Principles of Intensive Care Training

Scenario One

Recognition, Assessment and Management of the Critically Ill Patient: RAM

Summary
First presentation of asthma in a 17-year-old footballer. He has been admitted to HDU from the Emergency Department having been brought in by his coach with acute breathlessness.

Expected Duration of Scenario: 30 minutes

Intended Learning Outcomes
At the end of the scenario and debriefing the learners will be able to:
• Demonstrate a systematic approach to the critically unwell patient using ABCDE ‘treating as you go’ approach
• Create a differential diagnosis in the young breathless patient with wheeze
• Recognise severe asthma and institute appropriate treatment
• Identify personal limitations and call for help
• Use appropriate technique of emergency intubation in the critically ill patient
• Describe ventilation in the patient with severe asthma
• Describe rescue therapies used in ventilated patients with severe asthma

Faculty of Intensive Care Medicine Competencies mapping: this is indicative, not exhaustive

Medical

Domain 1
1.1 Adopts a structured and timely approach to the recognition, assessment and stabilisation of the acutely ill patient with disordered physiology

Domain 2
2.1 Obtains a history and performs an accurate clinical examination
2.2 Undertakes timely and appropriate investigations
2.5 Obtains and interprets the results from blood gas samples
2.6 interprets imaging studies
2.7 Monitors and responds to trends in physiological variables
2.8 Integrates clinical findings with laboratory investigations to form a differential diagnosis

Domain 3
3.1 Manages the care of the critically ill patient with specific acute medical conditions: life threatening asthma

Domain 7
7.3 Manages sedation and neuromuscular blockade

Domain 12
12.1 Communicates effectively with patients and carers

Author Graham Nimmo: Scottish Centre for Simulation and Clinical Human Factors
12.2 Communicates effectively with members of the healthcare team
12.7 Collaborates and consults: promotes team working

**Advanced Critical Care Practitioners**

**Domain 2**

2.2 History taking and examination
Admission history taking and assessment
Physical assessment of the critically ill patient

2.3 Radiology
Indications for chest x-ray and chest x-ray interpretation

2.5 Principles of laboratory medicine
Biochemistry as it relates to critical care

**Domain 3**

3.5 Decision making and clinical reasoning
Interprets clinical features
Interprets history and clinical signs
Recognises critical illness and responds with due urgency

3.8 Team working and patient safety
Works well within the multidisciplinary team
Demonstrates awareness of own contribution to patient safety within a team

3.11 Communication with colleagues and cooperation
Communicates accurately, clearly, promptly and comprehensively with relevant colleagues appropriate to the urgency of a situation

**Domain 4**

4.1 Resuscitation and first stage management of the critically ill patient
Identify life-threatening conditions and institute appropriate measures to promote physiological stability
Can recognise, assess, stabilise and manage a critically ill patient who has acutely deteriorated
Appreciate importance of taking a structured history and performing a targeted clinical examination and creation of a working clinical diagnosis
Know when and how to call for help

4.2 Interpretation of clinical data and investigations in the assessment and management of critical care patients
Can perform, interpret blood gas analysis and adjust respiratory management plans according to this

4.3 Diagnosis and disease management within the scope of critical care: respiratory disorders including pneumonia, asthma, COPD, ARDS, TRALI
Can manage the patient with severe bronchospasm
4.4 Therapeutic interventions/organ support
Can initiate and manage oxygen administration devices
Can independently prescribe drugs and therapies: bronchodilators and steroids
Can use nebulisers/metered dose inhalers

4.12
Can communicate effectively with patients, relatives, carers
Can communicate effectively with members of the multi-professional healthcare team
Can collaborate, consult and promote team working

Setting the scene
- Standard set of supplies and equipment: see Appendix
- High flow, high concentration O\textsubscript{2} facemask in place
- Nebuliser
- Salbutamol nebulisers
- Ipratropium bromide nebulisers
- Aminophylline for infusion
- Salbutamol for infusion
- Magnesium sulphate for infusion
- Hydrocortisone for injection
- Infusion pumps
- Anaesthetic and muscle relaxant drugs

Monitoring in place or available

<table>
<thead>
<tr>
<th>Monitor</th>
<th>Status</th>
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</thead>
<tbody>
<tr>
<td>ECG</td>
<td>X</td>
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<tr>
<td>ABP</td>
<td>*</td>
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<tr>
<td>NIBP</td>
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<tr>
<td>SpO\textsubscript{2}</td>
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<td>EtCO\textsubscript{2}</td>
<td>X</td>
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<tr>
<td>ICP</td>
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</tbody>
</table>

* an arterial line is being sited at start of scenario

Investigations
- CXR with hyperinflated lung fields
- ECG 1 sinus tachycardia otherwise no abnormalities
- ECG 2 sinus tachycardia much faster
- ABG
- FBC, biochemistry

History of presentation

Briefing for learners
The football coach brought this 17-year-old man into hospital when he became breathless during the second half of the match. He was assessed in the ED had a CXR and was cannulated with standard bloods sent off. He has deteriorated since arriving in HDU.
Past history
He is a fit sportsman with hay fever and a family history of asthma. His sister has required hospitalisation in the past with asthma.

Clinical course of scenario
He will continue to deteriorate, with or without appropriate treatment, and will require intubation and mechanical ventilation.

Who is the patient?
Darren Williams
Date of Birth: 14\textsuperscript{th} March, adjusted to make him 17 years old

Drug and allergy history
No medicines
Allergic to cats

Physical examination
Airway: normal although speaking in short phrases
RR 34 breaths per minute, SpO\textsubscript{2} 95\% (on oxygen as above), HR 119/min SR, BP 105/74 mmHg
Trachea central, percussion note resonant, widespread tight polyphonic wheeze, quiet chest
Heart sounds normal, peripheral pulses present, cool skin, capillary refill 3 seconds
GCS 15
Abdominal exam normal

Investigations
FBC: Hb 156g l\textsuperscript{-1}, White Cell Count 12.7 x10\textsuperscript{9}l\textsuperscript{-1}, Platelets 328 x10\textsuperscript{9}l\textsuperscript{-1}
Biochemistry: Na\textsuperscript{+} 139mmol l\textsuperscript{-1}, K\textsuperscript{+} 3.1 mmol l\textsuperscript{-1}, Urea 9.1 mmol l\textsuperscript{-1}, Creatinine 84 umol l\textsuperscript{-1}
Blood glucose 7.6mmol/l

ABG: 1 H\textsuperscript{+} 52nmol l\textsuperscript{-1}, paCO\textsubscript{2} 3.7kPa, paO\textsubscript{2} 9.3kPa, HCO\textsubscript{3}\textsuperscript{-} 19.9mmol l\textsuperscript{-1}, BE -3.1, lactate 4.4mmol/l

ABG: 2 (worse) H\textsuperscript{+} 65nmol l\textsuperscript{-1}, paCO\textsubscript{2} 5.9kPa, paO\textsubscript{2} 7.1kPa, HCO\textsubscript{3}\textsuperscript{-} 17.4mmol l\textsuperscript{-1}, BE -8.1, lactate 5.8mmol/l

ABG: 3 (improving) H\textsuperscript{+} 57nmol l\textsuperscript{-1}, paCO\textsubscript{2} 5.1kPa, paO\textsubscript{2} 21.1kPa, HCO\textsubscript{3}\textsuperscript{-} 18.3mmol l\textsuperscript{-1}, BE -7.2; lactate 3.9mmol/l

CXR; hyperinflation, nil focal
**Debriefing notes**
The debriefing should be based on a balance of predetermined intended learning outcomes and empirical learning opportunities which are identified during the scenario by a process of educational diagnostics.

**Technical Factors**
- RAM
- Pathophysiology and treatment of asthma including rescue therapy (pharmacological and physical)
- Maintenance of oxygenation when administering nebulised drugs
- Emergency intubation

**Clinical human factors**
- Clinical decision making
- Preparation and planning
- Team working
- Task allocation
- Situation awareness
- Critical thinking
- Communication
- Care and compassion

**Putting it all together**
Recognition, assessment, resuscitation, stabilisation whilst making the diagnosis and initiating definitive therapy

**Suggested Supporting materials**
- NHS Lothian Clinical Companion App: Adult Medical Emergencies Handbook
- NHS Lothian Emergency Intubation Checklist
<table>
<thead>
<tr>
<th>Progression</th>
<th>Physiology</th>
<th>What to look for</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>RR 32/min&lt;br&gt;SpO₂ = 95%&lt;br&gt;HR 119/min in sinus rhythm&lt;br&gt;BP 103/76 mmHg&lt;br&gt;Cool peripheries, CRT 4 seconds</td>
<td>• Initial assessment and monitoring&lt;br&gt;• O₂ applied&lt;br&gt;• Call for help&lt;br&gt;• Administers salbutamol nebulisers +/- ipratropium nebulisers&lt;br&gt;• Ensures hydrocortisone has been given&lt;br&gt;• Administers infusion of at least one of: iv aminophylline, iv magnesium, iv salbutamol&lt;br&gt;• Prepares for emergency intubation&lt;br&gt;• Performs/assists intubation</td>
</tr>
<tr>
<td>Worsening: move to this when candidate is having handover from HDU staff. Patient becomes exhausted, eyes close, he stops responding to voice</td>
<td>RR 42/min&lt;br&gt;SpO₂ 87%&lt;br&gt;HR 137/min SR&lt;br&gt;BP 100/68 mmHg</td>
<td></td>
</tr>
<tr>
<td>Patient is intubated and ventilated</td>
<td>Ventilation at 12/min, prolonged I:E ratio&lt;br&gt;SpO₂ 91%&lt;br&gt;HR 121/min SR&lt;br&gt;BP 95/62 mmHg</td>
<td>• Stabilises and reassesses using ABCDE approach post intubation&lt;br&gt;• Gives fluid bolus&lt;br&gt;• Ensures adequate sedation and analgesia&lt;br&gt;• Considers rescue therapies for severe asthma</td>
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</tbody>
</table>
Scenario Two

Hypotension developing in the patient in Intensive Care

Summary
Severe hypotension develops in an ICU in-patient. The patient has been in ICU for 3 days having presented with respiratory failure secondary to pneumococcal pneumonia. He has long standing alcoholic liver disease with oesophageal varices, but this acute deterioration is due to a major bleed from a gastric ulcer.

Expected duration of scenario: 20 minutes

Intended Learning Outcomes
At the end of the scenario and debriefing the learners will be able to:
• Demonstrate approach to hypotension in the ICU patient
• Demonstrate assessment of acute cardiovascular deterioration in a ventilated patient
• Categorise and recognise haemorrhagic shock including severity
• Initiate treatment to restore circulation and to treat underlying causes of hypotension
• Initiate major haemorrhage protocol
• Communicate decisions and plan with the team
• Consider important aspects of blood product transfusion including coagulopathy, acidosis and hypothermia

Faculty of Intensive Care Medicine Competencies mapping: this is indicative, not exhaustive

Medical: CCT in Intensive Care Medicine

Domain 1
1.1Adopts a structured and timely approach to the recognition, assessment and stabilisation of the acutely ill patient with disordered physiology

Domain 2
2.1Obtains a history and performs an accurate clinical examination
2.2Undertakes timely and appropriate investigations
2.7Monitors and responds to trends in physiological variables
2.8Integrates clinical findings with laboratory investigations to form a differential diagnosis

Domain 3
3.1Manages the care of the critically ill patient with specific acute medical conditions: major haemorrhage
3.3Recognises and manages the patient with circulatory failure

Domain 4
4.3Administers blood and blood products safely
4.4Uses fluids and vasoactive/inotropic drugs to support the circulation
Domain 12
12.1 Communicates effectively with patients and carers
12.2 Communicates effectively with members of the healthcare team
12.7 Collaborates and consults: promotes team working

Advanced Critical Care Practitioners

Domain 2

2.2 History taking and examination
Physical assessment of the critically ill patient

2.5 Principles of laboratory medicine
Haematology testing and blood cross matching
Authorisation of blood products

Domain 3

3.5 Decision making and clinical reasoning
Interprets clinical features
Interprets history and clinical signs
Recognises critical illness and responds with due urgency

3.8 Team working and patient safety
Works well within the multidisciplinary team
Demonstrates awareness of own contribution to patient safety within a team

3.11 Communication with colleagues and cooperation
Communicates accurately, clearly, promptly and comprehensively with relevant colleagues appropriate to the urgency of a situation

Domain 4

4.1 Resuscitation and first stage management of the critically ill patient
Identify life-threatening conditions and institute appropriate measures to promote physiological stability
Can recognise, assess, stabilise and manage a critically ill patient who has acutely deteriorated
Appreciate importance of taking a structured history and performing a targeted clinical examination and creation of a working clinical diagnosis
Know when and how to call for help

4.2 Interpretation of clinical data and investigations in the assessment and management of critical care patients
Can perform, interpret blood gas analysis and adjust respiratory management plans according to this

4.3 Diagnosis and disease management within the scope of critical care
Can manage the patient with shock and major haemorrhage

4.4 Therapeutic interventions/organ support
Can manage fluids and vasoactive drugs to support the circulation
Can authorise and administer blood and blood products

4.12
Can communicate effectively with patients, relatives, carers
Can communicate effectively with members of the multi-professional healthcare team
Can collaborate, consult and promote team working

Setting the scene
• Standard set of ICU supplies and equipment: see Appendix
• Patient intubated and ventilated on alfentanil and propofol infusions
• Blood products including O Rh negative packed red blood cells available
• Pressure bags, rapid infusion devices, blood warmers available
• NG tube aspirate has fresh blood in it
• Melaena on the bed

Monitoring in place

<table>
<thead>
<tr>
<th>ECG</th>
<th>X</th>
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<tbody>
<tr>
<td>ABP</td>
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<tr>
<td>NIBP</td>
<td>X</td>
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<tr>
<td>SpO2</td>
<td>X</td>
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<tr>
<td>CVP</td>
<td>X</td>
</tr>
<tr>
<td>Temperature</td>
<td>X</td>
</tr>
<tr>
<td>EtCO₂</td>
<td>X</td>
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</tbody>
</table>

Investigations
ECG sinus tachycardia, 118 beats per minute, normal axis, no ischaemia
CXR lobar pneumonia, intubated, CVC in place

FBC: Hb 75g l⁻¹, White Cell Count 14.4x10⁹ l⁻¹, Platelets 67x10⁹ l⁻¹
Biochemistry: Na⁺ 131mmol l⁻¹, K⁺ 2.9mmol l⁻¹, Urea17.9 mmol l⁻¹, Creatinine 65umol l⁻¹
Blood glucose: 3.7mmol/l
PT ratio 1.9; APPT ratio 2.3, fibrinogen 1.3
ABG: 1 H⁺ 64nmol l⁻¹, paCO₂ 5.9kPa, paO₂ 17.7kPa, HCO₃⁻ 15.3mmol l⁻¹, BE –11, lactate 7.4mmol/l
ABG: 2 (worse) H⁺ 75nmol l⁻¹, paCO₂ 6.4kPa, paO₂ 15.6kPa, HCO₃⁻ 13.9mmol l⁻¹, BE -12, lactate 8.1mmol/l
ABG: 3 (improving) H⁺ 58nmol l⁻¹, paCO₂ 5.9kPa, paO₂ 15.9kPa, HCO₃⁻ 14.1mmol l⁻¹, BE -12, lactate 6.8mmol/l
History of presentation

Briefing for learners
You are on shift for ICU in the middle of the night and you are called to see this patient who has become tachycardic and hypotensive.

Past history
Alcoholic liver disease with varices on banding programme. Admitted with respiratory failure and sepsis from lobar pneumonia.

Clinical course of scenario
With volume and blood stabilises enough for oesophago-gastroduodenoscopy and therapy to bleeding duodenal ulcer.

Who is the patient?
John McIntyre a retired librarian
Date of Birth: 10th April, adjusted to make him 65 years old

Current Medicines and allergy history
Co-amoxiclav, clarithromycin, pantoprazole, pabrinex, terlipressin
No allergies

Physical Examination
Intubated size 9 oral ETT 23cm at teeth
SIMV 20x420 PEEP10 FiO₂ 0.75
BP 75/48 mmHg, HR 129 beats per minute, cool peripheries, CRT 4 seconds
Peripheral stigmata of chronic liver disease: spider naevi; palmar erythema
Temperature 36.5°C
Normal bilateral breath sounds,
Normal heart sounds
Abdomen soft, hyperactive bowel sounds present
Melaena on bed

Debriefing notes
The debriefing should be based on a balance of predetermined intended learning outcomes and empirical learning opportunities which are identified during the scenario by a process of educational diagnostics. Discuss common causes of hypotension in the ICU patient: technical (transducers/calibration), boluses of sedation/analgesia, drugs eg magnesium, vasodilators as well as pathological causes.

Technical Factors
• Rapid, safe volume resuscitation
• Categories of haemorrhagic shock (15/30/40/match)
• Search for source of bleeding

Clinical human factors
• Clinical decision making
• Preparation and planning
• Team working
• Task allocation
• Situation awareness
• Critical thinking
• Communication
• Care and compassion

**Putting it all together**
Recognition, assessment, resuscitation, stabilisation of the bleeding patient, whilst making the diagnosis and organising definitive therapy.

**Scenario**

<table>
<thead>
<tr>
<th>Progression</th>
<th>Physiology</th>
<th>What to look for</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>Intubated size 9 oral ETT 23cm at teeth</td>
<td>• Initiates volume resuscitation&lt;br&gt;• Rapid infusion devices&lt;br&gt;• Blood warmers&lt;br&gt;• Administers vasopressor&lt;br&gt;• Searches for bleeding source&lt;br&gt;• Calls for specialist help: GI or surgeon</td>
</tr>
<tr>
<td></td>
<td>SIMV 20x420 PEEP10 FiO₂ 0.75</td>
<td></td>
</tr>
<tr>
<td></td>
<td>HR 129/min, BP 72/54 mmHg, cool peripheries, CRT 4 seconds Temperature 36.5°C</td>
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<tr>
<td></td>
<td>Breath sounds normal&lt;br&gt;Bowel sounds hyperactive&lt;br&gt;Eyes closed&lt;br&gt;Pupils equal and reactive 3mm</td>
<td></td>
</tr>
<tr>
<td>Volume given</td>
<td>HR117/min&lt;br&gt;BP= 82/57 mmHg</td>
<td>• Administers more fluids&lt;br&gt;• Initiates major haemorrhage protocol&lt;br&gt;• Plans for endoscopy</td>
</tr>
<tr>
<td>Packed Red Cell Transfusion Started</td>
<td>HR= 112/min&lt;br&gt;BP= 98/73 mmHg</td>
<td>• Administers blood transfusion&lt;br&gt;• Corrects coagulopathy&lt;br&gt;• Prepares for OGD</td>
</tr>
<tr>
<td>Improvement</td>
<td>HR= 106/min&lt;br&gt;BP= 105/76 mmHg</td>
<td>• Reassesses patient with ABCDE approach</td>
</tr>
</tbody>
</table>
Scenario Three

Hypoxaemia in the ventilated patient

Summary
This patient has an infective exacerbation of COPD. The patient has been intubated and ventilated in the ED and high pressures are required to ventilate him. He has just arrived in ICU on a transport ventilator and oxygenation is worsening. The uncut ET tube is in the right main bronchus and wheeze is present in right lung.

Expected Duration of Scenario: 20 minutes

Intended Learning Outcomes
At the end of the scenario and debriefing the learners will be able to:

- Take handover from ED staff
- Assess the patient who is unstable on the ventilator considering patient, tubing, ET tube and ventilator as potential issues
- Remove patient from ventilator and hand ventilate
- Identify problem, call for help and rectify it
- Initiate appropriate drug therapy for a patient with bronchospasm
- Gain a history from a secondary source

Faculty of Intensive Care Medicine Competencies mapping: this is indicative, not exhaustive

Medical: CCT in Intensive Care Medicine

Domain 1
1.1 Adopts a structured and timely approach to the recognition, assessment and stabilisation of the acutely ill patient with disordered physiology

Domain 2
2.1 Obtains a history and performs an accurate clinical examination
2.2 Undertakes timely and appropriate investigations
2.7 Monitors and responds to trends in physiological variables
2.8 Integrates clinical findings with laboratory investigations to form a differential diagnosis

Domain 3
3.1 Manages the care of the critically ill patient with specific acute medical conditions: severe bronchospasm in COPD
3.3 Recognises and manages the patient with circulatory failure

Domain 12
12.1 Communicates effectively with patients and carers
12.2 Communicates effectively with members of the healthcare team

Author Graham Nimmo: Scottish Centre for Simulation and Clinical Human Factors
12.7 Collaborates and consults: promotes team working
12.8 Ensures continuity of care through effective handover

**Advanced Critical Care Practitioners**

**Domain 2**

2.2 History taking and examination
Physical assessment of the critically ill patient

2.7 Technology in critical care
Ventilators

**Domain 3**

3.5 Decision making and clinical reasoning
Interprets clinical features
Interprets history and clinical signs
Recognises critical illness and responds with due urgency

3.8 Team working and patient safety
Works well within the multidisciplinary team
Demonstrates awareness of own contribution to patient safety within a team

3.11 Communication with colleagues and cooperation
Communicates accurately, clearly, promptly and comprehensively with relevant colleagues appropriate to the urgency of a situation

**Domain 4**

4.1 Resuscitation and first stage management of the critically ill patient
Identify life-threatening conditions and institute appropriate measures to promote physiological stability
Can recognise, assess, stabilise and manage a critically ill patient who has acutely deteriorated: severe bronchospasm
Appreciate importance of taking a structured history and performing a targeted clinical examination and creation of a working clinical diagnosis
Know when and how to call for help

4.2 Interpretation of clinical data and investigations in the assessment and management of critical care patients
Can perform, interpret blood gas analysis and adjust respiratory management plans according to this

4.3 Diagnosis and disease management within the scope of critical care
Can manage the patient with severe bronchospasm

4.4 Therapeutic interventions/organ support
Can independently prescribe drugs and therapies: bronchodilators and steroids
Can use nebulisers/metered dose inhalers
4.12
Can communicate effectively with patients, relatives, carers
Can communicate effectively with members of the multi-professional healthcare team
Can collaborate, consult and promote team working

Setting the scene
• Standard set of ICU supplies and equipment: see Appendix
• Daughter of the patient is present
• Patient intubated and ventilated size 8 uncut ETT 27 cm at teeth
• Right chest moving; left chest not moving
• Alfentanil and propofol infusions running

Monitors in place

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</tr>
<tr>
<td>EtCO2</td>
<td>X</td>
</tr>
</tbody>
</table>

Investigations
CXR: not done yet
ECG: sinus tachycardia; p pulmonale; right axis deviation.

FBC: Hb 167g l\(^{-1}\), White Cell Count 11.9x10\(^9\)l\(^{-1}\), Platelets 324x10\(^9\)l\(^{-1}\)

Biochemistry: Na\(^+\) 143mmol l\(^{-1}\), K\(^+\) 3.9mmol l\(^{-1}\), Urea 8.9mmol l\(^{-1}\), Creatinine 123umol l\(^{-1}\)

ABG: 1 H\(^+\) 69mmol l\(^{-1}\), paCO\(_2\) 7.9kPa, paO\(_2\) 7.9kPa (mmHg), HCO\(_3\)\(^-\) 32mmol l\(^{-1}\), BE +7.9, lactate 6.4mmol/l

ABG: 2 (improving) H\(^+\) 61mmol l\(^{-1}\), paCO\(_2\) 6.9kPa, paO\(_2\) 12.9kPa, HCO\(_3\)\(^-\) 31mmol l\(^{-1}\), BE +8.1, lactate 5.9mmol/l

Information from daughter
This 63-year-old is Gordon Fraser was just brought in by his daughter. Mr. Fraser is a former hospital porter. He is heavy smoker with a long history of COPD. He is completely non-compliant with his medication. You receive handover from the ED staff. Mr. Fraser presented with severe dyspnoea, which has worsened during the last ten days. He was barely able to walk for the last 48 hours and was coughing up a lot of brownish sputum. He was intubated and ventilated in the Emergency Department.

Who is the patient?
Gordon Fraser hospital porter
Date of Birth: 17th November, adjusted to make him 63 years old

Author Graham Nimmo: Scottish Centre for Simulation and Clinical Human Factors
Current Medicines and allergy
No allergies

Physical Examination
Sedated, on transport ventilator
SIMV 15x450ml PEEP 6mmHg FiO₂ 0.6 PAW 48mmHg
HR 131/min SR, BP 127/83 mmHg, cool peripheries, CRT 3 secs
Temperature 37.5°C

Debriefing notes
The debriefing should be based on a balance of predetermined intended learning outcomes and empirical learning opportunities which are identified during the scenario by a process of educational diagnostics. A systematic approach to assessment including ET tube, ventilator tubing, filters, ventilator, gas supply, combined with clinical examination of the patient, should be taught.

Technical Factors
Airway assessment and management in the intubated patient

Clinical human factors
- Receiving handover
- Clinical decision making
- Preparation and planning
- Team working
- Task allocation
- Situation awareness
- Critical thinking
- Communication
- Care and compassion

Scenario

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<tr>
<td>Baseline</td>
<td>RR 15/min</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SpO₂ 84%</td>
<td>* Increases FiO₂ to 100%</td>
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<tr>
<td></td>
<td>HR 131/min SR</td>
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<tr>
<td></td>
<td>BP= 127/83 mmHg</td>
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<td></td>
<td>Skin cool</td>
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<td></td>
<td>Capillary refill 3 seconds</td>
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<tr>
<td>Improved</td>
<td>RR 15/min, SpO₂= 92%</td>
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<td></td>
<td>Both sides chest moving</td>
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<td></td>
<td>HR 95/min SR</td>
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<td></td>
<td>BP 118/64 mmHg</td>
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</tbody>
</table>

- Reassesses patient
- Organises Chest x-ray
Scenario Four Title:

Sepsis developing in the established ICU patient

Summary
A patient with pneumococcal pneumonia who is day 3 in ICU. His infection has been improving but he now develops further features of sepsis.

Expected duration of scenario: 20-30 minutes

Intended Learning Outcomes
At the end of the scenario and debriefing the learners will be able to:
• Recognise, assess and treat deterioration due to sepsis
• Employ a strategy for identifying causes of sepsis, in the ICU patient, and managing them

Faculty of Intensive Care Medicine Competencies mapping: this is indicative, not exhaustive

Medical: CCT in Intensive Care Medicine

Domain 1
1.1 Adopts a structured and timely approach to the recognition, assessment and stabilisation of the acutely ill patient with disordered physiology

Domain 2
2.1 Obtains a history and performs an accurate clinical examination
2.2 Undertakes timely and appropriate investigations
2.4 Obtains appropriate microbiological specimens and interprets them
2.7 Monitors and responds to trends in physiological variables

Domain 3
3.1 Manages the care of the critically ill patient with specific acute medical conditions: major haemorrhage
3.3 Recognises and manages the septic patient

Domain 4
4.2 Manages antimicrobial therapy
4.4 Uses fluids and vasoactive/inotropic drugs to support the circulation

Domain 12
12.1 Communicates effectively with patients and carers
12.2 Communicates effectively with members of the healthcare team
12.7 Collaborates and consults: promotes team working
Advanced Critical Care Practitioners

Domain 2

2.2 History taking and examination
Physical assessment of the critically ill patient

2.4 Principles of microbiology
Principles of microbiological sampling
Infection diagnosis and management
Appropriate antibiotic selection, prescribing, administration and monitoring

Domain 3

3.5 Decision making and clinical reasoning
Interprets clinical features
Interprets history and clinical signs
Recognises critical illness and responds with due urgency

3.8 Team working and patient safety
Works well within the multidisciplinary team
Demonstrates awareness of own contribution to patient safety within a team

3.11 Communication with colleagues and cooperation
Communicates accurately, clearly, promptly and comprehensively with relevant colleagues appropriate to the urgency of a situation

Domain 4

4.1 Resuscitation and first stage management of the critically ill patient
Identify life-threatening conditions and institute appropriate measures to promote physiological stability
Can recognise, assess, stabilise and manage a critically ill patient who has acutely deteriorated
Appreciate importance of taking a structured history and performing a targeted clinical examination and creation of a working clinical diagnosis
Know when and how to call for help

4.2 Interpretation of clinical data and investigations in the assessment and management of critical care patients
Can perform, interpret blood gas analysis and adjust respiratory management plans according to this

4.3 Diagnosis and disease management within the scope of critical care
Can manage the care of the patient with sepsis including shock syndromes, inflammatory response, common infection-causing organisms, multi-organ failure sequelae

4.4 Therapeutic interventions/organ support
Can manage fluids and vasoactive drugs to support the circulation
Can manage antimicrobial drug therapy in consultation with appropriate medical teams
4.12
Can communicate effectively with patients, relatives, carers
Can communicate effectively with members of the multi-professional healthcare team
Can collaborate, consult and promote team working

Setting the scene
• Standard set of ICU supplies: see Appendix
• Endotracheal tube inserted and connected to ventilator with settings of: VT 500ml, RR 14 breaths per minute, PEEP 8 cmH₂O, FiO₂ 70%, I:E 1:2, 21cm at teeth.
• Infusions of propofol, alfentanil, insulin, noradrenaline infusing via pumps in addition to crystalloid infusion
• Nasogastric tube attached to feeding pump
• Endotracheal suction apparatus

Monitors in place

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<tr>
<th>ECG</th>
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<tr>
<td>ABP</td>
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<td>NIBP</td>
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<td>CVC</td>
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<tr>
<td>Temperature</td>
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<tr>
<td>EtCO₂</td>
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</tbody>
</table>

Investigations available
• ECG sinus tachycardia
• Chest x-ray showing right lower lobe consolidation and pleural effusion, cuffed oral ET, CVC in right internal jugular vein
• Microbiology reports for blood, tracheal secretions and pleural fluid
• Chemistry report for pleural aspirate

Information for the learners
Mr. Harry Jones is a 67 year old gentleman who has previous diagnoses of Type II diabetes mellitus, mild chronic obstructive pulmonary disease and hypertension who presented to the Emergency Department three days ago with a two day history of rigors, high fever, cough and breathlessness. He was in septic shock, and was treated with oxygen, fluids and broad-spectrum antibiotics.

Mr. Jones continued to deteriorate and he was admitted to the ICU. For three days he required ventilatory support (IPPV via an ETT) and cardiovascular support with noradrenaline. Nasogastric feeding was started but not yet established and an insulin infusion started to keep blood glucose between 6 and 8 mmol l⁻¹. His antibiotics were rationalized to amoxycillin after tracheal aspirates and blood cultures grew a penicillin sensitive pneumococcus. His temperature normalised, his lactate fell and he started to pass urine. His creatinine improved, and his vasopressor requirements decreased.

You are on the ward round. The consultant has been called to the phone and your nursing colleague looking after Mr. Jones asks you to come and review him. She tells you that he
has needed a bolus of fluid over the last couple of hours, his noradrenaline has had to be increased, and his urine output has dropped off.

**Additional information**

Abdominal and renal ultrasound scans along with abdominal x-rays are normal. Line sites are clean. There are no signs of endocarditis (new murmurs, splinter haemorrhages) Urinalysis is normal. Ultrasound of his chest will show a right pleural effusion which is 5cm in depth.

His renal function is worse, due to poor renal perfusion. His platelets have fallen prompting a discussion of whether platelet concentrate should be given before an intercostal drain is inserted.

**Who is the patient?**
Harry Jones a retired naval submariner
Date of Birth: 14th February, adjusted to make him 67 years old

**Current medicines and allergy history**
- Propofol, alfentanil and noradrenaline infusions
- Heparin 5000 units SC twice daily
- Amoxicillin 1g IV three times daily
- Insulin by continuous infusion

**Physical examination**
Intubated and ventilated; CVC in right internal jugular vein; left radial arterial line
Airway: Cuffed oral ETT, 8.0mm, 21cm at lips
V_{\text{t}} 500ml, RR 14 breaths per minute, PEEP 8 cmH₂O, FiO₂ 0.7, I:E 1:2
SpO₂ 94%
Temperature 38.5°C,
HR 115/min sinus tachycardia, BP 105/42 mmHg
Chest: large airway crackles only, dull at the right base with decreased air entry and bronchial breathing
Normal heart sounds, cool to touch, cold to mid calf, capillary refill 5 seconds
Abdomen: normal
Renal: small amounts of dark urine

**Laboratory, Radiology, and other Relevant Studies**
Full Blood Count: Hb 9.7 g dl⁻¹, WBC 14.3 x10⁹l⁻¹, Platelets 45 x10⁹l⁻¹
Urea and Electrolytes: Na⁺ 135mmol l⁻¹, K⁺ 4.3mmol l⁻¹, HCO₃⁻ 22 mmol l⁻¹, Urea 15.0mmol l⁻¹, Creatinine 184 mmol l⁻¹, Glucose 6.4mmol l⁻¹,
Liver Function Tests: GGT 32units l⁻¹, ALT 54 units l⁻¹, AlkP 190 units l⁻¹, Bilirubin 23 mmol l⁻¹, Albumin 24 g l⁻¹, Ca²⁺ 2.32mmol l⁻¹, PO₄⁻ 1.4mmol l⁻¹, Mg²⁺ 0.53mmol l⁻¹
Chest x-ray: Consolidated right lower lobe and right pleural effusion
ECG: Sinus Tachycardia
Arterial Blood Gas (ABG): pH 7.42 (H⁺ 38nmol l⁻¹), PaO₂ 62.4mmHg (8.3 kPa), PaCO₂ 30mmHg (4.0kPa), HCO₃⁻ 19mmol l⁻¹, BE -2.7, Lactate 2.9mmol l⁻¹

Microbiology report (pleural fluid): Polymorphonuclear lymphocytes strong positive, Gram-positive cocci

Chemistry report (pleural fluid): Protein 20 g l⁻¹ pH 7.1 (H⁺ 79nmol l⁻¹), Glucose 3.8mmol l⁻¹, LDH 1150 U l⁻¹

Debriefing notes

Technical Skills:
• The approach to potential sources of new septic episodes: is it related to the initial pneumococcal pneumonia or is it a new infective agent? Top to toe approach:
  o CNS: meningitis; encephalitis; abscess
  o Sinusitis
  o Respiratory tract – secondary lower respiratory tract infection (VAP); empyema or abscess secondary to pneumococcal
  o Pneumococcal endocarditis/pericardial infection
  o Abdomen – abscess, cholangitis/cholecystitis; perforated viscus
  o Renal tract – urinary tract infection, pyelonephritis
  o Locomotor: septic arthritis; osteomyelitis
  o Skin
  o Infected lines and prostheses
• Identifies thrombocytopenia and importance for practical procedures

Non-Technical Skills: clinical human factors
• Clinical decision making
• Preparation and planning
• Team working
• Task allocation
• Situation awareness
• Critical thinking
• Communication
• Care and compassion

Note: debriefing at the bedside works well. Once scenario complete facilitator rejoins learners at the bedside (acting as registrar or consultant) and gets them to handover what has been happening, then goes through the ‘top to toe’ approach as above.

Suggested supporting materials
Identifying Sepsis Early teaching pack
### Scenario

<table>
<thead>
<tr>
<th>Progression</th>
<th>Physiology</th>
<th>What to look for</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>RR= 14 connected to ventilator SpO₂ 94% on V₁ 500ml, PEEP 8 cmH₂O, FiO₂ 0.7 I:E 1:2 HR 127/min BP 98/48 mmHg CVP 12 mmHg Temperature 38.5°C Peripheries cool to touch, cold to mid calf CRT 5 seconds</td>
<td>• ABCDE assessment</td>
</tr>
<tr>
<td>Worsening</td>
<td>BP to 80/50 mmHg over 10 minutes SpO₂ to 85% over 10 minutes</td>
<td>• Recognises second septic episode • Searches for source through diagnostic testing: o Lines o Cultures: Sputum, Blood, Urine o Chest x-ray o Ultrasound examination of the chest o Echocardiography o CT scanning</td>
</tr>
<tr>
<td>Improving</td>
<td>BP and SpO₂ improve with oxygen and fluid</td>
<td></td>
</tr>
</tbody>
</table>

**Author Graham Nimmo: Scottish Centre for Simulation and Clinical Human Factors**
Scenario Five Title:

Critically raised intra-cranial pressure: meningococcal meningitis

Karen Murray 04/07/year to make her 23

Summary
Bank teller living in a flat with 3 friends. Developed flu like symptoms around 24 hours ago and was complaining of headache this morning. She became confused (GCS E4 V4 M6) and was taken to hospital by a friend. Shortly after arrival she had a tonic-clonic seizure and dropped GCS to E1 V2 M5. She was intubated and ventilated, is being loaded with phenytoin and has been taken for CT scan en route to ICU.

Expected duration of scenario: 20-30 minutes

Intended Learning Outcomes:
At the end of the scenario and debriefing the learners will be able to:
• Demonstrate assessment of neurological function in the ventilated and sedated patient
• Recognise signs of raised intracranial pressure
• Initiate treatment to reduce intracranial pressure
• Call for senior (ICU) and specialist (Neurosurgical) assistance
• Communicate decisions and plan with the team

Faculty of Intensive Care Medicine Competencies mapping: this is indicative, not exhaustive

Medical: CCT in Intensive Care Medicine

Domain 1
1.1 Adopts a structured and timely approach to the recognition, assessment and stabilisation of the acutely ill patient with disordered physiology

Domain 2
2.1 Obtains a history and performs an accurate clinical examination
2.2 Undertakes timely and appropriate investigations
2.6 Interprets imaging studies: Ct scan of head
2.7 Monitors and responds to trends in physiological variables

Domain 3
3.1 Manages the care of the critically ill patient with specific acute medical conditions: raised intracranial pressure due to cerebral oedema in meningitis
3.6 Recognises and manages the patient with neurological impairment: medical causes of raised intracranial pressure
Indications for urgent imaging of the brain and neurosurgical consultation
Principles of cerebral perfusion pressure, cerebral oxygen delivery and methods by which they may be optimised

Domain 4
4.1 Prescribes drugs and therapies safely: hyperventilation and osmotic therapy
Domain 12
12.1 Communicates effectively with patients and carers
12.2 Communicates effectively with members of the healthcare team
12.7 Collaborates and consults: promotes team working

Advanced Critical Care Practitioners

Domain 2

2.2 History taking and examination
Physical assessment of the critically ill patient

2.3 Indications for CT and MRI scanning and basic head CT/MRI interpretation

2.7 Technology in critical care
Intracranial pressure monitoring

Domain 3

3.5 Decision making and clinical reasoning
Interpret clinical features
Interpret history and clinical signs
Recognise critical illness and respond with due urgency

3.8 Team working and patient safety
Work well within the multidisciplinary team
Demonstrate awareness of own contribution to patient safety within a team

3.11 Communication with colleagues and cooperation
Communicate accurately, clearly, promptly and comprehensively with relevant colleagues appropriate to the urgency of a situation

Domain 4

4.1 Resuscitation and first stage management of the critically ill patient: coma, meningitis
Identify life-threatening conditions and institute appropriate measures to promote physiological stability
Recognise, assess, stabilise and manage a critically ill patient who has acutely deteriorated
Appreciate importance of taking a structured history and performing a targeted clinical examination and creation of a working clinical diagnosis
Know when and how to call for help

4.2 Interpretation of clinical data and investigations in the assessment and management of critical care patients: CT brain scan

4.3 Diagnosis and disease management within the scope of critical care

4.4 Therapeutic interventions/organ support
Can independently prescribe drugs and therapies: mannitol; hypertonic saline
4.12
Can communicate effectively with patients, relatives, carers
Can communicate effectively with members of the multi-professional healthcare team
Can collaborate, consult and promote team working

Setting the scene
• Standard set of ICU supplies and equipment: see Appendix
• Three cannulae: one grey, one green, one pink
• Patient intubated size 8mm ETT and ventilated
• Alfentanil and propofol infusions running
• Phenytoin infusion running
• 0.9% saline 80ml/hr
• NG tube in situ

Monitoring in place

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<tr>
<th>ECG</th>
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<tr>
<td>EtCO₂</td>
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</table>

Investigations

ECG on admission: sinus tachycardia, 96 beats per minute, normal axis, no ischaemia
CXR ETT, NG tube, otherwise normal

FBC: Hb 139g l⁻¹, WBC 13.4 x10⁹ l⁻¹, Platelets 189 x10⁹ l⁻¹
Biochemistry: Na⁺ 138 mmol l⁻¹, K⁺ 3.8 mmol l⁻¹, Urea 6.8 mmol l⁻¹, Creatinine 98 umol l⁻¹
Blood glucose: 6.1mmol/l
ABG: H⁺ 45nmol l⁻¹, paCO₂ 4.3kPa, paO₂ 27.3kPa, HCO₃⁻ 20mmol l⁻¹, BE –2.5, Lactate 2.3 mmol/l

History of presentation

Briefing for learners
This 23 year old woman, Karen Murray, has recently been admitted to the ICU. She has had a normal CT scan and 15 minutes ago had a lumbar puncture. Her BP is high and the bedside nurse calls you concerned about this.

Past history
Fit and well. No allergies. On oral contraceptive pill.

Clinical course of scenario
Blows left pupil and becomes hypertensive and more tachycardic. All improves with hyperventilation and mannitol or hypertonic saline. Requires discussion with Neurosurgeon and repeat CT brain scan. Family should be contacted.
LP result: turbid fluid, 2,300 WBCs 95% neutrophils, Gram negative intra-cellular diplococci, 230 red cells. Looks like meningococci. Protein 3.2g/l; glucose 0.3mmol/l, plasma 7.6mmol/l.

Current Medicines
Alfentanil, propofol, phenytoin, ceftriaxone 2G iv bd.
No allergies.

Physical Examination
Intubated size ETT 20cm at teeth
SIMV 12x450 PEEP 5 FiO2 0.4
BP 195/86 mmHg, HR 114 beats per minute, cool peripheries, CRT 2 seconds
Temperature 38°C
Normal bilateral breath sounds,
Normal heart sounds
Abdomen soft, normal bowel sounds present
No rash

Debriefing notes
The debriefing should be based on a balance of predetermined learning objectives and opportunistic learning objectives which are identified during the scenario by a process of educational diagnostics.

Technical Skills
• Neurological assessment
• CT interpretation

Non-technical skills: clinical human factors
• Team work: specialist involvement
• Decision making: management of raised ICP
• Task allocation
• Situation awareness: relationship of LP to deterioration
• Communications including family
• Care and compassion
### Scenario

<table>
<thead>
<tr>
<th>Progression</th>
<th>Physiology</th>
<th>What to look for</th>
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</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>Intubated size 8 ETT 20cm at teeth SIMV 12x450 PEEP5 FiO₂ 0.4 HR 114/min, BP 195/86 mmHg, cool peripheries, CRT 2 seconds Temperature 38°C Breath sounds normal Bowel sounds normal Eyes closed Pupils right reactive 3mm, left 6mm unreactive</td>
<td>• Assesses GCS • Assesses pupils</td>
</tr>
<tr>
<td>Deteriorates</td>
<td>HR125/min BP 206/97 mmHg</td>
<td>• Hyperventilates using self inflating bag and 100% oxygen (not C-circuit) • Calls for senior help • Increases sedation and administers muscle relaxant • Ensures head up/straight neck to improve cerebral venous drainage • Administers mannitol or hypertonic saline treatment • Calls for help and Neurosurgery</td>
</tr>
<tr>
<td>Improvement</td>
<td>HR= 106/min BP= 125/76 mmHg</td>
<td>• Reassesses patient • Left pupil 4mm and reactive</td>
</tr>
</tbody>
</table>
Scenario Six Title:

Unintentional extubation

James Wyllie 17/03/year to make him 74.

Summary
This patient was admitted to ICU yesterday having presented with gram negative sepsis related to a ureteric calculus which he has passed. He had severe hyperkalaemia and reduced conscious level. He has been intubated and ventilated since then and is now having a sedation hold. He had 15 hours of veno-venous haemofiltration overnight. He has had a coughing fit and a cuff leak has developed. The ET tube falls out when he moves his head.

Expected duration of scenario: 20-30 minutes

Intended Learning Outcomes
At the end of the scenario and debriefing the learners will be able to:
• Demonstrate assessment of cuff leak in a ventilated patient
• Manage the airway in the extubated patient with reduced conscious level
• Plan and prepare for emergency intubation
• Communicate decisions and plan with the team
• Carry out emergency intubation
• Demonstrate systematic reassessment following intubation

Faculty of Intensive Care Medicine Competencies mapping: this is indicative, not exhaustive

Medical: CCT in Intensive Care Medicine

Domain 1
1.1 Adopts a structured and timely approach to the recognition, assessment and stabilisation of the acutely ill patient with disordered physiology

Domain 2
2.1 Obtains a history and performs an accurate clinical examination
2.2 Undertakes timely and appropriate investigations
2.7 Monitors and responds to trends in physiological variables
2.8 Integrates clinical findings with laboratory investigations to form a differential diagnosis

Domain 3
3.1 Manages the care of the critically ill patient with specific acute medical conditions: unintentional extubation

Domain 4
4.6 Initiates, manages, and weans patients from invasive and non-invasive ventilation

Domain 5
5.2 Performs emergency airway management
Domain 12
12.1 Communicates effectively with patients and carers
12.2 Communicates effectively with members of the healthcare team
12.7 Collaborates and consults: promotes team working

Advanced Critical Care Practitioners

Domain 2
2.2 History taking and examination
Physical assessment of the critically ill patient

2.6 Principles of pharmacology and prescribing
Sedatives and anaesthetic agents
Analgesics
Muscle relaxants

Domain 3
3.5 Decision making and clinical reasoning
Interprets clinical features
Interprets history and clinical signs
Recognises critical illness and responds with due urgency

3.8 Team working and patient safety
Works well within the multidisciplinary team
Demonstrates awareness of own contribution to patient safety within a team

3.11 Communication with colleagues and cooperation
Communicates accurately, clearly, promptly and comprehensively with relevant colleagues appropriate to the urgency of a situation

Domain 4
4.1 Resuscitation and first stage management of the critically ill patient
Identify life-threatening conditions and institute appropriate measures to promote physiological stability: emergency airway management to maintain oxygenation
Know when and how to call for help

4.2 Interpretation of clinical data and investigations in the assessment and management of critical care patients
Can perform, interpret blood gas analysis and adjust respiratory management plans according to this

4.4 Therapeutic interventions/organ support
Can initiate, manage, and wean patients from non-invasive ventilatory support

4.12
Can communicate effectively with patients, relatives, carers
Can communicate effectively with members of the multi-professional healthcare team
Can collaborate, consult and promote team working

Author Graham Nimmo: Scottish Centre for Simulation and Clinical Human Factors
**Setting the scene**
- Standard set of ICU supplies and equipment: see Appendix
- Patient intubated and ventilated with alfentanil and propofol (off) infusions
- NG tube and enteral feeding
- Quinton line in right femoral vein
- Quad lumen CVC in right IJV

**Monitoring in place**

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<th>ECG</th>
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<td>SpO2</td>
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<td>CVP</td>
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<tr>
<td>EtCO₂</td>
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</tbody>
</table>

**Investigations**

ECG 1: hyperkalaemia
ECG 2: sinus tachycardia, 75 beats per minute, normal axis, no ischaemia
CXR intubated, right IJV CVC

FBC: Hb 126g l⁻¹, White Cell Count 9.7x10⁹l⁻¹, Platelets 199x10⁹l⁻¹
Biochemistry: Na⁺ 137 mmol l⁻¹, K⁺ 5.8mmol l⁻¹, Urea 18.7 mmol l⁻¹, Creatinine 269 umol l⁻¹

ABG: 1 H⁺ 45nmol l⁻¹, paCO₂ kPa 6.5, paO₂ 14.9kPa, HCO₃⁻ 19.5mmol l⁻¹, BE −7

**Briefing for learners**
The patient was admitted to ICU yesterday having presented with gram negative sepsis related to a ureteric calculus which he has passed. He had severe hyperkalaemia and reduced conscious level. He has been intubated and ventilated since then and is now having a sedation hold. He had 15 hours of veno-venous haemofiltration overnight. He has had a coughing fit and a cuff leak has developed.

**Past history**
Hypertension; renal calculi

**Clinical course of scenario**
Requires re-intubation

**Who is the patient?**
James Wyllie: retired miner
Date of Birth: 17th March, year adjusted to make him 74 years old

**Current Medicines and allergy history**
Was on lisinopril, ibuprofen and atenolol at home.
Physical Examination

Intubated size 9 oral ETT 23cm at teeth
SIMV 20x550 PEEP 5 FiO$_2$ 0.45
BP 125/78 mmHg, HR 109 beats per minute, cool peripheries, CRT 4 seconds
Temperature 36.5°C
Normal bilateral breath sounds, Normal heart sounds
Abdomen soft bowel sounds present

Debriefing notes
The debriefing should be based on a balance of predetermined learning objectives and opportunistic learning objectives which are identified during the scenario by a process of educational diagnostics.

Technical Skills
Emergency intubation

Non-Technical Skills: clinical human factors
- Clinical decision making
- Preparation and planning
- Team working
- Task allocation
- Situation awareness
- Critical thinking
- Communication
- Care and compassion

Scenario

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<tr>
<th>Progression</th>
<th>Physiology</th>
<th>What to look for</th>
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<tbody>
<tr>
<td>Baseline</td>
<td>Intubated size 9 oral ETT 23cm at teeth</td>
<td>• Preparation, planning and execution of emergency intubation</td>
</tr>
<tr>
<td></td>
<td>SIMV 20x550 PEEP 5 FiO$_2$ 0.45</td>
<td>• Turns oxygen up to 100%</td>
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<td></td>
<td>SpO$_2$ 83%</td>
<td>• Uses intubation checklist</td>
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<tr>
<td></td>
<td>HR 109/min, BP 125/78 mmHg, cool peripheries, CRT 4 seconds</td>
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</tr>
<tr>
<td></td>
<td>Temperature 36.5°C</td>
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<tr>
<td></td>
<td>Breath sounds normal</td>
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<tr>
<td></td>
<td>Bowel sounds normal</td>
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<tr>
<td></td>
<td>Eyes closed</td>
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<td></td>
<td>Pupils equal and reactive 3mm</td>
<td></td>
</tr>
<tr>
<td>Improvement once</td>
<td>SpO$_2$ 97%</td>
<td>• Reassesses patient</td>
</tr>
<tr>
<td>intubated</td>
<td>HR= 106/min</td>
<td></td>
</tr>
<tr>
<td></td>
<td>BP= 105/76 mmHg</td>
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</tbody>
</table>
Scenario Seven Title

Tracheostomy problem in patient with COPD

Summary
This patient has COPD with an acute infective exacerbation. He has been intubated and ventilated for 10 days. He had a percutaneous tracheostomy performed uneventfully yesterday. He has desaturated in the last few minutes and his tidal volumes have fallen. The tracheostomy is subcutaneous and the patient requires re-intubation.

Expected Duration of Scenario: 20-30 minutes

Intended Learning Outcomes
At the end of the scenario and debriefing the learners will be able to:
• Demonstrate systematic approach to hypoxaemia in the ventilated patient with tracheostomy
• Optimise oxygen delivery and assess tracheostomy patency and position
• Optimise mechanical ventilation by setting specific ventilator parameters for a patient with COPD
• Initiate appropriate drug therapy for a patient with COPD

Faculty of Intensive Care Medicine Competencies mapping: this is indicative, not exhaustive

Medical: CCT in Intensive Care Medicine

Domain 1
1.1 Adopts a structured and timely approach to the recognition, assessment and stabilisation of the acutely ill patient with disordered physiology
Recognises and manages emergencies: seek assistance appropriately

Domain 2
2.2 Undertakes timely and appropriate investigations
2.7 Monitors and responds to trends in physiological variables

Domain 3
3.1 Manages the care of the critically ill patient with specific acute medical conditions: tracheostomy emergency

Domain 4
4.6 Initiates, manages, and weans patients from invasive and non-invasive ventilation
A systematic approach to checking ventilator, breathing circuit and monitoring devices

Domain 5
5.2 Performs emergency airway management in the patient with a compromised tracheostomy

Domain 12
12.1 Communicates effectively with patients and carers

Author Graham Nimmo: Scottish Centre for Simulation and Clinical Human Factors
12.2 Communicates effectively with members of the healthcare team
12.7 Collaborates and consults: promotes team working

**Advanced Critical Care Practitioners**

**Domain 2**

2.2 History taking and examination
Physical assessment of the critically ill patient

2.7 Technology in critical care
Tracheostomy

**Domain 3**

3.5 Decision making and clinical reasoning
Interprets clinical features
Interprets history and clinical signs
Recognises critical illness and responds with due urgency

3.8 Team working and patient safety
Works well within the multidisciplinary team
Demonstrates awareness of own contribution to patient safety within a team

3.11 Communication with colleagues and cooperation
Communicates accurately, clearly, promptly and comprehensively with relevant colleagues appropriate to the urgency of a situation

**Domain 4**

4.1 Resuscitation and first stage management of the critically ill patient
Identify life-threatening conditions and institute appropriate measures to promote physiological stability: emergency airway management to maintain oxygenation
Know when and how to call for help

4.2 Can perform, interpret blood gas analysis and adjust respiratory management plans according to this

4.4 Therapeutic interventions/organ support
Can perform emergency airway management to ALS provider standard

4.12
Can communicate effectively with patients, relatives, carers
Can communicate effectively with members of the multi-professional healthcare team
Can collaborate, consult and promote team working
Setting the scene
- Standard set of ICU supplies and equipment: see Appendix
- Tracheostomy in situ
- Radial arterial line
- NG tube and enteral feeding

Monitors Required

<table>
<thead>
<tr>
<th>Monitor</th>
<th>Required</th>
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<tbody>
<tr>
<td>ECG</td>
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<td>EtCO₂</td>
<td>X</td>
</tr>
</tbody>
</table>

History: briefing for learners
Gordon Fraser is a heavy smoker with a long history of COPD. He was intubated and ventilated in the Emergency Department 10 days ago. He has been weaning from ventilation and has had 2 failed extubations. He had an uneventful percutaneous tracheostomy performed yesterday.

Physical examination
Tracheostomy in situ
CPAP/PS 5/12 FiO₂ 0.7 (from 0.35)
RR 42/min, Vt 150ml
SpO₂ 78%

HR 136/min AF, BP 116/50 mmHg
Temperature 38.8°C
Chest: wheezy all over; reduced AE right base
Heart and abdomen: normal
Cool peripherally
GCS: E3 Vt M6

Investigations
Full Blood Count: Hb 16.6 g l⁻¹, White Cell Count 18.4 x10⁹l⁻¹, Platelets 346 x10⁹l⁻¹
Electrolytes and Urea: Na⁺ 139 mmol l⁻¹, K⁺ 3.4 mmol l⁻¹, Urea 15.7 mmol l⁻¹, Creatinine 98 umol l⁻¹

Arterial Blood Gas (ABG): H⁺ 62nmol l⁻¹, paCO₂ 8.7kPa, paO₂ 10.3kPa, HCO₃⁻ 32.5mmol l⁻¹, BE +9.8, lactate 1.2mmol/l

Chest x-ray from three days ago: hyperinflation, ET tube in correct position
ECG: p pulmonale, right axis deviation, right ventricular hypertrophy
Debriefing Items

**Technical Skills**
Safe and effective assessment of tracheostomy position and function

**Non-Technical Skills: clinical human factors**
- Clinical decision making
- Preparation and planning
- Team working
- Task allocation
- Situation awareness
- Critical thinking
- Communication
- Care and compassion

| Baseline | Intubated size 9 tracheostomy | • Turns oxygen up to 100%  
| | CPAP/PS 5/12 FiO₂ 0.45 SpO₂ 89%  
| | HR 136/min AF, BP 116/58 mmHg, cool peripheries, CRT 4 seconds  
| | Temperature 36.5°C  
| | Breath sounds normal  
| | Bowel sounds normal  
| | Eyes closed  
| | Pupils equal and reactive 3mm  
| Improvement once intubated | SpO₂ 97%  
| | HR= 106/min  
| | BP= 105/76 mmHg  
| | • Evaluation of tracheostomy  
| | • Removal of tracheostomy and initiation of oxygenation/ventilation by bag/mask/valve  
| | • Preparation, planning and execution of emergency intubation  
| | • Uses intubation checklist  
| | Note: can be used as alternative to scenario 6  
| | • Reassesses patient |
Further Reading


Nimmo GR, Hughes M. Communication and decision making pp 4-7 in ABC of Intensive Care Blackwell 2011.


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Appendix: Standard Supplies

Monitoring

• Non-Invasive BP Cuff
• 5 lead ECG
• Pulse oximeter
• Arterial line
• Central Venous Catheter
• Capnography
• Temperature probe

Ventilation and Airway Management

• Airway trolley
• Non-rebreathing mask/Hudson Mask with reservoir bag
• High flow nasal cannula system
• Bag-valve mask and Mapelson C-circuit
• Masks for non-invasive ventilation
• Endotracheal tube
• ICU ventilator
• Laryngoscopes
• Transport ventilator
• Endotracheal suction

Other

• Infusion pumps – at least 2
• Syringe drivers – at least 2
• ICU bed
• Feeding pump
• Nasogastric tube
• Urinary Catheter
• Defibrillator
• Cannulae
• Nasal speculæ
• Blood sampling equipment
• ABG syringes
• Endotracheal catheters
• Thoracic drain set
• Chart with appropriate forms, order sheets, and demographic data
• ID band
• Stethoscope
• Non-sterile gloves
• Hazardous waste disposal box
• 12 lead ECG without pathologies
• Chest x-ray without pathologies

Drugs and IV Solutions

• 3 litres of crystalloids (1000mL of Sterile Water for infusion labelled as Plasmalyte 148, 0.9% Saline or other solutions as required)
• Drugs for induction and maintenance of anaesthesia (Vials or ampoules of Sterile Water labelled as required drug)
• Resuscitation drugs (Minijets or vials of Sterile Water labelled as adrenaline, atropine, amiodarone, calcium chloride)

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