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Convection Warmers and Burn Injury—Still A Clear and Present Danger

by Jeffrey Feldman, MD, MSE

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Convection warmers are a well-established therapeutic adjunct in the operating room, helping to maintain normothermia safely for millions of patients every year. These devices increase body temperature by transferring heat to the skin where it is absorbed by the blood and distributed to the rest of the body. Burns can occur when the heat applied to the skin is high enough to cause injury and exceeds the capacity of the blood to absorb it. We learned many years ago that clinical convection warmers produce sufficient heat to cause a significant burn injury if the outlet hose is directed to the skin without a warming blanket to disperse the heat, a practice called "hosing." Fortunately, with education, the risk of hosing is well-known and patients should no longer be injured in this fashion.

In this issue of the *Newsletter*, Janik and Lewandowski report two cases where patients suffered a burn injury with the use of a warming blanket. They identified in their report potential causes, which include malfunction of the warming device and lack of a nozzle to disperse the heated air for one of the patients. They also raised some questions about the applicability of safety warnings in the operator's manual to the practice of anesthesia. We are fortunate to have a response from the manufacturer, Smiths Medical, confirming that the devices used to care for these patients were functioning within specifications. Smiths Medical also has taken action to ensure that proper hose connectors are available at the original authors' institution and reminds users of the device to ensure those connectors are in place when using the device.

It is clear, however, that for convection warmers to be effective, they must produce a certain amount of heat that can cause an injury if the device is not used properly. It is incumbent upon the clinicians at the bedside to understand how to safely apply this important therapy. Because of the positioning requirements of robotic prostatectomy and the design of the warming disposable blanket, the warming "arms" had to be tucked around the patient. Whether or not the tucking impaired distribution of heated air through the disposable, concentrating heat at the inlet site and contributing to the burn injury is not certain. We do know from the hosing experience that the disposable warming blanket is critical to mitigating the risk of burns, and this report raises the question of the risk when the disposables cannot be used exactly as designed.

What can we learn from these reports that we can implement at the bedside to eliminate the risk of burn injuries? Certainly, we do not want to stop using this highly effective technology. Further, we need to continue to use the warming blankets. The existing safety warnings however are instructive, particularly the warning to *"not use the highest temperature setting when treating patients who have decreased sensation, are nonsensate, or have poor perfusion."* While using the highest setting is common practice during anesthesia care, many patients may well be sufficiently warmed using the medium setting only or by using the high setting for a limited period of time. Given the information in these reports, there are a few recommendations to consider when using convection warmers to reduce the risk of burn injury:

1. Never use the hose without a warming blanket properly connected. (We know that!)
2. Reserve the highest temperature setting for patients who are significantly hypothermic and require rapid correction.*
3. Use the highest temperature setting for the shortest duration required to reach a clinically acceptable temperature.
4. The temperature setting selected for convection warmers should be guided by simultaneous measurement of body temperature with an internal temperature probe, especially when the highest output setting is used.

*NOTE: There are no data to guide the rate at which temperature should be corrected. Normothermia is the ultimate goal. Clinical judgement continues to be the best guide. In this author's opinion, mild hypothermia (35–36 degrees celsius) likely does not require rapid correction with the highest temperature setting. More significant hypothermia (<35 degrees celsius) likely warrants more aggressive correction, but the temperature setting can likely be reduced when the body temperature increases to greater than 35 degrees celsius. Factors like the ambient temperature and the amount of body surface that can be warmed will also influence the temperature setting required to achieve normothermia.

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