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MANAGEMENT OF CRISES DURING ANESTHESIA AND SURGERY. PART VIII: DESATURATION

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Desaturation (Hypoxia)

With the introduction of pulse oximetry use in the perioperative period, the occurrence of desaturation was obvious more commonly than was expected. Desaturation may be present in the patient preoperatively due to patient causes or it may occur in relation to anaesthesia[1].

The degree and duration of desaturation that mandates treatment has not been clearly defined and is, to some extent, dependent on the circumstances in which it occurs some of them are rare and obscure.

The rapidity with which the cause is determined and appropriate management is instituted may change the outcome of the condition as it is potentially life threatening. Care should be taken as desaturation is a common occurrence during general anaesthesia and it occurs for many reasons related to anaesthetic equipment and to the patient[2].

Causes:

*Laryngospasm
*Aspiration
*Difficult intubation
*Hypoventilation
*Bronchospasm
*Pulmonary oedema
*Hypotension
*Bradycardia
*Myocardial ischemia
*Drugs
*Anaphylaxis
*Embolism
*Pneumothorax
*Water intoxication
*Excessive secretions
*Underlying lung disease
*Obesity syndrome
*Monitor error

*Unknown

Timing of desaturation during anaesthesia according to the cause[3]:

	Induction	Maintenance	Recovery
Laryngospasm	++	+	+++
Aspiration/regurgitation	++	++	+
Difficult intubation	+++	++	+
Hypoventilation	+	++	+
Bronchospasm	+++	++	+
Pulmonary oedema	Rare or none	+	+
Hypotension	+	+++	Rare or none
Bradycardia	Rare or none	++	+
Myocardial ischaemia	Rare or none	+	Rare or none
Drugs	++	+++	+
Anaphylaxis	+	++	Rare or none
Embolism	Rare or none	++	Rare or none
Pneumothorax	Rare or none	++	Rare or none
Water intoxication	Rare or none	++	Rare or none
Overall incidence	++	+++	+

+ low occurrence ++ medium occurrence +++ high occurrence
Most desaturation occur during maintenance phase of anaesthesia

Desaturation emergency management:
*Hand ventilate with 100% oxygen
*Confirm the FIO2 is appropriate
*Confirm the ETCO2 is appropriate, if it is low consider: Anaphylaxis, Pneumothorax, Air embolism
*Auscultate again, specifically exclude endobronchial intubation

Review and treat other possible causes:
*Underlying cardiopulmonary problems
*If bronchial secretions or plugs are suspected
*Posture and suction ETT/bronchi
*Give a “long slow blow” especially in children
*If cardiovascularly stable consider PEEP/CPAP
*If acute shunt is suspected
*Ensure the patient is supine and level
*If a pneumoperitoneum is present, deflate the abdomen and consider gas embolism
*Pulse oximeter malfunction
*Consider: polycythaemia, methaemoglobinaemia, acute tricuspid incompetence, probe sited distal to an AV fistula.

Further care:
*Reassess the situation
*If persistent/unstable desaturation consider:
Completing/abandoning surgery

Chest X-ray, blood gases
*If stable and well saturated, Wake the patient up and extubate
*If unstable or desaturated, Admit to ICU

NOTES[4]:

Endobronchial intubation is the commonest cause of desaturation in anaesthetized patients. Only 2% of incidents were due to bronchial plugs or excessive bronchial secretions, which can produce marked desaturation, especially in young children. A shunt effect is produced, which may be unmasked by abolition of hypoxic pulmonary vasoconstriction with induction of anaesthesia.

"Obesity syndrome" refers to the rapid desaturation which may be seen at induction when anaesthetising obese patients, or those with tightly distended abdomens, and accounted for 2% of relevant incidents. Drug-induced abolition of hypoxic pulmonary vasoconstriction and an acute reduction in functional residual capacity resulting in sudden V/Q mismatching is thought to be the cause. The lithotomy and Trendelenberg positions, spontaneous ventilation and hypovolaemia all may exacerbate the problem, resulting in sudden desaturation at the start of a case and progressive desaturation during the maintenance phase. Of the incidents, 0.8% were suspected gas embolism. In 1% of incidents, unusual causes of pulse oximeter malfunction, including acute tricuspid incompetence, polycythaemia and methaemoglobinaemia. Acute tricuspid incompetence may lead to the oximeter sensing the venous pulse. A large plethysmographic wave form and a saturation of 70-75% is commonly seen. Arterial saturation, when directly measured, may be quite adequate. Polycythaemia may lead to artefactually low saturation readouts with high directly measured arterial oxygen saturations or tensions. Methaemoglobinaemia, depending on its extent, will cause the saturation to approach 85%.

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