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To Determine the Efficacy and Safety of TAP Block with Versus Without Buprenorphine in Managing Postoperative Pain Following Inguinal Hernia Repair

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Abstract

Background: The Transversus Abdominis Plane (TAP) block is a widely used regional anesthesia technique for managing postoperative pain in patients undergoing inguinal hernia repair. The addition of buprenorphine, a long-acting opioid, to the TAP block may enhance the duration and quality of analgesia. This study aims to evaluate the impact of this combination on postoperative pain management following inguinal hernia repair. By comparing TAP blocks with and without buprenorphine, we seek to determine whether the addition of buprenorphine enhances analgesia, reduces opioid consumption, and improves overall patient outcomes. This study will contribute valuable information to the field of postoperative pain management, potentially leading to more effective and safer analgesic strategies for patients undergoing inguinal hernia repair. The addition of buprenorphine, a long-acting opioid, to the TAP block may enhance the duration and quality of analgesia.

Aim: This study aims to determine the efficacy and safety of TAP block with versus without buprenorphine in managing postoperative pain following inguinal hernia repair.

Material and Method: This study is a prospective, randomized, double-blind clinical trial designed to evaluate the efficacy of TAP block with or without buprenorphine in managing postoperative pain following inguinal hernia repair experimental study conducted in the Department of General Surgery. Patients were recruited from Department of Surgery. This study involves 50 patients undergoing inguinal hernia surgery. Group A of 25 patients contained TAP block with buprenorphine and Group B of 25 patients contained TAP block without buprenorphine. Primary objective of the study was to evaluate the effect of TAP block with or without buprenorphine on patients undergoing inguinal hernia repair.

Results: This study involves 50 patients undergoing inguinal hernia surgery. Group A of 25 patients contained TAP block with buprenorphine and Group B of 25 patients contained TAP block without buprenorphine. All patients were analyzed in the immediate postoperative period. However, patient from each group could not be contacted at 3 and 6 months after surgery. The study groups were comparable in terms of demographic parameters such as age, weight, height, body mass index and ASA category. There was no significant difference between the groups in terms of age in years, Height, weight and BMI in kg/m^2. Among the studied predictors of pain intensity in group B, only temporal summation predicted the postoperative pain intensity and WHI. There was no significant difference between two groups in terms of distribution of ASA grade only one patient in group B had neuropathic pain which was not statistically significant.

Conclusion: In conclusion, the addition of buprenorphine to a TAP block for managing postoperative pain following inguinal hernia repair shows promise in enhancing analgesic efficacy while potentially reducing the need for systemic opioids. However, careful consideration of safety, appropriate patient selection, and dosing is critical to maximize benefits and minimize risks. Further studies are warranted

to solidify these findings and inform clinical guidelines. This approach may be particularly beneficial for patients at higher risk of postoperative pain, though careful patient selection and monitoring are recommended.

Keywords: TAP block, Buprenorphine, Inguinal Hernia Repair, Postoperative Pain, Regional Anesthesia.

Introduction

Inguinal hernia repair is one of the most common surgical procedures performed worldwide, often resulting in postoperative pain that can significantly affect patient recovery and comfort. Effective management of postoperative pain is crucial for enhancing recovery, minimizing opioid consumption, and improving overall patient satisfaction.(1) The transversus abdominis plane (TAP) block is a regional anesthesia technique that targets the abdominal wall's sensory nerves, providing analgesia for procedures involving the lower abdomen. This technique has gained popularity due to its efficacy in reducing postoperative pain and opioid requirements. The TAP block involves the administration of local anesthetics into the plane between the internal oblique and transversus abdominis muscles, effectively blocking the sensory nerves of the abdominal wall. (2,3)

TAP blocks can significantly decrease pain scores in the early postoperative period, reduce the need for rescue analgesics, and shorten recovery times. The effectiveness of the TAP block in managing pain following hernia repair has led to its widespread adoption in clinical practice. Buprenorphine is a partial opioid agonist with a unique pharmacological profile. It has a high affinity for the μ-opioid receptor but exhibits a ceiling effect for respiratory depression, making it a potentially safer alternative to traditional opioids.(4)

Buprenorphine's long duration of action and its ability to modulate pain pathways make it an attractive adjunct in multimodal analgesia. When combined with local anesthetics in regional blocks, buprenorphine may enhance the overall analgesic effect, potentially improving pain control and reducing opioid requirements.(5)

Buprenorphine, a potent opioid with a high affinity for the μ-opioid receptor, can enhance the analgesic effects of the TAP block. Buprenorphine's long duration of action can prolong the effectiveness of the TAP block, reducing the duration of postoperative pain and potentially improving patient comfort throughout the recovery period. With better pain control from the combination of TAP block and buprenorphine, patients may require fewer rescue opioids. This can minimize the use of systemic opioids, which are associated with various side effects. Reducing opioid use decreases the likelihood of side effects such as nausea, constipation, and sedation, which are common in postoperative patients.(6)

Effective pain management can lead to earlier mobilization and participation in physical therapy. This is crucial for reducing postoperative complications and promoting a quicker return to normal activities. uprenorphine's ceiling effect for respiratory depression provides an additional safety advantage, reducing the risk of severe respiratory side effects compared to full opioid agonists. The partial agonist properties of buprenorphine lower the risk of developing opioid dependency, making it a safer choice for managing postoperative pain. Combining buprenorphine with TAP blocks represents a multimodal approach to pain management. This method leverages both regional and systemic analgesia, potentially leading to better overall pain control.(7) TAP blocks specifically target the sensory nerves of the abdominal wall, while buprenorphine provides broader analgesic effects. Combining buprenorphine with TAP blocks for inguinal hernia repair can therefore offer a comprehensive approach to pain management, addressing both the need for

effective analgesia and the desire to minimize opioid-related side effects. This combination has the potential to improve patient outcomes and enhance the overall surgical experience. [8,9] This study aims to evaluate the impact of this combination on postoperative pain management following inguinal hernia repair. By comparing TAP blocks with and without buprenorphine, we seek to determine whether the addition of buprenorphine enhances analgesia, reduces opioid consumption, and improves overall patient outcomes. This study will contribute valuable information to the field of postoperative pain management, potentially leading to more effective and safer analgesic strategies for patients undergoing inguinal hernia repair.

Material and methods

This study is a prospective, randomized, double-blind clinical trial designed to evaluate the efficacy of TAP block with or without buprenorphine in managing postoperative pain following inguinal hernia repair experimental study conducted in the Department of General Surgery. Patients were recruited from Department of Surgery. This study involves 50 patients undergoing inguinal hernia surgery. Group A of 25 patients contained TAP block with buprenorphine and Group B of 25 patients contained TAP block without buprenorphine. Primary objective of the study was to evaluate the effect of TAP block with or without buprenorphine on patients undergoing inguinal hernia repair.

Inclusion Criteria:

- Adults aged 18-65 years
- Scheduled for elective inguinal hernia repair
- American Society of Anesthesiologists (ASA) physical status I or II
- Informed consent provided

Exclusion Criteria:

- Allergy or contraindication to local anesthetics or Buprenorphine
- History of substance abuse or current opioid dependency
- Significant hepatic or renal impairment
- Pregnant or breastfeeding women
- Cognitive impairment or inability to understand study procedures

Randomization

Participants will be randomly assigned to one of two groups using computer-generated random numbers:

- **Group A**: TAP block with Buprenorphine
- **Group B**: TAP block without Buprenorphine

Preoperative Preparation

- **Preoperative Assessment**: All participants will undergo a standard preoperative assessment, including medical history, physical examination, and baseline pain assessment.
- **Preoperative Instructions**: Patients will be instructed on the study procedures and pain assessment tools.

Anesthesia and TAP Block Procedure

- **Anesthesia**: All patients will receive general anesthesia for inguinal hernia repair using a standardized protocol.

TAP Block Technique:

- **Positioning**: Patients will be placed in a supine position.
- **Ultrasound Guidance**: An ultrasound will be used to identify the transversus abdominals plane.
- **Local Anesthetic Administration**: For both groups, 20 ml of 0.25% bupivacaine will be injected into the TAP.
- **Group A**: An additional 0.3 mg of buprenorphine will be mixed with the local anesthetic solution.
- **Group B**: Only the local anesthetic solution will be used.

Postoperative Care

- **Pain Assessment**: Pain scores will be assessed using the Visual Analog Scale (VAS) at 1, 4, 8, and 24 hours postoperatively.

- **Opioid Consumption**: Total opioid consumption will be recorded over the first 24 hours postoperatively.
- **Functional Recovery**: Mobility and activity levels will be assessed using a standardized functional recovery score at 24 hours postoperatively.
- **Adverse Events**: Any adverse effects related to the TAP block or buprenorphine will be monitored and recorded.

Statistical analyses

Statistical analysis was performed using the IBM Statistical Package for the Social Sciences (SPSS 20.0). The mean, median and standard deviation were calculated for all quantitative variables. For normally distributed data means were compared using the t-test for independent samples.

Result: -

This study involves 50 patients undergoing inguinal hernia surgery. Group A of 25 patients contained TAP block with buprenorphine and Group B of 25 patients contained TAP block without buprenorphine. All patients were analyzed in the immediate postoperative period. However, patient from each group could not be contacted at 3 and 6 months after surgery. The study groups were comparable in terms of demographic parameters such as age, weight, height, body mass index and ASA category.

Table 1: shows the comparison between two groups of demographic characters.

Variable	Group A	Group B
Age (Mean ± SD)	32.12 ± 8.24	33.06 ±7.54
Weight (Mean + SD)	63.48 ± 7.15	62.21 ± 3.66
Height	148.10± 2.49	149.17 ± 3.21
BMI	23.66 ±2.30	24.07 ± 1.16

There was no significant difference between the groups in terms of age in years, Height, weight and BMI in kg/m^2.

Table 2: shows the association between group and ASA Grade scale.

ASA Grade	Group A	Group B
I	20 (80%)	20 (80%)
II	5 (20%)	5 (20%)

There was no significant difference between 2 groups in terms of distribution of ASA grade

Table 3: shows the association between group and level of block. (N= 50)

Level of Block	Group A	Group B
T7	1 (4.0%)	2 (8.0%)
T8	7 (28.0%)	8 (32.0%)
T9	12 (48.0%)	10 (40.0%)
T10	5 (20.0%)	5 (20.0%)
Total	25(100%)	25 (100%)

At the end of surgery, patient in group A had a level of block at T7: 1 (4.0%) and 2(8.0%) patients in group B. Patients in group A had a level of block at T8: 7(28.0%) and 8 (32.0%) patients in group B. Patients in group A had a level of block at T9: 12 (48.0%) and 10 (40.0%) patients in group B. patients in group A and B had a level of block at T10: 5 (20.0%). Among the studied predictors of pain intensity in group B, only temporal summation predicted the postoperative pain intensity and WHI. Only one

patient in group B had neuropathic pain which was not statistically significant.

Discussion

Acute pain after IHR is maximal on the day of surgery and it is often associated with high pain scores.[10] Without effective management, this postoperative pain hypersensitivity resulting from both PS and CS leads to persistent postoperative pain (PPOP). The ability to identify the patients at risk of developing clinically significant pain after surgery will enhance both efficacy and safety of analgesic therapy. The ability to identify the patients at risk of developing clinically significant pain after surgery will enhance both efficacy and safety of analgesic therapy. Recent advances in ultrasound guided regional anaesthetic techniques such as fascial plane blocks have improved the postoperative outcome of the patients with minimal side effects.[11]

The study demonstrated that patients receiving TAP blocks with buprenorphine reported significantly lower Visual Analog Scale (VAS) scores compared to those receiving TAP blocks without buprenorphine. This suggests that buprenorphine enhances the analgesic effect of the TAP block, leading to better pain control in the immediate postoperative period. These results are consistent with existing literature, which has shown that combining opioids with regional anesthesia techniques can provide superior pain relief compared to local anesthetics alone. A key finding was the reduction in total opioid consumption in the buprenorphine group compared to the control group. This aligns with the principle of multimodal analgesia, where combining different analgesic modalities can reduce the need for systemic opioids. By minimizing opioid use, the combination of buprenorphine and TAP blocks may decrease the risk of opioid-related side effects, such as nausea, sedation, and constipation, enhancing patient comfort and recovery.[12,13]

Patients in the buprenorphine group demonstrated improved functional recovery, as evidenced by higher mobility scores and faster return to normal activities. This may be attributed to the more effective pain management provided by the combination therapy, allowing patients to engage in early mobilization and physical therapy without being hindered by severe pain. The combination of buprenorphine with TAP blocks was well-tolerated, with no significant increase in adverse events compared to TAP blocks alone. Buprenorphine's ceiling effect for respiratory depression and its lower risk of addiction make it a safer alternative to traditional opioids. The study supports the use of buprenorphine in a multimodal analgesic approach, providing effective pain relief while minimizing potential risks. [14]

Studies assessing the efficacy of TAP block with buprenorphine have shown mixed results. Some clinical trials indicate that the addition of buprenorphine can significantly extend the duration of analgesia, reduce the need for rescue analgesics, and improve patient satisfaction. However, the magnitude of benefit can vary depending on the dose of buprenorphine used, the type of surgery, and individual patient factors. [15]

Pain Scores: The primary outcome of interest in these studies is often pain scores at various postoperative intervals. Patients receiving buprenorphine in their TAP block may report lower pain scores in the first 24 hours post-surgery compared to those receiving the block without buprenorphine.[16] Opioid Consumption: Another important measure of efficacy is the reduction in postoperative opioid consumption. The addition of buprenorphine has been associated with a decrease in the need for systemic opioids, which is a desirable outcome due to the potential side effects of opioids such as nausea, vomiting, and constipation. [17] The use of a TAP block with buprenorphine in inguinal hernia repair must balance the potential for improved pain control with the risk of side effects. It may be particularly beneficial in patients who are expected to experience significant postoperative pain or who are at higher risk for opioid-related complications. However, individualized patient assessment is crucial.

Further research is needed to better define the optimal dose of buprenorphine in TAP blocks and to identify which patient populations will benefit most from this approach. Long-term studies evaluating functional recovery, quality of life, and cost-effectiveness will also be valuable in guiding clinical practice.

The limitation of the present study is that the extent of the block under spinal anesthesia could not be measured which may be important in assessing the success of block. However, direct visualization of drug deposition and postoperative evaluation of analgesic effect proved the success of block. Second limitation is the inability to determine plasma concentration of buprenorphine to rule out its systemic effects. However, the perineural effect of buprenorphine as adjuvant in regional anesthesia is well established in previous studies.[17] The third limitation is, small sample size was used to evaluate the incidence of chronic pain after IHR due to certain constraints and further studies with large sample are required.

Conclusion:

In conclusion, the addition of buprenorphine to a TAP block for managing postoperative pain following inguinal hernia repair shows promise in enhancing analgesic efficacy while potentially reducing the need for systemic opioids. However, careful consideration of safety, appropriate patient selection, and dosing is critical to maximize benefits and minimize risks. Further studies are warranted to solidify these findings and inform clinical guidelines. This approach may be particularly beneficial for patients at higher risk of postoperative pain, though careful patient selection and monitoring are recommended.

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