Pulse Oximetry Training Manual
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Foreword

A safe operation will save a life when nothing else can. But safe surgery is complicated and everyone in the operating theatre has an important role to play.

Lifebox Foundation is a global health charity focused on making surgery safer. We provide essential equipment and training to help colleagues step into the operating theatre with the tools and knowledge they need to deliver safer care.

The equipment and training you receive today will have an immediate impact on your patients and your practice but this workshop is just the beginning.

Talk to your colleagues and introduce the ideas discussed today. Share your stories about patients who caused you to change the way you think about safety in the operating theatre.

We want to hear from you. Access to safe surgery is one of the most important healthcare challenges of the 21st century. We know how hard you work to keep your patients safe, and we’re proud to work with you to make safe surgery available to every patient who needs it.

Lifebox Foundation
Website: www.lifebox.org
Email: info@lifebox.org

Lifebox workshop learning objectives

At the conclusion of this workshop the participants should be able to:

1. Have a basic understanding of the physiology of oxygen transport
2. Understand how to use a Lifebox pulse oximeter
3. Be familiar with using the Hypoxia Action Plan for managing a falling SpO₂
4. Have a basic familiarity with the Surgical Safety Checklist
All cells need O₂. It is the essential fuel that allows all cells to stay alive. How does the O₂ in the air we breathe get to the cells?

There are 6 steps:

1. O₂ breathed from air or anaesthesia circuit into lungs.
2. O₂ passes from alveoli in lungs to blood, which is known as “alveolar gas exchange.”
3. The blood contains haemoglobin, which carries oxygen. Blood must contain enough haemoglobin to carry O₂ to tissues.
4. Heart pumps blood to the tissues to meet patient’s O₂ requirements. This is called cardiac output.
5. Volume of blood in circulation must be adequate to distribute oxygenated blood to tissues.
6. Cells burn the O₂ and create carbon dioxide, which is returned to the lungs in venous blood and excreted, in the exhaled gas.
   - All six steps are important.
   - This process is called Oxygen Delivery.
Transport of Oxygen to blood

Notes
The red blood cell

Oxygen saturation = % of haemoglobin carrying $O_2$

Normal Haemoglobin Saturation

Venous blood in pulmonary artery
$O_2$ Saturation = 76%

Arterial blood in pulmonary veins
$O_2$ Saturation = 95-100%

Oxygen Dissociation Curve

$O_2$ Saturation (%)

Venous blood

Arterial blood

Oxygen tension ($PO_2$)
Oxygen Dissociation Curve

1.9

Hypoxia

1.10

- Shortage of $O_2$ in blood and tissues
- The tissues lose the **BRIGHT RED** appearance of being well oxygenated
- The tissues become **DARK RED** or look **BLUE** and explain what it measures

Notes

Clinical Detection of Hypoxia - Cyanoisis

1.11

- Look at skin and mucous membranes
- Can be difficult to clinically detect
  - darker skinned people
  - anaemic patients

Notes
Pulse Oximeter

Monitor
Microprocessor, Battery and display.

Probe
senses the pulse.

How does an Oximeter work?

Light Detector

Light Source, Light emitting diodes (LEDs)

Brightness red light

Oxygen Saturation Goal during Anaesthesia

• ALWAYS ≥ 95% for adults and children
• If the O₂ saturation < 90%, the patient is becoming hypoxic
• INTERVENTE EARLY!!!!
What is the best way to detect Hypoxia?

Summary

- O₂ from the air we breathe is an essential fuel for the cells in our body
- RBC in our blood contain a special oxygen binding protein called haemoglobin
- O₂ saturation = % of haemoglobin carrying O₂, and is the value measured by a pulse oximeter
- Hypoxia is a shortage of O₂ in the blood
- A pulse oximeter is the best way to detect hypoxia
Module 2

Practical Guide: Using the Lifebox Pulse Oximeter

Aims

• To go over what comes in the box with your Lifebox pulse oximeter
• To demonstrate proper care for your Lifebox pulse oximeter
• To demonstrate how to use a Lifebox pulse oximeter to measure O₂ saturation

Notes

The Lifebox Pulse Oximeter

Caring for your Oximeter

Lifebox power supply

Notes
Caring for your Oximeter

Lifebox rechargeable battery

• Arrives ½ charged
  1. use until fully discharged
  2. then recharge fully (4 hours) uninterrupted
• Thereafter use until recharge needed
• A fully charged battery should run for 12-16 hours between charges

Notes

If the “special” Lifebox rechargeable battery no longer works!

• Arrives ½ charged
  1. use until fully discharged
  2. then recharge fully (4 hours) uninterrupted
• Thereafter use until recharge needed
• A fully charged battery should run for 12-16 hours between charges

Notes

REMOVE BATTERY as risk of damage to device*

Options:
• Use normal AA batteries
• Use rechargeable AA batteries
• Plug device directly into Mains
  − NO battery should be in the device.
Caring for your Oximeter
Connecting / Disconnecting probe

- Insert probe connector correctly to avoid damage. Lead only inserts one way - check shape before inserting
- When disconnecting and connecting probe, grip end firmly and not cable. If cable is pulled, small wires inside will break

The Lifebox Pulse Oximeter

3 types of probes

Notes

Probes are FRAGILE and need to be handled with care.

Notes

Caring for your Oximeter

Clean probe between patients

Notes
Caring for your Oximeter

When not in use

- Keep in safe place
- Wrap the cable and sensor with care
- Don’t forget to recharge if needed

Notes

Using the Lifebox Pulse Oximeter

How does a pulse Oximeter work?

Notes
Review
Is the Oximeter functioning?

2.15

Light source

Light detector

Notes

2.16

Good tracing ⇒ Good signal ⇒ Oximeter working

Notes

Review
How to check if the Oximeter is working

2.17

Notes

Lifebox | Pulse Oximetry Training Manual
Review

To check probe

Well positioned probe

Notes

2.18

2.19

Causes of inaccurate Pulse Oximeter readings

Nail polish or dye on the digits

Notes

2.20

2.21

Notes

Solutions

• Place probe on sideways
• Place probe on toe

2.20

2.21
Causes of inaccurate Pulse Oximeter readings

Bright lights

- Operating room lights can interfere with light detector on probe
- Avoid shining bright light directly on the probe!

Movement

- SpO2 is 95% and pulse 84 bpm
- Pulse oximeter tracing shows good waveform with regular pulse

Low perfusion

- Scale of waveform is indicator of patient perfusion
- Peripheral vasoconstriction can lead to low perfusion
  - cold patient
  - hypovolemia

Notes

Solutions

- hold hand steady or
- wait until the patient has stopped shaking

Alarm!!

SpO2 67%
PR 42

Notes

- Pulse waveform is erratic and not well detected
- Patient may be moving or shivering
Module 3
Hypoxia Action Plan

Aims

• To present a systematic approach to managing a falling SpO₂ under anaesthesia

Oxygen Saturation (SpO₂) during anaesthesia

Normal measurement - SpO₂ 95-100%  
Safe zone - SpO₂ > 94%

Notes

Summary

• The pulse oximeter probe uses a light to measure oxygen saturation.  
• A good tracing means the pulse oximeter is working properly.

Notes

• C0 combines with haemoglobin (COHb) and displaces O₂  
• COHb is Bright Red  
• Pulse oximeter misinterprets COHb as oxygenated blood

Notes
Interpretation of pulse oximetry measurement

### Hypoxia Action Plan: Saturation < 94%

- **SpO₂ < 94%**
  - Assume HYPOXIA until proven otherwise
  - Administer high flow oxygen
  - Consider hand ventilation with large tidal volumes
  - Probe on patient?
    - **Good waveform?**
      - **YES**
        - Reposition probe if necessary check probe on your own finger
      - **NO**
        - Call for help if needed
        - Check A B C D E

### Notes

- **O₂ Saturation (%)**
- **SpO₂ > 94%**
- **SpO₂ 90% - 94%**
- **SpO₂ <90%**
  - OK
  - PROBLEM
  - ACTION

- **Notes**
Hypoxia Action Plan: Immediate action plan

Patient Problems

**Airway**
- Use chin lift / jaw thrust if using a mask
- Reposition LMA if necessary
- Check position of tracheal tube
- If in doubt take LMA or tracheal tube out
- Treat laryngospasm if present

**Breathing**
- Check adequate rate
- Check adequate tidal volume
- Check ET CO₂
- Listen to both lungs
- Bronchospasm? - consider bronchodilators
- Pneumothorax? - consider chest drain

**Circulation**
- Check pulse
- Check blood pressure
- Check ECG
- Blood loss / dehydration / fluid loss?
- Consider IV fluid replacement

**Drug Effects**
- Opioids
- Volatile agent
- Sedatives
- Muscle relaxant
- High spinal?

Equipment Problems

**Equipment**
- Check oxygen supply / concentrator / cylinder
- Check for breathing circuit disconnection
- Check for breathing circuit obstruction
- If problem not resolving:
  - Eliminate circuit - use self inflating bag
  - If self inflating bag not available consider:
    - Mouth to mouth / tracheal tube ventilation

If no pulse / BP / signs of life:
- Start CPR
- Find and treat the cause

Hypoxia Action Plan: Call for help early

Is the problem with the patient?
Is the problem with the equipment?
Call for help if needed
Check A B C D E

Notes
Hypoxia Action Plan: Solving the problem: patient vs. equipment

### A: Patient problems

#### Airway
- Use chin lift / jaw thrust if using a mask
- Reposition LMA if necessary
- Check position of tracheal tube
- If in doubt take LMA or tracheal tube out
- Treat laryngospasm if present

#### Breathing
- Check adequate rate
- Check adequate tidal volume
- Check ET CO₂
- Listen to both lungs
- Bronchospasm? - consider bronchodilators
- Pneumothorax? - consider chest drain

#### Circulation
- Check pulse
- Check blood pressure
- Check ECG
- Blood loss / dehydration / fluid loss?
- Consider IV fluid replacement

#### Drug Effects
- Opioids
- Volatile agent
- Sedatives
- Muscle relaxant
- High spinal?

### B: Patient problems

#### Breathing
- Check adequate rate
- Check adequate tidal volume
- Check ET CO₂
- Listen to both lungs
- Bronchospasm? - consider bronchodilators
- Pneumothorax? - consider chest drain
C: Patient problems

3.11 Circulation
Check pulse
Check blood pressure
Check ECG
Blood loss / dehydration / fluid loss?
Consider IV fluid replacement

3.12 Causes of inadequate circulation
Hypovolemia
Cardiac failure
Sepsis
Anaesthesia overdose
High spinal
Anaphylaxis
Arrhythmia

Hypotension
Decrease O₂ saturation
Tachycardia
Bradycardia
Poor signal on pulse oximeter

D: Patient problems

3.13 Drug Effects
Opioids
Volatile agent
Sedatives
Muscle relaxant
High spinal?

3.14 Equipment
Check oxygen supply / concentrator / cylinder
Check for breathing circuit disconnection
Check for breathing circuit obstruction

If problem not resolving:
Eliminate circuit - use self inflating bag

If self inflating bag not available consider:
Mouth to mouth / tracheal tube ventilation
When the SpO2 starts to fall – Take action!!!

Summary

When the SpO2 starts to fall – Take action!!

Case 1

A 12-year-old-child is scheduled for elective anaesthesia for foot surgery. The patient is ASA1. Anaesthesia is induced with thiopentone followed by halothane in air and oxygen via a facemask. During the induction the patient starts to cough and develops laryngospasm. The SpO2, which started at 98%, falls to 88% during coughing, and then 74% when laryngospasm starts.

Why has the saturation fallen? What would be the most appropriate actions?

Expected discussion points:

- Give 100% oxygen, assess ABCDE
- A - Is there airway obstruction due to laryngospasm? Apply positive pressure to the reservoir bag, deepen anaesthesia. If the situation does not resolve, a small dose of suxamethonium (0.5mg/kg) should be given.
- B - The breathing improves after resolution of laryngospasm
- C – Assess pulse rate. Bradycardia may occur due to hypoxia or secondary to suxamethonium. Consider atropine after treating hypoxia.
- D – Check that the halothane has not run out. Light anaesthesia can cause laryngospasm.
- E – Check that the anaesthesia equipment is functioning and connected appropriately.

After treating the laryngospasm, the patient improved and the SpO2 returned to normal.
Case 2

A 56-year-old obese patient is undergoing laparotomy for bowel obstruction. Preoperatively he is reasonably fit and his SpO$_2$ is 95%. After rapid sequence induction and intubation, the patient is ventilated and anaesthesia is maintained using halothane in air with 30% oxygen. Over the next 10 minutes the patient’s SpO$_2$ falls to 85%.

What are the most likely causes and what action would you take?

Expected discussion points:
• Give 100% oxygen, check ABCDE
• A – Check the airway and position of the tracheal tube. Check there is equal air entry to both sides of the chest and that the tube is not kinked. Check that there is no vomit in the mouth to suggest that the patient may have aspirated.
• B – Check that there are no added breath sounds to suggest aspiration, lung collapse or bronchospasm. Give large tidal volumes by hand and listen to the chest. Is ventilation easy?
• C – Assess whether the circulation is normal.
• D – Assess whether the patient is fully relaxed. Check that there are no signs to suggest drug reaction (particularly wheeze + hypotension+ rash, which are signs of anaphylaxis)
• E – Check that the anaesthesia equipment is functioning and connected appropriately.

After ventilating the patient with some large tidal volumes and increasing the inspired oxygen the patient improved. The problem was lung collapse (atelectasis).

Case 3

During a Caesarean section under spinal anaesthesia, a fit 23-year-old primigravida complains of tingling in the fingers and difficulty breathing. The SpO$_2$ falls from 97% to 88%.

What are the likely causes and what action would you take?

Expected discussion points:
• Give 100% oxygen and check ABCDE
• A – Check that the airway is clear.
• B – Assess breathing. A high spinal may paralyse the muscles of respiration. If breathing is inadequate, ventilate the patient and induce anaesthesia and intubate after rapid sequence induction. Ventilate until the block wears off.
• C – Check the blood pressure – hypotension is likely. Treat with left lateral tilt, IV fluids and vasopressors.
• D – Check the height of the block. Look for signs of a very high block – difficulty in breathing, whispering rather than talking, weak arms, poor handgrip and weakness of the shoulders. All indicate that nerves of the diaphragm are becoming blocked. This will make it impossible for the patient to breathe. If the block is not this high, the patient can talk in a normal voice and move their arms normally, but breathing may feel difficult due to paralysis of the intercostal muscles.
• E – Always ensure that equipment for resuscitation and induction of anaesthesia is ready in case this complication occurs.

After giving oxygen, the anaesthetist determined that the block was not too high and the patient settled with reassurance, left lateral tilt and IV fluids. The blood pressure returned to normal. The SpO$_2$ improved with oxygen.

Note – any hypoxia in a pregnant patient is dangerous for the baby.
Case 4

A 7-year-old boy is undergoing an open reduction of a fractured radius and ulna. Anaesthesia is induced with thiopentone and suxamethonium. After intubation you are unable to ventilate the patient. His saturation starts to fall.

What is your management?

Expected discussion points:
• Give 100% oxygen, check ABCDE
• You are unable to ventilate the patient. This could be a patient problem or an equipment problem.
• Replace the breathing circuit with a self-inflating bag to exclude possible equipment problems. Don’t forget to replace the angle piece, as this may be where the obstruction is. If there is no self-inflating bag, breathe down the tracheal tube.
• Investigate possible patient problems, including a problem with the tracheal tube – check ABCDE

The patient is easy to ventilate when the equipment is changed, and the obstruction was due to an obstruction in the breathing system. This case emphasises the importance of excluding an equipment problem prior to assessing the patient using ABCDE.

Case 5

Your colleague asks you to take over an anaesthetic for him, as he has to get away to a family event. The patient is a 19-year-old man who suffered major burns two weeks ago in a house fire. The patient is breathing spontaneously via a laryngeal mask airway and has received fentanyl for analgesia. The breathing mixture is air, oxygen and halothane. The surgery has been going for over an hour. There is an IV with normal saline in the right arm, which also has the blood pressure cuff and a pulse oximeter in place. The left arm and legs and part of the left side of the abdomen are involved in the burn debridement. Things continue for another hour and you notice the pulse rate going up to 110/min and the BP dropping to 80-90 systolic. The pulse oximeter seems to only work intermittently. When it does read, the saturation seems to be steadily decreasing. Your colleague documented the Spo2 at the start of the case at 97%. It is now reading 92%.

What issues are you thinking about as the case proceeds?

Expected discussion points:
• Give 100% oxygen, check ABCDE
• A – Check the airway - the airway is clear
• B – Give large tidal volume breaths and listen to the chest. The patient may be suffering respiratory depression from halothane, atelectasis from a long procedure or pre-existing lung damage from smoke inhalation.
• C – Check peripheral perfusion. The patient may be suffering volume loss from the burns or due to the debridement procedure.
• D – Consider hypoventilation due to halothane or opioid analgesia.
• E – Check the equipment, including the oximeter. The oximeter may have become displaced as used on the same limb as the blood pressure cuff. The oximeter may not be reading properly as the patient is hypothermic from wide exposure, or hypovolaemic due to the debridement.
• The patient has poor peripheral perfusion due to volume loss, and the oximeter trace shows ‘poor perfusion’. The ventilation is assisted and the patient volume resuscitated with warmed fluids including blood. The oximeter trace improves as the patient is resuscitated.

This case demonstrates how the oximeter is affected by poor perfusion, and can be used as an early warning of poor perfusion.
Case 6

In the recovery room, following a laparotomy under relaxant anaesthesia, a 43-year-old patient is reported to have a SpO₂ of 77% and is making twitchy, jerky movements.

What action would you take, and what are the most likely causes?

Expected discussion points:
• Give 100% oxygen, check ABCDE
• A – Open the airway
• B – Assess breathing. If chest expansion is inadequate, assist with a bag and mask.
• C – Check pulse and make sure that IV access is patent.
• D – Assess muscle power – ask the patient to grip your hand or to lift their head from the pillow. If inadequate reversal suspected, give anticholinesterase/anticholinergic reversal (e.g. neostigmine and atropine).
• E – Check the position of the oximeter probe.

Inadequate reversal of muscle relaxants is a common cause of breathing problems and hypoxia in recovery.

Case 7

A six-month old child is booked for general anaesthesia for an emergency laparotomy. She has been unwell for five days and required large amounts of fluid for resuscitation. Just prior to induction her pulse rate is 130 and SpO₂ is 95% on high flow oxygen. Anaesthesia is induced with thioentone and suxamethonium. She is intubated with a new size 4.0 tracheal tube. Just after intubation her saturation drops to 80%.

What is your management?

Expected discussion points:
• Give 100% oxygen and check ABCDE
• A – The tracheal tube is suctioned and does not seem blocked. Whilst preparing to listen to the chest, the saturation has fallen to 60%. Capnometry is not available.
• B – Her abdomen is swollen and chest expansion is difficult to assess. You are unable to hear breath sounds. Saturations are now 45% and the heart rate is 60.
• It is not certain that the tracheal tube is in the trachea. Participants should be prompted to return to A to check the position of the tracheal tube.
• A – repeat laryngoscopy shows the tracheal tube is not in the larynx. The SpO₂ falls to 30%, the patient is mask ventilated to raise the saturation and then reintubated.
• B – Chest expansion is now obvious and the saturation quickly returns to 96%.

This scenario highlights the importance of correcting a problem before moving on to the next part of the algorithm.
Case 8

You are giving an anaesthetic to a 75-year-old lady for fixation of a fractured hip. She fell a week ago and has been waiting for surgery since then. She has dementia and cannot give you a proper history. You hear a loud systolic murmur at the right sternal border radiating to the carotid. Air entry at the lung bases is poor and you think you can hear some coarse crackles as both lungs fill. You proceed with a general anaesthetic consisting of fentanyl, thiopentone, and atracurium. Following intubation, you connect the tracheal tube to the ventilator and give oxygen and halothane. Following positioning on the operating table, you notice you cannot get a trace on the pulse oximeter. You check the blood pressure but find it hard to hear the sounds. You try a couple more times but no luck. You feel for a carotid pulse and think you can feel it.

What is your management?

Expected discussion points:
• Give 100% oxygen, check ABCDE
• A – The tracheal tube appears to be correctly positioned.
• B – Listen to the chest. Does she have atelectasis or pneumonia, or both? Has she aspirated?
• C – Does she have heart failure? Aortic stenosis? Is there evidence of hypovolaemia from dehydration?
• D – Is her blood pressure low from thiopentone and/or halothane? What is the treatment for this? (Careful IV fluids, careful use of vasopressors).
• E – Is there a problem with the pulse oximeter? Does it work if the peripheral pulse is absent or weak? Is the patient cold? Is the oximeter working at all?

This is a complex case and there may be a number of contributing causes.

Case 9

You are giving an anaesthetic for a thyroidectomy in a 45-year-old woman. Preoperatively you notice that she has a large goitre and prominent upper incisors. You induce anaesthesia with fentanyl, thiopentone and suxamethonium and then oxygenate the patient via the facemask. You proceed to intubate the patient. With laryngoscopy, all you can see is the tip of the epiglottis. You try to intubate but are unable to. You can hear the pitch of the oximeter getting lower. You look and it is reading 90%. You ventilate the patient and get the saturation up to 96%. You try intubating again using a different blade with a stylet in the tube. You are unsuccessful. You call a colleague who tries a blind nasal intubation and causes a nosebleed. By now the oxygen saturation is 80%. It is becoming increasingly difficult to ventilate the patient.

What is your management?

Expected discussion points:
• Give 100% oxygen, check ABCDE
• A – Management of a difficult intubation (anticipated or unanticipated).
• Discuss different manoeuvres – different positions, different blades, airway, LMA, bougie, stylet. Wake the patient up
• B – Consider aspiration precautions
• C – Severe bradycardia secondary to hypoxia suggests poor oxygen delivery to the heart (and therefore the brain). Commence CPR if there is a cardiac arrest.
• D – Should anaesthesia drugs be continued or stopped?
• E – What is your back up plan for a difficult airway? What equipment do you keep nearby?

Discuss management of a ‘can’t intubate, can’t ventilate’ situation; encourage the participants to keep an overview of the general condition of the patient, to call for help early, and to have a low threshold to wake the patient up.
Module 5
The WHO Surgical Safety Checklist

Saving lives through safer surgery

Aim

• To review in detail each part of the checklist.
• To divide each section into manageable parts.

Errors are often repeated...

• Wrong patient
• Surgery on wrong side
• Penicillin given to a patient with penicillin allergy
• Unexpected difficult intubation
• Anesthetic machine not checked and malfunctions
• Oxygen tank empty
• No cross-matched blood available
• Blood products given to the wrong patient
• Sponges left inside patient

Notes

Reducing complications is not necessarily a question of resources

With better use of what is available... You have the ability to improve the system

Notes
### Prerequisites for safe surgery...

- Properly trained surgeons, anaesthesia providers and nurses  
  AND  
- Good preparation and planning  
  • An infection control plan  
  • Safe anaesthetic with adequate monitoring  
  • Good communication and teamwork  
  • Good leadership  

### How to reduce errors?

- Team work  
- Communication  
- Use of the Checklist and proper monitoring of the patient  
- Practising good habits every day  

### WHO and safe surgery

- 386 million operations  
- >7 million complications  
- >1 million patients die during surgery  
- 50% of complications are avoidable  

### Results

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<th>Outcome</th>
<th>Decrease (%)</th>
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<td>Deaths</td>
<td>47%</td>
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<td>Major complications</td>
<td>36%</td>
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<td>Reoperations</td>
<td>25%</td>
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<tr>
<td>Infections</td>
<td>50%</td>
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*Haynes et al. JAMA 2009; 302: 481-9*

### How to use the WHO Safe Surgery Checklist

#### Surgical Safety Checklist

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<th>Step</th>
<th>Description</th>
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<td>1.1</td>
<td>Confirm all instruments and equipment are in place.</td>
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*This checklist is not intended to be comprehensive. Additional and modifications to all local practice are encouraged.*
Prior to induction of anaesthesia

5.12

Before induction of anaesthesia
(with at least nurse and anaesthetist)

Has the patient confirmed his/her identity, site, procedure, and consent?
- Yes

Is the patient confirmed?
- Yes
- Not applicable

Is the anaesthesia machine and medication check complete?
- Yes

Is the anaesthesia machine and medication check complete?
- Yes

Is the pulse oximeter on the patient and functioning?
- Yes

Does the patient have a:
- Known allergy?
  - No
  - Yes
- Difficult airway or aspiration risk?
  - No
  - Yes, and equipment/assistance available
- Risk of >500ml blood loss (7ml/kg in children)?
  - No
  - Yes, and two IVs/central access and fluids planned

Notes

5.13

Prior to induction of anaesthesia

Equipment Checked?
Is the pulse oximeter on and functioning?
Prior to induction of anaesthesia

Before induction of anaesthesia
(with at least nurse and anaesthetist)

Has the patient confirmed his/her identity, site, procedure, and consent?
- Yes
- Not applicable

Is the site marked?
- Yes
- Not applicable

Is the anaesthesia machine and medication check complete?
- Yes

Is the pulse oximeter on the patient and functioning?
- Yes

Does the patient have a:

Known allergy?
- No
- Yes

Difficult airway or aspiration risk?
- No
- Yes, and equipment/assistance available

Risk of >500ml blood loss (7ml/kg in children)?
- No
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Time Out: Safety checks before starting surgery

Before skin incision
(with nurse, anaesthetist and surgeon)

- Confirm all team members have introduced themselves by name and role.
- Confirm the patient's name, procedure, and where the incision will be made.

Has antibiotic prophylaxis been given within the last 60 minutes?
- Yes
- Not applicable

Anticipated Critical Events
To Surgeon:
- What are the critical or non-routine steps?
- How long will the case take?
- What is the anticipated blood loss?

To Anaesthetist:
- Are there any patient-specific concerns?

To Nursing Team:
- Has sterility (including indicator results) been confirmed?
- Are there equipment issues or any concerns?

Is essential imaging displayed?
- Yes
- Not applicable
Time Out: Safety checks before starting surgery

### Before skin incision

(with nurse, anaesthetist and surgeon)

- Confirm all team members have introduced themselves by name and role.
- Confirm the patient’s name, procedure, and where the incision will be made.

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**Anticipated Critical Events**

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- What are the critical or non-routine steps?
- How long will the case take?
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#### To Anaesthetist:

- Are there any patient-specific concerns?

#### To Nursing Team:

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### Time Out: Safety checks before starting surgery

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Sign out: Safety checks at the end of the operation

Before patient leaves operating room
(with nurse, anaesthetist and surgeon)

Nurse Verbally Confirms:
- The name of the procedure
- Completion of instrument, sponge and needle counts
- Specimen labelling (read specimen labels aloud, including patient name)
- Whether there are any equipment problems to be addressed

To Surgeon, Anaesthetist and Nurse:
- What are the key concerns for recovery and management of this patient?

Notes

5.19

Sign out: Safety checks at the end of the operation

Before patient leaves operating room
(with nurse, anaesthetist and surgeon)

Nurse Verbally Confirms:
- The name of the procedure
- Completion of instrument, sponge and needle counts
- Specimen labelling (read specimen labels aloud, including patient name)
- Whether there are any equipment problems to be addressed

To Surgeon, Anaesthetist and Nurse:
- What are the key concerns for recovery and management of this patient?

Disposition of Patient
Where is the patient going post-op?
Are the orders clear?

Notes

5.20

The surgical safety checklist

- Acts as a reminder – too many things to remember perfectly every time
- Helps to reinforce the most important steps
- Encourages the team to do the right things for every surgery

Notes
WHO: 6 steps for safe surgery

1. Confirm patient identity and procedure
2. Assess the risk of difficult intubation
3. Assess the risk for blood loss
4. Use a pulse oximeter
5. Give antibiotics at the correct time
6. Count sponges before and after the operation

Notes

• There are 3 parts of the WHO Safe Surgical Checklist
  - before anaesthesia
  - before surgery
  - at the completion of surgery
• All team members must participate
• Each part is important in avoiding errors
• Communication is the key

Summary
Appendix

Hypoxia Action Plan

SpO₂ < 94%
- Assume HYPOXIA until proven otherwise
- Administer high flow oxygen
  - Consider hand ventilation with large tidal volumes
  - If probe on patient? Good waveform? NO Reposition probe
    - If necessary check probe on your own finger
  - YES
    - Is the problem with the patient? Is the problem with the equipment? Call for help if needed
      - Check A B C D E

**Patient Problems**

AIRWAY
- Use chin lift / jaw thrust if using a mask
- Reposition LMA if necessary
- Check position of tracheal tube
- If in doubt take LMA or tracheal tube out
- Treat laryngospasm if present

BREATHING
- Check adequate rate
- Check adequate tidal volume
- Check ET CO₂
- Listen to both lungs
- Bronchospasm? - consider bronchodilators
- Pneumothorax? - consider chest drain

CIRCULATION
- Check pulse
- Check blood pressure
- Check ECG
- Blood loss / dehydration / fluid loss?
- Consider IV fluid replacement

**Equipment Problems**

EQUIPMENT
- Check oxygen supply / concentrator / cylinder
- Check for breathing circuit disconnection
- Check for breathing circuit obstruction

If problem not resolving:
- Eliminate circuit - use self-inflating bag
- If self-inflating bag not available consider:
  - Mouth to mouth / tracheal tube ventilation

**If no pulse / BP / signs of life**
- Start CPR
- Find and treat the cause

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