OXYGEN FAILURE

MODULE: PATIENT SAFETY

TARGET: ALL ANAESTHETISTS

BACKGROUND:

Pipeline gas failure is a rare but possible event and is a common scenario practiced in many simulation centres. This scenario also leads to cylinder oxygen failure leading the participant to have to continue the anaesthetic using alternate strategies.

This scenario has been designed to be used as part of the Readiness for the Initial Assessment of Competency Training (RIACT) Course, but is applicable to anaesthetists of all grades with minimal modifications.

In our Simulation suite, we are able to independently shut off the pipeline gas supply from the control room, and the scenario has been designed on this basis. Due to differences between individual simulation suites, there may need to be practical modifications to this scenario in how the pipeline oxygen failure occurs. The cylinder oxygen supply failure can easily be simulated by having an empty cylinder on the back of the machine or by removing the Bodok seal.

RELEVANT AREAS OF THE ANAESTHETIC CURRICULUM

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| IG_BK_03 | In respect of the equipment in the operating environment:  
      • Demonstrates understanding of the function of the anaesthetic machine including  
        o Performing proper pre-use checks  
        o Changing/checking the breathing system |
| IG_BS_05 | Demonstrates how to obtain the attention of others and obtain appropriate help when a crisis is occurring |
| IO_BS_07 | Demonstrates role as team player and when appropriate leader in the intra-operative environment |
| IO_BS_08 | Communicates with the theatre team in a clear unambiguous style |
| IO_BS_09 | Able to respond in a timely and appropriate manner to events that may affect the safety of patients [e.g. hypotension, massive haemorrhage] |
| CI_BS_01 | Demonstrates good non-technical skills such as: [effective communication, team-working, leadership, decision-making and maintenance of high situation awareness] |
| CI_BS_02 | Demonstrates the ability to recognise early a deteriorating situation by careful monitoring |
| CI_BS_05 | Demonstrates ability to recognise when a crisis is occurring |
| CI_BS_06 | Demonstrates leadership in resuscitation room/simulation when practising response protocols with other healthcare professionals |
| CI_IS_01 | Demonstrates appropriate use of team resources when practising response protocols with other healthcare professionals |
LEARNING OBJECTIVES:

- Management of oxygen failure during general anaesthesia
- Understanding the importance of anaesthetic machine checks
- Recognising the practical importance of understanding the equipment used in anaesthesia and critical care

SCENE INFORMATION:

- Location: Theatre
- Expected Duration of Scenario: 20-25 mins
- Expected Duration of Debrief: 30-35 mins

EQUIPMENT & CONSUMABLES

Manikin – Male. Under general anaesthesia.
Anaesthetic machine – Mechanism for stopping pipeline supply of gas, and Bodok seal removed from O2 cylinder on back of machine. Ensure cylinder is off.
Spare oxygen cylinder with either a Schrader fitting (allowing continuation of anaesthesia via the anaesthetic machine) or only a standard oxygen output nozzle to allow connection of a self-inflating bag
Stocked airway trolley
Self-inflating bag
Infusion/TIVA pumps
(Simulated) Propofol for infusion ready to be drawn up into 50ml syringes
Simulated anaesthetic drugs

PERSONS REQUIRED

Anaesthetic Junior Trainee
Anaesthetic Assistant
Anaesthetic Senior Trainee

PARTICIPANT BRIEFING: (TO BE READ ALOUD TO PARTICIPANT)

Mr Levi Caine is a 60 year old man who is undergoing a right total knee replacement. He has had a right femoral nerve block awake, prior to having a general anaesthetic. 30mls 0.25% bupivacaine was used in the block. He was induced with midazolam, propofol, fentanyl and a size 3 LMA was inserted. He is ventilating spontaneously. He has been haemodynamically stable since induction and has received anti-emetics and antibiotics.

He has hypertension, mild COPD and arthritis. His regular meds are amlodipine, seretide and salbutamol. There are no known allergies.

Knife to skin was about 15 minutes ago, and the anaesthetist who started the case has had to leave. Please continue the anaesthetic care for this patient.
‘VOICE OF MANIKIN’ BRIEFING:

Unresponsive. Under General Anaesthetic.

‘IN SCENARIO PERSONNEL’ BRIEFING:

ANAESTHETIC CONSULTANT

At some point there will be a pipeline oxygen supply failure. Help the anaesthetist manage this, but do not volunteer solutions unless they are obviously struggling.

Remind them of the cylinder of the back of the anaesthetic machine and, if necessary, show them how to open the valve. The lack of Bodok seal should lead to a escape of gas from the cylinder and a loud hissing noise. If they do not recognise this as a problem, tell them that this is not normal – do not tell them this is caused by a lack of (or damaged) Bodok seal.

If necessary, offer to get another oxygen cylinder from another theatre, but do not volunteer to connect this up automatically.

The participant may need to be reminded that the patient may need to be kept asleep – do not suggest alternatives.

SURGICAL TEAM

At some point the anaesthetist will inform you that they are having problems with oxygen supply, and that surgery should conclude as soon as possible. Be initially resistant to this as surgery is proceeding, but if pushed by the anaesthetist acknowledge that it is possible to start to close if absolutely necessary.

Has the participant explored all the options to continue the anaesthetic?
CONDUCT OF SCENARIO

EXPECTED ACTIONS

- Ensure that anaesthetic machine is checked.
- Ensure that the induction drugs and emergency drugs are drawn up and correctly labelled.
- Review anaesthetic plan with assistant (IV induction, size of ETT)
- Allow assistant to perform check-in and WHO.
- Review history and examination if required.
- Attach monitoring
- Check IV access
- Optimise position of patient prior to induction.
- Pre-oxygenate
- Give appropriate induction drugs, including muscle relaxant.

INITIAL SETTINGS

A: LMA in situ
B: Spontaneously ventilating. RR 10. SaO2 98%
C: HR 80. BP 110/70. Isoflurane anaesthesia.
E: Draped for surgery on Rt knee. Surgery ongoing at the beginning of scenario.

OXYGEN FAILURE

Turn off pipeline oxygen supply. Anaesthetic machine low O2 pressure alarm will sound after a short period.

ONGOING O2 FAILURE

A: LMA
B: SaO2 96%. Spontaneous ventilation. If vapour is turned off or patient disconnected from circuit, then etISO% falls to 0 over 10mins.
D: If ISO% falls to 0% then patient starts to wake (e.g. coughs, surgeons report movement)
D: Eyes closed (AVPU).

EXPECTED ACTIONS

- Consider continuing with air and vapour from anaesthetic machine
- Consider self-inflating bag with new cylinder
- Consider reconnecting anaesthetic machine pipeline supply to new cylinder
- Consider switching to TIVA
- Contact theatre manager to establish extent of problem

LOW DIFFICULTY

- No deterioration in patient condition provided adequate steps taken
- Help arrives early to facilitate this

NORMAL DIFFICULTY

- Slow deterioration in SaO2 92% over 10mins unless adequate measures taken

HIGH DIFFICULTY

- No help provided.
- Surgeon aggressive and argumentative if asked to stop operating

RESOLUTION

Once patient safety and adequate anaesthesia maintained then scenario is complete

ADDITIONAL INFO

Mid-scenario: phone call to theatre informing team of a hospital-wide pipeline failure due to accidental disruption of pipelines during building works.

Version 9 – May 2015
Editor: Dr Andrew Darby Smith
Original Author: Dr P Shanmuha, Dr D Rosenorn-Lanng
**ANAESTHETIC RECORD SHEET**

**PATIENT DETAILS / ADDRESSOGRAPH**
Hospital No.  
SURNAMES: Levi Caine
(Block Letters)
FORENAMES: 60 years old
Address: Ward/Hosp.
DOB: Sex: M / F

**Procedure(s) proposed:**
RHS Total Knee Replacement
CEPOD CLASS: ELECTIVE / SCHEDULED / URGENT / EMERGENCY

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**Anaesthetist’s preoperative assessment by**

Name:  
Grade: □ Cons □ AS □ SG □ Trainee  
Date: Time: Signature

**Anaes / Surg history:**
Previous Appendicectomy

**Medical history:**
Hypertension  
COPD (mild) – no hospital admission  
Arthritis  
Good exercise tolerance – swims >200m weekly  
Walking limited by arthritis

**VTE Risk:** □ High □ Low

**NBM since**
Solids: 2200 yesterday  
Clear Fluids:  
Pregnancy: Neg  
Lactation:  

**Relevant Medication:**
Amlodipine 10mg OD  
Seretide 1 puff OD  
Salbutamol INH PRN

**Investigations**
□ Haematology FBC  
Hb 12.8  
Pt 311  
□ Biochemistry U & E  
NAD  
□ Coag NAD  
□ Gp & Save  
□ X - Match

**Sickle:**
□ GA  
□ Sedation  
□ Epidural  
□ Spinal  
□ Regional  
□ Other

**Notes / Discussion / Technique proposed:**
Consented for GA with LMA.
Risks explained and consented

□ Anaesthetic Information leaflet received by patient

**For attention of ward staff:** (further investigations, fasting, continue/omit current medication, etc.)

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**Hb** 12.8  
**Plt** 311  
**Hypertension**  
COPD (mild) – no hospital admission  
Arthritis  
Good exercise tolerance – swims >200m weekly  
Walking limited by arthritis

---

**Airway Assessment**
Mouth Opening:
MP Score: 1 2 3 4  
Jaw: Good mouth opening  
Neck: Neck ROM OK

**TEETH**
8 7 6 5 4 3 2 1 1 2 3 4 5 6 7 8  
8 7 6 5 4 3 2 1 1 2 3 4 5 6 7 8

X = Missing  
C = Caps / Crowns  
D = Damaged

**NAD**

**ALLERGIES**
NKDA

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**ASA**

**BP:**

**HR:**

**Temp:**

**Weight:**

**Height:**

**BMI:**

**Smoke:**

**Alcohol:**

**Apfel Score**

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**Received: [Date]**

**Signature:**

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**By:**

---

**Editor:** Dr Andrew Darby Smith
**Original Author:** Dr P Shanmuha, Dr D Rosenorn -- Lanng
DEBRIEFING

POINTS FOR FURTHER DISCUSSION:

- Management of oxygen failure during general anaesthesia
- Understanding the importance of anaesthetic machine checks
- Recognising the practical importance of understanding the equipment used in anaesthesia and critical care

DEBRIEFING RESOURCES


   [http://www.anesthesia-analgesia.org/content/102/3/865.full](http://www.anesthesia-analgesia.org/content/102/3/865.full)

**KEY POINTS:**
- Management of oxygen failure during general anaesthesia
- Understanding the importance of anaesthetic machine checks
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**RELEVANCE TO AREAS OF THE ANAESTHETIC CURRICULUM:**

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  - Demonstrates understanding of the function of the anaesthetic machine including  
    - Performing proper pre-use checks  
    - Changing/checking the breathing system |
| IG_BS_06 | In respect of monitoring:  
  - Manages monitors appropriately e.g. set alarms; start automatic blood pressure  
  - Demonstrates proficiency in the Interpretation of monitors |
| IO_BS_07 | Demonstrates role as team player and when appropriate leader in the intra-operative environment                                                |
| IO_BS_08 | Communicates with the theatre team in a clear unambiguous style                                                                               |
| IO_BS_09 | Able to respond in a timely and appropriate manner to events that may affect the safety of patients [e.g. hypotension, massive haemorrhage] |
| CI_BK_02 | Unexpected fall in SpO₂ with or without cyanosis                                                                                             |
| CI_BS_01 | Demonstrates good non-technical skills such as: [effective communication, team-working, leadership, decision-making and maintenance of high situation awareness] |
| CI_BS_02 | Demonstrates the ability to recognise early a deteriorating situation by careful monitoring                                                   |
| CI_BS_05 | Demonstrates ability to recognise when a crisis is occurring                                                                               |
| CI_BS_06 | Demonstrates how to obtain the attention of others and obtain appropriate help when a crisis is occurring                                     |
| CI_IS_01 | Demonstrates leadership in resuscitation room/simulation when practicing response protocols with other healthcare professionals            |
| CI_IS_02 | Demonstrates appropriate use of team resources when practicing response protocols with other healthcare professionals                        |

**FURTHER RESOURCES:**


   [http://www.anesthesia-analgesia.org/content/102/3/865.full](http://www.anesthesia-analgesia.org/content/102/3/865.full)

PARTICIPANT REFLECTION:

What have you learnt from this experience? (Please try to list 3 things)

How will your practice now change?

What other actions will you now take to meet any identified learning needs?
PARTICIPANT FEEDBACK

Date of training session: ........................................................................................................................................

Profession and grade: ........................................................................................................................................

What role(s) did you play in the scenario? (Please tick)

Primary/Initial Participant

Secondary Participant (e.g. ‘Call for Help’ responder)

Other health care professional (e.g. nurse/ODP)

Other role (please specify):

Observer

<table>
<thead>
<tr>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Neither agree nor disagree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
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<tbody>
<tr>
<td>I found this scenario useful</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I understand more about the scenario subject</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>I have more confidence to deal with this scenario</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>The material covered was relevant to me</td>
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Please write down one thing you have learned today, and that you will use in your clinical practice.

How could this scenario be improved for future participants?

(This is especially important if you have ticked anything in the disagree/strongly disagree box)
FACULTY DEBRIEF – TO BE COMPLETED BY FACULTY TEAM

What went particularly well during this scenario?

What did not go well, or as well as planned?

Why didn’t it go well?

How could the scenario be improved for future participants?