

MAQUET
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**MALIGNANT HYPERTHERMIA
PREPARING THE FLOW-i
FOR SUSCEPTIBLE PATIENTS**



MALIGNANT HYPERTHERMIA CAUSES, EFFECTS, AND TREATMENT

Malignant hyperthermia (malignant hyperpyrexia) is a condition caused by an uncontrolled release of Ca^{2+} from calcium deposits in the muscle tissue. Triggering factors include certain drugs used for general anesthesia, such as the volatile anesthetic agents Desflurane, Sevoflurane and Isoflurane and the neuromuscular blocking agent succinylcholine.^{1,2}

The extreme levels of Ca^{2+} induce drastically increased oxidative metabolism in the skeletal muscles. The demand for oxygen increases and carbon dioxide accumulates in the body. End tidal concentration of CO_2 increases as a result.

The ability to regulate body temperature also decreases. These effects may, if left untreated, lead to multi-organ failure and death.^{1,3}

The only known treatment after onset of MH is intravenous administration of dantrolene and supportive therapy to combat the symptoms.² This, together with preventive measures, has contributed to a decrease in the mortality rate from around 80% during the 1970s, to less than 5% today.²⁻⁵ The majority of patients developing MH have mutations in receptors regulating intracellular levels of Ca^{2+} in muscle tissues. These genotypic variants predispose individuals to develop MH when challenged with triggering factors.^{1,6}

MALIGNANT HYPERTHERMIA WASHOUT

Incidence: Estimates of the number of susceptible individuals range from 1 in 2000 to 1 in 3000, based on patient genotyping and review of the relatives' medical histories.⁴ The incidence of MH ranges from 1 in 10 000 to 1 in 220 000 general anesthesia procedures. Reported cases indicate a bias towards younger patients and male patients.^{3,4,7}

Preventive measures when working with the FLOW-i Anesthesia Delivery System: During a patient case using Sevoflurane, Isoflurane or Desflurane, a small amount of the agent is absorbed and retained by the parts comprising the breathing circuit. After delivery of agent has been discontinued, absorbed agent is released into the breathing circuit volume. Typical levels are in the ppm (parts per million) range, e.g. 30-60 ppm.¹⁰

The level of anesthetic agent in the breathing circuit gas volume decreases with time when ventilating using fresh gas only. Figure 1 shows a typical decrease in detectable agent when a washout procedure is implemented. While the

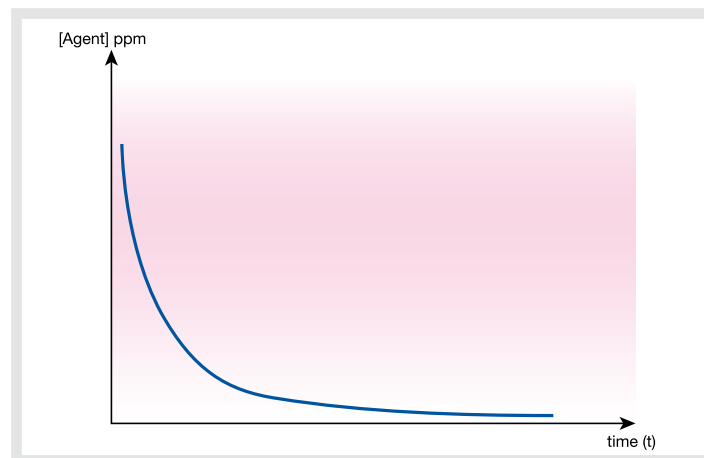


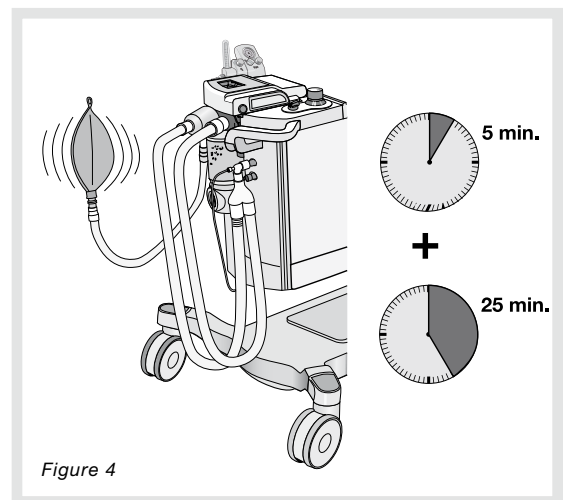
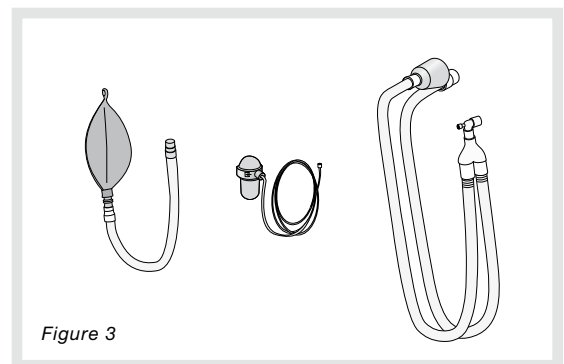
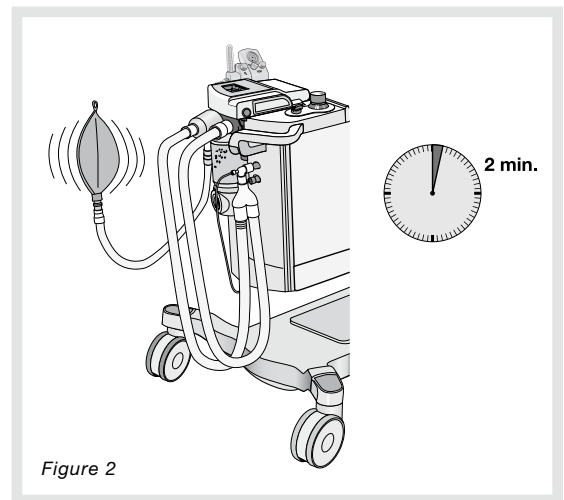
Figure 1: Detectable concentrations of agent in the breathing circuit gas volume. The initial level of agent and clearance rate depend primarily on agent solubility in the parts comprising the anesthetic system.¹⁰

minimum dose for triggering MH is unknown, a consensus concentration of ≤ 5.0 ppm has been adopted when preparing anesthetic systems for patients with a known history of MH, or who are suspected of being predisposed to MH.⁸⁻¹⁰

MALIGNANT HYPERTHERMIA WASHOUT PROCEDURE

Washout procedure: The following procedure describes how to clear the FLOW-i of remaining anesthetic agent to ensure an agent level of <5 ppm.

1. Disconnect the absorber and vaporizer. Discard the absorber.
2. Attach the patient tubings to the test plug.
3. Ventilate vigorously for 2 minutes using manual (MAN) ventilation with a FGF setting of 17 l/min and an APL setting of 10 cmH₂O (Figure 2).
4. Replace the patient tubings, manual breathing bag, sampling line, and water trap with new parts (Figure 3).
5. Ventilate vigorously for 5 minutes using the same settings as Step 3. Thereafter, leave the system for 25 minutes in MAN mode with the fresh gas flow still at 17 l/min (Figure 4).
6. Turn off MAN ventilation. Attach a new absorber.



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