Toxicity and Management of Waste Anesthetic Gases Using The Sci-Med Oxygenator

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Abstract

Toxic anesthetic waste products need to be scavenged to protect ourselves and our future generations. Heart teams using bubble oxygenators and membrane oxygenators requiring a Y in the scavenger line, should consider the Bain Circuit which is described below.

Introduction

In 1968, the Occupational Health and Safety Administration (OSHA) set up guidelines for hospitals to dispose of their waste anesthetic gases.[1] Operating room personnel and the recovery room staff are the most highly exposed group of people in the hospital setting.[2] They are exposed daily to nitrous oxide and halogenated agents, which are both thought to be toxic with longterm constant exposure. Research studies have been conducted since 1970 through 1980 which demonstrate the hazard to which these workers are exposed.[2-5]

The general health problems include: an increase in liver, kidney, and neurological disease; and an increase in spontaneous abortions and congenital abnormalities in off-spring of both females exposed and wives of exposed males. OSHA guidelines set standards for acceptable levels of anesthetic gases in the operating room. These guidelines mandate the use of scavenger systems, connected to a vacuum source, which vents waste anesthetic gases to the atmosphere.[6] OSHA permissible exposure limits are legally enforceable. This is now included in part of an audit visit for hospital accredidation, and perfusionists are also subject to this mandate.

Methods

All oxygenators should be scavenged to vacuum to eliminate waste halogenated agents. Threshold value limits set up by OSHA on halothane, ethrane, and forane are five parts per million (0.0005%). If you can smell the agent, this is a concentration of approximately 100 parts per million. Ports are available on bubble oxygenators to scavenge waste gases, and it is our obligation to use them according to the recommendation of the oxygenator manufacturer. Most require the use of a Y in-line to prevent a negative vacuum in the device. Massive venous air embolism can result from a blocked vacuum scavenging line on some bubble oxygenators, as recently reported by Wells and Stiles.[7] With increased use of membrane oxygenators, a need exists for an adequate scavenger system with these types of oxygenators. The Sci-Med membrane[a] is used at this institution, and gases are scavenged by means of a Bain Circuit.[b] This is a disposable breathing circuit, which can also be adapted for pollution control of

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submitted 10/20/81
revised 3/31/82
accepted 4/14/82

[a] Sci-Med Life System, Inc., Minneapolis, MN 55441
[b] Respiratory Care Inc., Arlington Height, IL 60004

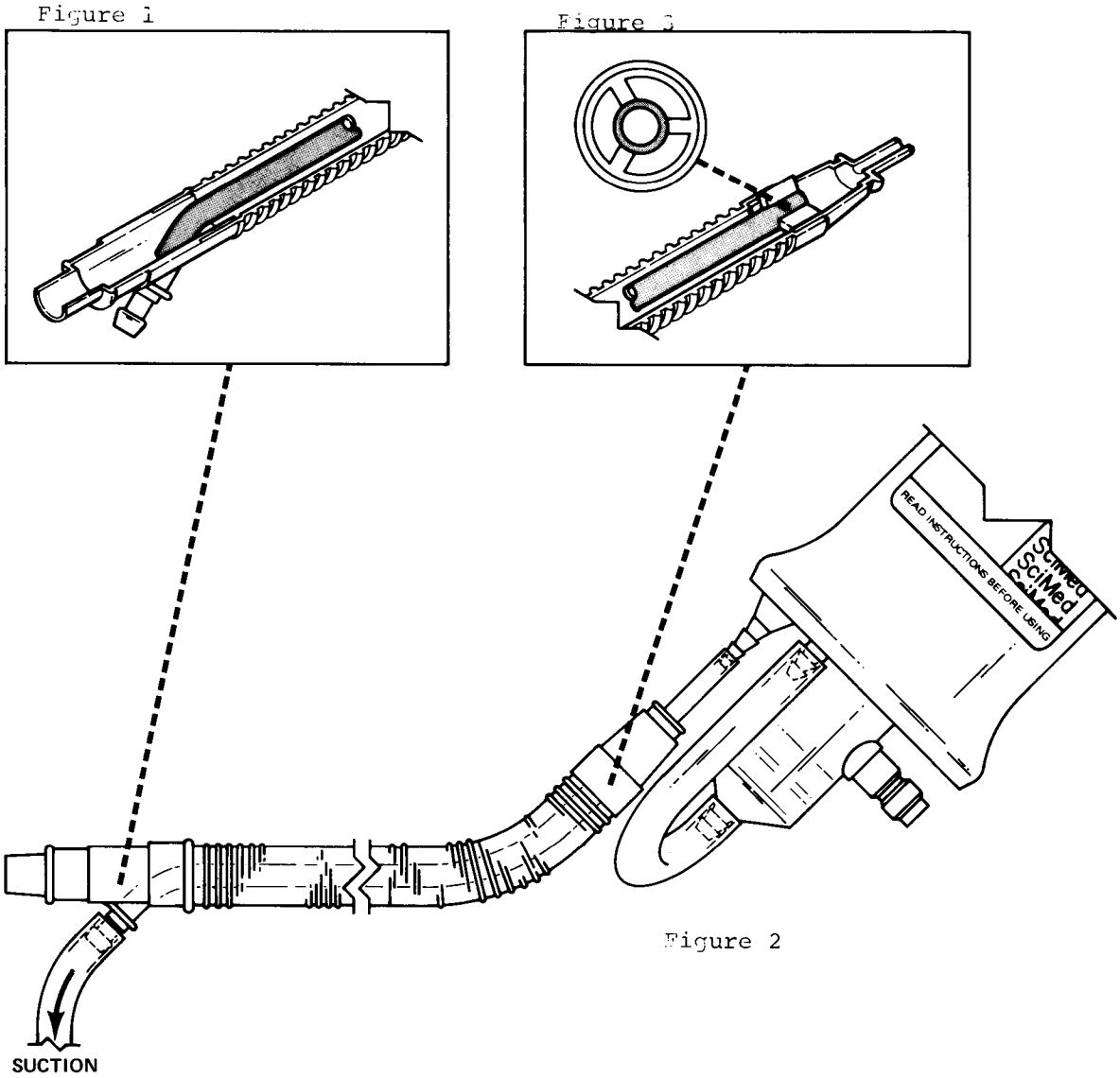

FIGURE 1. The Bain Circuit is a tube within a tube.

FIGURE 2. The scavenger line attached to the membrane exhaust port with a Shiley endotracheal adaptor.

FIGURE 3. Unrestricted gas will flow through the hose if the suction line is occluded.

exhaled gases. The circuit is a six foot long corrugated plastic hose. It has a inner tube which attaches to suction. (See Figure 1.)

The Sci-Med transmembrane pressure must be limited to 750 mm Hg or less. There must be *no* restriction of gas flow through the device,[8] and scavenger line must *never* be attached to the gas outflow port without a Y piece incorporated in the circuit.

The manufacturer suggests the use of a ¼ x ¼ X ¼ Y, but this essentially offers no dead space as it contains a volume of **5 ml** only. We utilize the Bain Circuit for more effective scavenging, which also provides the greatest margin of safety with the Sci-Med system. This system has a greater dead space with a volume of *400 ml*. The Circuit is fitted to the gas outflow port of the oxygenator with an 8 mm Shiley endotracheal adaptor.[c] (See Figure 2.)

[c] Shiley Inc., Irvine, CA 92714

The Bain Circuit allows gases to escape into the dead space and out the circuit, if the suction line is occluded accidentally. (See Figure 3.). Thus, no restriction to gas flow would occur. Low suction may then be controlled by an adjustable Puritan[d] gauge and gases are vented to atmosphere. The difference in volume gives a greater safety factor plus reaction time, when using the Bain Circuit.

Conclusion

It is our obligation to protect ourselves and others from toxic pollutants. Review with your manufacturer of choice, the proper method of scavenging your oxygenator. When using the Sci-Med Membrane, we recommend utilization of the Bain Circuit as your Y. It is low in cost, safe, reusable, and provides added protection to yourself and those around you. What are your Threshold Limit Values? Do you meet OSHA guidelines?

[d] Puritan Bennett Corp., Kansas City, MO 64106

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