

Preprocedure Warming to Prevent Intraoperative Hypothermia

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Background

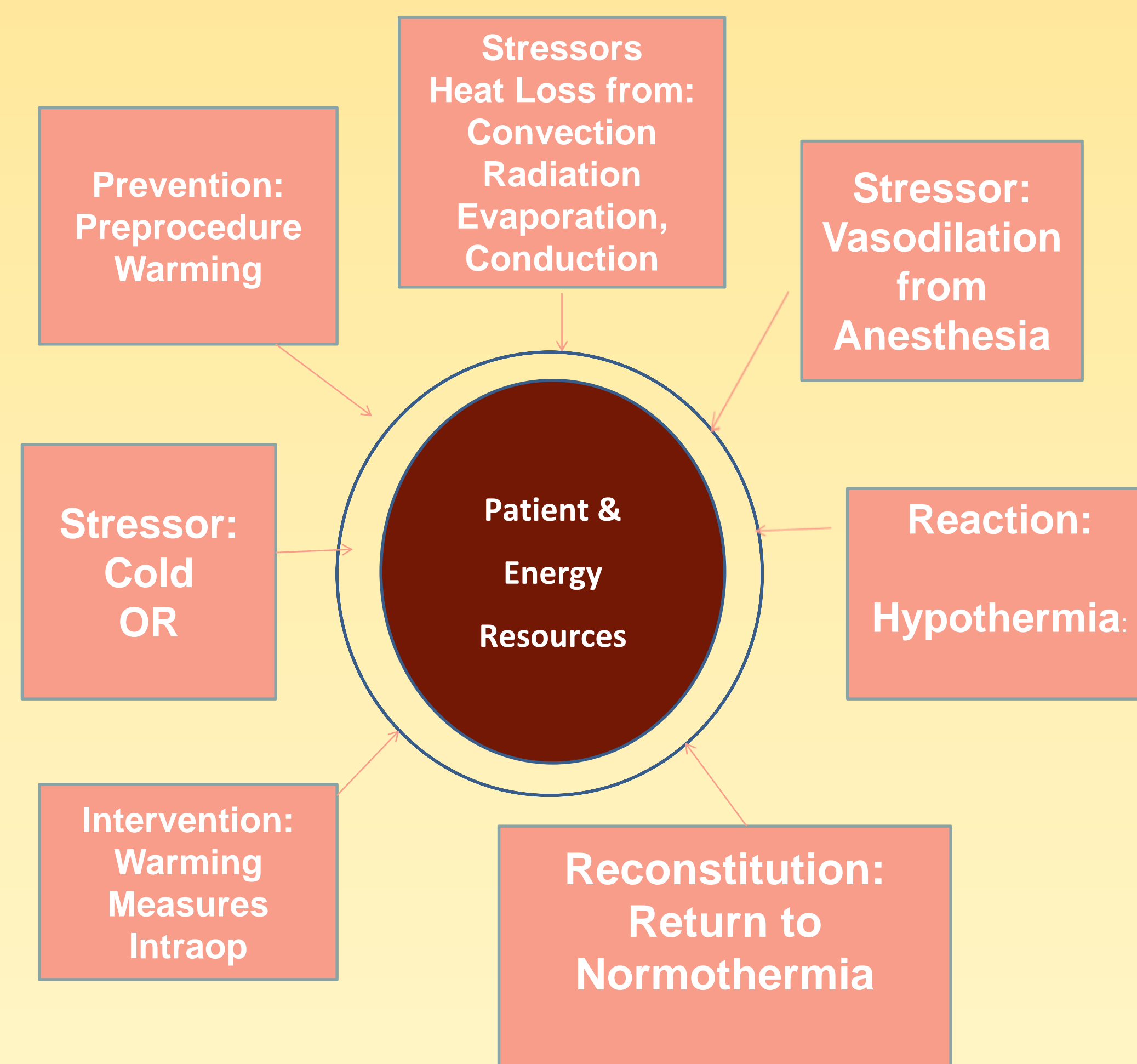
Unplanned hypothermia during a surgical procedure is a contributing factor in various postoperative complications. Even mild hypothermia in the surgical arena has been linked to impairment of the coagulation cascade, blunted respiratory function, cardiac irritability, decreased metabolism of anesthetics, and impaired wound healing. At the cellular level, hypothermia alters the function of neutrophils and macrophages, the body's natural defense against invading bacteria (Kurz, Sessler, & Lenhardt, 1996, p. 1210). Maintaining normothermia intraop helps prevent vasoconstriction and its resulting decrease in tissue oxygenation which can deter surgical site infection (Fiedler, 2001). Rapid heat loss in the operative environment occurs through four different avenues. The most significant heat loss occurs via the processes of radiation and conduction accounting for 85% of the body's loss of warmth (Lynch, Dixon, & Leary, 2010, p. 554). A consistent trigger for radiant heat loss happens through vasodilation immediately following induction of anesthesia which allows warm blood from the body's core to mix with cold blood in the peripheral compartments of the legs and arms. This is known as core to periphery redistribution hypothermia and can reduce core body temperature by 0.5 – 1.5° Celsius (Fossum, Hays, & Henson, 2001, p. 2). Barriers to implementation were identified such as cost and manufacturer recommendations to monitor temperature after application in Preop. This study investigated the effectiveness of prewarming to prevent intraoperative hypothermia in spine fusion cases.

Purpose

The purpose of this retrospective study was to determine if patients undergoing spine fusion surgery who received preprocedure warming utilizing a forced air warming blanket for at least 30 minutes maintained normothermia intraop or had a reduction in time spent hypothermic. Hypothermia is defined as a core temperature < 36° Celsius (C). Research supports a decrease in postoperative complications when a patient remains normothermic throughout the perioperative period.

Theoretical Framework

Neuman's Systems Model Applied to Intraoperative Hypothermia



In applying Neuman's Model to the research study, the patient was seen at the core of the circle surrounded by a concentric ring which should protect the core from external stressors. Related to the study, stressors included heat loss from radiation, a direct result of core to periphery redistribution from anesthetics. Convection and conduction occur when the patient is exposed to the cold environment of the operating room (OR). Heat loss can also happen via evaporation through respiratory exhalation and/or diaphoresis. Prewarming helps prevent hypothermia by "banking heat" in the peripheral compartments of the arms and legs to counteract core to periphery heat loss resulting in normothermia.

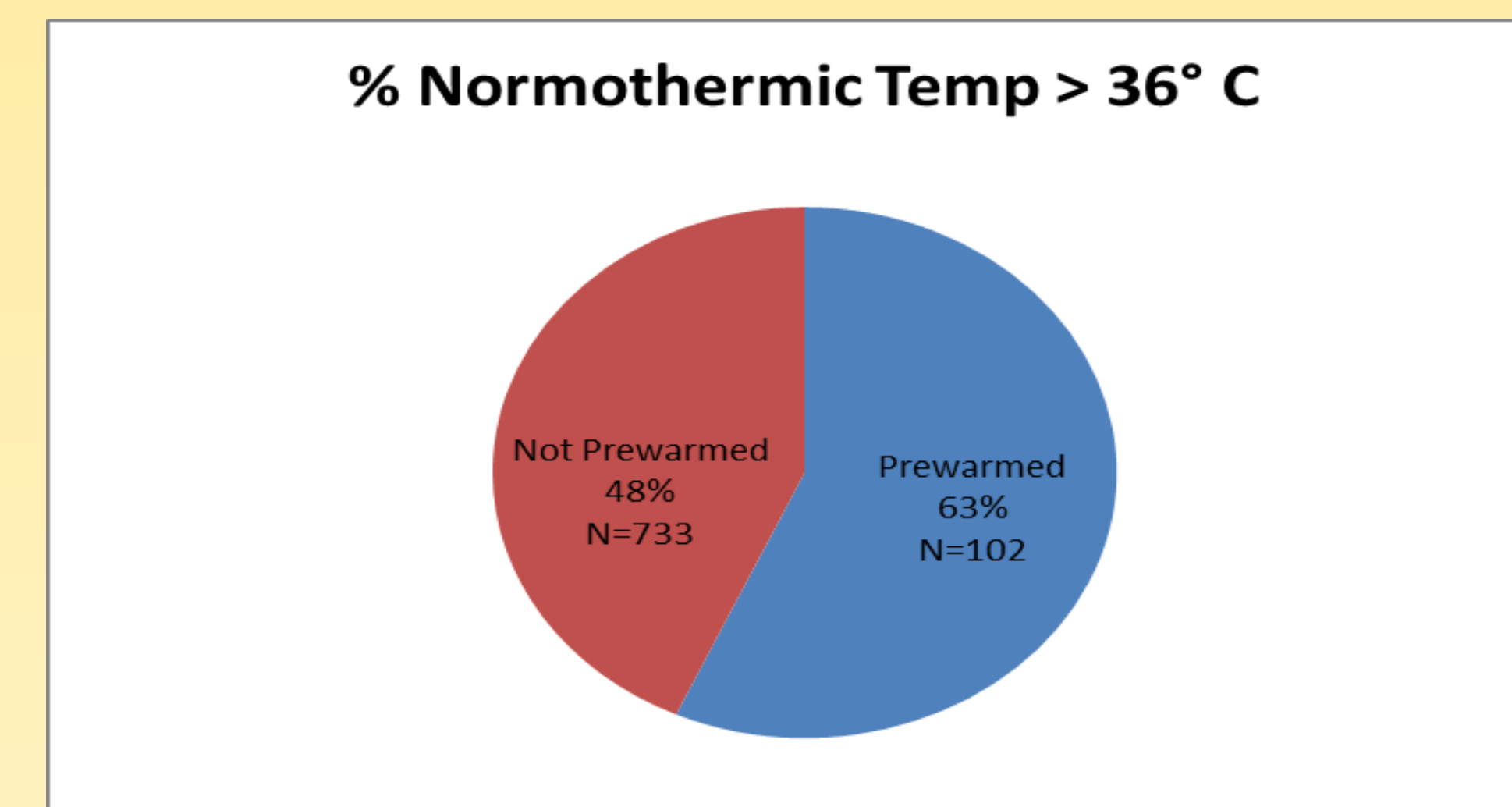
Methods

The setting for the study was a large regional referral tertiary hospital in Western North Carolina. The researcher utilized a retrospective chart review to compare spine fusion patients who received preprocedure warming with spine fusion patients who did not receive preprocedure warming for the occurrence of intraop hypothermia based on the core temperature measurements documented by the Certified Registered Nurse Anesthetist (CRNA) administering anesthesia during the surgical case. Core temperature was monitored every five minutes intraoperatively and automatically captured in the electronic anesthesia record. A researcher developed tool was utilized to capture data. Hypothermia was measured by the variable cold time minutes which refers to the time in minutes the patient was not producing a core temperature reading of $\geq 36^\circ\text{C}$ as measured by esophageal or nasopharyngeal probe intraop.

Results

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The sample size of this study was 889 surgical spine fusion cases. Fifty-four cases were eliminated due to missing data resulting in a sample size of 835 for Crosstabulation analysis of the variables prewarmed and hypothermic on admission to OR.



Crosstabulation analysis revealed there were 102 cases that were prewarmed with 63% remaining normothermic. Of the 733 cases that were not prewarmed, only 48% remained normothermic.

Chi-Square tests did not support a significant correlation between the variables prewarmed and hypothermia on admission to OR, $p = .120$.

However, prewarming significantly impacted the variable cold time minutes. Cold time minutes in the prewarmed group had a mean of 24.76 minutes compared to the group that was **not** prewarmed which had a mean of 33.85 minutes. Levene's test for equality of variances revealed a significance of .05.

Prewarming & Cold Time Minutes	N	Mean	Std. deviation	Std. error Mean	Levene's Test
Not Prewarmed	683	33.85	52.028	1.991	$F = 3.838$
Prewarmed	93	24.76	48.967	5.078	$\text{Sig.} = .05$

Conclusion

Variables	Cold time Minutes	
PACU Temp	Pearson Correlation -.087	with Sig. of .015
Last Intraop Temp	Pearson Correlation -.183	with Sig. of .000
Max Temp	Pearson Correlation -.274	with Sig. of .000
Min Temp	Pearson Correlation -.499	with Sig. of .000

The variable cold time minutes had a notable relationship to other variables such as minimum temp, maximum temp, last temp, and PACU temp with significance values below .05 as seen above. The relationship was significant in that the less time the patient registered "cold time in minutes", the higher the means for their PACU temp, last Intraop temp, and maximum temp indicating the patient was warmer overall. There was an inverse relationship between the variable cold time minutes to the variable minimum temp with an undesirable increase in the mean for minimum temps.

This study contributed to the body of knowledge regarding the need to prewarm patients to prevent perioperative hypothermia and its serious consequences. It also revealed the need for continued work in educating staff and patients regarding the need for prewarming. Sharing the results of this research study can help improve patient outcomes through prewarming.

Implications for Nursing

Prewarming surgery patients is an intervention supported by research. Barriers to prewarming need to be identified and removed to facilitate this important intervention. Raising awareness of the impact that prewarming had on reducing the time the surgical spine patient was hypothermic (measured by the variable cold time minutes) in the study should help reinforce this important evidenced base practice.

References

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