able to perform every aspect of the bundle. Despite this potential limitations the aim should be for the Sepsis Six to be completed within one hour of initial identification and immediate intervention and communication can ensure this time frame is met for services with short mean transit times. Where transit times are longer, the feasibility of delivery of each aspect of the Sepsis Six, including the use of point-of-care testing for lactate, the sampling of blood cultures and administration of antibiotics.

The Sepsis Six recommends that up to 30 mL/kg of crystalloid fluid be rapidly delivered in divided aliquots to patients with sepsis who have evidence of hypoperfusion (defined in Box 2). Some patients with initial hypoperfusion may respond rapidly to smaller volumes. There is strong evidence that expedient delivery of ‘basic’ aspects of care limits the maximum acuity of intervention required - early resuscitation can prevent the requirement for invasive monitoring and vasoactive support. In the prehospital environment it is recommended that in patients with signs of shock 250ml boluses are titrated to response with a maximum of 2000mls (JRCALC Guidelines).

Should blood pressure and heart rate return to normal levels following this initial fluid resuscitation, no further fluid needs to be given. The patient, however should still be transferred on blue lights to the most appropriate centre.

Those with persistent haemodynamic deficit following fluid resuscitation require more invasive strategies for ongoing resuscitation which will rarely be initiated in the prehospital phase unless by Prehospital Emergency Medicine (PHEM) teams and their equivalents.

3. Communication

High quality prehospital communication saves lives. Prehospital identification of sepsis with appropriate communication to emergency staff significantly reduces time to antibiotics and completion of time critical sepsis interventions (such as the Sepsis Six).
Should Red Flag Sepsis be identified, the prehospital practitioner should pre-alert the receiving unit immediately in order that appropriate personnel may be identified to receive and immediately assess the patient.
Exemplar Standards for the prehospital management of sepsis

Prehospital services have a key role to play in early sepsis management. The prehospital environment is where rapid identification of the septic patient must occur and where early intervention, communication and transfer can impact on mortality and morbidity. In designing clinical pathways, construction of both high level and low level process maps is a helpful starting point.

The standards below are those which have been identified by the UK Sepsis Trust and the All Party Parliamentary Group for Sepsis as important in the management of sepsis with specific relevance to prehospital care providers. They are the ‘Exemplar Standards’ which organizations should aspire to deliver. Achieving these standards will place a prehospital care providers well on the road to the provision of excellent sepsis care.

1. Clear guidance, policies and clinical pathways to be in place for the recognition, management and communication of sepsis and Red Flag Sepsis.
2. All patients with a NEWS score above trigger threshold (or a single NEWS criterion scoring 3), or with clinical suspicion of infection to be screened for the presence of sepsis with Sepsis Risk Stratification undertaken, and the outcome of this screening process recorded on the patient report form (PRF).
3. The Sepsis Six (or a modified prehospital equivalent) to be used as a delivery method for early sepsis care and to be delivered within 1 hour post diagnosis in ≥95% of cases in collaboration with receiving EDs
4. Definitive, documented decision made and communicated about the presence/absence of sepsis and the level of severity at time of handover to ED or other clinical group.
5. Mandatory annual sepsis training for all clinical members of staff.
6. A minimum of 80% of permanent staff to have received appropriate sepsis training at any one time point, audited at least biannually.
7. A nominated clinical Sepsis lead within the prehospital providers organization.
8. Interdisciplinary meetings to be undertaken between the ED and prehospital service staff together with managers and commissioners as appropriate, with remit to refine care pathways for sepsis and ensure compatibility between clinical areas. This work should be undertaken within the remit of, or fed back to, the organization’s Sepsis Group.
9. Voluntary reporting of performance data into the public domain.
References

1. Daniels R. Surviving the first hours in Sepsis: getting the basics right (an Intensivist’s perspective). Journal of Antimicrobial Chemotherapy 2011; 66(Suppl ii): 11-23


