ASK THE QUESTION

**Question 1:** Is use of forced-air warming (FAW) during surgery associated with increased risk for surgical site infection?

SEARCH FOR EVIDENCE

**Search strategies** included research-based articles published in English.

**Databases** included PubMed and Scopus, and a search of reference lists for relevant literature.

**Key words/terms** included (forced warm air OR forced air warming) AND ("surgical wound infection"[Mesh] OR infection* OR contamination)

CRITICALLY ANALYZE THE EVIDENCE

**Question 1:** Is use of forced-air warming (FAW) during surgery associated with increased risk for surgical site infection?

**Practice Recommendation:** There is insufficient evidence to establish that the use of FAW leads to an increase in surgical site infections compared to other warming methods. Strong Recommendation, Low Quality Evidence.

Five primary research studies were found specifically addressing the association between FAW and surgical site infections. Two studies—one by Huang et al. (2003) and one by Moretti et al. (2009)—primarily involved assessment of bacterial counts in different locations of the OR and at the surgical wound edges. These studies used slightly different approaches: Huang did cultures at the start...
and finish of surgery with use of an Augustine Medical Bair Hugger FAW system; Moretti did cultures with and without use of the Bair Hugger FAW system. The authors of the studies reported that no SSIs occurred in any patient in the studies (total of 46 patients combined).

A RCT by Melling et al. (2001) looked at SSI rates in a total of 421 patients who underwent breast, varicose vein, or hernia surgeries. Patients were randomized into three groups: 138 patients with localized warming before surgery, 139 patients with whole-body FAW before surgery, and 139 patients with no warming before surgery (control group). This study compared the Augustine Medical Bair Hugger FAW system to the Augustine Medical Warm-Up. The SSI rate was not significantly different between warming systems (3.6% for Warm-Up, 5.8% for Bair Hugger, \( p = 0.4 \)), but was significantly lower in warmed patients (5%) versus non-warmed (14%, \( p = 0.001 \)).

A study by McGovern et al. (2011) that examined effects of warming devices on OR ventilation also provided data on PJIs in patients treated by different technologies for maintaining body temperature during surgery. The study reports on 1,437 patients who underwent joint replacement surgery; 1,066 patients had surgery during a period when the hospital used FAW, and 371 had surgery during a period when the hospital switched to using conductive fabric for warming. Data was collected retrospectively. The study found a significant increase in deep joint infection, as demonstrated by an elevated infection odds ratio (3.8, \( p = 0.024 \)), during the period when forced-air warming was used compared to a period when conductive fabric warming was used. However, this study lacked documentation of normothermia during surgery. In addition, the authors reported that both the prophylactic antibiotic regimen and thromboprophylaxis regimens were altered during the study period. Since the two types of warming treatment were not applied concurrently, other treatment differences or changes during the two different time periods may have influenced PJI rates.

In addition, a study by Lista et al. (2012) involving 108 patients plastic surgery patients who received several simple measures to prevent perioperative hypothermia, including FAW, compared to 106 historical controls found no significantly significant difference in the incidence of complications between the two groups (4% of patients had SSI in warmed group, compared to <1% in control group).

Lastly, the Association of periOperative Registered Nurses published a statement based on a systematic review of the literature in 2013 stating there is no conclusive evidence that the use of forced-air warmers increases the risk of SSIs (Kellam et al.) 2013.

The currently available evidence does not justify discontinuing the use of FAW during surgery.

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<th>PICO Question: Is use of forced air warming during surgery associated with increased risk for surgical site infection?</th>
<th>Lower Quality Rating if:</th>
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<tbody>
<tr>
<td>Author/Date/</td>
<td>Purpose of</td>
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Quality Management/Library, Medical University of South Carolina
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<tr>
<th>Journal</th>
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<th>Design</th>
<th>Study Limitations</th>
<th>DATE: May 2014</th>
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</table>
| Huang et al., 2003, Critical Care | To evaluate whether use of the Bair Hugger forced-air patient warming system during prolonged abdominal vascular surgery leads to increased bacterial contamination of the surgical field by mobilization of the patient’s skin flora. | Descriptive study | • None  
- Non-Experimental/Observational Studies (case-control, cohort, cross sectional, longitudinal, descriptive, epidemiologic, case study/series, QI, survey)  
- Insufficient sample size  
- Sample not representative of patients in the population as a whole  
- Variables (confounders, exposures, predictors) were not described  
- Outcome criteria not objective or were not applied in blind fashion  
- Insufficient follow-up, if applicable  
- For prognostic study, sample not defined at common point in course of disease/condition  
- For diagnostic study, gold standard not applied to all patients  
- For diagnostic study, no independent, blind comparison between index test and gold standard |               |
| Lista et al., 2012, Aesthetic Surgery Journal | Evaluate the impact of perioperative warming in an outpatient plastic surgery setting | Retrospective review | 108 patients who received several simple measures to prevent perioperative hypothermia. Patients dressed in warm clothing and were covered with an electric blanket in both the holding area and the recovery room. Intraoperative interventions included higher ambient room temperature, skin exposure only at the surgical site, forced-air warming, and the use of warmed fluids. This warmed group was compared with a The requirement for intraoperative analgesia was significantly lower for the warmed group (111 vs 125 μg fentanyl in the control group; P = .042). Patients in the warmed group required less time in the recovery room and met discharge criteria sooner (127 vs 141 minutes; P = .001). No significant difference was observed in the incidence of complications (4% of patients had SSI in warmed group, compared to <1% in control group). Study Limitations =  
• None  
- Non-Experimental/Observational Studies (case-control, cohort, cross sectional, longitudinal, descriptive, epidemiologic, case study/series, QI, survey)  
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<tr>
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<th>Design</th>
<th>Patients</th>
<th>Methods</th>
<th>Results</th>
<th>Limitations</th>
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<tr>
<td>McGovern et al., 2011, <em>The Journal of Bone and Joint Surgery</em></td>
<td>Review infection data to determine whether joint infection rates are associated with the type of patient warming device used (forced air vs. conductive fabric)</td>
<td>Retrospective review</td>
<td>1,437 patients who underwent joint replacement surgery; 1066 patients had surgery during a period when the hospital used forced air warming; 371 had surgery during a period when the hospital switched to using conductive fabric for warming</td>
<td>A significant increase in deep joint infection, as demonstrated by an elevated infection odds ratio (3.8, p = 0.024), was identified during a period when forced-air warming was used compared to a period when conductive fabric warming was used</td>
<td>None</td>
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<td>Melling et al., 2001, <em>The Lancet</em></td>
<td>to assess whether warming patients before short duration, clean surgery would reduce infection rates</td>
<td>RCT</td>
<td>421 patients having clean (breast, varicose vein, or hernia) surgery were randomly assigned to either a nonwarmed (standard) group or one of two warmed groups (local and whole-body forced air). We applied warming for at least 30 min before surgery.</td>
<td>19 wound infections in 139 non-warmed patients (14%) but only 13 in 277 who received warming (5%; p=0.001). SSI rate was not significantly different between warming systems (3.6% for Warm-Up, 5.8% for Bair Hugger, p = 0.4), but was significantly lower in warmed patients (5%) versus nonwarmed (14%, p = 0.001).</td>
<td>None</td>
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<td>Moretti et al., 2011</td>
<td>Assess the risk of Level of bacterial</td>
<td>Descriptive</td>
<td>No SSIs occurred in</td>
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<td>2009, Journal of Hospital Infection</td>
<td>Contamination of the surgical site correlated to the use of the Bair Hugger blanket during hip replacement surgery.</td>
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<td>Study</td>
<td>Contamination and incidence of infections quantified with and without forced air Bair Hugger warmer for 30 total non-cemented hip implants in patients with osteoarthritis.</td>
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<td>Either group.</td>
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