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Original Research Article

Observational Study to Evaluate Transversus Abdominis Plane (TAP) Block in Abdominal Surgery by Total Requirement of Diclofenac as a Post Operative Analgesia drug

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Abstract

Background: Transversus Abdominis Plane Block (TAPB) is a regional anesthesia technique. It provides analgesia after lower abdominal surgery particularly where parietal wall pain forms major component of pain. It allows sensory blockade of lower abdominal wall skin and muscles via local anesthetic deposition between Transversus Abdominis muscle and internal oblique muscle. We evaluated efficacy of unilateral TAPB with bupivacaine for postoperative analgesia in hernia repair in a hospital based, double blind, and prospective, randomized controlled clinical trial.

Method: 60 patients undergoing elective unilateral inguinal hernioplasty surgery were randomized to undergo TAPB with bupivacaine (n =30) in study group and without TAPB in control group (n=30). At end of surgery performed under spinal anesthesia unilateral TAPB on side of surgery was performed using 20 ml of 0.25 % bupivacaine in study group. Each patient was assessed postoperatively by a blinded investigator in post-anesthesia care unit at 30 min., 2, 4, 6, 12, 18, 24 hours. The time required for first dose of rescue analgesia, vas score, total consumption of diclofenac was assessed in each group and comparison were performed by student t-test.

Result: Mean duration of analgesia was 669.66 minutes with SD of +346 in study group and 220.33 minutes with SD of +139.24 in control group which was found to be statistically significant. VAS score was significantly higher in control group as compared to the study group at all the time. Total dose of diclofenac consumption in study group was 95±33.73mg and in control group it was 202.5±44.69mg, which showed that diclofenac consumption was significantly decreased in study group.

Conclusion: TAPB with 0.25% bupivacaine provided potent and longer duration of analgesia, with very less requirement of diclofenac when used in patients of inguinal hernioplasty. There were no complications attributable to TAPB or drugs under study.

Keywords: TAPB, Bupivacaine, Postoperative analgesia, VAS score.

1. Introduction

The abdominal wall is a significant source of pain after abdominal surgery. Even a relatively small operation such as inguinal herniorraphy may be followed by a risk of a chronic pain state in about 5 to 10% of patients, with clinically significant effects on daily activities if postoperative pain is not taken care of. The usual trend is to prescribe an opioid or a NSAID for postoperative analgesia. The opioids have number of side effects such as respiratory depression, emesis, and reduction in motility of gut, sedation etc.

NSAIDs also have certain side effects like haemostasis alteration, renal dysfunction, gastrointestinal hemorrhage etc. However in regional analgesic technique, drugs have peripheral site of action, hence minimum systemic side effects. Hence regional analgesic technique has gained widespread popularity as an important component of postoperative analgesia regimen. TAPB is gaining popularity as one of such regional blocks.

Transversus Abdominis Plane Block (TAPB) can be performed through the lumbar triangle of Petit formed by external oblique muscle anteriorly, lattissimusdorsi muscle posteriorly, iliac crest inferiorly and is usually identified as a defect 1 cm above the iliac crest in midaxillary line. Rafi *et al* (2001) [1] first described the TAP block and was further developed and tested by McDonnell *et al* [2] in 2004. The technique involves injection of local

anesthetic into the plane between the transverses abdominis (TAM) and internal Oblique muscles. It allows sensory blockade of plexus of nerves from T-6 to L-1 supplying lower abdominal wall skin and muscles via local anesthetic drug deposition above the TAM.

The aim of this observational study is to evaluate transverses abdominis plane [TAP] block in abdominal surgery by total requirement of diclofenac as postoperative analgesia drug.

We selected inguinal hernia meshplasty for study as incision site in lower abdomen which can be blocked by TAP block with landmark technique.

2. Methods

After obtaining approval by the Institutional Ethics Committee, and written informed patient consent, we studied 60 ASA physical status I – II male patients between 20 to 65 years of age with normal liver and renal functions scheduled for unilateral inguinal hernioplasty in a prospective, randomized, double blind, controlled study. By using double blinded randomization technique we selected 30 patients in each group considering power to be 80%. Patients were not included if there was a history of sensitivity to local anesthetics, abnormal liver function, infection at injection site, clotting abnormalities.

Patients were randomized by Systematic Random Sampling to undergo TAP block with 0.25% Bupivacaine in study group (n = 30) or not received TAP block in control group (n=30). Standard monitoring, including electrocardiogram, non-invasive blood pressure, arterial oxygen saturation was used throughout. Patients were premedicated with intravenous Ranitidine and intravenous Ondansetron. Patients were preloaded with 15 ml/kg of Ringer Lactate.

All patients received standardized spinal anaesthesia with 0.5 % hyperbaric Bupivacaine 3.5 ml in sitting position. Level of analgesia achieved was noted. Assessment of block was done by pinprick. Target height was T6. Patients were monitored intraoperatively. Hypotension was taken as fall in systolic blood pressure > 20% of baseline and was treated with incremental doses of Mephentermine 3 mg and bolus of 200 ml of Ringer Lactate. Bradycardia was taken as heart rate < 50 beats per minute and treated accordingly with intravenous Atropine 0.6 mg. No analgesic or sedation was given to any patient intraoperatively.

At end of surgery Petit's triangle was identified on the side of surgery as a defect above the iliac crest in mid axillary line between the fibers of external oblique and latissimus dorsi muscles. Under all aseptic precautions the block was given by landmark technique through Petit' triangle with 23G blunt tipped 1.5 inch hypodermic needle. Needle was introduced perpendicular to skin and advanced until two "POPS" or "give way" were felt. Then the drug injection bupivacaine 0.25% 20 ml was deposited in the fascial plane after aspiration, check aspiration was done every 5 ml to rule out intravascular injection. The patient was observed for 15 minutes and then shifted to post-anaesthesia care unit.

The anaesthesiologist who observed the patients in PACU was blinded to the group. Patient was monitored at 30 min., 2, 4, 6, 12, 18, 24 hours postoperatively for pulse rate, systolic and diastolic blood pressure and respiratory rate, pain by VAS score and complications if any. Pain was assessed according to visual analogue score from 0 to 10. Patient was given rescue analgesia in the form of intramuscular Diclofenac 75 mg at a visual analogue pain score of 3 (i.e. minimal pain). Recession of motor block was noted by movement of ankle and knee joint. The duration of analgesia in TAPB was considered the time of first request for postoperative analgesia after surgery. Patient was also observed for any other postoperative complications.

Data was collected, tabulated and then analysed. Data was expressed as mean and standard deviation (SD), median and ranges.

Demographic data were analysed using student's t-test. Other measurement like duration of analgesia, total requirement of diclofenac, vas score, vitals were analysed by student t-test. A difference with significant level (p- value< 0.05) was considered statistically significant.

3. Results

This prospective study was carried out in 60 ASA I and II patients, who underwent inguinal hernioplasty during the year 2014-15. They were randomly divided into two different groups.

Study Group: Patients received TAP block with Bupivacaine (0.25%) 20 ml.

Control Group: Patients not received TAP block and was given injection diclofenac on demand for postoperative analgesia as per institute protocol for routine surgery.

Table 1: Demographic Data

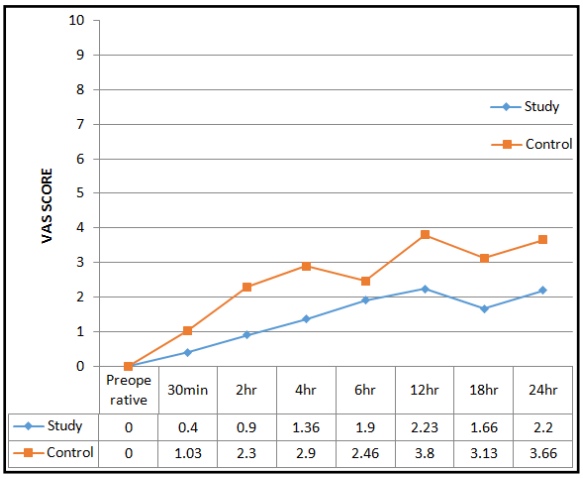
Group	Study group	Control group	P Value
Age (years)*	46.43±13.1	50.23±13.44	0.272
Weight (KG)*	63±5.37	61±5.24	0.1497
Height(CM)*	167.76±5.99	167.93±4.17	0.899

P* > 0.05

Majority of the patient were in age group of 30 to 50 in both group. Both groups were comparable in terms of age, weight and height.

No significant difference was observed between two groups in terms of demographic data.

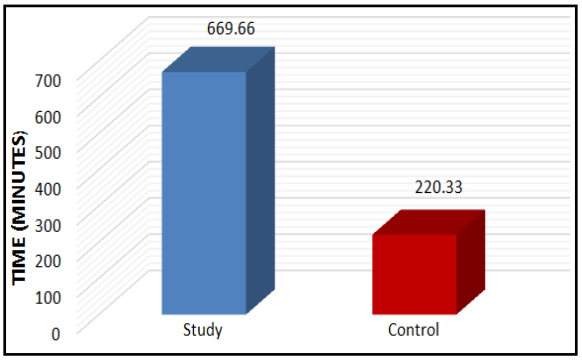
Figure 1: Comparison of VAS score



P* < 0.05

VAS score was significantly higher in control group as compared to the study group at all the time.

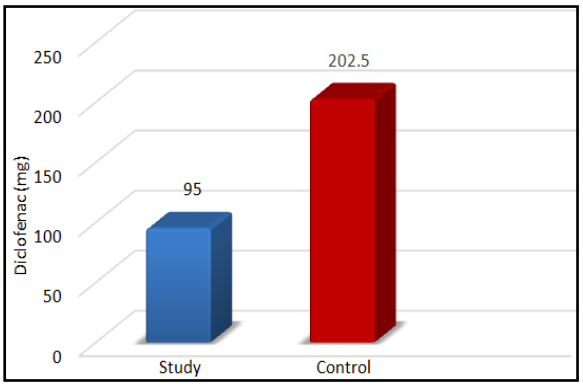
Figure 2: Time for first dose of rescue analgesia in minute



P* <.0001 highly significantly difference

First dose of rescue analgesia required in study group was at 669.66± 346 min and in control group was 220.33 ± 139.24 min which was statistically significant.

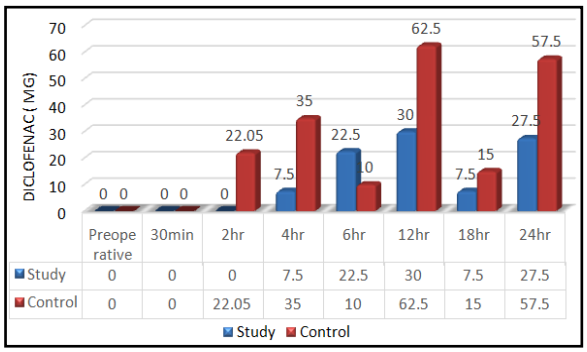
Figure 3: Total dose of Diclofenac



P* < 0.0001, statistically very highly significant.

Total dose of Diclofenac consumption in study group was 95±33.73mg and in control group it was 202.5±44.69mg, which showed that Diclofenac consumption was significantly decreased in study group.

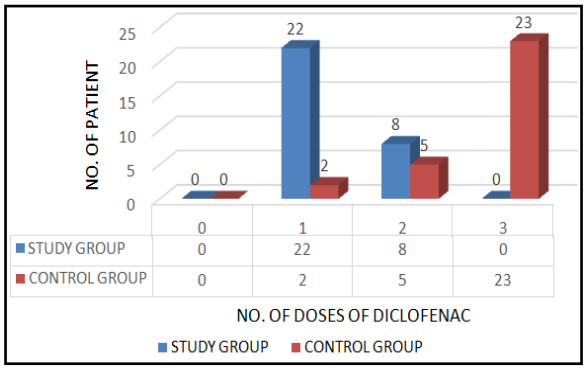
Figure 4: Cumulative diclofenac consumption



P*< 0.05, statistically significant difference in both groups.

Tap block with bupivacaine reduced cumulative post-operative DICLOFENAC consumption compared with the control group all the time except at 6 hour.

Figure 5: No. of times diclofenac required in 24 hrs



Diclofenac requirement in study group was one time in 22 patient and two time in 8 patient which was significantly less as compare to control group in which diclofenac requirement was one time in 2 patient and two time in 5 patient and three time in 23 patient in 24 hour.

There were no any complications related to the TAP block technique in both the groups.

4. Discussion

Inadequately controlled post-operative pain has undesirable physiological and psychological consequences such as morbidity, delayed recovery and patient dissatisfaction.

Safety and morbidity issues are therefore of utmost importance and should be constantly re-evaluated and optimized. Thus, the development of safe and well-tolerated analgesic techniques that provide optimal postoperative pain relief is of utmost importance.

Inguinal hernia repair is a common surgical procedure [17]. The incidence is reported as 11/10,000 in persons between 16 and 24 years of age, 200/10,000 in persons more than 75 years of age. Chronic pain occurs in 5-10% after the inguinal hernia repair that creates an important problem.

A significant part of pain after hernia surgery is caused by the abdominal wall incision and conducted by the lower intercostal nerves and iliohypogastric and ilioinguinal nerves (i.e. T11 to L1) [18]. Postoperative pain management in cases that undergo abdominal surgery is complicated. Despite the effective pain management methods, the frequency of moderate or severe pain is found to be 30-75%.

Various methods and medications are used in postoperative pain management. The most common approach to post-operative pain relief is multimodal using NSAIDs, opioids and local infiltration of local anesthetic. Opioids are effective for treatment of postoperative pain but can cause adverse effects such as nausea, vomiting, decreased gastrointestinal motility, respiratory depression and sedation which further increase the morbidity of the patient. Local infiltration does not relieve deep muscular pain and NSAID are nephrotoxic. Peripheral nerve blocks with local anesthetics are a method that may be used in inguinal hernia surgeries for pain management. Iliohypogastric (IH) and ilioinguinal (II) nerve with lower intercostal nerve (T-11 and T-12) block are used for this purpose.

Hence we thought of an alternative technique in the form of unilateral TAP block with 0.25% of Bupivacaine at the end of surgery to evaluate the efficacy of TAP block with requirement of other analgesic drugs.

TAP block was first described by Rafi in 2001. In this technique local analgesic is administered between IOAM and TAM via superficial landmark i.e. triangle of Petit with 'POP' technique. This is the neurovascular facial plane of abdomen musculature through which the seventh to eleventh intercostal nerves, sub costal nerve, iliohypogastric and ilioinguinal nerves (T7-L1) run a variable part of their course before supplying to anterior abdominal wall, so by injecting local analgesics in this facial plane we can block the sensory supply of the anterior abdominal wall [1,2].

POP technique described by *Rafi,* is associated with difficulties like anatomic variation of *triangle of petit*, difficulty in palpation of triangle in obese patients and complications like colonic puncture, liver injury [5], nerve injury or unpredictable spread of local anesthetic [7].

Recent studies by Hebbard *et al* [14,15] (posterior TAP block**),** T. M. Tran (cadaveric study), Dawlathy (Lap cholecystectomy)[7], Niraj *et al* (open appendicectomy)[8]' Belary *et al* (caesarean section delivery)[9]' D.J Sandeman (Lap appendicectomy)[11] have all proved that "In plane" USG guidance ensures the exact position of LA between the IOAM and TAM, resulting in improve safety and efficacy.

In this study we decided to give TAP block by landmark technique after completion of surgery for postoperative analgesia as effect of spinal anaesthesia wear off in 2 to 3 hours.

The results of our study showed that patients who received TAP block with local anesthetic had 10 to 12 hour duration of analgesia, significantly less pain up to 24 hrs., prolonged time to first dose of rescue analgesic and significant reduction in diclofenac consumption in 24hrs and the subsequent dose of diclofenac were required at longer time interval as compared to control group. VAS score was low in study group as compared to control group throughout 24 hours. This was similar to the study performed by Mc Donnell *et al* [4] in caesarean section delivery where VAS at rest and on movement was significantly low till 12 hours in patients who received TAP block with local anesthetic. Study performed by Niraj *et al* [8] in open appendicectomy and Neerja Bharti *et al* [12] in colorectal surgery also showed similar results.

Neha Fuladi *et al* [13] in 2014 conducted a comparative study of bupivacaine 0.25% versus ropivacaine 0.5% in transverses abdominis plane block for postoperative analgesia in lower abdominal surgeries. They observed that mean duration of analgesia was 420.6±14.01 minute in Bupivacaine group and 2187 ±1011.09 minute in Ropivacaine group which was found to be statistically significant.

Time to first dose of rescue analgesia (i.e. Diclofenac) was statistically significantly prolonged in study group (669.66±346 minutes) compared to the control group (220.33 ± 139.24 minutes). In studies performed by John Carney, Mc Donnell *et al* [6] in total abdominal hysterectomy and D. Belavy *et al* [9] in caesarean section, the time to first analgesic demand was 3-4 hours after completion of surgical procedure which was less compared to our study. This difference may be attributed to TAP block given before surgery where as we have given TAP block at the end of surgery. Also one time bolus injections of local anaesthetics can provide narcotic-limiting pain relief for 4–8 h after operation however it was about 11 hrs. in our study. Other studies also demonstrated that a single shot TAP technique can produce effective analgesia for 36-48 hrs attributing it to

relatively poor vascularised and therefore slow drug clearance.[3]

One important measure of analgesic efficacy in our study was requirement of diclofenac during first 24hrs. The 24 hours consumption of total diclofenac was 53% less in study group as compared to control group. The cumulative diclofenac consumption at 2, 4, 12, 18, 24 hours was also significantly less in study group compared to the control group. Our study results are comparable with Dawlatly *et al* [7] who showed 55% decrease in opioid requirement after USG guided TAP block in laparoscopic cholecystectomy. Niraj *et al* [8] showed 45% decrease in opioid requirement with USG guided TAP block in open appendicectomy. John Carney, McDonnell *et al* [6] also showed 47% decrease in opioid requirement with TAP block after total abdominal hysterectomy. Jumana M Baaj *et al* [10] also showed total consumption of morphine was reduced more than 60% after the TAP block in caesarean delivery under spinal anaesthesia.

Epidural catheter for postoperative analgesia is still gold standard but TAP block can be given for postoperative analgesia when epidural catheter is contraindicated in high risk patient or failure.

Although initial results of TAP block are encouraging, its complications are not well described in the literature but few case reports of complication including like bowel puncture, nerve injury and puncture of the liver. There is one report of liver injury with landmark technique in a short stature woman whose liver was enlarged. We did not observe any of these complications by landmark technique.

Another important concern is L/A toxicity particularly when bilateral blocks are performed as administration of local anaesthetic between fascia layers is associated with fast absorption kinetics. One study showed that TAP block has the potential to cause systemic toxicity if local anesthetic spills over into the adjacent muscles. We did not encounter this complication as surgical procedure selected required unilateral block and we did not cross the toxic dose of bupivacaine.

Haemodynamic parameters like HR, MAP and RR remained comparable in both the group at all the times. TAP block with bupivacaine showed stable hemodynamic in postoperative period because of good postoperative pain control in early period.

Opioid related side effects like sedation, nausea and vomiting are related to the dose of opioids which were absent in our study as we did not use opioid.

From this study, it seems that TAP block holds considerable promise for patients undergoing surgical procedures involving abdominal wall incisions as it provide analgesia to parietal peritoneum as well as skin and muscle of the anterior wall abdomen. It reduces pain (vas score), requirement of rescue analgesia and their side effect and provide better satisfaction to patient.

Advantage of TAP block by landmark technique over USG guided are easy to perform, cost effective, less time required for preparation to give TAP block, can be used at peripheral health center, can be used in emergency surgery when USG not available, can be given by anaesthesiologist without expertise in USG guided block.

However further large well controlled studies are required in terms of its safety, optimal dose and volume of local anaesthetic, single shot verses catheter, intermittent verses continuous catheter infusion, type of local anaesthetic, use of adjuvant, comparison of efficacy of TAP block with other technique like epidural catheter and local infiltration, use in patient with coagulation profile abnormality before it can be implemented in routine clinical practice.

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