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Adoption of Perioperative Lidocaine Infusion for the Reduction of Postoperative Pain

Brandon Scott Figueiredo
University of Southern Mississippi

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ADOPTION OF PERIOPERATIVE LIDOCAINE INFUSION
FOR THE REDUCTION OF POSTOPERATIVE PAIN

by

Brandon Scott Figueiredo

A Capstone Project
Submitted to the Graduate School
and the Department of Advanced Practice
at The University of Southern Mississippi
in Partial Fulfillment of the Requirements
for the Degree of Doctor of Nursing Practice

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December 2016
ABSTRACT

ADOPTION OF PERIOPERATIVE LIDOCAINE INFUSION FOR THE REDUCTION OF POSTOPERATIVE PAIN

by Brandon Scott Figueiredo

December 2016

Laparoscopic capability provides numerous benefits to patients requiring abdominal surgical procedures. However, the use of these techniques has presented the anesthesia provider with a unique set of challenges in terms of perioperative management and postoperative pain reduction. No standardized method has existed to reduce postoperative pain and improve recovery following these procedures. There were three primary goals of this project. The first goal was to conduct a meta-analysis of randomized controlled trials to determine the benefit of the use of intravenous lidocaine infusions to reduce postoperative pain in laparoscopic abdominal surgery. Twelve articles were included in the meta-analysis that pertained to the use of intravenous (IV) lidocaine with laparoscopic abdominal surgery to reduce postoperative pain. The result of the meta-analysis was that there was a statistically significant decrease in postoperative pain when lidocaine infusion was administered versus control in laparoscopic abdominal surgery ($p < 0.001$). The second goal was to use the information from the meta-analysis to produce an Evidence-Based Clinical Practice Update to present to a group of anesthesia providers about the benefits and risks of adding perioperative lidocaine infusions to current anesthesia practice with laparoscopic abdominal surgery. The third goal was to identify barriers in the clinical environment to the implementation of this practice change. A questionnaire was used in this study to identify these barriers to
future implementation from the perspective of anesthesia providers \((n = 7)\) and the information attained from the meta-analysis was used to formulate the *Evidence-Based Clinical Practice Update* that was presented to the participants of the study. Two barriers to implementation were found in the results of the questionnaire. Those barriers were a perceived increase in cost, and a lack of availability of pre-mixed lidocaine infusions.
ACKNOWLEDGMENTS

I would like to give a special thanks to three truly wonderful people, Dr. Cathy Hughes, Dr. Michong Rayborn and Dr. Sat Ananda Hayden. Through their many hours of selfless work and dedication, they have contributed such a great deal to my education.
DEDICATION

This project is dedicated to the memory of my mother Sandi, who always believed in me and who also dreamed of one day earning a Doctor of Nursing Practice degree. I would like to thank my wife Courtney, my partner throughout this journey and many more, for her never ending support and encouragement. I would also like to thank my daughter Layla, who provides me with immeasurable joy and motivation.
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<th>Full Form</th>
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<tbody>
<tr>
<td>AACN</td>
<td>American Association of Colleges of Nursing</td>
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<td>AANA</td>
<td>American Association of Nurse Anesthetists</td>
</tr>
<tr>
<td>ASA</td>
<td>American Society of Anesthesiologists</td>
</tr>
<tr>
<td>ADH</td>
<td>Antidiuretic Hormone</td>
</tr>
<tr>
<td>DVT</td>
<td>Deep Vein Thrombosis</td>
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<td>DNP</td>
<td>Doctor of Nursing Practice</td>
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<tr>
<td>EBP</td>
<td>Evidence-Based Practice</td>
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<tr>
<td>IV</td>
<td>Intravenous</td>
</tr>
<tr>
<td>Kg</td>
<td>Kilogram</td>
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<tr>
<td>Mcg</td>
<td>Microgram</td>
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<tr>
<td>Mg</td>
<td>Milligram</td>
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<tr>
<td>MAC</td>
<td>Minimum Alveolar Concentration</td>
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<td>pH</td>
<td>Potentia Hydrogenii</td>
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<tr>
<td>PE</td>
<td>Pulmonary Embolism</td>
</tr>
<tr>
<td>RCT</td>
<td>Randomized Controlled Trial</td>
</tr>
<tr>
<td>USM</td>
<td>The University of Southern Mississippi</td>
</tr>
<tr>
<td>TIVA</td>
<td>Total Intravenous Anesthesia</td>
</tr>
</tbody>
</table>
CHAPTER I - INTRODUCTION

Providing for effective postoperative pain relief is a fundamental element of the practice of anesthesia. For many reasons, this continues to be a challenge with patients who are undergoing laparoscopic abdominal surgery.

Background

The laparoscopic approach to abdominal surgery has been associated with several improved patient outcomes when compared to open laparotomies. These include: lowered morbidity, decreased length of hospital stays, as well as an overall decrease in postoperative pain and tissue deformity (Cho, Lee, Lee, Kim, & Lee, 2014). Relevant research findings have also demonstrated that abdominal surgeries performed using laparoscopic methods resulted in a faster resumption of an oral diet and bowel functioning, and lower mortality in the post-operative period (Tikuisis et al., 2014). While the less invasive laparoscopic surgeries afford several benefits over traditional open surgeries, they have also brought about a unique set of difficulties in the anesthetic management of these patients (Nagelhout & Plaus, 2014). For example, the consequences of the stress response and peritoneal irritation caused by abdominal insufflation make up a complex of unique challenges for the anesthetist with regard to controlling pain and other deleterious effects both during surgery as well as in the postoperative period (Yardeni, Beilin, Mayburd, Levinson, & Bessler, 2009).

Anesthesia providers are continually in search of multi-modal techniques of preventing and relieving pain (Joshi, 2005). This is done in effort to more closely target the underlying cause of pain, provide more complete and longer lasting relief of pain, as well as decrease the side effects of opioids, which are the predominant class of analgesics
used perioperatively (Kim et al., 2011). More than 50 years ago, intravenous (IV) lidocaine infusion was first described as a potential adjunctive anesthetic agent to decrease pain and improve postoperative recovery in certain applications. This technique has only recently been discussed in medical literature (Vigneault, Turgeon, & Cote, 2011).

Significance

Lidocaine is one of the oldest, least expensive, and likely the most versatile intravenous medications used adjunctively in contemporary anesthesia practice (Yardeni et al., 2009). The advantages of lidocaine infusion use are complemented by its broad safety profile and availability, and as such is used in a wide variety of applications (Kim et al., 2011). The significance of this project is that the of the characteristic actions of systemic lidocaine, such as inhibiting pain transmission and preventing inflammation and hyperalgesia, may make the drug especially suited to being employed for laparoscopic intraabdominal surgeries (Vigneault, Turgeon, & Cote, 2011).

Purpose

The purpose of this project is to determine the barriers to implementation of a novel anesthetic technique involving a commonly used drug in anesthesia practice. Another purpose of this doctoral project was to increase awareness of the use of IV lidocaine infusion for the purpose of decreasing postoperative pain following laparoscopic abdominal surgery. There was a possibility that many clinicians were not aware of this technique.

Prior to the assessment of the willingness of providers to change their practice, evidence on practice change needed to be evaluated. A thorough understanding of
barriers to implementation of evidence-based practice updates would have to be studied to determine the best way to achieve the most positive impact on clinical practice.

Statement of the Problem

Pain following laparoscopy is incredibly complex and brought about through several mechanisms (Nagelhout & Plaus, 2014). Various elements have been demonstrated to contribute to postoperative pain in laparoscopic surgery are as phrenic nerve compression and low humidity and pH within the peritoneum during abdominal insufflation (Mouton, Bessell, & Maddern, 1999). These elements demonstrate that a predominant cause of the pain is not the surgical incision itself but visceral pain in the very sensitive parietal peritoneum (Mouton et al., 1999).

Often times, this pain is experienced due to inflation and ischemia of organ compartments, as nociceptive pain receptors in the abdomen typically respond to inflammatory substances, distension, and muscle spasm (Nagelhout & Plaus, 2014). Visceral pain may induce a state of hyperactivity in both the parasympathetic and sympathetic nervous systems. This can be manifest as undesirable changes in hemodynamic parameters, nausea and vomiting, and profuse sweating (Morgan, Mikhail, & Murray, 2006). The quality of this type of pain is less localized than sharper somatic pain, with sufferers often describing the pain as a squeezing sensation (Nagelhout & Plaus, 2014).

Impact to Body Systems

Laparoscopic pain has many untoward consequences on different body systems. The systems discussed subsequently are the respiratory system, the cardiovascular system, and the endocrine system.
The existence of laparoscopic pain may have serious consequences for the respiratory system. These include decreased lung capacities, decreased movement of the muscles of breathing in effort to reduce pain. As a result, the ability to cough is effectively impaired, increasing the risk of pneumonia and atelectasis (Nagelhout & Plaus, 2014). These consequences predominate after abdominal and thoracic surgeries in particular, and are more pronounced in patients with a baseline reduction in functional residual capacity such as the elderly, obese, and patients with chronic obstructive pulmonary disease (Rawal, Sjostrand, & Christofferson, 1984). These respiratory derangements caused by inadequate pain relief increase the time to ambulation and increases the possibility of deep vein thrombosis (DVT) as well as pulmonary embolism (PE) (Nagelhout & Plaus, 2014).

The physiologic effects of visceral pain on the cardiovascular system occur through activation of a neuroendocrine response due to the release of epinephrine and norepinephrine, cortisol, antidiuretic hormone (ADH), the activation of the angiotensin axis, as well as other hormonal and metabolic changes (Barash, Cullen, & Stoelting, 2006). These effects may potentially result in aberrations in cardiac conduction, mismatched myocardial oxygen supply and demand, resulting in chest pain secondary ischemia of the myocardium. Existing coronary artery disease may be placed at increased risk of catastrophic events such as thrombus formation due to catecholamine-induced hypercoagulability and coronary artery rupture because of catecholamine-induced vasoconstriction of coronary arteries (Barash, Cullen, & Stoelting, 2006).

Laparoscopic surgery can trigger a variety of metabolic and endocrine alterations. These changes initiate a series of events are generally described as the “stress response”
to surgery (Kehler, 1988). Some features of this response may be adaptive mechanisms, although broadly it is considered to promote both morbidity and mortality (Kehler, 1988). The stress response is initiated and sustained from nerve impulses conducted from nociceptors at the surgical site (Kehler, 1988). These receptors cause the release of inflammatory substances such as cytokines and prostaglandins which can inhibit normal immunologic functioning and stimulate coagulation, thereby increasing the risk of DVT. Additionally, the local release of catecholamines may cause systemic sympathetic-mediated increase in heart rate and blood pressure (Barash, Cullen, & Stoelting, 2006). Hormones such as Antidiuretic Hormone (ADH) and aldosterone that are released increase circulating sodium and water, which may lead to pulmonary edema and congestive heart failure in susceptible patients (Barash et al., 2006).

Surgery-induced activation of peripheral nociceptors through injury of the tissues causes pain and a release of inflammatory substances, catecholamines, and excitatory neurotransmitters. Impulses are transmitted from these nociceptors, to the spinal cord, and on to the thalamus before finally being relayed to higher cortical brain centers responsible for the perception of pain (Nagelhout & Plaus, 2014). Both peripherally, and centrally, augmentation of these signaling pathways may occur that can either inhibit or intensify the magnitude of the impulse. Catecholamines and inflammatory cytokines released in the vicinity of the peripheral nociceptors “sensitize” the receptors to transmit afferent pain signals with little or even no direct stimulation. This phenomenon is known as peripheral sensitization and is the mechanism behind hyperalgesia (Levin, Coderne, & Basbaum, 1988). The degree of the discharge of catecholamines and cytokines has been associated with postoperative outcomes (Marano, Fong, & Moldawer, 1990).
Hyperactive pain modulation can also occur in the central nervous system (spinal cord and higher brain centers) and is known as central sensitization. The modulation usually develops in response to repeated stimulation with subsequent neurochemical release (Latrenoliere & Woolf, 2009). General anesthesia administered in a standard therapeutic concentration does not reliably abate these responses. Contemporary investigation on the subject has been directed at targeting anesthetic techniques to attenuate sensitization and hyperalgesia (Barash et al., 2006).

The augmented sympathetic outflow coupled with the decreased abdominal muscle functioning following abdominal laparoscopic surgery causes a decrease in gastrointestinal motility postoperatively (Livingston & Passaro, 1990). These factors, especially in the presence of opioid administration which can further decrease bowel motility, may lead to ileus postoperatively. Bowel obstruction following surgery is detrimental and leads to nausea, vomiting, postponement of continuation of an oral diet, increased morbidity, and prolonged hospitalization (Moore, Feliciano, & Andeassy, 1992). Ileus is most closely correlated with intraperitoneal procedures (Groudine et al., 1998). Several anesthetic techniques have been explored to facilitate the resumption of gastrointestinal function postoperatively following intraabdominal surgery. Though the precise function is currently unclear, local anesthetics administered through the epidural route have been associated with a lower risk of postoperative ileus and faster resumption of preoperative bowel habits. Observed reduction in postoperative pain and required opioid analgesics along with the attenuation of surgical stress via systemic absorption of the local anesthetic may be involved in this mechanism. If this mechanism is causative,
intravenous administration of local anesthetics should in turn speed the recovery of the gastrointestinal system (Groudine et al., 1998).

Needs Assessment

Despite the benefits afforded from laparoscopic surgery, adequate treatment of pain may be neglected as almost 80% require opiate administration postoperatively (Mouton et al., 1999), while nausea and vomiting following laparoscopy are significant problems with an incidence as high as 72% (Bradshaw, 2002). These problems require further exploration because the administration of postoperative opioids for analgesia only serves to exacerbate the nausea and vomiting through the action of these drugs on central nausea centers and contribute to the formation of postoperative ileus.

Uncontrolled postoperative pain, as well as nausea and vomiting, may cause a myriad of harmful outcomes such as psychological upset, wound dehiscence and surgical site infection, and pulmonary aspiration (Wang, 2002). All of these have been associated with increased length of stay, increased costs, and decreased patient satisfaction (Joshi, 2005). If intravenous lidocaine infusion decreases inflammation, speeds the return of bowel function, blunts the surgical stress response along with resulting complications, decreases post-operative pain (reducing narcotic requirements), and accelerates recovery, then costs could be reduced to both patient and organization.

The clinical facility studied in this doctoral project is a 169-bed level III trauma regional referral hospital in southwest Mississippi. The hospital services nine counties with a population of almost 200,000. The operative suite houses seven full-time operating rooms where a variety of surgeries are performed, including 373 laparoscopic
abdominal surgeries during the 2015 calendar year (D. Smith, personal communication, July 15, 2016).

Table 1 *Total Laparoscopic Abdominal Surgeries at Facility in 2015*

<table>
<thead>
<tr>
<th>Procedures</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laparoscopic Cholecystectomy</td>
<td>172</td>
</tr>
<tr>
<td>Laparoscopic Appendectomy</td>
<td>70</td>
</tr>
<tr>
<td>Laparoscopic Bilateral Tubal Ligation</td>
<td>38</td>
</tr>
<tr>
<td>Laparoscopic Colon Resection</td>
<td>1</td>
</tr>
<tr>
<td>Laparoscopic Colostomy Takedown</td>
<td>1</td>
</tr>
<tr>
<td>Laparoscopic Ectopic Pregnancy</td>
<td>7</td>
</tr>
<tr>
<td>Laparoscopic Salpingo Oophorectomy</td>
<td>10</td>
</tr>
<tr>
<td>Diagnostic Laparoscopy</td>
<td>25</td>
</tr>
<tr>
<td>Laparoscopic Robotic Assist Hysterectomy</td>
<td>47</td>
</tr>
<tr>
<td>Laparoscopic Robotic Assis Nephrectomy</td>
<td>2</td>
</tr>
<tr>
<td><strong>Total Laparoscopic Procedures</strong></td>
<td><strong>373</strong></td>
</tr>
</tbody>
</table>


Clinical Question

For anesthesia providers who deliver anesthesia for laparoscopic abdominal surgery, does the presentation of an Evidence-Based Practice Update promote translation of new anesthetic techniques into practice?

Doctor of Nursing Practice Essentials

There are eight core essentials of the Doctor of Nursing Practice (DNP) degree as outlined by the American Association of Colleges of Nursing (AACN) (Chism, 2013). DNP Essential I: Scientific Underpinnings for Practice, serves as a framework for this project as it pertains to the integration of the science of advanced practice nursing with other disciplines such as pathophysiology and pharmacology. Rosswurm and Larrabee’s (1999) model for change to evidence based practice was used as a framework for this project. The first three steps of this process: realizing the need for change, correlating the
clinical problem with outcomes, and integrating the best evidence were used in this capstone project. Additionally, the implementation and analysis of the subject matter contained in the methodology of this project adhere to this model, and thus, this essential as well. In addition to Rosswurm and Larrabee’s framework, the guiding theory used in this study is Rogers’ theory of the diffusion of innovation which illustrates how a new technology becomes standard practice by reaching a critical mass in the social structure of clinical providers (Rogers, 2003, p. 227).

DNP Essential II: Organization/Systems Leadership for Quality Improvement and System Thinking guides the development of practice changes that involve the entire system of delivery to influence patient outcomes (Zaccagnini & White, 2014). This essential defines the expanded role that the DNP prepared advanced nurse plays in modern healthcare organizations. The principal objective of practice changes that are developed in effort to improve quality are improved patient outcomes. For instance, in the case of this project, the objective of the employment of IV lidocaine infusions is to decrease postoperative pain and improve recovery. To achieve this objective, the advanced practice nurse leader must collaborate with other advanced practice providers, pharmacists, administrators, and others. DNP Essential III: Clinical Scholarship and Analytical Methods for Evidence-Based Practice (EBP), involves a methodological approach for the critical appraisal and utilization of the most novel available scientific literature (Zaccagnini & White, 2014). The review of literature section within this capstone project is an outline of such evidence.

DNP Essential IV: Information systems/technology and patient care technology for the improvement and transformation of health care, focuses on the rapidly advancing
use of electronic capabilities in patient care (Zaccagnini & White, 2014). This essential was realized in this project needs through the utilization of tracking software to determine the number of laparoscopic abdominal surgeries performed at the facility studied in one calendar year. DNP Essential VI: Interpersonal Collaboration for Improving Patient and Population Health Outcomes, is met at the conclusion of the meta-analysis when Evidence-Based Clinical Practice Update was presented to the group of anesthesia providers in the clinical setting (Zaccagnini & White, 2014). At this time participation of the anesthesia care team occurred.

DNP Essential VII: Clinical prevention and population health for improving the nation’s health is associated with the ultimate goal of this project, which is to improve patient outcomes (Zaccagnini & White, 2014). Through the adoption of perioperative lidocaine infusions by anesthesia providers, patients may experience a decrease in postoperative pain and an improvement of postoperative rehabilitation. DNP Essential VIII: Advanced Nursing Practice is successfully realized in this case by advancing the knowledge of the advanced practice nurse (Zaccagnini & White, 2014).

In this introductory section, the background, significance, purpose, problem statement, needs assessment, clinical question, and DNP essentials were discussed. In the following section the review of literature will be discussed.
CHAPTER II – REVIEW OF LITERATURE

Relevant Literature

Introduction

In this section the methods for searching the current literature pertaining to practice change will be reviewed. The major topics that will be covered are: theories of change, models relating to individual professionals, models relating to care delivery systems, tailored techniques for practice change, and strategies to identify and overcome barriers to change. After these topics are covered, the pertinence of Rosswurm and Larrabee’s (1999) model for change to evidence-based practice and Rogers’ (2003) theory of diffusion of innovation will be discussed in relation to this doctoral project.

A broad review of the literature was performed in effort to locate information regarding successful implementation of evidence-based practice change. The search was undertaken using a multitude of databases accessed through The University of Southern Mississippi library online database catalogue. Databases searched include Google Scholar, PubMed, CINAHL with full text, Medline, and Science Direct. The search terms used in the article databases were barriers, practice change, improve practice, evidence-based practice change, and research implementation. The search returned with no date restrictions was 256. The results were sorted by relevance. The decision to include any articles older than ten years was made based on whether the article was regarded as a seminal work. The number of articles that were chosen from the original 456 based on pertinence to the topic was 7, this was done to reduce repeat articles and foreign language results. This review is an integration of evidence related to barriers to
implementing evidence-based practice change, including what barriers are, how they are identified, and strategies to overcome barriers to promote successful practice change.

Research in healthcare regularly concludes that a significant gap exists between current evidence and current clinical practice (Grol & Wensing, 2004). Baker and colleagues (2010) state that more than thirty percent of patient care in the United States is not in accordance with the best available evidence. With respect to this major divide between the evidence and clinical practice, many experienced in healthcare quality improvement place an emphasis on a comprehensive understanding of the clinical problem as well as the barriers to practice change (Grol & Wensing, 2004).

According to Grol and Grimshaw (2003), there are three fundamental concerns that impact the use of current research in clinical practice: the characteristics of the research, obstacles and promotors of clinical practice change, and the capability of the approaches to achieve evidence-based practice. There have been numerous strategies that attempt to improve the uptake of evidence into practice. These strategies have ranged from comprehensive problem analysis and barrier identification to improving the availability of research findings to clinicians (Grol & Wensing, 2004). There is no consensus as to which strategy is the most the most effective.

This review focuses on the barriers of implementing evidence based practice change in the clinical environment. Barriers to the change to evidence-based practice are recognized determinants that may undermine the influence of strategies to practice change (Baker et al., 2010). A classification of 9 types of barriers to clinical practice change has been categorized by the Cochrane Effective Practice and Organization of Care Group (EPOC, 2015). These include: current expectations of practice – both by patients
and other providers, liability, professional competence, organizational constraints, financial motivations, concerns of effectiveness, information management, and other (EPOC, 2015). An assumption can easily be made that strategies to implement clinical practice change based on research would be much more successful if barriers to change are recognized. The efforts to implement evidence-based methods of clinical practice have continued to produce inconsistent outcomes.

Theories of Change

The majority of information about barriers and stimuli for practice change is brought about from theory rather than experimental studies. Many of these theories have major elements that can be found throughout a plethora of practice change theories (Grol & Wensing, 2004). A common theme among several major practice change theories is that the successful implementation of change relies on a myriad of components, though the evidence for the effectiveness of any particular model or theory in scientific research is narrow (Grol & Wensing, 2004). For the purpose of this review of literature, the researcher classifies models of practice change into two categories: those that pertain to the providers themselves, and those that focus on the care organization as a whole.

Models Relating to Individuals

Care providers have to be educated, persuaded, and even instructed on how to implement the best available research into practice. Cabana et al. (1999) describe a model known as the Professional Perception Model which where multiple barriers to change were recognized. These barriers focus on the individual provider, and include inadequate understanding of the process change, lack of buy-in, and anticipated organizational push-back. This model demonstrates that an inadequate interest in the
practice change on the part of the professional to be an especially important barrier that must be overcome for successful adoption of clinical practice guidelines (Cabana et al., 1999).

The Stages of Change model focuses on the individual course of behavior change on the part of the provider (Grol & Wensing, 2004). The behavior change takes place over a series of steps in a process of implementation. Reviews of these types of practice change models have demonstrated a limited degree of success (Grol & Wensing, 2004).

Models Relating to Systems

Clinical professionals provide care in complex social structures that inherently contribute to or detract from the success of practice changes. One model that focuses on the organization as a whole is the Precede-Proceed model (Green, Kreuter, Deeds, & Partridge, 1980; Grol & Wensing, 2004). This model distinguishes components of the organization as predisposing, enabling, or reinforcing factors. All three component types may facilitate or hinder change. For example, a predisposing factor would be an element inherent to the organization such as underlying qualities of the team. An enabling factor may be the organization’s available resources. Finally, a reinforcing factor would be the attitudes of individuals within the organizational structure (Grol & Wensing, 2004). The preponderance of evidence shows that the most effective evidence-based practice changes involve all three component types (Green et al., 1980; Grol & Wensing, 2004).

Tailored Techniques for Practice Change

Knowledge about obstacles and stimuli related to practice change are gathered through numerous methods. These methods include questionnaires, personal interviews, Delphi techniques, direct clinical observation, as well as information collected from
patient charts (Grol & Wensing, 2004). Once collected, this data can then be utilized to mold techniques to bring about practice change. Due to a lack of consistent evidence of the usefulness of tailored techniques for practice change, and no standardized method for tailoring implementation strategies, more research is needed to confirm the utility of tailored interventions (Baker et al., 2010).

**Attributes of Research Affecting Implementation**

Attributes of evidence may have a significant impact on its potential implementation. In some instances, the conclusions of the evidence are easily adopted into clinical practice. Yet most often, practice changes involve complex multi-disciplinary transformations at the system level (Grol & Grimshaw, 2003).

Generally, clinical practice guidelines are prepared and distributed to improve patient outcomes and advance the provision of care. Not all clinical practice guidelines are easily adopted. There are numerous causes of this, including: the culture of the practice environment, the clinical problem being addressed by the guideline, the proposed changes in the guidelines, and the manner in which the guidelines are disseminated (Grol & Grimshaw, 2003).

Successful implementation of clinical practice change is typically correlated with practice environments more suited to practice improvements. For instance, tertiary care centers are more conducive to changes in practice than long term care facilities (Grol & Grimshaw, 2003). Additionally, guidelines that are based on more substantial research are usually much more successfully adhered to that those based on lesser quality research (Grol & Grimshaw, 2003). To conclude, the subject matter of the research is a
substantial determinant of how effective guidelines are at being implemented (Grol & Grimshaw, 2003).

Strategies to Identify and Overcome Barriers to Change

Obstacles to practice change are determined using numerous strategies. These include direct clinical observations, conferences with healthcare professionals, and evaluation of the practice facility (Baker et al., 2010). Another method involved in the identification of barriers are provider interviews - through mailed surveys, over the telephone, and in person (Grol & Wensing, 2004). Provider surveys are often most useful in identifying issues with implementation that may be classified into themes (Olson, Rao, Marienau, & Smischney, 2015). These themes can then be targeted specifically by strategies to overcome them. Some of these targeted methods to improve uptake of the evidence are: educational sessions with the providers, personal performance assessments (Frenzel, Kee, Ensor, Riedel, & Ruiz, 2010), as well as clinical practice reminders (Grol & Grimshaw, 2003). Strategies that are specifically targeted to previously identified barriers appear to be more powerful than those strategies that are not, however research to support this idea has thus far been inconclusive (Grol & Grimshaw, 2003).

Conclusion

Despite the fact that there is now a general awareness of the potential for external and internal factors having an impact on change implementation, there remains to be a comprehensive understanding of how specific elements may impact certain practice changes (Olsen et al., 2015). These elements may vary greatly between practice
environments and across different types of practice changes. Without this understanding, there will be unforeseeable outcomes of potential practice changes (Baker et al., 2010).

Model for Evidence-Based Practice

In effective care settings, providers must be equipped with more than their operative knowledge bases and skill sets. These providers need to be capable of exploring current literature within their discipline, evaluate relevant findings, and combine their own experimental knowledge with the evidence. Existing methods of providing care should constantly be evaluated and updated in accordance to both the best available evidence and applied experiences. This type of incorporation has come to be known in healthcare as evidence-based practice (Rosswurm & Larrabee, 1999).

For more than forty years, there has been a dramatic increase in the amount of experimental and observational studies conducted surrounding patient care, especially pertaining to outcomes. Several theoretical frameworks have been developed in attempt to enable practitioners in utilizing this large body of new knowledge. However, many providers have found the process of integrating new evidence into a change in practice to be a challenging endeavor (Rosswurm & Larrabee, 1999).

The model established by Rosswurm and Larrabee (1999) is the result of a considerable amount of literature concerning the use of evidence, change theories, and evidence based practice. This framework provides a background for healthcare providers to make practice advancements based on evidence. This process is composed of a series of six steps.

The first step in this process is a needs assessment (Rosswurm & Larrabee, 1999). Information in a needs assessment may come from a multitude of sources. Frequently,
this entails quality improvement data and information taken from surveyed patients or other providers. Data collected internally is commonly benchmarked with national databases. This is done by comparing indicators in order to identify a practice or operational design that is either helpful or detrimental.

The second step in the process of the evidence-based practice model is connecting the clinical problem with possible solutions. Of particular significance within this phase is the adoption of a systematic classification method with specific means to measure the success or failure of the intervention through the use of indicators (Rosswurm & Larrabee, 1999). In this way, interventions may be measured against external systems.

The third step is associated with an integration of the most recent research findings applicable to the clinical problem with clinician expertise and data culled from the needs assessment. This step was the power of the evidence. This step is also known as a synthesis of research (Rosswurm & Larrabee, 1999).

The practice change is planned in step four. A comprehensive staging of events that the provider will use in the proposed process is sequenced (Rosswurm & Larrabee, 1999). Important to this step are considerations of the practice setting, financial and time commitments, as well as the views of whomever the practice change will affect. Frequently, the proposed change will come in the form of a protocol (Rosswurm & Larrabee, 1999). The adoption of new protocols are often planned to be implemented through pilot studies where results of the implementation can be evaluated using previously discussed indicators (Rosswurm & Larrabee, 1999). The viability and costs of a system-wide implementation of a process can be more accurately determined when analyzing the results of a pilot study.
The practice change is put into effect in step five. As stated earlier, this is normally accomplished through a pilot study. Ideally, the process is closely monitored after it is operationalized (Rosswurm & Larrabee, 1999). The effectiveness of the practice change is evaluated based on provider and patient interviews, as well as quality improvement data.

Finally, in step six, any changes that have been made are implemented. The clinicians are then trained in the use of the new process, and the system becomes part of accepted standards for practice (Rosswurm & Larrabee, 1999). Further analyses may take place after the practice change has taken effect to ensure the process is being used appropriately and to evaluate outcomes (Rosswurm & Larrabee, 1999).

Rogers’ Theory of Diffusion of Innovation

The theory of the diffusion of an innovation put forth by Rogers (2003) is perhaps the most relevant theory to describe the adoption of an evidence-based practice change by clinicians. Rogers portrays clinicians as members of a social system, and for practice change to occur on a large scale, the innovation must reach a critical mass that he calls a “tipping point” (Rogers, 2003, p. 221). In his theory, Rogers divides healthcare providers into five categories based on the rate at which they adopt an innovation (Rogers, 2003, p. 221).

The first category of providers are the innovators, which are on the “cutting edge” of new technologies (Rogers, 2003, p. 227). Innovators are often enthusiastic about the prospect of practice improvements and are vital to starting the process of implementation of practice changes. The early adopters fall into the second category of providers who adopt practice change. The early adopters are a much larger portion of the social system
of providers in clinical practice, and are made up of “opinion leaders” who are typically well-versed in evidence-based practice change (Rogers, 2003, p. 228). Once a large enough portion of the early adopters incorporate a practice change, the innovation begins to reach a critical mass. Because of this reason, the group of early adopters are perhaps the most important group of providers within the social system of clinicians to adopt change. The early and late majority groups follow and typically focus on remaining abreast of current practice standards which are often established by the opinion leaders in their respective field of expertise. The fifth and final category of providers are known by Rogers as the laggards who often fall far behind on the adoption of new innovations. This category of laggards are usually made up of isolated rural providers and those clinicians who hold a degree of suspicion towards practice change (Rogers, 2003, p. 228).
CHAPTER III - METHODOLOGY

Introduction

The objective of this doctoral project is the identification of barriers to the use of clinical use of perioperative lidocaine infusion to decrease postoperative pain. In addition, this study includes a meta-analysis on this use of IV lidocaine infusion to decrease postoperative pain in laparoscopic abdominal surgery patients. This information was then catalogued into an Evidence-Based Practice update sheet and presented along with an oral presentation to a group of providers in the clinical setting. The providers were asked to complete a questionnaire after the presentation. This process served two objectives: to identify barriers to implementation, as well as any changes in thoughts or attitudes on the part of the providers following the presentation.

Population

The population in this study was all anesthesia providers that deliver general anesthesia for laparoscopic abdominal surgeries. This include all anesthesia providers licensed and certified to provide anesthesia for these procedures. The findings of the meta-analysis were disseminated to these anesthesia providers.

Setting

The retrieval of case numbers involving laparoscopic abdominal surgeries, presentation, and questionnaires were performed and distributed at a 163-bed regional referral hospital in a suburban setting in south Mississippi. The facility services approximately 125,000 patients with 300,000 patient visits annually. The surgical suite at this facility houses 7 full-time operating rooms, providing surgical services for a vast array of procedures, including many laparoscopic abdominal procedures.
Meta-Analysis

Introduction

There are many suggested anesthetic approaches to reduce pain following surgery. Some of these techniques involve various methods of local anesthetic administration. One of these methods is the perioperative infusion of intravenous (IV) lidocaine.

The use of IV lidocaine infusions to decrease postoperative pain is a recent development. This technique has not yet been extensively adopted. A meta-analysis was conducted in order to assess the utility of perioperative lidocaine infusions to decrease pain after laparoscopic abdominal surgery. This research technique allows for the pooled assessment of an intervention across multiple studies (Holly, Salmond, & Saimbert, 2012).

Methods for Meta-Analysis

An electronic search was undertaken using the electronic databases Medline, Google Scholar, CINAHL, PubMed, and Science Direct. The search was limited to randomized controlled trials in the English language, and there were no stipulations in the search strategy based on date of publication. The terms used in the search were lidocaine, infusion, pain, postoperative, and intravenous. In order to identify further pertinent research articles, the sources used in the retrieved literature were searched. The sole outcome measure for this analysis was pain reduction, which was evaluated by the use of visual analog pain scale (VAS) and analgesic consumption in the postoperative period.
A total of 2,171 articles were retrieved from the searched online databases. This number was reduced to 920 articles after 1,251 articles were found to be duplicate publications. The remaining 920 articles were reduced to 42 articles that focused on intravenous lidocaine infusions to reduce postoperative pain. This total was reduced by twelve that did not pertain to abdominal surgery and a further eight that did not pertain to laparoscopic abdominal surgery specifically. Six articles were left out of the analysis because of a lack of a placebo group, and a further four were excluded because the outcome measures were not VAS pain scores or postoperative analgesic consumption, which were the only two outcome measures that were studied in this analysis. The final number of studies included in the meta-analysis were twelve with a total of 597 study participants.

Pain following surgery was measured in ten studies from the first thirty minutes through the first twenty-four hours postoperatively. In the other two studies pain was assessed by measuring the total amount of analgesics administered during the first twenty-four hours postoperatively. The two outcome measures to determine postoperative pain reduction were deemed to be sufficiently comparable to be pooled in the meta-analysis. In the studies used for the meta-analysis, the researchers explained that a reduction in the amount of administered postoperative analgesic is analogous to a reduction in postoperative pain.

Data were evaluated using Comprehensive Meta Analysis Version 3.0 (2016) employing a random effects model to evaluate the point estimate of the standard difference of means. The confidence interval was 95% for this analysis. In addition to an
observed total variance, a tau-squared value was calculated to show an estimate of between-study variance within the analysis.

**Findings of Meta Analysis**

Of the twelve studies and 597 total participants, there was a statistically significant \((p < 0.001)\) reduction in postoperative pain during the first twenty-four hours of the postoperative period in the patients who received with IV lidocaine infusions. The calculated common effect size in standard difference of means is 0.665 \((p < 0.001)\). The 95% Confidence Interval had a lower limit of 0.500, and an upper limit of 0.830. The observed variance was 0.007, with a Tau-squared value of 0.000.

<table>
<thead>
<tr>
<th>Study name</th>
<th>Std diff in means</th>
<th>Standard error</th>
<th>Variance</th>
<th>Lower limit</th>
<th>Upper limit</th>
<th>Z-Value</th>
<th>p-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yang, 2013</td>
<td>0.569</td>
<td>0.289</td>
<td>0.080</td>
<td>0.000</td>
<td>1.135</td>
<td>1.971</td>
<td>0.049</td>
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<tr>
<td>Kaba, 2007</td>
<td>0.942</td>
<td>0.333</td>
<td>0.111</td>
<td>0.289</td>
<td>1.596</td>
<td>2.627</td>
<td>0.005</td>
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<tr>
<td>Ram, 2013</td>
<td>0.991</td>
<td>0.300</td>
<td>0.090</td>
<td>0.404</td>
<td>1.579</td>
<td>3.338</td>
<td>0.001</td>
</tr>
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<td>Kim, 2013</td>
<td>0.699</td>
<td>0.353</td>
<td>0.125</td>
<td>0.006</td>
<td>1.391</td>
<td>1.977</td>
<td>0.046</td>
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<td>Kim, 2011</td>
<td>0.616</td>
<td>0.312</td>
<td>0.097</td>
<td>0.004</td>
<td>1.228</td>
<td>1.973</td>
<td>0.048</td>
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<tr>
<td>Tikuisis, 2014</td>
<td>0.688</td>
<td>0.266</td>
<td>0.071</td>
<td>0.167</td>
<td>1.208</td>
<td>2.589</td>
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<tr>
<td>Cho, 2011</td>
<td>0.536</td>
<td>0.272</td>
<td>0.074</td>
<td>0.003</td>
<td>1.069</td>
<td>1.970</td>
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<td>Saadawy, 2009</td>
<td>0.445</td>
<td>0.226</td>
<td>0.051</td>
<td>0.002</td>
<td>0.889</td>
<td>1.967</td>
<td>0.049</td>
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<tr>
<td>Lauwick, 2008</td>
<td>0.693</td>
<td>0.291</td>
<td>0.085</td>
<td>0.122</td>
<td>1.264</td>
<td>2.379</td>
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<tr>
<td>Tausin-Fin, 2014</td>
<td>0.606</td>
<td>0.300</td>
<td>0.095</td>
<td>0.004</td>
<td>1.213</td>
<td>1.973</td>
<td>0.049</td>
</tr>
<tr>
<td>De Oliveira, 2012</td>
<td>0.633</td>
<td>0.290</td>
<td>0.084</td>
<td>0.005</td>
<td>1.201</td>
<td>2.183</td>
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</tr>
<tr>
<td>Lauwick, 2009</td>
<td>0.645</td>
<td>0.330</td>
<td>0.109</td>
<td>0.199</td>
<td>1.492</td>
<td>2.582</td>
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</tr>
</tbody>
</table>

**Figure 1. Meta-Analysis of IV Lidocaine**

Note: Meta-Analysis of 12 randomized controlled trials demonstrating reduction of postoperative pain following laparoscopic abdominal surgery through the use of perioperative IV lidocaine infusion.
Discussion of Meta-Analysis

Perioperative IV lidocaine infusion was correlated to a statistically significant \( p < 0.001 \) reduction in postoperative pain following laparoscopic abdominal surgery over control. This pain reduction was seen during the first twenty four postoperative hours. This analysis demonstrates that perioperative IV lidocaine infusion is a useful anesthetic adjunct agent that provides for an improved recovery for laparoscopic abdominal surgery patients. Earlier analyses that have included multiple surgery types have shown an inconsistent overall benefit from IV lidocaine infusion (Ventham et al., 2015), and thus a particularly positive element of this analysis is that it only included laparoscopic abdominal surgeries.

Procedures

After USM institutional review board approval and consent from the facility was obtained, the findings of the meta-analysis were included an oral presentation along with the delivery of the researcher-developed Evidence-Based Clinical Practice Update sheet. The update included pertinent pharmacokinetic information, dosing parameters, and safety considerations of IV lidocaine infusion. These materials were supplied prior to the start of the presentation. Following the presentation an eight item researcher-constructed questionnaire was delivered to the group of providers in effort to assist with the identification of potential barriers. Furthermore, following the presentation, the group was afforded the opportunity to ask questions and provide comments. These gave insight to the thoughts and beliefs of the providers as well as interest in a clinical practice change.
The survey was administered by the researcher, a senior student registered nurse anesthetist. No personal identifiers were used in the survey, and survey results will continue to be stored in a lockbox and transcribed to a computer file that is double password protected. Both of these will be destroyed six months after all graduation requirements have been met. No participants were be at risk for bodily or psychological harm during this study, and there was no compensation for participation in this study.

Conclusion

Data analysis of the questionnaires was used to evaluate the data obtained in the questionnaires. Answers to the questions in the survey were compared to the group as a whole to determine the attitudes and concerns of the anesthesia providers. These concerns pertained to the implementation of adjunct IV lidocaine infusions for laparoscopic abdominal surgery.

In this section, the methodology of this doctoral project was discussed. This included the population, setting meta-analysis, and survey. In the following section, the results will be discussed.
CHAPTER IV – RESULTS

Summary

There were two primary goals of this doctoral project. The first goal was to complete a meta-analysis of RCTs about lidocaine infusions used to decrease postoperative pain with laparoscopic abdominal surgeries and present the findings to a group of anesthesia providers in the clinical setting. The second goal was to survey the group to assess buy in from the providers and gain insight into potential barriers to the use of lidocaine infusions in the clinical setting to decrease postoperative pain following laparoscopic abdominal surgery.

Findings

The meta-analysis demonstrated the effectiveness of the lidocaine infusions to decrease postoperative pain. This information was used in the formulation of the Evidence-Based Clinical Practice Update sheet that was provided to the group of anesthesia providers at the beginning of the oral presentation in the clinical setting. An eight-question survey was administered to the group after this presentation which was followed up by a question and answer discussion.

A total of seven providers were available to complete the surveys as well as take part in the discussion and clinical practice update presentation. When asked how serious of a problem post-laparoscopy pain poses, as well as how significant the role of the anesthetic technique plays in reducing such pain, three (43%) providers answered “very significant” and four providers (57%) “somewhat significant”, to both questions. When asked if currently employed techniques were sufficient to control post-laparoscopy pain, one provider (14%) answered “yes”, four providers (57%) answered “somewhat
sufficient”, and two providers (29%) answered “not sufficient”. Two of the more interesting revelations from the survey came from the answers to the questions: “how likely are you to use non-narcotic agents to decrease post-surgical pain?”, and “what is your level of interest in learning about novel anesthetic techniques to reduce postoperative pain?” To both questions, six of the seven providers (86%) answered “very likely” and “very interested”, respectively. The final question in the survey was “are there potential barriers to your use of lidocaine infusions in laparoscopic abdominal surgery?” Six of the seven providers (86%) answered “no”. The one affirmative answer (14%) came with a notation which listed “potentially cost prohibitive” and “patient allergy” as barriers to use.

Following the survey, a brief discussion/question and answer session took place where the researcher offered to answer questions from the anesthesia providers about topics discussed during the presentation and barriers to the use of lidocaine infusions in their clinical practice. There were some interesting themes were discovered from the survey and the question and answer session. Six out of the seven anesthesia providers (86%) stated that they were very likely to use non-narcotic or multi-modal agents to control pain. This was the same number who stated that they were very interested to learn about new techniques to reduce postoperative pain. Also of note, six of the seven subjects (86%) who completed the questionnaires stated that there were no perceived barriers to the use of lidocaine infusions in their clinical practice. This shows a considerable amount of interest in this novel technique. During this time period, one provider (14%) stated that the lidocaine infusion would need to be premixed from either the manufacturer or the hospital pharmacy in order to be used as part of the anesthetic.
This provider went on to explain that if they were forced to prepare the infusion prior to every administration, this would dissuade them from the use of the drug due to time constraints. The other potential barrier to implementation of the use of lidocaine infusion that was discovered during this time period was a perceived high cost of administration. After consulting with a clinical pharmacist within the facility, the cost of a 250 ml pre-mixed 0.4% lidocaine infusion is $6.00 per bag. The pharmacist also stated that at the current time, only enough infusions were being ordered to stock the facility’s crash carts. The pharmacist went on to declare that the cost per bag would be lower if the facility purchased the drug on a larger scale that would be needed if the lidocaine infusions were to be used on a routine basis in the operative suite as volume purchasing would decrease cost.

Limitations and Barriers

The primary limitation of this study was that the size of the sample of providers was small. The self-selected sample included seven out of seven nurse anesthetists. Another limitation was the relatively short time that was allotted for the dissemination of the findings of the meta-analysis in the form of the Evidence-Based Practice Clinical Update. The primary barrier to the utilization of the knowledge generated by this study is the recognized lack of clinical experience on the part of the graduate student nurse anesthetist.

Recommendations

Based on the outcomes of this doctoral project, several recommendations can be made for clinicians in anesthesia practice. In the delivery of anesthesia to patients without contraindications to lidocaine, the administration of lidocaine infusion should be
considered to augment the general anesthetic in laparoscopic abdominal surgery. In consideration of a future pilot study, barriers to implementation in the chosen organization should be identified prior to the launch of the study. If this step is performed, then interventions may be targeted to the identified to these identified barriers. In this study, the two main barriers identified were cost of administration and the availability of the pre-mixed infusion bags. In the case of the facility studied in this doctoral project, the cost of administration would in fact decrease if more units were purchased by the facility.

Dissemination

One of the most efficient forms of dissemination of evidence such as that presented in this doctoral project is through publication in a professional journal. The most likely target for publication of this subject matter is the Journal of the American Association of Nurse Anesthetists. Beyond publication of a manuscript, an oral presentation of the Evidence-Based Clinical Practice Update that was based on the meta-analysis performed in this study could be delivered to a regional audience, such as a conference of the Mississippi Association of Nurse Anesthetists.

Implications for Future Practice

The evaluation and analysis of the gathered information from this study may be used to guide the implementation of a future pilot study. Successful adoption of the pilot study to standard practice may offer clinicians a technique that offers patients a reduction in pain, the incidence of complications, expedited recovery, as well as a reduction in the cost of care. Inherent to these benefits are a reduction in morbidity, shorter hospital stays, and the potential for reduced costs. If future research reveals consistent benefit
from the perioperative use of lidocaine infusions to decrease postoperative pain in other types of surgery, this could potentially result in a further increase in the use of this technique. Issues that may need to be evaluated prior to large-scale implementation are availability of pre-mixed infusions and infusion pumps, as well as the potential for a prolonged postoperative monitoring due to delayed effects of the lidocaine infusion.

Summary

As the field of healthcare remains in a constant state of advancement, healthcare providers face considerable obstacles in keeping up with innovations in technology and research. These providers are challenged with maintaining currency within their field of expertise. They also have to make perpetual improvements within their system of care delivery. This can prove to be especially problematic when the clinical structure is not contributive to practice changes.

This study demonstrated the anesthesia providers’ interest of adopting a novel anesthetic technique to include the use of lidocaine infusion to reduce postoperative pain associated with laparoscopic abdominal surgery. The clinical question of this doctoral project pertained to the identification of perceived barriers by anesthesia staff of the implementation of this technique. The cost and availability of premixed infusion bags appear to be the predominant concern among the providers surveyed. If the administration of lidocaine infusions were to become standard practice, the cost of its use would be reduced, and the availability of the drug would be increased with an adoption of this technique to standard practice within the facility.
Table A1. Literature Matrix

<table>
<thead>
<tr>
<th></th>
<th>Reduction of Post-operative Pain</th>
<th>Benefits to Post-operative Recovery</th>
<th>Reduction in Anesthetic Requirements</th>
<th>Cases Where Lidocaine Is Not Effective</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cho, Lee, Lee, Kim, Lee (2014)</td>
<td>Lidocaine infusion used as an adjunct to general anesthesia performs as well as dexmedetomidine to reduce postoperative pain following gallbladder surgery. (p. 228)</td>
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<tr>
<td>Koppert et al. (2014)</td>
<td>Parenteral infusion of IV lidocaine reduces morphine requirements and pain following major abdominal surgery (p. 1050)</td>
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<tr>
<td>Cassuto et al. (1985)</td>
<td>Low doses of lidocaine infused perioperatively decreased pain without the addition of negative side-effects. (1010)</td>
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<tr>
<td>Reference</td>
<td>Summary</td>
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<tr>
<td>Yardeni, Beilin, Mayburd, Levinson (2009)</td>
<td>Perioperative IV lidocaine improves postoperative immune function and decreases pain after abdominal hysterectomy. (p. 1468)</td>
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<tr>
<td>Kim et al. (2010)</td>
<td>IV lidocaine infusions decrease postoperative pain in abdominal surgery as consistently as local infiltration of lidocaine. (p. 1684)</td>
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<tr>
<td>Tikuisis et al. (2013)</td>
<td>Intravenous lidocaine reduces pain and improves recovery following laparoscopic surgery on the colon. (p. 377)</td>
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<tr>
<td>Ventham et al. (2015)</td>
<td>Lidocaine provides a statistically significant decrease in postoperative pain</td>
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<tr>
<td><strong>Choi, Kim, Jeong, Lee (2012)</strong></td>
<td>Analgesic requirements during the first postoperative day, and improves the quality of postoperative recovery. (p. 2232)</td>
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<tr>
<td><strong>Martin et al. (2008)</strong></td>
<td>For extrathoracic breast surgeries, adjunctive lidocaine infusion provided no benefit to postoperative pain or recovery indices (p. 431)</td>
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<tr>
<td><strong>Terkawi, et al. (2014)</strong></td>
<td>Infusion of lidocaine during total hip replacement surgery provides no benefit to pain or recovery (p. 121)</td>
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<tr>
<td></td>
<td>Following hip and tonsil surgery, perioperative IV lidocaine infusion offered no benefits to postoperative pain as seen</td>
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<tr>
<td>Study</td>
<td>Outcome</td>
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<td>--------------------------------------------------------------------------</td>
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<tr>
<td>Altermatt et al. (2012)</td>
<td>The mean maintenance requirement of general anesthetic agent was much lower in the group receiving lidocaine (p. 981)</td>
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<tr>
<td>Senturk et al. (2002)</td>
<td>During approximately the first half-hour after the start of the infusion, the lidocaine group was maintained on a significantly reduced amount of propofol. (p. 851)</td>
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<td>Gaughen and Durieux (2002)</td>
<td>An interaction was observed between lidocaine and a general anesthetic to maintain a more profound depth of anesthesia. (p. 1865)</td>
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<tr>
<td><strong>Herroeder et al. (2007)</strong></td>
<td>The addition of lidocaine infusions sped the return of gastrointestinal function and decreased the time to discharge (p. 198)</td>
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<tr>
<td><strong>Kaba et al. (2007)</strong></td>
<td>Lidocaine infusions provided benefits to gastrointestinal motility and decreased fatigue and pain postoperatively. (p. 10)</td>
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<td><strong>Groudine et al. (1998)</strong></td>
<td>Participants that received perioperative lidocaine infusions experienced a decreased time to the return of gastrointestinal motility. (p. 237)</td>
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<tr>
<td><strong>Vigneault et al. (2010)</strong></td>
<td>The use of perioperative IV lidocaine infusion was associated with decreased pain during recovery, faster</td>
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</table>
return of bowel function, decreased anesthetic requirements, and an incidence of adverse effects that was comparable. (p. 36)
New benefits from an Old Drug?

**Potential Advantages:**
- Decreased postoperative narcotic consumption of up to 75% over controls
- Decreased pain for as long as 2 postoperative days
- MAC by approximately 30%
- Improved hemodynamic stability in the presence of laparoscopy
- Improved postoperative bowel functioning

Multi-modal management of perioperative surgical pain has demonstrated several advantages over opioid analgesics alone. While proven to be effective, some of these techniques such as and thoracic epidurals and regional nerve blocks can be time consuming, expensive, and an untenable risk in certain patients. Multiple studies have indicated that Intravenous Lidocaine (IV) infusion used as an adjunct to General Anesthesia may provide for a reduction in postoperative pain. IV lidocaine has proven to be of particular benefit with laparoscopic abdominal surgeries, as this drug is especially effective at treating visceral pain and has analgesic, anti-hyperalgesic, and anti-inflammatory properties. These effects have been shown to last for hours to days beyond the pharmacologic elimination of the drug.

**IV Lidocaine Administration**

1. 1.5 mg/kg bolus at induction of anesthesia, followed by 1.5-2.0 mg/kg/hr infusion to be discontinued at time of skin closure

**Usual Preparation:** 1g/250ml NS (4mg/ml) or 2g/500ml NS (4mg/ml)

**Onset of IV bolus:** 30 seconds to 1.5 minutes

**Clinical Duration of IV bolus:** 10-20 minutes (due to rapid redistribution)

**Elimination half-Life of IV Bolus:** 1.5-2 hours

**Context Sensitive half-time of 2 hour infusion:** <20 min in most patients

**Contraindications:** Poorly compensated heart failure; Significant first degree or higher cardiac conduction delays. Allergies to Amide local anesthetics; severe hepatic impairment. Large concomitant doses of α-1 agonists and β-1 antagonists are relatively contraindicated, and caution should be used in geriatric patients. If hemodynamic instability develops and the infusion needs to be discontinued, the context-sensitive half-time of IV lidocaine is approximately 10-20 minutes in most patients following a 2 hour-long infusion.
APPENDIX C  Letter of Consent for Participation

Consent for Participation

My name is Brandon Figueiredo and I am doctoral student in The University of Southern Mississippi's nurse anesthesia program. As a part of my academic requirements, I am conducting a project entitled *Adoption of Perioperative Lidocaine Infusion for the Reduction of Postoperative Pain*. This study will use a survey design to investigate the barriers to clinical practice change of implementing lidocaine infusions perioperatively in an effort to decrease pain and improve the outcomes of patients undergoing laparoscopic abdominal surgeries. Participation is voluntary and responses are anonymous.

Your participation in this study will include:
1. Listening to an oral presentation on the perioperative use of lidocaine infusion
2. Receipt of a lidocaine infusion fact sheet
3. Completion of an anonymous survey which will take approximately 5 minutes. You must be 18 years of age to participate. Your participation is voluntary, you do not have to answer any questions with which you are uncomfortable, and you can withdraw from the presentation at any time without penalty. There will be no compensation for participation or penalty for nonparticipation in this study.

All participant responses to the survey will remain confidential. Your answers will be used to provide insight on barriers, strengths, and opportunities related to the adoption of lidocaine infusion to decrease postoperative pain following laparoscopic abdominal surgery. The researchers involved with this study will have access to your responses. In any reports written about this study, no identifying information will be included. Participation in this study is strictly voluntary and completing the study survey indicates an agreement to participate in this study and that you are at least 18 year of age.

The principal researcher of this study is Brandon Figueiredo, and he can be contacted at brancon.figueiredo@eagles.usm.edu. He is working with his advisor, Cathy Hughes, DNP, RN, who can be reached at cathy.hughes@usm.edu. This project has the approval and support of the project committee of Dr. Cathy Hughes, Dr. Michelle Rayborn, and Dr. Sat Ananda Haydien.

This project has been reviewed and approved by the University of Southern Mississippi’s Institutional Review Board Human Subjects Protection Review Committee, which ensures that research projects involving human subjects follow federal regulations. Any questions or concerns about rights as a research subject should be directed to the chair of the Institutional Review Board, The University of Southern Mississippi, 118 College Drive #3147, Hattiesburg, MS 39406-0001, (601) 266-5997. The results of this study will be made available upon completion of the project.

Thank you for consideration to participate in this study.

Brandon Figueiredo
APPENDIX D  Chief CRNA Letter of Consent

July 8th, 2016

RE: Brandon Figueiredo Request for Letter of Support

I am the Chief Certified Registered Nurse Anesthetist in practice at [Redacted] Mississippi Regional Medical Center in [Redacted], Mississippi. I am offering this letter of support of the SRNA doctoral student, Brandon Figueiredo, in his Capstone project titled Adoption of Perioperative Lidocaine Infusion for the Reduction of Postoperative Pain.

I understand that Brandon Figueiredo, is a doctoral student in the nurse anesthesia program at the University of Southern Mississippi who is planning to graduate in December of 2016. This letter of support will be included in the University of Southern Mississippi IRB application. I understand that open participation will be presented to anesthesia providers practicing at this facility. There is no compensation for their participation.

I understand the planned dates are from July 1st, 2016 to December 1st, 2016 after USM IRB approval is received. His chair contact information is Dr. Cathy Hughes at cathy.hughes@usm.edu and at (601) 550-7357.

I understand that participation is completely anonymous and voluntary. If anesthesia providers at this facility may choose not to participate or withdraw from the study at any time, there will be no penalty.

I am looking forward to hearing the results of research and impact on clinical practice.

Sincerely,

[Signature]

[Name], Chief Certified Nurse Anesthetist
RE: Brandon Figueiredo Request for Letter of Support

I am an administrator at Mississippi Regional Medical Center in Natchez, Mississippi. I am offering this letter of support of the SRNA doctoral student, Brandon Figueiredo, in his Capstone project titled Adoption of Perioperative Lidocaine Infusion for the Reduction of Postoperative Pain.

I understand that Brandon Figueiredo, is a doctoral student in the nurse anesthesia program at the University of Southern Mississippi who is planning to graduate in December of 2016. This letter of support will be included in the University of Southern Mississippi IRB application. I understand that open participation will be presented to anesthesia providers practicing at this facility. There is no compensation for their participation.

I understand the planned dates for his research are from July 1st, 2016 to December 1st, 2016 after USM IRB approval is received. His chair contact information is Dr. Cathy Hughes at cathy.hughes@usm.edu and at (601) 550-7357.

I understand that participation is completely anonymous and voluntary. If anesthesia providers at this facility may choose not to participate or withdraw from the study at any time, there will be no penalty.

I am looking forward to hearing the results of research and impact on clinical practice.

Sincerely,

[Signature]

Richard North, COO/Administrator
APPENDIX F  Anesthesia Provider Survey

Anesthesia Provider Survey

Participation in this questionnaire is strictly voluntary and anonymous. Results of this survey will be used for educational purposes only.

1) Are you over the age of 18?
   □ Yes
   □ No

2) Do you give your consent for the results of this survey to be used in an educational research project?
   □ Yes
   □ No

3) In your clinical judgement, how serious of a problem is post-laparoscopy pain?
   □ Very significant
   □ Somewhat significant
   □ Not significant
   □ No experience
   □ No opinion

4) How significant of a role do you believe the anesthesia technique plays in postoperative pain and rehabilitation following laparoscopic abdominal surgery?
   □ Very significant
   □ Somewhat significant
   □ Not Significant
   □ I have no experience
   □ No opinion

5) How likely are you to use non-narcotic multi-modal agents/techniques perioperatively with the intent of decreasing post-surgical pain?
   □ Very likely
   □ Somewhat likely
   □ Not likely
   □ I have no experience
   □ No opinion
6) Do you feel that the anesthetic techniques you use currently are sufficient to control postoperative pain following laparoscopic abdominal surgery?
□ Yes
□ Somewhat sufficient
□ Not sufficient
□ I have no experience
□ No opinion

7) Are there potential barriers to your use of lidocaine infusions in laparoscopic abdominal surgery?
□ Yes
□ No
□ If Yes, please explain:
________________________________________________________________________

8) How would you characterize your level of interest in learning about novel anesthetic techniques to reduce postoperative pain?
□ Very interested
□ Somewhat interested
□ Not very interested
□ I have no experience
□ No opinion
## Table A2. *Doctor of Nursing Practice Essentials*

<table>
<thead>
<tr>
<th>DNP Essential I</th>
<th>Scientific Underpinnings for practice</th>
<th>Rosswurm and Larrabee’s model for change to evidence based practice was used as a framework to guide the transition from the realization of a need for practice change to the eventual design for a proposed practice change.</th>
</tr>
</thead>
<tbody>
<tr>
<td>DNP Essential II</td>
<td>Organizational &amp; Systems Leadership for Quality Improvement &amp; System Thinking</td>
<td>Potential practice change focuses on improving quality through improving patient outcomes.</td>
</tr>
<tr>
<td>DNP Essential III</td>
<td>Clinical Scholarship &amp; Analytical Methods for Evidence Based Practice</td>
<td>Evaluation of the goals set forth by this project were performed at the conclusion of the proposal delivered in the clinical setting.</td>
</tr>
<tr>
<td>DNP Essential IV</td>
<td>Information Systems/Technology and Patient Care Technology for the Improvement and Transformation of Health Care</td>
<td>Information technology was utilized in this project through the needs assessment where case tracking software was used in gathering case totals in the studied facility.</td>
</tr>
<tr>
<td>DNP Essential VI</td>
<td>Interpersonal Collaboration for Improving Patient and Population Health Outcomes</td>
<td>Participation of the entire anesthesia care team took place following the proposal presentation</td>
</tr>
<tr>
<td>DNP Essential VII</td>
<td>Clinical Prevention and Population Health for Improving the Nation’s Health</td>
<td>The proposed use of perioperative lidocaine infusion may lead to a decrease postoperative pain and improvement in patient outcomes.</td>
</tr>
<tr>
<td>------------------</td>
<td>-------------------------------------------------</td>
<td>--------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>DNP Essential VIII</td>
<td>Advanced Nursing Practice</td>
<td>The objective of this project is to improve the clinical practice of the advanced practice anesthesia provider. The use of IV lidocaine can produce more favorable patient outcomes and improve satisfaction with care.</td>
</tr>
</tbody>
</table>
APPENDIX H  Logic Model

Table A3. Logic Model

<table>
<thead>
<tr>
<th>Inputs/Resources</th>
<th>Interventions</th>
<th>Outputs</th>
<th>Outcomes</th>
<th>Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assets available to accomplish goals</td>
<td>Activities performed using accessible resources</td>
<td>The products that are generated from the activities performed</td>
<td>Anticipated advancements made possible through the outputs produced</td>
<td>Long-term systemic improvements based on the positive effect of the outcomes</td>
</tr>
</tbody>
</table>

- Anesthesia providers who are agreeable to listening to a proposal
- Peer reviewed journal articles of sufficient caliber to support the project

- Conduct a comprehensive integrated review of the literature.
- Perform a meta-analysis on applicable evidence.
- Produce an *Evidence-Based Clinical Practice Update* suited to the anesthesia provider that demonstrates the advantages and disadvantages of the concept.
- Delivery of the EBP update

- Short term outcomes (1-3 years) improved patient pain control and reduced narcotic requirements perioperatively.
- Long term outcomes (4-6 years) awareness of providers of the benefits of Lidocaine use to complement analgesic administration.

- Acknowledgement of the benefits of using Lidocaine in patients with a history of polypharmacy exposure.
- Enhanced surgical patient outcomes nationwide.
- Cost reduction to providers and facilities.
APPENDIX I – USM IRB Approval Letter

THE UNIVERSITY OF SOUTHERN MISSISSIPPI

INSTITUTIONAL REVIEW BOARD
118 College Drive #5147 | Hattiesburg, MS 39406-5147
Phone: 601.266.5000 | Fax: 601.266.4377 | www.usm.edu/research/institutional-review-board

NOTICE OF COMMITTEE ACTION

The project has been reviewed by The University of Southern Mississippi Institutional Review Board in accordance with Federal Drug Administration regulations (21 CFR 25, 111), Department of Health and Human Services (45 CFR Part 46), and university guidelines to ensure adherence to the following criteria:

- The risks to subjects are minimized.
- The risks to subjects are reasonable in relation to the anticipated benefits.
- The selection of subjects is equitable.
- Informed consent is adequate and appropriately documented.
- Where appropriate, the research plan makes adequate provisions for monitoring the data collected to ensure the safety of the subjects.
- Where appropriate, there are adequate provisions to protect the privacy of subjects and to maintain the confidentiality of all data.
- Appropriate additional safeguards have been included to protect vulnerable subjects.
- Any unanticipated, serious, or continuing problems encountered regarding risks to subjects must be reported immediately, but not later than 10 days following the event. This should be reported to the IRB Office via the "Adverse Effect Report Form".
- Projects that exceed this period must submit an application for renewal or continuation.

PROTOCOL NUMBER: 16081802
PROJECT TITLE: Adoption of Perioperative Lidocaine Infusion for the Reduction of Postoperative Pain
PROJECT TYPE: New Project
RESEARCHER(S): Brandon Figueiredo
COLLEGE/DIVISION: College of Nursing
DEPARTMENT: Advanced Practice
FUNDING AGENCY/SPONSOR: N/A
IRB COMMITTEE ACTION: Exempt Review Approval
PERIOD OF APPROVAL: 08/23/2016 to 08/22/2017
Lawrence A. Hosman, Ph.D.
Institutional Review Board
REFERENCES


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http://doi.org/10.12659/MSM.893944


function. *Anesthesia & Analgesia, 109*(5), 1464-1469. doi:

10.1213/ANE.0b013e3181bab1bd