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POSTOPERATIVE EFFECTS

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ABSTRACT

Postoperative pain can effect almost every organ function and may adversely influence postoperative morbidity and mortality. This study's purpose was to compare one institutions postoperative epidural opioid/local anesthetic protocol, currently fentanyl with bupivacaine or ropivacaine and compare it to the previously used morphine. Pain control efficacy and incidence of side effects were compared using a retrospective chart audit. The sample was obtained from the inpatient records of a 155-bed medical center. A description of patients' age, gender, surgical procedure, opioid/local anesthetic, side effects, treatments, and occurrence of breakthrough pain were recorded using a tool adapted by Bell for a similar study and data were analyzed using the SPSS program. Data analysis revealed that differences between groups were statistically insignificant regarding age, gender, and surgery type. Occurrence of breakthrough pain and side effects were similar for fentanyl/local anesthetic and morphine. No significant respiratory depression was reported in either group. Nausea and vomiting incidence between groups was similar and seemed related to type of surgery, with a higher incidence in abdominal procedures. Pruritis and urinary retention was equal in both groups. Under-reporting and incomplete documentation, as well as the management of breakthrough pain were found to be problematic. Prospective research, ongoing education of staff and patients, and further development of the anesthesia directed pain management program at this facility is recommended.

Keywords: **Postoperative pain, epidural analgesia, fentanyl, morphine, bupivacaine**

TWO DIFFERENT EPIDURAL ANALGESIC COMBINATIONS: MORPHINE VS.

FENTANYL/BUPIVACAINE OR FENTANYL/ROPIVACAINE

AND THEIR POST OPERATIVE EFFECTS

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PREFACE OR FORWARD

This research was conducted to look at the effects of two different epidural analgesic combinations on pain, pain in conjunction with surgical procedure, and presence of nausea and vomiting in conjunction with surgical procedure. Findings from this study provide important information for Anesthesia providers to administer safe and effective postoperative pain control to their patients.

DEDICATION AND ACKNOWLEDGEMENT

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

CHAPTER I: INTRODUCTION

Background

Treatment of postoperative pain is an essential element of perioperative care. For as

long as surgery has been performed, the management of postoperative pain has presented

problems. Advances in pharmacologic sciences have contributed to the development of

the variety of therapeutic analgesics, which are currently available (Katzung, 1998).

However, postoperative pain continues to be one of the most difficult problems

encountered in clinical practice (Slack & Faut-Callahan, 1990). Effective postoperative

pain management not only increases the comfort and satisfaction of the surgical patient,

but may also enhance the postoperative recovery process by diminishing pain-related

complications associated with delayed mobility and ineffective lung expansion.

"Moderate to severe pain, regardless of site, can affect nearly every organ function and

may adversely influence postoperative morbidity and mortality" (Morgan & Mikhail,

1996, p. 2284).

The International Association for the Study of Pain defines pain as, "the sensory and

emotional experiences associated with actual or potential tissue damage," (Taber, 1989, p.

1405). Pain has both physical and psychological facets. Physically, surgery produces

tissue damage and destruction and causes substances, such as prostaglandins, substance P,

and histamine to be released. These and other irritants stimulate free nerve endings

located in the cutaneous and subcutaneous tissue (Purves, 1997). These nerve endings,

known as nociceptors, transmit the noxious stimuli to the central nervous system. These

pain receptor axons are lightly myelinated or unmyelinated fibers of the A-delta or C-fiber

caliber. The A-delta fibers transmit fast, sharp, surgical-type pain while the slow, dull,

aching-type of pain is transmitted via C-fibers. These first-order neurons have their cell

bodies located in the dorsal root ganglion. They have a synapse within the spinal cord, after traveling up or down for two vertebral segments, with the second order neuron in the substantia gelatinosa of the dorsal horn. This is an area that is rich in opioid receptors where endogenous and exogenous opioids bind to block pain transmission. Some pain impulses will travel directly to the cerebral cortex by way of the marginal zone located in the dorsal horn, while most second-order neurons will synapse with third-order neurons in the thalamus. From there, they will project to the primary sensory cerebral cortex.

Descending neurotransmitter systems play a role in pain modulation. These systems originate in the somatic sensory cortex, the hypothalamus, peri-aquaductal gray, and raphe nuclei. These pain modulation pathways are complex, and mechanisms of pain perception are only beginning to be understood (Dubner & Gold, 1999).

The psychological aspects of pain are influenced by many interacting factors which are dynamic and fluctuating. Pain is subjective in nature and there are no universally accepted means for its quantification. Pain responses and thresholds vary between individuals with fear and anxiety often accentuating the pain response (Taber, 1989). In addition to the patients' perception and experience of pain, the healthcare providers' beliefs, biases, and attitudes must also be considered.

A number of options exist for the treatment of postoperative pain, one of which is epidural analgesia. Epidural narcotics are effective for alleviation of postoperative pain, with a markedly reduced incidence of central nervous system depressant effects and gastrointestinal irritation when compared to intravenously administered opioids. Intravenous opioids have more pronounced systemic effects leading to greater incidences of respiratory depression, nausea, and sedation. An extensive body of literature shows

that pain management with epidural opioids is well accepted worldwide in the management of acute surgical pain (Rawal, 1999).

Epidural Narcotics

Epidural narcotics are one of the most recent advances in postoperative pain management. Narcotic medications and, in many cases, local anesthetics, are injected into the epidural space. Epidural narcotics were initially used for alleviating intractable pain associated with cancer. Discovery of their efficacy led to widespread postoperative use of epidural opioids in the 1980s.

Epidural analgesic management is useful because lower doses of narcotics are necessary and a higher quality of pain relief is achieved than with other analgesic routes (Slack & Faut-Callahan, 1990). Epidural analgesia, however, is not without its limitations. In many facilities, use of epidural narcotics is limited to the intensive care setting; and, as with other analgesic protocols, there are also adverse effects associated with epidural narcotics. These include, but are not limited to respiratory depression, pruritis, nausea, vomiting, urinary retention, and lower extremity weakness and numbness (Badner, 1992).

Historical Links to Nursing

Nurses have always played a pivotal role in the management of acute postoperative pain, because of the time they spend with patients. It is the nurse who is the patient advocate and liaison between the patient and other health care providers. Patients being cared for by nurses who are knowledgeable about pain management modalities receive the best pain relief (McCaffrey & Beebe, 1989). The success or failure of pain control outside the operating room depends, in part, on nursing vigilance and care (McShane, 1992).

Problem

Epidural opioid/local anesthetic combinations are effective for postoperative pain management. Anesthesia providers are in a key position to analyze data about analgesics currently in use for the purpose of improving epidural efficacy and minimizing side effects. More information needs to be gathered, however, regarding the effectiveness and side effects of specific anesthetic agents in different populations.

Purpose

The purpose of this study was to examine one institution's epidural opioid/local anesthetic protocol, currently fentanyl/bupivacaine or fentanyl/ropivacaine, and comparing it to the drug morphine, which was previously. A comparison of pain control efficacy and the incidence of side effects were made using a retrospective chart audit.

Research Question

The research question posited was, "What is the effect of epidural morphine compared to fentanyl with bupivacaine or ropivacaine in the management of postoperative pain?" Three comparisons were made: (a) presence of pain and drug type; (b) presence of pain and surgery type; and, (c) presence of nausea and vomiting and surgery type.

Conceptual Framework

This study was based on two theoretical frameworks: Virginia Henderson's conceptual framework for nursing, and a physiologic framework based on principles of

pharmacokinetics. Virginia Henderson's conceptual framework incorporates physiologic and psychologic principles into the concept of nursing. Henderson identifies 14 basic needs of the patient, which make up the components of nursing care. She views health in terms of the patient's ability to perform these components without assistance. The components include the ability to: (a) breathe normally, (b) eat and drink adequately, (c) eliminate body waste, (d) move and maintain a desirable position, (e) sleep and rest, (f) select suitable clothes and be able to dress and undress, (g) maintain body temperature within normal range by adjusting clothing and modifying the environment, (h) keep their body clean and well-groomed and protect the integument, (i) avoid dangers in the environment and avoid injuring others, (j) communicate with others in expressing emotions, needs, fears, or opinions, (k) worship according to one's faith, (l) work in such a way that there is a sense of accomplishment, (m) play or participate in various forms of recreation, (n) learn, discover, or satisfy the curiosity that leads to normal development and health and use the available health facilities (Henderson, 1966).

Henderson links health with independence. She believes that people help to choose their state of health and that the nurse can assist and encourage wise choices. She also describes components of the nurse-patient relationship in which the nurse can substitute for the patient, help the patient, or be a partner with the patient (DeMeester, Lauer, Marriner-Tomey, Neal, & Williams 1994,). Nurses and nurse anesthetists are put in a position to be "substitutes" for patients intraoperatively, "helpers" for patients postoperatively, and "partners" with patients in formulating plans of care. As patient independence increases, the nurse's role diminishes.

The physiologic framework of this study was based upon the pharmacokinetics of opioids. The principle side effect of epidural opiates, life-threatening respiratory

depression, is thought to result from the supraspinal redistribution of free drug in the spinal space. Epidural fentanyl is cleared relatively quickly from the cerebral spinal fluid. Because of its hydrophobic, lipophilic nature, it is not associated with delayed respiratory depression, in contrast to morphine, which is a lipophobic, hydrophilic compound and is thus more likely to cause this problem. The differences between these two opioids may also be a factor in their efficacy as epidural analgesics.

<p align="center">Definitions: Conceptual and Operational</p>

Independent Variables

1. Morphine: Conceptual-morphine is an opioid derivative, which has a potent analgesic effect. Operational-an infusion documented on the patient's record.

2. Fentanyl/bupivacaine or fentanyl/ropivacaine: Conceptual-fentanyl is a synthetic narcotic, which produces potent analgesic effects. Bupivacaine and ropivacaine are amide local anesthetics that produce sensory greater than motor blockade. Operational-an infusion documented on the patient's record.

Dependent Variables

1. Postoperative pain: Conceptual-unpleasant sensation or discomfort resulting from a surgical procedure. Operational-a score on a numeric pain scale as documented on the patient's record.

2. Side Effects: Conceptual-unwanted outcomes. Operational-pruritis, breakthrough pain, nausea, vomiting, urinary retention hypotension, respiratory depression, lower extremity weekness or numbness as recoreded on the patient's chart.

3. Hypotension: Conceptual-low blood pressure. Operational-a decrease in systolic blood pressure of 20% or greater from baseline.

4. <u>Respiratory depression/distress:</u> Conceptual-difficulty breathing. Operational-respiratory rate less than or equal to 10 breaths per minute, apnea greater than 20 seconds, oxygen saturation less than 90%, or $PaCO_2$ greater than 50mmHg.

Assumptions

1. Documentation of pain relief and side effects were annotated appropriately.

2. Pain was undesirable.

3. Patients reported pain and side-effects accurately.

Limitations

1. Retrospective nature of this study limits the generalizability of findings.

2. Forms used for documentation of pain relief and side effects are generic, so other areas of interest may not be documented.

Summary

Pain management is a key focus for patient care. If pain can't be controlled, patients usually suffer detrimental effects. The ability to provide patients with quick recovery and pain-free postoperative experiences is a priority. The goal of this study was to compare the effectiveness of two different methods of epidural analgesia to determine the most effective and safe drug combination.

CHAPTER II: LITERATURE REVIEW

Introduction

The challenge of effective management of postoperative pain is an integral part of the overall perioperative care plan. Most patients experience some degree of postoperative pain related to the surgical procedure (Rolant & Ennis, 1996). Ideally, an effective analgesic will provide optimal analgesia with minimal side effects. Many pharmaceutical agents employing various routes, dosages, and mechanisms of action are currently available to therapeutically treat postoperative pain. Epidural opioid delivery is one such option. The administration of epidural local anesthetics, opioids, or a combination of the two is an excellent technique for managing postoperative pain following abdominal, pelvic, thoracic, or orthopedic procedures on the lower extremities (Morgan & Mikhail, 1996). Numerous studies have demonstrated that epidural opioids, in use since 1979, can provide profound postoperative analgesia with less central and systemic adverse effects than can opioids administered systemically (Rawal, 1999). With the use of epidural analgesia, patients often have improved preservation of pulmonary function, earlier ambulation and earlier benefit from early physical therapy as compared with patients who receive systemic narcotics for postoperative pain control (Morgan & Mikhail, 1996).

Comparison of Continuous Epidural Infusion of Fentanyl-Bupivacaine or Ropivacaine with Morphine in Management of Postoperative Pain

Almost all opioid narcotics have been administered via the epidural route for the management of postoperative pain. The differences in opioid uptake affecting onset and duration of action as well as incidence of undesirable reactions have been linked to the biochemical nature of the compounds, specifically lipophilicity and the degree of protein

binding (Katzung, 1998). Absorption of drugs through the cell membrane is dependent upon whether their chemical structures are lipophilic or hydrophilic. Lipophilic molecules readily penetrate opioid receptor cell membranes, while hydrophilic (hence, lipophobic) structures penetrate membranes more slowly. Several studies have demonstrated an association of onset of analgesia and duration of action with lipophilicity of the opioid. Of the two most common and widely used opioids, fentanyl, a highly lipophilic compound, has the fastest onset (5-10 minutes) while morphine, a hydrophilic compound has the slowest onset (30-45 minutes). Opioid duration and potency are also influenced by factors other than solubility, including dosage and the intensity of the pain stimulus (Rawal,1999). Ropivacaine is an enantiomerically pure (s-enantiomer) amide local anesthetic drug. Bupivacaine is a racemic mixture (s and r enantiomers) amide local anesthetic. Studies have shown that ropivacaine is less potent than bupivacaine when the concentrations are equal. This difference is most noticeable in terms of the motor blockade produced, with less difference in degree of sensory blockade. Direct comparisons indicate that epidurally administered ropivacaine provides generally similar efficacy in terms of pain relief, when administered in equianalgesic doses, but ropivacaine is better tolerated and has fewer side effects. Animal studies have shown ropivacaine to be less cardiotoxic than bupivacaine; the lesser degree of motor blockade with ropivacaine is advantageous in certain situations, namely postoperative pain management.

In a random, single-blinded study in which patients were blinded to which opioid was administered epidurally, the efficacy and safety of postoperative analgesia with continuous epidural infusions of either morphine or fentanyl in combination with bupivacaine were evaluated (Saito, Uchida, Kaneko, Nakatini, & Kosaka, 1994). Eighty-

five patients, ages 53-73, classified as American Society of Anesthesiologists' (ASA) physical status I (normal, healthy patients) or II (patients with mild, systemic disease such as diabetes mellitus, obesity, or controlled hypertension), undergoing thoracic and/or upper abdominal surgery were randomly allocated to one of two groups based on which opioid was administered epidurally. Forty-five patients, 34 men and 11 women, were assigned to the morphine/bupivacaine group and 40 patients, 28 men and 12 women, were assigned to the fentanyl/bupivacaine group. No significant differences existed in average age, body weight, height, and site of epidural catheter placement between the two groups. The morphine/bupivacaine group received morphine at 0.2 milligrams/hour and bupivacaine at 10 milligrams/hour for the first 24 hours and morphine 0.2 milligrams/hour and bupivacaine at 5 milligrams/hour for the second 24 hours. The patients in the fentanyl/bupivacaine group received the same bupivacaine dose for the first and second 24-hour periods as did the patients in the morphine/bupivacaine group in combination with equianalgesic fentanyl doses of 20 micrograms/hour. Both groups had their epidural infusions for 48 hours postoperatively, and their degree of pain was measured by scoring the requirement for supplementary analgesics for 48 hours. The numeric pain scale ranging from zero (no pain) to 10 (severe pain) was also used to assess pain in both groups.

Data analysis from this study demonstrated that there was no significant difference in incidence of postoperative pain in either group, and that both groups experienced excellent pain relief. Seventy-four percent (n =33) of the patients in the morphine/bupivacaine group and 76% percent (n =30) in the fentanyl/bupivacaine group required no supplemental analgesics. However, the incidence of side effects was greater in the morphine/bupivacaine group than in the fentanyl/bupivacaine group. Hypotension,

with its potential for circulatory compromise, can be a serious untoward reaction of analgesics. The incidence of hypotension was 33% (n =15) in the morphine/bupivacaine group compared with 18% (n =7) in the fentanyl/bupivacaine group (p <0.05). The incidence of pruritis was 36% (n =16) in the morphine /bupivacaine group contrasted with 10% (n =4) in the fentanyl/bupivacaine group. Nine percent (n =4) of the patients in the morphine/bupivacaine group experienced nausea and vomiting while only 6% (n =2) of the patients in the fentanyl/bupivacaine group had nausea and vomiting (p <0.05). Patients who did not experience pruritis, nausea or vomiting were more comfortable and required fewer nursing interventions than those who did. The incidence of drowsiness was 20% for both groups while neither group had any incidence of respiratory depression, motor block, or other side effects. Based on these findings, the use of fentanyl with bupivacaine appears to be preferential in patients undergoing thoracic or upper abdominal surgery relative to the use of morphine with bupivacaine.

Evidence of the superior benefits of epidural fentanyl/bupivacaine over epidural morphine/bupivacaine has been supported in a double-blind study, which compared the continuous infusion of fentanyl/bupivacaine with morphine/bupivacaine in the management of postoperative pain following cesarean section (Fischer, Lubenow, Liceaga, McCarthy, & Ivankovichy, 1988). One hundred and seven ASA I and II patients were randomized to one of two groups: 59 patients were placed in the fentanyl/bupivacaine group and 48 were placed in the morphine/bupivacaine group. There were no significant differences between the two groups in age, race, socioeconomic status, weight or height. The epidurals were placed at identical dosage levels for patients in both groups. Patients in group I were given epidural infusions of morphine .01% with bupivacaine 0.1%, patients in group II received comparative doses

of fentanyl at 0.001% with bupivacaine 0.1%. A continuous epidural infusion of the study drug was administered at 5 ml/hour, and remained on for 24 hours postoperatively. The results indicated that the degree of analgesia was satisfactory, without differences between the two types of analgesia. Once again, however, the incidence of side effects was greater in the morphine/bupivacaine group (group I) than in the fentanyl/bupivacaine group (group II). The incidence of pruritis occurred significantly less often in the fentanyl/bupivacaine group (20%, n =13) than in the morphine/bupivacaine group (42%, n =20, p =0.03). Nausea occurred less frequently in the fentanyl/bupivacaine group, (3.4%, n =2) than in the morphine/bupivacaine group (17.4%, n =8). Time to ambulate was the same in both groups and there were no incidences of respiratory depression in either group.

A similar study compared epidural infusions of fentanyl and morphine (with bupivacaine) after orthopedic surgery, specifically total hip replacements. (Berti et al. 1998). This study was a prospective, randomized, double-blind study of 30 ASA physical status I-II patients. A combined general/regional (epidural) anesthetic was administered. Patients were randomly assigned to postoperative epidural analgesia by continuous infusion of bupivacaine 0.125% (4ml/hour) with either 0.05 milligrams/ml morphine (morphine, n =15) or 0.005 milligrams/ml fentanyl (fentanyl, n =15). The numeric pain scale was used to evaluate pain, and both groups were educated on its use. No differences in age, weight, height, sex distribution, or ASA status existed between members of either group. The results of this study also support the preferential use of fentanyl/bupivacaine over morphine/bupivacaine. Similar degrees of pain relief were noted in both groups. However, patients in the morphine group showed a more marked decrease in blood oxygen saturation. This could reflect a greater propensity of morphine

to cause respiratory depression, although the average oxygen saturation remained more than 90% in both groups. Forty-percent (n =6) of the patients in the morphine group had nausea which required treatment with an antiemetic compared with only 20% (n =3) in the fentanyl group. The patients in this study had non-abdominal procedures, which may account for the lower incidence of nausea and vomiting. No differences in the hemodynamic parameters were found in either group.

In a double-blind, randomized study in patients undergoing open hysterectomy, ropivacaine was compared to bupivacaine in postoperative pain relief, degree of motor blockade, and effect on gastrointestinal function. (Jorgensen, Tomsgaard, Dirks, Wetterslee & Dahl, 2000). Patients, aged 18-75 years, classified as ASA I or II, undergoing elective abdominal total or supravaginal hysterectomy were randomly allocated to either the bupivacaine or ropivacaine group. A total of 53 patients participated in the study, 28 were assigned to the ropivacaine group and 27 to the bupivacaine group. There were no significant differences between groups for patient characteristics or operative data, in particular, intraoperative hypotension was not a problem. Before induction of general anesthesia an 18-gauge epidural catheter was inserted via a Tuohy needle and advanced four to five centimeters into the epidural space at the T-10-11 level and a four milliliter test dose of two percent lidocaine with epinephrine was administered. A bolus dose of 16 ml. of 2% lidocaine with epinephrine was administered, followed by continuous infusion of eight ml./hour of 2% lidocaine throughout the operation. General anesthesia was maintained with a continuous propofol drip. At skin closure, patients were allocated randomly to receive an epidural bolus dose of either ropivacaine 2% or bupivacaine 2% of eight milliliters, followed by a continuous infusion of 0.2% of the same drugs bolused. Infusions ran at eight milliliters per hour for

24 hours. Patients' degree of pain was measured using the numeric pain scale (NPS)

score. No significant differences were found between groups for NPS scores or in the

number of patients requesting supplemental analgesic. However, in the subgroup of

patients who received supplementary analgesics 0-24 hours after surgery, those in the

ropivacaine group received significantly more ketorolac than those in the bupivacaine

group (p =0.018). There were no differences in the spread of sensory blockade between

groups, except at 26 hours after surgery when patients in the ropivacaine group had a

smaller spread than those in the bupivacaine group (p =0.042). There was no significant

difference in motor blockade. Twenty-one of 28 (75%) in the ropivacaine group

compared with 15 of 25 (60%) in the bupivacaine group (p =0.38) were able to ambulate

without difficulty at six hours and at 24 hours after surgery. The two groups had similar

incidences of nausea and vomiting. There were no differences in time to first flatus or

time to first bowel movement. There was no difference in time to discharge. Since

significantly more doses of rescue analgesic were administered to patients in the

ropivacaine group, this may indicate that ropivacaine is less effective for analgesia when

administered in identical concentration. Seven percent of the patients who received

ropivacaine suffered from motor block at six hours after surgery compared with 15% of

the bupivacaine group, at 24 hours, corresponding values were zero percent and 16%

respectively. However, these differences were not statistically significant due to the

small sample size. Consistent with previous findings, gastrointestinal function returned

to normal within 48 hours in both groups.

    In a 1999 study by Bell, an epidural pain management protocol was evaluated using a

retrospective chart audit. Data were collected from 133 inpatient records including: age,

gender, type of surgery, epidural analgesic used, the effect of the epidural on

postoperative pain, and side effects of the analgesic. Duramorph (morphine) was the most frequently administered analgesic (n =112), followed by fentanyl/bupivacaine (n =18), and Duramorph/bupivacaine (n =2).

In these patients, the occurrence of breakthrough pain was 58.9% of all cases regardless of procedure, with the highest amount occurring in patients having thoracic surgery. Side effects were most frequent in patients receiving Duramorph alone. Respiratory depression occurred only in patients receiving Duramorph (n =6). Nausea and vomiting were also more common in the patients receiving Duramorph alone, especially if these patients had undergone abdominal surgery.

This study demonstrated a need for further research into the use of epidural analgesia in an effort to find a drug that provides the highest degree of pain relief with minimal side effects.

Summary

Postoperative pain is currently a significant and ubiquitous problem. It is associated with a myriad of postoperative complications, which lead to delayed recovery and prolonged hospitalizations. Untreated severe pain causes stimulation of the sympathetic component of the autonomic nervous system resulting in increased release of catecholamines. This stress response (increased heart rate, blood pressure, etc.) has many negative effects including postoperative ileus and cardiac ischemia in susceptible individuals (Scheinin & Orko, 1987). Pain is well known to contribute to improper postoperative coughing and deep breathing exercises, which predispose patients to pulmonary complications. Similarly, the presence of postoperative pain is a factor in delayed mobility, as patients with pain are often more reluctant to get out of bed. One of

the more serious complications of delayed mobility after surgery is the development of deep vein thrombosis (Morgan & Mikhail, 1996).

Postoperative pain has been clearly shown to be ameliorated effectively by epidural opioid administration. The drug of choice is one which alleviates postoperative pain with the fewest unwanted side effects. The evidence continues to mount in support of the use of fentanyl over morphine in combination with a local anesthetic. Further studies are warranted in order that the safest, most effective therapeutic regime can be employed in the treatment of postoperative surgical clients. Further, enhanced patient comfort results in diminished labor intense hours of nursing care, thus providing patients with the additional benefit of decreased hospital time and costs.

CHAPTER III: METHODOLOGY

Research Design and Procedures

In this study, data were collected for analysis of the epidural pain management service in a major military medical center. Current epidural opioid/local anesthetic protocol, fentanyl/bupivacaine or fentanyl/ropivacaine were compared to the previously used morphine. Data were collected through a retrospective chart review of pharmacy records and an analgesia flow sheet (Appendix A). The pharmacy records provided information about the type and concentration of opioids and anesthetic agents. The analgesia flow sheet is a document used by nursing staff to record the type of analgesic medication, route of administration, dose, rate of continuous infusion, rescue doses, untoward effects, and level of pain relief achieved based on a scale of 1-10.

Sample

The sample was obtained from the inpatient records of a military medical center with an epidural pain management program. All charts reviewed in the study were those of patients who received epidural opioid/anesthetic combinations postoperatively from January 1, 1999 to December 31, 2000. Group I consisted of morphine; Group II consisted of fentanyl/bupivacaine or ropivacaine.

Measurement

Data were recorded using a tool previously used in a similar study by Bell (Appendix B). Variables included: gender, type of surgery, opioid/anesthetic combination, concentration and rate of administration, degree of pain based on a numeric pain scale and incidence of side effects (urticaria, nausea, vomiting, urinary retention, and respiratory depression). Any treatments provided were included. A coding system

was employed to facilitate data entry into the SPSS software, version 10.0, and is
outlined in Appendix C.

Protection of Human Rights

Since data were obtained from a retrospective chart audit, there were no inherent risks
to patients. Patients' identities were not included in the study and the confidentiality of
their hospital records was protected.

Data Analysis

Statistical analyses of all data obtained were performed using SPSS software. Data
were cross-tabulated by type of opioid or opioid/anesthetic combination and degree of
pain relief achieved. The chi-square tests for independence and t-tests were performed to
determine if a statistically significant relationship existed between the variables.

CHAPTER IV: STUDY FINDINGS

Introduction

The purpose of this study was to examine one institution's epidural opioid/local anesthetic protocol, currently fentanyl with bupivacaine or ropivacaine and compare it with the previous anesthetic protocol, morphine. A retrospective chart audit was used to identify patients in both groups. In this chapter, a description of the data and a comparison of the efficacy of both protocols along with associated side effects were presented.

Characteristics of Study Sample

One hundred and fifty-one charts were reviewed; 41% (n =62) were female patients and 59% (n =89) were males. The average age of patients was 62. Surgical categories comprised four different groups: abdominal, thoracic, orthopedic, and "other". Charts were examined for pain control efficacy and incidence of side effects. Data about the type and amount of drugs infused epidurally also were collected.

Abdominal cases 48% (n =73) included abdominal aortic aneurysm repairs, colon surgeries, bladder and prostate surgeries, liver surgeries, exploratory laparotomies, and hysterectomies. Thoracic surgeries 24% (n =36) included tumor removal from the chest, lobectomies, and wedge resections. Orthopedic surgeries 11% (n =16) included total hip and knee replacements and open reduction and internal fixation procedures. The "other" category encompassed retroperitoneal procedures including nephrectomies and vascular cases outside of the chest and abdomen.

Morphine alone was used in 42 % (n=64) of cases while fentanyl was used in combination with a local anesthetic (bupivacaine or ropivacaine) in different

concentrations and rates of infusion in 58% (n=87) cases. There were no cases in which

fentanyl was used alone or morphine was used with a local anesthetic.

<div align="center">Pain</div>

Breakthrough pain, defined as pain greater than 4/10 on the NPS, occurred in

60 % (n =86) of cases. Of those, 53% (n =38) were patients who had abdominal surgery,

81% (n =29) had thoracic surgeries, 35% (n =6) were orthopedic surgeries, and   48% (n

=12) were surgeries in the category of "other" (See Figure 1). A chi-square test for

independence was performed to compare presence of pain (NPS>4) and surgery type

(orthopedic, thoracic, abdominal, "other"). The results of the chi-square test indicated a

significant but weak association between presence of pain and surgery type (χ^2=12.62, p

=.006, Cramer's V =.289). Subpartitioning of the contingency tables revealed that

patients with thoracic surgery were significantly more likely to have pain than patients

with orthopedic, abdominal, or "other" surgery.
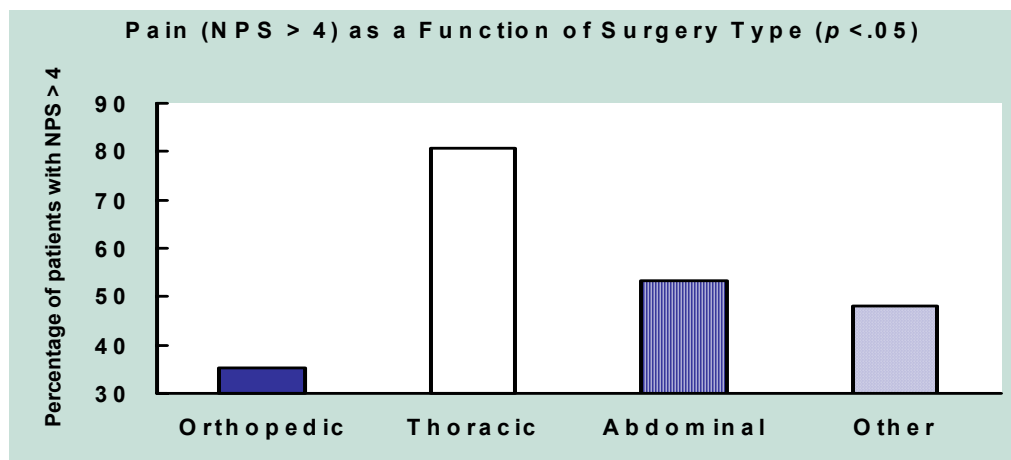
Figure 1

Pain as a function of Surgery Type

$P<.05$

Breakthrough pain occurred in 25%(n =38) of cases in which patients received

morphine and 32%(n =48) of patients receiving fentanyl with bupivacaine or ropivacaine

(See Figure 2). A t-test was performed comparing infusion type (morphine vs. fentanyl

with bupivacaine or ropivacaine) to pain (NPS scores). No significant difference was

found between groups ((t) =1.27; p >.05).
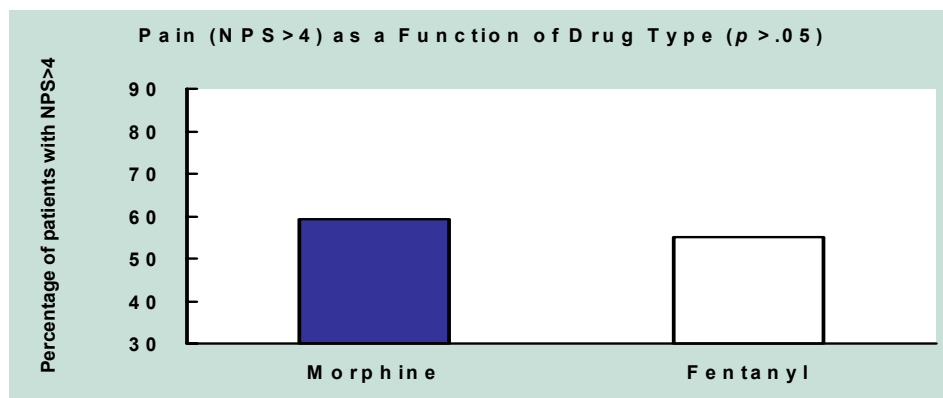
Figure 2

Pain as a Function of Drug Type

P >.05

Treatment of Pain

Anesthesia providers managed the treatment of breakthrough pain. The methods

employed to relieve patients' postoperative breakthrough pain included increasing rates

of infusion, changing types of drug, rescue dosing, and discontinuing epidural and

changing to intravenous patient-controlled analgesia.

Side Effects

Respiratory Depression

There was only one case of respiratory depression recorded in the charts reviewed.

This patient had received fentanyl and bupivacaine. This case was not serious enough to

warrant resuscitative efforts and was resolved by administering supplemental oxygen and decreasing the rate of epidural infusion.

Nausea and Vomiting

Of the 151 charts reviewed, 8% (n =12) reported incidents of nausea and vomiting. Nausea and vomiting occurred in 3% (n =5) patients receiving morphine and 5% (n =7) of patients receiving fentanyl (see Table 1). No significant differences were found between infusion type and percentage of nausea and vomiting (p >.05). Patients who had orthopedic procedures (12%) experienced the highest percentage of nausea and vomiting, followed by those who had thoracic surgery (11%) (see Figure 3). Two of the patients who experienced nausea and vomiting had orthopedic surgery and one was in the "other" category. A chi-square test for independence was performed to compare surgery type and presence of nausea and vomiting. No statistically significant relationship was found ($\chi 2$ =1.48, p >.05). Treatment of nausea and vomiting included Zofran in one cases and inapsine in two cases, rate reduction in one case; no documentation of treatment was found in the remaining eight cases.

Table 1

Presence or Absence of Nausea and Vomiting (P>0.05)

Infusion Type	Present N	%	Absent N	%	Total N	%
Morphine	5	3.31	59	39.07	64	42.38
Fentanyl plus	7	4.64	80	52.98	87	57.62
Total	12	7.95	139	92.05	151	100.0

Presence of nausea/vomiting as a function of surgery type (*p* > .05)
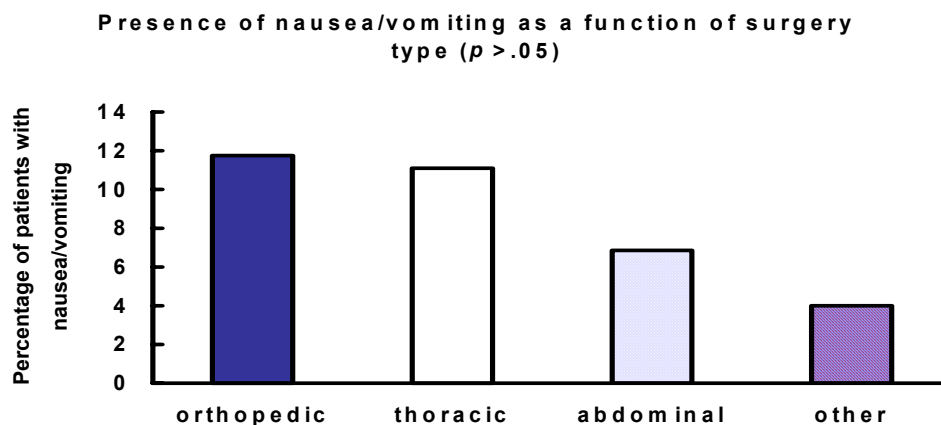
Figure 3

Presence of Nausea/Vomiting as a Function of Surgery Type

P > .05

Pruritis

Two patients (1%) reported pruritis. One had received morphine and one received fentanyl. One patient was treated with benadryl alone, and the other patient received benadryl in combination with narcan. There was no documentation to indicate if these treatments were effective.

Urinary Retention

Since all patients, except one, had foley catheters, the incidence of urinary retention could not be determined. The one patient who did not have a foley catheter did experience urinary retention.

Discontinued Epidural Catheters

Epidural catheters were discontinued within twenty-four hours after surgery in 4% (n =6) cases secondary to documented inadequate pain control, and in 1.3% (n =2) cases when the catheter became dislodged.

Documentation

Incomplete documentation was frequently noted on the Anesthesia Flow Sheet as well as in the progress notes. Because treatment of side effects is not recorded on the flow sheet, progress notes and medication records were reviewed when the flow sheet reflected occurrence of side effects. Although twelve occurrences of nausea and vomiting were noted on form 256, in only three of these cases did the progress notes and medication records indicate how this was managed. This also occurred with the one case of urinary retention noted on the analgesia flow sheet.

CHAPTER V: CONCLUSIONS

Introduction

A retrospective chart audit of 151 charts was conducted to determine which epidural opioid or opioid/local anesthetic combination was most effective for the relief of postoperative pain with the fewest side effects. Charts of patients with postoperative epidurals following abdominal, thoracic, orthopedic, and "other" types of surgery were reviewed and analyzed.

Discussion

In this study patient data were collected from four categories of surgical procedures and treatment with two different opioids, morphine without local anesthetic and fentanyl with either ropivacaine or bupivacaine.

Similar pain relief was achieved for patients in both the fentanyl and morphine groups. Breakthrough pain was successfully treated with rescue dosing and increasing the rate of infusion. In some cases, epidurals were pulled and the method of postoperative pain control was converted to intravenous patient-controlled analgesia without attempts to enhance the pain control achieved with the epidural, such as rescue dosing, increasing rate of infusion, manipulation and repositioning of catheter, or test-dosing the catheter to determine dermatome level of sensory anesthesia. The efficacy of epidural pain control is consistent with studies by Saito, et al. (1994), Fisher, et al. (1988), and Berti et al. (1988).

Side effects noted in the records of the 151 charts reviewed were infrequent and minor. The one patient who experienced respiratory depression received fentanyl, in contrast to the higher incidence of respiratory depression with epidural morphine

compared to epidural fentanyl in a study by Berti et al. (1998). This, however, is clinically and statistically insignificant.

The occurrence of nausea and vomiting in the fentanyl group 5%,(n =7) was comparable to the morphine group 3%, (n =5). The incidence of nausea and vomiting was similar for patients who had abdominal 4%,(n =6) and thoracic 2.5%,(n =4) surgeries. This could indicate the higher incidence of nausea and vomiting associated with abdominal surgeries (Bell, 1999).

The total incidence of nausea and vomiting was low 8%, (n =12) overall and could be attributable to numerous other factors including effects of general anesthesia, other medications, and coexisting disease. Since, the incidence of pruritis was also low, reported in 1.3% (n =2) of cases. No conclusions regarding the association of pruritus with certain drugs could be drawn because of the small number of patients experiencing this effect.

<div align="center">Recommendations</div>

Nurses managing patients with epidurals need to be further educated related to the importance of accurate documentation. Insufficiencies in current documentation were noted in that no treatment or intervention was documented, in many instances, for side effects noted on the flow sheet.

Anesthesia providers managing patients with postoperative epidurals may need to be more proactive. They could consistently test epidural catheters when patients complain of breakthrough pain, and adjust rates of infusion and catheter position as necessary to improve effectiveness of pain control. Epidurals are frequently discontinued and converted to intravenous patient control analgesics without documentation of these other measures having been attempted. However, significant improvements have been made in

management of epidural analgesics since the implementation of a Pain Management Service at this institution in 1999, based on a study by Bell (1999). As a result of Bell's study, surgeons are no longer solely responsible for postoperative pain management of patients with epidural catheters. Anesthesia providers have assumed this responsibility. Bell noted that 25% (n =33) out of 133 cases had epidurals pulled within 24 hours compared to only 5% (n =8) in their more recent study at the same institution.

Postoperative pain continues to be a universal problem with a multitude of detrimental consequences, therefore it is imperative that we ensure optimal pain relief for all of our surgical patients with epidural catheters. Anesthetists, because of their expertise in pain management modalities, are in key positions to implement and evaluate pain management strategies. It is strongly recommended that the pain management service at this institution be continued and further developed to ensure the highest quality of service possible.

Further studies may be warranted to determine which pain management approaches are most effective in reducing postoperative pain. This study may prove helpful as a basis for such future investigations.

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APPENDICES

Appendix A: Analgesia Flow Sheet

Appendix A: Analgesia Flow Sheet

WONG-BAKER FACES PAIN RATING SCALE

0   1   2   3   4   5

BEHAVIORAL PAIN RATING SCALE

PAIN RATING	DEFINITION	CHARACTERISTIC
0	no apparent pain	
1	uncomfortable	
2	mild pain	
3	moderate pain	
4	severe pain	
5	extreme pain	

POLICY REMINDERS

MONITORING REQUIREMENTS

A. EPIDURAL/INTRATHECAL

CIRCUMSTANCE	MONITORING FREQUENCY
1. All bolus injections	
2. Change of medications	
3. Start of continuous infusion	
4. Change in infusion rate	
Infusion bag changes	

B. LOCAL ANESTHETIC DRUG PRECAUTIONS:

1) In addition to the monitoring requirements listed above, patients receiving local anesthetics (e.g., Bupivacaine) will have their motor function assessed and documented on the analgesia flow sheet every 4 hours.

2) Watch for postural changes in vital signs and advise the patient to change position slowly. Check postural BP and pulse prior to first ambulation.

C. EXTRAPLEURAL/INTRAPLEURAL
- BP Q1° x 4, then Q4°
- TPR Q4°
- DOSE INCREASE : BP Q1° x 4, then Q4°

Initials	Signatures	Initials	Signatures

50 MDG Form 406. AUG 95   (Reverse)

ANALGESIA FLOWSHEET

(This Form is subject to the Privacy Act of 1974 - see Basic PAS - DD Form 2005)

ROUTE:	PAIN SCALE	LEVEL OF SEDATION (LOS) CODE	MOTOR FUNCTION	PATIENT'S IDENTIFICATION
☐ PCA IM	☐ 0 - 10	1 - AWAKE/ALERT	LOCAL ANESTHETICS ONLY	
☐ EPIDURAL	☐ WONG-BAKER FACES	2 - DROWSY, EASY TO AROUSE	+ NORMAL STRENGTH	
☐ INTRATHECAL	☐ BEHAVIORAL PAIN RATING	3 - SLEEPING, EASY TO AROUSE	- SIGNS DECREASED STRENGTH	
☐ EXTRAPLEURAL		4 - STUPOR, DIFF TO AROUSE	NV - NAUSEA, VOMITING	
☐ INTRAPLEURAL		5 - COMA	UR - URINARY RETENTION	
☐ PCA EPIDURAL			U - URTICARIA	
☐ _____	See Reverse for Scales		+ PRESENT / - ABSENT	

DATE	TIME	PCA MODE (DOSE mg / LOCK min)	CONTINUOUS MODE (BASAL) mg/hr	MAXIMUM LOCKOUT INTERVAL hrs	LOADING DOSE OR BOLUS mgs	PCA (DEM / INJ)	CUMULATIVE DOSE q8 hr mg	MOTOR FUNCTION (UPPER / LOWER +/-)	ASSESSMENT PAIN SCORE / RESP RATE / O2 SAT / LOS / NV (+/-) / UR/U (+/-)	PHYS. ORDER/COMMENTS ex. CHANGES, WASTE, CLEARED PUMP HISTORY q8 hr	INT

50 MDG Form 406 AUG 95

Appendix B: Data Collection Tool

Date	ID #	Age/S	TOS	O T	Infusion	Rt	Pain	Tx	R D	Tx	N&V	Tx	Pru	Tx	U R	Tx	Other

Appendix C: Coding System

Coding System

Gender: 1= Female   2= Male

Type of surgery: 1= Orthopedic   2= Thoracic   3= Abdominal   4= Other

Type of infusion: 1= Morphine   2= Fentanyl/bupivacaine or ropivacaine

Analgesic effect: 1= Present-4 or greater on numeric pain scale   2= Absent-3 or

Less on NPS

Respiratory depression: 1= <10 breaths/min. or SpO2 <90%   2= None

Urticaria: 1= Present   2= Absent

Nausea/vomiting: 1= Present   2= Absent

Urinary retention: 1= Present 2= Absent   3= Foley catheter in place

Rescue treatment for untoward effects: 1= Name of treatment   2= None