Surviving Sepsis Campaign

Guidelines for Management of Severe Sepsis and Septic Shock

This is a summary of the Surviving Sepsis Campaign International Guidelines for Management of Severe Sepsis and Septic Shock: 2008 condensed from *Dellinger RP, Levy MM, Carlet JM, et al: Surviving Sepsis Campaign: Guidelines for management of severe sepsis and septic shock. Intensive Care Medicine (2008).* This version does not contain the rationale or appendices contained in the primary publication. The SSC guidelines do not cover every aspect of managing critically ill patients, and their application should be supplemented by generic best practice and specific treatment as required. Please refer to the guidelines for additional information at www.survivingsepsis.org.

Strength of recommendation and quality of evidence have been assessed using the GRADE criteria, presented in brackets after each guideline. For added clarity:

- ♦ Indicates a strong recommendation or "we recommend"
- ◊ Indicates a weak recommendation or "we suggest"

SSC GUIDELINES HAVE BEEN ENDORSED BY

American Association of Critical-Care Nurses; American College of Chest Physicians; Canadian Critical Care Society; European Society of Clinical Microbiology and Infectious Diseases; European Society of Intensive Care Medicine; European Respiratory Society; International Sepsis Forum; Japanese Association for Acute Medicine; Japanese Society of Intensive Care Medicine; Society of Critical Care Medicine; Society of Hospital Medicine; Surgical Infection Society, World Federation of Intensive and Critical Care Societies. Participation and endorsement by German Sepsis Society and Latin American Sepsis Institute.

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Initial resuscitation (first 6 hours)

- ♦ Begin resuscitation immediately in patients with hypotension or elevated serum lactate >4mmol/l; do not delay pending ICU admission.(1C)

- ♦ Resuscitation goals: (1C)
  - Central venous pressure (CVP) 8–12 mm Hg*
  - Mean arterial pressure ≥ 65 mm Hg
  - Urine output ≥ 0.5 mL.kg^{-1}.hr^{-1}
  - Central venous (superior vena cava) oxygen saturation ≥ 70%, or mixed venous ≥ 65%

- ◊ If venous O_2 saturation target not achieved: (2C)
  - consider further fluid
  - transfuse packed red blood cells if required to haematocrit of ≥ 30% and/or
  - dobutamine infusion max 20 µg.kg^{-1}.min^{-1}

* A higher target CVP of 12-15 mmHg is recommended in the presence of mechanical ventilation or pre-existing decreased ventricular compliance.

Diagnosis

- ♦ Obtain appropriate cultures before starting antibiotics provided this does not significantly delay antimicrobial administration.(1C)
  - Obtain two or more blood cultures (BCs)
  - One or more BCs should be percutaneous
  - One BC from each vascular access device in place > 48 hours
  - Culture other sites as clinically indicated
- ♦ Perform imaging studies promptly in order to confirm and sample any source of infection; if safe to do so.(1C)

Antibiotic therapy

- ♦ Begin intravenous antibiotics as early as possible, and always within the first hour of recognising severe sepsis (1D) and septic shock.(1B)
- ♦ Broad-spectrum: one or more agents active against likely bacterial/fungal pathogens and with good penetration into presumed source.(1B)
- ♦ Reassess antimicrobial regimen daily to optimise efficacy, prevent resistance, avoid toxicity & minimise costs.(1C)
- ◊ Consider combination therapy in Pseudomonas infections.(2D)
- ◊ Consider combination empiric therapy in neutropenic patients.(2D)
- ◊ Combination therapy no more than 3-5 days and de-escalation following susceptibilities.(2D)
- ♦ Duration of therapy typically limited to 7–10 days; longer if response slow, undrainable foci of infection, or immunologic deficiencies.(1D)
- ♦ Stop antimicrobial therapy if cause is found to be non-infectious.(1D)

Source identification and control

- A specific anatomic site of infection should be established as rapidly as possible(1C) and within the first 6 hrs of presentation.(1D)
- Formally evaluate patient for a focus of infection amenable to source control measures (eg: abscess drainage, tissue debridement).(1C)
- Implement source control measures as soon as possible following successful initial resuscitation.(1C)
- Exception: infected pancreatic necrosis, where surgical intervention best delayed. (2B)
- Choose source control measure with maximum efficacy and minimal physiologic upset.(1D)
- Remove intravascular access devices if potentially infected.(1C)

Fluid therapy

- Fluid-resuscitate using crystalloids or colloids.(1B)
- Target a CVP of ≥ 8mmHg (≥12mmHg if mechanically ventilated).(1C)
- Use a fluid challenge technique while associated with a haemodynamic improvement.(1D)
- Give fluid challenges of 1000 ml of crystalloids or 300–500 ml of colloids over 30 minutes. More rapid and larger volumes may be required in sepsis-induced tissue hypoperfusion.(1D)
- Rate of fluid administration should be reduced if cardiac filling pressures increase without concurrent haemodynamic improvement.(1D)

Vasopressors

- Maintain MAP ≥ 65mmHg.(1C)
- Norepinephrine or dopamine centrally administered are the initial vasopressors of choice.(1C)
- ◊ Epinephrine, phenylephrine or vasopressin should not be administered as the initial vasopressor in septic shock.(2C)
- ◊ Vasopressin 0.03 units/min maybe subsequently added to norepinephrine with anticipation of an effect equivalent to norepinephrine alone.
- ◊ Use epinephrine as the first alternative agent in septic shock when blood pressure is poorly responsive to norepinephrine or dopamine.(2B)
- Do not use low-dose dopamine for renal protection.(1A)
- In patients requiring vasopressors, insert an arterial catheter as soon as practical.(1D)

Inotropic therapy

- Use dobutamine in patients with myocardial dysfunction as indicated by elevated cardiac filling pressures and low cardiac output.(1C)
- Do not increase cardiac index to predetermined supranormal levels.(1B)

Steroids

- ◊ Consider intravenous hydrocortisone for adult septic shock when hypotension remains poorly responsive to adequate fluid resuscitation and vasopressors.(2C)
- ◊ ACTH stimulation test is not recommended to identify the subset of adults with septic shock who should receive hydrocortisone.(2B)
- ◊ Hydrocortisone is preferred to dexamethasone.(2B)
- ◊ Fludrocortisone (50µg orally once a day) may be included if an alternative to hydrocortisone is being used which lacks significant mineralocorticoid activity. Fludrocortisone is optional if hydrocortisone is used.(2C)
- ◊ Steroid therapy may be weaned once vasopressors are no longer required.(2D)
- Hydrocortisone dose should be < 300mg/day.(1A)
- Do not use corticosteroids to treat sepsis in the absence of shock unless the patient's endocrine or corticosteroid history warrants it.(1D)

Recombinant human activated protein C (rhAPC)

- ◊ Consider rhAPC in adult patients with sepsis-induced organ dysfunction with clinical assessment of high risk of death (typically APACHE II ≥ 25 or multiple organ failure) if there are no contraindications.(2B,2C for post-operative patients)
- Adult patients with severe sepsis and low risk of death (eg: APACHE II<20 or one organ failure) should not receive rhAPC.(1A)

Blood product administration

- Give red blood cells when haemoglobin decreases to <7.0 g/dl (<70 g/L) to target a haemoglobin of 7.0 – 9.0 g/dl in adults.(1B)
- A higher haemoglobin level may be required in special circumstances (eg: myocardial ischaemia, severe hypoxaemia, acute haemorrhage, cyanotic heart disease or lactic acidosis)
- Do not use erythropoietin to treat sepsis-related anaemia. Erythropoietin may be used for other accepted reasons.(1B)
- ◊ Do not use fresh frozen plasma to correct laboratory clotting abnormalities unless there is bleeding or planned invasive procedures.(2D)
- Do not use antithrombin therapy.(1B)
- ◊ Administer platelets when: (2D)
  - counts are <5000/mm^3 (5 X 10^9/L) regardless of bleeding.
  - counts are 5000 to 30,000/mm^3 (5–30 X 10^9/L) and there is significant bleeding risk.
  - Higher platelet counts (≥ 50,000/mm^3 [50 X 10^9/L]) are required for surgery or invasive procedures.

Mechanical ventilation of sepsis-induced acute lung injury (ALI)/ARDS

- ♦ Target a tidal volume of 6ml/kg (predicted) body weight in patients with ALI/ARDS.(1B)
- ♦ Target an initial upper limit plateau pressure ≤30cmH2O. Consider chest wall compliance when assessing plateau pressure.(1C)
- ♦ Allow PaCO2 to increase above normal, if needed to minimise plateau pressures and tidal volumes.(1C)
- ♦ Positive end expiratory pressure (PEEP) should be set to avoid extensive lung collapse at end expiration.(1C)
- ◊ Consider using the prone position for ARDS patients requiring potentially injurious levels of FiO2 or plateau pressure, provided they are not put at risk from positional changes.(2C)
- ♦ Maintain mechanically ventilated patients in a semi-recumbent position unless contraindicated.(1B)
  - ◊ We suggest that elevation is maintained between 30° - 45°.(2C)
- ◊ Non invasive ventilation may be considered in the minority of ALI/ARDS patients with mild-moderate hypoxemic respiratory failure. The patients need to be haemodynamically stable, comfortable, easily arousable, able to protect/clear their airway and expected to recover rapidly.(2B)
- ♦ Use a weaning protocol and a spontaneous breathing trial (SBT) regularly to evaluate the potential for discontinuing mechanical ventilation.(1A)
  - SBT options include a low level of pressure support with continuous positive airway pressure 5 cm H_2O or a T-piece.
  - Before the SBT, patients should:
    - be arousable
    - be haemodynamically stable without vasopressors
    - have no new potentially serious conditions
    - have low ventilatory and end-expiratory pressure requirement
    - require FiO2 levels that can be safely delivered with a face mask or nasal cannula
- ♦ Do not use a pulmonary artery catheter for the routine monitoring of patients with ALI/ARDS.(1A)
- ♦ Use a conservative fluid strategy for patients with established ALI who do not have evidence of tissue hypoperfusion.(1C)

Sedation, analgesia, and neuromuscular blockade in sepsis

- ♦ Use sedation protocols with a sedation goal for critically ill mechanically ventilated patients.(1B)
- ♦ Use either intermittent bolus sedation or continuous infusion sedation to predetermined end points (sedation scales), with daily interruption/lightening to produce awakening. Re-titrate if necessary.(1B)
- ♦ Avoid neuromuscular blockers (NMBs) where possible. Monitor depth of block with train of four when using continuous infusions.(1B)

Glucose control

- ♦ Use IV insulin to control hyperglycaemia in patients with severe sepsis following stabilisation in the ICU.(1B)
- ◊ Aim to keep blood glucose <150 mg/dl (8.3mmol/L) using a validated protocol for insulin dose adjustment.(2C)
- ♦ Provide a glucose calorie source and monitor blood glucose values every 1-2 hrs (4 hrs when stable) in patients receiving intravenous insulin.(1C)
- ♦ Interpret with caution low glucose levels obtained with point of care testing, as these techniques may overestimate arterial blood or plasma glucose values.(1B)

Renal replacement

- ◊ Intermittent haemodialysis and continuous veno-venous haemofiltration (CVVH) are considered equivalent.(2B)
- ◊ CVVH offers easier management in haemodynamically unstable patients.(2D)

Bicarbonate therapy

- ♦ Do not use bicarbonate therapy for the purpose of improving haemodynamics or reducing vasopressor requirements when treating hypoperfusion-induced lactic acidaemia with pH ≥ 7.15.(1B)

Deep vein thrombosis (DVT) prophylaxis

- ♦ Use either low-dose unfractionated heparin (UFH) or low-molecular weight heparin (LMWH), unless contraindicated.(1A)
- ♦ Use a mechanical prophylactic device, such as compression stockings or an intermittent compression device, when heparin is contraindicated.(1A)
- ◊ Use a combination of pharmacologic and mechanical therapy for patients who are at very high risk for DVT.(2C)
- ◊ In patients at very high risk LMWH should be used rather than UFH.(2C)

Stress ulcer prophylaxis

- ♦ Provide stress ulcer prophylaxis using H2 blocker(1A) or proton pump inhibitor(1B). Benefits of prevention of upper GI bleed must be weighed against the potential for development of ventilator-acquired pneumonia.

Consideration for limitation of support

- ♦ Discuss advance care planning with patients and families. Describe likely outcomes and set realistic expectations.(1D)