PREVALENCE OF VISIBLE AND OCCULT BLOOD ON THE

SURFACES OF FIBEROPTIC BRONCHOSCOPES

Jeffery W. McKamey
Capt, USAF, NC

APPROVED:

_____   _____
Chair: Maura S. McAuliffe, CRNA, PhD   Date

_____   _____
Cynthia Cappello, CRNA, NC, USN   Date

_____   _____
Member: Eugene Levine Ph.D.   Date

APPROVED:

_____   _____
Faye G. Abdellah, Ed.D., Sc.D., RN, FAAN   Date
Dean

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ABSTRACT

Previous studies have demonstrated visible and/or occult *blood* on operating room

equipment such as laryngoscope blades, blood pressure cuffs, anesthesia control knobs

and pulse oximetry probes identified as ready for use. Anesthesia providers are in close

contact with many or all of the equipment noted and have a responsibility to ensure

proper cleaning is occurring to prevent transmission of *blood*-borne pathogens. This

study was conducted to determine if current cleaning, *disinfection* and *sterilization*

procedures used at one medical center was adequate to remove visible and occult *blood*

from fiberoptic *bronchoscopes*. Data were collected on 27 *bronchoscopes* from a major

medical center and each flexible shaft, distal tip and biopsy channel was tested. These

samples were subjected to a visible inspection and a modified *Phenolphthalein*

DISCHAP" test to determine the presence or absence of occult   *blood*. This test detects

the presence of *blood* via an oxidation-reduction reaction. If hemoglobin is present, the

hydrogen peroxide releases an oxygen to *phenolphthalein* resulting in a color change

(bright pink). None of the fiberoptic *bronchoscopes* used for this study tested positive

for visible or occult *blood*. Fiberoptic *bronchoscopes* must undergo high-level

disinfection.   This includes removing all organic debris before exposing the

bronchoscope to chemical agents followed by either manual (gastroenterology clinic) or

mechanical (operating room) *disinfection* with appropriate agents. It appears that these

guidelines are adequate for removing *blood* from fiberoptic *bronchoscopes* and the

medical center chosen adheres to these guidelines.

    Key Words: **bronchoscope** **blood** **disinfection** **sterilization** **phenolphthalein**

PREVALENCE OF VISIBLE AND OCCULT BLOOD ON THE

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by

JEFFERY WAYNE MCKAMEY

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TABLE OF CONTENTS

LIST OF TABLES

CHAPTER I: INTRODUCTION

Background

In this chapter a brief review of current, relevant literature is presented. The

purpose of the study is then described, followed by the research questions. A theoretical

framework is discussed along with the assumptions and limitations of the study.

In 1988, Bready found 1.5 to 2.5 million patients acquired a nosocomial infection

from which 15,000 died. By 1998, it was estimated 2 million patients acquired

nosocomial infections and approximately 90,000 died as a result (Beck-Sague, Jarvis, &

Martone, 1997). Nosocomial infections are infections acquired after admission to a

hospital that occur from human to human contact (cross-infection) or from instruments

that have not been properly decontaminated. Multiple researchers have found blood on

various pieces of medical equipment after cleaning and sterilization (Kanefield, Monro &

Eisele, 1989; Morell et al., 1992; Nikkola, 1999; Perry, 1997). As a result, there is an

increased awareness about blood-borne pathogens such as: hepatitis and human

immunosuppressive virus (HIV).

Phillips and Monaghan (1997) found, after the autoclaving of 65 laryngoscope

blades, 20% tested positive for occult blood. In 1998, Perry reported varying percentages

of visible and/or occult blood on anesthesia monitoring equipment ranging from blood

pressure cuffs to electrocardiogram cables. Recently a study was completed to determine

visible and/or occult blood on emergency equipment located outside the perioperative

arena. Study findings indicated the presence of blood contaminated surfaces on

emergency airway equipment (Nikkola, 1999). Other investigators have reported positive

bacterial colonization (i.e., *Mycobacterium chelonae and Rhodotorula rubra*) in the

suction channels of fiberoptic endoscopes. (Cox, deBorja, & Bach, 1997; Hagan, Koltz, Bartholomew, Potter, & Nelson, 1996). In 1997, in two separate studies, researchers reported multiple patients who had contracted mycobacterium tuberculosis (TB) from inadequately disinfected bronchoscopes (Agerton et al., 1997; Michele et al., 1997). In these studies data showed the growth of bacteria or the presence of blood was found after the medical equipment had reportedly been properly decontaminated and/or sterilized, and labeled as ready for patient use.

Cross-contamination and the transmission of blood-borne pathogens and other potentially lethal bacteria and viruses continues to be a concern to both patients and healthcare providers. Detailed guidelines have been published on decontamination of endoscopes and other medical equipment from multiple agencies such as; Occupational Safety and Health Administration (OSHA), Centers for Disease Control and Prevention (CDC), American Practitioners of Infection Control and Epidemiology (APIC), and the American Association of Nurse Anesthetists (AANA) (Baker, 1984; Beck-Sague, Jarvis & Martone, 1997; Martin & Reichelderfer, 1994; OSHA, 1991). All these agencies have published detailed guidelines for adequate disinfection and/or sterilization. Most importantly though, healthcare equipment must first be thoroughly cleaned of all foreign material (Martin & Reichelderfer, 1994). This requires adherence to cleaning protocols and personnel specially trained in techniques and charged with the responsibility to clean and disinfect medical equipment.

After searching MEDLINE and CINHAL between 1970 and 1999, no studies were found to determine the adequacy of disinfection of the outer surface and tip of the fiberoptic endoscopes. Nor were studies found which examined the presence of visible

and/or occult blood on the surfaces of previously decontaminated or sterilized fiberoptic bronchoscopes. It is the responsibility of all healthcare providers to ensure adequate disinfection and sterilization of all medical equipment in order to help prevent nosocomial infections.

Endoscopes were first introduced in 1853 but it was not until 1959 and 1960 that the optical and fiberoptics were added (Spaner & Warnock, 1997). These improvements along with other additions have increased the usage of endoscopes (including bronchoscopes), allowing for more cost-effective surgery and procedures. As a result of increased endoscope usage, hospitals have decreased surgery times and increased the number of surgeries, which may lead to less time dedicated to effectively disinfect or sterilize endoscopes. Kozak and Owings (1998) reported that endoscopy is one of the most frequntly conducted procedures for both ambulatory surgery patients and inpatients. Endoscopes/bronchoscopes are routinely used by various departments for a variety of procedures. Increased use may be associated with an increased risk of exposure and transmission of infection. Methods for decontamination and sterilization must be challenged to ensure adequate disinfection to protect patients as well as healthcare providers.

<div align="center">Purpose of the Study</div>

The purpose of this study was to determine the adequacy of decontamination and sterilization techniques for fiberoptic bronchoscopes as evidenced by the absence of visible and occult blood.

Research Questions

1.   What is the prevalence of visible and occult blood on the exterior and interior

surfaces of fiberoptic bronchoscopes which are identified as ready for patient use?

2.   Is there any difference between manual (Gastroenterology Clinic) or machine

(Operating Room) high-level disinfection as evidenced by the presence or absence of

visible and occult blood on fiberoptic bronchoscopes identified as ready for patient

use?

Theoretical Framework

In order to be useful, information acquired through nursing research must be

developed into nursing theories. The meaning of research findings is explained by

theories (Burns & Grove, 1997). Florence Nightingale initiated the application of nursing

theory to nursing practice. As a result of her contributions to nursing theories, nursing

research has had a profound growth especially over the past decade. Through the use of

theories, nurses are able to understand and describe how their practice is founded on

theory (Hayne, 1992).

Florence Nightingale lists pure air, efficient drainage, pure water, light and

cleanliness as essential ingredients of good nursing care for health (Barnum, 1998). She

was a strong proponent of a healthy environment for the patient and is referred to as an

environmental engineer. Nightingale's theories on this subject ranged from cleanliness of

rooms, walls, and air, to hand washing (Nightingale, 1859). She also postulated washing

hands with hot water and soap was more sanitary than with cold water and soap.

Nightingale expanded on this by describing how the use of steam was more effective in

removing dirt than hand washing alone. Nightingale was the first to believe that asepsis

protected patients as well as medical personnel and promoted the healing process (de Graff, Marriner-Tomey, Mossman, & Slebodnik, 1994). Nightingale's discoveries propelled nurses to the forefront in infection control in many hospitals.

The fundamental theory of maintaining a clean environment described by Florence Nightingale to enhance patient safety is the foundation upon which this thesis is based. Nurses are in a position to exert control over their environment and ensure that personnel and medical equipment are properly cleaned or sterilized according to established specifications. It is the responsibility of nurse anesthetists to ensure adequate disinfection for key anesthesia equipment, such as fiberoptic bronchoscopes.

<div align="center">Definitions</div>

1. <u>Conceptual definition of visible blood</u>. Blood easily seen with the unaided eye

<u>Operational definition of visible blood</u>. Blood easily seen by the investigator on the exterior portion of all fiberoptic bronchoscopes located in the gastroenterology clinic and the operating room in a large medical center with the investigators unaided eye.

2. <u>Conceptual definition of occult blood</u>. Blood recognized by chemical or microscopic examination only.

<u>Operational definition of occult blood</u>. Blood discovered on any fiberoptic bronchoscope located in the gastroenterology clinic or operating room in a large medical center. (by a three-step phenolphthalein test)

3. <u>Conceptual definition of fiberoptic bronchoscope</u>. An optical system where images are conveyed via a compact bundle of glass or plastic fibers and constructed with a head containing controls and a flexible shaft with a maneuverable tip. Specialized endoscopes may contain a light source, an optically transmitted image, air and water channels and/or

operating channels for suction, biopsy or cytology brushes.

Operational definition of fiberoptic bronchoscopes. Fiberoptic bronchoscopes are utilized at the medical center by various departments. Most of the fiberoptic bronchoscopes (n=24) in the Medical Center are located in the gastroenterology clinic and three are located in the operating

room.

Assumptions

1. All fiberoptic bronchoscopes tested had undergone previous high-level disinfection and were determined by the institution ready for use.

2. There may be an association between visible and occult blood found on the bronchoscopes and subsequent patient infections.

3. The test was sensitive enough to detect small amounts of blood in and on the fiberoptic bronchoscopes.

Limitations

1. Since the study was conducted at one large military medical facility and data were collected over a one-day period, generalizability of the findings may be limited.

2. Can not make the assumption that blood on equipment after cleaning and/or sterilization will cause a nosocomial infection.

Summary

In this chapter, previous studies discovering blood and other contaminants on various pieces of medical equipment were presented which provided the background and research question for this study. Florence Nightingale s (1859) theory pertaining to cleanliness and environment was explained. Variables were defined conceptually and

operationally and assumptions and limitations were stated.

CHAPTER II: REVIEW OF THE LITERTURE

Introduction

Bready (1988) reported that 1.5 to 2.5 million patients in hospitals in the United States acquired a nosocomial infection, and as many as 15,000 died as a direct result. The death rate increased over the following ten years and in 1998, two million patients reportedly acquired a nosocomial infection of which 90,000 are estimated to have died (Beck-Sague, Jarvis & Martone, 1998). Petersdorf (1980) stated anesthetic agents, stress, trauma and concurrent disease states may depress the immune system making patients more susceptible to infections. These infections can be relatively benign while others such as Hepatitis B (HBV) and Human Immunodeficiency Virus (HIV) can be life threatening. In this chapter a review of the current literature pertaining to or related to fiberoptic bronchoscopes will be presented. A review of HBV, HIV and *Mycobacterium tuberculosis* (TB) will be discussed along with anesthesia provider s risk of blood exposure. Studies about blood contamination on surfaces of medical equipment will be reviewed and a classification system will be described as well as specific guidelines for proper decontamination of fiberoptic bronchoscopes. Finally, different methods to clean bronchoscopes and some possible solutions to decrease the risk of transmission will be discussed.

Review of the Literature

Although blood-borne pathogens had not been identified in the mid 1800s, Florence Nightingale was aware of the need for a clean environment to promote healing (Nightingale, 1859). According to Nightingale, an appropriate environment for patients would have fresh air, clean walls, efficient drainage, pure water and health care providers

would have adequate hand washing (Barnum, 1988; Nightingale, 1859). Nightingale investigated handwashing methods and reported warm water and soap was better than cold water with soap. She also reported steam would remove dirt that hand washing would not (deGraff et al., 1994). It is evident Florence Nightingale was a pioneer in infection control and one of the first advocates for patients and staff alike.

Infection control should be a key element in any nurse anesthetist s daily routine. Lynch and White (1993) studied the degree to which operating room personnel were in direct, unprotected contact with blood during the perioperative period. In this study of 8,052 surgical procedures in nine hospitals, 1,054 staff members were found to be contaminated with blood. Anesthesia providers were frequently contaminated on upper extremities as a result of inadequate arm protection. Anesthesia staff were also noted to frequently manipulate intravenous cannulas without gloves leading to blood contamination of the hands. Of the 1,054 contamination instances, 252 pertained to exposure to the face and neck.

In a related study covered by Tait and Tuttle (1995), 1,149 surveys were sent to anesthesiologists in the United States to determine compliance with CDC universal precautions guidelines. Forty-three percent (n=493) of the surveys were returned. Ninety-three percent reported they washed their hands if the patient was a known carrier of HIV, but 58% said washing hands did not decrease the risk of infection. This increases the risk of blood-borne pathogens coming in contact with anesthetists or patients mucous membranes.

In the middle 1980s, HIV was discovered as one of the blood-borne pathogens which included other viruses such as HBV and HCV. Handsfield, Cummings and

Swenson (1987) completed a study where they examined the risk of healthcare providers contracting a blood-borne pathogen by sampling laboratory blood specimens designated for discarding. The study hospital collected approximately 1,000 specimens over a four-day period. Data were collected on five separate days over 14 days. The researchers found 11 specimens were contaminated with HIV, 49 with HBV, and 57 were contaminated with both HIV and HBV.

In 1993, Short and Bell listed three factors that increase the risk of blood-borne pathogens from patient to healthcare provider: the prevalence of infection in the patient population, the chance of acquiring an infection from a single exposure and the nature and frequency of blood contact. They also stated that during 1991 the CDC estimated 5,100 healthcare workers contracted HBV from work related exposure. The CDC also estimated that 5% may require hospitalization, 0.1% may die of hepatic failure and 10% may become chronic carriers, of which 21% may die of cirrhosis or hepatocellular carcinoma. Short and Bell also concluded anesthesiologists had a higher seroprevalence of HBV than surgeons did in the 1970s and 1980s.

Anesthesia personnel have a small risk (0.4%) of seroconverting to HIV after inoculation (O Donnell & Asbury, 1992). This small incidence is expected to increase due to the increasing number of individuals infected with HIV. With this in mind, O Donnell and Asbury conducted a survey in Britain to determine if anesthetists adhered to the Association of Anesthetists guidelines pertaining to blood and body fluids. A total of 2,525 questionnaires were distributed and 1,992 were returned (79%). The authors reported 16% of anesthetists in this survey still did not routinely wear gloves, and one in three were resheathing needles.

Blood on various surfaces of medical equipment identified as ready for use have also been documented. Kanefield et al. (1989) were the first to study if visible and occult blood were present on airway management equipment utilized in anesthesia. They collected data on 100 elective general anesthetic cases with endotracheal intubation. Each piece of equipment was inspected for visible blood, submerged in tap water for five minutes, and the water was then tested for occult blood via a chemstrip. They reported 86 of 100 samples tested positive for blood (58% visible blood and 42% occult blood). The presence of blood on airway equipment after oral intubation may support the need for anesthesia personnel to use protective equipment. It also suggests that there may be contamination of fiberoptic bronchoscopes used for intubation.

Chrisco and DeVane (1992) conducted research on a convenience sample of 163 patients to determine the presence of blood in the oral cavity 15 minutes after oral intubation. They found blood was present after 34% of intubations. Seventy percent of those were positive for blood in the oral/pharyngeal cavity and 52% had blood on the laryngoscope blade.

Laryngoscope blades and handles have been studied for occult blood on at least two separate occasions since 1994. Morell et al. (1994) tested 38 laryngoscope blades and handles and found 10.5% of the blades and 50% of the handles were positive for occult blood. In this study, a guiac-based assay was utilized and was able to detect blood at concentrations as low as 1:10,000. Phillips and Monaghan (1997) also found laryngoscope blades and handles with blood contamination. Sixty-five blades and handles were tested and 20% of the blades and 40% of the handles positive for occult blood. This study also tested for the presence of blood at the beginning and end of an

operating day and found a greater number of blades and handles contaminated at the end

of the day. Phillips and Monaghan utilized a modified phenolphthalein blood indicator

test, which also detected blood at concentrations of 1:10,000. Both studies produced

further evidence that cross-contamination is possible and poses a risk for patients

contracting a blood-borne pathogen.

Other studies have attempted to discover if blood contamination was present on

various surfaces in the operating room. The following studies used the phenolphthalein

blood indicator to determine the presence of occult blood. In 1994, Hall sampled 19

surfaces in 22 operating suites including anesthesia equipment and monitoring devices   and

found 33% to be positive for blood contamination. Perry (1997) repeated a similar study

and sampled 210 surfaces including parts of the anesthesia machine and monitoring

equipment such as blood pressure cuffs and pulse oximeter probes. Two facilities were

examined and 33% blood contamination was reported on 33% of these surfaces. In

addition to these two studies, research was being conducted at the Uniformed Services

University of the Health Sciences in Bethesda, Maryland by Nikkola (1999) who tested

emergency airway equipment outside/inside the perioperative arena. She tested 211

pieces of airway management equipment located in various departments. She found the

prevalence of occult blood ranged from 1.6% to 57% depending on the department tested.

Anesthesia had the highest prevalence with 57% of the pieces of equipment positive for

occult blood.

In a search of the literature, no studies were found describing the presence of blood

on fiberoptic bronchoscopes. However, multiple studies were found about the presence of

various strains of bacteria on or in fiberoptic bronchoscopes. In 1982, Sammartino,

Israel, & Magnussen isolated *Pseudomonas aeruginsoa* from bronchoscope channels as

the culprit for a patient outbreak, and in 1997, Cox and colleagues isolated

Mycobacterium chelonae from bronchoscopes after 34 of 91 (34%) patients grew acid

fast bacilli from their lungs.

Two studies in 1997 documented TB as the cause for cross contamination and lead

to subsequent patient infections. Michele et al. (1997) conducted research to locate the

source of TB when two patients were reported having the same pattern (*10-banded*

156110 RFLP) of TB. These researchers reviewed medical charts, ventilation systems,

bronchoscopy records and bronchoscopy disinfection procedures. They found that a

patient with TB underwent a bronchoscopy, and two days later a second patient with a

mediastinal mass had a bronchoscopy with the same scope. The second patient was

diagnosed with small cell carcinoma and after six months of chemotherapy developed a

cough and fever, and was diagnosed with TB. The investigators described cleaning and

disinfection techniques in this hospital that were not in accordance with national

guidelines.

The second TB case involved a nosocomial transmission via a contaminated

bronchoscope. Agerton et al. (1997) investigated a North Carolina hospital where eight

patients were identified to be infected with the same strain (W1) of multi-drug resistant

TB (MDR TB). All patients underwent bronchoscopy, but one patient who died of MDR

TB was identified to be the initial contaminator of the bronchoscope. After Agerton and

colleagues reviewed the data, they found two patients were false positive for MDR TB.

One of these patients had been exposed to TB, but it was not active. The other contracted

the same W1 active strain of MDR TB. This patient was immunosuppressed and died as

a result of the MDR TB. In this case, inadequate disinfection and cleaning of bronchoscopes were cited as the cause of TB transmission.

Advances in disinfection began in 1843 by Robert Koch who discovered the use of steam as a disinfectant and sterilization technique (Groah, 1983). In 1859, the bactericidal properties of Ethylene Oxide (ETO) had been discovered, and by 1950 were being utilized in many hospitals. Currently several different methods are incorporated to sterilize and disinfect medical instruments including sterilization (i.e., steam), high-level disinfection (i.e., Glutaraldehyde), and low-level disinfection (i.e., soap and warm water)(Muscarella, 1996).

In order to determine the level of disinfection required (high, intermediate and low-level) for various types of medical instruments, they must first be categorized. Spaulding (1972) developed a framework for this classification based on a potential risk for patients to acquire nosocomial infections from these instruments (Muscarella, 1996; Spaulding, 1972). The classification was divided into three groups: critical, semi-critical and non-critical. The classification has been accepted with minor revisions by agencies such as the CDC, APIC, OSHA, and the AANA.

Critical items include those entering and coming in contact with sterile tissue or vascular systems (Spaulding, 1972). Several examples of these items include spinal or intravascular needles, surgical instruments, and implants, and endotracheal tubes. These items can be disposable or resterilized.

Semi-critical items include those that contact mucous membranes and these should undergo sterilization or high-level disinfection. Several examples of these items include laryngoscopes, breathing circuits, fiberoptic endoscopes, stylets, esophageal catheters,

and masks. High-level disinfection can be achieved via a chemical agent or wet pasteurization which destroys all microorganisms except for bacterial spores. Heat sterilization is preferred for these items, but due to the complex mechanical nature of some items complete sterilization may not be possible (Spaulding, 1972).

Non-critical items are those that contact the patients skin but rarely contact mucous membranes or other body fluids. These require low or intermediate-level disinfection, or in some cases, scrubbed with detergent and warm water (Spaulding, 1972). Examples of these include blood pressure cuffs, stethoscopes, and electrocardiogram cables and electrodes.

Sterilization is the best-known method used to destroy all bacteria and viral spores in hospitals today. Fiberoptic bronchoscopes are thermolabile and can not withstand the extreme temperatures generated by sterilization. For this reason, chemical germicidal agents are used, however these agents lack maximal sporicidal activity (Spaulding, 1972). Germicides currently recommended by the APIC include glutaraldehyde, hydrogen peroxide and peracetic acid. Ethylene Oxide gas (ETO) and a formaldehyde solution also are used, but are not recommended because of the 10 to 24 hours processing time. Formaldehyde, ETO and glutaraldehyde are germicides labeled as protoplasmic poisons which act by destroying the outer cell membrane (protoplasm) of all cells including the epithelium of reprocessing personnel (Spaulding, 1972). These chemicals among others will be discussed further.

In 1994, Martin and Reichelderfer published the APIC guidelines for infection prevention and control in flexible endoscopy. They recommend steam sterilization whenever possible because of its sporicidal properties and it requires very little time. It

also exposes personnel to less toxic chemicals. Some bronchoscopes are unable to withstand this environment and must undergo, at a minimum, high-level chemical disinfection. Regardless of the method, APIC states all organic material must first be removed mechanically before sterilization or disinfection because many chemicals are inactivated by organic material. Bronchoscope channels must be brushed and suctioned with detergents to facilitate removal of organic material. All bronchoscopes should have detachable elements removed and sterilized or soaked in detergent. After immersion in detergent, the bronchoscope should be rinsed with water to remove toxic chemicals. The above steps must occur or the sterilization or disinfection process may be rendered ineffective.

Martin and Reichelderfer (1994) described advantages and disadvantages of using an automated processor, sterilizer or disinfectant. The automated processors are less time consuming, decrease personnel exposure to toxic chemicals and irrigate most channels. However, the automated processor is expensive and has been associated with transmission of infections. APIC recommends a critical evaluation of these new technologies before implementation.

In Spaulding s (1972) classification system, bronchoscopes are classified as semi-critical items, and bronchoscope instruments penetrating sterile areas classified as critical items. The critical items can be removed and sterilized and all semi-critical items should undergo at least high-level disinfection. For adequate high-level disinfection all surfaces (internal and external) must be in contact with the disinfecting solution a minimum of 20 minutes.

The APIC guidelines list three recommended chemical agents proven effective (Martin & Reichelderfer, 1994). The first includes glutaraldehyde preparations that are available in an alkaline mixture and an acidic mixture. The alkaline solution requires adding a bicarbonate solution to increase the pH (7.5-8.5) increasing its microbicidal power. Bicarbonate also increases the shelf life of this preparation to 14 days. The acidic form may be corrosive to metal, but has a longer shelf life and has been accepted as a high-level disinfectant. Hydrogen peroxide is the second agent but has properties making it damaging to plastic and rubber, and can corrode some metals (see Table 1). However it is acceptable for endoscopes without the above contents. Finally, peracetic acid agents are active against bacteria, fungi, spores and enteroviruses. Crow (1993) notes peracetic acid is now produced with an anticorrosive buffering agent offering sterilization and a quick turn-around time. Peracetic acid is nontoxic to personnel and less damaging to the endoscope than steam of ETO (see Table 1). She continues by stating ETO is an acceptable agent yet impractical for sterilization due to the 10-24 hours required for the process. Muscarella (1998) states ETO is incapable of destroying spore-forming bacteria on internal surfaces of endoscopes.

Table 1.

The Activity and Corrosiveness of Various Agents

Agent	HBV	HIV	TB	Sporicidal	Bactericidal	Plastic/Metal
Gluteraldehyde	Y	Y	Y	N	Y	N
H-Peroxide	Y	Y	Y	N	Y	Y
Peracetic Acid	Y	Y	Y	N	Y	N
Ethylene Oxide	Y	Y	Y	N	Y	N
Formaldehyde	Y	Y	Y	N	Y	Y
Steam	Y	Y	Y	Y	Y	Y/N

(Y= active or corrosive, N= not active or corrosive)

Rinsing and drying bronchoscopes after sterilization or disinfection is required (Martin & Reichelderfer, 1994). During the rinsing process, APIC guidelines recommend using sterile water due to reports of contaminated tap water. There also have been reports of chemical colitis from glutaraldehyde and 3% hydrogen peroxide, reinforcing the necessity for rinsing and complete drying (Durante, Zulty, & Israel, 1992; Jonas, Mahones, Murray, & Gerther, 1988). It is recommended by the APIC that 70% alcohol be used in bronchoscope channels, followed by compressed air to facilitate drying. APIC also recommends this drying technique be implemented between patients when tap water is used and before storage.

There are alternatives for disinfection methods undergoing testing. These new technologies may be quicker, more effective and less toxic. The following technologies were cited by various authors either as new technologies or low-temperature sterilization processes: gas plasma, vapor-phase hydrogen peroxide, ozone, chorine dioxide gas and disposable, sterile-sheathed endoscopes (Crow, 1993; Martin & Reichelderfer, 1994; Muscarella, 1998).

A common thread among all viral outbreaks is inadequate disinfection procedures. Properly trained personnel should be the only ones undertaking sterilization and disinfection. They should also have an understanding of the scientific principles underlying contamination and containment (Dorsch & Dorsch, 1984; Martin & Reichelderfer, 1994). APIC recommends utilizing commercial test kits to determine if chemical agents are becoming too dilute, as reported with repeated use of the same chemical bath for multiple scopes. They also recommend, if automatic processors are used, periodic culturing should be instituted.

In 1988, Mayinger et al. conducted research on a disposable sheath for flexible gastroenterologic endoscopes and found by sheathing endoscopes turn-around time was decreased, but no difference was seen in contamination compared to regular endoscopes. Endoscopists and reprocessors preferred the regular endoscopes, but with modification and further research it is possible this technique could be modified for the bronchoscope. Double gloving is also an option and was studied by Telford and Quebbeman (1993) who found 11.5% less finger contamination with double gloved personnel and 1.2% for single gloved personnel. This study supports another method to decrease contamination of equipment (bronchoscopes) as well as staff.

Muscarella (1996) studied whether high-level disinfection was adequate for endoscopes. He discovered high-level disinfected endoscopes did not have a higher infection rate, nor were they less safe. He attributed the contamination difficulties to inadequate cleaning or storage and/or a breach in processing protocol. Muscarella concluded there is no consistent disinfecting or sterilization process adequate for flexible endoscopes.

No reports were found in the literature that examined bronchoscopes contaminated with blood. The reason for this is possibly because there have been no reported patients contracting HBV, HIV or any blood-borne pathogens. In addition, current agents are shown to destroy these pathogens (Muscarella, 1996). It should be noted, however, that considerable difficulties exist in actually identifying transmission from patients to health care providers. Even so, patients still contract bacterial infections from bronchoscopes and there-in lies the risk. Baker (1984) noted HIV has been discovered in a number of areas including blood, semen, vaginal secretions, saliva and tears. Rosenquist & Stock

(1989) also noted HBV has the capability of surviving for weeks on surfaces at room temperature. Therefore a potential risk of the transmission of a blood-borne pathogen exists and must be continually scrutinized.

Summary

The exceedingly high rate of nosocomial infections requires providers to have a more critical understanding of defining the actual cause, risk and mechanism. In Chapter Two a review of the literature was presented about how various pieces of medical equipment have served as possible fomites in the nosocomial process and the role this equipment has played in the transmission of bacterial infections.   Evidence pertaining to inadequate cleaning procedures was presented and demonstrates a need for more studies to document the problem to bring about corrective action to reduce risk/occurrence to both patients and providers. Finally, Florence Nightingale s (1859) theory pertaining to environmental cleanliness was restated.

CHAPTER III: METHODOLOGY

Introduction

Multiple studies were presented in Chapter Two in which medical equipment was found to be contaminated with blood which was labeled ready for use . These findings prompted the investigation of fiberoptic bronchoscopes and examination of the effectiveness of cleaning and decontaminating this type of equipment. In this chapter, the methods utilized to collect data on fiberoptic bronchoscopes will be described. The methods include research design, sampling and setting, protection of human rights, and plan for data analysis.

Research Design

Descriptive studies are classified as non-experimental research. Descriptive studies are conducted to increase knowledge about important characteristics in a certain field (Burns & Grove, 1993). They can also be utilized to identify problems with current practice or to justify current practice. A descriptive design includes identifying a phenomenon of interest, identifying the variables within the phenomenon, developing conceptual and operational definitions of the variables, and describing the variables. In this study, data were gathered and analyzed using a descriptive design to determine the presence of visible and occult blood on fiberoptic bronchoscopes labeled ready for use.

Prior to data collection, approval from the Uniformed Services University of the Health Sciences (USUHS) and the Military Medical Center Institutional Review Boards (IRB) was obtained. Also a representative from the medical center acted as the research sponsor.

21

On the day of data collection, Clean gloves were donned and a visual inspection was performed for the presence of blood on the entire external shaft and distal tip of the bronchoscope. This was done at the beginning of testing on every bronchoscope. If a visible stain was located, it was swabbed with a 70% isopropyl alcohol pad and tested for blood using the modified Phenolphthalein DISCHAP" (disposable chemical applicators) Test (Finger Print Laboratories, Inc., Youngsville, NC) to verify if the stain was blood. The data were then entered on the collection tool as yes or no for visible blood (see Appendix A).

Each bronchoscope (shaft, tip and suction/biopsy channel) was tested for occult blood utilizing the modified Phenolphthalein DISCHAP" Test (SIRCHIE¤). Clean technique was employed for all collection of data. This included donning clean latex gloves before visible inspection of the bronchoscope, swabbing of the shaft, the tip, and the suction/biopsy channel. After each of these sites was swabbed and the 70% alcohol pad or brush was placed in a zip-lock storage bag, the gloves were discarded and new gloves were donned.

After visual inspection was completed, a sterile 70% alcohol pad was removed from its package, and the entire external surface of the bronchoscope shaft was wiped with the alcohol pad which was then placed in a zip-lock storage bag. Each bag was labeled with time, date and area on bronchoscope swabbed. All surfaces were tested within five minutes. The latex gloves were discarded and new gloves were donned. A new sterile 70% alcohol pad was removed from its package and only the distal tip of the bronchoscope was swabbed. Then the alcohol swab was placed in a separate zip-lock storage bag, appropriately labeled. Again, the gloves were discarded. Before donning

clean gloves, one sterile package containing one160 centimeter bronchoscope cleaning wire with brush (provided by BARD, MD) was opened. Clean gloves were then donned and the sterile wire with brush was removed using clean technique. Four drops of 70% isopropyl alcohol from a sterile squeeze bottle were placed on the brush tip. Next the wire with brush were inserted the entire length of the suction/biopsy channel and then removed. The brush was removed and all sides were wiped with an alcohol pad. The alcohol pad was then placed in a storage bag appropriately labeled. This procedure was performed on each fiberoptic bronchoscope to prevent cross-contamination. While continuing to use clean technique, the modified Phenolphthalein DISCHAP" test was completed (explained in detail under measurement methods).

Sample and Setting

A convenience sample was taken from all the available fiberoptic bronchoscopes (n=27) located in the gastroenterology clinic and the operating room in a large medical center.

Methods

In previous studies (Perry & Monaghan, 1998; Phillips & Monaghan, 1997), a three-stage phenolphthalein test kit produced by CLUEFINDERS¤, Inc. (Tampa, Florida) was used. Since this test is no longer available the Phenolphthalein DISCHAP" Test (SEARCHIE¤) was used for this study. Nikkola (1999) successfully used the SEARCHIE¤ method and completed sensitivity, specificity, reliability and validity testing.

Nikkola (1999) described the Phenolphthalein DISCHAP" Test to be specific for human blood only and not other substances such as iodine. She completed two serial

dilutions where 0.9% normal saline was used as a control and found the sensitivity to be able to identify 1:10,000 parts blood to normal saline within 60 seconds. The sensitivity test was performed (with freshly collected human blood) on filter paper moistened with both distilled water and on sterile 70% isopropyl alcohol pads. She found the alcohol pads turned positive (pink coloration) immediately and the moistened filter paper took up to 60 seconds to reveal a positive reading. For this reason, she used the alcohol pads for her data collection. She also noted the test was reliable for up to four hours by placing blood on six alcohol pads, placing them in six separate plastic bags and testing one pad per hour with the phenolphthalein reagent. This method was utilized for this study based on Nikkola s results for sensitivity.

The phenolphthalein test is based on the chemical reaction of oxidation and reduction. The two active chemical elements of this test are phenolphthalein and hydrogen peroxide. If hemoglobin is present, the hydrogen peroxide is reduced and gives up a oxygen molecule to the phenolphthalein molecule. It is this oxidation of the phenolphthalein that causes the pink color change indicating the presence of blood.

Prior to using the test, a reliability test was performed on the solution by placing a drop of my blood on an alcohol pad and performing the test. This test was repeated for the bronchoscope brush as well. Once activity was confirmed, testing began on the alcohol pads in the zip-lock storage bags. Since there was enough reagent for 10 to 12 specimens, three sets of bronchoscope specimens were tested at the same time. Storage bags labeled bronchoscope one and two were tested first which included separate samples from the shaft, tip and suction/biopsy channels. Clean latex gloves were donned and an alcohol pad was removed and placed on a clean white piece of paper for a clearer view of

color changes. This was repeated for the remaining two bags. Each labeled bag was placed above each specimen to eliminate confusion. Once all nine specimens were on the white paper, the phenolphthalein tube containing two ampules was crushed and then shaken for one minute to mix the chemicals. At that time, one drop of reagent was placed on each specimen and observed for the presence or absence of pink color change within 60 seconds. The method was repeated until all the samples had been tested.

Nikkola (1999) reported that sterile 70% alcohol pads without blood would turn slightly pink tinged after two minutes. Readings were therefore obtained within 60 seconds of reagent placement. All testing of specimens occurred within five minutes of bronchoscope sampling. All results were recorded on a data collection form (see Appendix A.).

Plan for Data Analysis

Data was recorded on the data collection form (see Appendix A). Further analysis was not necessary due to the findings.

Summary

In this chapter, a descriptive design was described to determine the presence of visible and/or occult blood on fiberoptic bronchoscopes identified as ready for use. Methods for collecting and testing the specimens also were described.

CHAPTER IV: ANALYSIS OF DATA

Introduction

A descriptive study was conducted to determine the prevalence of visible and/or occult blood on fiberoptic bronchoscopes labeled ready for patient use. A total of 27 bronchoscopes located in a large military medical center were tested. In this chapter the sample will be discussed and the analysis/interpretation of the data will be provided. The questions presented in Chapter One of this study will be discussed.

Restatement of the Questions

The research questions were:

1.   What is the prevalence of visible and occult blood on the exterior and interior surfaces of fiberoptic bronchoscopes which are identified as ready for patient use?

2.   Is there any difference between manual (gastroenterology clinic) or machine (operating room) high-level disinfection as evidenced by the presence or absence of visible and occult blood on fiberoptic bronchoscopes identified as ready for patient use?

Results

The data were collected during one day at the military medical center. Personnel at this facility were not aware when data collection would take place. All 27 fiberoptic bronchoscopes were inspected for the presence of blood and then were tested with the three-step phenolphthalein blood indicator test.

The Gastroenterology Clinic maintained 24 of the 27 bronchoscopes tested (88.8%). The 24 bronchoscopes included four travel/pediatric bronchoscopes (16.6%).

Only the shaft and tip of the pediatric bronchoscopes were tested because the suction/biopsy channels were too narrow for the bronchoscope brush used for testing. The remaining 20 bronchoscope shafts, tips and suction/biopsy channels were tested. Upon visual inspection of the exterior surfaces of the bronchoscopes none were positive for visible blood and none of the exterior or interior surfaces of the bronchoscopes tested with the phenolphthalein blood indicator were positive within 60 seconds.

The operating room had three of the 27 bronchoscopes tested (11.2%). All three bronchoscopes were pediatric and, therefore, only the shafts and tips were exposed to the blood indicator test. The results mirrored the gastroenterology clinic. None of the specimens were positive for visible blood and none of the exterior surfaces (shaft, tip) were positive for occult blood within sixty seconds when exposed to the phenolphthalein blood indicator test.

The reagent used for the blood indicator test was then tested to ensure it was reading properly when exposed to blood. A drop of blood was placed on an alcohol pad and then placed a drop of the phenolphthalein reagent was then placed near the blood. The area around the blood turned pink within sixty seconds as would be expected if the reagent was phenolphthalein.

Summary

In this study visible and occult blood was not present on fiberoptic bronchoscopes identified as ready for patient use. Additionally, at this medical center there appears to be no difference between manual (see Appendix B) or machine(see Appendix C) high-level disinfection. These results are not consistent with previous studies completed by Morell, James et al.(1994), Phillips and Monaghan (1997), Perry (1997), and Nikkola

(1999) which all found visible and/or occult blood on various medical surfaces identified

as ready for patient use.

CHAPTER V: DISCUSSION, CONCLUSIONS & RECOMMENDATIONS

Introduction

In this chapter, the research questions will be presented, followed by a description of the study. The methodology will follow and the results of the study will be restated. The findings of the study are then summarized, and the recommendations for future practice presented.

Purpose of the Study

The purpose of this study was to determine the adequacy of decontamination and sterilization techniques for fiberoptic bronchoscopes as evidenced by the absence of visible and occult blood. The first research question posed was: What is the prevalence of visible and occult blood on the exterior and interior surfaces of fiberoptic bronchoscopes which are identified as ready for patient use? The second question posed was: Is there any difference between manual or machine high-level disinfection as evidenced by the presence or absence of visible and/or occult blood on fiberoptic bronchoscopes identified as ready for patient use. The findings from this study answer both of these questions.

Methodology

Approval from the Uniformed Services University of the Health Sciences and the military medical center s Institutional Review Boards was obtained. Also a representative from the medical center was obtained to sponsor the investigator.

On the day of data collection, clean gloves were donned and inspection for the visible presence of blood on the entire external shaft and distal tip of the bronchoscope was completed. This was done at the beginning of testing on every bronchoscope. If a

visible stain was located, it would have been swabbed with a 70% isopropyl alcohol pad and tested for blood using the modified Phenolphthalein DISCHAP" (disposable chemical applicators) Test to determine if the stain was blood. Data were entered on the data collection tool as yes or no for visible blood (see Appendix A).

Each bronchoscope (shaft, tip and suction/biopsy channel) was tested for occult blood utilizing the modified Phenolphthalein DISCHAP" Test (SIRCHIE¤). Clean technique was employed for all collection of data. This included donning clean latex gloves prior to visible inspection of the bronchoscope, swabbing of the shaft, the tip, and the suction/biopsy channel. After each of these sites was swabbed and the 70% alcohol pad or brush was placed in a zip-lock storage bag, the gloves were discarded and new gloves donned.

After visual inspection was completed, a sterile 70% alcohol pad was removed from its package and wiped over the entire external surface of the bronchoscope shaft and the alcohol pad was then placed in a zip-lock storage bag. Each bag was labeled with time, date, location in hospital and area on bronchoscope swabbed. All surfaces were tested within ten minutes. The latex gloves were discarded and new gloves donned. A new sterile 70% alcohol pad was removed from its package and only the distal tip of the bronchoscope was swabbed. Then the alcohol swab was placed in a separate zip-lock storage bag appropriately labeled. Again, the gloves were discarded. Prior to testing the suction/biopsy channel a sterile squeeze bottle was filled with 70% isopropyl alcohol. One sterile package containing one 160 centimeter bronchoscope cleaning wire with brush (provided by BARD) was opened and the sterile wire with brush was removed using clean technique. Four drops of 70% isopropyl alcohol from the squeeze bottle was

placed on the brush tip. Next the wire and brush were inserted the entire length of the

suction/biopsy channel and removed. The brush was then removed and placed in a

storage bag appropriately labeled. This procedure was performed on each fiberoptic

bronchoscope to prevent cross-contamination. Utilizing clean technique, the modified

Phenolphthalein DISCHAP" test was performed (explained in detail under measurement

methods).

<p align="center">Discussion</p>

In Chapter One, the research questions were presented. The first question asked

about the prevalence of visible and occult blood on various surfaces of fiberoptic

bronchoscopes identified as ready for patient use. As stated in Chapter Four, none of the

bronchoscopes tested positive for visible or occult blood. The second question asked if

there was a difference between manual or machine high-level disinfection. In this study,

there appears to be no difference between manual or mechanical disinfection in removing

blood.

Even back as far as 1859, Florence Nightingale believed and taught that asepsis

protected patients as well as medical personnel and promoted the healing process. She

also described how steam was better at removing dirt than room temperature water and

soap. The basic concept has not changed in over 100 years and the nursing profession

continues to strive for cleanliness and ensure standards are not only met but exceeded.

The results of this study demonstrate the vigilance in maintaining a clean environment in

the medical center examined and coincides with Florence Nightingale s theory of

cleanliness. It is the role of the nurse to ensure that proper disinfection is occurring and

to continue to question and test our procedures for infection control.

Conclusions

None of the fiberoptic bronchoscopes tested positive for visible and/or occult

blood. There are several possible reasons for these results. First, there may have been

increased vigilance in the months preceding data collection. It is unlikely the medical

center increased its vigilance because the staff were not aware of the month data would be

collected.

Second, the material of the fiberoptic bronchoscopes may be more resistant to the

adherence of blood or blood may be more easily removed form its surfaces than other

studied surfaces such as blood pressure cuffs, laryngoscope blades and handles, and pulse

oximeter probes. Currently fiberoptic bronchoscopes are composed of different materials

depending on the area of the bronchoscope. The flexible tip is made of fluoro rubber and

the body or insertion tube is made of polyester with a polyurethane coating. The control

head which was not tested in this study is composed of plastic reinforced with fiberglass.

Results may have been different if all the internal channels of the bronchoscopes were

tested (74% of internal channels were tested). Finally, the high-level disinfection

methods recommended by the APIC appear to be adequate for eliminating blood whether

manual (gastroenterology clinic) or mechanical (Steris) cleaning (Operating Room) is

performed.

Recommendations

Recommendations for future study include using a larger sample size over a longer

period of time. This may include involving multiple medical centers, not excluding

civilian facilities. The sample size may include other types of endoscopes, including but

not limited to colonoscopes and laporascopes. It is also possible a more sensitive blood

indicator test is available and could detect the presence of blood at more minute levels than the phenolphthalein blood indicator test utilized. Lastly, all the appropriate size bronchoscope brushes should have been available on the day of testing for completeness.

Recommendations for practice include not changing current cleaning practice for fiberoptic bronchoscopes. The current practice appears to be adequate. Future studies may include a cost comparison between manual disinfection and mechanical (Steris) disinfection.

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APPENDICES

APPENDIX A: DATA COLLECTION TOOL

Presence of Visible and Occult Blood on the Surfaces

of Fiberoptic Bronchoscopes

(Sample of Multi-use Tool)

I.   **Demographics**

    A.   **Date of specimen collection:**   ____/_____/_____

                           Day Month Year

    B. **Day of the week:**   **S M T W Th F S**

    B.   **Actual time of specimen collection:**   _____/_____

                           Hour   Min

I.   **Specific Unit:** _____

II.   **Type of Endoscope:** _____

Bronchoscope	Area Tested	Visible Blood		Occult Blood	
		Yes	No	Yes	No
Bronch #1					
Bronch #2					
Bronch #3					
Bronch #4					
Bronch #5					
Bronch #6					

Area Tested = E (Exterior), T (Distal Tip), BC (Biopsy Channel)

APPENDIX B: CLEANING PROTOCOL - GASTROENTEROLOGY CLINIC

Subject: Care and Cleaning ofEndoscopic Equipment

References: Infection Control Manual
              SGNA Guidelines for Infection Control in Endoscopy
              JCAHO Manual

Policy:

1.   All endoscopic equipment will be thoroughly cleaned and
disinfected between patients in order to prevent transmission of
organisms and preserve the life of the equipment.

2.   The cleaning will be done with an enzymatic detergent solution.

3.   High level disinfection will be accomplished by using a
glutaraldehyde based chemical germicide, dilution, temperature and
soaking time as per recommendations with additional guidelines as
per infection control committee.

Procedure:

   I.   Endoscopes
       A.   Cleaning

           1.   Immediately after the scope is removed from the
                patient, the air and water channels are to be
                cleared. The suction channel is to be flushed
                with detergent solution.

           2.   The soaking cap should be attached, the scope should
                then be placed in a contaimined bag and removed to
                separate cleaning area.

           3.   Immediately after arriving in the cleaning area and
                before manual cleaning, scope should be leak tested
                per manufacturers instructions. Results are
                documented in disinfection log.

           4.   All accessory pieces are to be removed and soaked
                in a detergent solutions. (A/W, suction, bx valves
                and diaphragm).

           5.   Scope is to be wiped down with detergent solution
                Ports are to be cleaned with Q-tips soaked in
                detergent solution.

           6.   Bx channel and suction channel (to lite source and
                tip of scope) are to be brushed cleaned and flushed
                with detergent solution.

IF USING AUTOMATIC SCOPE WASHER:

a. If scope washer is available proceed to
    disinfection part of instructions.
b. If scope washer is in use place scope in detergent
    solution to soak until scope washer can
    accommodate.

MANUAL CLEANING

a. Soak scope in detergent solution for 5 min. Using
    all channel irrigator - fill A/W channel with
    detergent and soak 5 min.
b. Rinse scope and all channels with tap water to
    remove detergent residue.

B. Disinfection

1. Scope washer
    a. Hook up scope to scope washer and run cycle.
        (42 minute cycle that includes a 20 minute
        disinfection-time).
    b. Add detergent as indicated by manufacturer.

2. Manual
    a. Fill all channels with disinfectant using all
        channel irrigator and suction.
    b. Soak scope in disinfectant for 20 min (use
        complete immersion for immersible scopes).
    c. Rinse scopes thoroughly in tap water using all
        channel irrigator and suction for channels.
        (Use 1500 cc H20 for channels to assure
        thorough rinsing).

C. Storage

1. Flush channels with alcohol before removing from
    scope washer. Depress air button for 2 min.
2. For manually cleaned scopes flush all channels with
    alcohol and hook up to wall 02
3. Dry all outside portions of scope.
4. Store without buttons and soaking caps.
5. Hang in well vented area.
6. Cover tip of scope with protective sponge

II. Accessory Equipment

ENDOSCOPIC ACCESSORY EQUIPMENT WILL BE DEFINED AS ANY
EQUIPMENT USED DURING A PROCEDURE THAT COMES INTO CONTACT
WITH PATIENT SECRETIONS OR BREAKS THE MUCOSA.

A. Disposable Equipment

1. All disposable equipment will be used on a 1 time basis only.

B. Reusable Equipment
   1. Any equipment that breaks the mucosa barrier (such as bx forceps) are to be cleaned and steam sterilized between pts.
   2. Water bottles are to be cleaned and steam sterilized daily.
   3. Cleaning brushes must be disinfected between usages (may not be used to clean 2 scopes in a row without disinfecting in between).
   4. Accessory equipment should not be care for in the same soaking bins as the scopes in order to prevent scope damage:

C. Other non-disable equipment
   1. Cleaning
      a. All accessory equipment is to be thoroughly cleaned between patients with a detergent solution.

If using automatic scope washer proceed to disinfection part of instructions.
      b. Soak equipment in detergent solution for 5 min.
      c. Rinse with H20 to prevent soap residue buildup.

   2. Disinfection
      a. Scope washer
         1. Insert equipment in scope washer and run thru 42 min cycle (20 min disinfection time).
      b. Manual
         1. Soak equip in disinfectant for 20 min.
         2. Rinse equip thoroughly.

   3. Storage
      a. Dry all equip at the end of the day.
      b. Store in well vented area.

III. General Surgery, ENT, Pulmonary and Radiology Scopes.
   A. Cleaning
      A. Scope is brought to GI cleaning room in red bag and cleaned in the same manner as the endoscopes.
   B. Disinfection
      1. Scopes are disinfected in the same manner as the endoscopes.
   C. Storage
      1. The scopes are stored in the same manner as the endoscopes.

IV. Cardiology and Ultra Sound Probes
    A. Cleaning
        1. Probe is brought to the GI cleaning room in a red
            bag.
        2. The submergible part of the probe is put in the
            sink and the non-submergible part is put on the
            counter next to the sink.
3. Probe is wiped down with 4x4s that are saturated
    with detergent and rinsed with hot water several
    times.
    B. Disinfection
        1. Probe is placed in the appropriate cidex container
            with the non-submergible part resting on hooks
            attached to outside of the container for 20 min.
        2. Probe is taken out of the cidex container and
            rinsed off with hot water thoroughly.
    C. Storage
        1. Dry off submergible portion of probe.
        2. Hang in well ventilated area until tech picks up
            probe.

APPENDIX C: CLEANING PROTOCOL - OPERATING ROOM

FIBEROPTIC SCOPES
DECONTAMINATION AND TERMINAL CLEANING

1. Contaminated Fiberoptic scopes are to placed in enzol for 3-5 minutes to break down all surface contaminants.

2. The F.O.S. must then be leak tested with the leak testing equipment. Attach the leak tester to the end of the fiberoptic scope while the scope itself is submerged in the enzol. Check the tip of the fiberoptic scope where it flexes to see if the bubbles appear. If bubbles appear then there is a leak and it must be services as soon as possible. If no bubbles appear, the leak tester is secured.

3. Place the cleaning wire through the larger of the two ports until it becomes visible, then retract the wire.

4. Suction the scopes port with a suction unit to collect any debris that may have been broken by the cleaning wire.

5. Using a small bristled scope brush, clean the inner aspects of both ports.

6. Fill a 60cc syringe with enzol and flush the fiberoptic scope through the smaller port, then flush with tap water.

7. Scrub the outer portion of the scope with the special scrub sponge.

8. Once the fiberoptic scope has been leak tested, suctioned, cleaned and flushed, it is ready for terminal cleaning.

9. The scope is to be placed in the Steris machine with the proper indicators and cleaning solution (which can be found in center core).

10. The fiberoptic scope is then placed back in the scope cart.