

## Awareness due to vaporizer malfunction

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Accidental awareness during anaesthesia is multifactorial. Despite the cause it is harmful to both the patient and the anaesthetist. This case report is of a 68-year-old ASA 1 lady coming for a routine plastic surgery who had experienced accidental awareness under anaesthesia due to a faulty vaporizer. Timely detection and intervention may have prevented the long-term harmful sequelae of accidental awareness to the patient.

**Keywords:** awareness; vaporizer malfunction; post-traumatic stress disorder; MAC monitoring; anaesthesia depth monitoring

### Introduction

Intraoperative awareness is a distressing complication to the patient with long-term adverse sequelae such as post-traumatic stress disorder and it may raise litigation problems to the anaesthetist. Here we present a case of intraoperative awareness due to malfunction of the vaporizer.

### Case presentation

A 68-year-old female patient (body weight 58kg, BMI 26.7 kg/m<sup>2</sup>) was scheduled for reconstruction of a large scalp defect under general anaesthesia (GA). She was attacked by a dog, five days previously and sustained the scalp injury and right upper arm injury for which she had undergone primary wound suturing under GA without any complications. There was no significant medical or allergic history. Clinical examination and perioperative investigations were normal apart from low haemoglobin levels (8.5g/dl) for which adequate red cell concentrate was reserved. Premedication was with oral famotidine 20mg and metoclopramide 10mg, two doses since she had mild dyspeptic symptoms. Paracetamol 1g was given orally 2hrs before the surgery as a preemptive analgesic. Patient was

kept fasting according to AAGBI guidelines. Informed written consent was obtained.

Anaesthetic machine, pipeline gas supply, breathing circuit, ventilator, difficult airway trolley and emergency resuscitation equipment were checked preoperatively. When checking the vaporizer included to the breathing circuit, there was about a 5mm dip observed when common gas outlet was occluded.

Multipara monitor was applied and baseline readings were taken. Her initial non-invasive blood pressure (NIBP), heart rate(HR) and on-air oxygen saturation (SpO<sub>2</sub>) were 135/67 mmHg, 86 beats per minute (bpm) and 99% respectively. Intravenous (iv) access was taken in the left hand with a 20G cannula. Cefuroxime 1.5g and metronidazole 500mg were given i.v. as prophylactic antibiotics.

WHO surgical checklist was performed. Preoxygenation was done with 100% oxygen for 3mins and anaesthesia was induced with morphine 6mg, propofol 120mg i.v. Atracurium 40mg was given after checking the ability to bag mask ventilate and 1.5% isoflurane in oxygen 6L/min was continued for 3min. Laryngoscopy was performed (Cormack-Lehane view II) and trachea was intubated with reinforced cuffed endotracheal tube (ID 7.5mm) which was anchored at lip level length of 18cm after confirming bilateral equal air entry and capnography trace. Dexamethasone 8mg was given i.v. as an antiemetic.

Anaesthesia was maintained with 1% isoflurane, oxygen 1L/min and nitrous oxide 2L/min. She was connected to accoma ventilator with tidal

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volume of 300 ml, ventilator rate of 12 /min and I:E ratio of 1:2. Patient was positioned prone and bilateral equal air entry was confirmed. Patient warming device was applied.

Intraoperative monitoring of electrocardiogram (ECG), heart rate, NIBP, temperature, end tidal carbon dioxide (ETCO<sub>2</sub>) was continued throughout. End tidal oxygen and inhalational vapour analyzers, neuromuscular blockade monitor and bispectral index (BIS) were not available.

It took about 30mins since the induction of anaesthesia to start surgery after positioning and preparation of surgical site. 15mins after induction gradual increase in heart rate and blood pressure were noted; she was not hypoxic nor hypercarbic. Despite the increase of isoflurane concentration to 2.5% and giving fentanyl 50mcg and atracurium 10mg i.v., tachycardia and hypertension worsened. Soon after surgical incision HR was around 125bpm while NIBP was 207/110mmHg. At that point propofol 50 mg i.v. bolus was given and it was decided to start an antihypertensive. But following propofol bolus HR and NIBP became normalized. Light plane of anaesthesia and possible awareness was suspected since patient only responded well to hypnotic. Propofol 100mg/h i.v. infusion was started and continued throughout surgery.

Surgery lasted for 3.5hrs. Blood loss was around 100ml and 1L of crystalloids was transfused. Her intraoperative parameters following propofol infusion were as follows: HR 81 – 102 bpm, ECG – sinus rhythm, systolic BP 105 – 139mmHg, diastolic BP 79 – 91mmHg, EtCO<sub>2</sub> 35 – 41mmHg and SPO<sub>2</sub> 98 – 100%.

Morphine 3mg i.v. was repeated during surgery and ondansetron 8mg was given i.v. towards the end of surgery. At the end of surgery residual neuromuscular blockade was reversed with neostigmine 2.5mg and atropine 1.2mg i.v. Awake extubation was done, recovery was uneventful and she was sent back to the ward.

Next morning, on inquiry she revealed that at the beginning of the surgery until her head was shaved and surgery was started, she was aware that surgery was going on. She was not scared as there was no pain and after some time it had disappeared. Next, she remembered the extubation. Further she had explicit recall of

conversations of surgical room personnel at the initial part of the surgery suggestive of intra operative awareness. She was explained and counselled regarding intraoperative awareness and no psychological problem was identified after one week of surgery.

On detailed examination of the anaesthetic machine by biomedical engineer, malfunction of the isoflurane vaporizer was identified. The vaporizer did not deliver the correct vapour concentration indicated in the dial due to the defect. It was repaired and recalibrated correctly.

### **Discussion**

Awareness is said to occur when there is inadequate anaesthetic vapour delivered to the brain resulting in inadequate depth of anaesthesia. It can be either explicit awareness or implicit awareness. Explicit awareness is conscious recollection of intraoperative events either spontaneously or when directly questioned; whereas implicit awareness denotes memories that exist without conscious recall of the patient but they can alter patient's subsequent behavior following the event. The incidence of awareness in UK is estimated to be 0.1-0.2%.

In this case, accidental explicit awareness occurred due to the faulty vaporizer which was not detected during conventional anaesthetic machine check. Other contributory factors were scarcity of resources such as vapour analysis and depth of anaesthesia monitoring (i.e. BIS). But it was diagnosed early with cardiovascular changes of tachycardia and hypertension and suspicion. Other physiological responses like pupillary reactions and lacrimation were not seen as head was covered with drapes. The use of neuromuscular blocking agents may have contributed to late detection.

### **Conclusion**

Vaporizer malfunction may not be detected during conventional anaesthetic machine check and it is recommended to have regular vaporizer service checks and calibrations. Further, at least vapour analysis and MAC monitoring (0.8-1.0) should be used when anaesthetizing patients using inhalational agents to minimize intraoperative awareness.

**Consent**

Consent was obtained directly from the patient to allow for discussion and review of her case in this case report.

**Declaration of interest**

None

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