FRCA SAQ - ICU

Anthony Cochrane ST7
Overview

• Advice from examiners
• Question 1
• Question 2
• Question 3
• Question 4
• Question 5
• Hot topics
Advice from the Examiners…

Candidates continued to disadvantage themselves in a number of ways:

• Failing to answer the question asked. (RTQ)

• Poor weighting of answers (Weighting)
  • the marks allocated to each section of the question are clearly indicated.
  • Writing extensively on the low scoring sections of the question to the detriment of sections where more marks are available limits the maximum score attainable.

• Giving general and superficial answers to specific questions (Detail)
  • e.g. “give oxygen” instead of dealing with specific details of management.

• Illegible handwriting
  • Examiners take great care to extract answers from a candidate’s script, but it remains true that only material that can be read will achieve a score.
  • *Candidates are encouraged to set out their answers in a “bullet point” or “table” format* which will aid legibility and time management, and also serve as an aide memoir to the number of key points required for each section.

• In preparation for this exam it might be prudent to arrange 1-2 day “taster” sessions in some of the mandatory units of training (experience)
Question 8

• a) What are the indications for arterial cannulation? (35%)
• b) How may an invasive arterial pressure measuring system be calibrated? (20%)
• c) Outline the sources of error when measuring invasive arterial pressure. (45%)
A 45-year-old man with a history of ulcerative colitis and alcohol abuse is admitted to the intensive care unit for inotropic and ventilatory support following a laparotomy to excise a toxic megacolon.

His body mass index is 18kg/m².

- a) Why should this patient receive early nutritional support and what are the clinical benefits? (30%)
- b) What is the specific composition of a nutritional regimen for this patient? (30%)
- c) List the advantages and disadvantages of enteral nutrition. (40%)
September 2014

• a) What is Propofol-Related Infusion Syndrome (PRIS) and what are its clinical effects? (7 marks)
• b) List the risk factors for PRIS. (5 marks)
• c) What specific laboratory findings might be expected in a case of PRIS? (3 marks)
• d) How may PRIS be prevented (3 marks) and managed? (2 marks)
March 2015

• a) Define critical illness weakness (CIW, 1 mark) and list the types that may occur. (3 marks)
• b) List the risk factors for the development of weakness on the ICU. (6 marks)
• c) What are the clinical features of CIW? (4 marks)
• d) How may nerve conduction studies determine the type of CIW? (4 marks)
• e) What are the options for the management of CIW? (2 marks)
a) What is meant by the term ventilator associated pneumonia (VAP)? (3 marks)
b) List the factors that increase the risk of the development of VAP. (10 marks)
c) What measures may reduce the risk of development of VAP? (7 marks)
Question 8

- a) What are the indications for arterial cannulation? (35%)
- b) How may an invasive arterial pressure measuring system be calibrated? (20%)
- c) Outline the sources of error when measuring invasive arterial pressure. (45%)
35.8% pass rate.

“This question was poorly answered and therefore had a high failure rate despite a low pass mark being set.”
What are the indications for arterial cannulation? (35%)= 7 marks

- Many candidates wrongly interpreted the question as “indications for intra-aortic balloon pump”. (RTQ)
- The indications for arterial cannulation:
  - **measurement** (continuous blood pressure; cardiac output; blood gases)
  - **diagnostic** (angiography)
  - **therapeutic** purposes (thrombolysis, vasodilators chemotherapy, EVAR, ECMO, stenting, renal replacement therapy).
- “Many candidates focused on aspects of measurement only.” (Weighting)
b) How may an invasive arterial pressure measuring system be calibrated?

(20%) = 4 marks

- All transducers are calibrated in the factory but calibration is carried out in the clinical environment using static and dynamic testing methods, a short description was all that was required.
- Static
- Dynamic
c) Outline the sources of error when measuring invasive arterial pressure.

(45%)

- Sources of error included transducer drift, the causes of damping/resonance and incorrect transducer height.
- “There appeared to be a lack of understanding of the physical principles of transducers and confusion between damping and resonance.”
"The ODP might well calibrate the transducer for you but this fact was not included in the model answer as it is important that anaesthetists understand the methods and principles of calibration even if they do not carry them out themselves."
Arterial Line

- Others
- Complications
  - Bleeding, haematoma, distal ischaemia, infection, pseudo-aneuysm, compartment syndrome, exsanguination if disconnected…
- Waveform analysis
A 45-year-old man with a history of ulcerative colitis and alcohol abuse is admitted to the intensive care unit for inotropic and ventilatory support following a laparotomy to excise a toxic megacolon. His body mass index is 18kg/m².

• a) Why should this patient receive early nutritional support and what are the clinical benefits? (30%)
• b) What is the specific composition of a nutritional regimen for this patient? (30%)
• c) List the advantages and disadvantages of enteral nutrition. (40%)
44.9% pass rate

“Many candidates failed to be specific enough. Leaving the prescribing to the “nutrition team” or “Intensive Care dietician” are not appropriate answers” (Experience/Detail)
a) Why should this patient receive early nutritional support and what are the clinical benefits? (30%) = 6 marks

- Critical illness- hypermetabolic, catabolic state.
- Decreased risk of infection
- Better immunity (trace elements/amino acids/vitamins)
- Reduced risk of critical illness weakness
  - Reduced loss of muscle mass
  - Improved respiratory function
- If enteral feeding possible; reduces gut mucosal atrophy
- Prevents poor wound healing
b) What is the specific composition of a nutritional regimen for this patient? 
(30%) = 6 marks

• Water (30 ml/kg/day)
• Calories (25kCal/kg/day)
• Protein (1-1.25g/day protein) (1/3\textsuperscript{rd} of calories)
• Fat and carbohydrate (2/3\textsuperscript{rd} calories)
• Na (1-2 mmol/kg/day)
• K (0.7-1 mmol/kg/day) and minerals
• Vitamins
• Immunonutrition (omega 3 fatty acids, arginine, nucleotides)
c) List the advantages and disadvantages of enteral nutrition.

(40%) = 8 marks

<table>
<thead>
<tr>
<th>Feed type</th>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enteral</td>
<td>Cheaper, easier</td>
<td>Increased VAP</td>
</tr>
<tr>
<td></td>
<td>Gut mucosa preserved</td>
<td></td>
</tr>
<tr>
<td>Paraentral</td>
<td>Reduced VAP</td>
<td>More expensive</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Requires central venous access</td>
</tr>
</tbody>
</table>
When considering Total Parenteral Nutrition (TPN) give an estimate of the daily requirements for calories, protein, fat and carbohydrate in a 70 kg critically ill adult? (30%)

What volume of water is usually prescribed? (10%)

What other components should be given? (10%)

List the potential complications and disadvantages of the administration of TPN. (50%)
a) What is Propofol-Related Infusion Syndrome (PRIS) and what are its clinical effects? (7 marks)
b) List the risk factors for PRIS. (5 marks)
c) What specific laboratory findings might be expected in a case of PRIS? (3 marks)
d) How may PRIS be prevented (3 marks) and managed? (2 marks)
a) What is Propofol-Related Infusion Syndrome (PRIS) and what are its clinical effects? (7 marks)

b) List the risk factors for PRIS. (5 marks)

c) What specific laboratory findings might be expected in a case of PRIS? (3 marks)

d) How may PRIS be prevented and managed? (3 marks)
Pass Rate 35.8%

- “This question was felt to be hard to answer”.
- “It proved to be another very strong discriminator between candidates and was answered poorly in the main”.
- “Trainees undertaking a block of intensive care medicine will use propofol sedation for some patients so it is important that they understand any potential complications.” (Experience)
a) What is Propofol-Related Infusion Syndrome (PRIS) and what are its clinical effects? (7 marks)

- Propofol-related Infusion Syndrome is a life-threatening condition characterised by acute refractory bradycardia progressing to asystole and one or more of:
  - metabolic acidosis
  - rhabdomyolysis
  - hyperlipidaemia
  - enlarged or fatty liver
b) List the risk factors for PRIS. (5 marks)

- >4mg/kg/hr for 48 hours (large dose, long time); but can occur at lower doses
- younger age
- acute neurological injury
- low carbohydrate intake
- catecholamine infusion
- corticosteroids infusion
c) What specific laboratory findings might be expected in a case of PRIS? (3 marks)

- AKI
- High Lipids
- Raised CK
d) How may PRIS be prevented (3 marks) and managed? (2 marks)

- Avoid propofol sedation in children
- Correct dosing of Propofol to Ideal Body Weight
March 2015

• a) Define critical illness weakness (CIW, 1 mark) and list the types that may occur. (3 marks)
• b) List the risk factors for the development of weakness on the ICU. (6 marks)
• c) What are the clinical features of CIW? (4 marks)
• d) How may nerve conduction studies determine the type of CIW? (4 marks)
• e) What are the options for the management of CIW? (2 marks)
Pass Rate 30.4%, 46.6% of candidates received a poor fail

- “This question was anticipated to be difficult for the candidates and the pass and poor fail rates reflect this expectation.”

- “Many candidates had no idea that the definition excluded pre-existing pathology, and that the weakness was symmetrical with cranial nerves sparing.”

- “Few candidates had knowledge of the use of nerve conduction studies and even fewer mentioned the MRC scale of scoring muscle power.” (Detail)

- “The importance of preparing detailed notes on mandatory units of training when revising for the Final FRCA is exemplified by this question” (Experience)
a) Define critical illness weakness (CIW, 1 mark) and list the types that may occur. (3 marks)

- Critical Illness Neuropathy
- Critical Illness Myopathy
- Mixed neuropathy/myopathy
b) List the risk factors for the development of weakness on the ICU. (6 marks)

- Sepsis
- Systemic Inflammation states
- Mechanical Ventilation
- Steriods
- Poor Glycaemic control
- NMB
- Immobility
- Malnutrition
c) What are the clinical features of CIW? (4 marks)

- Onset usually about 1 week into critical illness
- Symmetrical weakness - proximal > distal
- Not usually involving cranial nerves/autonomic nerves
- Sensation preserved
- Score <48 on MRC sum score
- Myopathy - CK may be elevated but only mildly and transiently
d) How may nerve conduction studies determine the type of CIW? (4 marks)

- Critical Illness Polyneuropathy
  - decreased compound muscle action potentials (CMAPs)
  - Preserved conduction velocities
- Critical Illness Myopathy
  - Reduced amplitude and increased duration of CMAPs
e) What are the options for the management of CIW? (2 marks)
a) What is meant by the term ventilator associated pneumonia (VAP)? (3 marks)

b) List the factors that increase the risk of the development of VAP. (10 marks)

c) What measures may reduce the risk of development of VAP? (7 marks)
Pass rate 44.3%

- “This is a common condition that candidates should have seen so it was surprising that it was quite poorly answered. “
- “Very few candidates were able to give a definition of VAP or to give details of the care bundles used in its prevention and treatment.”
- “Merely stating “a care bundle would be used“ suggests inadequate depth of knowledge.”
a) What is meant by the term ventilator associated pneumonia (VAP)? (3 marks)

- Nosocomial infection
- Occurs in patients who have been invasively mechanically ventilated within 48 hours of onset of infection

<table>
<thead>
<tr>
<th>Clinical Pulmonary Infection Score</th>
<th>0</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature</td>
<td>≥ 36.5 &amp; ≤ 38.4</td>
<td>≥ 38.5 &amp; ≤ 38.9</td>
<td>≥ 39 &amp; ≤ 36.4</td>
</tr>
<tr>
<td>TLC</td>
<td>≥ 4 &amp; ≤ 11</td>
<td>&lt; 4 or &gt; 12</td>
<td></td>
</tr>
<tr>
<td>Tracheal Secretions</td>
<td>None</td>
<td>Non-purulent</td>
<td>Purulent</td>
</tr>
<tr>
<td>Oxygenation PaO₂/FIO₂ mmHg</td>
<td>&gt; 240 or ARDS</td>
<td>≤ 240 &amp; no ARDS</td>
<td></td>
</tr>
<tr>
<td>Chest Radiograph</td>
<td>No opacity</td>
<td>Diffuse (patchy) opacities</td>
<td>Localized opacity</td>
</tr>
<tr>
<td>Progression of Radiographic Opacities</td>
<td>No progression</td>
<td>Progression (after HF &amp; ARDS excluded)</td>
<td></td>
</tr>
<tr>
<td>Culture of Tracheal Aspirate</td>
<td>Pathogenic bacteria cultured in rare/few quantities or no growth</td>
<td>Pathogenic bacteria cultured in moderate or heavy quantity</td>
<td></td>
</tr>
</tbody>
</table>
b) List the factors that increase the risk of the development of VAP. (10 marks)

- Age > 60
- Severe illness
- Chronic lung disease
- Hypoalbuminaemia
- GCS <9
- Smoker
- Burns
- Head and neck trauma/ infection
- Increased time on ventilator
- Excessive sedation
- H2 antagonists/PPI
- Supine
- Reintubation
- Enteral feeding
- Poor absorption
c) What measures may reduce the risk of development of VAP? (7 marks)

- Reduce colonisation - selective oral and/or selective gut decontamination
- Prevent aspiration - 45 degree head up, subglottic suctioning, maintaining adequate cuff pressures
- Minimising time on ventilator - early trachestomy, daily sedation holds
- Chest physiotherapy
HOT TOPICS

Published Studies
Reports
BJA Education
BJA Education and CEACCP 2014-15

- Analgesia in ICU
- Oesophageal Injury
- Sepsis in Obs
- Peri-op AKI
- LA Toxicity
- Tracheostomy Management
- Obesity on ICU
- Viral Illnesses in ICU
- Coma
- Percutaneous Tracheostomy
- Fungal Infections in ICU
- End of Life Care
- Management of Acute Spinal Cord Injury
Tracheostomy

- NAP 4 2011
  - 50% ICU events trache
- NCEPOD 2014
  - Documentation/consent
  - Diff airway trolley rapid avail.
  - Training in displaced/blocked tubes
  - Capnography
  - Safe d/c from ICU - Passport
  - MDT-physio/SALT
- TRACMAN 2013
  - Early (D4) vs late (D10+)
  - Mort/LOS same
  - Slight ↑ complications if late
# SEPSIS

- Surviving Sepsis Guidelines 2012

## Surviving Sepsis Campaign Bundles

<table>
<thead>
<tr>
<th>TO BE COMPLETED WITHIN 3 HOURS:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Measure lactate level</td>
</tr>
<tr>
<td>2) Obtain blood cultures prior to administration of antibiotics</td>
</tr>
<tr>
<td>3) Administer broad spectrum antibiotics</td>
</tr>
<tr>
<td>4) Administer 30 mL/kg crystalloid for hypotension or lactate ≥4 mmol/L</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TO BE COMPLETED WITHIN 6 HOURS:</th>
</tr>
</thead>
<tbody>
<tr>
<td>5) Apply vasopressors (for hypotension that does not respond to initial fluid resuscitation) to maintain a mean arterial pressure (MAP) ≥65 mm Hg</td>
</tr>
<tr>
<td>6) In the event of persistent arterial hypotension despite volume resuscitation (septic shock) or initial lactate ≥4 mmol/L (36 mg/dL):</td>
</tr>
<tr>
<td>- Measure central venous pressure (CVP)*</td>
</tr>
<tr>
<td>- Measure central venous oxygen saturation (Scvo₂)*</td>
</tr>
<tr>
<td>7) Remeasure lactate if initial lactate was elevated*</td>
</tr>
</tbody>
</table>

*Targets for quantitative resuscitation included in the guidelines are CVP of ≥8 mm Hg, Scvo₂ of ≥70%, and normalization of lactate.
## SEPSIS

<table>
<thead>
<tr>
<th></th>
<th>Rivers et al</th>
<th>ProMISE</th>
<th>ProCESS</th>
<th>ARISE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location</td>
<td>US</td>
<td>UK</td>
<td>US</td>
<td>Australasia</td>
</tr>
<tr>
<td>Population</td>
<td>263</td>
<td>1260</td>
<td>1351</td>
<td>1600</td>
</tr>
<tr>
<td>APACHE II (approx)</td>
<td>20</td>
<td>18</td>
<td>21</td>
<td>15</td>
</tr>
</tbody>
</table>

### Sepsis Definition

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>Yes</th>
<th>Yes</th>
<th>Yes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Suspected / Actual Infection</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SIRS criteria ≥ 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Refractory ↓BP or lactate &gt; 4 mmol/l</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

### Protocol

<table>
<thead>
<tr>
<th></th>
<th>20–30 ml/kg</th>
<th>&gt; 1000 ml</th>
<th>~20–30 ml/kg Changed during study</th>
<th>&gt; 1000 ml</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fluid before randomisation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recruitment</td>
<td>not specified</td>
<td>&lt;6h from ED arrival &amp; &lt;2h from shock criteria</td>
<td>&lt;12h from ED arrival &amp; &lt;2h from shock criteria</td>
<td>&lt;6h from ED arrival &amp; &lt;2h from shock criteria</td>
</tr>
<tr>
<td>Intervention</td>
<td>EGDT 6 hours</td>
<td>EGDT 6 hours</td>
<td>EGDT 6 hours</td>
<td>EGDT 6 hours</td>
</tr>
<tr>
<td>Control</td>
<td>Usual therapy</td>
<td>Usual therapy</td>
<td>1) Protocol usual therapy 2) Usual therapy</td>
<td>Usual therapy</td>
</tr>
<tr>
<td>Primary outcome</td>
<td>In-hospital mortality</td>
<td>90-day mortality</td>
<td>60-day mortality</td>
<td>90-day mortality</td>
</tr>
</tbody>
</table>

### Primary Outcome

<table>
<thead>
<tr>
<th></th>
<th>Intervention</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intervention mortality</td>
<td>30.5%</td>
<td>46.5%</td>
</tr>
<tr>
<td>90-day mortality</td>
<td>29.5%</td>
<td>29.2%</td>
</tr>
<tr>
<td>60-day mortality</td>
<td>21.0%</td>
<td>1) 18.2%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2) 18.9%</td>
</tr>
<tr>
<td>90-day mortality</td>
<td></td>
<td>18.6%</td>
</tr>
</tbody>
</table>
SEPSIS

- Surviving Sepsis Guidelines 2012- update April 2015

Either
- Repeat focused exam (after initial fluid resuscitation) by licensed independent practitioner including: vital signs, cardiopulmonary, capillary refill, pulse, and skin findings.

Or two of the following:
- Measure CVP
- Measure ScvO2
- Bedside cardiovascular ultrasound
- Dynamic assessment of fluid responsiveness with passive leg raise or fluid challenge

Surviving Sepsis Campaign Bundles

TO BE COMPLETED WITHIN 3 HOURS:
1) Measure lactate level
2) Obtain blood cultures prior to administration of antibiotics
3) Administer broad spectrum antibiotics
4) Administer 30 mL/kg crystalloid for hypotension or lactate ≥4 mmol/L

TO BE COMPLETED WITHIN 6 HOURS:
5) Apply vasopressors (for hypotension that does not respond to initial fluid resuscitation) to maintain a mean arterial pressure (MAP) ≥65 mm Hg
6) In the event of persistent arterial hypotension despite volume resuscitation (septic shock) or initial lactate ≥4 mmol/L (36 mg/dL):
   - Measure central venous pressure (CVP)*
   - Measure central venous oxygen saturation (Scvo₂)*
7) Remeasure lactate if initial lactate was elevated*
SEPSIS

- New Sepsis Definition Feb 2016
  SIRS out
  Infection plus organ dysfunction
    (SOFA ≥ 2)
  qSOFA
  (altered mental state/systolic BP/RR)

NICE Guideline July 2016
SEPSIS trials

- Antibiotics
  - Kumar 2006
- Fluids
  - SAFE 2004
  - 6S 2012
  - CHEST 2012
  - ALBIOS 2013
- Steroids
  - Annane 2002
  - CORTICUS 2008
- MAP
  - SEPSISPAM 2014
- Vasopressor
  - VASST 2008
  - SOAP II 2010

- Increased mortality with each hour delay in ABx
- Saline vs Albumin no diff (trend to Alb in Sepsis)
- HES vs LR- HES ↑ 90d mortality, RRT, blood
- HES vs Saline no diff 90d mort but ↑RRT ↑blood
- Albumin >30g/L- no diff mortality, ↓ inotropes
- Hydrocort+fludro ↑ survival in non responders
- Hydrocort- didn’t improve survival, ↓ inotropes
- MAP 65-70 v 80-85 no diff, less renal dys in HTN
- VP v NA no diff; VP + Hcmodt effective ?↓RRT
- DOP v NA on diff mort, DOP ↑ arrythmias
ARDS- Berlin definition 2012

<table>
<thead>
<tr>
<th>Timing</th>
<th>Acute Respiratory Distress Syndrome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Within 1 week of a known clinical insult or new/worsening respiratory symptoms</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Chest Imaging a</th>
<th>Bilateral opacities – not fully explained by effusions, lobar/lung collapse, or nodules</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Origin of Edema</th>
<th>Respiratory failure not fully explained by cardiac failure or fluid overload; Need objective assessment (e.g., echocardiography) to exclude hydrostatic edema if no risk factor present</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Oxygenation b</th>
<th>Mild</th>
<th>Moderate</th>
<th>Severe</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$200 &lt; \text{PaO}_2/\text{FiO}_2 &lt; 300$ with $\text{PEEP or CPAP} \geq 5 \text{cmH}_2\text{O}$</td>
<td>$100 &lt; \text{PaO}_2/\text{FiO}_2 &lt; 200$ with $\text{PEEP} \geq 5 \text{cmH}_2\text{O}$</td>
<td>$\text{PaO}_2/\text{FiO}_2 \leq 100$ with $\text{PEEP} \geq 5 \text{cmH}_2\text{O}$</td>
</tr>
</tbody>
</table>
ARDS - treatment options

- Noninvasive Ventilation
- Low – Moderate PEEP
- Low Tidal Volume Ventilation
- Higher PEEP
- Neuromuscular Blockade
- HFO
- ECCO$_2$-R
- ECMO

Increasing Intensity of Intervention

Increasing Severity of Injury

Mild ARDS
Moderate ARDS
Severe ARDS

$\text{PaO}_2/\text{FiO}_2$
ARDS Trials

- Low tidal Volumes/PEEP - ARDsnets 2000
- NMB Agents - ACURASYS 2010
- HFOV
  - OSCAR 2013 (UK - no diff)
  - OSCILLATE 2013 (Canada - increases mortality)
- Prone position - PROSEVA 2013
- Fluid balance - FACCT 2006
- ECMO - CESAR 2009

- 6-7ml/kg IBW
- Benefit 1\textsuperscript{st} 48 hrs
- HFOV harmful
- ?if not ECMO
- 16 hours prone
Temperature Control

- September 2011

- a) What are the cerebral physiological benefits of induced hypothermia following successful resuscitation from cardiac arrest? (25%)

- b) How can a patient be cooled in these circumstances? (20%)

- c) What adverse effects may occur due to the use of induced hypothermia? (35%)

- d) In what other non-surgical clinical scenarios may the use of induced hypothermia be beneficial? (20%)
Targeted Temperature Management

OOH Cardiac Arrest

- Bernard 2002 (Aus) + HACA 2002 (Euro)
  - OOH VF/VT improved outcome
- TTM 2013- no benefit 33 vs 36°C
- Resus Guidelines 2015
  “Targeted temperature management remains important but the target temperature can be in the range of 32°C to 36°C according to local policy. There was a preference for 36°C among the guidelines group because it is easier to implement and there is no evidence that it is inferior to 33°C.”

Other indications

- Head Injury
  - Eurotherm 3235 2015
  - Better ICP control
  - Worse outcomes+ mort.
- Sepsis
  - Sepsiscool- ext cooling
  - Early ↓ vasopressor- no LTO
  - HEAT- paracetamol- no diff
- DBD renal graft
  - Niemann 2015 NEJM
  - Less delayed graft function
Hypothermia - complications
Scoring Systems

- APACHE II score
- used in ICNARC data
  - Standardised mortality ratios can be used for large patient populations
- Most abnormal results in 1st 24 hours on unit
- Sum of
  - Acute Physiology Score
  - Age
  - Chronic Health Score
### APACHE II Score

APACHE II score = (acute physiology score) + (age points) + (chronic health points)

<table>
<thead>
<tr>
<th>Physiologic Variable</th>
<th>+4</th>
<th>+3</th>
<th>+2</th>
<th>+1</th>
<th>0</th>
<th>+1</th>
<th>+2</th>
<th>+3</th>
<th>+4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rectal temperature (°C)</td>
<td>≥ 41</td>
<td>39-40.9</td>
<td>38-38.9</td>
<td>36-38.4</td>
<td>34-35.9</td>
<td>32-33.9</td>
<td>30-31.9</td>
<td>≤ 29.9</td>
<td></td>
</tr>
<tr>
<td>Mean arterial pressure (mm Hg)</td>
<td>≥ 160</td>
<td>130-159</td>
<td>110-129</td>
<td>70-109</td>
<td>50-69</td>
<td>≤ 49</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heart rate (bpm)</td>
<td>≥ 180</td>
<td>140-179</td>
<td>110-139</td>
<td>70-109</td>
<td>55-69</td>
<td>40-54</td>
<td>≤ 39</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Respiratory rate (bpm)</td>
<td>≥ 50</td>
<td>35-49</td>
<td>25-34</td>
<td>12-24</td>
<td>10-11</td>
<td>6-9</td>
<td>≤ 5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oxygen delivery (mL/min) OR PaO₂ (mm Hg)</td>
<td>≥ 500</td>
<td>350-499</td>
<td>200-349</td>
<td>&lt; 200</td>
<td>61-70</td>
<td>55-60</td>
<td>&lt; 55</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arterial pH</td>
<td>≥ 7.7</td>
<td>7.6-7.69</td>
<td>7.5-7.59</td>
<td>7.33-7.49</td>
<td>7.25-7.32</td>
<td>7.15-7.24</td>
<td>&lt; 7.15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Serum sodium (mmol/L)</td>
<td>≥ 180</td>
<td>160-179</td>
<td>155-159</td>
<td>150-154</td>
<td>130-149</td>
<td>120-129</td>
<td>111-119</td>
<td>≤ 110</td>
<td></td>
</tr>
<tr>
<td>Serum potassium (mmol/L)</td>
<td>≥ 7</td>
<td>6-6.9</td>
<td>5.5-5.9</td>
<td>3.5-5.4</td>
<td>3.3-4</td>
<td>2.5-2.9</td>
<td>≤ 2.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Serum creatinine (mg/dL)</td>
<td>≥ 3.5</td>
<td>2-3.4</td>
<td>1.5-1.9</td>
<td>0-1.4</td>
<td>&lt; 0.6</td>
<td>&lt; 0.6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hematocrit (%)</td>
<td>≥ 60</td>
<td>50-59.9</td>
<td>46-49.9</td>
<td>30-45.9</td>
<td>20-29.9</td>
<td>&lt; 20</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White cell count (10^3/mL)</td>
<td>≥ 40</td>
<td>20-39.9</td>
<td>15-19.9</td>
<td>3-14.9</td>
<td>1-2.9</td>
<td>&lt; 1</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Age Points

<table>
<thead>
<tr>
<th>Age</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ 44</td>
<td>0</td>
</tr>
<tr>
<td>45-54</td>
<td>2</td>
</tr>
<tr>
<td>55-64</td>
<td>3</td>
</tr>
<tr>
<td>65-74</td>
<td>5</td>
</tr>
<tr>
<td>≥ 75</td>
<td>6</td>
</tr>
</tbody>
</table>

### Chronic Health Points

<table>
<thead>
<tr>
<th>History of Severe Organ Insufficiency</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nonoperative patients</td>
<td>5</td>
</tr>
<tr>
<td>Emergency postoperative patients</td>
<td>5</td>
</tr>
<tr>
<td>Elective postoperative patients</td>
<td>2</td>
</tr>
</tbody>
</table>
SOFA score

- Based on 6 organ systems
  - (CVS/Resp/CNS/Renal/Coagulation/Liver)
- Mean and highest SOFA scores predict outcome

<table>
<thead>
<tr>
<th>Organ System</th>
<th>Score 0</th>
<th>Score 1</th>
<th>Score 2</th>
<th>Score 3</th>
<th>Score 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Respiration</td>
<td>4</td>
<td>2</td>
<td>13</td>
<td>9</td>
<td>2</td>
</tr>
<tr>
<td>Coagulation</td>
<td>18</td>
<td>4</td>
<td>5</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Hepatic</td>
<td>27</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Circulatory</td>
<td>12</td>
<td>5</td>
<td>3</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>Neurological</td>
<td>20</td>
<td>3</td>
<td>0</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Renal</td>
<td>24</td>
<td>2</td>
<td>0</td>
<td>1</td>
<td>3</td>
</tr>
</tbody>
</table>

SOFA, Sequential Organ Failure Assessment.

Source: Crit Care Med © 2005 Lippincott Williams & Wilkins
P-POSSUM

**PHYSIOLOGY SCORE**
- Age
- Cardiac signs
- Respiratory history
- Systolic blood pressure
- Pulse
- Glasgow coma score
- Haemoglobin
- White cell count
- Urea
- Sodium
- Potassium
- Electrocardiogram

**OPERATIVE SCORE**
- Operative severity
- Multiple procedures
- Total blood loss
- Peritoneal soiling
- Presence of malignancy
- Mode of surgery

[Logo: National Emergency Laparotomy Audit]
THE FIRST PATIENT REPORT OF THE NATIONAL EMERGENCY LAPAROTOMY AUDIT (NELA)

June 2015
NELA standards of care

**Before surgery**
- Clinical review and formulation of a care plan by a consultant surgeon soon after admission
- Ready availability of diagnostic investigations to help define the need for and type of surgery.
- Formal assessment of a patient’s risk of death and complications.
- Prompt administration of antibiotics where there is evidence of infection.
- Prompt access to an operating theatre.

**During surgery**
- Direct care by a consultant surgeon and consultant anaesthetist.

**After surgery**
- Planned admission to critical care for patients when the estimated risk of death exceeds 5%.
- Review of patients older than 70 years by specialists in Medicine for Care of the Older Person (MCOP).
Technique vs Knowledge

• Read the question
• Don’t be tempted to write EVERYTHING YOU KNOW
  • Wastes time
  • No marks
• Leave enough time to answer all questions
• Bullet points
• Clear handwriting
• Practice timed tests
• It’s a hard exam- but if I can pass it so can you 😊
P-POSSUM

- Age
- Cardiac signs
- Respiratory history
- Systolic blood pressure
- Pulse
- Glasgow coma score
- Haemoglobin
- White cell count
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- Potassium
- Electrocardiogram

- Operative severity
- Multiple procedures
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National Emergency Laparotomy Audit (NELA)