

Intraoperative awareness due to malfunctioning of anaesthesia machine - A rare incident

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A 15 year old female patient of ASA class I was posted for implant removal from left forearm under general anaesthesia. Intraoperative period was uneventful. In the immediate postoperative period, she became restless which subsided after administration of haloperidol and promethazine intramuscularly. On interview, she complained of intraoperative awareness. Thorough checking of the anaesthesia machine revealed that the floats in both oxygen and nitrous oxide rotameters were moving up even when both nitrous oxide cylinders were closed and one oxygen cylinder was kept open. The diaphragm of oxygen failure safety valve was found to be ruptured which allowed oxygen to flow through nitrous oxide flow meter. Preoperative checking of the anaesthesia machine could not identify these abnormalities. Thus, meticulous checking of anaesthesia machine including the oxygen failure safety valve, intraoperative monitoring of depth of anaesthesia, use of oxygen and end-tidal anesthetic gas analyzer may be helpful to prevent such an incident.

Keywords: intraoperative awareness; anaesthesia machine; oxygen failure safety valve

Introduction

Intra operative awareness is an important complication during general anaesthesia, incidence ranging from 0.2 to 0.4%.¹ Significant psychological sequelae may develop after such an episode. Here we present a case of intra operative awareness due to malfunctioning of anaesthesia machine.

Case Report

A 15 year old female patient weighing 42kg, was posted for implant removal from left forearm. She had undergone open reduction and internal fixation of left radius under general anaesthesia (GA) 1 year back. There was no history of medical or surgical illness. Clinical examination and preoperative blood investigations were within normal limits. We planned for a GA because the patient refused regional anaesthesia.

Preoperative checking of anaesthesia machine, breathing circuit, airway equipment and emergency resuscitation equipment was performed. One oxygen (O₂) cylinder attached to the anaesthesia machine was opened and then closed after confirming a cylinder pressure of

around 2000 psi. The other O₂ cylinder whose pressure was around 1000 psi and one nitrous oxide (N₂O) cylinder were kept open for use. Flow meters were checked for smooth operation of the floats and undamaged flow tubes. Attempt to create a hypoxic gas mixture by reducing O₂ flow by rotating O₂ flow control valve reduced flow of N₂O through N₂O flowmeter.²

Intravenous line was secured in right hand of the patient. Premedication was done with glycopyrrolate 0.2mg, ranitidine 50mg, ondansetron 4mg and tramadol 40mg intravenously (IV) 10 min before induction. Patient was preoxygenated with 100% oxygen for 5 minutes. Anaesthesia was induced with propofol 80mg i.v. Trachea was intubated with cuffed endotracheal tube (ID 7mm) after giving atracurium 20mg i.v.

Intraoperative monitoring of pulse rate, non invasive blood pressure, electrocardiogram (ECG), SpO₂ and end tidal carbon dioxide (EtCO₂) was done. BIS monitor and end tidal oxygen and anaesthetic gas analysers were not available.

Anaesthesia was maintained with N₂O and O₂ (2:1). Propofol 10mg was administered intravenously 10 minutes and 20 minutes after the surgical incision. Duration of surgery was about 30 minutes. Her intraoperative monitoring parameters were as follows: PR- 86-104/min, Systolic BP- 118-138mmHg, Diastolic BP- 75-90mmHg, SpO₂- 99-100%, EtCO₂- 28-33mmHg, ECG- sinus rhythm. No tearing or sweating was noted. Neuromuscular blockade was reversed with neostigmine 2mg and glycopyrrolate 0.4mg i.v. She was shifted to the post anaesthesia recovery room after regaining consciousness and recovery from neuromuscular blockade.

After 5 minutes, she became restless and had confused speech. She developed sinus tachycardia, but other vital signs were stable. She was given O₂ by face mask. Midazolam 2mg i.v. was administered, but no improvement was observed. Psychiatrist was consulted and haloperidol 4mg and promethazine 50mg were given intramuscularly. Restlessness subsided and she slept after about 15 minutes. There was no history of any psychiatric diseases or any incidence of personal or family disturbances.

Next day, she told that she was aware that the surgery was going on and could hear the conversations of the operating room personnel suggestive of explicit recall and intra operative awareness.

On thorough examination of the anaesthesia machine, it was found that the floats in both O₂ and N₂O rotameters were moving up even when both the N₂O cylinders were closed and one O₂ cylinder was kept open. (Figure 1) On opening the oxygen failure safety valve by the mechanic, it was found that the diaphragm was ruptured.

Over next two days, psychological counseling was done and the patient behaved normally. Patient and her family members did not complain of any symptoms. No psychological problem was found when she was followed up 1, 6 and 12 months after the surgery.



Figure 1:

Floats in both O₂ and N₂O rotameter were moving up even when both the N₂O cylinders were closed

Discussion

There are reported cases of intraoperative awareness due to machine malfunction. A defective fail-safe gas-loaded regulator resulted in oxygen flow through the N₂O flowmeter.³ A similar case of leakage of O₂ through N₂O flow meter due to faulty O₂ fail safe device was also reported.⁴

In this case report, ruptured diaphragm and loose packing in oxygen failure safety valve allowed oxygen to flow through N₂O flow meter (Figure 2).⁵ This also explains why gas was flowing through both N₂O and O₂ rotameter even when N₂O cylinders were closed. This defect could not be detected on routine checking of anaesthetic machine.

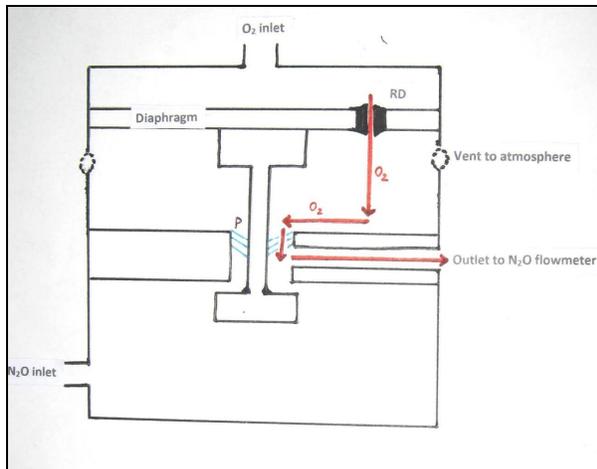


Figure 2:
Ruptured diaphragm (RD) and loose packing (P) in oxygen failure safety valve allowed oxygen (shown by red arrow) to flow through N₂O flow meter

We did not find any significant haemodynamic changes like tachycardia and hypertension in the intra operative period. Awareness has been reported to occur in the absence of tachycardia or hypertension.^{6,7} The use of neuromuscular blocking agent which is associated with higher incidence of intraoperative awareness masked the movement of the patient.⁸

In conclusion, it can be stated that meticulous checking of anaesthesia machine including the oxygen failure safety valve and intraoperative use of BIS monitoring, O₂ and end-tidal anaesthetic gas analyzer may be helpful to prevent awareness.

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