RESEARCH ARTICLE

The Clinical Impact of Ambient Operating Room Temperature and Other Perioperative Factors on Patient Comfort during Wide-awake Hand Surgery Using Local Anesthesia

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Abstract

Background: The prevalence of wide-awake hand surgery using local anesthesia has increased substantially. The full influence of perioperative factors, namely operating room temperature, on patient comfort during these procedures is presently underreported.

Methods: One hundred and fifty-eight patients undergoing wide-awake hand surgery using local anesthesia were prospectively enrolled. Surveys with visual analog scale (VAS) were administered after surgery to assess overall patient comfort (OPC) and patient comfort with temperature (TPC). Operating room temperature at the initiation of the procedure, surgery type, duration of surgery, tourniquet use and local anesthetic use were all recorded and their impact on patient comfort analyzed. The VAS used ranged from 1 (least comfortable) to 5 (most comfortable).

Results: Across all patients, the mean OPC was 4.7 (Range: 2 – 5, SD=0.6) and the mean TPC score was 4.7 (Range 2 – 5, SD=0.6). There were weakly negative correlations between room temperature and VAS score for OPC (r_s=-0.2, *P=.038*) and TPC (r_s=-0.2, *P=.051*). The mean OPC score was lower with tourniquet use [4.6 (SD=0.7) versus 4.9 (SD=0.4), *P=.002*].

Conclusion: Patient comfort during surgery using local anesthesia is not substantially affected by operating room temperature. Tourniquet use negatively impacts patient-reported comfort. Continued studies into the optimization of patient comfort during wide-awake hand surgery are warranted.

Level of evidence: IV

Keywords: Hand surgery, Operating room, Patient comfort, Temperature

Introduction

Wide-awake hand surgery using local anesthesia has become increasingly common. The technique is considered a safe and efficacious alternative to general anesthesia or sedation for many surgical indications (1–4). Moreover, it has been shown to decrease preoperative patient anxiety, reduce

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operative costs, and is associated with high rates of patient satisfaction and a low risk of complications (5, 6). As the prevalence of wide-awake local anesthesia continues to increase in hand surgery, concerns regarding patient comfort and satisfaction must be evaluated.

The physical environment of the operating room (OR) is an important consideration when performing any procedure (7). OR temperature is a notoriously debated topic centered around the comfort of its inhabitants. Higher OR temperatures can potentially influence surgeon performance and lead to surgeon perspiration, which theoretically carries an increased risk of infection (8, 9). Higher temperatures can also detract from the performance of other operative team members (7–9). Conversely, from the patient perspective, the impact of ambient temperature is traditionally considered through its physiological effects and maintenance of patient normothermia (10). which carries a theoretical concern associated with colder OR temperatures. In wide-awake surgeries, patient comfort becomes an additional factor in the OR temperature setting debate and could be affected by both warmer and colder environments. A change in skin temperature of ± 3.6 °F has been shown to elicit feelings of discomfort, but due to individual differences in regulatory mechanisms, the ambient temperature gradient required to change skin and core body temperature is highly variable (11, 12). Currently, as supported by regulatory guidelines, the OR is typically kept just below ambient room air temperatures (13). However, patient comfort during wide-awake surgery across this general temperature range has not been fully assessed.

The positive impact of no tourniquet use on patient comfort during wide-awake hand surgery is a referenced benefit of the increasingly common WALANT (Wide-awake local anesthesia no tourniquet) technique, and although existing studies have also identified acceptable overall patient comfort during WALANT surgeries, the specific impact of OR temperature on comfort in this setting is underreported (14, 15). Therefore, the aims of this study are to evaluate the effect of OR temperature on patient comfort during wide-awake hand surgery using local anesthesia and secondarily assess other perioperative factors that may influence patient comfort, including tourniquet use. We hypothesize that room temperature, as experienced by the patient under standard operative practices, will not correlate with perioperative patient comfort scores to a clinically significant degree, defined as $r \geq 0.5$.

Materials and Methods

After Institutional Review Board approval, patients undergoing wide-awake hand surgery by one of two fellowship trained hand surgeons from a single group were prospectively enrolled. The procedures included are presented in Table 1. Prior to surgery, patients were given a brief description of the study, and consent for participation was obtained. All patients undergoing hand surgery under local anesthesia were considered for inclusion in the study. Patients were excluded if their surgery was performed with any form of anesthesia beyond local-only (intravenous sedation, regional block plus sedation, or general anesthesia). Patients included in the study were given a two-question survey in the recovery room immediately postoperatively, which asked them to assess their overall comfort level during surgery (OPC) as well as their comfort level with the room temperature (TPC). Both question response options utilized a Visual Analog Scale of 1 – 5 (1 = Very uncomfortable, 5 = Very comfortable). The operating surgeons were not involved in providing the survey and were blinded to the responses. Room temperature was measured using the OR's digital thermometer and recorded at the initiation of the procedure. Temperatures were not actively manipulated at any point during the study, and any observed variations were inherent to facility or room differences. Standard procedures at each facility were intentionally maintained regarding the use of blankets for patient comfort during surgery. Duration of surgery, type of surgery, tourniquet use, and local anesthetic use were also recorded at the time of surgery. Data collection lasted for a duration of six months.

Survey data was compiled and analyzed using the Statistical Package for the Social Sciences (SPSS Inc., Ver. 26.0). Descriptive statistics were used to report patient demographics, details of surgery, and patient comfort scores. The primary outcome measure was established as the relationship between patient comfort and OR temperature. The effect of tourniquet

Table 1. Frequency of included procedures

Procedure Description	
Endoscopic Carpal Tunnel Release	77
Trigger Finger Release	26
Multiple	10
Mass Excision	9
Excisional Biopsy	7
Cyst Excision	5
Dorsal Compartment Release	5
Closed Reduction Percutaneous Pinning	4
Open Reduction Internal Fixation	3
Open Carpal Tunnel Release	2
Cubital Tunnel Release	2
Exploration	2
Removal of Hardware	1
Tendon Transfer	1
Central Slip Repair	1
Fasciectomy	1
Foreign Body Excision	1
Amputation	1

use, duration of surgery and type of anesthetic used were secondarily assessed. Spearman's correlation analyses were used to assess the relationships between these variables. After assessing for normality, Mann-Whitney U tests were appropriately used to analyze mean differences between comfort scores within the established categorical subgroups (i.e. tourniquet use). To assess mean score differences across the different anesthetic combinations used, a Kruskall-Wallis test was performed. Significance level for all statistics was established at *P<.05*.

Results

A total of 158 patients were enrolled in the study. The mean age of the patients was 61.3 years (Range: 23 – 92 years, SD=14.6 years). Eighty-one patients (51.3%) were female and 77 (48.7%) were male. A tourniquet was used in 53.8% of surgeries. The most common local anesthetic solution used was 1% lidocaine with epinephrine buffered with sodium bicarbonate, which was utilized in 89.2% of surgeries. Unbuffered 1% lidocaine with epinephrine was used in 8.9% of surgeries and plain 1% lidocaine in 1.3%. Plain 1% lidocaine with 0.25% Marcaine was used in one surgery. The most common procedure was endoscopic carpal tunnel release (48.7%). Mean surgery duration for all procedures was 15.1 minutes (Range: 4 – 79 minutes, SD=12.5 minutes).

The mean recorded temperature was 67.6 °F (Range: 64.0–69.7 °F, SD=1.0 °F). Median temperature was 67.7 °F. Across all patients, the mean OPC score was 4.7 (Range: 2 – 5, SD=0.6) and the mean TPC score was 4.7 (Range 2 – 5, SD=0.6). The characteristics of patients reporting OPC scores of three or less are presented in Table 2.

There were weakly negative correlations between room temperature and VAS score for OPC (r_s=-0.2, *P=.038*) and TPC (r_s=-0.2, *P=.051*) [Figures 1; 2]. Surgery duration did not correlate with OPC scores (r_s=-0.001, *P=.99*). The mean OPC score was lower with tourniquet use [4.6 (SD=0.7) versus 4.9 (SD=0.3), *P=.002*] [Figure 3]. Among the local anesthetics most commonly used, there were no significant differences in OPC scores between buffered lidocaine with epinephrine (Mean=4.7, SD=0.6) and unbuffered lidocaine with epinephrine (Mean =4.8, SD=0.4) (*P=.78*).

Table 2. Characteristics of patients with Overall patient comfort score (OPC) of 3 or less

Patient ID	Age	Sex	Surgery	Tourniquet	Anesthetic	Surgery Duration[a]	OR Temperature[b]	TPC	OPC
51	75	M	ECTR	Y	BLE	7	68.6	5	2
71	75	M	ECTR	Y	BLE	8	67.0	5	3
77	70	M	Mass Excision	Y	PL	24	65.0	3	3
115	47	F	ECTR	Y	BLE	11	69.0	4	3
145	60	F	ECTR	Y	BLE	10	66.1	5	3
148	76	F	Multi	Y	BLE	24	66.6	5	3

ECTR = Endoscopic Carpal Tunnel Release, Multi = Multiple procedures, BLE = Buffered lidocaine with epinephrine, PL = Plain lidocaine, a Surgery duration in minutes, **b**OR temperature in °F, TPC = Patient comfort with temperature score

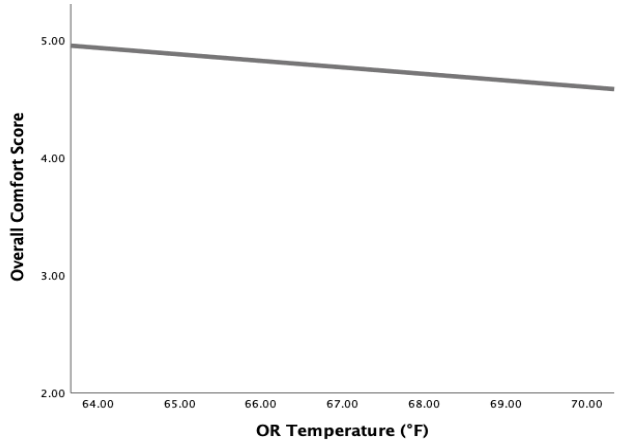

Figure 1. Fit line of overall comfort score by OR temperature (r_s=0.2, *P=.038*).

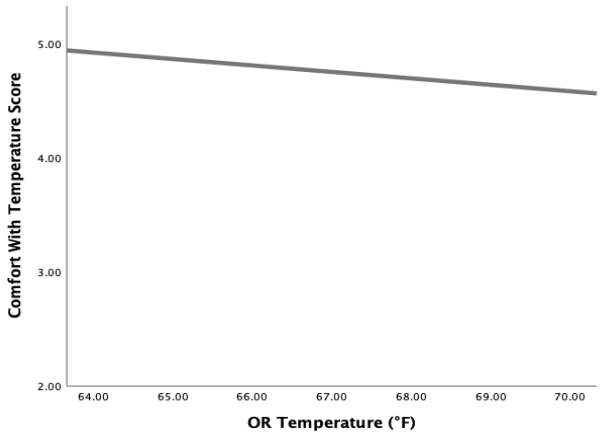

Figure 2. Fit line of comfort with temperature score by OR temperature (r_s=-0.2, *P=.051*)

Figure 3. The effect of tourniquet use on mean overall patient comfort scores.

Discussion

Wide awake hand surgery using local anesthesia is an increasingly common technique that is equally efficacious to techniques that involve sedation or general anesthesia (16). The patient's awake status necessitates expanded considerations for perioperative patient comfort. Our results suggest that OR temperature does not substantially impact patient comfort during surgery when proper patient warming measures are in place. Tourniquet use may, however, detract from patient comfort.

Within our study cohort, higher temperatures were weakly correlated to lower comfort scores across a total range of 5.7 °F. The combined study results support the hypothesis and quantify the impact of a core OR variable on patient comfort. A warmer environment has long been associated with added patient comfort, and traditionally, measures are taken to warm the patient prior to induction of anesthesia (7). While there is physiological importance to maintaining patient normothermia during longer procedures under general anesthesia, this becomes less vital in shorter wide-awake hand surgeries where comfort level may outweigh physiological factors. However, patients are still traditionally thought to be more comfortable in a warmer operative environment. Conversely, the operative team often prefers colder OR temperatures to optimize performance and comfort. These conflicting considerations in determining the optimal OR temperature can be better reconciled through the perioperative use of patient warming devices. In our study, patients were given warm blankets as requested. This strategy permits a slightly colder OR if preferred by the operative staff, and is in line with standard clinical practice. With the use of blankets, we did not find that patients were less comfortable in colder rooms. The efficacy of warming devices in offsetting colder OR temperatures to maintain patient comfort has been reported in the literature. During nonanaesthetized cardiac catheterization, the use of warm blankets was found to effectively prevent substantial body temperature changes and maintained thermal comfort in the large majority of patients across an ambient temperature range of 3.6 °F (17). Surgeon and staff preference, in accordance with facility standards, can therefore reliably drive OR temperature decisions without compromising patient comfort.

Mean comfort scores were significantly lower with tourniquet use, which is consistent with prior reports in the literature. Multiple studies have described a decrease in patient comfort associated with tourniquet use during hand and upper extremity surgeries (5,14,16,18–20). The commonality of no tourniquet use has paralleled the broader implementation of WALANT technique hand surgeries, and the associated benefits are well documented (21–23). The primary concern in surgeries without tourniquet use is achieving hemostasis to allow acceptable surgeon visualization and prevent unnecessary blood loss. To address this, reported WALANT protocols have highlighted the efficacy and safety of epinephrine containing local anesthetic to control blood loss in the absence of tourniquet use (24).

Both of the patients given plain lidocaine in the present study also had a tourniquet placed during surgery, demonstrating the correlation between the two variables. Mohd Rashid et al. better emphasized this through their study on the effect of epinephrine use with local anesthetic during trigger finger release. While comfort scores were higher in their intervention group (patients receiving epinephrine), the control group utilized a tourniquet during surgery while the intervention group did not (25). In all, given the present findings and similarly reported outcomes in WALANT techniques, patient comfort during wide-awake hand surgery is likely maximized without the use of a tourniquet, which is often augmented by epinephrine-containing anesthetic solutions.

There are several limitations to this study. First, OR temperatures were not actively manipulated during the

study and the temperature was measured only once. Given that no perioperative thermostat adjustments were performed, we expect the magnitude of any potential temperature fluctuations to be low. Second, the range of temperatures that our patient group was exposed to was somewhat narrow (~6° F). However, considering the previously cited literature, this should have been a large enough range to trigger physiological skin temperature differences and possible discomfort had warming devices been withheld. Still, it is likely that there are low and high temperature thresholds that our ORs did not reach beyond which patients would be uncomfortable. Third, patient warming devices, most notably the use of warm blankets, were not controlled for in the study in order to maximize the clinical applicability of our results. Such measures should be available in most operative environments and can assist in maintaining patient comfort despite temperature variation. While temperature alone may in fact correlate with patient reported comfort, the scope of this study was to examine the clinical impact of room temperature on patient comfort. We hypothesized that in standard practice any impact that room temperature may have on comfort is easily negated with readily available resources, as was demonstrated through our results. By incorporating the use of blankets, our findings demonstrate that patients are able to be made comfortable across a range of temperatures, supporting the notion that operative staff preference can safely guide OR temperature decisions without sacrificing patient comfort. Finally, data was collected through patient survey, and was therefore susceptible to response bias. Future studies with randomized groups to predetermined temperature settings may provide more accurate conclusions on the impact of OR temperature on patient comfort.

Overall, the results of our study demonstrate that patient comfort during wide-awake hand surgical procedures is acceptable, and clinically unaffected by OR temperature within the range of temperatures we assessed. Surgeon and operative staff preference can guide temperature setting without impacting patient comfort, which can be easily augmented through the use of warming devices. Tourniquet use may impact patient-reported outcomes.

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