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The Impact of Handheld Fogging of Hypochlorous Acid on Procedural Room Humidity Levels

INTRODUCTION

Controlling proper humidity levels in the operating room is essential for infection prevention and patient safety. CMS and AORN guidelines recommend that humidity levels in surgical suite procedure rooms should be maintained between 20% and 60%[1].

To manage these specifications, healthcare facilities have adopted computerized systems that automatically adjust room humidity levels to set parameters, conduct record keeping and provide alerts when the humidity levels are outside of the assigned range.

> *Low humidity levels increase the opportunity for electrostatic discharge from medical equipment that could potentially ignite a fire. Humidity levels above the higher limit increase the chances of surface mold and wound infections, potentially compromise sterile supplies and create an environment that is uncomfortable for operating room personnel[2].*

Humidity is influenced by room temperature, geographical environmental conditions, and limitations of a facility's mechanical and cooling HVAC system. Disinfection fogging devices can influence humidity levels during their application cycles.

The purpose of this case study is to understand the impact of Stratus handheld fogging with Microburst™ hypochlorous acid (HOCl) when used for procedural room turn disinfection, and its effect on elevating humidity levels.

BACKGROUND

Advances continue to be made in infection control practices, including improved operating room ventilation, sterilization methods, barriers, and surgical technique for the reduction of bioburden and prevention of Surgical Site Infections (SSI). Still these infections remain a substantial cause of prolonged hospitalization, morbidity and mortality.

The average SSI extends the patient's hospital length of stay by 9.7 days, with cost of hospitalization increased by more than $20,000 per episode[4]. To improve patient safety, decrease bioburden and lower the risk of developing an SSI, healthcare facilities continue to design robust infection prevention strategies that incorporate the use of new technologies including foggers and disinfectants that maintain the required humidity levels in the surgical environment.

SSIs account for **20% of all healthcare-associated infections** (HAI) and is the most costly HAI type with an **estimated annual cost of $3.3 billion.[3]**

Introduced in May of 2023, the Stratus handheld fogging of Microburst™ hypochlorous acid (HOCl) was designed to be used as part of the disinfection protocol for between case procedural room turns and the end-of day terminal cleaning of hospital operating rooms (OR), ambulatory surgical centers (ASC) and physician offices where invasive procedures potentially create the risk of infection.

Microburst™ is an EPA registered, hospital grade disinfectant whose primary ingredient is hypochlorous acid. During the Stratus fogging process Microburst™ is aerosolized at < 40µm level allowing for immediate surface contact and disinfection.

The Stratus procedural room turn disinfection protocol is a two-minute fogging application of Microburst™ conducted between surgical procedures to all designated high touch, patient centric equipment and locations after the patient has left the room. Longer fogging applications are performed as part of end of day terminal cleaning protocols.

Hypochlorous acid has been proven to be a safe, highly effective disinfectant against common viral, bacterial and fungi pathogens including spores and C. Auris[5].

METHODOLOGY

To understand the direct impact of the Stratus and Microburst™ fogging application on room humidity levels, a clinical study was conducted in Gilbert, Arizona, for room turn disinfection in two different sized outpatient procedural rooms measuring 1300 cu ft and 3325 cu ft. No adjustments were made to room HVAC settings. Rooms contained standard OR equipment.

Beginning room temperatures averaged 71.8F. Two GOVEE Thermohygrometers Model #H5075 were selectively placed in the rooms for precise humidity monitoring. One gauge was positioned at the head of the OR table 36 inches from the floor and the second was placed at table center 18 inches off the floor.

Per manufacturer's instructions for use (IFU) the F8 handheld Stratus device was set at level two and used for all fogging applications. At the start of each use the Stratus reservoir was filled with 500cc of Microburst™. A two-minute continuous fogging was conducted for four room turns. A four-minute fog application was used on two turns to understand if application length of time could impact humidity levels.

For the purposes of technique and accuracy, one trained staff member conducted all fogging applications. Starting and ending humidity levels were logged for each gauge pre and post fogging. All rooms were monitored for length of time to return to starting humidity levels.

Day one involved data collection of two sequential small room turns using a two-minute fog application. The third turn used a 4-minute fogging time. The larger, 3325 cu ft room applications were conducted on day two using the same application times, sequence and data collection.

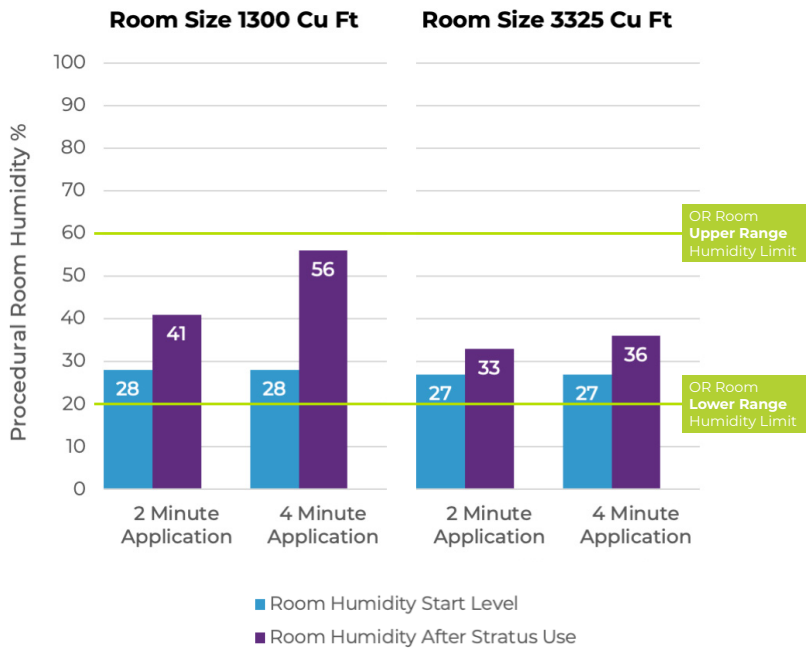
RESULTS

Six procedural room turns incorporating the Stratus and Microburst™ fogging disinfection protocol were monitored for change in humidity levels. The humidity levels before and after the two- and four-minute applications were documented. A total of twenty-four readings were collected and evaluated.

The average starting humidity for the smaller, 1300 cu ft room was 26.75%. Post two-minute Microburst™ application, the smaller rooms reached an average elevation to a 41.25% humidity level. An average of 155cc of Microburst™ was fogged in the smaller rooms during the 2-minute applications.

In the small room 4-minute fogging process a total of 275cc of Microburst™ was dispersed. Post application the humidity reading of the room was elevated from 27.5% to an average of 53%. (Figure 1) Regardless of the length of fogging times it took an average of 19 minutes for humidity levels to return to their normal starting level in the small room.

FIGURE 1: Changes in Room Humidity Levels with Stratus Disinfection Fogging of HOCl



The larger 3325 cu ft room had a beginning humidity of 27% and ended with an average reading of 33% after the two-minute application. During the fogging process an average of 157.5cc of Microburst was dispersed. The four-minute application in the same room used 290cc of solution and raised the humidity level from 26.5% to 34.25%. In all applications the larger room returned to initial humidity levels after 14 minutes.

DISCUSSION

As operating room and infection control teams continue to evaluate fogging technologies that improve patient safety, lower bioburden and assist with the reduction of SSIs, it is important they incorporate a device and disinfectant that maintains required OR humidity levels. The selected products must deliver efficacious results in an efficient manner.

In the past, hydrogen peroxide vapor (HPV) and hydrogen peroxide aerosolization (aHP) have been evaluated as disinfection fogging methods for surgical procedure rooms. While an effective disinfectant, the hydrogen peroxide (H2O2) application requires elevated humidity during the disinfection cycle followed by extended aeration times due to its chemical toxicity and the need to return the room to appropriate humidity levels.

> *Fogging protocols with hydrogen peroxide are inefficient for the standard OR room turn between cases, when disinfection must be quickly and safely completed.*

Newer handheld devices such as Stratus fog with a non-toxic, EPA registered, hospital-grade disinfectant, have shorter application times and minimal impact on the required humidity levels. These are more appropriate for room turn disinfection and should be considered as part of an enhanced approach to infection prevention.

CONCLUSION

This study demonstrated the impact of the Stratus handheld fogging of Microburst™ hypochlorous acid on humidity levels in two different size procedure rooms while adhering to the manufacturer's recommended application method and disinfection times. Size of the procedure room and application length of time influenced room humidity level outcomes.

The smaller procedure room's humidity levels were elevated higher than those in the larger room after the same two-minute fogging application of identical equipment. Results indicated the larger the room size, the less effect fogging has on increasing the room humidity level and the more quickly the room returns to its starting humidity level. The same was true with the four-minute application.

Even with the humidity elevations, all procedure rooms maintained acceptable ranges during peak elevations for safe surgical practice.

This study suggests the Stratus fogging of Microburst™ hypochlorous acid incorporated into the OR room turn disinfection process maintains safe, optimal humidity levels and should be considered part of standard disinfection protocol.

REFERENCES:

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