

Global Pulse Oximetry Workshop

Clinical Scenarios

Scenario teaching or case-based teaching can be defined as any situation where real or simulated case histories are used for teaching and learning.

The format ranges from simple case discussions of written cases to simulations using manikins.

The advantages of scenario teaching are: it encourages active involvement by students; it is patient centred and can be used to teach knowledge, clinical decision making, professionalism and team work.

For the Global Pulse Oximetry Project, scenario teaching aims to teach participants the basics of clinical use of pulse oximeters and problem solving by the use of the ABCDE action plan.

Selection of Cases and Preparation

It is important that the selected case scenarios are appropriate for the target audience. This requires some knowledge of the level of training of the participants, the types of anaesthesia they administer, the scope of surgery and the medical problems of their patients. The way a scenario is used will vary from one hospital and one country to another.

A number of scenarios have been provided for you as teaching tools. Instructors are most welcome to adapt these scenarios to suit the participants on their course. Instructors are encouraged to develop their own scenarios, especially if it is felt that the scenarios provided are not suitable.

It is not essential to use all scenarios in the workshop. Try and choose scenarios that identify different ABCDE problems, remembering that airway problems are probably the most common cause of desaturation.

Consider the seating arrangement for the teaching session. Try to avoid creating the atmosphere of a lecture. Seating in a circle, or semi circle, if using a black/white board works well and encourages active involvement by participants. If using written scenarios, provide each participant with a copy of the scenario, but not the expected discussion points per case, which should be given to the participants, by the instructor, as needed.

Teaching Format

The simplest form of scenario teaching is to use a written scenario and for the participants to discuss the management of the case. Instructors with clinical skills-laboratory simulation experience may use more sophisticated forms of teaching using role play or manikins. The simulated pulse oximeter, if available, may be useful for all forms of teaching.

In scenario teaching the instructor introduces the scenario and encourages participants to manage the case as they would in a real clinical situation. The instructor should act as a facilitator for the process only.

It is important that the participants understand the format of the scenario teaching sessions and the role of the instructor.

Participants should be encouraged to work through each case using the ABCDE action plan. It is important that participants identify and treat serious problems before moving onto the next step. A number of discussion points are included as expected discussion points for each case. These discussion points contain the causes, or potential causes, of the oximetry problem for each case.

The simulated oximeter can be quickly programmed to provide the saturation and pulse rate described in the written scenario. The instructor can adjust these values as the scenario evolves. This will add realism to the teaching session.

Try to get all participants involved in the discussion as with all small group teaching. Remember that the main focus of the teaching is the appropriate use of the oximeter and recognition and correction of hypoxia, rather than choices of anaesthesia technique.

Allow enough time for discussion at the end of each scenario. It may take up to thirty minutes to complete a scenario and discussion. Some of the provided scenarios are more complex than others.

At the end of each discussion ask for questions and summarise the key findings and reinforce the use of the action plan.

Case 1

A 12-year-old child is scheduled for elective anaesthesia for foot surgery. The patient is ASA 1. Anaesthesia is induced with thiopentone followed by halothane in air and oxygen via a face mask. During the induction the patient starts to cough and gets laryngospasm. The SpO₂, which started at 98%, falls to 88% during coughing and then to 74% when laryngospasm occurs. Discuss why the saturation has fallen and 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 the halothane has not run out. Light anaesthesia can cause laryngospasm.
 - E – Check that the anaesthesia equipment is functioning and connected appropriately.
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- After treating the laryngospasm, the patient improved and the SpO₂ returned to normal.

Case 2

A 56-year-old obese patient is undergoing a laparotomy for bowel obstruction. Preoperatively he is reasonably fit and his SpO₂ is 95%. After rapid sequence induction and intubation, the patient is ventilated and anaesthesia maintained using halothane in air with 30% oxygen. Over the next 10 minutes the patient's SpO₂ 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 SpO₂ falls from 97% to 88%. What are the most likely causes and what action would you take?

Expected discussion points:

- Give 100% oxygen. 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 breathing, whispering rather than talking, weak arms and numbness on the shoulders. All indicate the nerves to 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 the paralysis of the intercostals muscles.
- E – Always ensure that equipment is ready in case this complication occurs
- After giving oxygen, the anaesthetist determined the block was not too high and the patient settled with reassurance, left lateral tilt and IV fluids. The SpO₂ improved with oxygen. 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:

- High flow oxygen is given.
- You are unable to ventilate the patient – this could be a patient problem or an equipment problem
- Replace the patient breathing circuit with self-inflating bag to exclude possible equipment problems. Don't forget to replace the angle piece as this may be where the obstruction is.
- Investigate possible patient problems, including a problem with the tracheal tube - Check ABCDE
- This case emphasises the importance of excluding an obvious 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 yr old man who suffered major burns 2 weeks ago in a house fire. The patient is breathing spontaneously via an LMA. The mixture is air, oxygen and halothane. The surgery has been going on for over an hour. There is an IV of NS in the right arm which also has a BP cuff and a pulse oximeter in place. The left arm and both legs and part of the left 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 as 97%. It is now reading 92%. What issues are you thinking about as this case proceeds?

Expected discussion points:

- A – The airway is clear.
- B - Respiratory depression from Halothane; atelectasis from long procedure; pre-existing lung damage from fire
- C - Volume loss due to burns; blood loss due to debridement.
- D – Consider hypoventilation secondary to opioids.
- E - Use of oximeter on same limb as BP cuff; hypothermia from wide exposure and debridement and inadequate signal due to shivering.

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 twitching, jerky movements. What are the most likely causes and what action would you take?

Expected discussion points:

- A – Open the airway and give 100% oxygen.
- B – If chest expansion is inadequate assist ventilation with a bag and mask.
- C – Check pulse and ensure intravenous access.
- D – Give anticholinesterase as relaxant reversal.
- E – Check position of pulse oximetry probe.
- Inadequate reversal is a common cause of breathing problems and hypoxia in recovery.

Case 7

A 6 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 thiopentone and suxamethonium. Just after intubation her saturations drop to 80%. What is your management?

Expected discussion points:

- A – The tracheal tube is a new size 4.0. It does not seem to be blocked. Whilst preparing to listen to the chest, saturations have 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 heart rate is 60.
- It is not certain that the TT is in the trachea. Participants should be prompted to return to A to check the position of the TT.
- A – Repeat laryngoscopy shows the TT is not in the larynx. The SpO₂ falls to 30% before the patient is reintubated.
- B – Chest expansion is now obvious and the saturations quickly return to 96%.
- This scenario highlights the importance of correcting a problem before moving to the next step of the algorithm.

Case 8

You are giving an anaesthetic to a 75 yr old woman for an ORIF of a fractured hip. She fell 1 week ago and has been waiting for surgery since then. She has dementia and cannot give you any proper history. You hear a grade 3 systolic murmur at the right sternal border radiating to the right carotid. Air entry at the lung bases is very poor and you think you can hear some coarse crackles over both lung fields. You proceed with a general anaesthetic consisting of fentanyl, thiopentone and atracurium. Following intubation, you connect the TT to the ventilator and give oxygen and halothane. The patient is moved onto the operating table. Following positioning, you replace the pulse oximeter and cannot get a trace. 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:

- A – The TT 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 congestive heart failure? Does she have aortic stenosis? Is low BP a problem in aortic stenosis? Is there evidence of low blood volume?
- D - Is her blood pressure low from thiopentone and/or halothane? What is the treatment for this?
- This is a complex case and there may be a number of contributing causes.
- E - What is the 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?

Case 9

You are giving an anaesthetic for a laparoscopic cholecystectomy in a 45 yr old woman. Preoperatively you notice that she has prominent upper incisors. You induce anaesthesia with fentanyl, thiopentone and suxamethonium and then oxygenate the patient via a face mask. When relaxed, 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 pulse 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 and with a stylette in the tube. You are unsuccessful. You call a colleague who tries a blind nasal intubation and causes a nose bleed. By now the oxygen saturation is 80%. It is becoming increasingly difficult to ventilate the patient. What is your management?

Expected discussion points:

- A - Management of unanticipated difficult intubation. Discuss management of a “can’t intubate, can’t ventilate” situation
- B - Aspiration
- C - Severe bradycardia secondary to hypoxia. Treating A + B should treat the bradycardia. Commence CPR if there is a cardiac arrest.
- D – Should anaesthesia drugs be continued or stopped?
- E – What is your backup plan for an unexpected difficult airway? What equipment would you have nearby?