TAP Blocks Performed with Bupivacaine Versus Liposomal Bupivacaine in Colorectal Surgery Patients: A Prospective, Cluster Randomized Trial

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Sponsor:
N/A

Site of Investigation:
Inova Fairfax Hospital

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ABSTRACT

Title: TAP Blocks Performed with Bupivacaine Versus Liposomal Bupivacaine in Colorectal Surgery Patients: A Prospective, Cluster Randomized Trial

Short Title: TAP Blocks: Bupivacaine versus Exparel

Rationale: Multimodal pain regimens to minimize opioid use have become central to enhanced recovery after surgery (ERAS) protocols. The transversus abdominis plane (TAP) block is one intervention that contributes to this regimen. Patients who receive TAP blocks prior to colorectal operations have been shown to have reduced opioid consumption and length of stay compared to patients who do not. TAP blocks can be performed with local anesthetic, such as bupivacaine. More recently, these have been performed with liposomal bupivacaine, which is released over a period of 96 hours rather than metabolizing over 8-9 hours. However, very little retrospective data comparing regular versus liposomal bupivacaine exists, and results have been mixed. No prospective randomized studies have compared these two forms of the drug.

Objectives: This study aims to compare opioid consumption in colorectal patients receiving preoperative TAP blocks of either regular or liposomal bupivacaine. Secondary objectives would compare postoperative pain scores, total amount of pain medication use (opioid and non-opioid), time to patient mobilization, time to return of bowel function, length of stay, antiemetic use, complications, readmissions, mortality, and hospitalization costs between these two groups.

Study Type: Prospective, Cluster Randomized Trial

Study Design: Power analysis indicates that a minimum of 101 patients per group should be enrolled. Patients will be approached for consent if they are 18 years of age or older and underwent elective colectomy by the surgeons of Fairfax Colon and Rectal Surgery. Exclusion criteria are the following: patients under age 18, patients unable to receive TAP block due to allergy, contraindication, or other reason, patients unable to provide consent, pregnant patients, patients on chronic opioids, patients undergoing emergent operations, patients undergoing loop ileostomy reversal and abdominoperineal resections, patients who primary language is not English or Spanish, and patients who received the TAP block with local anesthetic off of the cluster randomization assignment.

Study Methodology: Patients will receive a preoperative TAP block with either regular or liposomal bupivacaine. Each drug will be alternately used as the practice standard of care until an adequate number of patients are enrolled. The drugs will be alternated for four month periods for the first cycle, followed by two month intervals. Patients will be approached postoperatively to consent to use of their data for research purposes. Both drugs are currently FDA approved and both are routinely used for TAP blocks; the current understanding based off of scant literature is that there is clinical equipoise between the two drugs. The standard of care postoperative pain management regimen and diet advancement protocol will be used for all participants. Pain scores and opioid consumption will be recorded and collected in a prospective fashion.

Statistical Methodology: Demographic and clinical factors will be compared between groups using t-tests for continuous variables, Pearson's χ^2 tests for categorical variables and rank-based methods if necessary. Generalized linear mixed effects model for ordinal outcomes will be applied to analyze pain scores under the proportional odds assumption. Daily opioid consumption will be analyzed using a linear mixed effects model.

1. INTRODUCTION

1.1. Specific Aims

The aim of a multimodal pain medication regimen is to reduce opioid consumption as part of the enhanced recovery after surgery (ERAS) protocols. The transversus abdominis plane (TAP) block can be used to reduce pain in patients undergoing abdominal surgery. Traditionally, TAP blocks are performed with local anesthetics such as bupivacaine. More recently, these have also been performed with liposomal bupivacaine, which has a duration of action much greater than regular bupivacaine (96 hours versus 8-9 hours, respectively). To date, no prospective, randomized trial has been performed to directly compare TAP blocks performed with liposomal and regular bupivacaine. The *primary objective* of this study is to compare in-hospital postoperative opioid consumption in patients who undergo TAP blocks with either liposomal bupivacaine or regular bupivacaine prior to colorectal operation. The *secondary objectives* are to compare pain scores, total amount of pain medication use (opioid and non-opioid), time to mobilization, time to return of bowel function, length of stay, antiemetic use, 30-day postoperative complications, 30-day readmissions, 30-day mortality, and hospitalization costs in the same patient population.

1.2. Hypothesis

Alternative hypothesis: Postoperative in-hospital opioid consumption differs between patients who receive TAP blocks performed with liposomal bupivacaine and patients who receive TAP blocks performed with regular bupivacaine prior to colectomy.

Null hypothesis: Postoperative in-hospital opioid consumption does not differ between patients who receive TAP blocks performed with liposomal bupivacaine and patients who receive TAP blocks performed with regular bupivacaine prior to colectomy.

1.3. Background and Significance

Pain control is a factor that is central to the surgical patient's postoperative experience. Opioid pain medications are a mainstay of postoperative pain management. However, these have several adverse effects, ranging from respiratory arrest to slowing of the gastrointestinal tract motility causing nausea, vomiting, and constipation. These last few side effects run counter to the goal of return of bowel function in patients undergoing colorectal surgery. ERAS protocols emphasize the use of multimodal pain regimens to decrease opioid use and thus reduce both morbidity and hospital stay for patients.

The TAP block, a type of abdominal field block, is one intervention that has become a part of these multimodal regimens. It was first introduced in 2001 by Rafi, and was described as a blind technique aimed at placing a single injection of local anesthetic into the lumbar triangle of Petit, bordered by the external oblique, latissimus dorsi, and iliac crest[1]. Since 2007, ultrasound

guidance has been used to direct injection of local anesthetic into the fascial layer between the internal oblique and the transversus abdominis, through which branches from T9-L1 run to innervate the anterior abdominal wall[2]. Studies investigating the overall effect of TAP block have yielded somewhat mixed results. Randomized studies comparing TAP block to local wound infiltration or placebo in colorectal patients have shown no significant difference in opioid consumption or pain scores[3, 4]. By contrast, another randomized study demonstrated decreased opioid consumption in patients who received TAP blocks when compared to patients who had not[5]. Non-randomized studies performed in colorectal patients have shown that TAP blocks are associated with decreased opioid use, time to return of bowel function, and length of stay[6, 7], contributing to the goals of enhanced recovery pathways. Of note, these studies were all performed with regular bupivacaine.

Liposomal bupivacaine (Exparel, Pacira Pharmaceuticals) was introduced in 2012. It is formulated as particles that contain microscopic internally aqueous chambers that are separated by lipid membranes, allowing for release of unaltered bupivacaine over a period of about 96 hours.[8] By contrast, non-liposomal bupivacaine has a duration of action of a maximum of 8-9 hours. Liposomal bupivacaine is currently FDA-approved for administration into surgical sites to provide postsurgical anesthesia.[9]

When compared to a multimodal pain regimen following thoracotomy, liposomal bupivacaine was found to offer no significant difference in pain control following thoracotomy[10]. For total knee arthoplasty, ropivicaine was actually found to be superior to liposomal bupivacaine[11, 12]. In laparoscopic hysterectomy, local wound infiltration with liposomal bupivacaine was found to be no different than standard bupivacaine in terms of postoperative opioid consumption and pain scores[13]. However, when applied in an abdominal field block prior to abdominoplasty, administration of liposomal bupivacaine did result in reduced postoperative opioid use and earlier mobilization[14]. Studies comparing administration of liposomal versus standard bupivacaine have generated mixed results as well. A study by Haas and colleagues in 2012, one of the earliest to assess liposomal bupivacaine, showed that use of the liposomal formulation resulted in reduced opioid consumption following hemorrhoidectomy[15]. However, a more recent study comparing local infiltration of liposomal versus regular bupivacaine following colorectal procedures noted no difference in postoperative opioid use[16].

There are few studies that compare TAP blocks performed with liposomal and regular bupivacaine. One study conducted in 2016 compared the two formulations in patients undergoing laparoscopic hand-assisted donor nephrectomy and found that liposomal bupivacaine TAP blocks resulted in decreased opioid use (expressed in fentanyl equivalents 105 versus 182, p=0.03), lower pain scores (5/10 versus 6/10 at 24-48h, p=0.009, and 3/10 versus 5/10 at 48-72h, p=0.02), decreased length of stay (67.7 versus 87.1 hours, p=0.02), and fewer complaints of postoperative nausea and vomiting[17]. Of note, the primary author of this study is on the speaker's bureau and acts as a consultant for the drug company Pacira, which produces and sells liposomal bupivacaine under the label Exparel. A non-randomized retrospective cohort study published this year assessed colorectal patients who were given TAP blocks with liposomal versus regular bupivacaine. This study noted that earlier in the postoperative course, pain control scores in the liposomal bupivacaine patients were lower; however, at 36-48 hours postoperatively, there was no significant difference in pain scores. IV opioid use was decreased, but oral opioid use was

unchanged in patients undergoing minimally invasive procedures; in open procedures, there was no difference in opioid use. Length of stay and hospitalization costs were found to be the same between the two groups[18].

Due to its extended duration of action, we have incorporated administration of liposomal bupivacaine TAP blocks into our institution's multimodal pain control regimen following colorectal resection, with the aim of reducing opioid use. The aforementioned mixed data certainly calls into question whether the increased up-front expense of using liposomal bupivacaine can be justified. To date, no prospective, randomized trial has been performed to directly compare TAP blocks performed with liposomal and regular bupivacaine. This study would generate recommendations for practice regarding which formulation should be used for preoperative TAP block.

1.4. Preliminary Studies

To the investigators' knowledge, this is the first prospective, randomized study comparing the effect of regular versus liposomal bupivacaine TAP blocks on postoperative opioid requirements. Dr. Colvin is a colorectal surgeon who founded Fairfax Colon and Rectal Surgery. He also currently holds an academic position as an Associate Professor of Surgery with the Medical College of Virginia. When Exparel was first used for TAP blocks at Inova Fairfax Hospital, he spearheaded a Quality Improvement project to assess the effectiveness of TAP blocks with Exparel as part of the ERAS protocol.

2. STUDY DESIGN AND SUBJECT SELECTION

2.1. Study Type

This study is a prospective randomized trial designed to compare postoperative opioid requirements and pain related outcomes in patients who receive regular or liposomal bupivacaine TAP blocks prior to colorectal resection. Participants will receive a transversus abdominis plane (TAP) block with either liposomal bupivacaine or regular bupivacaine immediately prior to their procedure. Each drug will be used as the practice standard of care for alternating periods; all patients undergoing colorectal resection with the surgeons of Fairfax Colon and Rectal Surgery will receive the same type of TAP block in each period. The drugs will be alternated for four month periods for the first cycle, followed by two month intervals. The two drugs will be alternated until an adequate number of patients have been enrolled in the study. Clinical equipoise is assumed by clinicians and hypothesized to exist between the two formulations of bupivacaine, but previous studies comparing the two medications have produced mixed results. Patients will be approached for consent in the hospital postoperatively to request the use of their data for research purposes.

2.2. Setting/Location

The proposed prospective study would take place at Inova Fairfax Hospital, 3300 Gallows Road, Falls Church, VA 22042.

2.3. Duration of Study

We anticipate approximately two years to obtain an adequate number of subjects. In most cases, patients' active participation in the study would conclude after their initial hospitalization; hospital and office records would be actively reviewed for the first 30 days postoperatively for

any complications or mortality and 30 days post-discharge for any readmissions. Patients who have a hospital stay ending before 1 pm on postoperative day 3 (POD 3) will receive one or two phone calls to gather information up until POD 4 from the investigators to collect information on pain medication consumption from discharge up until end of day on postoperative day 4. These phone calls would take place within 96 hours of discharge, and only for those patients with a discharge prior to 1 pm on POD 3. This is a very rare occurrence due to the average length of stay for these procedures being 4-5 days. A note for these phone calls would be entered into the patient's electronic medical record. The only data points to be collected from the patient from the phone calls are the same as the ones collected while in the hospital postoperatively, these are rows 51-58 on the data collection tool excel (POD0 to POD4).

2.4. Number of Subjects

By our power analysis, we require a minimum of 101 subjects per group (202 subjects in total). Approval will be sought for an enrollment goal of 250 total to allow for growth.

2.5. Study Population

2.5.1. Gender of Subjects

All patients who qualify under the inclusion criteria will be included, regardless of gender.

2.5.2. Age of Subjects

All patients who qualify under the inclusion criteria and who are 18 years of age or older will be included.

2.5.3. Racial and Ethnic Origin

All patients who qualify under the inclusion criteria will be included, regardless of racial or ethnic origin.

2.5.4. Vulnerable Populations

Patients under age 18, pregnant women, patients undergoing emergent operations, and individuals who are unable to appropriately provide consent for themselves or appropriately report pain scores will be excluded from the study population. Primarily Spanish-speaking participants who have limited English fluency will be provided with an in-person, telephonic, or video interpreter when consent is being obtained. The consent form would also be translated into Spanish.

2.6. Recruitment

Recruitment will take place in the hospital when patients are approached postoperatively to request the use of their data for research purposes. The multimodal pain regimen and the ERAS protocol are already explained to patients during the patient's preoperative visit to the surgeon's office, emphasizing the goal of reducing opioid consumption. All staff who would be obtaining consent will receive the appropriate training.

TAP blocks have become an essential component of our institution's ERAS protocol in order to minimize opioid use postoperatively. Thus, unless there is a contraindication, patients will receive a TAP block regardless of whether or not they participate in the study. All patients undergoing colorectal resection with the surgeons of Fairfax Colon and Rectal Surgery will

receive the same type of TAP block (liposomal or regular bupivacaine) in each period, regardless of whether or not they participate in the study. These cycles will continue until we have reached enrollment goals, up to a 2-year period.

2.7. Inclusion Criteria

Patients will be approached for consent if they are:

1. 18 years of age or older
2. Undergoing elective colectomy by surgeons of Fairfax Colon and Rectal Surgery

2.8. Exclusion Criteria

Patients will be excluded from the study if they fall into the following categories:

1. Patients under age 18
2. Patients unable to receive TAP block due to allergy, contraindication, or other reason
3. Patients unable to provide consent
4. Pregnant patients
5. Patients on chronic opioids. Patients previously on a regular opioid regimen would need to be opioid-free for a period of 1 year for inclusion in the study.
6. Patients undergoing emergent operations
7. Patients undergoing loop ileostomy reversal, as this does not require a new incision through the abdominal wall
8. Patients undergoing abdominoperineal resection, pelvic exenteration, or perineal rectal prolapse repairs, as the TAP block would not control pain at the perineum
9. Patients whose primary language is not English or Spanish
10. Patients who received TAP block with local anesthetic off of the cluster randomization assignment (ex. patients receiving liposomal bupivacaine during the standard bupivacaine period)

3. STUDY METHODS AND PROCEDURES

3.1. Study Treatment/Intervention

Unless there is a medical contraindication, all patients undergoing colectomies with Fairfax Colon and Rectal Surgery, whether open, laparoscopic, hand-assisted laparoscopic, or robotic, will receive a preoperative TAP block. Equal volumes of either standard (0.25% bupivacaine) or liposomal bupivacaine (133mg in 10mL, diluted with 20mL saline) will be injected into the fascial layer between the internal oblique and the transversus abdominis with ultrasound guidance, 30mL per side for a total of 60mL. No extra local anesthetic will be injected during or at the conclusion of the case.

Patients will be blinded to which drug they received. The Numeric Rating Scale, rating pain on a level from 0 (no pain) to 10 (worst pain), will be used to evaluate pain levels in our postoperative patients. This scale is already used and recorded into the patient's electronic chart for routine nursing evaluations. These scores would be collected approximately every 4 hours through postoperative day four while in hospital. If in the rare occasion patients are discharged prior to POD 3 at 1 pm average pain scores per day up to POD 4 will be collected via the follow-up telephone call. Though there are not specific blinding procedures for nursing staff, they will not be overtly aware of randomization and this should reduce the potential for nursing bias. Our standard post-op pain regimen includes the following standing medications: acetaminophen

650mg every 6 hours scheduled, ketorolac 15mg every 6 hours for 24 hours, after which it is converted to ibuprofen 600mg every 6 hours. As-needed drugs include oxycodone 5-10mg every 6 hours as needed, or Tramadol 50mg every 6 hours as needed for individuals age 65 or older. Two doses of Hydromorphone 0.4 mg are available within the first 24 hours of the operation as needed for individuals who feel that this regimen is insufficient. Enhanced recovery protocol is followed for diet advancement, with clear liquids being given to the patient on post-op day zero, followed by advancement to a low-residue diet after tolerance of clear liquids for two meals. Early ambulation, even in the recovery room, is strongly encouraged as standard practice for our patients. These regimens, as well as practices regarding post-op IV fluids, Foley catheter removal, deep vein thrombosis (DVT) prophylaxis, and lab draws, are standardized across the entire practice of colorectal surgeons at Fairfax Colon and Rectal Surgery.

Additionally, a standardized form within the electronic medical record will be provided to the nursing staff to facilitate data collection. Total amount of opioids and non-opioid pain medications given is also simple to calculate since opioid use is automatically recorded into the chart. These would eventually be added together and reported in morphine equivalents (opioid medications only). Some data will be prospectively (time during hospital admission and post-discharge only through postoperative day 4) and all follow-up data will be collected retrospectively after 30-days postoperative collected into a secure REDCap database.

Please see the Appendix, Figures 1 and 2 for the study timetable and study procedure flow chart.

3.2. Control Group

There is no currently research-proven standard of care. However, as liposomal bupivacaine is a newer formulation, we will use the regular bupivacaine group as a control to compare these two commonly-used medications.

3.3. Randomization

We will alternate standard of care between regular and liposomal bupivacaine every 2 months (apart from the first cycle of 4 months per drug), therefore patients will be randomized to either study group in clusters. By using cluster randomization instead of individual randomization, we can better avoid potential nursing bias. Surgical approach (minimally invasive or open surgery) might impact opioid consumption postoperatively; therefore, we will stratify based on surgical procedures. To achieve stratification, we will perform an interim analysis following each cycle. Coordinators, investigators, and statisticians will then determine what type of patient to continue to approach for participation in the following cycle. To allow for this analysis, we will build in a short enrollment break at the beginning of each period. Additionally, we hope that this break will assist in the TAP block type change-over. Additionally, to adjust for any potential imbalance between two study groups in terms of any important clinical factors, propensity score matching may be used to select randomized patients to construct two comparable study groups.

3.4. Endpoints/Outcomes Measurements

3.4.1. Primary outcomes.

The primary end-point is in-hospital postoperative opioid consumption in patients who undergo TAP blocks with either liposomal bupivacaine or regular bupivacaine prior to elective colectomy.

3.4.2. Secondary outcomes

The secondary end-points are differences in pain scores, total pain medication consumption (opioid and non-opioid), time to mobilization, time to return of bowel function, length of stay, in-hospital antiemetic use, 30-day postoperative complications (infection, small bowel obstruction, dehydration, deep vein thrombosis/pulmonary embolism, anastomotic leak, cardiac arrest, stroke, sepsis) or mortality, 30-day post-discharge readmissions, and hospitalization costs in patients who undergo TAP blocks with either liposomal bupivacaine or regular bupivacaine prior to elective colorectal resection.

3.5. Consent/Assent

Clinical consent for the TAP block procedure itself will be obtained in the preoperative area by the anesthesia team, as is the standard practice now. Consent for participation in the study will be obtained postoperatively; patients will be approached in the hospital to request the use of their data for research purposes. Ample opportunity will be given to ask questions regarding the research study.

3.6. Monitoring Subjects and Criteria for Withdrawal of Subjects from the Study

In hospital pain scores will be collected approximately every 4 hours until 1 pm on postoperative day 4 and entered into the electronic medical record by the nursing staff. Very rarely, patients may go home on postoperative day two. We would like to capture data from these patients, as this reflects a shorter length of stay. To capture their opioid and other pain medication use, these patients would be contacted by a phone call within 96 hours of discharge and will be asked how much oral opioids and other non-opioid pain medications that were required for pain control in the period from discharge until POD 4. A note reflecting the details of this conversation will then be entered in to the patient's electronic medical record. As medications are scanned prior to administration, all medications given to a patient in the hospital are automatically entered into the system.

Epic electronic medical records and practice office records will be checked up to 30 days following discharge to assess for any complications, readmissions, or mortality.

Per our research department standard operating procedures, quality control monitoring will be done on a regular basis to ensure data integrity.

Given the completely voluntary nature of participation in the study, all patients have the right to refuse participation, or withdraw from the study at any point in time for any reason without medical, personal, or financial repercussions. Patients may be withdrawn from the study by investigators if they have unforeseen intraoperative complications that necessitate continued intubation and sedation following the initial operation (as these patients would not be able to report pain scores), if they have an identified non-abdominal pain source, or if they have an emergent return to the operating room.

4. STATISTICAL CONSIDERATIONS/DATA ANALYSIS

4.1. Sample Size

The power analysis is conducted to detect whether there is a significant difference in the post-operative opioid consumption between the two groups during the patient's first three days postoperatively. We assume that the two groups have an approximately equal number of subjects after randomization and the length of stay equals to 4 such that we can obtain three repeated measurements of daily opioid and non-opioid consumption for each patient. Based on the results from Hutchins et al, we further assume that the average opioid usage is 18 mg morphine equivalents (180 μg fentanyl equivalents in Hutchins et al.) with a standard deviation equal to 13 mg for the control group and we expect to observe a 30% reduction in the treatment group. With an alpha=0.05, a moderate autocorrelation (ρ=0.5) between the different measurements of opioid consumptions and a 20% attrition rate, we estimate that 82 patients per group is sufficient to achieve 80% power. Given the possible necessity to perform propensity score matching after enrollment and data collection to ensure two comparable study groups in terms of key factors, 10% increase of sample size is proposed resulting in 101 patients in each group and 202 in total.

4.2. Method of Data Analysis

Patients' charts will be analyzed and the following variables will be collected prospectively: Patient age, gender, BMI, race, presence of pre-existing conditions (smoking, diabetes, renal failure, dialysis, cardiac, GI infection, other infection, transplants), site of operation, type of TAP block (liposomal versus standard bupivacaine), type of operation (open, laparoscopic, hand-assisted laparoscopic, robotic), presence of ostomy, pathology (benign/malignant), ASA grade, operative time, estimated blood loss, length of stay, daily overall opioid use recorded as morphine equivalents, amount of medications given for pain control (opioid and non-opioid), time to first flatus/gas into ostomy bag and/or bowel movement/ostomy output, time to diet advancement (clear liquids and then low fiber), time to mobilization, pain scores, 30-day complications, 30-day readmissions, and mortality. We would also attempt to determine differences in hospitalization costs. Much of this data is already captured in a Research Electronic Data Capture (REDCap) database about Fairfax Colon and Rectal patients, which is already maintained by Inova. These data points would be exported to a separate research database, where study-specific data would be entered.

Descriptive statistics will be provided for demographic and clinical factors of each group. They will also be compared using the appropriate hypothesis testing procedure, t-test for continuous variables, Pearson's χ^2 test for categorical variables and rank-based methods if necessary. Statistical significance will be evaluated at alpha=0.05. Pain scores will be recorded on the scale of 1 to 10 approximately every 4 hours through postoperative day 3. We will calculate the average daily pain scores for each patient and then code it as low pain (1-3), medium pain (4-6) and severe pain (7-10). A generalized linear mixed effects model for ordinal outcomes will be applied to analyze the pain scores under the proportional odds assumption. Both univariate and multivariate models will be considered. Estimated odds ratios and 95% confidence intervals will be reported. Daily opioid consumption can be considered as a continuous variable, so a linear mixed effects model will be applied here. Parameter estimates and the 95% confidence intervals for univariate and multivariate models will be presented. Further univariate subgroup analysis will be conducted for open and minimally invasive procedures, and multivariate subgroup analysis will be implemented if the sample sizes are sufficiently large. Intention-to-treat analysis will be performed.

We will perform an interim analysis following each cycle as described in section 3.3.

4.3. Data Storage

4.3.1. Data Management

Data will be collected and maintained using Inova's password-protected REDCap software system. Any data exported from REDCap for analysis will be saved on Inova-secured shared drives. Some of the data that will be used for this study is already collected for all colorectal patients and maintained in a colorectal quality database. Any data points specific to the study (study ID, type of TAP block, pain scores, opioid use, time to bowel function/clear liquid diet/low fiber diet/mobilization, antiemetic use, and costs) will be recorded in a separate, study-specific REDCap database. Only approved study personnel will be given access to this database.

4.3.2. Records Retention

Study-specific data will be destroyed 3 years after completion of the study, per HIPAA regulations.

5. HUMAN SUBJECTS PROTECTION (RISKS, BENEFITS, AND ALTERNATIVES)

5.1. Risks

Risks to the patient include standard risks associated with the TAP block; these, however, are quite rare, and have been published as case reports. Patients would be subject to these risks regardless of whether or not they participate in research as both TAP blocks are used as standard of care in this practice. There are no published reports describing local anesthetic toxicity after TAP blocks. While there are case reports detailing liver lacerations with right-sided TAP blocks, these were with landmark-based blocks or due to inadequate needle visualization with ultrasound guidance[2]. Other potential risks include bleeding and infection, but these are also quite rare. As stated previously, the anesthesiologists of Fairfax Anesthesiology Associates have a highly standardized method for ultrasound-guided TAP block under sterile conditions. Providers are closely mentored prior to performing the TAP block independently. To date, there have been no complications from TAP blocks performed at Inova Fairfax Hospital. As nearly all patients receive the TAP block with either standard or liposomal bupivacaine as standard of care prior to elective colorectal resection with the associates of Fairfax Colon and Rectal Surgery, the risk of participating in this study is essentially equivalent to standard treatment.

Participants will also have a risk of potential loss of confidentiality. The risk of potential loss of privacy is of low severity and rare probability. There is also a risk of unknown side effects.

5.2. Benefits

There may be no direct benefits to patients who participate. The results of this study will benefit future patients at our institution and throughout the colorectal surgery field.

5.3. Alternatives

Patients may choose not to take part in the study.

5.4. Confidentiality

Data will be kept in a secure REDCap research database, accessible only to authorized research personnel. The data will be de-identified prior to data analysis, further reducing the risk of compromising confidentiality.

6. SUBJECT COMPENSATION

6.1. Costs

There are no costs to participants outside of the usual costs that would already be associated with undergoing the elective operation.

6.2. Payment

There will be no payment for participants.

7. ADVERSE EVENT REPORTING

Adverse events due to TAP blocks are quite rare, as stated above; however, should any complications occur as a direct result of the block, these will be reported to the IRB. These rare events include liver lacerations, bleeding, and infection at the injection sites. All other serious adverse events will be reported to the IRB (including death, life-threatening events, prolonged hospitalizations, disability or permanent damage). Additionally, the following will be reported should they occur: inappropriate invasions of privacy, breaches of confidentiality, data loss, or data security issues. For adverse event and severe adverse event form see appendix.

8. FUNDING

This project has not received any funding.

9. CONFLICTS OF INTEREST

There are no financial or other conflicts of interests to disclose. If any arise, they will be immediately recorded and reported to the Inova IRB.

10. FACILITIES AND EQUIPMENT

The study will be conducted at Inova Fairfax Hospital and corresponding practice offices. TAP blocks are administered in the operating room preoperatively, after induction of anesthesia. Ultrasound guidance is used as a standard practice. All equipment is readily available. Patients will be admitted to the surgical floor postoperatively and pain scores and opioid use will be collected in a standard fashion. Patients will be approached postoperatively regarding consent for use of their data for research purposes.

11. OUTSIDE CONSULTANTS/COLLABORATORS

N/A

12. CONTRACTURAL AGREEMENTS

N/A

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14. APPENDIX

- Study procedures flowchart
- Recruitment and study timeline
- Numeric Rating Scale (Pain Scores)
- Adverse event and severe adverse event reporting form

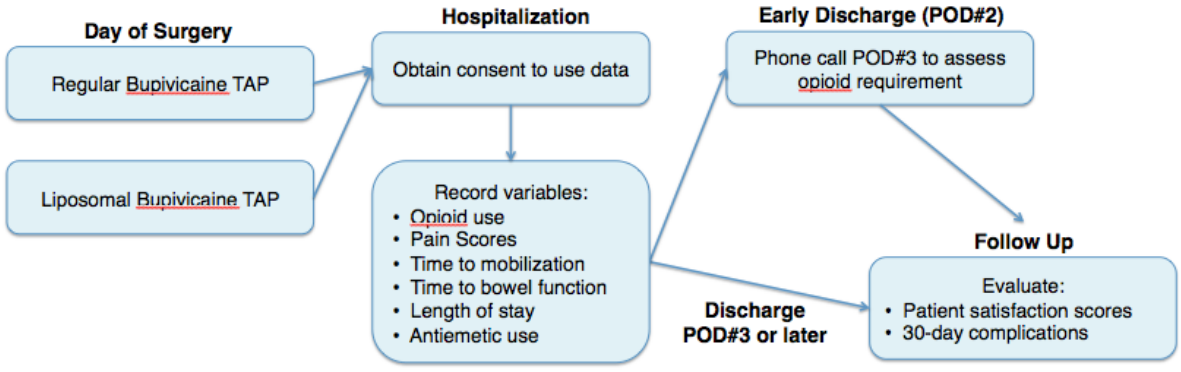

Figure 1: Study procedures flowchart

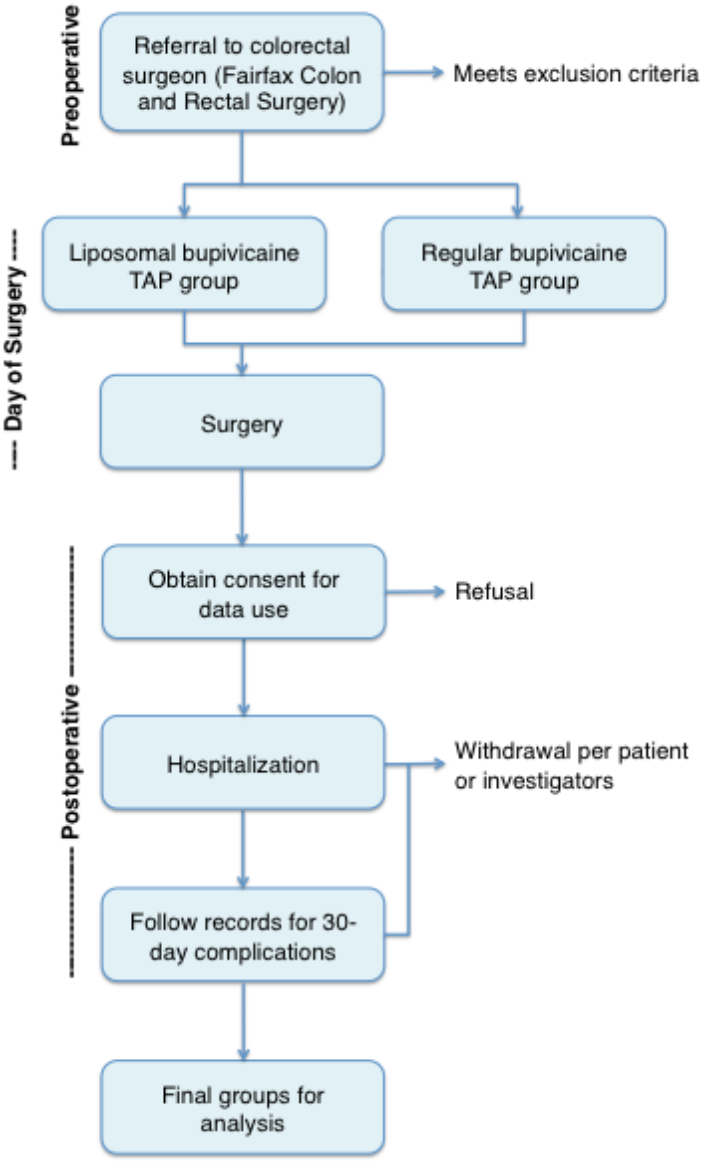

Figure 2: Recruitment and study timeline

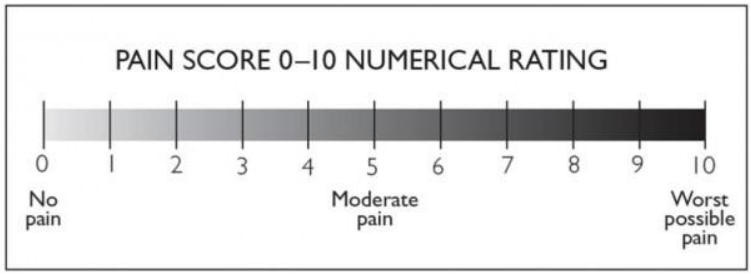

Figure 3: Depiction of the Numerical Rating Scale to assess pain scores. Patients are asked to rate their pain from 0-10, with 0 being no pain and 10 being the worst possible pain. Image source: www.physio-pedia.com/Numeric_Pain_Rating_Scale.