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Improving safety of personnel exposed to disinfectants by introducing an Endoscopy Quality Assurance Program

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KEYWORDS

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Endoscopy

Abstract *Background:* Chemical disinfection is the most commonly used method in gastrointestinal endoscopy reprocessing. The main problem with chemical disinfection is that it is potentially harmful to humans. Risk assessment of employees using toxic substances is recommended and the control of exposure to these substances is required. In 2003, an endoscopy quality-assurance program was instituted in a secondary care governmental hospital in Egypt.

Aim: The aim of the study was to assess the risk to health of personnel exposed to disinfectants in the course of their work and determine the effect of instituting an endoscopy quality-assurance program on the safety of personnel exposed to disinfectants.

Materials and methods: Health surveillance was provided for personnel exposed to disinfectants in the endoscopy unit over an 8-year period between January 2004 and January 2012. A quality improvement program was implemented (improving ventilation, providing instructions and education) to control exposure to these substances. The effectiveness of the change was assessed.

Abbreviations: COSHH, control of substances hazardous to health; PPE, personal protective equipment.

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Results: Prior to a quality assurance program being implemented, allergic reactions related to disinfectants were reported in 33% of working days in 2004. Subsequent allergic reactions decreased to 6–8% in 2010 and 2011 and this was contingent on the solution used for reprocessing.
Conclusion: The implementation of a quality assurance and improvement program in endoscopy unit improved the safety of personnel exposed to disinfectants.

Introduction

Chemical disinfection is the most commonly used method for disinfection in gastrointestinal endoscopy reprocessing. The main problem with chemical disinfection is that it is potentially harmful to humans.[1] Aldehydes including glutaraldehyde are the most frequently used. Glutaraldehyde enables rapid disinfection and is economical however it is classified by the Health and Safety Executive in the United Kingdom as an irritant and regulations relating to the control of substances hazardous to health (COSHH) require employers to assess the risk to employees using toxic substances of which glutaraldehyde is one.[1] The COSHH regulations require the risk of exposure to glutaraldehyde to be controlled. This may include air monitoring to ensure that concentrations of glutaraldehyde remain below the Maximum Exposure Limit of 0.05 ppm, for both short-term (15 min) and long-term (8 h time-weighted average) exposure.[2] Peak vapor concentrations should not exceed this level. The main disadvantage of glutaraldehyde is that it is irritant and causes sensitization.[2] The vapor phase may cause irritation of the nose, eye, throat and respiratory system. The liquid phase may cause skin irritation.[1] Peracetic acid is a highly effective disinfectant but currently available commercial preparations are expensive and it too is highly irritant at high concentrations.[1] There has been reports of burns on hands or arms with accidental contact.[1] It is a toxic substance and likely to be hazardous to health even though it is not currently subjected to the same controls as the aldehyde disinfectants.[1]

Bolak Eldakror Hospital is a secondary-care governmental hospital in Giza, Egypt. The gastrointestinal endoscopy unit was set up in 1999. A quality-assurance program was instituted in 2003.[3–9] Accordingly, quality indicators developed by the American Society of Gastrointestinal Endoscopy and the British Society of Gastroenterology were implemented.[10,11] For easy application, quality indicators were identified for five major groups: patients, procedures, endoscopists, assistant staff and equipment. Process or outcome indicators were used to evaluate and monitor the quality of endoscopic procedures and the performance of staff. Benchmarking was used to assess suboptimal performance. A quality improvement process was implemented; this involved changing some of our practices to improve the quality of our endoscopic care and patient outcomes. Quality improvement was a continuous process based on Deming cycle for continuous quality improvement [Plan-Do-Check-Act].[12] Health surveillance of personnel exposed to disinfectants was established in 2004. The aim of the study was to assess the risk to health of personnel exposed to disinfectants in the course of their work and determine the effect of instituting an endoscopy quality-assurance program on the safety of personnel exposed to disinfectants.

Materials and methods

The study was performed in a secondary-care governmental hospital in Egypt. The endoscopy unit is furnished with four upper gastrointestinal endoscopes (Olympus GIF-E and GIF-Q230) and two colonoscopes (Olympus CF-EL and CF-230L). The average endoscopy volume is 40 procedures per month, 80% of these are esophago-gastro-duodenoscopies and 20% lower gastrointestinal endoscopies (sigmoidoscopy and colonoscopy). Endoscopic procedures are performed twice per week. Emergency cases (bleeding) are performed on the morning of the next day. The endoscopy unit is staffed by four endoscopists and five qualified nurses. Quality in endoscopic procedures is discussed with staff from their first day in the unit and they are provided with a handbook which includes unit policy and practice guidelines. Assessment, monitoring and improving performance are performed. Regular monthly meetings for open discussion and education are held. Staff and assistant staff are encouraged to identify areas that need improvement. Nursing staff receive supervised training for their first month in the unit. After training they are supervised until judged competent. Endoscope reprocessing and disinfection are carried out in a separate room. A written protocol for decontamination and reprocessing of endoscopes and their accessories is available (table 1). A checklist for reprocessing is used to ensure compliance with the protocol. Three manual disinfectors (Olympus TD-20) are used for disinfection. Glutaraldehyde 2% and peracetic acid are the most commonly employed disinfectants. The time of exposure to the glutaraldehyde 2% is 20 min and peracetic acid is 10 min. Symptoms thought to be related to disinfectant exposure are assessed at the end of each working day. Nurses record disinfection procedures.

Health surveillance was provided for personnel exposed to disinfectants over an 8-year period between January 2004 and January 2012. A quality improvement program was implemented (improving ventilation, providing instructions and education) to control exposure to these substances. The effectiveness of the change was assessed.

The study was a prospective one. All nurses responsible for the reprocessing of endoscopes were included in the study. A risk assessment check list was used. Allergic reactions recorded included chest symptoms (cough, asthma), conjunctivitis (red conjunctiva, tears, itching), rhinitis (running nose, sneezing) and skin symptoms (dermatitis, rashes, itching). The working days in which the staff came into contact with disinfectants, during reprocessing, were recorded. The working days in which one staff or more reported allergic reactions to disinfectant, type of disinfectant and the allergic symptoms were also recorded. Microsoft Excel was the database used for storage and analysis of the data. The working days in which staff came

Table 1 Cleaning and disinfection procedures.

Pre-cleaning
- Feed water (10 sec) followed by air (10 sec)
- Aspirate enzymatic detergent solution
- Aspirate water followed by air (repeat three times or until aspirated water is clear)
- Wipe insertion tube with a soft lint-free cloth soaked in detergent solution

Leakage testing
Perform leak test procedure

External cleaning
- Immerse entire endoscope in the detergent solution (60 sec)
- Scrub all external surfaces
- Wash all valves and immerse in detergent solution

Brushing through suction & biopsy channels
- Insert channel cleaning brush through the channel opening into insertion tube and universal cord
- Push and pull the brush (3 times in each channel)
- Observe and clean the end of the brush each time it emerges from the end of the endoscope before pulling it back through the channel and after each use

Flushing of internal channels with detergent
Flush all channels with detergent using the channel cleaning adaptor

Intermediate rinsing and drying
- Immerse the entire endoscope in clean water
- Flush all channels with clean water until thoroughly rinsed
- Dry external surface of the endoscope with Kleenex and flush all channels with air to expel water

Disinfection
- Immerse entire endoscope in disinfectant solution and allow to remain for the recommended period of time
- Pump disinfectant solution through all channels
- Dry external surface of the endoscope and flush all channels with air to expel disinfectant solution

Final rinsing and drying
- Immerse entire endoscope in clean water (60 sec)
- Flush all channels with clean water until thoroughly rinsed
- Dry external surface of the endoscope and flush all channels with air
- Flush all channels with 30 ml ethyl alcohol (70%)
- Flush all channels with air to expel the alcohol
- Wipe endoscope with an alcohol saturated cloth
- Wipe external surface dry

into contact with disinfectants were 39 working days in 2004, 117 in 2005, 148 in 2006, 147 in 2007, 153 in 2008, 179 in 2009, 190 in 2010 and 204 in 2011. The use of disinfectants is shown in fig. 1.

Between 2004 and 2012 annual quality assurance reports were transmitted to an independent experienced endoscopist with a particular interest in quality assurance for comment and advice.

Results

Allergic reactions related to disinfectants are shown in table 2. Prior to a quality assurance program being implemented, allergic reactions related to disinfectants were reported in 13 (33%) working days in 2004. Subsequently, following implementation of the quality improvement program, allergic reactions

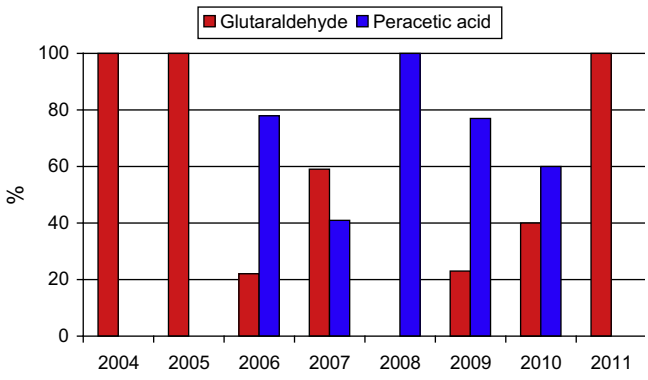

Figure 1 The use of glutaradehyde 2% and peracetic acid over studied years.

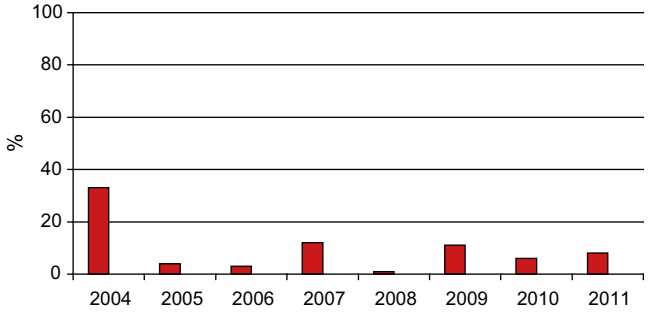

Figure 2 Allergic reactions related to disinfectants.

decreased to 6–8% in 2010 and 2011 as noted in fig. 2 and this was contingent on the solution used for reprocessing. Allergic reactions related to glutaraldehyde 2% and peracetic acids are shown in tables 3 and 4 and fig. 3. Glutaraldehyde 2% was not available in 2008 and peracetic acid was not available in 2004, 2005 and 2011.

Discussion

Gastrointestinal endoscopy is an essential diagnostic and therapeutic service for outpatient and intensive hospital settings. Optimal design of facilities and services and professional administration for safety, quality, and efficiency are important to its success on each of these levels.[13] Developing a modern endoscopy unit requires instituting a quality assurance program, continuous training and monitoring of service delivery.[14] Continuous quality improvements have been recommended by professional societies as a part of every endoscopy program.

The common method of decontamination of endoscopes is immersion in two percent activated alkaline glutaraldehyde for 20 min. Glutaraldehyde is highly effective for the disinfection of endoscopes, but it is irritant and allergenic. It must be used only in a well-ventilated room large enough to ensure adequate dilution of vapor, exhaust-vented cabinet or an enclosed automated processor.[2] If a risk assessment shows that there is a significant risk to the health of employees then health surveillance should be carried out. It is important that the results of health surveillance lead to action that will benefit the health of employees.[2]

Table 2 Allergic symptoms related to disinfectants.

Years	Working days	Cough	Rhinitis	Conjunctivitis	Itching
2004	39	11 (28%)	3 (8%)	6 (15%)	3 (8%)
2005	117	2 (2%)	0	3 (3%)	0
2006	148	0	0	1 (1%)	3 (2%)
2007	147	3 (2%)	8 (5%)	5 (3%)	4 (3%)
2008	153	0	0	1 (0.7%)	0
2009	179	14 (8%)	17 (9%)	17 (9%)	0
2010	190	6 (3%)	8 (4%)	8 (4%)	0
2011	204	6 (3%)	8 (4%)	9 (4%)	0

N.B. More than one symptom may occur in the same working day.

Table 3 Allergic symptoms related to glutaraldehyde 2%.

Years	Working days	Cough	Rhinitis	Conjunctivitis	Itching
2004	39	11 (28%)	3 (8%)	6 (15%)	3 (8%)
2005	117	2 (2%)	0	3 (3%)	0
2006	33	0	0	0	0
2007	87	2 (2%)	8 (9%)	5 (6%)	4 (5%)
2008[a]	–	–	–	–	–
2009	42	14 (33%)	17 (40%)	17 (40%)	0
2010	76	5 (7%)	6 (8%)	8 (11%)	0
2011	204	6 (3%)	8 (4%)	9 (4%)	0

N.B. More than one symptom may occur in the same working day.
[a] Glutaraldehyde 2% was not available.

Table 4 Allergic symptoms related to peracetic acid.

Years	Working days	Cough	Rhinitis	Conjunctivitis	Itching
2004[a]	–	–	–	–	–
2005[a]	–	–	–	–	–
2006	115	0	0	1 (1%)	3 (3%)
2007	60	1 (2%)	0	0	0
2008	153	0	0	1 (0.7%)	0
2009	137	0	0	0	0
2010	114	1 (1%)	2 (2%)	0	0
2011[a]	–	–	–	–	–

N.B. More than one symptom may occur in the same working day.
[a] Peracetic acid was not available.

In this study we assessed the risk to health of personnel exposed to disinfectants in the course of their work and determined the effect of instituting an endoscopy quality-assurance program on the safety of personnel exposed to disinfectants. The initial risk assessment performed in 2004 showed that working days with allergic reactions related to disinfectants were reported 33% of the time. Staff reported these symptoms while working with glutaraldehyde. Consequently the disinfection room was furnished with two window ventilators to ensure adequate ventilation. Annual health checks showed that allergic reactions decreased to 4% and 3% in 2005 and 2006, respectively but increased again reaching 12% and 11% in 2007 and 2009, respectively. These were also related to exposure to glutaraldehyde. Staff reported symptoms while working with glutaraldehyde in 18% and 45% of the time in 2007 and 2009 while they reported symptoms while working with peracetic acid in 2% in 2007 and with no effect reported in 2009. Glutaraldehyde 2% was not available in 2008. The results of the annual health checks were communicated to staff. The reasons of increased allergic reactions were identified. The tray cover was not regularly placed over the top tray during the immersion of the endoscope in glutaraldehyde. Glutaraldehyde spillage occurred several times. Glutaraldehyde had drained on the floor because the drain cock of the manual disinfector was not always closed before filling with glutaraldehyde. Staff was encouraged to be more careful and pay greater attention to safety in reprocessing. Also they were provided with information about the safe use of glutaraldehyde and clean up spills whether small or large spills. As a result allergic reactions decreased to 6% and 8% in 2010 and

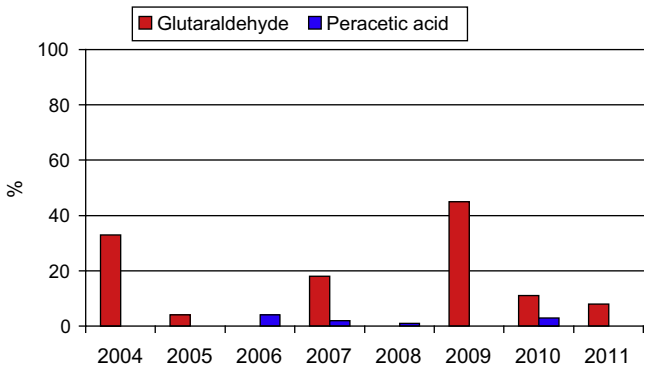

Figure 3 Allergic reactions related to glutaraldehyde 2% and peracetic acid, gluaraldehyde was not available in 2008, peracetic acid was not available in 2004, 2005, 2011.

2011, respectively. In spite of these measures, allergic reactions are still too high for our staffs who work with glutaraldehyde (11% in 2010 and 8% in 2011). A nurse, who has a previous history of asthma, was suffering from persistent cough when she came into contact with glutaraldehyde. She was excluded from work with disinfectants. Glutaraldehyde vapor monitoring methods are not available in the hospital. A further audit is planned to assess the risks in order to improve the process further.

Adverse reactions to glutaraldehyde are common among endoscopy personnel who come in contact with it.[15] They must be protected. Every endoscopy unit should develop and implement systems and procedures to minimize or eliminate exposures to glutaraldehyde. The use of substitute disinfectants and the provision of a fully automated washer/disinfector with a local air exhauster should be considered.[15]

Our hospital is not in a position to eliminate glutaraldehyde or to have automated reprocessing equipment at present because of financial reasons. The cost of one bottle of glutaradehyde 2% is 70 Egyptian pounds and peracetic acid is 213 Egyptian pounds. Because of the cost differential between the two disinfectants, however, access to peracetic acid has been suboptimal. To improve safety of staff working in areas where glutaraldehyde has to be used for disinfection, routine health screening is mandatory with annual health checks for the occurrence of any symptoms related to glutaraldehyde exposure.[1] Staff must be properly informed, trained and supervised. Education is essential for the safe management of disinfectants. Written procedures for safe working practices should be provided for all members of the staff. They should include instructions regarding the use of control measures and spillage procedures.[1] Adequate ventilation is an essential part of any glutaraldehyde management strategy.[16] Other measures that can be taken include: keeping lids on all containers and safe disposal procedures (rather than pouring down the drain).[2] Additionally, personal protective equipment (PPE) should be provided. COSHH limits the use of PPE to those situations where other measures cannot adequately control exposure.[2] When handling glutaraldehyde, gloves (nitrile not latex), aprons, goggles, respirators are all suitable PPE, however these are not foolproof and steps should be taken to ensure that equipment is regularly inspected, maintained and validated for effectiveness.[2]

Employers are responsible for providing a safe and healthful workplace for their employees and to assure the safety and health of employees by setting and enforcing standards, providing training, education and encouraging continual improvement in workplace safety and health.[17]

This audit describes the health hazards from exposure to chemical disinfectants for endoscopes in a secondary care government hospital in Egypt and the implementation of continuous quality improvement to control exposure to disinfectants and improve safety of health care workers exposed to disinfectants.

Conclusion

The implementation of a quality assurance and improvement program in endoscopy unit improved the safety of personnel exposed to disinfectants.

Conflict of interest

None declared.

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