working place, source of risk exposure, COVID-19 vaccination history, hospital transmission, and compliance with the hospital IPC policy. The primary outcome of this study was to evaluate hospital transmission among HR-HCP prior to and after the change in the quarantine policy. Hospital transmission was considered as exposed HCP who transmitted COVID-19 to patients and/or to other HCP both prior to and after the quarantine policy was implemented. The secondary outcome included compliance with quarantine policy including use of double masks, compliance with physical distancing, and the isolation policy. We used χ^2 tests to compare categorical variables. Independent *t* tests were used for continuous data. All *P* values were 2-tailed, and $P < .05$ was considered statistically significant.

From January 2021 to February 2022, 636 HCP had high-risk exposures: 440 during SARS-CoV-2 non-(omicron) waves (ie, α- and δ-variant waves) and 196 during the (omicron) wave. The median age of exposed HCP was 30 years (range, 26–36). Demographics and characteristics of exposed HCP are summarized in Table 1. Most HCP were female and had no underlying disease. We detected no significant differences between exposed HCP during SARS-CoV-2 non-(omicron) waves versus the (omicron) wave in terms of characteristics, type of contact, and working unit. During the entire study period, 173 (27%) of 636 transmission events occurred from exposed HCP to other HCP. Of 440 transmissions, 120 (27.3%) occurred during SARS-CoV-2 non-(omicron) waves and 53 (27%) of 196 transmissions occurred during the (omicron) wave (Table 1). All HCP developed infection prior to quarantine due to the delay in recognition of the index case. Notably, 143 (73%) of 196 exposed HCP tested negative on day 5 and returned to work during the SARS-CoV-2 (omicron) wave. No in-hospital transmission occurred after the entire follow-up period, and all exposed HCP tested negative on day 10. All HR-HCP were fully compliant with the hospital quarantine policy (Table 1). Also, vaccination among exposed HCP increased from the SARS-CoV-2 non-(omicron) periods to the (omicron) period.

Our findings have demonstrated that the reduced quarantine time for HCP exposed to COVID-19 was safe and effective in preventing in-hospital transmission from HCP with high-risk exposure to patients and/or to other HCP and this may, in part, have been due to increased vaccinations among our HCP. Importantly, our policy was implemented without concerns by HR-HCP. Notably, of 623 exposed HCP, 173 (27%) developed COVID-19 prior to recognition of their exposure. This proportion was less than the pooled infection rate (51.7%) reported by a meta-analysis study of infection among frontline HCP during non-(omicron) waves.[6] The fact that HCP acquired COVID-19 prior to quarantine emphasizes that all HCP should be considered at risk for exposure and must strictly comply with IPC policies for COVID-19. Lastly, despite increases in COVID-19 vaccination, it is vital that HR-HCP adhere to hospital IPC policies.

Our study had several limitations. First, the data were collected from a single center, which may limit the generalizability of our findings. Second, we did not obtain the genotype of the variant; instead, we assumed the variant involved based on Thai Nation Institute of Health database.[6] Third, our sample size was relatively small. Despite these limitations, our data have demonstrated that the reduced quarantine time was safe and effective in Thai HR-HCP who generally received >3 vaccine doses. Additional studies are needed to evaluate an appropriate duration of quarantine for SARS-CoV-2–exposed HCP given the high rate of vaccination among HCP and that COVID-19 is now an endemic disease.

Acknowledgments.

Financial support. No financial support was provided relevant to this article.

Conflicts of interest. All authors report no conflicts of interest relevant to this article.

References

1. Classification of omicron (B.1.1.529): SARS-CoV-2 variant of concern. World Health Organization website. https://www.who.int/news/item/26-11-2021-classification-of-omicron-(b.1.1.529)-sars-cov-2-variant-of-concern. Published November 21, 2021. Accessed March 15, 2022.
2. Wolter N, Jassat W, Walaza S, *et al.* Early assessment of the clinical severity of the SARS-CoV-2 omicron variant in South Africa: a data linkage study. *Lancet* 2022;399:437–446.
3. Corona Virus Disease (COVID-19). 2022. Department of Disease Control website. https://ddc.moph.go.th/viralpneumonia/eng/situation.php. Updated January 7, 2021. Accessed March 30, 2022.
4. Contact tracing and quarantine in the context of the omicron SARS-CoV-2 variant: interim guidance. World Health Organization website. https://www.who.int/publications/i/item/WHO-2019-nCoV-Contact-tracing-and-quarantine-Omicron-variant-2022.1. Published Febuary,17, 2022. Accessed March 25, 2022.
5. Strategies to Mitigate Healthcare Personnel Staffing Shortages. Centers for Disease Control and Prevention website. https://www.cdc.gov/coronavirus/2019-ncov/hcp/mitigating-staff-shortages.html. Updated January 21, 2022. Accessed April 1, 2022.
6. Gholami M, Fawad I, Shadan S, *et al.* COVID-19 and healthcare workers: a systematic review and meta-analysis. *Int J Infect Dis* 2021;104:335–346.

Bair Hugger: A potential enemy within the operating room

William G. Watkins MD, Richard A. Jaffe MD, PhD and John G. Brock-Utne MD, PhD

Department of Anesthesiology, Perioperative & Pain Medicine, Stanford University School of Medicine, Stanford, California

Author for correspondence: John G. Brock-Utne, E-mail: brockutn@stanford.edu

Cite this article: Watkins WG, Jaffe RA, and Brock-Utne JG. (2023). Bair Hugger: A potential enemy within the operating room. *Infection Control & Hospital Epidemiology*, 44: 164–166, https://doi.org/10.1017/ice.2022.98

To the Editor—The American Society of Anesthesiologists practice guidelines recommend normothermia as a goal during anesthetic emergence and recovery[1] in part to reduce adverse cardiac events.[2] The Bair Hugger (3M, St Paul, MN) is a type of forced-air warming (FAW) device commonly used to maintain intraoperative

normothermia; however, its use is not without the potential for harm.[3] Surgical site infection (SSI) is a major risk of any surgical procedure. Rates of SSI have been reported to be as high as 6.8% in some types of orthopedic surgery.[4] Contamination of operating room (OR) air with human pathogens has been directly attributed to FAW[5]; however, contamination of OR air is not sufficient for demonstrating SSI causation.[6]

Contamination of the OR air with human pathogens may be an intraoperative safety hazard, and adherence to recommended FAW-device filter-replacement guidelines may improve patient safety. Bair Hugger devices draw in ambient air through a HEPA filter before heating and traveling through a distal hose to a disposable patient blanket.[7] The manufacturer recommends that the HEPA filter should be changed "every 12 months or 500 hours of use," whichever comes first.[7] Our institution changes these filters on an annual basis presuming that the usage of each device is below the 500 hours per year limit. We examined mean annual usage among 36 Bair Hugger devices at our institution and compared the results to manufacturer recommendations.

Methods

Bair Hugger usage was determined by utilizing the Bair Hugger alternative modes feature (activated by a button concealed within the logo), which displays accumulated run time. The serial number of each Bair Hugger unit along with its total run time was logged. Each device's purchase date and last filter change date was obtained from our institution's technology registry system. The average annual run time in hours was calculated by dividing the total number of run hours for each Bair Hugger unit by time elapsed since its purchase date in years. A mean annual run time in hours was calculated for all devices. A 1-sample *t* test was used to compare the sample mean to the recommended maximum run time of 500 hours.

In addition, we surveyed 60 regional hospitals and surgical centers in California regarding their Bair Hugger filter-change practice.

Results

The mean annual run time for our 36 Bair Hugger units was 785.09 hours (SD, 239.72 hours) (Fig. 1). Furthermore, 32 units (89%) had >500 hours average annual run time. The sample mean (785.09 hours) was significantly different from the recommended maximum of 500 hours ($P < .0001$).

The results of this survey revealed that none of the 60 hospitals or surgical centers in California followed manufacturer recommendations for filter change.

Discussion

The Bair Hugger device may increase the risk for an SSI in several ways. First, a Bair Hugger unit draws air in from a potentially contaminated floor, warms it, then blows it into the disposable warming blanket. This warmed air is released through small pores on the underside of the blanket, often in the vicinity of the surgical field. Contamination of the Bair Hugger, the outlet hose, and/or the warmed air passing through them could occur as the efficiency of the inlet HEPA filter decreases over time.

Our study revealed that only 4 of the 36 Bair Hugger devices examined were compliant with the manufacturer's filter-change recommendations. The fact that Bair Hugger devices have been shown to potentially spread human pathogens across open surgical wounds[5] should alert healthcare institutions to strictly follow the recommended filter replacement after 500 hours of run time rather than simply changing the filter on an annual basis. To see how our institution compared to others regarding compliance with manufacture's recommendations, we informally surveyed 60 regional hospitals and surgical centers in California that used Bair Hugger units. The survey revealed that none of the institutions followed the manufacturer's 500-hour maximum use-time recommendation. Instead, most of them changed filters on an annual basis without regard to actual usage hours.

Regarding potential modifications to Bair Hugger devices, simply incorporating an alarm to indicate when 500 hours of run time had elapsed may lead to improved patient safety. Recognizing that 500 hours of use in an environment with a high particulate load may not be equivalent to 500 hours in a "cleaner" environment; the best alarm system would indicate when filter efficacy had dropped below an acceptable minimum. Even more simply, placing a disposable HEPA filter at the end of the Bair Hugger hose where it attaches to the blanket may prove most advantageous.[5]

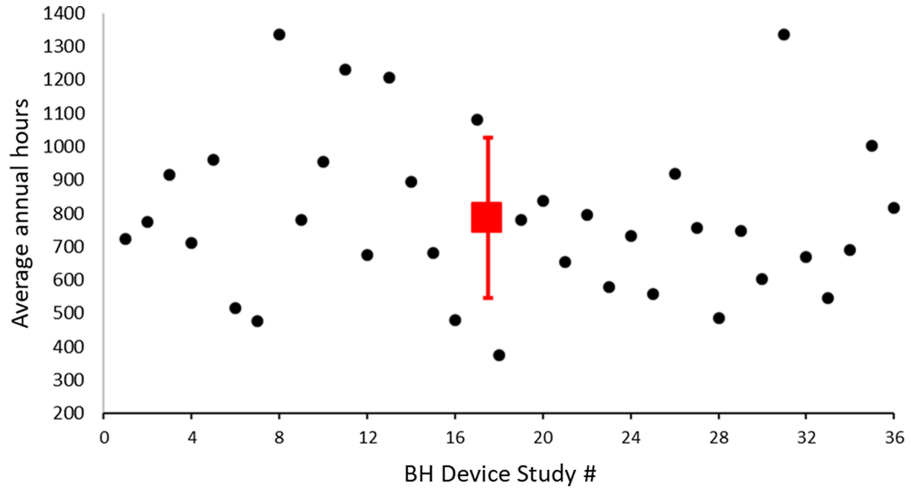

Fig. 1. Average annual run hours per Bair Hugger. Scatter plot with each data point representing 1 Bair Hugger device (x-axis) and its annual run time (y-axis). The overlaid red square with error bars represents mean annual run hours (785 ± 240) among all 36 Bair Hugger devices studied.

https://doi.org/10.1017/ice.2022.98 Published online by Cambridge University Press

Although it remains unproven that the Bair Hugger or other FAW devices may cause surgical site or implant-associated infections,[6] we recommend that alternative patient-warming methods[8] be used, especially in immunosuppressed patients and in procedures involving surgical implants. We believe that FAW devices may represent an unnecessary risk in these cases. Unfortunately, no randomized controlled clinical trials have been conducted to directly answer this question. Future studies should investigate a possible link between higher Bair Hugger run hours and increased SSI.

In conclusion, we recommend that institutions track Bair Hugge run time and change filters at least every 500 hours or at 1 year, whichever comes first. 3M should also consider implementing a 500-hour filter use alarm or installing a disposable HEPA filter at the end of the hose as it enters the warming blanket.

Acknowledgments.

Financial support. No financial support was provided relevant to this article.

Conflicts of interest. All authors report no conflicts of interest relevant to this article.

References

1. Practice guidelines for postanesthetic care. American Society of Anesthesiologists website. http://www.asahq.org. Accessed March 10, 2021.
2. Frank SM, Fleisher LA, Breslow MJ, *et al.* Perioperative maintenance of normothermia reduces the incidence of morbid cardiac events. A randomized clinical trial. *JAMA* 1997;277:1127–1134.
3. Onyekwelu I, Yakkanti R, Protzer L, Pinkston CM, Tucker C, Seligson D. Surgical wound classification and surgical site infections in the orthopaedic patient. *J Am Acad Ortho Surg Glob Res Rev* 2017:e022.
4. Baker N, King D, Smith EG. Infection control hazards of intraoperative forced air warming. *J Hosp Infect* 2002;51:153–154.
5. Brock-Utne JG, Taylor Ward J, Jaffe RA. Unexpected sources of airborne microbial contamination in the operating room. *J Hosp Infect* 2021; 113:59–64.
6. Wood AM, Moss C, Keenan A, Reed MR, Leaper DJ, Infection control hazards associated with the use of forced-air warming in operating theatres. *J Hosp Infect* 2014;88:132–140.
7. Bair Hugger model 505 and model 500 OR warming units operators manual. 3M website. https://www.3m.com/3M/en_US/p/d/v000265003/. Accessed February 26, 2021.
8. Santa Maria P, Santa Maria C, Eisenried A, *et al.* A novel thermal compression device for perioperative warming. A randomized trial for feasibility and efficacy. *Boston Med Center Anesthesiol* 2017;17:102–108.

Recurrent central-line–associated bloodstream infection in a single high-risk patient

Zachary Pek[1,a], Hannah Canepa[1,a], Karen L. Gregg MSN, RN, CIC[2], Marie K. Cabunoc BSN, RN, CIC[2], Surbhi Leekha[1] and Jonathan D. Baghdadi[1]

[1]University of Maryland School of Medicine, Baltimore, Maryland and [2]University of Maryland Medical Center-Midtown Campus, Baltimore, Maryland

To the Editor—We report the case of a 44-year-old man with total parenteral nutrition (TPN) for short-bowel syndrome who was diagnosed with his 17th central-line–associated bloodstream infection (CLABSI). He had primarily been admitted to a single hospital unit during the period of his multiple infections. A timeline of his infections is provided in Figure 1. This case report was reviewed by the IRB of the University of Maryland, Baltimore and determined to be not human-subjects research. The patient provided consent to have his case information published.

Short-bowel syndrome arose from complications of an abdominal gunshot wound. During a difficult and prolonged recovery, he developed extensive bowel necrosis and eventually required total colectomy, partial enterectomy, and placement of a jejunal ostomy. With his entire colon and most of his small bowel removed, he developed severe malnutrition. Bowel transplant was declined due to lack of social support.

TPN, which the patient had required for >5 years, was administered through a tunneled catheter in his right external jugular vein. Repeated placement and removal of central lines had rendered other options for venous access unavailable. Bilateral internal jugular veins, brachiocephalic veins, and subclavian veins were either occluded or stenosed. Previous femoral access had been placed and removed in the context of bacteremia and sepsis. He declined placement of permanent transhepatic or translumbar venous access. Consultants from interventional radiology and vascular surgery advised that his current catheter was a "lifeline." Its removal would likely result in permanent loss of upper-extremity central venous access.

The current line had been placed by exchange over a guidewire 6 months earlier in response to a CLABSI. Gentamicin lock therapy was instilled daily for prophylaxis. Alcohol-impregnated caps were used on all ports. Regular central-line care was provided by attentive staff who reviewed the plan for central-line maintenance with nursing leadership, infection prevention, and the attending physician. Examination of his chlorhexidine-impregnated central-line dressing did not reveal any breaches or areas of concern. He received daily bathing with chlorhexidine gluconate in the preceding week, and he had not recently left the unit. Manipulation of the central line by the patient was not suspected.

Peripheral blood cultures collected after a fever of 39.3°C grew *Escherichia coli* that was resistant to gentamicin. No localizing symptoms suggested metastatic focus of infection or source besides the catheter. Blood cultures remained positive the following day but subsequently cleared. After initially receiving intravenous

Author for correspondence: Jonathan Baghdadi, E-mail: jbaghdadi@som.umaryland.edu

[a]Authors of equal contribution.

Cite this article: Pek Z, *et al.* (2023). Recurrent central-line–associated bloodstream infection in a single high-risk patient. *Infection Control & Hospital Epidemiology*, 44: 166–168, https://doi.org/10.1017/ice.2022.190