Monitoring inhaled agents for ambulatory surgery

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Abstract

This presentation explores monitoring inhalation anesthetic agents to control the level of general anesthesia for ambulatory surgery.

Keywords: Monitoring.

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Introduction

Several types of anesthesia are used for ambulatory surgery. Regional anesthesia anesthetizes the part of the body that will undergo surgery. General anesthesia anesthetizes the brain and spinal cord and allows surgery to be performed on any part or parts of the body.

Inhaled anesthetics are one of the choices for general anesthesia and this class of drugs and monitoring will be explored here. Inhaled anesthetics are administered with a vaporizer and anesthesia machine that provides a precise concentration of anesthetic drug to the patient. This concentration represents a partial pressure or tension which propagates from the vaporizer to the patient's brain along the path indicated in Figure 1. It passes through vaporizer, breathing circuit, lungs, arterial blood, and arrives in brain and other tissues. It then comes back from these locations to the patient's lungs and breathing circuit and then goes back to the patient so the drug is not wasted. Allowing the drug to be rebreathed by the patient requires monitoring inspired and expired gas concentrations. With proper monitoring and educated adjustment of vaporizer dial setting, anesthetic depth can be controlled accurately, precisely, and inexpensively. More advanced anesthesia machines allow the anesthesia professional to dial in the desired end-tidal concentration and thereby directly control the level in the blood that is perfusing the brain.

Methods

Examples show how theory is applied to clinical practice with conventional anesthesia machines and agent monitors. Graphic Trends with the shortest trend time (6 minutes here) are displayed and photographed.

Results

Figure 2 shows the trend graph of inspired and expired sevoflurane controlled carefully, producing a rapid and stable increase in concentration followed by a rapid fall in concentration. These changes are typically reflected in anesthetic depth changed three minutes later.

Figure 3 shows the effect of turning the vaporizer off at the end of surgery with maximum fresh gas flow (upper) and typical 15 LPM fresh gas flow (lower). Note the slower fall in inspired and expired concentration with the lower fresh gas flow. This will result in slower awakening.

Figure 4 shows the rapid attainment of stable and adequate end-tidal agent concentration and the rapid reduction of this concentration to achieve wake up. Use of the agent monitor to guide adjustment of the vaporizer allows the anesthesia professional to make the adjustments necessary to maintain desired anesthetic depth.

New anesthesia machines by Draeger, GE, and Maquet allow direct setting of desired end-tidal anesthetic level and should allow anesthesia professionals to provide precise control with far less mental and technical effort.

Conclusion

Monitoring inhaled agents for ambulatory surgery can guide anesthesia professionals to precisely control anesthetic depth from induction to emergence. Conventional anesthesia machines with agent monitors and good graphic trends allow anesthesia care providers to do this. Anesthesia machines should do more1. New anesthesia machines with feedback control of end-tidal gases do this automatically.

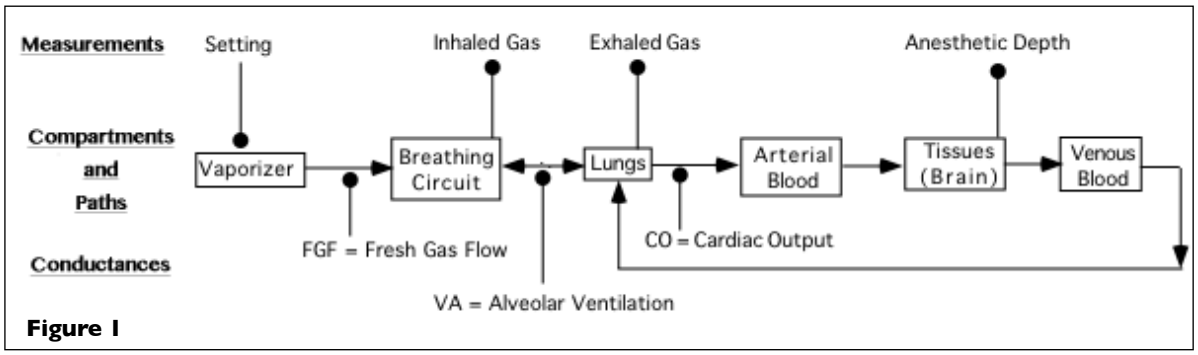

Figure 1

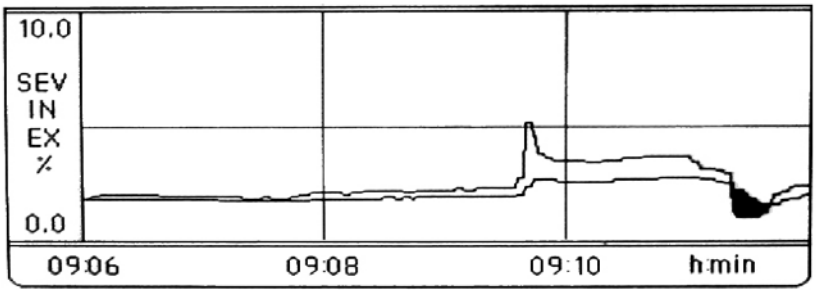

Figure 2 Graphic trend of inhalation agent inspired and expired concentration following bolus up and bolus down using vaporizer, FGF, and captured on agent monitor.

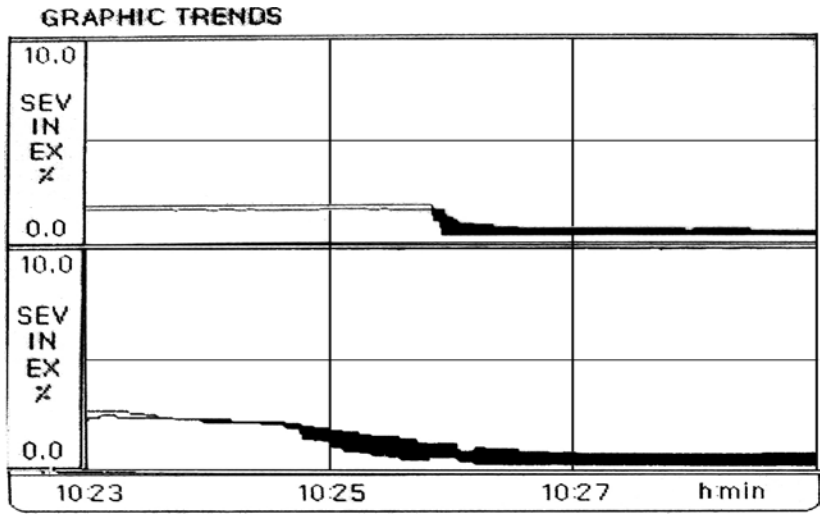

Figure 3 Graphic trend of inhalation agent inspired and expired concentration at emergence with high (top) and lower (bottom) fresh gas flow.

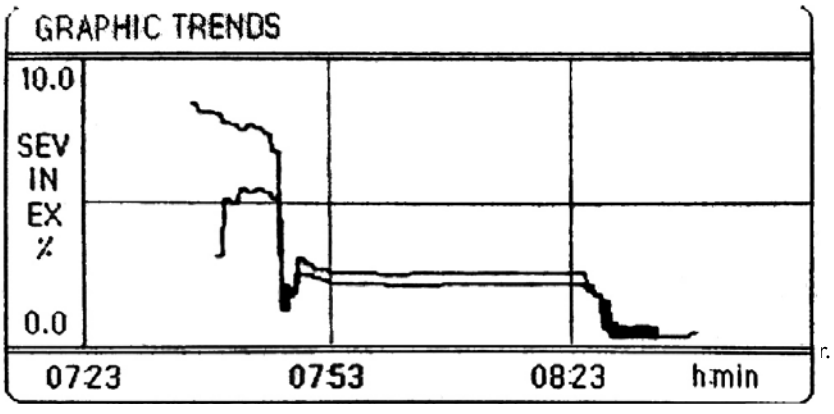

Figure 4 Graphic trend of inhalation agent inspired and expired concentration after carefully controlled VIMA (volatile induction and maintenance) anesthesia.

Reference

1. Philip JH. Anesthesia Machine as a Monitor. In: Ehrenfeld J, Cannesson M. ***Monitoring Technologies in Acute Care Environments***, Springer, 2014, 197–201.