

SEPSIS

- Early Goal Directed Therapy -
- ARISE
- Sepsis Kills
- Surviving Sepsis

SEPSIS PATHWAY

MRN _____
Name _____
DOB _____
Address _____

Does your patient have risk factors, signs or symptoms of infection?

- | | |
|--|---|
| <input type="checkbox"/> History of fever or rigors | <input type="checkbox"/> Indwelling medical device |
| <input type="checkbox"/> Any non- specifically unwell patient if Elderly, immunocompromised or chronically ill | <input type="checkbox"/> Any suspected infection |
| <input type="checkbox"/> Recent surgery / invasive procedure | <ul style="list-style-type: none"> o Skin: Cellulitis, wound; o Urine: dysuria, frequency, odour; o Abdomen: pain, peritonism o Chest: cough, shortness of breath; o Neuro: decreased mental alertness, neck stiffness, headache |

AND

Does your patient have 2 or more qSOFA criteria?

- ☐ Respirations > 22 per minute
- ☐ Altered mentation (GCS <15)
- ☐ Systolic BP ≤ 100

N

Assess for other causes
Treat as indicated
Sepsis may still be a concern
Repeat obs in 30 mins

Y

OVERHEAD: SEPSIS CALL

Triage category as per ATS discriminator (Minimum ATS 3); Protocol commenced on EDIS

Insert IVC, obtain VBG (Check lactate result ASAP) &
FBC, EUC, LFTs, BSL, Glucose, COAGS, Blood Cultures x2 (from different sites)

Does your patient have any red criteria below?

- | | | |
|---|---|--|
| <input type="checkbox"/> SBP < 90mmHg | <input type="checkbox"/> Lactate > 4 mmol/L | <input type="checkbox"/> Base Excess < - 5.0 |
| <input type="checkbox"/> Age > 65 years | <input type="checkbox"/> Immunocompromised | |

Y

N

SEVERE SEPSIS PATHWAY

- ☐ Inform the ED Medical Team Leader
- ☐ Consider transfer to a resuscitation area or equivalent
- ☐ Turn over page for Resuscitation Guideline

**** START IV ANTIBIOTICS WITHIN 60 MINUTES ****

- ☐ Early ICU consultation

MODERATE SEPSIS PATHWAY

- ☐ Inform the ED Medical Team Leader
- ☐ Monitor vital signs & fluid balance
- ☐ Administer empiric IVAB's within 1 hr unless another diagnosis is more likely
- ☐ Start IV fluids
- ☐ Continue septic work up eg: x-rays/swabs/urine/etc
- ☐ Refer / Communicate with admitting team

If patient develops any:

- Hypotension or urine output <0.5ml/kg/hr,
→ Go to severe sepsis pathway
- Increasing respiratory rate or fall in GCS by 2 points, notify ED Medical Team Leader Immediately

RECOGNISE

RESPOND AND ESCALATE

SEPSIS PATHWAY

MRN _____
Name _____
DOB _____
Address _____

Severe Sepsis Guideline

Does the patient have an Advance Care Directive/MOLST? Are there treatment limitations?

Patient assessment and treatment proceeds simultaneously

- ☐ Maintain SpO₂ ≥ 95%
- ☐ Monitor resp rate, SpO₂, heart rate and rhythm, BP, temp every 30 mins
- ☐ Strict fluid balance
- ☐ Fluid resuscitate

- Give 500ml of 0.9% sodium chloride STAT fluid challenge
- If no response in BP, repeat 500ml bolus and if available lung US/bedside echo
- If no response, insert IDC and consider early vasopressor administration to achieve a MAP of > 65mmHg

**** START IV ANTIBIOTICS WITHIN 60 MINUTES OF PATHWAY ACTIVATION ****
(Refer to eTG Antibiotic guidelines)

**** Do not wait for results of investigations ****

- ☐ Investigate source of infection e.g. urine M/C/S, chest x-ray, sputum, wound
- ☐ Refer / communicate with ICU

RESUSCITATE

RE-ASSESS

IS YOUR PATIENT RESPONDING TO RESUSCITATION?

Signs of improvement	If improving, take the following action:
MAP > 65mmHg	<ul style="list-style-type: none"> <input type="checkbox"/> Continue monitoring vital signs every 1 hour <input type="checkbox"/> Strict monitoring of fluid balance <input type="checkbox"/> Investigate and treat the source of infection
Urine Output > 0.5mL/kg/hr	
SpO ₂ > 95%	
Decreasing serum lactate level	
Improving LOC	

N

IF NO IMPROVEMENT INTENSIVE CARE MANAGEMENT IS REQUIRED

- ☐ Reassess suitability to continue resuscitation
 - o MOLST
 - ☐ Request review by ICU team
- Minimum requirements for patient monitoring:
- ☐ Invasive arterial line BP monitoring, urine output via IDC, q 30 mins vital observation
 - ☐ Repeat serum lactate every 4 hours

REFER

Definition

- Sepsis= “life-threatening organ dysfunction caused by a dysregulated host response to Infection” (Singer et al., 2016)
- “Sepsis is a life threatening condition that arises when the body's response to an infection injures its own tissues and organs” (Czura, 2011)
- Septic shock= “a subset of sepsis where underlying circulatory and cellular/metabolic abnormalities are profound enough to substantially increase mortality’ requiring vasopressors to maintain a mean arterial pressure of 65mmHG or greater AND serum lactate greater than 2mmol/L despite adequate fluid resuscitation.”

Recognition can be difficult

Sepsis recognition in the ED

Sepsis is a clinical syndrome with no tissue diagnostic or reliable serological test. Sepsis often presents insidiously, and the clinical features can be heterogeneous and non-specific. A

The question of how to optimally identify sepsis in the ED remains unresolved. The Surviving Sepsis

Defined as Organ dysfunction, not abnormal vital signs

No biomarker to date has been sufficiently validated as a single test to rule-in or rule-out sepsis but this article high-

qSOFA

- Quick Sequential Organ Failure Assessment
- has been proposed as a bedside tool to identify patients with infection who are at increased risk of in hospital death or treatment in an intensive care unit for 3 or more days.
- Organ dysfunction due to infection is identified by an increase in the Sequential Organ Failure Assessment (SOFA) score of 2 points or more
- qSOFA Criteria:
 1. Respiratory Rate $>22/\text{min}$
 2. SBP $<100\text{mmHg}$
 3. Altered Mentation
- ❖ 24% of infected patients with 2 or 3 qSOFA points account for 70% of deaths
- ❖ 177 hospitals worldwide, including community and academic, rural, suburban, and urban, public, private, and federal hospitals.

SOFA is ICU derived – not validated in ED

Focusses on organ dysfunction

TABLE 1. Sequential Organ Failure Assessment (SOFA) score,¹⁵ with modification of respiratory component to include FiO₂/SpO₂ or supplemental oxygen where the PaO₂ is not measured or patient is not ventilated (Pandharipande et al., Crit. Care Med. 2009; 37: 1317–21)

System	Score	0	1	2	3	4
Respiratory	PaO ₂ /FiO ₂	>400	<400	<300	<200	100
	SpO ₂ /FiO ₂	>400	<400	<315	<235	<150
	SpO ₂	>94% (RA) ± respiratory support	≥90% on 6 lpm ± respiratory support	<90% on >6 lpm ± respiratory support	+respiratory support	+respiratory support
Cardiovascular	Blood pressure (mmHg) +	SBP >90 at all times	SBP >90 after fluid bolus 20 mL/kg	SBP <90 mmHg despite fluid bolus		
	Vasopressor (µg/kg/min)			Dopamine ≤5 Dobutamine	Dopamine >5 Noradrenaline ≤0.1	Dopamine >15 Noradrenaline >0.1
Haematology	Platelets (×10 ⁹ /L)	>150	100–150	50–99	20–49	<20
Gastrointestinal	Bilirubin (µmol/L)	<20	20–32	33–101	102–204	>204
Neurological	GCS	15	13–14	10–12	6–9	3–5
Renal	Creatinine (µmol/L) or urine output (mL/kg/h)	<110	>110–170 <0.5 for 2 h	>171–300	301–440	>440

sensitivity for detecting adverse outcomes outside the ICU has been found to be limited.^{16,22,23} Thus, it cannot be recommended



Sepsis Pathway - Adult - Emergency Department

Use local febrile neutropenia guideline if patient has haematology/oncology diagnosis



RECOGNISE

Does your patient have risk factors, signs or symptoms of infection?

- | | |
|--|---|
| <input type="checkbox"/> Immunocompromised | <input type="checkbox"/> Abdomen: pain, peritonism |
| <input type="checkbox"/> Indwelling medical device | <input type="checkbox"/> Lung: cough, shortness of breath |
| <input type="checkbox"/> Recent surgery/invasive procedure | <input type="checkbox"/> Neuro: altered LOC, new onset of confusion, neck stiffness, headache |
| <input type="checkbox"/> History of fever or rigors | <input type="checkbox"/> Skin: wound, cellulitis |
| <input type="checkbox"/> Re-presentation within 48 hours | <input type="checkbox"/> Urine: dysuria, frequency, odour |
| <input type="checkbox"/> Fall not related to mechanism of injury | |

AND

Does your patient have 2 or more yellow criteria?

- | | |
|---|--|
| <input type="checkbox"/> Respirations ≤ 10 or ≥ 25 per minute | <input type="checkbox"/> Heart rate ≤ 50 OR ≥ 120 per minute |
| <input type="checkbox"/> SpO ₂ < 95% | <input type="checkbox"/> Altered LOC or new onset of confusion |
| <input type="checkbox"/> Systolic blood pressure ≤ 100 mmHg | <input type="checkbox"/> Temp < 35.5 or > 38.5°C |

YES
Perform venous
blood gas if
available

Does your patient have any red criteria?

- | | |
|--|--|
| <input type="checkbox"/> SBP < 90mmHg | <input type="checkbox"/> Age > 65 years |
| <input type="checkbox"/> Lactate ≥ 4 mmol/L | <input type="checkbox"/> Immunocompromised |
| <input type="checkbox"/> Base excess < - 5.0 | |

NO

NO

YES

Sepsis may still be a concern

- Monitor vital signs and fluid balance
- Treat and re-assess
- Consider septic screen

Patient may have SEPSIS

- Obtain senior clinician review within 30 minutes
- Look for other causes of deterioration
- Turn over page for SEPSIS SIX

Patient has SEVERE SEPSIS or SEPTIC SHOCK until proven otherwise

- Obtain IMMEDIATE senior clinician review
- Expedite transfer to resuscitation area or equivalent
- Commence resuscitation as per SEPSIS SIX

RESPOND & ESCALATE

ADULT SEPSIS PATHWAY v2

Does the patient have an Advance Care Directive; are there any treatment limitations?

Sepsis Six

Acknowledgement: The Sepsis Six in this document is an adaption of the Sepsis Six by Ron Daniels, UK Sepsis Trust.

1. OXYGEN	Administer oxygen to maintain SpO ₂ > 95%
2. BLOOD CULTURES	Take blood cultures (2 aerobic, 2 anaerobic), FBC, EUC, LFTs, coags, glucose, +/- wound, urine, sputum or other cultures
3. LACTATE	Take blood for formal lactate or VBG
4. IV FLUIDS	Give 20mL/kg 0.9% sodium chloride fluid challenge STAT Aim to achieve MAP of > 65mmHg or SBP > 100mmHg If no response, repeat 20mL/kg 0.9% sodium chloride <i>unless there are signs of pulmonary oedema</i> If no response commence inotropes as per local protocol and in consultation with senior doctor
5. IV ANTIBIOTICS	Prescribe and commence within 60 MINUTES from triage/time of diagnosis <i>or within 30 MINUTES if haematology/oncology patient</i> (refer to local guidelines and seek specialist advice) Do not wait for results of investigations
6. MONITORING	Monitor respiratory rate, SpO ₂ , blood pressure, heart rate, temperature, LOC, fluid balance, urinary output Review antibiotics when blood/specimen results available

RESUSCITATE

SIGNS OF IMPROVEMENT

- | | |
|---|---|
| <input type="checkbox"/> SpO ₂ > 95% | <input type="checkbox"/> MAP > 65mmHg or SBP > 100mmHg |
| <input type="checkbox"/> Decreasing tachycardia | <input type="checkbox"/> Decreasing serum lactate level |
| <input type="checkbox"/> Improving LOC | <input type="checkbox"/> Urine output > 0.5mL/kg/hr |

IF IMPROVING TAKE THE FOLLOWING ACTION

- Refer to admitting team/ICU
- Continue monitoring vital signs and fluid balance closely
- Investigate and treat the source of infection

RE-ASSESS

IF NO IMPROVEMENT THIS PATIENT NEEDS INTENSIVE CARE MANAGEMENT

- Reassess suitability to continue resuscitation
- Request review by ICU doctor to occur within 30 minutes
- If no ICU at your facility, seek advice immediately from the **ADULT MEDICAL RETRIEVAL SERVICE 1800 650 004** or local Critical Care Advisory Service

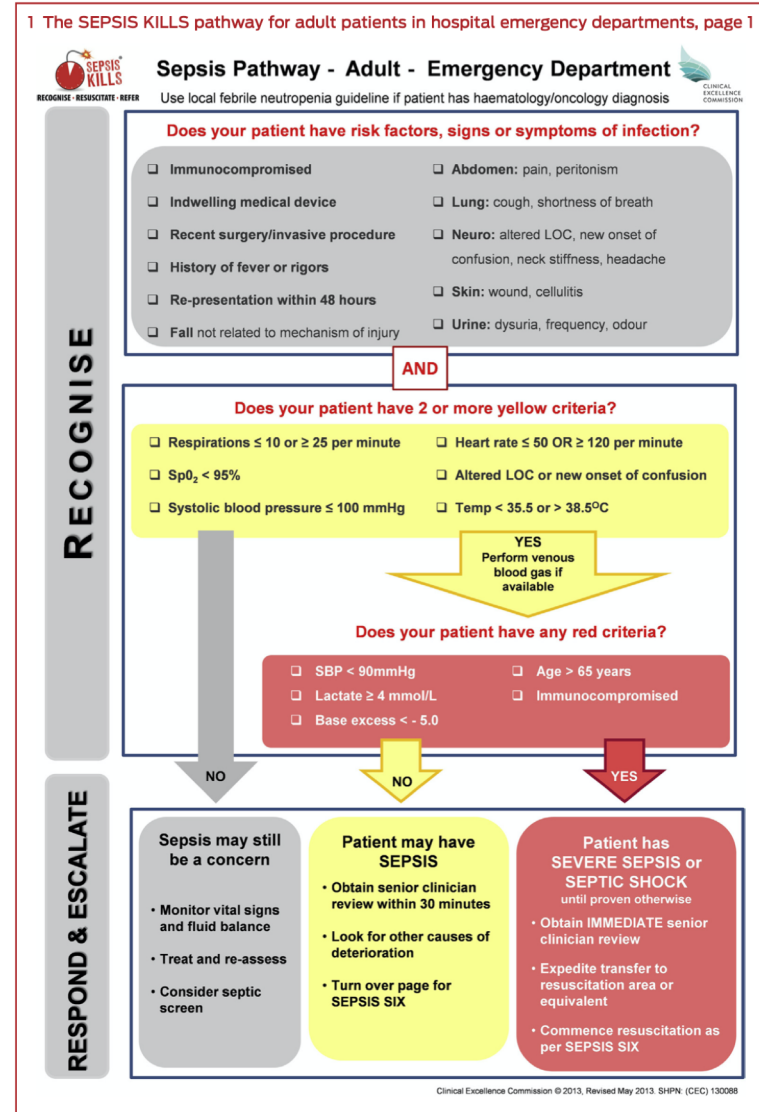
Minimum patient monitoring requirements:

- Respiratory rate, SpO₂, blood pressure, heart rate, temperature, LOC
- Repeat serum lactate every 4 hours
- Fluid balance, consider measuring urine output via IDC



REFER

Recognise



Resuscitate

2 The SEPSIS KILLS pathway for adult patients in hospital emergency departments, page 2

ADULT SEPSIS PATHWAY v2

RESUSCITATE

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6. MONITORING	Monitor respiratory rate, SpO ₂ , blood pressure, heart rate, temperature, LOC, fluid balance, urinary output Review antibiotics when blood/specimen results available

FLUIDS and ANTIBIOTICS

- Early Fluids and antibiotics have shown to improve survival

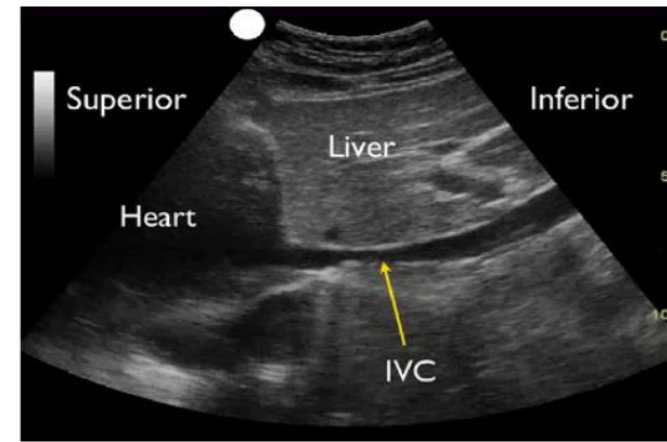
Empiric broad spectrum antibiotics within 1 hour; modify when cultures results and sensitivities available.

- Take x2 sets of blood cultures
- 2g Flucloxacillin and 7mg/kg Gentamicin is local empirical cover
- Tazoxacin 4.5g (+/- Vancomycin) for Febrile Neutropenic patients

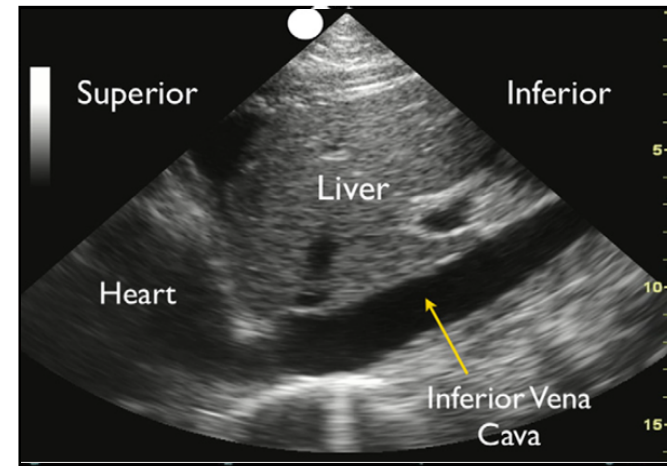
- Fluid regimen:-

- Should have at least 30ml/kg in the first 3 hours after recognizing sepsis
- Initially bolus 20ml/kg and reassess
- No fluid is proven to be superior however general consensus is after 2 litres of normal saline change to Hartmans

Collapsing IVC = More Fluids



Non-Collapsing IVC = Adequate fluids



Multiple B lines on Lung Ultrasound = Too Much Fluids



Although our analysis confirms that EGDT as a packaged protocol of care is not superior to usual care, there are still unresolved questions regarding the most effective fluid and vasopressor regimens, the role of hemodynamic monitoring, and appropriate targets in the resuscitation of patients with sepsis and septic shock. Even

General consensus - Use fluids and inotropes to achieve a MAP of >65mmHg



*Emergency
Care Institute*
NEW SOUTH WALES

Peripheral Vasopressors

In emergency situations, short-term administration (<2 hours) of vasopressor infusions via proximal, well-placed peripheral IVs is unlikely to cause local tissue injury. This should only be performed as a temporizing measure until central venous access is obtained.

1. We recommend norepinephrine as the first-choice vasopressor (strong recommendation, moderate quality of evidence).

Vasopressor Use for Adult Septic Shock (with guidance for steroid administration)

Initiate norepinephrine (NE) and titrate up to 35-90 $\mu\text{g}/\text{min}$
to achieve MAP target 65 mm Hg

Bedside echo to assess cardiac function.

Add epinephrine up to
20-50 $\mu\text{g}/\text{min}$ to achieve MAP
target**

E. SOURCE CONTROL

Early intervention for source control

Removal of intravascular access devices that are a possible source.

Re-assess for Response and Refer

RE-ASSESS

SIGNS OF IMPROVEMENT

- | | |
|---|---|
| <input type="checkbox"/> SpO ₂ > 95% | <input type="checkbox"/> MAP > 65mmHg or SBP > 100mmHg |
| <input type="checkbox"/> Decreasing tachycardia | <input type="checkbox"/> Decreasing serum lactate level |
| <input type="checkbox"/> Improving LOC | <input type="checkbox"/> Urine output > 0.5mL/kg/hr |

IF IMPROVING TAKE THE FOLLOWING ACTION

- Refer to admitting team/ICU
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- Investigate and treat the source of infection

REFER

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Minimum patient monitoring requirements:

- Respiratory rate, SpO₂, blood pressure, heart rate, temperature, LOC
- Repeat serum lactate every 4 hours
- Fluid balance, consider measuring urine output via IDC



H. CORTICOSTEROIDS

1. We suggest against using IV hydrocortisone to treat septic shock patients if adequate fluid resuscitation and vasopressor therapy are able to restore hemodynamic stability. If this is not achievable, we suggest IV hydrocortisone at a dose of 200 mg per day (weak recommendation, low quality of evidence).

IV hydrocortisone 200 mg/day if remain unstable despite fluids and vasopressors (low quality evidence).

I. BLOOD PRODUCTS

RBC transfusion when Hb < 70 g/L

Recommend against FFP

Give platelets if

<10,000 even in absence of bleeding;

<20,000 if significant risk of bleeding

target >50,000 for active

bleeding/surgery/invasive procedure

J. IMMUNOGLOBULINS

No role.

M. MECHANICAL VENTILATION

ARDSNET lung protective strategies

TV 6 ml/kg predicted body weight;

plateau pressure <30 cm H₂O

higher PEEP if hypoxic

conservative fluid strategy

avoid β 2-agonists if no bronchospasm

avoid routine use of pulmonary artery catheter

30-45 deg head elevation

7. We make no recommendation regarding the use of noninvasive ventilation (NIV) for patients with sepsis-induced ARDS.

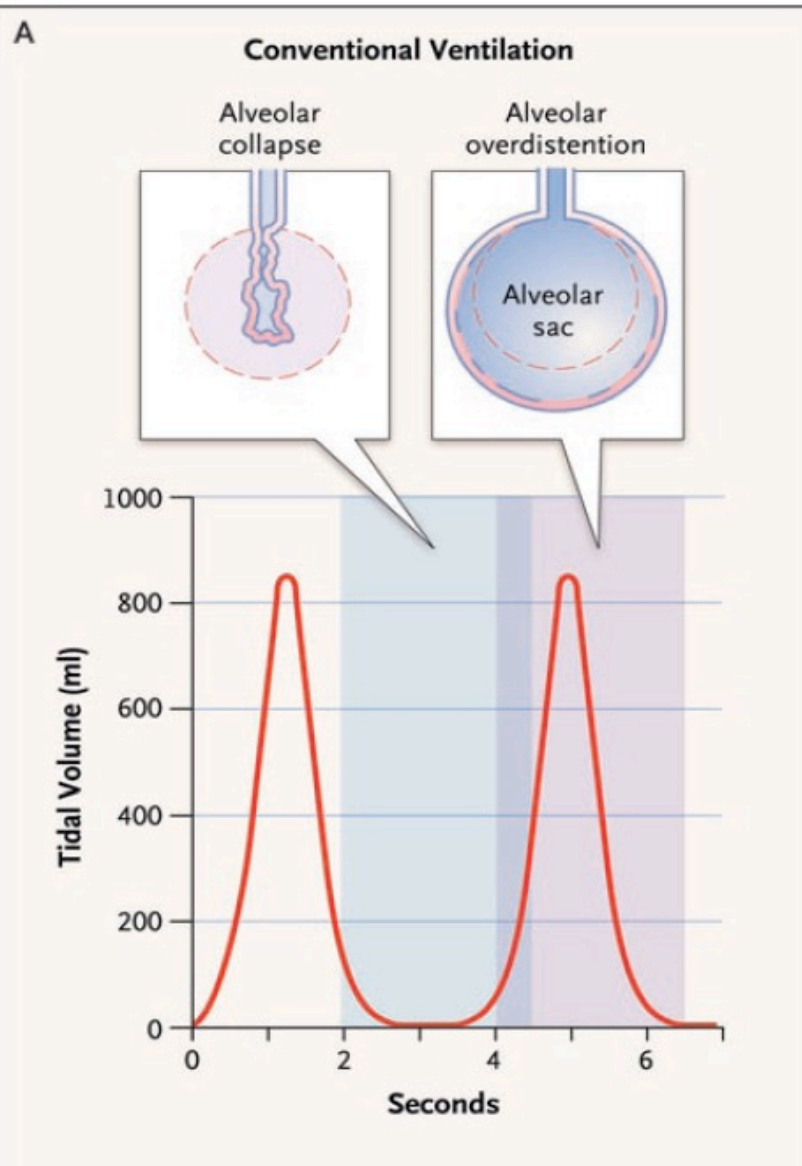


Figure 2. Conventional Ventilation as Compared with Protective Ventilation.

This example of ventilation of a 70-kg patient with ARDS shows that conventional ventilation at a tidal volume of 12 ml per kilogram of body weight and an end-expiratory pressure of 0 cm of water (Panel A) can lead to alveolar overdistention (at peak inflation) and collapse (at the end of exhalation). Protective ventilation at a tidal volume of 6 ml per kilogram (Panel B) limits overinflation and end-expiratory collapse by providing a low tidal volume and an adequate positive end-expiratory pressure. Adapted from Tobin.¹⁸

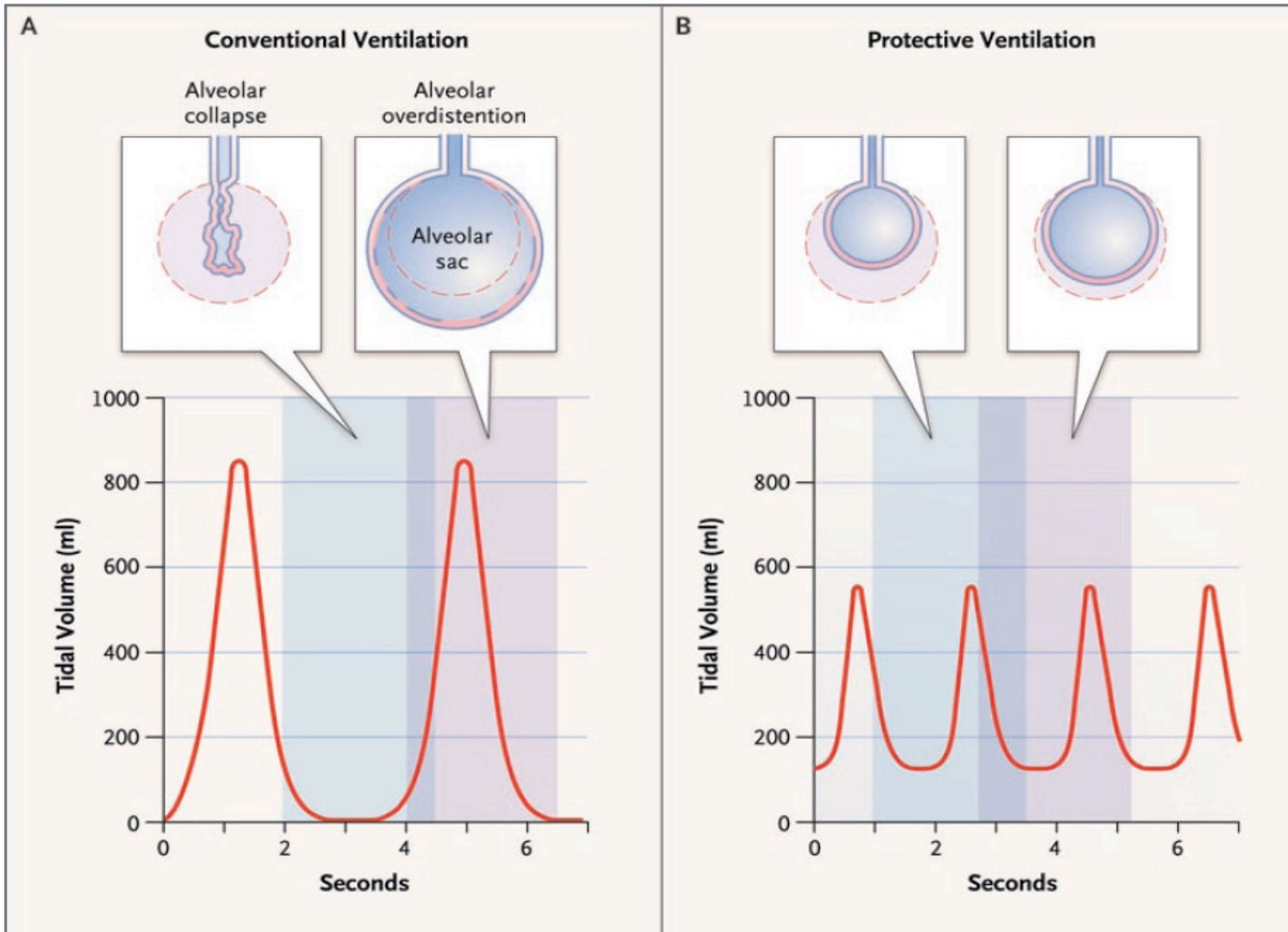


Figure 2. Conventional Ventilation as Compared with Protective Ventilation.

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Normal
lungs

After 5 min
of ventilation

After 20 min
of ventilation

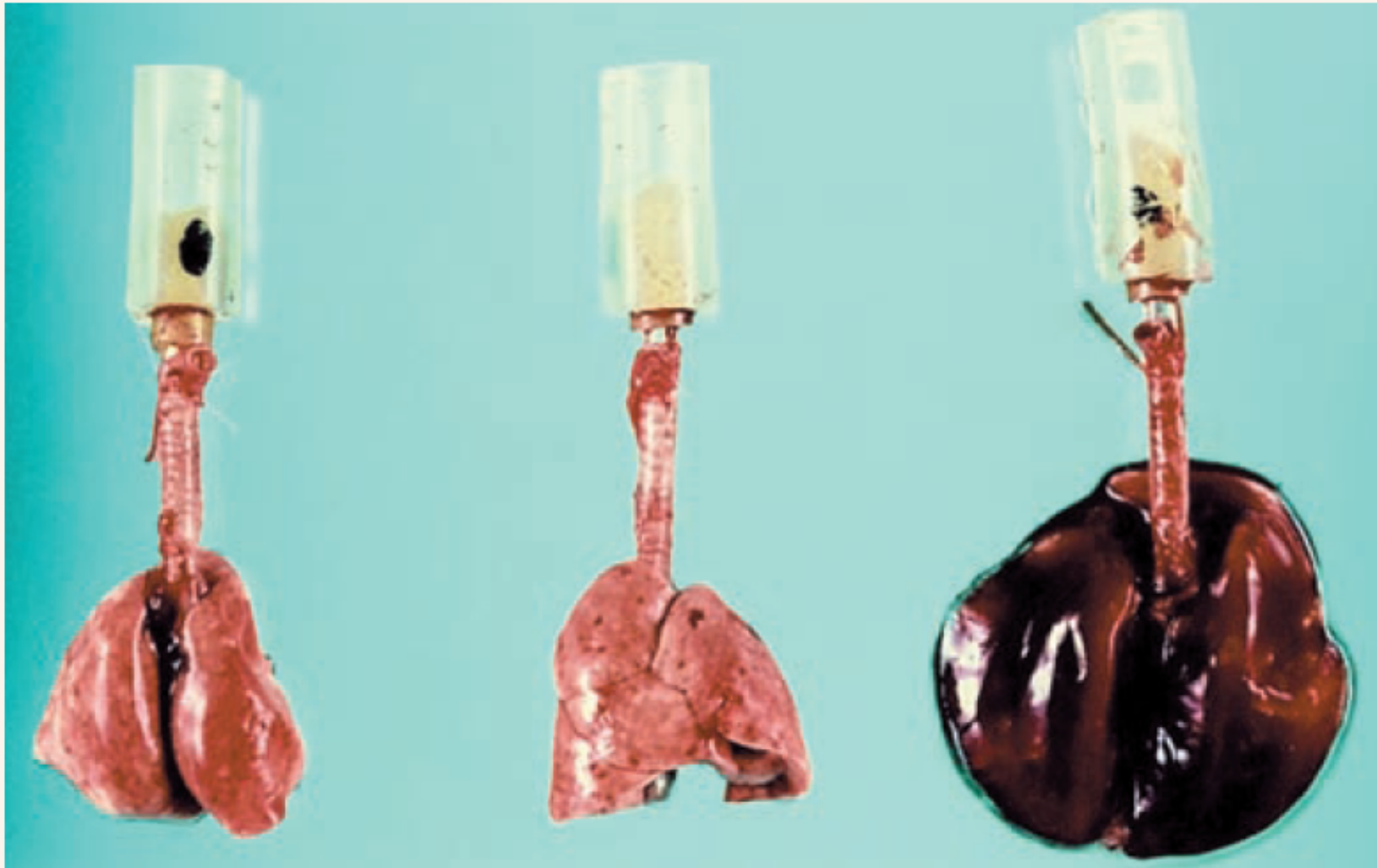


Figure 1. Normal Rat Lungs and Rat Lungs after Receiving High-Pressure Mechanical Ventilation at a Peak Airway Pressure of 45 cm of Water.

Induction agents

Ketamine 1 - 2 mg/kg

Rocuronium 1.2 mg/kg or
suxamethonium 1.5 mg/kg

Ideal or actual body weight ?

Rocuronium

Ideal drug, use ideal weight

Suxamethonium

Actual body weight

N. SEDATION AND ANALGESIA

Prefer opioids (e.g. fentanyl) alone

Avoidance of sedatives

propofol, dexmedetomidine preferred

avoid benzodiazepines.

O. GLUCOSE CONTROL

Target an upper blood glucose < 10 mmol/L;

recomendations for tighter control
removed

Intensive Care
Network Podcasts

Bellomo - Glycemic Control In
Diabetic ICU Patients

18 Jan • 55 min.

Recent work questions benefit from tight glycaemic control, especially in diabetics, and emphasises harm from hypoglycaemia.

Other

bicarbonate therapy (limited role if any;
limited data; not recommended if pH >7.15)

VTE prophylaxis (LMW heparin + mechanical
proph)

stress ulcer proph. (only if risk factors for GI
bleed)

nutrition (prefer enteral)

setting goals of care

In Summary

- Recognise Sepsis
- Resuscitate with IV fluids and Early Antibiotics
- Early Uses of inotropes if required (guided by bedside USS)
- Source control
- Extras (e.g. modified ventilation of ARDS)
- Re-asses for Response to treatment and Early Appropriate Referral