Ensuring early recognition and treatment of sepsis and septic shock

It is estimated that 37,000 people a year die due to sepsis in the UK (Shahin et al, 2012), while survivors are often left with serious long-term complications including amputation and irreversible organ damage, according to a review by the National Confidential Enquiry into Patient Outcome and Death (2015). The review found that there was a delay in identifying 36% of cases of sepsis, that only 63% of patients received antibiotics in the first hour of diagnosis, and that this delay negatively affected outcomes for 44% of patients (NCEPOD, 2015).

Definitions old and new
Defining sepsis is not straightforward, as it is not an illness but a syndrome that can manifest through a range of non-specific symptoms (Singer et al, 2016; Daniels, 2014). Without a clear definition of sepsis, it is difficult to provide early recognition and prompt treatment.

Old definitions
A first definition of sepsis was established in 1991, the focus being on the body’s systemic inflammatory response syndrome (SIRS) criteria: 
- Altered temperature; 
- Altered heart rate; 
- Altered partial pressure of carbon dioxide in arterial blood (PaCO₂); 
- Altered white blood cell count.
Severe sepsis was defined as sepsis with one or more organ dysfunctions, while septic shock was defined as sepsis-induced hypotension not remedied by fluid resuscitation (Daniels, 2014; Bone et al, 1992). Levy et al (2003) stated that a first attempt at revising these definitions was made in 2001; the SIRS criteria were expanded but, due to a lack of evidence, the definitions themselves were not modified.

The 2014 task force
In 2014, an international task force of experts from the fields of surgery, critical care, infectious disease and pulmonary disease – the Third International Consensus Definitions for Sepsis (Sepsis-3) – was set up with the aim of developing an evidence-based, consensual definition of sepsis. Since 1991, there had been several developments in technology, and the impact of sepsis on the body was much better understood, so it was time to seek a more specific definition.

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In this article...
- The 1991 and 2016 definitions of sepsis and septic shock
- Tools that can be used to ascertain the likely presence of sepsis
- Why it is important to detect sepsis as early as possible
New definition of sepsis

The outcomes of Sepsis-3, including new definitions – which are given in Box 1 – were published in February 2016 by Singer et al (2016). The new definition of sepsis means the focus is no longer on the SIRS criteria (Tait and Miles, 2012). The inflammatory response triggered by sepsis is not specific to infection and is, therefore, deemed to be unhelpful in diagnosing sepsis. Although the SIRS criteria may be useful in identifying a deteriorating patient, the adverse outcomes associated with sepsis are not consistent with other illnesses causing inflammatory response (Singer et al, 2016).

New definition of septic shock

The term ‘severe sepsis’ is now considered obsolete and should no longer be used to indicate a stage of advanced sepsis; however, ‘septic shock’ remains a valid term and has been redefined, as outlined in Box 1. This new definition encompasses a slightly broader view acknowledging that there is a cellular component to sepsis. A diagnosis of septic shock is made when, in a patient identified as having sepsis:

- Serum lactate is >2mmol/L;
- Despite adequate fluid resuscitation, vasopressors are required to maintain a mean arterial pressure ≥65mmHg (Shankar-Hari et al, 2016) (Box 2).

Septic shock carries a mortality rate of around 50%; this is far greater than that for sepsis, for which the figure is approximately 10% (Singer et al, 2016; Daniels, 2014).

Assessment tools

Esteban et al (2007) found that 71% of patients with sepsis had acquired their infection in the community. In addition, it has been shown that treatment with antibiotics within four hours of admission reduced mortality and length of stay in hospital (Houck et al, 2004). Early diagnosis and treatment are therefore crucial, which means health professionals working in the community – GPs, practice nurses, district nurses – are on the front line. Staff in call centres, emergency departments, minor injury units and urgent care centres also have a key role.

The Sepsis-3 definitions need to be complemented by a simple assessment tool that enables health professionals to identify as early as possible those patients who have, or at risk of developing, sepsis and septic shock.

Sepsis-related organ failure assessment

One assessment tool used in some intensive care units is the Sepsis-related Organ Failure Assessment (SOFA, also known as Sequential Organ Failure Assessment). However, while it is a good predictor of outcome when used in the first few days of admission to the ICU (Ferreira et al, 2001), it does not solve the problem of identifying patients early, before they need to be admitted to the ICU.

qSOFA

The Sepsis-3 group suggested the Quick SOFA (qSOFA) as a suitable assessment tool at the bedside. This simplified version of the SOFA takes into account altered mental state, low blood pressure and high respiratory rate (Box 3), and is seen as a robust and valid tool for measuring the predictive possibility of sepsis outside of critical care (Seymour et al, 2016).

However, with the use of the National Early Warning Score (NEWS) (Royal College of Physicians, 2012) becoming standard practice in trusts, the question is whether, and how, the qSOFA could work alongside other methods of determining deterioration in patients.

Red flag sepsis

The UK Sepsis Trust endorses a system known as ‘red flag sepsis’ (Daniels, 2014), whereby sepsis must be suspected when there is evidence of new infection and at least one of the following ‘red flags’:

- Heart rate >110 beats/min;
- Respiratory rate >25 breaths/min;
- AVPU (Alert, responds to Voice, responds to Pain, Unresponsive) score: V, P or U.

Sepsis guideline

All three approaches described above can highlight deterioration and possible sepsis, but a standardised, easy-to-use tool is still needed to quickly establish a diagnosis of suspected sepsis. In an attempt to standardise practice, the National Institute for Health and Care Excellence has released a guideline on sepsis recognition, diagnosis and early management. NICE (2016) defines a risk of sepsis that is closely aligned with the NEWS:

- Moderate-to-high risk – corresponds to a NEWS of 1 and 2;
- High risk – corresponds to a NEWS of 3.

Treatment: the ‘sepsis six’

When sepsis is suspected or diagnosed, time is of the essence: any delay in treating the patient increases the likelihood of them dying. The ‘sepsis six’ (Daniels, 2011) is a set of six measures required within the first hour of diagnosis (Box 4). These are:

- Administering oxygen;
- Giving antibiotics;
- Supporting circulation with fluids;
- Carrying out a venous blood test to check serum lactate and haemoglobin levels;
- Taking blood cultures to ensure the most appropriate antibiotic is used;
- Supporting respiration and oxygenation.

Box 1. Sepsis and septic shock: new definitions

Sepsis

“Sepsis is defined as a life-threatening condition that arises when the body’s response to an infection injures its own tissues and organs”

Septic shock

“Septic shock is defined as a subset of sepsis where underlying circulatory and cellular/metabolic abnormalities are profound enough to substantially increase mortality”

Source: Singer et al (2016)

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Box 4. ‘Sepsis six’ measures needed within one hour

1. Deliver oxygen to achieve saturations of 94-98%, or 88-92% in patients who retain carbon dioxide
2. Take blood cultures and other cultures
3. Administer intravenous antibiotics
4. Measure venous bloods: glucose and lactate, full blood count, urea and electrolytes, creatinine, C-reactive protein and clotting screen
5. Commence crystalloid IV infusion 500ml in 15 minutes and reassess
6. Measure urine output

Sources: Adapted from National Institute for Health and Care Excellence (2016) and Daniels R (2014)

● Measuring urine output.

The case study described in Box 5 illustrates the speed with which sepsis can progress and highlights the importance of quick recognition.

Conclusion

The new definitions of sepsis and septic shock pave the way for consistent and timely identification and treatment. The NEWS already helps with identifying deteriorating patients. A clear step-by-step tool to detect sepsis or suspected sepsis is now needed. The qSOFA could act as a prompt for health professionals working in the community or other non-acute settings, while the NEWS complemented by clinical factors triggering suspicion of sepsis may be the best option in hospitals. Nurses and student nurses should consider sepsis in any patient who has a suspected infection as well as high respiratory rate, low blood pressure and altered mental state. NT

References

National Confidential Enquiry into Patient Outcome and Death (2015) Just Say Sepsis! A Review of the Process of Care Received by Patients with Sepsis. London: NCEPOD. Bit.ly/NCEPODSaySepsis
National Institute for Health and Care Excellence (2016) Sepsis: Recognition, Diagnosis and Early Management. London: NICE. nice.org.uk/ng51

Box 5. Case study

George Carter, aged 76, has chronic obstructive pulmonary disease and is admitted to the emergency unit at the request of his GP. Six months ago, he was hospitalised for an exacerbation of COPD. This time, a chest infection is suspected.

<table>
<thead>
<tr>
<th>Observations</th>
<th>On admission</th>
<th>4 hours after admission</th>
<th>6 hours after admission</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature (°C)</td>
<td>37.5</td>
<td>37.6</td>
<td>37</td>
</tr>
<tr>
<td>Respiratory rate (breaths/min)</td>
<td>20</td>
<td>20</td>
<td>24</td>
</tr>
<tr>
<td>Blood pressure</td>
<td>111/62 (MAP 78mmHg)</td>
<td>101/55 (MAP 70mmHg)</td>
<td>96/50 (MAP 65mmHg)</td>
</tr>
<tr>
<td>Pulse (beats/min)</td>
<td>89</td>
<td>101</td>
<td>109</td>
</tr>
<tr>
<td>Oxygen saturation</td>
<td>82% on air</td>
<td>92% on oxygen</td>
<td>92% on oxygen</td>
</tr>
<tr>
<td>AVPU</td>
<td>A</td>
<td>A</td>
<td>A</td>
</tr>
<tr>
<td>NEWS</td>
<td>3</td>
<td>6</td>
<td>9</td>
</tr>
</tbody>
</table>

AVPU = Alert, responds to Voice, responds to Pain. NEWS = National Early Warning Score. MAP = mean arterial pressure.

Mr Carter is sent for a chest X-ray and blood test. He is to receive 1L of normal saline over four hours, antibiotics and oxygen.

Four hours after admission, he has been commenced on fluids and is having his first dose of antibiotics. He is diagnosed with pneumonia. Observations are to be recorded more frequently.

Six hours after admission, the nurse escalates concerns to the registrar. The critical care outreach team is asked to review the patient due to his worsening NEWS. He is given several fluid boluses and the registrar temporarily increases the amount of oxygen.

Mr Carter is reviewed and is identified as having a high risk of sepsis. His blood pressure remains low after the administration of fluid and it is decided that he should be admitted to intensive care for support with his blood pressure. He responds well to treatment and is discharged to a ward after 48 hours. He remains in hospital for a further five days before he is discharged home.

The patient’s name has been changed.

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