The Universal Oxygen Connector

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Abstract

The purpose of this paper is to describe the benefits of using the Universal *Oxygen Adapter. Until now, an oxygen hose was only able to connect to a 22 mm fitting, such as those found on a humidifier used in the recovery room, and oxygen tubing was only able to connect to a Christmas tree type adapter. The Universal Oxygen Adapter was developed to allow the practitioner to connect either 22 mm oxygen hose, oxygen tubing or a 15 mm oxygen connector to the same adapter.*

Patients benefit from the administration of supplemental oxygen in the perioperative period. Supplemental oxygen has been shown to decrease postoperative hypoxemia, infection, and in some cases, nausea and vomiting. As such, oxygen should be administered during transport from the operating room to the recovery room , in the recovery room, and at times during transport to the patient room and in the patient room.

Use of the Universal Oxygen Adapter decreases material waste, decreases hospital costs, saves time and effort and, most importantly, promotes patient safety by providing a versatile system for oxygen delivery.

Introduction

Patients benefit from the administration of perioperative supplemental oxygen. Supplemental oxygen decreases postoperative hypoxemia, infection, and in some cases, nausea and vomiting. Because different delivery systems are used in the operating room, recovery room, hospital room and during transport, an added expense is realized for supplies. As a result, practitioners may refrain from using supplemental oxygen during transport. The Universal Oxygen Adapter connects to each type of delivery system. As such, the Universal Oxygen Adapter may save time, ease transition between systems, eliminate material waste and encourage practitioners to provide supplemental oxygen to their patients. The Universal Oxygen Adapter is manufactured by International Medical, Inc. located in Burnsville, MN 1(800) 328-2983. E mail: Gwatk36216@aol.com.

History of Oxygen therapy

Karl W. Scheele and Joseph Priestley independently discovered oxygen in 1771. In 1880, Macewen introduced the concept of performing endotracheal intubations via the mouth. [1] In 1885, Hewitt constructed the first practical apparatus for nitrous oxide and oxygen delivery. [2] Between 1917 and 1920, endotracheal inhalation was developed by

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Rowbotham and Magill. In 1938, Crafoord constructed the “spiropulsator”, the first practical positive pressure respirator for use in anesthesia. [1]

Benefits of postoperative oxygen administration

Reduction of hypoxemia. Xue et al. found that in the immediate postoperative period, 8% of healthy, ASA 1 adults and 24% of healthy, ASA 1 pediatric patients under the age of 14, breathing room air, experience hypoxemia. [3] In another study, 43% of ASA 1 pediatric patients experienced moderate to severe hemoglobin desaturation in the immediate postoperative period. [4] Hypoxemia is not always predictable or apparent. [5] Most practitioners hyperoxygenate patients prior to leaving the operating room. Hyper-oxygenation has helped reduce the incidence of hypoxemia in patients during transport to the recovery room. However, Chripko et al. found that the patient breathing room air desaturates fastest during the first two minutes of transport. [6] As such, many practitioners support the routine use of oxygen during transport to the recovery room.

Although the development of atelectasis is a concern when high concentrations of inspired oxygen are delivered, Akca et al. found no difference in lung volumes, atelectasis or

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alveolar gas exchange between patients receiving 30% or 80% oxygen during and for 2 hours after surgery. [7]

Decreased incidence of wound infections. Subcutaneous oxygenation [8,9] and perfusion are important components of immunity to wound infection. Conditions that restrict peripheral perfusion, such as hypovolemia, excessive pain, vasoconstricting drugs and hypothermia should be avoided postoperatively. [9]

Neutrophils destroy bacteria through an oxidative process. This process requires oxygen. Hypoxia impairs the neutrophil's ability to kill bacteria and should be avoided in the postoperative period. Conversely, hyperoxia enhances bactericidal activity. [8]

Poulsen et al. determined that up to 0.5% of hospital costs can be attributed to wound infections. [10] Sessler and Akca found that the administration of 80%, as opposed to 30%, oxygen in the perioperative period reduced the rate of postoperative wound infections in patients undergoing colon resection. [11] In a separate study, Greif et al. found that the administration of 80% oxygen to patients during, and for the first 2 hours following, colorectal surgery reduced the incidence of wound infection by 50%. [12]

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Decreased incidence of nausea and vomiting. It is not well understood why the administration of oxygen, in the postoperative period, reduces the incidence of nausea and vomiting. It is thought that oxygen administration may decrease intestinal ischemia. [13,14] In a study of Greif et al., patients undergoing colon resection receiving 80% oxygen during surgery and for the first two hours postoperatively, experienced close to a 50% reduction in the incidence of nausea and vomiting when compared to patients that received 30% oxygen. [13]

In another related study, Groll et al. demonstrated that the use of a high FiO_2 decreased the incidence of postoperative nausea in colon resection patients. In this study, patients were divided into three groups. Group 1 received 30% oxygen, balanced nitrogen during surgery and for two hours postoperatively. Group 2 received 30% oxygen, balanced nitrogen during surgery and for two hours postoperatively and 8mg of ondansetron immediately after induction. Group 3 received 80% oxygen, balanced nitrogen during surgery and for two hours postoperatively. Group 1 had 44% incidence of nausea, group 2 had a 30% incidence of nausea and group 3 had a 22% incidence of nausea.[14]

However, in a study by Purhonen et al., the administration of 80% oxygen in the perioperative period failed to prevent nausea and vomiting after ambulatory gynecologic

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laparoscopic procedures. [15] Another study by Purhonen et al. found similar results. Patients having breast surgery were assigned to two groups. One group received 30% oxygen the other 80% oxygen intraoperatively and for 2 hours postoperatively. Although none of the patients in the group receiving 80% oxygen vomited during the administration of oxygen, when the oxygen was discontinued, there was no difference in the incidence of nausea and vomiting between the groups.[16] Joris et al. evaluated the efficacy of providing supplemental oxygen to patients undergoing thyroid surgery. They found that there was no difference in the incidence of nausea and vomiting when supplemental oxygen was administered in concentrations of 30 and 80% .[17]

Discussion

Until now, the type of tubing used to administer oxygen was dictated by the connection on the delivery system, typically a conventional Christmas tree adapter or a hose adapter. The idea for the Universal Oxygen Adapter came about six years ago when we were looking for ways to encourage practitioners to transport patients who had a general anesthetic to the recovery room with supplemental oxygen. One reason practitioners gave for not using oxygen on transport was that it was wasteful to use three oxygen administration systems within a short period of time. The first oxygen delivery system is t

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the anesthetic circuit, the second is the oxygen tubing and mask used during transport and the third is the humidifying hose, and mask used in the recovery room.

The Universal Oxygen Adapter was developed to solve this problem. The Universal Oxygen Adapter allows the tubing from the anesthesia circuit to be used during transport, in the recovery room and in the patient room.

Another reason identified by practitioners for not using oxygen on the way to recovery is that the oxygen in the E cylinder is expensive. On the contrary, an E cylinder costs approximately $1.80 to refill. There are 660 liters of oxygen in each E cylinder. If oxygen is administered at 10 liters per minute, for 4 minutes, 40 liters of oxygen is used. In this scenario, the cost is approximately 10 cents.

The cost of the Universal Oxygen Adapter needs to be taken into account. Currently, each metal Universal Oxygen Adapter costs $10 to $14 and each plastic adapter costs $1.20 to $1.60. The plastic adapters come in the female type only (they work well on oxygen flow meters). The metal adapters are male or female (they work well on oxygen tank regulators or flow meters).

A number of hospitals and surgery centers are currently using the Universal Oxygen Adapter. At Hennepin County Medical Center located in Minneapolis, MN, the savings realized in material costs, is in excess of $6,000 per year. Hennepin County Medical Center has saved between 12,000-13,000 oxygen hoses, masks and tubings per year. Additionally, the number of patients who received a general anesthetic and are transported to the recovery room with oxygen has increased from an estimated 25% two years ago, to over 80% today.

Product design

The design of the Universal Oxygen Adapter is simple. As shown in figure 1, the adapter has a standard tubing connector that can accommodate oxygen tubing, such as that used with a nasal cannula or mask. The adapter also has a 15mm and 22 mm hose connection for use with an oxygen hose. The 22 mm hose can be connected to a standard oxygen mask, a tent mask, a T-piece or tracheotomy dome.

Procedure

After the surgery is over and when the patient's airway is secure and the patient is ready for transport, the cleaner inspiratory limb of the expandable anesthesia circuit is used for transport. The inspiratory hose is removed from the circuit by rocking and pulling the

hose from the “Y” end. Having a cuff at the “Y” end of the inspiratory limb can make disconnection easier. (Figure 2) To prevent contamination, the cleaner, machine, end of the hose is attached to the Universal Oxygen Adapter, and the facemask is applied to the “Y” end of the oxygen hose. This system can be used for transport to the recovery room and in the recovery room. The same system can be used when transporting from the recovery room to the patient’s hospital room and then in the hospital room. (Figure 3 and 4) The King Systems Corporation has a single limb expandable circuit that after surgery can be hooked directly to the 15 mm part of the Universal Oxygen Connector. The advantages of this circuit include complete filtration and warming of anesthesia gases during surgery while being light weight and flexible. (Figure 5)

If the patient is not ready to be extubated after surgery, but is breathing at an adequate depth and rate, the expandable circuit can be used for oxygen delivery during transport of the patient to the recovery room. To use the circuit as a T-piece, the inspiratory limb of the circuit is connected to the Universal Oxygen Adaptor and the expiratory limb of the circuit is cut 4 inches from the Y end of the circuit. The T-piece hose can now be used for transport to the recovery room and also in the recovery room.

King Systems, Medline, Smith Medical, and Vital Signs all have expandable circuits that will accommodate the Universal Oxygen Adapter. If the circuit hose will not accommodate the Universal Oxygen Adapter, the hose used in the recovery room could be

made available in the operating room. The recovery room hose can then be used for transport to recovery room, in the recovery room band beyond.

The Universal Oxygen Adapter has applications outside of the anesthetizing area as well. Patients throughout the hospital who receive oxygen by hose can continue to use the same hose for oxygen administration when being transported from one area to another. As it is sometimes hard to find oxygen tubing that is compatible for tracheotomy domes and tent masks, the practitioner saves time because a separate oxygen system is not required during the transport. Using a single oxygen administration system also reduces the possibility that a patient would suffer a corneal abrasion while systems are exchanged.

Summary

The Universal Oxygen Adapter simplifies oxygen delivery because it accommodates both oxygen hose and tubing. The adaptability of the connector saves the practitioner time and saves the hospital, or clinic, money by decreasing the material waste of oxygen tubing and masks. But most importantly, the Universal Oxygen Adapter may promote patient safety if practitioners are encouraged to administer postoperative oxygen; as supplemental oxygen decreases postoperative hypoxemia, infection, and in some cases nausea and vomiting. The Universal Oxygen Adapter has other applications and can be used throughout the hospitals and clinics.

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