Case Report

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Preventable Anesthesia Mishaps: An Overview

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Abstract

We report a case of malposition of the vaporizer on the selectatec manifold of the anesthesia workstation leading to interruption in the fresh gas flow at anesthesia machine outlet. We emphasize the importance of checking the anaesthetic vaporizer after mounting it on the backbar of the anesthesia workstation.

Keywords: Interruption in fresh gas flow; General anesthesia; Tilted vaporizer; Selectatec manifold.

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Introduction

Anesthesia workstations have come a long way since the ancient Boyles apparatus. The main focus of research in these machines has been to improve the safety features, in order to prevent delivery of hypoxic gas mixtures and alert the anesthesia care provider of any other problems. Modern anesthesia machines have several safety features, for patient as well as user safety. Ultramodern anaesthetic machines have additional safety features and are programmed with a computerized safety self checkout feature which is initiated at start up which needs to be repeated before every case and ideally not to be bypassed.

Inspite of all the advances and safety features, the occurrence of anaesthetic misadventures is still a problem of concern. We report a case of interruption in the fresh gas flow (FGF) during general anesthesia caused by incorrectly mounted vaporizer on the Selectatec manifold of the Blease Sirius Spacelabs anesthesia workstation (Blease Medical Equipment Limited, Washington, USA).

Case Report

A 42 year old male patient, ASA grade 1 with diagnosis of subacute intestinal obstruction was scheduled for emergency laparotomy. An automated checkout was performed for Blease Sirius Spacelabs anesthesia workstation (Blease Medical Equipment Limited, Washington, USA) before the case and it passed all the tests. On table, standard monitors were attached to the patient and

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the baseline parameters recorded. Preoxygenation was done with 100% oxygen for 3 mins. After preoxygenation, rapid sequence induction was performed using 1.5 mg/kg of propofol and rocuronium 1 mg/kg used as muscle relaxant to aid intubation. Airway was secured with 8.5 mm portex cuffed oral endotracheal tube, bilateral equal air entry confirmed and patient connected to accoma ventilator for volume controlled ventilation with tidal volume of 500 ml, frequency of 12 /min, I:E ratio of 1:2. Anesthesia plan for maintainance included air–oxygen mixture, isoflurane, intermittent doses of rocuronium and fentanyl. Around 3-5 minutes after connecting to the ventilator, there was a low minute volume alarm and the bellows started collapsing. Immediately we looked for any cuff leak, circuit disconnections, loosening of CO_2 canister and malfunctioning of the valves but couldnot find any fault with them. So, an attempt to ventilate was made by changing to manual ventilation with increased FGF and later tried by connecting the Bain's system to auxiliary common gas outlet but there was inadequate filling of the reservoir bag. The bag could only be filled by activating the oxygen flush which was also short lived as enough pressure could not be generated. This guided us to have a strong suspicion about anesthesia machine malfunction to be the cause for ventilation failure and the patient was immediately disconnected from the workstation and was ventilated with a manual resuscitator until another workstation was ready for use. Simultaneously, we watched the patients vital parameters with a vigilant eye and found it to be stable throught this period. Meanwhile the previous anesthesia workstation was inspected and we could not found anything functionally wrong except that the isoflurane vaporizer was slightly lifted up and tilted to one side and the locking lever was not in place. The concentration control dial could be turned on and when the test lung was attached, it barely inflated. The vaporizer was removed, remounted properly, checked again for any leak by attaching the test lung and after confirming for its proper functioning by complete inflation of the test lung it was reconnected to the patient and the

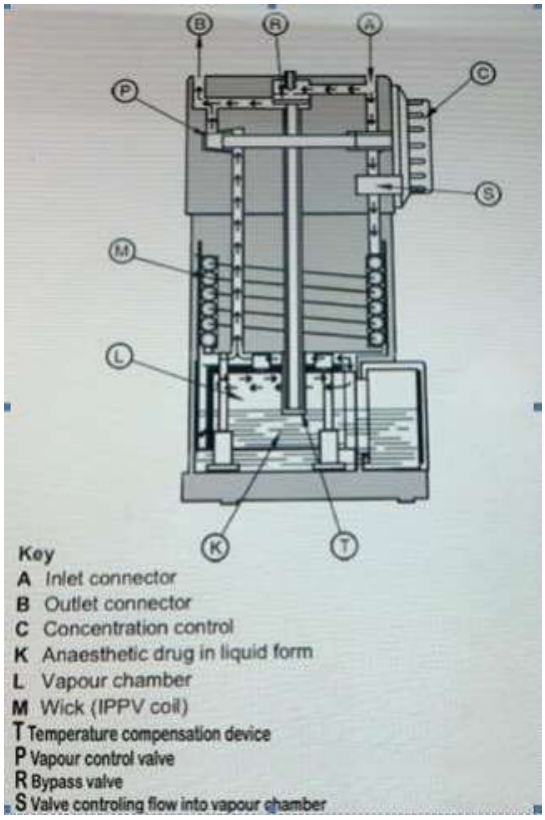

Fig. 1:

Fig. 2:

surgical procedure was carried out successfully. At the end of surgery, patient was extubated with an uneventful recovery and he did not experience any consequence like awareness as a result of this momentary loss of FGF.

Discussion

There are 2 types of vaporizer mounting systems: permanent mounting and detachable mounting. Detachable mounting systems are the standard on most anesthesia machines as they allow the vaporizer to be mounted and removed without the use of tools. The Selectatec system and a Plug-in system from Drager Medical are the most widely-used detachable mounting systems. The Selectatec system consists of a pair of port valves for positioning of each vaporizer[1]. The Blease Datum cage mount vaporizer has a special mounting bracket containing two plungers (spindles) which fits over the port valves. Weight of the vaporizer and an O-ring around each port valve creates a seal between the mounting system and the vaporizer. The interlocking extension rods prevent more than one vaporizer being used simultaneously (Fig. 1). Swinging the locking lever clockwise to 90 degrees is necessary to secure the vaporizer on the manifold and the concentration control dial cannot be moved unless the locking lever of the system is engaged. The FGF through the vapour chamber to produce the required concentration is regulated by the concentration control C (Fig. 2). When the concentration dial is in the zero position the bypass valve R opens isolating the FGF from the vapour chamber. When the dial is turned past zero, valve S opens allowing flow into the vapour chamber[2]. In the modern designs the vapour concentration supplied by the vaporizer is virtually independent of the FGF between 0.5 and 15 litres/minute.

There are three reported cases of anesthetic vapor leakage from unlocked vaporizers. In two of them, awareness with recall was identified after surgery[3,4] while in one there was desaturation and hypercapnia[5]. Accidental removal or damage of the O-ring due to frequent changing of the vaporizers in the Selectatec system increases the potential for leaks leading to alteration in the fresh gas composition and flow, operating room pollution, hypoventilation, rebreathing, desaturation and awareness in patients[1] is known. In our case and the case reported by Kim and Kim,[5] the concentration dial could be opened even when there was a faulty mounting of the vaporizer on the manifold leading to interruption in the FGF at the outlet. However, because of quick detection and rectification of the problem there was no signs of hypoxemia or hypercarbia noticed in our case. This case report highlights about the fault which is not detectable by performing the routine anesthesia machine check as recommended by the manufacturers and also the importance of anaesthetic agent monitors in detection of such faults. It also provides an insight into the lapses and lacunae in the level of training, alerts us about equipment malfunction, human errors and emphasizes that constant vigilance of the anesthetist is highly essential for the safe conduct of anesthesia.

Conclusion

Vaporizer malfunction may not be detected during conventional anaesthetic machine check and human errors can recur. We would like to highlight that the vaporizer interlock safety mechanism is not a part of routine safety check but needs incorporation in the revised safety checklist with the advent of newer technology.

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

Declaration of interest: None

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