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**ORIGINAL RESEARCH**

# A Comparative Study of Tap, Dual Tap and Ilioinguinal-Iliohypogastric Nerve Blocks for Postoperative Analgesia in Inguinal Hernioplasty

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**ABSTRACT**

**Aim & Objectives:** Open inguinal hernia repair is a commonly performed procedure which is associated with substantial postoperative pain. The objective of this study is to compare the efficacy of TAP, Dual TAP and Ilioinguinal-Iliohypogastric nerve blocks in post op analgesia after inguinal hernioplasty, first rescue analgesia requirement in the three groups and total analgesic consumption over 24 hours in the three groups. **Methods:** In this prospective comparative study 60 patients undergoing elective unilateral inguinal hernioplasty under SAB were randomly assigned in three equal groups. Group T received TAP block with 20ml (0.25%) bupivacaine, Group D received both TAP & IL-IH block with 15ml (0.25%) bupivacaine each and group I received Ilioinguinal-Iliohypogastric block with 15ml (0.25%) bupivacaine before SAB given for surgery. TAP was given by landmark technique and IL-IH block by PNS guided technique using stimuplex needle 50mm. **Results:** There is no significant difference in mean age, pulse rate, spo2, systolic, diastolic and mean arterial pressure in all the three groups. The mean VAS with rest and movement at 2 hours, 6 hours, 12 hours and 24 hours was significantly more among Ilioinguinal-Iliohypogastric and TAP groups compared to Dual TAP group. Similarly the mean PCM (mg) and Tramadol (mg) usage was significantly more among Ilioinguinal-Iliohypogastric and TAP groups compared to Dual TAP group. **Conclusion:** Dual TAP block is significantly provide better post op analgesia compared to TAP and illioinguinal-illiohypogastric block. Also TAP and IL/IH are equivocal in relieving postop pain after herniolasty.

**Keywords:** TAP block, Ilioinguinal-Iliohypogastric nerve block, hernioplasty, SAB, PNS.



## INTRODUCTION

Hernioplasty is one of the common procedures performed across the world and is associated with pain. The incidence is reported to be 11 to 200/10,000 populations in the age group of 16-24 years and over 75 years, respectively.[1]

Open inguinal hernia repair is a commonly performed procedure [1] which is associated with substantial postoperative pain.[2] Inguinal hernia repair usually performed under spinal anaesthesia in adults. The incidence of postoperative pain after inguinal hernia repair varies from 0-37%. Acute postoperative pain reduces the patient quality of life greatly and results in chronic persistent pain.[3] Pain after hernia repair can also be due to neuropathic etiology, resulting from nerve injury or compression and may be due to non-neuropathic cause resulting from scar tissue, mechanical pressure or meshomas.[1]

A promising approach to the provision of postoperative analgesia after abdominal incision is to block the sensory nerve supply to the anterior abdominal wall.[4,5] However, the clinical utility of current approaches to the blockade of these nerve afferents, such as abdominal field blocks, is limited and the degree of block achieved can be unpredictable.

The anterolateral abdominal wall is innervated by thoracolumbar nerves T7 to L1 which emanates from the anterior rami of the spinal nerves and thereby traversing through the plane between the layers of the transversus abdominis and internal oblique muscles of the abdomen. This plane is known as TAP.[6]

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The Iliohypogastric nerve (L1) divides between the internal oblique and transversus abdominis near the iliac crest supplying part of the skin over the inguinal region, gluteal region, and hypogastric region.[6]The Ilioinguinal nerve (L1) supplies the upper and medial part of the thigh and also part of the skin covering the genitalia. TAP block and IIIH nerve blocks are regional anesthetic techniques in which local anesthetics are deposited to block the sensory nerves supplying the anterior abdominal wall. These nerve block techniques offer great degree of pain relief in post-operative period and thus facilitate early ambulation and discharge.[6]

Since there are no conclusive studies favouring either of the two afore mentioned techniques, the present study was conducted to compare the analgesic efficacy of TAP, Dual TAP and Ilioinguinal/Iliohypogastric nerve blocks using VAS score in inguinal hernioplasty. Also in this study efficacy of recently advancing PNS guided IL/IH block was also assessed in comparison groups.

## MATERIALS & METHODS

After institutional and ethical committee approval and written informed consent, this prospective comparative study was conducted in department of anaesthesiology, critical care, pain and palliative medicine, Dr. Susheela Tiwari Hospital, GMC, Haldwani, Nanital, Uttarakhand. A sample size of 60 patients undergoing elective unilateral inguinal hernioplasty were included in the study. Patients who fulfill inclusion criteria of belonging to ASA physical status grade I & II between age 18 to 80years and BMI <25 and undergoing surgery under spinal anaesthesia and not having any exclusion criteria of ASA physical status grade III & IV, pregnancy, morbid obesity, liver &kidney disease, psychiatric illness, were randomly divided into three groups (20 patients each group) group T, group D & group I.

The anaesthetic technique was standardized in all the patients. In the operating room, intravenous access was secured and standard monitors were attached including electrocardiogram (ECG), noninvasive blood pressure (NIBP) and pulse oximeter SpO2.

A standard anaesthesia protocol was followed according to the group to which the patient is allocated using a computer generated sequence of numbers.

Group T (n= 20) patients were administered TAP block, with the patient in a supine neutral position and appropriate identification of the border i.e subcostal margins and iliac crest a short bevelled 20Gaze needle was inserted between subcostal margin and iliac crest. The needle was inserted perpendicular to the skin, the two pops was felt. The first through the fascial extension of the external oblique and second through the fascial extension of the internal oblique. After negative aspiration 15-20ml of 0.25% bupivacaine was injected.

Group D (n = 20), patients were administered TAP block with the patient in a supine neutral position and appropriate identification of the border i.e., subcostal margins and iliac crest a short beveled 20Gaze needle was inserted between subcostal margin and iliac crest. The needle was inserted perpendicular to the skin, the two pops were felt. The first through the fascial extension of the external oblique and second through the fascial extension of the internal oblique. After negative aspiration 10-15ml of 0.25% bupivacaine was injected. After that patient was administered IIN/IHN block using a stimuplex needle(50mm size) (BBraun) which was inserted at a point 5cm cranial and 5cm posterior to the anterior superior iliac spine. Nerve stimulator was set at 1mA, 0.2ms, 2Hz current and once needle pierced IO fascia, We observed for the twitches in the lower abdominal wall and the inguinal region (T10 to L1 territory). Current was then reduced to 0.5mA, and after twitching fades, 15-20ml of 0.25% bupivacaine is injected after negative aspiration at every 5ml aliquots.

Group I (n =20), patient was administered IIN/IHN block using a stimuplex needle(50mm size) (BBraun) which was inserted at a point 5cm cranial and 5cm posterior to the anterior superior iliac spine. Nerve stimulator was set at 1mA, 0.2ms, 2Hz current and once needle pierced IO fascia, We observed for the twitches in the lower abdominal wall and the inguinal region (T10 to L1 territory). Current was then reduced to 0.5mA, and after twitching fades, 15-20ml of 0.25% bupivacaine is injected after negative aspiration at every 5ml aliquots.

After administration of blocks, Subarachnoid block was given to all patients by 25Gquinkes needle (hyperbaric bupivacaine 0.5% 15mg) was given either at L2-L3 or at L4-L5.

Standardised post-operative analgesia protocol was followed in all the three groups i.e. inj. Diclofenac1mg/kg iv BD and inj Tramadol 2mg/kg TDS.

Pain intensity was measured using VAS score(1–10) at 0hr, 2hr, 6hr,12h, 24hr at rest and at 2hr, 6hr, 12hr and 24hr. If patient's VAS Score goes >4, rescue analgesia-1 was provided in form of Inj. PCM 1000mg in 100 ml infusion, even thenifpatient complains of pain VAS >4 in next visiting hour, Inj. tramadol 1-2mg/kg i.v. was given as rescue analgesia.

## OBSERVATION & RESULTS

In our study physical characteristics i.e. age & BMI were comparable in all the three groups. Hemodynamic parameters i.e. heart rate, mean blood pressure & saturation was also compared post-operatively at 0, 2, 6, 12 & 24 hours and no significant difference was found in all three groups.

The VAS score at rest & with movement was assessed immediately post-operatively followed by at 2, 6, 12 and 24 hours after surgery and compared in TAP, Dual TAP and Ilioinguinal-Iliohypogastric groups using the one-way ANOVA test. The mean VAS with

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rest at 2 hours, 6 hours, 12 hours and 24 hours was significantly more among Ilioinguinal-Iliohypogastric and TAP groups compared to Dual TAP group. The findings were consistent with movement also with P-value <0.05.

The mean PCM (mg) and Tramadol (mg) consumption was compared between TAP, Dual TAP and Ilioinguinal-Iliohypogastric groups using the one-way ANOVA test. The total amount of rescue analgesia consumption in group T, Group D & group I was PCM (first rescue analgesia) 2000±00, 1666±483, 1952±511 and tramadol (second rescue analgesia) 71.33±7.05, 61.50±5.98, 63.33±2.89 respectively. The mean PCM (mg) and Tramadol (mg) consumption was significantly more among Ilioinguinal-Iliohypogastric and TAP groups compared to Dual TAP group.

First rescue analgesia consumption in group T, group D & group I was taken by 6 patients (28.6%), 4 patients (19%), 5 patients (23.8%) respectively at 6$^{th}$ hour in post op period. Then at 12 hour 15 patients (71.4%) in group T, 10 patients (47.6%) in group D and 13 patients (61.9%) in group I required rescue analgesia. And at 24 hour all patients of each group required rescue analgesia. Thus time of 1$^{st}$ Rescue analgesia at 6 hours and 12 hours was significantly more among Ilioinguinal-Iliohypogastric and TAP groups compared to Dual TAP group.

Second rescue analgesia was required at 12 hour by 6 patients (28.6%) in group T, 4 patients (19%) on group D and 3 patients (14.3%)in group I suggesting that 2$^{nd}$ Rescue analgesia at 12 hours was significantly more among TAP group compared to Ilioinguinal-Iliohypogastric and Dual TAP groups.

| | Age | | | |
|---|---|---|---|---|
| | **Mean** | **Std. Deviation** | **F-Value** | **p-Value** |
| TAP | 40.90 | 14.94 | 1.816 | 0.172 |
| Dual TAP | 47.33 | 20.28 | | |
| Ilioinguinal-Iliohypogastric | 51.52 | 18.93 | | |

**Table 1: Comparison of mean age in TAP, Dual TAP and IL/IH group**

| | **Mean** | **Std. Deviation** | **Minimum** | **Maximum** | **F-Value** | **p-Value** |
|---|---|---|---|---|---|---|
| **TAP** | 23.11 | 1.32 | 20.55 | 26.30 | 1.606 | 0.106 |
| **Dual TAP** | 22.99 | 1.68 | 20.83 | 26.67 | | |
| **Ilioinguinal-Iliohypogastric** | 24.44 | 1.63 | 21.05 | 28.65 | | |
| **Total** | 23.51 | 1.66 | 20.55 | 28.65 | | |

**Table 2: Comparison of BMI (body mass index) in TAP, Dual TAP and IL/IH block group**

| **MAP** | | **Mean** | **Std. Deviation** | **F-value** | **p-Value** | **Post-HOC Comparisons** |
|---|---|---|---|---|---|---|
| 0 hour | TAP | 88.48 | 9.64 | 1.997 | 0.145 | N/A |
| | Dual TAP | 93.27 | 8.46 | | | |
| | Ilioinguinal-Iliohypogastric | 93.43 | 9.14 | | | |
| 2 hours | TAP | 88.67 | 9.99 | 1.826 | 0.17 | N/A |
| | Dual TAP | 93.65 | 7.57 | | | |
| | Ilioinguinal-Iliohypogastric | 92.98 | 9.77 | | | |
| 6 hours | TAP | 90.51 | 9.33 | 0.903 | 0.411 | N/A |
| | Dual TAP | 93.17 | 7.22 | | | |
| | Ilioinguinal-Iliohypogastric | 93.78 | 8.49 | | | |
| 12 hours | TAP | 91.65 | 8.76 | 0.357 | 0.701 | N/A |
| | Dual TAP | 93.78 | 7.48 | | | |
| | Ilioinguinal-Iliohypogastric | 92.86 | 8.27 | | | |
| 24 hours | TAP | 91.65 | 8.62 | 0.362 | 0.698 | N/A |
| | Dual TAP | 93.84 | 8.23 | | | |
| | Ilioinguinal-Iliohypogastric | 93.05 | 8.49 | | | |

**Table 3: Comparison of MAP (mean arterial pressure) in TAP group, dual TAP and IL/IH block**

| **Pulse rate (beats/min)** | | **Mean** | **Std. Deviation** | **F-Value** | **p-Value** | **Post-HOC Comparisons** |
|---|---|---|---|---|---|---|
| 0 hour | TAP | 75.71 | 9.89 | 0.804 | 0.452 | N/A |
| | Dual TAP | 76.48 | 10.31 | | | |
| | Ilioinguinal-Iliohypogastric | 79.43 | 9.88 | | | |

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| | | | | | | |
|---|---|---|---|---|---|---|
| 2 hours | TAP | 75.05 | 10.17 | 1.088 | 0.343 | N/A |
| | Dual TAP | 77.14 | 9.39 | | | |
| | Ilioinguinal-Iliohypogastric | 79.52 | 9.94 | | | |
| 6 hours | TAP | 75.24 | 9.33 | 0.666 | 0.518 | N/A |
| | Dual TAP | 77.52 | 8.48 | | | |
| | Ilioinguinal-Iliohypogastric | 78.48 | 10.16 | | | |
| 12 hours | TAP | 75.33 | 9.47 | 0.387 | 0.681 | N/A |
| | Dual TAP | 76.86 | 10.40 | | | |
| | Ilioinguinal-Iliohypogastric | 78.00 | 9.65 | | | |
| 24 hours | TAP | 75.33 | 8.66 | 0.362 | 0.698 | N/A |
| | Dual TAP | 76.38 | 9.44 | | | |
| | Ilioinguinal-Iliohypogastric | 77.71 | 9.17 | | | |

**Table 4: Comparison of pulse rate in TAP group, dual TAP and IL/IH block**

| VAS at rest | | Mean | Std. Deviation | F-Value | p-Value | Post-HOC Comparisons |
|---|---|---|---|---|---|---|
| 0 hour | TAP | 0.00 | 0.00 | 0.000 | 1.000 | N/A |
| | Dual TAP | 0.00 | 0.00 | | | |
| | Ilioinguinal-Iliohypogastric | 0.00 | 0.00 | | | |
| 2 hours | TAP | 1.43 | 0.68 | 8.632 | 0.001 | T, I> D |
| | Dual TAP | 0.81 | 0.51 | | | |
| | Ilioinguinal-Iliohypogastric | 1.38 | 0.54 | | | |
| 6 hours | TAP | 3.24 | 0.62 | 2.075 | 0.034* | T, I > D |
| | Dual TAP | 2.90 | 0.67 | | | |
| | Ilioinguinal-Iliohypogastric | 3.29 | 0.75 | | | |
| 12 hours | TAP | 4.67 | 0.73 | 9.147 | 0.001* | T, I> D |
| | Dual TAP | 3.81 | 0.75 | | | |
| | Ilioinguinal-Iliohypogastric | 4.76 | 0.83 | | | |
| 24 hours | TAP | 5.33 | 0.73 | 4.810 | 0.012* | T, I > D |
| | Dual TAP | 4.71 | 0.56 | | | |
| | Ilioinguinal-Iliohypogastric | 5.24 | 0.73 | | | |

**Table 5: Comparison of mean VAS in TAP group, dual TAP and IL/IH block**

| VAS with movement | | Mean | Std. Deviation | F-Value | p-Value | Post-HOC Comparisons |
|---|---|---|---|---|---|---|
| 2 hours | TAP | 2.48 | 0.51 | 5.278 | 0.008* | T, I > D |
| | Dual TAP | 1.90 | 0.62 | | | |
| | Ilioinguinal-Iliohypogastric | 2.52 | 0.74 | | | |
| 6 hours | TAP | 4.14 | 0.57 | 4.952 | 0.010* | T, I > D |
| | Dual TAP | 3.62 | 0.50 | | | |
| | Ilioinguinal-Iliohypogastric | 4.19 | 0.64 | | | |
| 12 hours | TAP | 4.90 | 0.62 | 11.927 | 0.001* | T, I > D |
| | Dual TAP | 4.33 | 0.48 | | | |
| | Ilioinguinal-Iliohypogastric | 4.81 | 0.54 | | | |
| 24 hours | TAP | 5.48 | 0.60 | 15.363 | 0.001* | T, I > D |
| | Dual TAP | 4.52 | 0.68 | | | |
| | Ilioinguinal-Iliohypogastric | 5.38 | 0.60 | | | |

**Table 6: Comparison of VAS with movement in TAP group, dual TAP and IL/IH block**

| | | Mean | Std. Deviation | F-value | p-value | Post-hoc Comparisons |
|---|---|---|---|---|---|---|
| PCM (mg) | TAP | 2000.00 | 0.00 | 7.596 | 0.001* | T, I > D |
| | Dual TAP | 1666.67 | 483.05 | | | |
| | Ilioinguinal-Iliohypogastric | 1952.38 | 511.77 | | | |
| Tramadol (mg) | TAP | 71.33 | 7.005 | 3.330 | 0.038* | T, I > D |
| | Dual TAP | 61.50 | 5.972 | | | |
| | Ilioinguinal-Iliohypogastric | 63.33 | 2.887 | | | |

**Table 7: Comparison of total rescue analgesia consumption in TAP group, dual TAP and IL/IH block**

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| Time of 1st Rescue analgesia | | Groups | | | Chi-square value | p-value |
|---|---|---|---|---|---|---|
| | | TAP | Dual TAP | Ilioinguinal-Iliohypogastric | | |
| 2 hours | No dose | 21 | 21 | 21 | 0.000 | 1.000 |
| | | 100.0% | 100.0% | 100.0% | | |
| 6 hours | No dose | 15 | 17 | 16 | 2.357 | 0.047* |
| | | 71.4% | 81.0% | 76.2% | | |
| | 1 dose | 6 | 4 | 5 | | |
| | | 28.6% | 19.0% | 23.8% | | |
| 12 hours | No dose | 6 | 11 | 8 | 4.964 | 0.048* |
| | | 28.6% | 52.4% | 38.1% | | |
| | 1 dose | 15 | 10 | 13 | | |
| | | 71.4% | 47.6% | 61.9% | | |
| 24 hours | 1 dose | 21 | 21 | 21 | 0.000 | 1.000 |
| | | 100.0% | 100.0% | 100.0% | | |

**Table 8: Comparison of time for first rescue analgesia in TAP group, dual TAP and IL/IH block**

| Time of 2nd Rescue analgesia | | Groups | | | Chi-square value | p-value |
|---|---|---|---|---|---|---|
| | | TAP | Dual TAP | Ilioinguinal-Iliohypogastric | | |
| 2 hours | No dose | 21 | 21 | 21 | 0.000 | 1.000 |
| | | 100.0% | 100.0% | 100.0% | | |
| 6 hours | No dose | 21 | 21 | 21 | 0.000 | 1.000 |
| | | 100.0% | 100.0% | 100.0% | | |
| 12 hours | No dose | 15 | 17 | 18 | 2.357 | 0.047* |
| | | 71.4% | 81.0% | 85.7% | | |
| | 1 dose | 6 | 4 | 3 | | |
| | | 28.6% | 19.0% | 14.3% | | |
| 24 hours | No dose | 21 | 21 | 21 | 0.000 | 1.000 |
| | | 100.0% | 100.0% | 100.0% | | |

**Table 9: Comparison of time for second rescue analgesia in TAP group, dual TAP and IL/IH block**

## DISCUSSION

On looking for age of patients undergoing inguinal hernioplasty the mean age in TAP, Dual TAP and Ilioinguinal-Iliohypogastric groups was 40.90±14.94 years, 47.33±20.28 years and 51.52±18.93 years respectively in our study. Goel et al[7] found that the mean age of the subjects was 58.1±23.51 and 59.9±22.76 years among ultrasound guided ilioinguinal and iliohypogastric nerve block and subarachnoid block groups respectively. In the study by Jin et al[8] there were significant differences between the TAPB group and the IHINB group in mean age.

There was no significant difference in mean Systolic blood pressure (mmHg) at 0 hour, 2 hours, 6 hours, 12 hours and 24 hours between TAP, Dual TAP and Ilioinguinal-Iliohypogastric groups. Abiy et al[9] also reported no significant differences in baseline heart rate and MAP.

Vinod hosalli et al[10] in there study combined TAP and IL/IH block in one group and compared it to IL/IH block and found Dual TAP to be more effective in controlling post op pain with VAS significantly lower at 12 and 24 hours after surgery in D-TAP group. Similarly the mean VAS at rest at 2 hours, 6 hours, 12 hours and 24 hours was significantly more among TAP and Ilioinguinal-Iliohypogastric compared to Dual TAP groups in our study. Abiy et al[9] showed that the distribution of the pain scores (NRS) for TAP and II/IH groups were similar at rest as assessed by visual inspection which is in concordance with our findings.

These mean VAS score findings correlated with Petersen et al[11] and Kamal et al[12] who found that in their studies the pain scores were significantly lower in the IIN/IHN block group than the TAP group. Aveline et al[13] observed that the TAP group have lower significant pain scores than the IIN/IHN group. But this contrast in observation may be due to the fact that the IIN/IHN block in their study was performed by landmark technique without ultrasound guidance, causing less efficacy of the block. Similar results from the study by Okur et al[14] were obtained, with the analgesic effect of TAPB and IHINB being comparable after the first 12 hours. However, better analgesia was achieved in the IHINB group than that in the TAPB group after 24 hours, with a lower VAS score and morphine consumption.

Kamal et al[15] observed that in immediate post-operative period and up to 90 minutes after surgery, the VAS at rest was comparable in both the groups. However, at 2 hours and up to 8 hours thereafter, the group which received IIN/IHN block had a significantly lower VAS score at rest than the group

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which received TAP block. Thereafter, though the VAS score remained lower in IIN/IHN group, the difference was not found to be statistically significant. These findings correlate with those of Petersen et al[11] who found that pain scores for the first area under curve 6 h (AUC) were significantly lower in group IIN than in group TAP both at rest and on coughing.

From a technical standpoint, TAP block and ilioinguinal nerve block are very similar. TAP block is a commonly used nerve block for operations below the umbilicus and can anesthetize dermatomes from T10 to L1 roots[16]and it can be given by blind and USG guided technique. ILIH block is another nerve block that provides analgesia to the abdominal wall (skin and muscle layers) and parietal peritoneum. This block may have analgesic benefit in various general and gynecological surgeries. It must be kept in mind that performing US-guided IINB requires more skill than TAP block, and in cases of recurrent hernia, an adequate US visualization of this nerve might not be possible.[17] However ILIH block using peripheral nerve stimulator decreases failure rates which are higher in landmark technique i.e. 45-72% and also useful in settings where USG guided blocks are not accessible.

It is possible that the superior analgesic quality of Dual TAP is caused due to higher dose of local anesthetic solution compared to IINB and TAP blocks. TAP block is essentially a “fieldblock” of the plane in which the ilioinguinal and iliohypogastric nerves are found, and and alone it requires a higher volume of local anesthetic injectate to reach the intended site of action and surround these nerves. Conversely, in the IINB the injectate is delivered directly in the vicinity of the nerves specially when done under PNS guidance, thereby requiring a smaller volume of local anesthetic compared to the TAP block, to achieve similar perineural concentrations of local anesthetic.

## CONCLUSION

A substantial amount of pain is experienced by patients after abdominal surgeries and is mainly attributed to anterior wall incision and hernioplasty is very common among them. Thus this study aimed to provide some better pain management modality through its comparison between common blocks in abdominal surgeries.

Dual TAP block is more effective in controlling post-op pain in patients undergoing elective unilateral hernioplasty. TAP block and IL/IH block alone are equally effective in controlling pain and reduces pain only upto 6 hours of surgery. Demographic and hemodynamic parameters are not significantly affected by type and timings of blocks given in such short duration surgeries.

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