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Original Research Article

To Study the Effect of Transversus Abdominis Plane Block with or without Buprenorphine after Inguinal Hernia Repair

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Abstract

Background: One of the most frequent surgical procedures worldwide is inguinal hernia repair. It is frequently accompanied by moderate to severe postoperative pain, which peaks the day of surgery. A risk factor for prolonged postoperative pain following surgery is poorly managed postoperative pain, which can also lengthen the hospital stay and postpone the return to normal activities. Recent research indicates that the severity of initial postoperative pain correlates with peri-incisional hyperalgesia, which may be a precursor to persistent postoperative pain. After inguinal hernia repair, there is an approximately 23.48% incidence of persistent pain with both nociceptive and neuropathic characteristics. Given the enormous number of people receiving treatment, even a rare severe long-term consequence would have a significant effect. In order to effectively control postoperative pain, multimodal analgesia that combines opioids, local infiltration, and nonsteroidal anti-inflammatory medications (NSAIDs) has been employed.

Material and Method: Sixty patients from ASA I and II were enrolled in a prospective, randomized, double-blinded research for unilateral inguinal hernia repair under spinal anesthesia. Utilizing 180g Vonfrey filament, mechanical temporal summation was assessed. Patients in groups B and BB got 20ml of 0.25% bupivacaine and 300g of buprenorphine for an ultrasound-guided transversus abdominis plane block at the conclusion of their surgeries, respectively. Effect of age, BMI, anxiety, mechanical temporal summation on pain intensity were determined in group B. Finally, effect of buprenorphine on high pain responders and incidence of persistent postoperative pain upto 6 months were recorded.

Results: Patients with perineural buprenorphine had prolonged duration of analgesia with reduced tramadol consumption and pain scores up to 24 hours both at rest and sitting along with the reduction of extent of WHI both at 24 and 48 hours. 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.

Conclusion: The present study shows that TAP block with buprenorphine produces superior analgesia and lowers the extent of wound hyperalgesia compare to control group without any significant side effects even in high pain responders. Among the studied predictors of pain intensity only enhanced mechanical temporal summation predicted the pain intensity and wound hyperalgesia. The enhanced mTS can be utilized as a possible clinical predictor to identify high pain responders, who may need antihyperalgesic drug in postoperative period.

Keywords: TAP, Mechanical temporal summation, Acute postoperative pain, Cyclic adenosine monophosphate.

Introduction

Inguinal hernia accounts for 75% of all abdominal wall hernias. Nearly 20 million groin hernia repairs are carried out each year and it is one of the commonly performed surgical procedure worldwide [1]. History of hernia surgery has gone through many stages of development from ancient time to era of tensionless repair. Out of the several described techniques, Lichtenstein tension free mesh repair remains the criterion standard. It is simple and effective with minimal pain [2,3].

Compared to open repair, laparoscopic repair has the advantage of quick recovery with less pain, but it requires long learning curve (200-250 cases) [4]. It also requires general anaesthesia (GA), which results in high cost of care. There is a small but definite risk of serious injury to intra -abdominal organs. A meta – analysis of 41 randomized controlled trials (RCT) and total of 7161 participants have shown that the laparoscopic repair takes longer time and has more certain complications like visceral and vascular injuries [5]. Compared to open repair, the early postoperative pain is less in laparoscopic repair, however there is no significant difference found in the occurrence of numbness, chronic pain and recurrence rate between two procedures in 2321 patients [6].

Repairing an inguinal hernia is a frequent surgical surgery carried out all over the world. The majority of patients have successful surgical repair of their inguinal hernias with minimal postoperative discomfort complications. However, the prevalence of chronic pain might vary among patients by up to 53% [7]. It also affects the daily activities of patient at the rate of 7-15% and it results in loss of professional workdays. As it is a commonly performed procedure, the incidence of any, even rare or severe long-term complication would be of great impact. So efficient management of acute postoperative pain through multimodal analgesic techniques may reduce the incidence of persistent postoperative pain. Interindividual variation in perception of pain could be predicted with the simple bedside tests like Quantitative Sensory Testing. Low pain responders need simple approaches whereas high pain responders may need antihyperalgesic drugs for interventional pain management.

Procedure specific approaches like transversus abdominis plane block may offer the greatest promise after the development of ultrasound guided regional anaesthetic techniques. TAP block has already been shown to reduce persistent pain following hernioplasty. Because it is straightforward and treats the pain at its source before centrally mediated alterations can take place, the peripheral approach is intriguing [8].

Acute postoperative pain and hyperalgesia at the surgical site have been linked, and the latter may be a sign of persistent pain. Targeting peripheral opioid receptors has several benefits, not the least of which is that their mode of action—inhibiting calcium (and perhaps sodium) ion channels—leaves nociceptor receptors insensitive to the abundance of stimulating chemicals expressed in wounded tissue [9]. In earlier investigations, the addition of buprenorphine to perineural blocks considerably decreased the pain scores and analgesic needs in the initial postoperative period. The goal of the

study was to ascertain how adding buprenorphine to a TAP block with bupivacaine affected the descriptions of both short-term and long-term pain.

Material and Methods

The study was a prospective randomized double blinded experimental study conducted in the Datta Meghe Medical College, Wanadongri Nagpur in the Department of Biochemistry in collaboration with the Department of General Surgery. Patients were recruited from Department of Surgery and the duration of study was from May 2020 to April 2021. Primary objective of the study was to evaluate the effect of TAP block with or without buprenorphine on patients undergoing inguinal hernia repair.

Sample size

Power analysis was conducted based to detect a clinically significant difference in the duration of analgesia between the groups. The sample size of 25 in each group was required for a power of 90% and a confidence interval of 95%

Patient selection criteria

Inclusion criteria

- American Society of Anaesthesiologist (ASA) I and II of male patients, posted for elective open IHR • Unilateral hernia • Age 18- 60 years • Body Mass Index 30 kg/m^2

Exclusion criteria

- Any complicated hernia, • Bilateral hernia, • Patients with coagulopathy, • BMI > 30 kg/m^2, • Patients with history of any chronic pain, • Previous surgery and • Opioid addiction

Study population

70 patients posted for elective unilateral open inguinal hernia were enrolled into the study. After examining inclusion and exclusion criteria and given written informed consent, 70 patients were randomized and allocated into group B (n= 35) and group BB (n= 35). There was no exclusion or drop-out in the immediate postoperative period. The analysis included all patients. At 3 and 6 months, just one patient from each group could be reached. On the basis of randomly generated numbers from a computer, the patients were divided into two equal groups. Before administering the transversus abdominis plane block, serially numbered sealed envelopes containing the group allocation were cracked open in the operating room.

Group B – Received 20 ml of 0.25% bupivacaine for TAP block

Group BB – Received 20 ml of 0.25% bupivacaine containing 300 μg of buprenorphine for TAP Block

Parameters Studied

Primary outcome of the study was the analgesic and anti-hyperalgesic effect of buprenorphine compared to control group. The duration of analgesia, analgesic consumption, postoperative pain scores at rest and sitting up to 48 hrs., effect on wound hyperalgesia at 24 and 48 hrs were evaluated. Secondary outcomes of the study include predictors of pain intensity such as demographic (age, BMI), psychological (anxiety) and psychophysical (mTS) in group B were determined and incidence of side effects and TAP block related complications were recorded. Effect of buprenorphine on patients with predicted high pain scores and incidence of persistent postoperative pain were also determined.

Result

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. Therefore, parameters regarding chronic pain were complete for 35 patients in each group. The study groups

were comparable in terms of demographic parameters such as age, weight, height, body mass index and ASA category.

Table 1: Comparison between two groups of demographic characters.

Variable	Group B	Group BB
Age (Mean ± SD)	35.23 ± 10.37	36.09 ±10.87
Weight (Mean + SD)	70.65 ± 9.23	68.33 ± 5.77
Height	154.15± 3.58	151.23 ± 4.28
BMI	25.88 ± 2.35	26.10 ± 1.29

There was no significant difference between the groups in terms of age in years, Height, weight and BMI in kg/m2.

Table 2: Association between group and ASA Grade scale.

ASA Grade	Group B	Group BB
I	18 (60.2%)	18 (60.2%)
II	7 (25.1%)	7 (25.1%)

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

Table 3: Association between group and level of block. (n= 70)

Level of Block	Group B	Group BB
T7	1 (3.0%)	2 (6.0%)
T8	10 (30.0%)	14 (37.0%)
T9	14 (37.0%)	12 (33.0%)
T10	10 (30.0%)	7 (24.0%)
Total	35(100%)	35 (100%)

At the end of surgery, one patient in group BB had a level of block at T7: 10 (30.0%) patients in group B and 14 (37.0%) patients in group BB had a level of block at T8: 14 (37.0%) patients in group B and 10 (30.0%) patients in group BB had a level of block at T9; 12 (33.0%) patients in group B and 7 (24.0%) patients in group BB had a level of block at T10.

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].

Both the groups were comparable in terms of demographic characteristics such as age, weight, height, BMI and ASA category. Mean age was comparable between the two groups. The mean BMI was also comparable between the groups. The present study included patients with BMI of less than 30 kg/m^2. The normal and overweight patients were equally distributed among the groups. Though the USG techniques may be challenging and may increase the procedural time in obese patients, the theoretical concern of thickness of subcutaneous fat is not clinically reflected in the studies [12,13]. Analgesic effect of TAP block is often beneficial in obese patients

after abdominal surgeries due to high risk of postoperative pulmonary complications [14]. Patients with higher ASA classification had been shown to be associated with postoperative pain [15]. However present study included only patients of ASA 127 classification I & II.

The functional role of peripheral opioid receptors in attenuating pain and hyperalgesia has been demonstrated for decades [16,17]. Buprenorphine with its mixed agonistic and antagonistic properties at different opioid receptors, produces significant anti-hyperalgesic effect than any other opioids [18]. Even though the hyperalgesia contributes to POP and may even enhance the amount of pain [19,20], its reduction was not associated with clinical pain scoring reduction at 24 and 48 hours [21].

Similar findings have been observed with systemic ketamine and buprenorphine [22]. The differential antihyperalgesic and analgesic effect of buprenorphine becomes more obvious following SL administration. The area of hyperalgesia was reduced by 40% at a time, even when pain ratings were unchanged [23].

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 [24,25]. 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

The present study shows that TAP block with buprenorphine produces superior analgesia and reduces the extent of wound hyperalgesia compare to control group without any significant side effects even in high pain responders. Among the studied predictors of pain intensity only enhanced mechanical temporal summation predicted the pain intensity and wound hyperalgesia. The enhanced mTS can be utilized as a possible clinical predictor to identify high pain responders, who may need anti-hyperalgesic drug in postoperative period.

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