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**Original Research Article**

# Clinical evaluation of ultrasound guided transversus abdominis plane block versus subcutaneous infiltration of bupivacaine 0.125% for post-operative analgesia in patients undergoing lower abdominal surgeries.

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**ABSTRACT**

**Background & Aims-** Postoperative analgesia is an important part of the anaesthetic care. For abdominal surgery, both subcutaneous infiltration and TAP block target on relieving somatic pain. Subcutaneous anaesthetic wound infiltration is easy to perform with low risk. As the advancement of ultrasound technology, performing the TAP block also becomes easier, safer and more accurate. This study is to compare the postoperative pain score, opioid consumption, side effects, and hemodynamic changes between these two analgesic methods in patients undergoing lower abdominal surgery. To compare bilateral ultrasound guided transversus abdominis plane (TAP) block with subcutaneous infiltration of local anaesthetic drug for analgesia after lower abdominal surgeries under general anesthesia.

**Study Design**: -This study was an Observational hospital based study.

**Materials and methods**- This prospective observational study, conducted at Gandhi Medical College and associated hospitals, bhopal, After obtaining Institute Ethics Committee approval and written informed consent, 60 participants were included in the study who were undergoing lower abdominal surgeries, 30 participants received 20 ml 0.125 bupivacaine (P) as bilateral ultrasound guided TAP block and 30 participants received 20 ml, 0.125% bupivacaine (P) as subcutaneous wound infiltration at the end of surgery performed under general anesthesia. The primary outcomes were pain scores at 1,2,4,6, 8,12 and 24 hours postoperatively and cumulative tramadol consumption over 24 hours. The secondary outcomes were time to first rescue analgesic, dose of rescue analgesic use and opioids-related side-effects.

**Statistical Analysis**: The data entry was done in the Microsoft EXCEL spreadsheet and the final analysis was done with the use of Statistical Package for Social Sciences (SPSS) software. For statistical significance, p value of less than 0.05 was considered statistically significant.

**Results:** The mean time to first analgesia request in minutes were longer in TAP-block with 6.68±2.2 hours compared to mean time of 4.2±1.5 hours in the subcutaneous infiltration group. There were also statistical significant difference with regard to mean Tramadol consumption within 24 h between the two group with P-value<0.001. The mean post operative pain score in PACU at different intervals were significantly lower in TAP block group.

**Conclusion:** The first analgesia request was significantly longer in addition to less total analgesia consumption in the TAP-block group when compared to subcutaneous infiltration group. Furthermore the TAP-block showed extended pain relief with lower pain VNRS but for immediate and early postoperative pain relief subcutaneous infiltration group recorded lower pain VNRS score than the TAP-block group.

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**Keywords**- Transverse Abdominis Plane (TAP) block, subcutaneous infiltration, post operative analgesia, VNRS score

## 1. INTRODUCTION

Post-operative pain management is a major issue as it is critical for patient satisfaction and a timely discharge, for better outcomes and to reduce health care costs[1]. Knowledge of pain pathways and mechanisms related to there action has helped to the development of a variety of drugs that alleviate pain[2]. Transversus abdominis plane (TAP) block has become an effective postoperative analgesia technology after Rafi formally described it in 2001[3]. It is safe and effective adjunct for proving postoperative analgesia in variety of general[4,5] urological[9], plastic[10,11] gynecological[6,7,8], as well as pediatric surgery[12,13] and is a part of the multimodal anesthetic approach after lower abdominal surgeries. Ultrasound guided Transverse Abdominis Plane block has an advantage of real-time imaging of injected local anesthetic spread hereby improving both safety and efficacy of the block[14]. However, subcutaneous infiltration of local anesthetics into the incision, is still the major method used for postoperative analgesia in some areas. This study intends to compare ultrasound-guided transversus abdominis plane block with local infiltration for post-operative analgesic efficacy and total dose of opioid which is required in 24 hours period.

## 2. MATERIAL AND METHODS

In this prospective, observational study, we included all American Society of Anaesthesiologist (ASA) physical status I and II patients of either sex between the ages of 16 and 50 years undergoing lower abdominal surgeries under general anaesthesia after obtaining informed consent of participants. All patients were taught how to define pain using the Visual Numerical Rating Scale (VNRS) 0–10; 0 = no pain, 1–3 = mild pain, 4–6 = moderate pain, and 7–10 = severe pain.

In preoperative waiting room detailed history and physical examination was done. On arrival of patient to operating room standard anaesthesia monitors like Pulse oximetry, noninvasive BP, and ECG were connected and baseline values of Heart Rate, Blood Pressure, SPO2 were recorded. Peripheral intravenous access was secured. Patients in both the groups were explained about the procedures and post-operative follow up. The patients were premedicated and general anaesthesia induced with inj. fentanyl 2mcg/kg, inj. thiopentone 3-5 mg/kg, or inj. Propofol 2-3mg/kg, and endotracheal intubation with cuffed ET Tube facilitated with muscle relaxant inj. Atracurium 0.5mg/kg i.v. Intraoperatively both groups received inj. paracetamol 1g intravenous infusion.

The Patients were randomly allocated to undergo ultrasound guided bilateral Tranversus Abdominis Plane block with 20 ml of 0.125% bupivacaine On each side and subcutaneous infiltration with 20 ml of 0.125% bupivacaine administered by the surgeon before Extubation. In group A, Linear array ultrasound probe with 6-13 MHZ high frequency was used. The skin was disinfected under sterile technique for right TAP block, The USG probe was placed in the midline of abdomen 2 cm below the xiphisternum and moved laterally towards right along the subcostal margin to the anterior axillary line. The transversus abdominis muscle was identified and18g needle was then guided in-plane, to a point between the internal oblique and transverse abdominis muscles within the neurovascular facial plane, following carefull aspiration 20 ml of 0.125% bupivacaine was deposited within the plane. Bilaterally follows the same procedure.

ISSN 2515-8260 Volume 10, Issue 03, 2023

In group B, the subcutaneous infiltration was performed by a surgeon using 20 ml of 0.125% bupivacaine was injected.

After observing closely for a signs of local anaesthetic toxicity and post-op complications, patients were shifted to the post-operative ward. Presence and severity of pain were assessed using VNRS scores immediately after shifting out of OT, 1,2,4,6,12,24 hours post-operatively. Vitals BP, Heart rate, SPO2, was also recorded up to 8 hours in the immediate postoperative period after TAP block and Subcutaneous infiltration. Tramadol 50 mg i.v. was used as rescue analgesia whenever VNRS score was >4. Time for first rescue analgesia demand, and total dose of tramadol as rescue analgesia to the patient was noted.

**Statistical Analysis:**

The presentation of the Categorical variables was done in the form of number and percentage (%). On the other hand, the quantitative data were presented as the means ± SD. The following statistical tests were applied for the results:

1. The comparison of the variables which were quantitative in nature were analysed using Independent t test.
2. The comparison of the variables which were qualitative in nature were analysed using Chi-Square test. If any cell had an expected value of less than 5 then Fisher's exact test was used.

The data entry was done in the Microsoft EXCEL spreadsheet and the final analysis was done with the use of Statistical Package or Social Sciences (SPSS) software, IBM manufacturer, Chicago, USA, ver 25.0.

For statistical significance, p value of less than 0.05 was considered statistically significant.

ISSN 2515-8260 Volume 10, Issue 03, 2023

## 3. RESULTS

Demographic and perioperative characteristics:
Sixty patients (30 patients in each group) were analyzed based on whether they received TAP-block or subcutaneous infiltration of local anaesthetics at the wound site after lower abdominal procedures at end of the surgery. There was no statistical significant difference between the two groups in demographic and perioperative characteristics such as age, sex, ASA classification and mean weight between the two groups.

**Table 1: Distribution according to study group**

| **Study Groups** | | **No. of Patients** | **%** |
|---|---|---|---|
| Group A | Subcutaneous Infiltration | 30 | 50% |
| Group B | Tap Block | 30 | 50% |
| Total | | 60 | 100% |

**Table 2: Age**

| **Age Group (years)** | **Group** | | | | **Total** | |
|---|---|---|---|---|---|---|
| | **Subcutaneous Infiltration** | | **Tap Block** | | | |
| | **No.** | **%** | **No.** | **%** | **No.** | **%** |
| 20-30 | 6 | 20.0% | 2 | 6.7% | 8 | 13.3% |
| 31-40 | 8 | 26.7% | 8 | 26.7% | 16 | 26.7% |
| 41-50 | 16 | 53.3% | 20 | 66.7% | 36 | 60.0% |
| Total | 30 | 100.0% | 30 | 100.0% | 60 | 100.0% |
| Mean±SD | 41.20 ±8.99 | | 43.60± 7.46 | | 42.40± 8.28 | |
| Range | 22-50 | | 20-50 | | 20-50 | |

| | | | |
|---|---|---|---|
| t value | -1.125, df = 58 | | |
| P value | .265, Not Significant | | |

**Table 3: Sex**

| Sex | Group | | | | Total | |
|---|---|---|---|---|---|---|
| | Subcutaneous Infiltration | | Tap Block | | | |
| | No. | % | No. | % | No. | % |
| Male | 19 | 63.3% | 20 | 66.7% | 39 | 65.0% |
| Female | 11 | 36.7% | 10 | 33.3% | 21 | 35.0% |
| Total | 30 | 100.0% | 30 | 100.0% | 60 | 100.0% |

Pearson Chi-Square = .073, df = 1, p value = .787, Not Significant

**Table 4: Comparison Mean Weight between the two groups**

| Group | No | Mean±SD | 't' value | df | P value |
|---|---|---|---|---|---|
| Group A | 30 | 63.13±4.64 | .647 | 58 | .520 |
| Group B | 30 | 62.37±4.53 | | | |

**Unpaired 't' test applied. P value <0.05 was taken as statistically significant**

**Table 5: ASA Grading**

| ASA | Group | | Total |
|---|---|---|---|
| | Subcutaneous Infiltration | Tap Block | |

| Grading | | | | | | |
|---|---|---|---|---|---|---|
| | No. | % | No. | % | No. | % |
| 1 | 13 | 43.3% | 12 | 40.0% | 25 | 41.7% |
| 2 | 17 | 56.7% | 18 | 60.0% | 35 | 58.3% |
| Total | 30 | 100.0% | 30 | 100.0% | 60 | 100.0% |

Pearson Chi-Square = .069, df = 1, p value = .793, Not Significant

Significant difference was seen in heart rate(per minute) immediately after shifting out of OT, at 60 minutes, at 2 hours, and at 8 hours between subcutaneous infiltration group and TAP block group.(p value <.05)

**Table 6: Comparison of Mean Heart Rate between the two groups**

| Time Interval | Subcutaneous Infiltration | Tap Block | 't' value | P value |
|---|---|---|---|---|
| Immediately after shifting out of OT | 79.30±4.55 | 72.63±3.09 | 6.631, df = 58 | .000* |
| At 60 minutes | 76.50±5.18 | 71.87±3.10 | 4.200, df = 58 | .000* |
| At 2 Hours | 74.03±5.06 | 70.00±4.06 | 3.399, df = 58 | .001* |
| At 8 Hours | 74.10±4.71 | 65.47±4.80 | 7.024, df = 58 | .000* |

**Unpaired 't' test applied. P value <0.05 was taken as statistically significant**

No significant difference was seen in mean arterial pressure immediately shifting out of OT.(p value =0.749) but difference between the two groups was significant at 60 minutes, at 2 hours, and at 8 hours post operatively.(p value <.05)

**Table 7: Comparison of Mean Arterial Pressure between the two groups**

| Time Interval | Subcutaneous Infiltration | Tap Block | 't' value | P value |
|---|---|---|---|---|
| Immediately after shifting out of OT | 93.35±2.58 | 93.15±2.20 | .322, df=58 | .749 |
| At 60 minutes | 91.31±2.35 | 89.66±2.85 | 2.433, df=58 | .018 |
| At 2 Hours | 91.02±2.65 | 86.66±2.84 | 6.132, df=58 | .000 |
| At 8 Hours | 89.55±2.53 | 85.93±2.29 | 5.800, df=58 | .000 |

**Unpaired 't' test applied. P value <0.05 was taken as statistically significant**

No significant difference was seen in VNRS score at 1 hr post operatively.(p value =0.313) but significant difference between the two groups was significant at 2 hours, 4 hours, 6 hours, 12 hours and 24 hours post operatively.(p value <.05).

**Table 8: Post op VNRS score at 1 hour**

| VNRS score at 1 hour | Group | | | | Total | |
|---|---|---|---|---|---|---|
| | Subcutaneous Infiltration | | Tap Block | | | |
| | No. | % | No. | % | No. | % |

| | | | | | | |
|---|---|---|---|---|---|---|
| 0 | 29 | 96.7% | 30 | 100.0% | 59 | 98.3% |
| 1 | 1 | 3.3% | 0 | 0.0% | 1 | 1.7% |
| Total | 30 | 100.0% | 30 | 100.0% | 60 | 100.0% |

**Pearson Chi-Square = 1.017, df = 1, p value = .313, Not Significant**

**Table 9: Post op VNRS score at 2 hours**

| **VNRS score at 2 hours** | **Group** | | | | **Total** | |
|---|---|---|---|---|---|---|
| | **Subcutaneous Infiltration** | | **Tap Block** | | | |
| | **No.** | **%** | **No.** | **%** | **No.** | **%** |
| 0 | 1 | 3.3% | 16 | 53.3% | 17 | 28.3% |
| 1 | 11 | 36.7% | 13 | 43.3% | 24 | 40.0% |
| 2 | 18 | 60.0% | 1 | 3.3% | 19 | 31.7% |
| Total | 30 | 100.0% | 30 | 100.0% | 60 | 100.0% |

**Pearson Chi-Square = 28.612, df = 2, p value = .000, Significant**

**Table 10: Post op VNRS score at 4 hours**

| **VNRS score at 4 hours** | **Group** | | | | **Total** | |
|---|---|---|---|---|---|---|
| | **Subcutaneous Infiltration** | | **Tap Block** | | | |
| | **No.** | **%** | **No.** | **%** | **No.** | **%** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 0 | 0 | 0.0% | 3 | 10.0% | 3 | 5.0% |
| 1 | 0 | 0.0% | 11 | 36.7% | 11 | 18.3% |
| 2 | 13 | 43.3% | 14 | 46.7% | 27 | 45.0% |
| 3 | 17 | 56.7% | 2 | 6.7% | 19 | 31.7% |
| Total | 30 | 100.0% | 30 | 100.0% | 60 | 100.0% |

**Pearson Chi-Square = 25.879, df = 3, p value = .000, Significant**

**Table 11: Post op VNRS score at 6 hours**

| VNRS score at 6 hours | Group | | | | Total | |
|---|---|---|---|---|---|---|
| | Subcutaneous Infiltration | | Tap Block | | | |
| | No. | % | No. | % | No. | % |
| 1 | 0 | 0.0% | 1 | 3.3% | 1 | 1.7% |
| 2 | 1 | 3.3% | 12 | 40.0% | 13 | 21.7% |
| 3 | 8 | 26.7% | 12 | 40.0% | 20 | 33.3% |
| 4 | 10 | 33.3% | 4 | 13.3% | 14 | 23.3% |
| 5 | 7 | 23.3% | 1 | 3.3% | 8 | 13.3% |
| 6 | 4 | 13.3% | 0 | 0.0% | 4 | 6.7% |
| Total | 30 | 100.0% | 30 | 100.0% | 60 | 100.0% |

**Pearson Chi-Square = 22.179, df = 5, p value = .000, Significant**

**Table 12: Post op VNRS score at 12 hours**

| VNRS score at 12 hours | Group | | | | Total | |
|---|---|---|---|---|---|---|
| | Subcutaneous Infiltration | | Tap Block | | | |
| | No. | % | No. | % | No. | % |
| 1 | 0 | 0.0% | 2 | 6.7% | 2 | 3.3% |
| 2 | 0 | 0.0% | 7 | 23.3% | 7 | 11.7% |
| 3 | 3 | 10.0% | 9 | 30.0% | 12 | 20.0% |
| 4 | 9 | 30.0% | 7 | 23.3% | 16 | 26.7% |
| 5 | 8 | 26.7% | 4 | 13.3% | 12 | 20.0% |
| 6 | 6 | 20.0% | 1 | 3.3% | 7 | 11.7% |
| 7 | 4 | 13.3% | 0 | 0.0% | 4 | 6.7% |
| Total | 30 | 100.0% | 30 | 100.0% | 60 | 100.0% |

**Pearson Chi-Square = 21.155, df = 6, p value = .002, Significant**

**Table 13: Post op VNRS score at 24 hours**

| VNRS score at 24 hours | Group | | | | Total | |
|---|---|---|---|---|---|---|
| | Subcutaneous Infiltration | | Tap Block | | | |
| | No. | % | No. | % | No. | % |

| | | | | | | |
|---|---|---|---|---|---|---|
| 2 | 0 | 0.0% | 1 | 3.3% | 1 | 1.7% |
| 3 | 2 | 6.7% | 6 | 20.0% | 8 | 13.3% |
| 4 | 7 | 23.3% | 19 | 63.3% | 26 | 43.3% |
| 5 | 13 | 43.3% | 3 | 10.0% | 16 | 26.7% |
| 6 | 8 | 26.7% | 1 | 3.3% | 9 | 15.0% |
| Total | 30 | 100.0% | 30 | 100.0% | 60 | 100.0% |

**Pearson Chi-Square = 20.233, df = 4, p value = .000, Significant**

The mean time to first analgesia request in minutes were longer in TAP-block with 6.68±2.2 hours compared to mean time of 4.2±1.5 hours in the subcutaneous infiltration group. There were also statistical significant difference with regard to mean Tramadol consumption within 24 h between the two group with P-value<0.001.

**Table 14: Comparison Mean Time of First Rescue Analgesia (in hours) the two groups**

| Group | No | Mean±SD | 't' value | df | P value |
|---|---|---|---|---|---|
| Group A | 30 | 4.217±1.506 | -4.990 | 58 | .000 |
| Group B | 30 | 6.683±2.249 | | | |

**Unpaired 't' test applied. P value <0.05 was taken as statistically significant**

**Table 15: Total dose of tramadol (mg)**

| Total dose of tramadol (mg) | Group | | | | Total | |
|---|---|---|---|---|---|---|
| | Subcutaneous Infiltration | | Tap Block | | | |
| | No. | % | No. | % | No. | % |
| 0 | 0 | 0.0% | 1 | 3.3% | 1 | 1.7% |

| | | | | | | |
|---|---|---|---|---|---|---|
| 50 | 4 | 13.3% | 15 | 50.0% | 19 | 31.7% |
| 100 | 7 | 23.3% | 10 | 33.3% | 17 | 28.3% |
| 150 | 13 | 43.3% | 4 | 13.3% | 17 | 28.3% |
| 200 | 6 | 20.0% | 0 | 0.0% | 6 | 10.0% |
| Total | 30 | 100.0% | 30 | 100.0% | 60 | 100.0% |

Pearson Chi-Square = 18.663, df = 4, p value = .001, Significant

## 4. DISCUSSION

This study was conducted to evaluate the efficacy of USG guided TAP block in prolonging the duration of postoperative analgesia when compared with subcutaneous infiltration of local anaesthetic in lower abdominal surgeries done under general anaesthesia. In this study, we found that USG-guided TAP block with 0.125% Bupivacaine has better post-operative pain relief, reduced rescue analgesic consumption and longer duration of pain relief when compared with wound site infiltration of local anaesthetic.
There is no evidence of age bias and an average weight and body mass in the two groups weren't significantly different. ASA grade I and II were included in the study and were comparable between both the groups making this a insignificant factor in the study.

TAP block had lower VNRS scores at 2, 4, 6, 12 and 24 hours postoperatively, but there was no significant difference at 1 hour which might indicate that both subcutaneous infiltration and TAP block has almost similar analgesic effect initially. This may also indicate that the subcutaneous infiltration has a brief profound analgesic effect which decreases in intensity more than that with TAP block. The results of this study are consistent with the observations reported by Ortiz and other researchers, that the efficacy of TAP is of longer duration than that of subcutaneous infiltration[15]. One of the reason for the short duration of action of wound infiltration may be that it could result in rapid drug absorption as it is infiltrated in the subcutaneous plane[16], whereas, the local anesthetics is injected into the space between the muscles that contains abundant nerve branches in case of TAP block, where thoracolumbar nerves run from the T6 to L1 spinal roots, which control the sense of the whole anterolateral abdominal wall, making the block more efficient[17].
Decrease in hemodynamic parameters was long lasting in TAP block, which was statistically significant when compared with local infiltration, suggesting greater reduction of stress response due to pain in case of TAP block.
The Post operative Nausea Vomiting (PONV) incidence was not significant between the two groups in our study. Also, no serious complications were reported following two groups. Although TAP block is a less invasive method, risk of liver, bowel, nerve injuries and intraperitoneal and intravascular injection following TAP block have been reported.
The limitation of aforementioned study was the absence of control group so as to know more accurate impact of TAP block and wound site skin infiltration on the reduction of post-operative pain scores and opioid sparing effects. Further research can be made to compare wound infiltration and TAP block by increasing the dose for the infiltration group and adding a controlled group in this study.

## 5. CONCLUSION

Efficacy of TAP block is comparable to subcutaneous infiltration for short-term analgesia; but it could also provide a better long-lasting analgesia after lower abdominal surgeries for a duration of 24 hours. Continuous TAP block using a catheter might be a better option for longer durations of analgesia and a topic of research for future. Also, relative efficacy of epidural analgesia and TAP block should be determined for better outcomes.

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Nil.

**Conflicts of interest**
There are no conflicts of interest.

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