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Development and effectiveness of plasma hydrogen peroxide mist disinfection in ambulance

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***Abstract*—Ambulance environments are associated with a high risk of infection. We have developed surface disinfector using low concentration hydrogen peroxide and plasma. To verify the performance of the development device, disinfection was performed in 2 different ambulances. Surfaces were swabbed before and after disinfection for counting the CFU of bacteria. Plasma hydrogen peroxide mist disinfection resulted in significant decreases in the CFU values of bacteria on ambulance surfaces.**

I. INTRIDUCTION

Various infectious disease such as Middle East respiratory syndrome (MERS) and COVID-19 (Coronavirus disease) have emerged in recent years. Ambulances are easily exposed to infections and required high disinfection efficacy. Also short disinfection time needed to respond quickly to emergency situations. Several studies have reported that hydrogen peroxide can inactivate pathogens [1,2], plasma disinfection have effectiveness inactivation of bacteria [3]. We have developed plasma hydrogen peroxide mist disinfector for high disinfection efficacy and rapid disinfection. We aimed to verify the efficacy of plasma hydrogen peroxide mist disinfection for inactivating bacteria on ambulance surfaces.

II. METHOD

As shown in Fig. 1 (a), we made the disinfector as dividing disinfectant part and a plasma part. 5.9% w/w hydrogen peroxide was used as disinfectant, air passed through DBD (Dielectric Barrier Discharge) plasma jet was sprayed combined with disinfectant. The disinfectant solution sprayed from the disinfection gun was 50 mL per minute.

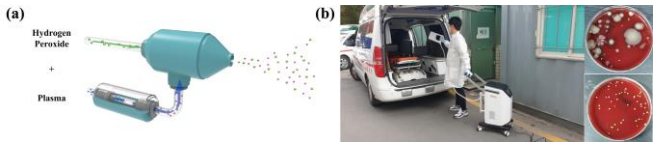

Figure 1. Plasma hydrogen peroxide mist disinfection: (a) Schematic of developed disinfector, (b) Ambulance disinfection and cultured bacteria.

Disinfection was performed in 2 different ambulances, including normal and infection ambulance (Fig. 1 (b)). The most contacted surfaces in the ambulance environments were selected, and 24 surfaces were swabbed and cultured before and after disinfection. Objects that were used as cultured surfaces included beds, seats, cabinets, knobs, and medical devices. To identify both opportunistic and pathogenic bacteria, swab samples were cultured in blood and McConkey agar plates and incubated for 24 h at 37°C.

III. RESULT

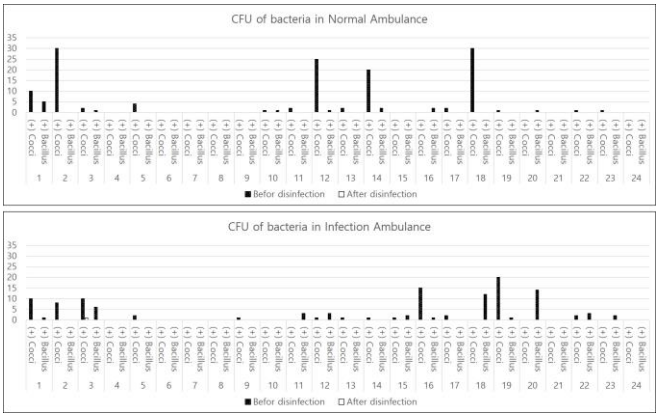

Figure 2. CFU of gram-positive bacteria from 24 surfaces in ambulances before and after disinfection with plasma hydrogen peroxide mist disinfection.

As shown in Fig. 2, we classified gram-positive cultured from surfaces into positive cocci and bacillus. CFU of positive cocci and bacillus were observed before disinfection for 146 and 146 on normal ambulance, 117 and 112 on infection ambulance, respectively. After disinfection, only 1 CFU of positive cocci was observed on infection ambulance.

IV. DISCUSSION & CONCLUSION

The result shown that disinfection efficacy of developed surface disinfector seems to be a suitable level for use in ambulances. In conclusion, we believe that this study will help to promote efficient infection control.

ACKNOWLEDGMENTS

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