



Department of Veterans Affairs Office of Inspector General

Healthcare Inspection

Issues Related to Ultraviolet Germicidal Irradiation Light Exposure in an Operating Room Lebanon VA Medical Center Lebanon, PA

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Executive Summary

The VA Office of Inspector General Office of Healthcare Inspections conducted an inspection to determine the validity of allegations made by an anonymous complainant. A complainant alleged that a surgical patient and 10 Lebanon VAMC employees suffered injury due to Ultraviolet Germicidal Irradiation (UVGI) light overexposure. The purpose of the review was to determine whether this and related allegations had merit.

We substantiated the allegation that Operating Room (OR) staff was harmed on January 17, 2012, as a result of inadvertent UVGI light overexposure, but the patient was not, because he was protected from ultraviolet light exposure (UV) by surgical drapes. Affected facility staff suffered temporary blindness, eye irritation, or skin burns. The extent of the overexposure was not known until the following morning when the staff noticed symptoms of overexposure from the UVGI lights. We found that facility leadership acted promptly by reporting the incident, notifying and referring employees for care, and disabling the UVGI light switch.

We did not substantiate the allegation that facility management was previously warned about potential safety hazards from UVGI light overexposure.

We substantiated the allegation that there were no warning labels on the UVGI light switch. Guidance from medical and technical journals contains recommendations regarding staff safety and installation of mechanisms to ensure that UVGI lights are not accidentally turned on. There were no signs to warn the OR staff that the UVGI lights were on. No mechanisms were in place to prevent lights from being turned on and because of this, staff were unaware the lights were on during an operative procedure.

Facilities leaders took immediate action to disconnect UVGI lights the same day exposures were reported. At the time of our site visit on March 7, 2012, we verified that the UVGI lights were disconnected and facility leaders ensured that they would remain inoperable.

We made no recommendations.



DEPARTMENT OF VETERANS AFFAIRS
Office of Inspector General
Washington, DC 20420

TO: Director, VA Healthcare (10N4)

SUBJECT: Healthcare Inspection –Issues Related to Ultraviolet Germicidal
Irradiation Light Exposure in an Operating Room
Lebanon VA Medical Center, Lebanon, PA

Purpose

The VA Office of Inspector General (OIG) Office of Healthcare Inspections received allegations that patients and employees of Lebanon, PA, VA Medical Center suffered injury due to overexposure to ultraviolet germicidal irradiation (UVGI) at that facility. The purpose of this review was to determine the validity of these allegations.

Background

A. Lebanon, PA, VA Medical Center (VAMC)

Lebanon VA Medical Center (the facility) is located in Lebanon, Pennsylvania, and is 1 of 10 medical centers that comprise Veterans Integrated Service Network 4. It provides acute medical, surgical, and behavioral health care, and inpatient hospice care. Additional services provided by the facility include a Community Living Center, Home Based Primary Care, Homemaker Home Health Care, Community Residential Care, Adult Day Health Care, and Homeless Veteran Care.¹

B. Ultraviolet Germicidal Irradiation (UVGI)

Ultraviolet (UV) light may be toxic to microorganisms. Since this observation in the first half of the twentieth century, UV light has been utilized as a disinfectant in laboratory, medical and other settings.² Brickner et. al. have noted that a wide range of airborne respiratory pathogens are susceptible to deactivation by UVGI.³ Thus, UVGI lights have

¹ For example, see: <http://www.lebanon.va.gov/index.asp> [accessed May 7, 2012]

² <http://www.engr.psu.edu/iec/abe/control/ultraviolet.asp> [accessed May 8, 2012]

³ Brickner PW, Vincent RL, First M, Nardell E, Murray M, Kaufman W, *Public Health Rep.* 2003 Mar-Apr;118(2):99-114.

been used in healthcare facilities to control the spread of airborne infectious particles in ORs. Memarzadeh has noted, “Ultraviolet germicidal irradiation (UVGI) has been used to “scrub” the air in health care facilities and laboratories for many decades.”⁴

Consistent with the above practice, the facility had one OR (OR #1) configured for UVGI lamps, which were used during orthopedic surgeries to minimize the risk of post-operative infection rates. Staff had training in the use of personal protective equipment (PPE) during surgery, including the use of goggles and sunscreen, to avoid the effects of UVGI overexposure.

C. Allegations

An anonymous complainant contacted VA’s OIG Hotline Division and alleged that several facility surgical patients and a facility surgical team suffered adverse effects from inadvertent overexposure to UVGI. These effects allegedly included first degree burns to the face and photokeratitis (corneal burns) with loss of visual acuity. Additionally, it was alleged that:

- A patient and 10 facility employees were unknowingly exposed to UVGI for up to 4 hours without any protection.
- A surgeon lost his vision for 3 days and the rest of the OR team suffered problems with night vision and skin burns.
- Several other patients and staff were burned with no reports or follow-up.
- UVGI light switches had no warning label and were on a standard switch.
- Management was warned multiple times that the UVGI lights were unsafe and did not follow Occupational Safety & Health Administration (OSHA) or Association of Peri-Operative Registered Nurses (AORN) standards in this regard.

Scope and Methodology

On March 7–8, 2012, we conducted a site visit and toured OR #1 to inspect the UVGI lights and switch referred to in the complainant’s letter. We interviewed managers and employees knowledgeable of the incident including 9 of 10 OR team members (a student who was present during this incident was unavailable for an interview). We reviewed the electronic medical records (EMRs) of the affected patient and employees, employee training records, facility policies, and other relevant documents.

⁴ Memarzadeh F, Olmsted, RN, Bartley, . MPH, CIC,b and JM, “Applications of ultraviolet germicidal irradiation disinfection in health care facilities: Effective adjunct, but not stand-alone technology,” *American Journal of Infection Control* June 2010

We conducted the inspection in accordance with the *Quality Standards for Inspection and Evaluation* published by the Council of the Inspectors General on Integrity and Efficiency.

Inspection Results

Issue 1: Inadvertent UVGI light overexposure

We substantiated the allegation that facility employees were unknowingly exposed to UVGI light.

On January 17, 2012, at 8:00 a.m., an orthopedic surgical team began surgery on a patient's ankle in OR #1. Approximately 2 hours later, when the surgery was completed, an Environmental Management Service (EMS) employee entered the OR and noticed that the UVGI lighting was on. She asked one of the OR team members if the UVGI lighting should be on. The OR team member answered, "No," and the EMS employee immediately turned the switch off.

The following morning, facility managers learned that the orthopedic surgeon who had performed the previous day's surgery went to a private hospital emergency room the night before due to eye pain and impaired vision. Also, other OR team members reported experiencing visual problems and skin burns. After becoming aware of the OR team members' symptoms, that same day an OR team member remembered that the UVGI lights had been found to be on after the operation was completed. The OR team member reported this to the OR Nurse Manager.

The subject patient's EMR showed that the patient was mostly protected from ultraviolet light exposure by surgical drapes. After the possibility of unprescribed UV light exposure was raised, the patient was examined by a dermatologist who noted that the patient's skin was unharmed.

The Nurse Manager alerted management of the incident and documented the patient's condition on a VA Form 10-2633, Report of Special Incident Involving a Beneficiary, and submitted it to the facility Risk Manager. After reviewing the incident report, the facility Risk Manager concluded that the patient did not suffer injury. Facility managers appropriately disclosed the incident to the subject patient in accordance with Veterans Health Administration guidelines on disclosure of adverse events.⁵

Issue 2: Injury to an Orthopedic Surgeon and OR Team Members

We substantiated the allegation that a surgeon lost his vision for 3 days and that other OR team members suffered photokeratitis injuries to their eyes and skin.

⁵ VHA Handbook 1050.01, *VHA National Patient Safety Improvement Handbook*, March 4, 2011.

The orthopedic surgeon told us that he experienced abdominal pain during the day of the surgery and went home shortly after the surgery was completed. That evening, he experienced sudden severe vision loss and immediately went to a local hospital's emergency room for evaluation and treatment. The emergency room physician told him that he had suffered a "welder's burn."⁶ Because of his visual impairment, he was unable to return to work for several days.

Other OR team members who also experienced visual complications and skin burns were unable to report to duty when scheduled. Our review of the affected employees' EMRs found that they suffered injuries due to UVGI overexposure in OR#1, and were appropriately referred to the facility's Ophthalmology and Dermatology Clinics for evaluation and treatment.

Issue 3: Prior Episodes of UVGI Light Overexposure to other Patients and Staff

We did not substantiate the allegation that there had been earlier documented reports of incidents involving UVGI light overexposure to OR patients and staff.

During interviews with facility employees and managers, we heard several verbal descriptions of possible prior incidents where staff suffered UVGI light overexposure during surgery. However, we were unable to obtain evidence to support these assertions, and the purported incidents as described were unrelated to inadvertent operation of the UVGI light switch.

Issue 4: Inadequate Safety Labeling of the UVGI Light Switch

We substantiated the allegation that the UVGI light was controlled by a standard light switch with no warning label.

The UVGI switch was located on the wall near the OR entrance and in proximity to a calibration dial. There were no markings or labels to indicate the purpose of the switch, which looked like a standard light switch. The UVGI lights were located on the OR ceiling and out of the team's normal line of vision. In our interviews, OR team members were not aware of any previous times when the light switch was inadvertently turned on.

The UVGI lights had not been used between May 2011 and the January 2012 subject event due to calibration issues. During that time, the facility's Quality Manager stated that there was no observed increase in infection rates.

⁶ "Flash burns [to the eye] are like sunburn in the eye and are also called welder's flash or arc eye. A flash burn occurs when you are exposed to bright ultraviolet (UV) light. Sources of UV light include a welding torch, direct sunlight, reflection of the sun off water or snow, a sunlamp and other lamps including halogen lamps. See http://www.betterhealth.vic.gov.au/bhcv2/bhcarticles.nsf/pages/eye_injuries_flash_burns [accessed 5/16/2012]

On January 18, the facility Director ordered that OR #1 UVGI lights be disabled indefinitely; therefore, we were only able to observe the lights while they were turned off. A new OR currently under construction will utilize UVGI lighting located in the air handlers and will not subject staff or patients to direct UVGI light. Moreover, use of these lights will not require PPE or pose potential harm to the surgical team.

Issue 5: Lack of Management Response to Previous Safety Warnings

We did not substantiate the allegation that management was previously warned that the UVGI lights were unsafe.

We interviewed facility employees involved in the incident, as well as managers, to determine whether they had knowledge of prior safety warnings regarding the UVGI lighting. We were not provided with any evidence during our interviews to support this allegation.

Issue 6: Compliance with OSHA and AORN Guidelines

We substantiated that the facility did not fully comply with OSHA or AORN guidelines regarding UVGI lights. For example, the facility did not have signs or symbols indicating specific hazards that could harm workers or the public, as required by OSHA.⁷ Although several team members mentioned the need for a sign to be posted outside during surgeries when lights were in use, we found no specific guidance in the local policy to address this issue.

We also found that the facility only partially complied with guidelines published in an AORN Journal regarding the safe usage of UVGI lights.⁸ While applicable facility policy included guidelines regarding the use of safety glasses and UVGI absorbing cream, it did not include requirements for protective clothing when the UVGI lights are in operation.

Safety consultants, hired to perform an ultraviolet exposure assessment after the incident, recommended that warning signs be conspicuously placed in an area near the light fixtures.⁹ Another recommended practice to prevent inadvertent light switch activation is to include the use of a key or code to secure the UVGI lights.

Conclusions

We substantiated the allegation that OR staff were harmed as a result of UVGI light overexposure. The facility did not take adequate measures prior to the incident to secure

⁷ OSHA 29 CFR 1910.145.

⁸ Association of PeriOperative Registered Nurses (AORN) Journal - *Using Ultraviolet Lighting to Decrease the Rate of Infections*, Allen, December 2007.

⁹ High Safety Consulting Services, Ltd., *UVC/UVG Exposure Estimate Assessment*, January 24, 2012.

the UVGI light switch and to follow guidance to install warning signs or adhere to other recommended practices in relation to UVGI light use.

We did not substantiate the allegation that there were documented reports of incidents involving UVGI light overexposure to patients or staff in the OR prior to January 17, 2012. The day after the inadvertent overexposure of a patient and staff to UVGI light, the facility took prompt action. It reported the incident to appropriate parties including facility leadership and OSHA, assessed the patient for adverse effects from the exposure, notified employees, referred employees for care, and disabled the light switch.

We found that facility leaders disconnected the UVGI lights and managers ensured that they would remain inoperable. A new OR currently under construction will utilize a safer UVGI lighting system. Therefore, we made no recommendations.

Comments

The Veterans Integrated Service Network and Medical Center Directors concurred with the report. No further action is required.



JOHN D. DAIGH, JR., M.D.
Assistant Inspector General for
Healthcare Inspections

VISN Director Comments

**Department of
Veterans Affairs**

Memorandum

Date: July 18, 2012

From: Director, VA Healthcare (10N4)

Subject: **Healthcare Inspection – Issues Related to Ultraviolet Germicidal Irradiation Light Exposure in an Operating Room, Lebanon VA Medical Center, Lebanon, Pennsylvania**

To: Director, Financial Analysis Division, Office of Healthcare Inspections (54D)

Thru: Director, Management Review Service (VHA 10A4A4)

I have reviewed the response provided by the Lebanon VA Medical Center and I am submitting it to your office as requested. I concur with the response.

(original signed by:)

Michael E. Moreland, FACHE
Director, VA Healthcare (10N4)

Facility Director Comments

**Department of
Veterans Affairs**

Memorandum

Date: June 26, 2012

From: Director, Lebanon VA Medical Center (595/00)

Subject: **Healthcare Inspection – Issues Related to Ultraviolet Germicidal Irradiation Light Exposure in an Operating Room, Lebanon VA Medical Center, Lebanon, Pennsylvania**

To: Director, VA Healthcare (10N4)

1. I have reviewed and concur with the Healthcare Inspection report. Executive Leadership appreciates the team's comprehensive review and efforts to ensure a safe environment for both our Veterans and staff.
2. Our new surgical construction project will include UV lights in enclosed ductwork eliminating any possibility of exposure.
3. If you have additional questions or require additional information, please contact Timothy S. Brown, Director Quality Management at 717-272-8820, extension 4407.

(original signed by:)
Robert W. Callahan, Jr.
Director, Lebanon VA Medical Center (595/00)

OIG Contact and Staff Acknowledgments

OIG Contact	For more information about this report, please contact the Office of Inspector General at (202) 461-4720.
Acknowledgments	Tom Seluzicki, CPA, Project Leader Donald Braman, RN Murray Leigh, CPA Nelson Miranda, LCSW Cynthia Gallegos, Program Support Assistant

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