



TECHNOLOGY STATUS EVALUATION
PERSONAL PROTECTIVE EQUIPMENT

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INTRODUCTION

In order to promote the appropriate use of new or emerging endoscopic technologies which impact on endoscopic practice, the ASGE Technology Committee has developed a series of Status evaluation papers. By this process, relevant information about these technologies may be presented to practicing physicians for the education and care of their patients. In many cases, data from randomized controlled trials is lacking and only preliminary studies are available. Practitioners should continue to monitor the medical literature for subsequent data about the efficacy, safety and socioeconomic aspects of these technologies.

BACKGROUND

Personnel working in and other visitors to the endoscopy environment are exposed to many types of hazards - sharps, chemicals, pathogens, radiation, and lasers. Protection can best be accomplished by applying consistent practices whenever and wherever the potential for exposure exists. Actual risks include exposure to pathogens by needle stick injuries, splash and aerosolization; radiation; chemical exposure (38-60% responding reported symptoms associated with glutaraldehyde vapors¹); and laser injury (ocular or respiratory). The Occupational Safety and Health Act (OSHA) of 1991 established guidelines for healthcare facilities. According to the Blood Borne Pathogens Standard (OSHA ST 29 CFR part 1910.1030), OSHA requires the employer to evaluate each task and provide training to protect employees from exposure to harmful substances^{2,3}.

Definitions:

Blood-Borne Pathogens are pathogenic microorganisms that are present in human blood and can cause diseases in humans. These pathogens include but are not limited to hepatitis B virus

(HBV) and human immunodeficiency virus (HIV) (BBP Standard 1910/1030 definitions)^{4,5}.

Other Potentially Infectious Material (OPIM) is defined as the following human body fluids: semen, vaginal secretions, cerebrospinal fluid, synovial fluid, pleural fluid, pericardial fluid, peritoneal fluid, amniotic fluid, saliva in dental procedures, any fluid that is visibly contaminated with blood, and all body fluids in situations where it is difficult or impossible to differentiate between body fluids^{2,3}.

Personal Protective Equipment (PPE) is specialized clothing or equipment worn by an employee for protection against a hazard, which does not permit blood or OPIM to pass through clothes, skin, eyes, or mouth. General work clothes (uniforms, pants, shirts, lab coats) not intended to function as protection against a hazard are not considered PPE^{2,3,6}.

Occupational Exposure is a reasonably anticipated skin, eye, mucous membrane, or parenteral contact with blood or OPIM that may result from the performance of an employee's duties^{2,3}.

Universal Precautions (UP) assumes that the blood and body fluids of all patients are considered potentially infected with the AIDS virus (HIV), hepatitis B virus (HBV), hepatitis C virus (HCV), and other blood-borne pathogens, and must be handled accordingly to protect employees^{2,3}.

TECHNICAL CONSIDERATIONS

Gowns may be reusable or disposable, and are available in a range of permeability options (Table 1). Material composition may include fabric, paper, plastic, or combinations⁷.

Permeable (cloth patient-type): Body fluids may permeate through the gown into the worker's clothing.

Semi-permeable (paper-type): If the splash is not excessive this type will protect the worker.

Table 1.
Gowns

MANUFACTURER	TYPE/ DESCRIPTION	PRICE PER UNIT
Single use		
American Threshold Ind., Inc.	Plastic (M/L)	\$0.65 ea.
Medline Industries Inc.	Water-resistant paper	\$0.65 ea.
Kimberly-Clark	SMS* polypropylene (PP)	\$0.80 ea.
Kimberly-Clark	Impervious, polyethylene(PE) film	\$0.85 ea.
Kimberly-Clark	Impervious, PE film + fabric	\$1.01 ea.
Kimberly-Clark	SMS polypropylene, sterile	\$2.63 ea.
Baxter	Fluid-resistant, open back	\$1.04 ea.
Baxter	Fluid-proof, open back, uni-size	\$1.48 ea.
Baxter	Sterile paper	\$1.90 ea.
GI supply/Chek-Med	Defenz apron-gown	\$2.45 ea.
Multiple use		
Standard Textile	Surgical, sterile, fluid resistant, reusable (L/XL)	\$28.18 ea. †

* SMS = spunbond, meltblown, spunbond

† Does not include estimated number of uses or cleaning/ reprocessing costs

Non-Permeable (moisture repellent): This will protect the worker from any type of splash. This is can be made of fabric which may be laundered (although limited by a finite number of washings before the barrier is no longer effective), or disposable plastic.

Eye protection is available in prescription and non-prescription safety goggles or glasses, face shields for eyes and face, or add-on plastic adapters for glasses (Table 2). Eye protection must meet certain minimum requirements under the OSHA standard. It should be designed to provide adequate protection against the particular hazards to which the employee is exposed^{4,5}.

The equipment should be comfortable, easy to clean, and capable of being disinfected

The fit should be snug enough to protect properly and still not restrict movement.

The equipment should be durable and kept clean and in good repair^{4,5}.

Masks are available in a variety of materials and shapes (half-sphere, flat, or pleated) with ties or an elastic band to secure to the face (Table 3). Some masks contain latex. Face shields combining mouth and eye protection are available. The objective of wearing a mask during endoscopy procedures is to protect the wearer from splashing⁸.

Gloves are available in latex, non-latex, powdered, unpowdered, hypoallergenic, or non-allergenic (Table 4). The wearer must determine which is most appropriate for his/her needs⁹. Non-latex gloves may have a diminished puncture resistance after an extended wearing period.

Radiation Protection. Please refer to ASGE

Table 2.
Eye protection

MANUFACTURER	TYPE/ DESCRIPTION	PRICE PER UNIT
3M	Disposable plastic full face shield	\$1.44 ea.
3M	Reusable anti-fog spectacle	\$5.89 ea.
3M	Reusable anti-fog goggle	\$16.05 ea.
3M	Reusable full faceshield	\$38.00 ea.
Baxter	Reusable plastic goggles	\$6.72 ea.
Herarty Industries	Plastic eye wear	\$1.10 ea.
Moore Medical Goggles	Plastic eye wear	\$1.24 ea.
Moore Medical Shields	Face shield	\$1.54 ea.
North Safety Equipment	Glass, eye safety	\$1.12 ea.
Kimberly-Clark/Tecnol	Plastic 3/4-length visor	\$1.99 ea.
Kimberly-Clark/Tecnol	Plastic full-length visor	
Timely Medical	Frames/shields/ replacement lens	\$1.00 ea.

Technology Assessment Status Evaluation Report on Radiation Safety During Endoscopy¹⁰ and SGNA monograph on Radiation Safety in the Endoscopy Setting¹¹. Leaded eyewear is available.

Laser protection. Please refer to ASGE Technology Status Evaluation Report on Developments in Laser Technology¹². Eyewear and masks are available

INDICATIONS AND EFFICACY

The intent of OSHA is to guide the correct use of PPE for each anticipated exposure. However, risks for endoscopy have not been quantified, and there are currently no OSHA guidelines specific to endoscopy. Therefore, it is up to the individual institution to interpret¹³.

“Gloves shall be worn when it can be reasonably anticipated that the employee may have contact

TABLE 3.
Masks

MANUFACTURER	TYPE/ DESCRIPTION	PRICE PER UNIT
Masks		
3M	Pleated, earloop	\$0.10 ea.
3M	Molded cup	\$0.11 - \$0.15 ea.
3M	Pleated, tie-on	\$0.11 - \$0.15 ea.
3M	Duckbill	\$0.15 - \$0.20 ea.
3M	Fluid resistant, pleated, tie on	\$0.28 ea.
Kimberly-Clark/ Tecnol	Polypropylene or cellulose/polyester, duckbill*	\$0.10 ea.
Kimberly-Clark/ Tecnol	Paper, pleated, ear loops	\$0.11 ea.
Kimberly-Clark/ Tecnol	Cellulose/ polyester, pleated*	\$0.12 ea.
Kimberly Clark/ Tecnol	Polypropylene, pleated	\$0.13 ea.
Kimberly-Clark/ Tecnol	Cup, polyester	\$0.14 ea.
Kimberly-Clark/ Tecnol	Splash-resistant coating, pleated*	\$0.17 ea.
Kimberly-Clark/ Tecnol	Fluid-shield, pleated or duckbill*	\$0.23 ea.
Kimberly-Clark/ Tecnol	Cup, fluid shield	\$0.40 ea.
Washington-Greene PAB	Paper contour cup	\$0.16 ea.
Mask/Eye protection		
3M	Pleated, earloop with face shield	\$0.75 ea.
3M	Pleated, tie-on, with face shield	\$0.80 ea.
3M	Duckbill, tie-on, with face shield	\$0.85 ea.
3M	Fluid resistant, pleated, with face shield	\$0.85 ea.
Kimberly Clark/ Tecnol	Splash-resistant coating, pleated, visor*	\$0.64 ea.
Kimberly Clark/ Tecnol	Fluid-shield, pleated or duckbill, visor*	\$0.77 ea.
Kimberly Clark/ Tecnol	Cup, fluid shield, visor*	\$0.97 ea.
Medline Industries Inc.	Paper with plastic visor	\$0.91 ea.*

*also available in fog-free versions

with blood, other potentially infectious materials, mucous membranes and non-intact skin..."³.

"Masks, Eye Protection, and Face Shields. Masks in combination with eye protection devices, such as goggles or glasses with solid side shields, or chin-length face shields, shall be worn whenever splashes, spray, splatter or droplets or other infectious materials may be generated and eye, nose, or mouth contamination can be reasonably anticipated"³.

"Gowns, aprons, and Other Protective Body Clothing. Appropriate protective clothing such as, but not limited to, gowns, aprons, lab coats, clinic jackets, or similar outer garments shall be worn in

TABLE 4.
Gloves

MANUFACTURER	TYPE/ DESCRIPTION	PRICE PER UNIT
LATEX		
American Health Care Products	Powder-free, non-sterile (S-L)	\$0.10 ea.
Ansell- Perry Inc.	White latex, sterile (6-8 1/2)	\$0.30 ea.
Ansell-Perry Inc.	Powder-free, non-sterile (xs-xl)	\$0.07 ea.
Baxter	Brown latex, sterile, (6 8 1/2)	\$2.16/pr
Baxter	Large individually packaged	\$0.16 ea.
General Medical	Light texture, uni-size	\$0.08 ea.
Johnson & Johnson	Brown latex, sterile, hypoallergenic (5 1/2 -8)	\$1.98/pr
Johnson and Johnson	Surgical	\$0.56/pr
Pharmaseal	Powdered, unbeaded	\$0.04 ea.
Pharmaseal	Powdered, beaded cuff	\$0.05 ea.
Pharmaseal	Unpowdered	\$0.06 ea.
Pharmaseal	Powder-free, textured, beaded cuff	\$0.06 ea.
Pharmaseal	Single sterile, large	\$0.11 ea.
Phoenix	Powder-free	\$0.08 ea.
Safeskin Corp.	Hypoallergenic, powdered	\$0.06 ea.
Safeskin Corp.	Powder free	\$0.07- \$0.010 ea.
Safeskin Corp.	Powdered	\$0.07 ea.
Savacare	Powdered, non-sterile	\$0.05 ea.
Shamrock	Low-protein, powder-free, (xs-xl)	\$0.05 ea.
Shamrock	Low protein, lightly powered (xs-xl)	\$0.04 ea.
Triflex	Sterile surgeon's gloves	\$0.33/pr
VINYL		
American Health Care Products	Synthetic, non-latex, non-sterile (S-M)	\$0.06 ea.
Baxter	Powder-free textured	\$0.06 ea.
Baxter	Large, powder-free, beaded cuff	\$0.06 ea.
Baxter	Utility-large	\$0.10 ea.
Dash Medical Gloves Inc.	PVC polymer (powder free)	\$0.07 ea.
Maxim Medical	Sensicare	\$0.04 ea.
Medline Industries Inc.	Powder-free, sterile	\$0.26 ea.
Shamrock	Lightly powdered (xs-xl)	\$0.04 ea.
Shamrock	Powder-free (xs xl)	\$0.05 ea.
Tilitson	Powder free	\$0.11 ea.
Triflex	Powdered	\$0.18 ea.
Triflex	Single, sterile (S/M/L)	\$0.12- \$0.13 ea.
NITRILE		
Best Manufacturing	(S/M/L)	\$0.15 ea.
Nitrimed	Powder-free	\$0.15 ea.
Shamrock	Protein-free, powdered (XS-XL)	\$0.10 ea.
Shamrock	Protein & powder-free (XS-XL)	\$0.11 ea.
Shen-Wei (USA)	Unsterile (S/M/L)	\$0.12 ea.
Synthetex	Latex-free	\$0.07 ea.

occupational exposure situations. The type and characteristics will depend on the task and degree of exposure anticipated”³.

When cleaning endoscopes it is important that the individual choose a glove made of material that is appropriate to the situation or the chemical being used. For information contact the manufacturer regarding testing on each glove⁷. Many units now use a glove made of nitrile.

“Employers shall ensure that employees wash their hands immediately or as soon as feasible after removal of gloves or other personal protective equipment.”³

FINANCIAL CONSIDERATIONS

The Facility must provide PPE and training in its use at no cost to the employee. The employer is responsible for enforcing the use of PPE by staff and can be penalized for failure to comply with OSHA regulations³. Costs can vary depending on purchasing contracts and type of PPE selected (Tables 1-4: costs determined as of 9/98). It is the responsibility of the wearer to communicate special needs (e.g. allergies) as well as preference, to the purchasing agent of the facility. The cost of PPE per procedure is a function of the number of wearers and the amount and type of PPE used per person. Although these items are an inherent expense, the cost of PPE is nominal when compared to the expense of treating employees who have become infected (average cost ranges from \$3,000 to \$6,000), and potential OSHA fines for non-compliance.

SUMMARY

Personal protective equipment, when used properly, can protect the wearer from harmful exposure. The selection of appropriate PPE should be individualized to the type and degree of exposure anticipated.

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