

TITLE: PERIOPERATIVE BODY TEMPERATURE REGULATION IN REGIONAL VS. GENERAL ANESTHESIA**AUTHORS:** S.M. Frank, M.D., H. Crowley, M.D., S. Parker, M.D., R. Christopherson, M.D., Ph.D., M. Williams, M.D., P. Rock, M.D., B. Perler, M.D., C. Beattie, M.D., Ph.D.**AFFILIATION:** Departments of Anesthesiology and Critical Care Medicine and Surgery, Johns Hopkins Medical Institutions, Baltimore, Md., 21205

The regulation of body temperature in the perioperative period has important implications. Hypothermia can cause altered mental status and cardiac rhythm while shivering leads to increased myocardial stress to meet metabolic demands (1). A leftward shift in the oxyhemoglobin dissociation curve results in less oxygen delivery to the tissues. Few investigators have addressed the issue of body temperature maintenance associated with different anesthetic techniques. Epidural anesthesia (EA) causes heat loss by cutaneous vasodilation while general anesthesia (GA) has complex central and peripheral effects. Therefore, it is not obvious which type of anesthesia is superior. We report the results of a trial comparing EA and GA with regard to perioperative changes in body temperature.

Fifty-six patients undergoing lower extremity vascular surgery were prospectively randomized to receive EA or GA. Informed consent was obtained from all patients and the protocol approved by the Clinical Research Committee. The anesthesia and temperature conservation measures were performed by protocol. EA consisted of 0.75% bupivacaine to achieve a T-8 sensory level. GA consisted of thiamylal, 5-10 mcg/kg fentanyl, 0.5-1.0 % enflurane, nitrous oxide, and pancuronium. Although the thermostats were set to similar temperatures in each operating room (OR), the rooms varied in the measured ambient temperatures. One room, in which cardiac cases were often performed, was consistently colder (21.3°C) than the others (24.5°C). There was random assignment to either the cold OR (20 patients) or the warm OR (36 patients). All intravenous fluids and blood were given through a warmer. During GA the inspired gases were humidified and warmed. All body temperature measurements were made using an electronic digital thermometer (IVAC Temp-plus II, San Diego, CA). Temperatures were taken orally in 85% of patients. The others were taken via the axillary or rectal routes and

were equally distributed between the EA and GA groups. Temperatures were taken every hour following admission to the ICU. The time from admission to the ICU until warming to 36°C was used as a measure of ability to rewarm. The data were analyzed using an unpaired two-tailed T-test and a two-factor ANOVA with significance defined as $p < 0.05$.

The preoperative temperatures were $36.5 \pm .3^\circ\text{C}$ and $36.6 \pm .3^\circ\text{C}$ in the EA and GA groups respectively. The postoperative temperatures and the hours to rewarm are summarized in the table and are reported as mean \pm SEM. All temperatures are in degrees centigrade. There were no differences between the EA and GA groups in preoperative temperature, hours spent in the OR, blood loss, or amount of IV fluids and blood transfused.

Intraoperatively, the results show that EA and GA have similar effects on the maintenance of body temperature when given in a warm OR. However, the patients receiving GA had a greater intraoperative temperature drop compared to those receiving EA when anesthesia was given in a cold OR. Postoperatively, the patients receiving EA warmed to 36°C faster than those receiving GA regardless of the OR temperature.

Given a patient population with a high incidence of cardiac morbidity and mortality, such as the vascular surgery patients in this study, an anesthetic technique that preserves temperature homeostasis may be beneficial. The results suggest that intraoperatively, EA may be more desirable than GA only if the OR ambient temperature is low. Also, EA may offer some advantage over GA with respect to rewarming in the postoperative period.

Supported by NIH grant # GM38177.

	Epidural anesthesia		General anesthesia	
	cold OR	warm OR	cold OR	warm OR
postop temp.	$35.8 \pm .2$ *	$35.3 \pm .4$	$34.5 \pm .3$	$35.3 \pm .2$
hours to warm	$1.5 \pm .6$ §	$2.4 \pm .5$ §	4.4 ± 1.0	$3.1 \pm .6$

* $p < .05$ Epidural anesthesia vs. General anesthesia in a cold OR

§ $p < .05$ all Epidural patients vs. all General patients

1. Bay J, Nunn JF, Prys-Roberts C: Factors influencing arterial pO₂ during recovery from anesthesia. *Brit J Anaes* 40:398-406, 1968.

A786

Title: Differences in the Intrinsic Efficacy of Spinally Administered Mu Opioid Agonists in the Production of Analgesia

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Agonists acting at the same receptor may differ in the fraction of the receptor population that each must occupy to produce a given magnitude of effect. Agents which can produce a given effect by occupying a small proportion of the available receptors are said to have a large spare receptor population and to possess high intrinsic efficacy. To determine whether well defined mu agonists such as morphine (M), sufentanil (S), alfentanil (A) or the mu peptide DAGO (D) differ in this property, dose response curves on the 52.5C hot plate test were carried out with lumbar intrathecal injections in rats pretreated intrathecally (24 hrs) with either saline, 0.2, 2 or 20 nmol of the irreversible mu receptor antagonist B-Funaltrexamine (BFNA) (1).

BFNA dose (nmol):	Ratio of ED50 as compared to saline		
	0.2	2.0	20.0
Test Drug			
Morphine	5.3#	15.3#	37.3#*
Sufentanil	1.2	1.9	5.3*
Alfentanil	--	2.0	2.5
DAGO	1.9	4.1	7.4

#: $P < 0.05$: across drugs at this B-FNA dose; * $p < 0.05$ across doses of this drug

As indicated, consistent with a progressive reduction in the population of spinal mu receptors, there was a right shift in the dose response curves for each agent with the ratio of the increase in the ED₅₀ as compared to saline pretreated rats with any given dose of BFNA being: $M \gg S = D = A$. These data are consistent with the interpretation that M possesses relatively few spare receptors, requires a high fractional receptor occupancy and has a lower intrinsic efficacy as compared to the other mu agonists. Agents which must occupy a large fraction of the receptor population will show a greater rightward shift for a given degree of receptor inactivation than an agonist which produces the same effect by the occupancy of a smaller fraction of the receptor population (2). Significantly, these results showing different intrinsic activity for these agent are consistent with previous results obtained in studies of spinal opioid tolerance (3).

- References
- 1) Ward, SJ, Portoghesi, PS, and Takemori, AE Pharmacological profiles of B-FNA and B-CNA on the mouse vas deferens preparation. *Eur J. Pharm.* 80: 377-384, 1982.
 - 2) Kenakin, TP. Pharmacologic analysis of Drug receptor Interactions, Raven Press, 1988.
 - 3) Stevens, C. and Yaksh, T.L. Potency of infused spinal antinociceptive agent is inversely related to magnitude of tolerance after continuous infusion. *J Pharm exp Ther.* 250: 1-8; 1989.