



Anesthesiology

A COMPARATIVE STUDY OF ROPIVACAINE AND ROPIVACAINE WITH DEXAMETHASONE IN TRANSVERSUS ABDOMINIS PLANE BLOCK FOR POSTOPERATIVE ANALGESIA IN PATIENTS UNDERGOING LOWER ABDOMINAL SURGERIES.

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ABSTRACT

Background: The great majority of patients scheduled to undergo surgery suffer from emotional stress due to anxiety about the pain which is expected in the postoperative period. Opioids remain the mainstay of postoperative pain relief but can result in significant adverse effects. A transversus abdominis plane (TAP) block is the technique to block the sensory nerves of the anterior abdominal wall and the TAP block has been used to control the pain after abdominal surgery in many cases. Steroids are very potent anti-inflammatory and immunosuppressive agents. Peri-neural injection of steroid influences the postoperative analgesia.

Aim: to compare time for first rescue analgesia, VAS score after surgery, total rescue analgesia, PONV in control group, Ropivacaine group and ropivacaine with dexamethasone group.

Methods: Patients were randomly allocated into three groups using computer-generated random numbers. **GROUP I(N=30):** Control group (without TAP block) **GROUP II (N=30):** TAP block Ropivacaine (1.5mg/kg of 0.375%) with 2ml normal saline **GROUP III(N=30):** TAP block Ropivacaine (1.5mg/kg of 0.375%) with 2ml (8mg) dexamethasone. The TAP block was performed after intubating the patient, before skin incision using double-pop technique. A 21-gauge 1.5 inch blunted hypodermic needle was attached with flexible tubing to a syringe filled with the study solution. A loss-of-resistance technique was used to locate the TAP.

Results: Significant reduction of VAS scores in group II and group III when compared with group I at all specified time intervals and also significant reduction of VAS scores when compared in between group II and group III. Mean time for first rescue analgesia after surgery in group I was 125 mins, in group II it was 416.9 mins, in group III it was 540.83 minutes. ($p < 0.0001$). Total rescue analgesia (fentanyl in mcg) for 48hrs after surgery in group I 299 ± 23.09 mcg, in group II it 180.16 ± 17.18 mcg, in group III it was 59.66 ± 4.188 mcg. ($p < 0.0001$). Postoperative nausea and vomiting for 48hrs in group I 16 members, in group II 14 members, in group III it was 5 members. ($p < 0.0001$).

Conclusion: The addition of dexamethasone as an adjuvant to ropivacaine in TAP block prolongs the time for first rescue analgesia, decreases VAS scores, decreases requirement of total rescue analgesia for 48 hours post-operatively, decreases incidence of postoperative nausea and vomiting.

KEYWORDS : Transversus abdominis plane block, Ropivacaine, Dexamethasone, VAS score.

INTRODUCTION

The great majority of patients scheduled to undergo surgery suffer from emotional stress due to anxiety about the pain which is expected in the postoperative period. Opioids remain the mainstay of postoperative pain relief but can result in significant adverse effects including sedation, nausea, vomiting, urinary retention, respiratory depression, delayed recovery of intestinal motility, and prolonged postoperative ileus.

But there are concerns with regard to the potential of systemically administered opioids to cause nausea, vomiting, drowsiness and respiratory depression.

Recently, peripheral nerve blocks have been advocated to alleviate the above problems in addition to controlling the postoperative pain effectively at the same time.

A transversus abdominis plane (TAP) block is the technique to block the sensory nerves of the anterior abdominal wall and the TAP block has been used to control the pain after abdominal surgery in many cases. Despite a relatively low risk of complications and a high success rate using modern techniques, TAP blocks remain overwhelmingly underutilized.

TAP blocks have been described as an effective component of multimodal postoperative analgesia for a wide variety of abdominal procedures including large bowel resection, open/laparoscopic appendectomy, inguinal hernia repair, cesarean

section, total abdominal hysterectomy, laparoscopic cholecystectomy, open prostatectomy, renal transplant surgery, abdominoplasty. Steroids are very potent anti-inflammatory and immunosuppressive agents. Peri-neural injection of steroid influences the postoperative analgesia. Dexamethasone a 9 alpha derivative of synthetic glucocorticoid was preferred because of potent anti-inflammatory property about 25 to 30 times more potent than hydrocortisone and without any mineralocorticoid activity thus was found to be safer and devoid of potential side effects.

Most reports demonstrate the efficacy of TAP blocks by highlighting some combination of reduced postoperative opioid requirement, lower pain scores, and/or reduction in opioid-related side effects such as nausea and vomiting by adding adjuvants (dexamethasone) steroids.

AIMS & OBJECTIVES

To compare the following factors in three groups – group I – control group without TAP block, in group II – 1.5 mg/kg of 0.375% ropivacaine with 2ml normal saline in TAP block, in group III – 1.5mg/kg 0.375% ropivacaine with 2ml dexamethasone (8mg) with TAP block in lower abdominal surgeries (inguinal hernia, appendicitis) with respect to:

- Time for first rescue analgesia (fentanyl) at VAS30 after surgery
- VAS score after surgery at 1h, 2h, 4h, 12h, 24h, 48h
- Total rescue analgesia (fentanyl) requirement after surgery for 48 hrs
- Postoperative nausea and vomiting

METHODOLOGY

Patients and Methods

After approval from hospital ethics committee and obtaining written informed consent from patients, 90 adult patients of ASA-physical status 1 & 2 scheduled for lower abdominal surgery (inguinalhernia,appendicitis) under general anesthesia were included in the study.

Type of study: Prospective randomized single blind controlled trial.
Inclusion criteria: All adult patients of ASA physical status 1 & 2 posted for lower abdominal surgery(inguinal hernia,appendicitis) under general anesthesia

Exclusion criteria:

1. Sensitivity to local anesthetics
2. BMI >40
3. Preexisting coagulation disorders
4. Patients with renal impairment
5. Patients with hepatic impairment
6. Local infection

GROUPS: Patients were randomly allocated into three groups using computer generated random numbers.

- GROUP I(N=30):** Control group(without TAP block)
- GROUP II (N=30):**TAP block Ropivacaine (1.5mg/kg of 0.375%) with 2ml normal saline
- GROUP III(N=30):**TAPblock Ropivacaine(1.5mg/kgof0.375%)with 2ml(8mg) dexamethasone

All the patients received general anaesthesia with standard monitoring which included pulse oximetry, NIBP, ECG and Endtidal carbon-dioxide. The TAP block was performed after intubating the patient,before skin incision using double- pop technique¹⁴. A 21-gauge 1.5 inch blunted hypodermic needle was attached with flexible tubing to a syringe filled with the study solution. A loss-of resistance technique was used to locate the TAP. This is possible because the fascial extensions of the abdominal wall muscles within the floor of the triangle of Petit create an easily appreciated increased resistance to needle advancement. With the patient in a supine position and the investigator standing on the ipsilateral side, the iliac crest was palpated from anterior to posterior until the latissimus dorsi muscle insertion was appreciated. The triangle of Petit was palpated between the anterior border of latissimus dorsi, the posterior border of the external oblique, and the iliac crest. The skin over the triangle of Petit was pierced with the needle held at right angles to the coronal plane. The needle was stabilized and advanced at right angles to the skin in a coronal plane until resistance was encountered. This first resistance indicated that the needle tip was traversing the fascial extension of the external oblique muscle. Further gentle advancement of the needle resulted in a loss of resistance, or “pop” sensation, as the needle entered the plane between the external and internal oblique fascial layers. Further gentle advancement resulted in the appreciation of a second increased resistance as the needle traversed the fascial extension of internal oblique.

A second pop indicated entry into the transversus abdominis fascial plane. After careful aspiration to exclude vascular puncture, a test dose of 1 mL was injected. The presence of substantial resistance to this injection indicated that the needle was not between fascial planes, indicating the need to reposition the needle. After aspiration to exclude intravascular injection,1.5mg/kg of 0.375% ropivacaine ± dexamethasone 8mg was injected observing closely for signs of toxicity. All patients received diclofenac 1.5mg/kg IV in 500 ml of normal saline and IV ondansetron 0.1mg/kg 30 minutes before completion of surgery. All patients were extubated after giving neostigmine 0.05mg/kg with glycopyrrolate 10µg/kg IV. After completion of the surgical procedure, patients were transferred to the post anesthesia care unit (PACU).

Postoperative analgesia was administered with an infusion of diclofenac 1.5 mg/kg IV 12th hourly and rescue analgesia fentanyl 1mcg/kg given when VAS score ≥30.

Pain severity was measured using a visual analog scale (VAS, 100 mm unmarked line in which 0 mm =no pain and 100 mm =worst pain imaginable).

Mark on the line below, the point that best describes your current level of pain.



Rescue antiemetics were offered to any patient who complained of nausea or vomiting. The study ended 48hrs after surgery.

Comparing the following parameters

- Time for first rescue(fentanyl) analgesia after surgery at VAS30
- VAS score after surgery at 1h,2h,4h,12h,24h,48h
- Total rescue analgesia (fentanyl) requirement after surgery for 48 hrs
- Postoperative nausea and vomiting

Statistical Methods

Before the study, a power analysis was performed to determine the necessary number of patients in each group based on postoperative VAS score for pain. With atwosided type I error of 5% and study power at 80% it was estimated that 30 patientsin each group would be enough to detect a 25% difference in the VAS score for pain based on detection of a 10mm difference between the groups. Descriptive and inferential statistics were used to analyze the data.

Descriptive statistics:

Mean and standard deviations were calculated for age, weight, height, body mass index,total duration of surgery,VAS score at 1hr,2hr,4hr,12hr,24hr,48hrs. Time for first analgesia after surgery,total rescue analgesia after surgery for 48 hrs.

Inferential statistics:

Quantitative data analyzed by anova test,student t-test, chi square test was used for analysis of resultsfor p-values by graphpad prism software version 6.03(graph pad software Inc. USA) P value < 0.05 was considered statistically significant.

RESULTS

Ninety patients were enrolled into the study .None of the patients were excluded from the study after enrollment.

- GROUP I(N=30):** Control group(without TAP block)
- GROUP II (N=30):** TAP block Ropivacaine(1.5mg/kg of 0.375%) with 2ml normal saline
- GROUP III(N=30):** TAP block Ropivacaine(1.5mg/kg of 0.375%) with 2ml(8mg).dexamethasone

Demographic Data

Groups were comparable with respect to age, height, weight,body mass index and male to female ratio,type of surgery

TABLE NO

	GROUP I	GROUP II	GROUP III	P VALUE
AGE(MEAN ±SD) IN YRS	38.80±(6.56)	38.66(±6.46)	III 38.8(±6.18)	0.995 (N.S)
WEIGHT(KG) MEAN±SD	59.8±4.61	60.2±5.29	59.66±4.18	0.9 (N.S)
HEIGHI(CM) MEAN±SD	168.2±3.87	169.6±4.48	168.23±4.53	0.359(N.S)
BMI(MEAN ±SD)	21.27±1.06	21.17±1.06	21.22±0.65	0.919(N.S)
MALE	22	21	21	p>0.05
FEMALE	8	9	9	

TYPE OF SURGERY

TYPE OF SURGERY	GROUP I	GROUP II	GROUP III
APPENDECTOMY	17	18	17
INGUINAL HERNIA	13	12	13

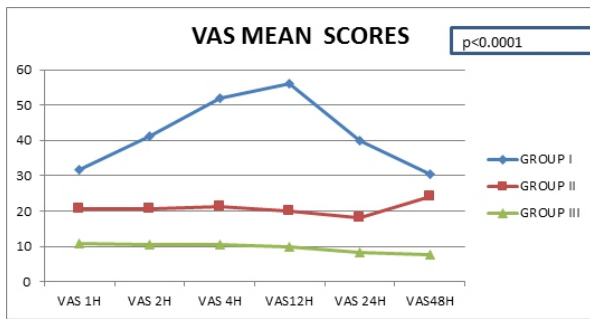
DURATION OF SURGERY IN MINUTES

	GROUP	GROUP II	GROUP III	P VALUE
TOTAL DURATION OF SURGERY IN MINS(MEAN±SD)	57.66±1.93	58.2±1.34	58.23±2.45	0.451(N.S)

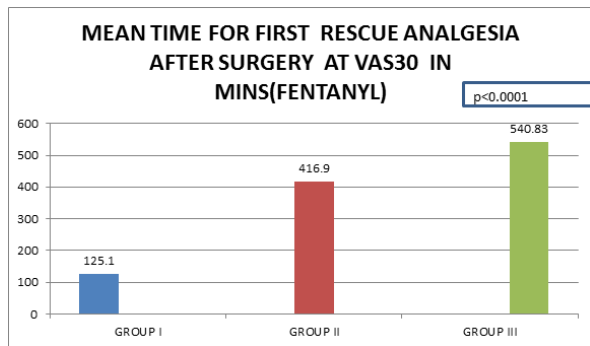
PAIN SCORES

Pain scores (VAS) at 1hr,2hr,4hr,12hr,24hr,48hr between three groups compared. when compared between group I and group II VAS score reduced at all specified time intervals as P values <0.0001(highly significant).when compared between group I and group III VAS score reduced at all specified time intervals as P values <0.0001(highly significant). When compared between group II and group III VAS score reduced at all specified time intervals as P values <0.0001(highly significant).

Significant reduction of VAS scores in group II and group III when compared with group I at all specified time intervals and also significant reduction of VAS scores when compared in between group II and group III.



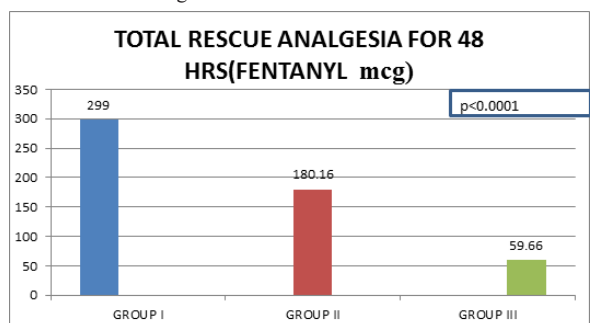
TIME FOR FIRST RESCUE ANALGESIA(FENTAYL)AT VAS30 AFTER SURGERY IN MINUTES



Mean time for first rescue analgesia after surgery in group I was 125 mins, in group II it was 416.9 mins, in group III it was 540.83 minutes.

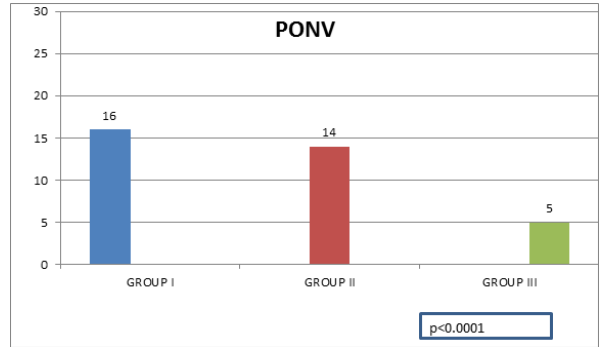
TOTAL RESCUE ANALGESIA FOR 48HRS(FENTANYL)

Total rescue analgesia (fentanyl in mcg) for 48hrs after surgery in group I 299±23.09mcg, in group II it 180.16±17.18mcg, in group III it was 59.66±4.188mcg.



POST OPERATIVE NAUSEA AND VOMITING FOR 48HRS:

Postoperative nausea and vomiting for 48hrs in group I 16 members, in group II 14 members, in group III it was 5 members.



DISCUSSION

The transversus abdominis plane (TAP) block is a regional anesthesia technique that provides analgesia to the parietal peritoneum as well as the skin and muscles of the anterior abdominal wall. Poorly controlled acute pain after abdominal surgery is associated with a variety of unwanted postoperative consequences including patient suffering, distress, respiratory complications, delirium, myocardial ischemia, prolonged hospital stay and an increased likelihood of chronic pain. A major contributor to the pain experienced after abdominal surgery is pain from the incision made in the abdominal wall, with the remainder resulting from internal visceral trauma. Traditionally analgesia for abdominal surgery is provided either by systemic drugs such as opioids, ketamine, nonsteroidal anti-inflammatory drugs (NSAIDs), alpha-2 agonists and paracetamol, or by epidural analgesia. Peripheral nerve blockade is an alternative means of providing analgesia by anesthetizing the sensory nerves conveying pain impulses from the incision site to the spinal cord and brain.

Steroids are very potent anti-inflammatory and immunosuppressive agents. A direct effect on nerve membrane rather than an anti-inflammatory has been suggested as the corticosteroids were able to inhibit ectopic neural discharge originating in experimental neuromas. Dexamethasone is also known for modulation of pain signals in the spinal cord. But steroids may potentiate the action of local anesthetics through modulation of the function of potassium channels in the excitable cells. Perineural injection of steroid influences the postoperative analgesia.

Selection of drug & dosage

In the present study ropivacaine (0.375%) 1.5mg/kg, dexamethasone 8mg(2ml) was used for TAP block. While local anesthetic agent, volume, concentration, and delivery method differ between studies. The exact dose of dexamethasone for peripheral nerve block has not been described. In all the previous studies dexamethasone was used in dose of 4-8 mg for TAP block and was found to be safe without any adverse effects.

Saradha sinha et al conducted a study comparing bupivacaine and ropivacaine in TAP block. Patients receiving ultrasound-guided TAP block with ropivacaine (Group II) had significantly lower pain scores when compared to patients who received the block with bupivacaine (Group I) at 10 min, 30 min and 1 h. However both the drugs had same post-operative analgesia and 24 h cumulative rescue analgesic requirement. Hence in the present study ropivacaine was used because it provides better early postoperative analgesia when compared with bupivacaine.

The various studies conducted by Andrijan kartalov et al Saradha sinha et al, Carney et al, Griffith et al, Mei et al, Heil et al used different doses and concentration of ropivacaine for TAP block. No study was done using different doses of ropivacaine. The exact dose and volume of ropivacaine for TAP block has not been described in previous studies. So in the present study ropivacaine (0.375%) of 1.5mg/kg (20ml-36ml) was used.

Timing of the TAP block

In the present study TAP block was performed after induction of anaesthesia and before skin incision. Most of the studies Carney et

al13,MC'Donnell et al,EL Daulatly et al,Niraj et al,Andrijan kartalov et al,Ammar AS et al performed TAP block immediately after induction similar to present study. Some of the studies Griffith et al and Saradha sinha et al performed TAP block after the completion of surgery.

Time for first rescue analgesia after surgery

In the present study first rescue analgesia fentanyl 1mcg/kg was given when VAS score was ≥ 30 . The time for first rescue analgesia in group I was 125 minutes, in group II was 416 minutes and in group III was 540 minutes. The mean time for first rescue analgesia was prolonged and statistically significant in group III when compared with group I and group II.

In study by McDonnell et al, time for first rescue analgesia in TAP block group was prolonged compared to control group and these results are similar to present study. Another study of TAP block for TAH was conducted by Carney et al time for first rescue analgesia was prolonged in TAP block with ropivacaine group when compared to TAP block with normal saline group. These above results were similar to the present study in comparison with group I and group II.

Total rescue analgesia (fentanyl) requirement after surgery for 48 hrs In the present study rescue analgesia (fentanyl 1mcg/kg) was given when VAS score ≥ 30 . The total rescue analgesia for 48 hrs in group I was 299 mcg, in group II was 180 mcg and in group III was 59.66 mcg. The mean requirement of total rescue analgesia significantly lower in group III when compared with group II and group I. On intergroup comparison total rescue analgesia requirement in group II was lower when compared with group I

In study by Carney et al total rescue analgesia (morphine) requirement after surgery for 48 hrs was significantly less in TAP block group compared to control group (26.8 ± 19.8 mg and 55.3 ± 17.6 mg respectively, $p < 0.0001$). These results are similar to the present study results. In study done by MC Donnell et al on TAP block with L-bupivacaine for bowel resection, the rescue analgesia (morphine) requirement for 24 hrs was significantly less in TAP block group compared to control group (21.94 ± 8.8 mg and 80.44 ± 19.2 mg respectively, $p < 0.0001$) and these observations are similar to the observations of the present study.

VAS SCORES

The mean VAS score was significantly less in group III when compared with group II and group I. On intergroup comparison VAS scores in group II was lower when compared with group I.

Charlton et al done metaanalysis of 5 studies of TAP block with control group and they observed postoperative VAS pain scores at 0hr, 1hr, 12hr, 24hr and 48hr. They found significantly low VAS scores in TAP block group. These results are similar to the present study.

PONV (postoperative nausea and vomiting)

- The mean PONV was less and statistically significant in group III when compared with group I and group II. On intergroup comparison there is no statistically significant difference between group I and group II.

Carney et al compared nausea scores They observed for 48 hrs in which 16/24 members in TAP block group and 16/26 in control group had nausea. no significant difference in nausea between two groups. This study results are similar to present study.

CONCLUSION

In conclusion the addition of dexamethasone as an adjuvant to ropivacaine in TAP block

- Prolongs the time for first rescue analgesia
 - Decreases VAS scores
 - Decreases requirement of total rescue analgesia for 48 hours post operatively
 - Decreases incidence of postoperative nausea and vomiting.
- So as we recommend the use of dexamethasone as an adjuvant with local anaesthetics in TAP block.

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