

Implementing Recommended Perioperative Pain Practice Guidelines by Incorporating
Intravenous Acetaminophen

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Abstract

Optimizing perioperative pain management is important in decreasing adverse outcomes in surgical patients. The purpose of this project was to implement recommended perioperative pain practice guidelines by incorporating intravenous acetaminophen (IVA) as part of multimodal analgesia at an acute care hospital in Northern Arizona. Lewin's change theory guided this project by using strategies to break barriers in accepting and changing perioperative pain guidelines by completing a retrospective chart review to determine IVA efficacy. Data was obtained from adult surgical patients at this facility from January 1, 2014-July 31, 2014 which resulted in 74 charts that met criteria; 37 patients received IVA and 37 patients did not receive IVA. Chi-square analysis and a paired t-test compared mean pain scores, total opioid dosages in the first 24 hours, length of hospital stay (LOS) and patient demographics/clinical characteristics. Statistically significant differences were noted in pain scores at 12 and 24 hours, total opioid dosages and LOS ($p < 0.05$) in the IVA group. There were no statistically significant difference in demographic characteristics between the two groups nor in postoperative care unit (PACU) pain scores ($p > 0.05$). These findings support current literature review that IVA is an effective non-analgesic for perioperative pain management.

Keywords: perioperative pain, intravenous acetaminophen, practice guidelines, Lewin's change theory

Implementing Recommended Perioperative Pain Practice Guidelines by Incorporating Intravenous Acetaminophen

Clinical practice guidelines (CPGs) are developed to inform clinicians about the best options for managing treatment, with the explicit intent to influence behavior (Jaeschke, Jankowski, Brozek, & Antonelli, 2009). The best evidence is based upon systematic reviews and patient-oriented evidence to support practice guidelines (Lin & Slawson, 2009). Practice guidelines for perioperative pain management developed by the American Society of Anesthesiologists (ASA) have met rigorous criteria set by the National Clearinghouse Guideline (NCG) and serve as a resource for physicians and healthcare professionals who manage perioperative pain (ASA, 2012).

The Institute of Medicine (IOM) (2011a), define CPGs, hereafter known as practice guidelines, as statements with recommendations that are intended to optimize patient care, and are based on a systematic review of the existing evidence which include potential benefits and harms to patients (p.15). The benefits of using evidence-based research (EBR) are improvements for quality of life by supporting interventions that are beneficial in decreasing morbidity and mortality (Lim et al., 2008, p. 26). There are several reasons that healthcare providers do not implement or adhere to practice guidelines, which could be related to lack of organizational priorities, poor practitioner knowledge, and lack of physician collaboration (Samuels & Fetzer, 2009). Organizational culture and shared beliefs can influence attitudes and behaviors of its members in supporting and utilizing the use of practice guidelines (Dodek, Cahill, & Heyland, 2010, p. 669).

Optimizing Perioperative Pain

Pain affects millions of Americans which contributes substantially to morbidity, mortality, and disability resulting in personal and economic tolls for the patient and health care system (IOM, 2011b, p. 5). The ASA (2012) developed guidelines to reduce the risk of adverse outcomes resulting from inadequate control of perioperative, which can lead to delayed discharge, hospital readmissions, needless suffering, and impaired health-related quality of life (p. 249). The best outcomes from pain management result in the least adverse outcomes for the patient and enhancing restoration of function and recovery of the ability to breath, cough, and ambulate without limitations.

Inadequate Acute Pain Management

Inadequate pain management not only result in adverse physiological outcomes, but can result in emotional outcomes such as anger, fear, anxiety, frustration, guilt and depression (Linton & Shaw, 2011). These physiological and emotional consequences can play a role in delayed healing and recovery. There were two national surveys, a decade apart, which concluded acute pain management is inadequate in surgical patients (Apfelbaum, Chen, Mehta & Gan, 2003; Warfield & Khan, 1995). A systematic review by Correll, Vlassakov, and Kissin (2014) evaluated the implementation of new techniques and drugs for the treatment of acute pain over the past 20 years and concluded there is no real progress in relieving acute pain.

Survey scores from the Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) from 2429 hospitals were evaluated by Gupta, Daigle, Mojica, & Hurley (2009), who concluded that 68% of patients reported adequate pain control. According to this information, it appears that pain control is adequate, but the HCAHPS survey question regarding pain control, does not adequately address perioperative pain management, but instead only

addresses overall how well their pain was controlled in the hospital (HCAHPS, 2014, p.2). The results from these scores can mislead healthcare provider's interpretation of how well they are managing perioperative pain. A national patient survey about postoperative pain management needs to be conducted to determine adequacy of pain management and to update previous statistics. Healthcare providers can contribute to the pain challenge, by continuously improving and optimizing pain management, which include adopting recommended practice guidelines.

Intended Improvement

This project is important knowing that acute surgical pain progresses into chronic pain in 10–50% of patients who undergo common surgical procedures, with progression to severe chronic pain in 2–10% of these patients (IASP, 2011). Chronic post-surgical pain persists 3-6 months after surgery, but the incidence can be decreased if multimodal analgesia is implemented pre-emptively and perioperatively (Vadivelu et al., 2014). Chronic pain decreases activities of daily living, increases morbidity and mortality and leads to a lifelong decreased quality of life (Vijayan, 2011). The intended improvement for this project is to optimize perioperative pain management, by incorporating IVA in a multimodal approach, for all surgical patients at an acute care facility in Northern Arizona.

Multimodal Analgesia

Multimodal analgesia is recommended by the ASA to decrease adverse outcomes from monotherapy use of opioids which can cause, “respiratory depression, over-sedation, circulatory depression, nausea, vomiting, pruritus, constipation, ileus, urinary retention and sleep disruption” (ASA, 2012, p. 239). The Joint Commission (TJC) (2012), concerned about the negative outcomes from monotherapy pain management, published a sentinel event alert, *Safe Use of Opioids in the Hospital*, which recommended appropriate pain management techniques. The

techniques recommended by TJC are avoidance of unintended opioid use in hospitalized patients, support use of multimodal pain management, and encouraging clinicians to use non-opioid analgesics, such as acetaminophen (TJC, 2012, p. 3). Using monotherapy pain management, can lead to higher tolerance to pain medications which lead to increased adverse outcomes (Nordquist & Halaszynski, 2014, p. 3).

Strategies to reduce opioid usage will reduce adverse outcomes which lead to optimized pain management (Oderda, 2012, p.6s). A reduction in opioids by using a multimodal approach, such as incorporation of non-analgesics, such as IVA, can result in increased patient satisfaction and better health outcomes (Smith, 2011, p. 973). Safe and effective pain management is important for every patient, but it is absolutely imperative to use multimodal analgesia in populations, such as the elderly and morbidly obese.

Local Problem

Healthcare providers who manage perioperative pain, at the facility this project was conducted, implement a multimodal approach, and incorporate non-steroidal anti-inflammatories (NSAIDS) and cyclooxygenase 2 inhibitors (COXIBS), but do not routinely use acetaminophen. The majority of the patients at this facility are older adults who have contraindications to NSAIDS or COXIBS, such as impaired renal function or history of cardiovascular disease. These medications inhibit platelet function resulting in increased bleeding, which can be unfavorable during the perioperative period. Acetaminophen is an alternative non-opioid analgesic, with the least contraindications, and effective for relieving moderate to severe acute pain.

Indications for Route of Administration

The intravenous route is more favorable during the perioperative period, because of delayed gastric absorption due to altered gastric emptying, from having nothing per mouth

(NPO), stress, surgery, opioids and anesthesia (Ofirmev, 2015). Oral acetaminophen is absorbed in the small intestine and undergoes first-pass metabolism which results in accumulation in the liver, whereas IVA avoid first-pass metabolism, thus a decreased accumulation in the liver (Jahr & Lee, 2010). The advantages of IVA are its low side effects, compared to opioids, and its rapid onset to reach the maximum plasma concentration (Tmax) of 15 minutes, compared to oral Tmax times of 45-75 minutes (Lachiewicz, 2013). This project focused on incorporating IVA because of decreased absorption of oral forms in the perioperative period.

It is important to note IVA was initially approved in January 2014, at the facility where the project was conducted, for surgical patients who were having total joint replacements. Although, IVA's use was limited to total joint surgeries, surgeons who were authorized to order IVA were not routinely incorporating it for perioperative pain. Barriers to implementing IVA could be related to lack of knowledge of efficacy and its benefits for perioperative pain.

Purpose of the Project

The purpose of this project was to change healthcare provider's current pain practice and implement recommended perioperative pain practice guidelines by incorporating intravenous acetaminophen. Acquiring knowledge supporting efficacy of IVA, resulted in collaboration between the interdisciplinary team, with goals to improve the health outcomes of surgical patients, by optimizing pain management in the perioperative period. The blueprint for pain prevention include the development and dissemination of clinical practice guidelines in areas of pain care by implementing quality standards to improve the care of patients suffering pain (IOM, 2011b, p. 43).

Research Question

A major strategy in changing behavior or to support a change is producing evidence. A literature review was conducted to determine if IVA is effective for acute pain in the perioperative period. Thus, the research question, “Among surgical patients over the age of 18, is IVA more effective in acute pain management compared to omission of IVA, in the perioperative period?” guided the literature search and resulted in numerous articles, nationally and worldwide, which conclude that IVA is safe and effective for moderate to severe acute pain.

Stakeholders

Current stakeholders that support this project include anesthesia providers who are considered experts in pain management, and collaborate effectively with all members of the healthcare team. The clinical system in which the project was conducted is described as a mesosystem of Pharmacy and Therapeutics (P&T) committee members, anesthesia providers and surgeons from different specialty areas, which include general surgery, orthopedics, gynecology, urology, and cardiovascular.

Surgeons are important stakeholders, generating revenue for the hospital, but as traditional healthcare is replaced with value-based purchasing; pain satisfaction will be an important factor to improving outcomes and receiving financial incentives. Payers and healthcare organizations should align EBR and payment incentives as way to break the barriers for providing adequate pain management (IOM, 2011b, p. 164).

Literature Review

Intravenous acetaminophen; known as paracetamol internationally, has been widely used in over 60 countries since 2002 (Harrington, 2013). Numerous studies have been conducted internationally which support the safety and efficacy of IVA for acute pain management.

Intravenous acetaminophen; marketing name Ofirmev, was approved in the United States in 2010, for the management of mild to moderate pain, the management of moderate to severe pain with adjunctive opioid analgesics, and for reduction of fever (“FDA approves Ofirmev”, 2010).

The objective of the literature review was to synthesize the best available evidence regarding the efficacy of intravenous acetaminophen for pain control. The key search terms for this literature search were *IVA or paracetamol, efficacy, acute pain and surgery*. The search strategy aimed to find both published and unpublished studies in English language from 2008 to 2014. Multiple databases were searched including Medline, CINAHL, Cochrane, and EBSCO. Ninety-two articles were selected based on validity and reliability, study design, surgical procedure, and type of setting; and after critical appraisal, ten articles were chosen to determine efficacy of IVA (see Table 1 for Synthesis Table).

One article was a systematic review and nine articles involved randomized controlled tests (RCTs). These studies were conducted in the perioperative period, in inpatient settings and in a wide variety of surgical procedures with patient ages ranging from 18 years to 80 years. The three studies conducted outside the United States, define IVA as paracetamol, but for the purpose of this article, IVA will be the name referred. Most of these studies compared groups that received IVA and those who received a placebo, opioid or other non-opioid. The variables or endpoints to determine efficacy included pain scores, total opioid dosages, side effects and length of hospital stay.

A study by Candiotti et al. (2010) found IVA to be safe and well tolerated up to five days postoperatively. Significant reductions in pain scores of up to 50% were noted in patients who received IVA (Apfel, Souza, Portilla, Dalal & Bergese, 2014; Jahr, Breitmeyer, Pan, Royal & Ang, 2012; Sinatra et al., 2012, Wininger et al., 2010). IVA was more effective, had no severe

side effects and decreased the amount of opioid consumption, when compared with fentanyl and ketamine (Choudhuri & Uppal, 2011, Faiz et al., 2014) and is effective in the elderly population (Jahr et al., 2012). Intravenous acetaminophen is effective when administered every four hours at a lower dose, every six hours at a higher dose, as a single or repeated dose (Candiotti et al., 2010; Singla et al., 2014; Tzortzopoulou et al., 2011). Macario and Royal (2010) analyzed 22 studies testing the efficacy of IVA; 19 out of 22 studies concluded that IVA is an effective analgesic across a variety of surgical procedures.

The results of this review indicate that IVA has been used during and following a variety of surgical procedures with moderate improvement in post-procedural pain. It is a safe non-opioid in the adult population with reduction in pain scores, reduced total opioid dosages and can be administered as a single or repeated dose. The level of evidence and the well-designed methods in these studies provide strong evidence that IVA is an effective non-opioid analgesic for acute pain.

Methodology

The implementation plan to persuade healthcare providers to utilize IVA for perioperative pain management included the application of Lewin's change theory. This theory (see Figure 1 for Lewin's change theory) was the framework that guided this project by using strategies to change practice guidelines, resulting in a new culture for optimizing perioperative pain management. The key driving forces behind this project included the Doctor of Nursing Practice (DNP) student and anesthesia providers, and the restraining forces included P & T committee members and surgeons who manage perioperative pain. This theoretical model provided the foundation for changing behavior by using the strategies presentation of EBR articles, and retrieving data from a retrospective chart review to increase driving forces strategy.

Theoretical Model

Lewin's change theory involves changing prior learning or ideas and rejecting existing beliefs by replacing it with new information ("Change Theory", 2013). There are three stages in changing behavior: unfreezing, changing and refreezing, with driving forces diminishing retraining forces (Ash & Miller, 2011). Implementing the three stages in sequence resulted in accomplishment of the purpose of this study; incorporating IVA for perioperative pain.

The *unfreezing stage* starts by challenging many of the beliefs, attitudes, and behaviors of people within the organization, by addressing concerns, such as lack of utilization of acetaminophen, as recommended by the ASA. This stage was activated, when P & T members discussed discontinuing IVA from the formulary, due to their perception of inadequate EBR regarding efficacy and rising costs of this medication. This became an opportunity to challenge members by submitting EBR articles to support efficacy of IVA and presenting current HCAHPS pain scores from this facility, which at this time were lower than state and national scores. A proposal was made to the P & T committee to conduct a retrospective chart review to obtain data from patients at this facility to determine if IVA is effective for perioperative pain. The data analysis would be the deciding factor if IVA would be taken off the hospital formulary.

Lewin's second stage of *change* begins when unfreezing occurs. This stage was completed when positive outcomes from the chart review were presented to organizational members resulting in approval for one dose of IVA for all surgical patients. The decision to approve only one dose was related to insurance reimbursement and price discrimination which is beyond the scope of this project. This data was also presented at a surgical staff meeting which included all physicians, physician assistants and certified registered nurse anesthetists (CRNAs)

who manage perioperative pain. Once the evidence was translated into knowledge, providers began to accept and support the use of IVA as an alternative to other non-opioid analgesics.

The final stage of this theory is *refreezing* when guidelines are updated and accepted within the organization. Strategies to refreeze the audience will include audit and feedback, performance measures and possibilities of the organization offering financial incentives which can have positive effects on changing provider practice behavior (IOM, 2011a, p. 152).

Although, HCAHPS scores can be misleading for perioperative pain, they will be used to update the organization in overall pain satisfaction scores to complete the refreezing stage. The initial HCAHPS pain satisfaction scores were low, but are now higher than state scores.

Research Design

The design for this project was a retrospective chart review of all adult surgical patients admitted from January 1 to July 31, 2014. A list of patient names was retrieved from the pharmacy department of all patients who received IVA from January 1 to July 31, 2014 and the surgical database retrieved patient names who had surgery for these dates. Inclusion criteria included > 18 years and admitted for a minimum of 24 hours. Exclusion criteria included patients admitted < 24 hours, on scheduled dosages of an NSAID, history of chronic pain, dementia, alcohol abuse, and patients who were sent to extended care facilities. Secondary exclusion criteria included undocumented pain scores and discharge times.

The electronic medical record (EMR) was accessed to extract age, gender, type of surgery, ASA physical status, pain scores, total opioid dosages and length of hospital stay. Pain scores were obtained at three points; initial assessment upon arrival to recovery room, pain scores at 12 and 24 hours. Total opioid dosages were calculated for a 24 hour period by converting all narcotics; oral, rectal, or intravenous into morphine equivalents by using the

GlobalRPh online calculator. Length of hospital stay was calculated in days; time started when they were discharged from PACU. Frequencies and percentages were obtained for age, gender, type of surgery and ASA physical status with a p -value set at < 0.05 to determine if there were any differences in these categories (see Table 2 for patient characteristics). Chi-square analysis calculated categorical variables and paired t-tests were used to compare the means of pain scores, total opioid dosages and LOS between the two groups. To determine mean differences, a p -value of < 0.05 was considered statistically significant with lower pain scores, lower total opioid dosages and decreased length of hospital stay (see Table 3 for outcome measures).

Ethical Considerations

Institutional review board (IRB) gave approval and data collection began in October, 2014. Ethical considerations in retrospective chart reviews include protection against privacy (confidentiality) of the research subjects by not disclosing identifying information that may reveal their identity. Data extraction was a two-step process, initially transferring the data using paper and pencil, then inputting this information into a Microsoft Access software program. Personal identifiers, such as patient names, medical record numbers, and birth dates were de-identified by using a numbering system after data extraction was accessed.

Sample

A power analysis was not performed to determine sample size because of the small setting (99 beds) and short data collection period (6 months) IVA was implemented. A convenience sample size of 145 charts was selected, but after inclusion and exclusion criteria were met, a sample size of 74 charts were analyzed. Thirty seven patients received IVA, and 37 did not receive IVA. Initial exclusion criteria included scheduled dosages of NSAIDS, but after review of the charts, all patients in both groups, were on scheduled doses of ketorolac, so this

exclusion criteria was eliminated. The sample source was representative of the targeted population, which only included patients having total joint arthroplasties.

Findings

The sample size included 53% female and 47% male that were evenly matched to the two groups (IVA) or (No IVA). Three types of major orthopedic surgeries were identified and group matched according to surgery type: total knee arthroplasty (TKA), total hip arthroplasty (THA) and unilateral knee arthroplasty (UKA). There were no statistically significant differences ($p > 0.05$) in age, gender, type of surgery and ASA physical status (see Table 2). The mean age for both groups were 70 years and the most frequent type of surgery was TKA (57%), followed by THA (27%) and UKA (16%). There were no ASA I or IV patients in this sample size, which concluded that patients in this sample group had mild systemic disease (ASA II) or severe systemic disease (ASA III). The group which did not receive IVA had the highest percentage of ASA II patients (68%) and the group who received IVA had the highest percentage of ASA III patients (49%).

There were statistically significant differences ($p < 0.05$) in total opioid dosages, LOS and pain scores at 12 and 24 hours (see Table 2). Total opioid dosages were less in the IVA group (16.57mg) compared to the group who did not receive IVA (32.14 mg), which translates into a 48% lower requirement for opioids. LOS in the IVA group (1.81 days) were lower compared to the group who did not receive IVA (2.08 days) and mean pain scores at 12 and 24 hours were lower for the IVA group ($p = 0.0001$, $p = 0.006$) compared to the group who did not receive IVA. The only variable that did not show a significant difference were PACU pain scores ($p = 0.07$) which could be attributed to aggressive intraoperative pain management with long acting opioids.

Discussion

This project began due to an observation that IVA was not available for all surgical patients for the treatment of perioperative pain. The concern to improve perioperative pain management became the focus of changing policy to optimize pain management. Lewin's change theory was instrumental in facilitating healthcare provider's implementation and use of IVA. The findings from this retrospective chart review support the evidence from the literature review that IVA is effective for acute pain. This project was successful in gaining approval from the P & T committee by approving the use of IVA for all surgical patients in the perioperative period. It was also successful in translating evidence into knowledge, resulting in increased implementation and incorporation of IVA by surgeons. The refreeze stage of performing quarterly audits are in process, but increased usage of IVA has been noticed. The DNP can play an important role by evaluating current and new practice guidelines and policies, care delivery models and strategies, health outcomes, and approaches to reducing health disparities with the use of collaboration to evaluate EBP and make recommendations to change practice (Tymkow, 2011).

Limitations

The retrospective nature of this chart review is a limitation, as it relied on documentation from others, resulting in missing or incomplete data. Because this was a retrospective review, there were no pure samples of patients who only received IVA, but instead consisted of samples that received IVA and/or an NSAID or COXIB. Another limitation included a small sample size, older adults, and only patients who had orthopedic surgery. The data analysis resulted in significant differences for patients who received IVA, however the preferred design to investigate the outcomes reported in this project would be prospective in nature.

Key Lessons Learned

There were obstacles encountered and lessons learned while conducting the retrospective chart review. It was disappointing to see that pain scores were not being documented before and after administration of pain medications, at the beginning of the shift or not at all. This lack of documentation resulted in charts that could have been used to determine efficacy, but instead, resulted in exclusion of data. Uncovering the lack of knowledge in pain assessment and documentation by nursing staff, lead to questions regarding lack of pain assessment, as a barrier to patients receiving optimal pain management. Pain management improves when health care providers are taught to be consistent in their pain assessments, by completing and documenting accurately, so patients will receive the right care at the right place and the right time (IOM, 2011b).

Implications for Future Study

Future research to support the use of IVA is to conduct a prospective RCT on patients at this facility, so a more pure sample can be evaluated. Conducting a chart review from all types of surgeries as well as outpatients will give valuable information regarding efficacy of IVA. A cost-benefit analysis of IVA should be presented, to determine the economic impact on the organization, which could lead to approval of increased dosages.

Implications for Nursing

Providing adequate perioperative pain management will improve patient outcomes which is important for nursing and healthcare providers, to prevent progression of acute pain to chronic pain. This will reduce health disparities for patients and decrease strain on the healthcare industry. It is important for advanced practice nurses (APNs), who have the ability to facilitate change, by collaborating with providers who manage perioperative pain, to decrease health

disparities. Nurses must abide by the *Code of Ethics* as patient advocates, by promoting the health and safety of patients (American Nursing Association, 2015, p. 7) and it is a moral and professional responsibility for all healthcare professionals to provide effective pain management (IOM, 2011b, p. 22).

Implications for Policy

The 2011 IOM report, *Relieving Pain in America*, resulted in recommendations to improve practice and policy by addressing pain. Organizations and healthcare providers are encouraged to adopt evidence based research in changing policy to effectively manage pain. This project used EBR and data analysis from the retrospective chart review to influence healthcare policy. Challenges within healthcare can be addressed at the local and national level with APNs as key leaders in reforming healthcare. These challenges are accomplished by collaborating interdisciplinary and interprofessionally to improve patient and population health outcomes.

Conclusions

There are major gaps in knowledge about pain, and needs for a national campaign to educate health professionals to understand pain better, will result in quality pain management (IOM, 2011b). The ASA's recommendations for administering multimodal analgesia in the perioperative setting, is aimed at avoiding or decreasing the need for opioids, thus reducing opioid-related side effects. Acute pain that is undertreated is a major source of suffering, disability, resource utilization, and increased health-care costs, both in this country and throughout the world (Vadivelu et al., 2012).

A problem was identified and a strategy was used to break barriers in changing behavior by providing internal evidence via a retrospective chart review. The findings from this facility determined that patients who received IVA had better pain scores, decreased total opioid dosages

and decreased LOS in patients who underwent major orthopedic surgery. It is the duty and responsibility of all health care professionals to provide effective pain management to patients and organizational collaboration is imperative for problems to be addressed and implementation to occur. This project was successful and resulted in translating research into practice, by adopting practice changes, and utilizing IVA for perioperative pain.

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Table 1

Synthesis Table

	Primary Author and Publication Year									
	Apfel et al. (2014)	Candiotti et al. (2010)	Choudhuri et al. (2011)	Faiz et al. (2014)	Jahr et al. (2012)	Macario et al. (2011)	Salihoglu et al. (2009)	Sinatra et al. (2012)	Singla et al. (2014)	Winger et al. (2010)
Design	*RCT	RCT	RCT	RCT	RCT	*SR	RCT	RCT	RCT	RCT
Sample	726	213	80	80	231	1464	40	101	130	244
Gender M/F	125/592	N/S	59/21	0/80	120/111	N/S	9/31	50/51	70/60	46/198
Age (years)	< 65	>18	18-70	25-70	>65	N/S	23-57	59-62	59-66	18-80
Surgery	*Gyn. *Abd.	*L/S C	L/S C	Abd. *Hyst.	Ortho	N/S	L/S C	Hip Knee	Hip	L/S A
Setting	I	I	N/S	I	I	N/S	N/S	I	I	N/S
Country	US	US	India	Iran	US	US	Turkey	US	US	US
Placebo	X				X	X	X	X	X	X
NSAIDs						X				
Ketamine				X						
Fentanyl			X							

Note: * RCT (randomized controlled test), SR (systematic review), Gyn. (gynecology), Abd. (abdominal), Ortho. (orthopedic), L/S (laparoscopy), A (abdominal) C (cholecystectomy), Hyst. (hysterectomy), Inpt (Inpatient), US (United States) N/S (not stated) I (inpatient)

Table 2

Characteristics of Patients

	IVA(n=37)	No IVA (n=37)	<i>p</i> - value *
Age: mean years (SD)	69.9 (8.14)	70.4 (9.5)	<i>p</i> = 0.64
Gender			<i>p</i> = 0.64
Male, n (%)	17 (46)	18 (49)	
Female, n (%)	20 (54)	19 (51)	
Type of surgery			<i>p</i> = 1.0
TKA, n (%)	21 (57)	21 (57)	
THA	10 (27)	10 (27)	
UKA	6 (16)	6 (16)	
ASA physical status			<i>p</i> = 0.15
ASA I	0	0	
ASA II, n (%)	19 (51)	25 (68)	
ASA III, n (%)	18 (49)	12 (32)	
ASA IV	0	0	

Note: TKA (total knee arthroplasty), THA (total hip arthroplasty), UKA (unilateral knee arthroplasty), ASA (American Society of Anesthesiologists) **p* < 0.05 statistically significant.

Table 3

Outcome Measures

Dependent Variables	IVA group	No IVA group	<i>p</i> -value **
Total Opioid Dosages (mean)*ME	16.57 mg (11.22)	32.14 mg (17.85)	<i>p</i> < 0.0001
LOS (days)	1.81	2.08	<i>p</i> = 0.0484
PACU pain scores (mean)	1.16	2.24	<i>p</i> = 0.0701
12 hour pain scores (mean)	1.89	5.03	<i>p</i> = 0.0001
24 hour pain scores (mean)	3.19	4.7	<i>p</i> = 0.0066

Note: *ME (morphine equivalents), PACU (post anesthesia care unit) LOS (length of hospital stay) ***p* < 0.05 is statistically significant.

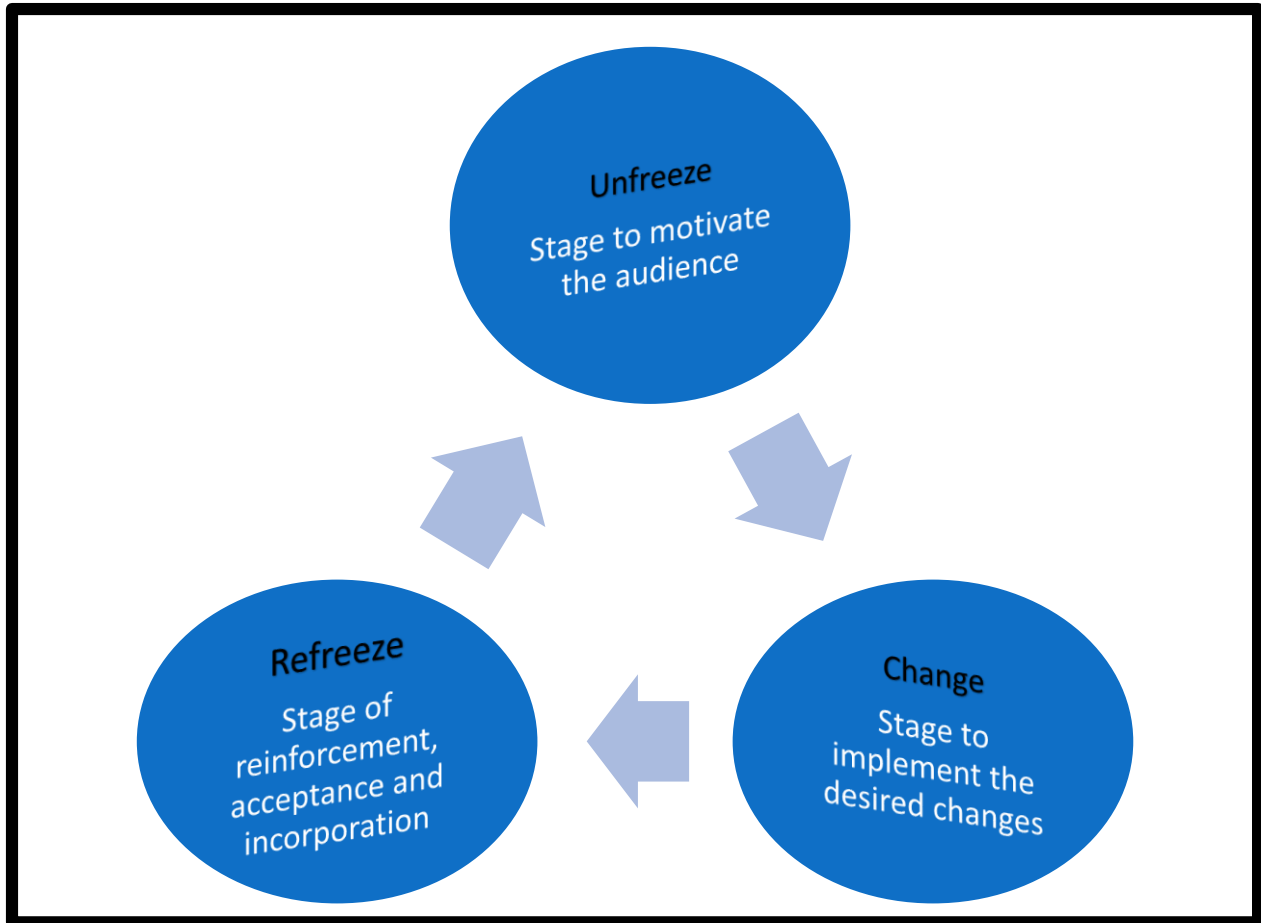


Figure 1. Lewin's Change Theory