



Surviving Sepsis Campaign

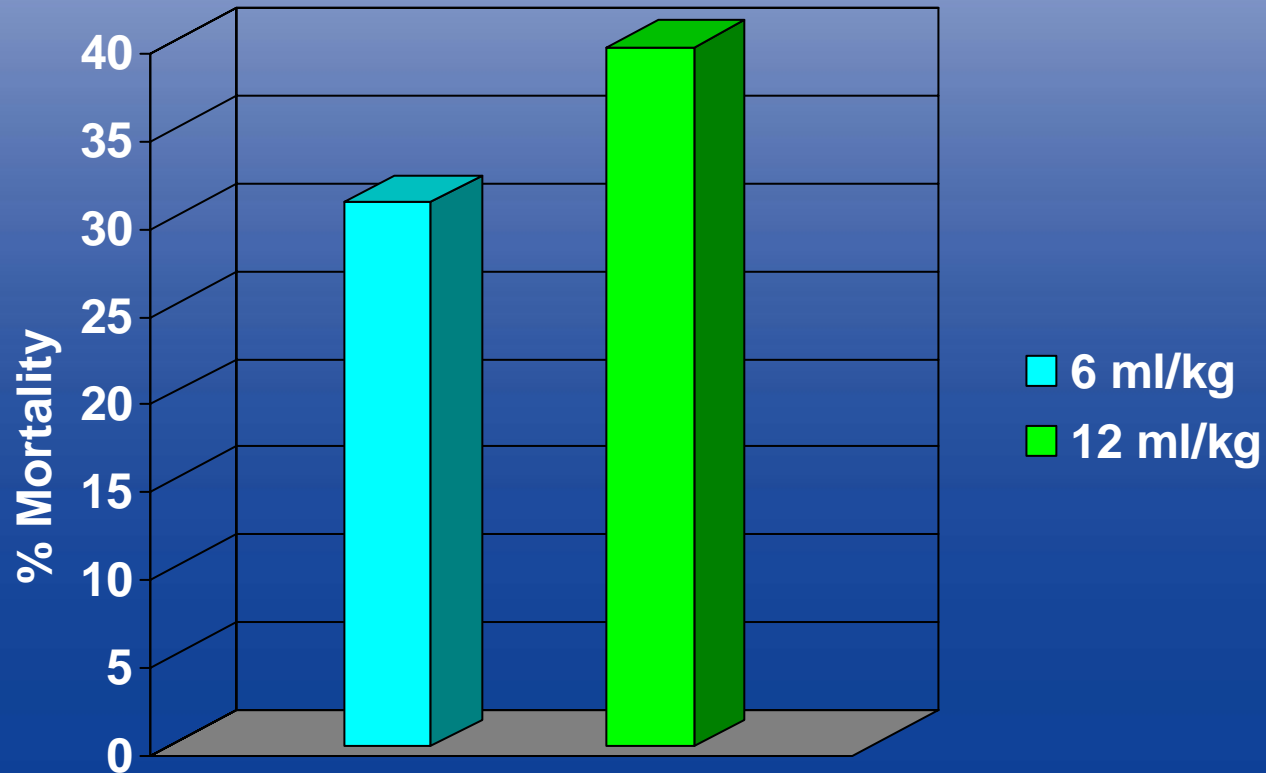
Guidelines for Management of Severe Sepsis/Septic Shock

An Overview

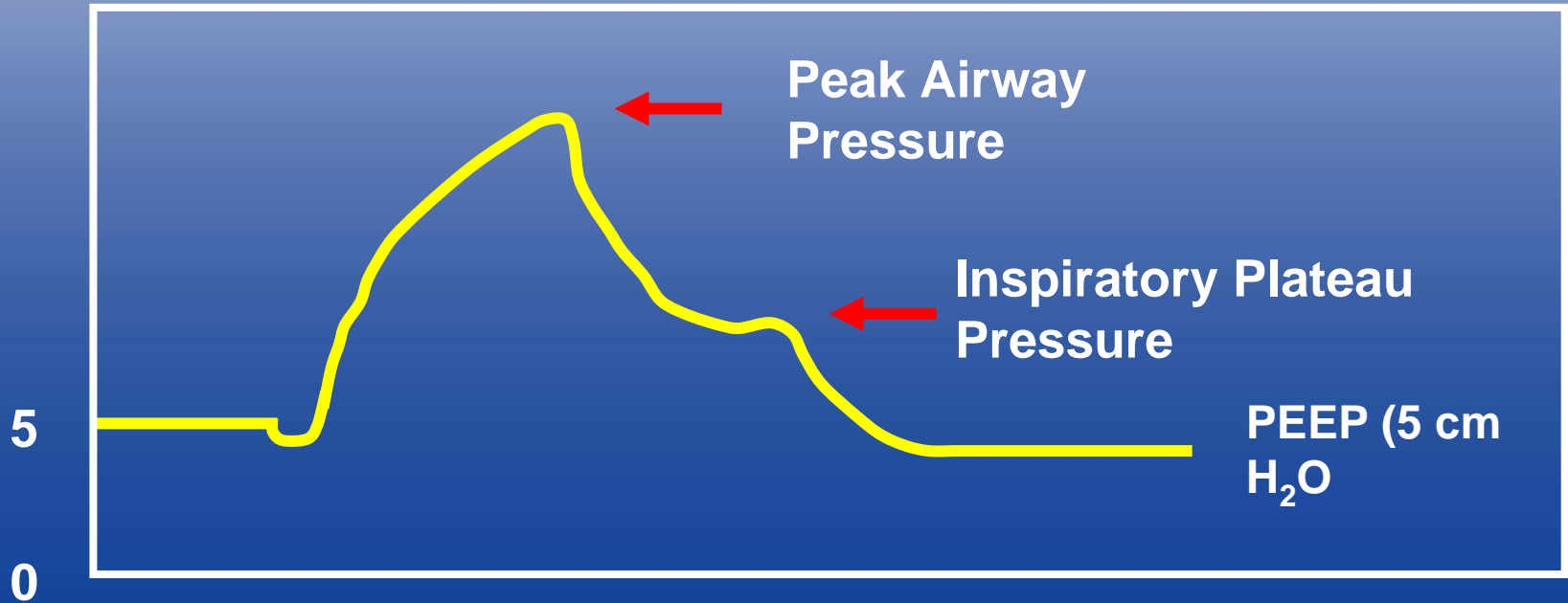


Mechanical Ventilation of Sepsis-Induced ALI/ARDS

ARDSnet Mechanical Ventilation Protocol Results: Mortality



Adapted from Figure 1, page 1306, with permission from The Acute Respiratory Distress Syndrome Network. *N Engl J Med* 2000;342:1301-1378



Mechanical Ventilation of Sepsis-Induced ALI/ARDS

- Reduce tidal volume over 1–2 hrs to 6 ml/kg predicted body weight
- Maintain inspiratory plateau pressure < 30 cm H₂O

Grade B

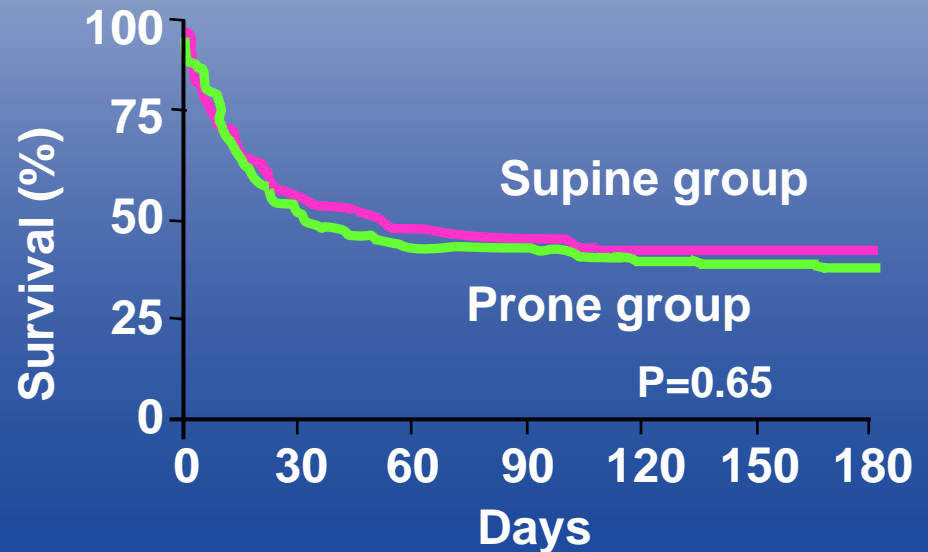
Mechanical Ventilation of Sepsis-Induced ALI/ARDS

- **Minimum PEEP**
 - Prevent end expiratory lung collapse
- **Setting PEEP**
 - FIO₂ requirement
 - Thoracopulmonary compliance

Grade E

The Role of Prone Positioning in ARDS

- 70% of prone patients improved oxygenation
- 70% of response within 1 hour
- 10-day mortality rate in quartile with lowest PaO₂:FIO₂ ratio (≤ 88)
 - Prone – 23.1%
 - Supine – 47.2%



Kaplan-Meier estimates of survival at 6 months

The Role of Prone Positioning in ARDS

Consider prone positioning in ARDS when:

- Potentially injurious levels of F_1O_2 or plateau pressure exist
- Not at high risk from positional changes

Grade E

Mechanical Ventilation of Severe Sepsis

- Semirecumbent position unless contraindicated with head of the bed raised to 45°

Grade C

Mechanical Ventilation of Septic Patients

- Use weaning protocol and a spontaneous breathing trial (SBT), at least daily

Grade A

Ely, et al. NEJM 1996; 335:1864-1869

Esteban, et al. AJRCCM 1997; 156:459-465

Esteban, et al. AJRCCM 1999; 159:512-518

Mechanical Ventilation of Septic Patients

SBT options

- Low level of pressure support with continuous positive airway pressure 5 cm H₂O
- T-piece

Prior to SBT

- a) Arousable
- b) Hemodynamically stable (without vasopressor agents)
- c) No new potentially serious conditions
- d) Low ventilatory and end-expiratory pressure requirements
- e) Requiring levels of FIO_2 that could be safely delivered with a face mask or nasal cannula

Consider extubation if SBT is unsuccessful

Sedation and Analgesia in Sepsis

- **Sedation protocol for mechanically ventilated patients with standardized subjective sedation scale target.**
 - **Intermittent bolus**
 - **Continuous infusion with daily awakening/retitration**

Grade B

**Kollef, et al. Chest 1998; 114:541-548
Brook, et al. CCM 1999; 27:2609-2615
Kress, et al. NEJM 2000; 342:1471-1477**

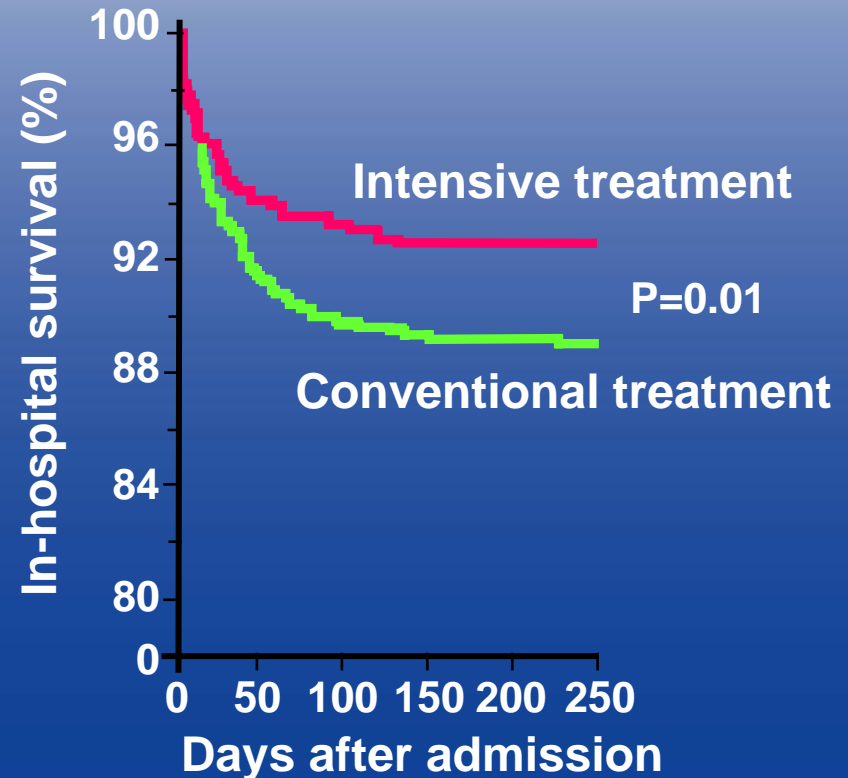
Neuromuscular Blockers

- Avoid if possible
- Used longer than 2-3 hrs
 - PRN bolus
 - Continuous infusion with twitch monitor

Grade E

The Role of Intensive Insulin Therapy in the Critically Ill

- At 12 months, intensive insulin therapy reduced mortality by 3.4% ($P < 0.04$)



Glucose Control

- **After initial stabilization**
 - **Glucose < 150 mg/dL**
 - **Continuous infusion insulin and glucose or feeding (enteral preferred)**
 - **Monitoring**
 - **Initially q30–60 mins**
 - **After stabilization q4h**

Grade D

Renal Replacement

- **Absence of hemodynamic instability**
 - Intermittent hemodialysis and continuous venovenous filtration equal (CVVH)
- **Hemodynamic instability**
 - CVVH preferred

Grade B

Bicarbonate Therapy

- Bicarbonate therapy not recommended to improve hemodynamics in patients with lactate induced pH >7.15

Grade C

Cooper, et al. Ann Intern Med 1990; 112:492-498
Mathieu, et al. CCM 1991; 19:1352-1356

Changing pH Has Limited Value

| Treatment | Before | After |
|-------------------------------------|--------|-------|
| NaHCO₃ (2 mEq/kg) | | |
| pH | 7.22 | 7.36 |
| PAOP | 15 | 17 |
| Cardiac output | 6.7 | 7.5 |
| 0.9% NaCl | | |
| pH | 7.24 | 7.23 |
| PAOP | 14 | 17 |
| Cardiac output | 6.6 | 7.3 |

Deep Vein Thrombosis Prophylaxis

- Heparin (UH or LMWH)
- Contraindication for heparin
 - Mechanical device (unless contraindicated)
- High risk patients
 - Combination pharmacologic and mechanical

Grade A

Primary Stress Ulcer Risk Factors Frequently Present in Severe Sepsis

- **Mechanical ventilation**
- **Coagulopathy**
- **Hypotension**

Choice of Agents for Stress Ulcer Prophylaxis

- H₂ receptor blockers
- Role of proton pump inhibitors

Grade C

Consideration for Limitation of Support

- **Advance care planning, including the communication of likely outcomes and realistic goals of treatment, should be discussed with patients and families. Decisions for less aggressive support or withdrawal of support may be in the patient's best interest.**

Grade E



Surviving Sepsis

Phase 1 Barcelona declaration

Phase 2 Evidence based guidelines Paediatric issues

Phase 3 Implementation and education

Fluid Resuscitation

- Aggressive fluid resuscitation with boluses of 20 ml/kg over 5-10 min
- Blood pressure by itself is not a reliable endpoint for resuscitation
- Initial resuscitation usually requires 40-60 ml/kg, but more may be required

Hemodynamic Support

- Hemodynamic profile may be variable
- Dopamine for hypotension
- Epinephrine or norepinephrine for dopamine-refractory shock
- Dobutamine for low cardiac output state
- Inhaled NO useful in neonates with post-partum pulmonary hypertension and sepsis

Therapeutic Endpoints

- Capillary refill < 2 sec
- Warm extremities
- Urine output > 1 ml/kg/hr
- Normal mental status
- Decreased lactate
- Central venous O₂ saturation > 70%

Other Therapies

- **Steroids: recommended for children with catecholamine resistance and suspected or proven adrenal insufficiency.**
- **Activated protein C not studied adequately in children yet.**
- **GM-CSF shown to be of benefit in neonates with sepsis and neutropenia.**
- **Extracorporeal membrane oxygenation (ECMO) may be considered in children with refractory shock or respiratory failure.**