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Evaluation of ultraviolet-C lamps sterilization in veterinary operating theatre

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ABSTRACT: Ultraviolet (UV) lamp is the simplest method for sterilizing operating theatre. This method is effective, easily operated, and does not require high cost. Furthermore, there were several studies of microorganism contamination in the air and surface at human operating theatre. However, studies in veterinary operating theatre related to the effectiveness of UV light on sterilization process is still limited, especially in Indonesia. Bacterial contamination samples were collected three times each in three different conditions: A) before surgery and without UV, B) before surgery but UV was already used, and C) after surgery and UV was already used. Samples were taken with settle plate and swab method for collecting the air and operating table contamination, respectively. One-way repeated measures ANOVA determined that there was statistically significant difference in the number of bacterial contaminations between three conditions (A, B, and C) in settle plate method (p=0.009), as well as in swab method (p=0.010). The result revealed that the UV light was effective to sterilize operating theatre, which can be seen from the significant decreases on the number of bacterial contaminations before and after the UV was used, both in settle plate and swab method. The result of this study supported the theory that the UV light can reduce the air bacterial and surface contamination at operating theatre. However, the result of microorganism contaminations in this study was still not appropriate based on the standard minimum of total bacterial in the operating theatre from The Ministry of Health, Republic of Indonesia. Consequently, the use of another method of sterilization at the operating theatre is still required for a better sterilization result.

Keywords:
bacteria, operating theatre, sterilization, ultraviolet light

■ INTRODUCTION

Nosocomial infection or infection originated from clinic, hospital, or health facility isnot an infection which is obtained by a patient right after entering the hospital. However, it will be occurred ± 72 hours after being exposed at the clinic, hospital or health facility. Generally, the patients that enter the hospital and show clinical signs of infection in less than 72 hours are not considered as nosocomial infection because the incubation period has already started before the patient enter the hospital. Nevertheless, the infection that shows clinical signs after 72 hours in the hospital is considered as nosocomial infection. The main objective of this study was to determine the UV lamp effectiveness as one of sterilization methods for room and surface at operating theatre. Therefore, it will strengthen the development and the implementation of effective preventive measures in order to reduce nosocomial and surgical site infection.

■ MATERIAL AND METHODS

Research was conducted at operating theatre of Department of Surgery and Radiology, Faculty of Veterinary Medicine Universitas Gadjah Mada. The type of UV lamp was Philips TUV T8 36W SLV/6 (Figure 1).

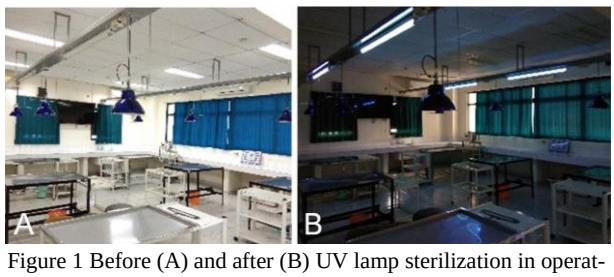

Figure 1 Before (A) and after (B) UV lamp sterilization in operating theatre.

Bacterial contamination samples were collected by settle plate (air contamination) and swabs method (operating tables contamination). Collected samples were analyzed to measure the total plate count (TPC) at Department of Microbiology, Faculty of Veterinary Medicine UGM. Both settle plate and swabs on the operating table were conducted

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three times in each of 3 conditions: A) before surgery and without UV, B) before surgery but UV was already used, and C) after surgery and UV was already used.

Total microorganisms in settle plate technique can be calculated using Omeliansky formula (CFU /m3) (Hameed & Habeeballah, 2013) which is: N = 5a x 10^4 $(bt)^{-1}$(N = *colony forming unit* per cubic meter (CFU/m^3), a = total colonies in petri dish, b = surface area of petri dish (cm^2), t = exposure time of petri dish in minute). One-way repeated measure (RM) ANOVA was used to determine the significant differences in the number of bacterial contaminations between three conditions (A, B, and C). The statistical significance was set at 95% (p<0.05). Data were analysed by IBM SPSS Statistics version 25.

■ RESULTS AND DISCUSSION

One-way RM ANOVA determined that there was statistically significant difference in the bacterial air contamination between three sampling times (p=0.009). Figure 2 depicts the bacterial air contamination using the settle plate method. Bacterial air contamination in the sampling time A (124.33±8.083 CFU/m^3) was significantly higher than C (27.33±16.563 CFU/m^3), p=0.01. However, there were no significant differences between sampling time A and B (95.67±21.825 CFU/m^3), p=0.671, and between sampling time B and C p=0.269.

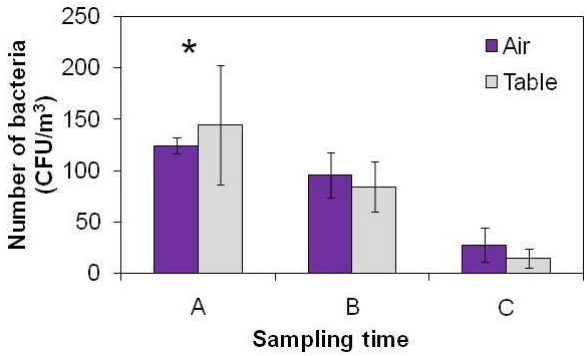

Figure 2 The number of bacterial air contamination with settle plate and swab methods. A: before surgery and without UV; B: before surgery but UV was already used; C: after surgery and UV was already used. *Significantly different than C (p<0.05).

Total bacterial air contamination mighthave been influenced by several factors which support the efficacy of UV lamps for sterilization method at operating theatre. According to CDC (2008), efficacy of UV light isaffected by the presence of organic material, wavelength, exposure time, relative humidity, temperature, UV intensity, and UV lamp distance. The humidity and temperature on this research showed 43% and 21.4^{0}C, respectively. The distance of UV light was set 2.5 meter on the ceiling of operating theatre. In addition, UV lamp was also switchedon for 30 minutes both in B and C conditions. All of these results were suitable with CDC (2008) which stated that in the condition with relative humidity at 30-60% and temperature around 20^0-24^{0}C, the UV light exposure should be done for 30 minutes at maximum distance from lamp to the object is 2.5 meter for effective sterilization at operating theatre. Results obtained from Figure 2 indicated that the number of bacterial contaminations on operating table was statistically significant different between the three sampling times(p=0.010). The number of bacterial contamination on the operating table in sampling time A (144±57.73 CFU/m^3) was significantly higherthan C (14.67±8.96 CFU/m^3) p=0.021, but no other differences were shown between sampling time A and B (84.33±24.13 CFU/m^3) p=0.324, as well as B and C p=0.062.

This finding was in accordance with Kramer *et al*. (2006), who argued that most nosocomial pathogens can persist for weeks or months on inanimate object, which followed by poor degree of cleanliness and disinfection method at operating theatre. Furthermore, after disinfection process with cleaning wipes it showed lower amount of pathogenic bacterial compared with the absence of wipes cleaning process (Shakir *et al.* 2015).

■ CONCLUSION

Sterilization method using UV lamps wasable to reduce the total number of air bacterial and operating table microorganisms at operating theatre Department of Surgery and Radiology, Faculty of Veterinary Medicine, Universitas Gadjah Mada.

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