ORIGINAL RESEARCH

Adoption of the use of a reflective blanket for passive re-warming of the stable mildly hypothermic patient to reduce unnecessary ICU admissions: A pilot study

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ABSTRACT

Background and objective: In adult inpatients, thermoregulation is important to support vital functions. Occasionally, due to procedures or benign clinical conditions, such as hypoglycemia, autonomic instability, brain injury, paraplegia, autonomic dysreflexia, and septic shock, patients' body temperature falls below 35°C and thus, requires intervention. Due to the floor nursing constraints of hourly monitoring of forced air re-warming, these active warming techniques often lead to clinically unnecessary admissions to intensive care units and utilization of scarce and costly resources. The purpose of this pilot study was to explore passive re-warming with alternative technologies to avoid unnecessary admissions to the intensive care unit.
Methods: A pilot study based on a sample of seventeen patients was conducted to assess the adoption and associated outcome of the use of the reflective blanket. Intervention: Application of a reflective blanket to patients who were mildly hypothermic, yet clinically stable, was explored as an effective mechanism to re-warm these patients in the non-intensive care unit setting.
Results: The investigation based on the use of a reflective blanket on a sample of seventeen hypothermic patients had a success rate of 0.7059 (70.59%).
Conclusions: We conclude that the use of a reflective blanket is an effective and safe passive rewarming mechanism that leads to avoidance of unnecessary intensive care unit admissions. This leads to both cost reductions to patients and appropriate use of ICU resources.

Key Words: Reflective blanket, Normothermia, Hypothermia

1. BACKGROUND

Hypothermia, described as a body core temperature of less than 35°C, can be a serious threat to patients if it produces the dangerous cycle of hypothermia, acidosis, and coagulopathy.[1] In emergency department settings, warm cotton blankets and warmed IV fluids have been used in cases of mild hypothermia with success.[2,3] Case studies in the field of search and rescue have shown using passive warming such as reflective blankets for the treatment of patients with mild hypothermia outside acute care settings to also be adequate.[4] And although many researchers have looked at active, forced air rewarming and passive methods of warming patients in the perioperative setting,[5–8] no research has been found that has examined hospitalized patients requiring intensive care admission (ICU) for their mild hypothermia diagnosis and the monitoring required for their forced air treatment.

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In a standard review of quality and safety procedures at a large academic medical center, an opportunity was identified that would assist in quality patient care while simultaneously improving patient throughput and resource utilization. Due to institution policy, it was discovered that the ICU triage team and the Hospitalist team believed patients were being sent to the ICU unnecessarily due to mild hypothermia. In these patients, nurses were routinely using a forced warm air machine to warm the patients, which was in accordance with institution policy. However, when these machines are used, the frequency requirement of the monitoring of the patients' temperature increases to hourly. Because the increased requirements extended beyond the limitations of the nursing staff on the wards with high nurse to patient ratios, the patients were required to be moved to the ICU where the patient to nurse ratio allows for more intense monitoring. While the patient move allowed the staff to monitor more intensely, both the nursing and medical teams felt it was not the best resource utilization. The purpose of this pilot study was to explore passive re-warming with alternative technologies such as a combination of a warmed blanket and a reflective blanket to avoid unnecessary admissions to the intensive care unit which is required for monitoring the patient receiving forced air rewarming.

2. METHOD

To explore the perceptions of the clinical staff, a team consisting of a clinical nurse specialist, an intensivist, and a hospitalist collaborated to explore methods of re-warming that would meet the clinical needs of the patient while allowing nurse autonomy. Options discussed included the application of pre-warmed blankets, administration of warmed fluids, modification of the room temperature, and use of a reflective blanket. When reviewing the use of pre-warmed blankets, the team discussed that in our practical experience the effects of the warming were short lived. The team also discussed the use of warm fluid administration; however, it was not pursued as it would require a provider order, potentially not be clinically appropriate, and did not support nurse autonomy. The modification of the room temperature was not discounted as an effective mechanism, but the team felt it was an intervention that would not provide fast enough warming. The team ultimately decided to pursue the use of the reflective blanket based on literature that demonstrated efficacy like forced warm air machines.[9] Additionally, Koenen et al. in 2016[10] found that reflective blankets were more effective than cotton blankets, which supported their use as well.

The novel approach of using a warmed blanket along with a reflective blanket was accepted as standard practice for mildly hypothermic patients who met no other conditions for admission to the adult medical ICU. This was based on extant literature describing the use in perioperative settings. The causes of hypothermia in this patient population varied and included post-procedure induced hypothermia, hypoglycemia, autonomic instability, brain injury, paraplegia, and autonomic dysreflexia, and septic shock. Since it was a new use of the device, a protocol was developed to guide appropriate use in the inpatient setting. After IRB approval, a proposal was sent to the supply and distribution chain leadership to acquire a non-purchase PO to procure a supply amount of the reflective blankets to trial with appropriate patients. Upon approval, the clinical nurse specialist engaged with the Division of Hospital Medicine to inform the entire team of the trial use of the reflective blankets with clinically stable but mildly hypothermic to avoid consultation of the ICU team.

Over the course of several months, successful re-warming of twelve patients with conditions ranging from post-procedural hypothermia to hypoglycemia induced hypothermia was achieved using the reflective blanket. All the patients were successfully able to remain on the acute ward and did not require transfer to the ICU for use of a forced warm air device. Incidentally, one patient did go to the ICU one week after needing the blanket. However, the ICU admission was due to a new gastrointestinal bleed and not associated with transient hypothermia.

2.1 Statistical analysis

Statistical analysis was performed on the collected data. The main objective of the analysis was to assess the adoption and effectiveness of the use of reflective blankets for passive re-warming of stable mildly hypothermic patients. A pilot study based on a sample of seventeen patients was conducted to assess the adoption and associated outcome of the use of the reflective blanket. The outcome variable is the status of a patient in terms of the treatment of hypothermia, defined as a binary variable (1 = resolved and 0 = not resolved). The outcome variable was presented and summarized using proportions and associated 95% confidence intervals. Recognizing that the sample size is small, the Binomial exact confidence interval approach was used. The point estimate of the proportion of resolved cases using reflective blankets along with its confidence interval is expected to provide the necessary input for designing a formal study to evaluate the efficacy of the use of reflective blankets in hypothermic patients.

3. RESULTS

Table 1 presents a summary of the outcome based on the use of reflective blankets on hypothermic patients. Figure 1 is a

corresponding bar plot of the results. The investigation based on the use of a reflective blanket on a sample of seventeen hypothermic patients had a success rate of 0.7059 (70.59%). The causes of hypothermia included post-procedure induced hypothermia, hypoglycemia, autonomic instability, brain injury, paraplegia, and autonomic dysreflexia, and septic shock.

Table 1. Patient outcome following the use of reflective blanket

Outcome status	Frequency	Relative frequency
Resolved hypothermia	12	0.7059
Clinical decline in patient leading to admission to ICU or death	4	0.2353
Unknown	1	0.0588

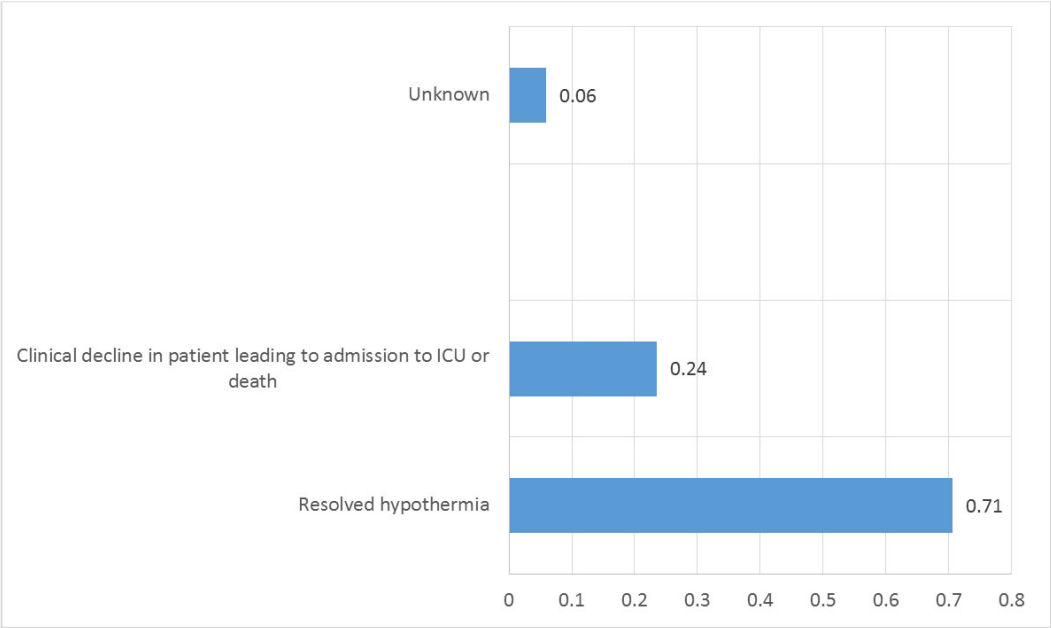

Figure 1. Bar plot of hypothermic patient status after the use of reflective blankets

The Binomial exact 95% confidence interval was (0.4404, 0.8969). The 95% confidence interval for the success rate of resolving hypothermia was 44.04% to 89.69%. This confidence interval contains 50%. Therefore, it implies that there is no convincing evidence to infer that the success rate with the use of reflective blankets is more than 50%. However, since the study is only a pilot, the estimate of 0.7059 with a standard error of 0.1105 can be used as a starting point for the design of a formal study. Specifically, this input can be used as part of the power analysis to determine the optimal sample size required to detect a minimum meaningful success rate at least equal to or more than alternative intervention methods.

4. Conclusion

Due to the successful pilot study trial use of the reflective blanket, full adoption of the protocol was pursued for the institution. The team was informed of the institutional approval after presentation of the trial information to an established value analysis team. Subsequently, a supply purchase of two hundred blankets was approved. Additionally, a pre-existing nursing guideline, which provides parameters of use and monitoring of warming and cooling devices, was modified to include reflective blankets. Continuous quality improvement processes for monitoring of the protocol will be ongoing to ensure best practices are followed.

This pilot project demonstrated the efficacy of the reflective blanket in the inpatient setting to provide passive warming to mildly hypothermic patients. There is value in a more robust clinical investigation related to the use of a reflective blanket in hospital settings. However, any acute care setting with similar institutional policies regarding ICU monitoring & ICU resources for forced air treatment of mild hypothermia could benefit from the use of reflective blankets leading to a more appropriate use of ICU resources during a time when these resources are so very scarce.

Conflicts of Interest Disclosure

The authors declare that there is no conflict of interest.

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