Original Research Paper

Volume - 13 | Issue - 02 | February - 2023 | PRINT ISSN No. 2249 - 555X | DOI : 10.36106/ijar

Anaesthesiology

COMPARATIVE STUDY OF PRE-OPERATIVE ULTRASOUND GUIDED TRANSVERSUS ABDOMINIS PLANE BLOCK VERSUS POST OPERATIVE ULTRASOUND GUIDED TRANSVERSUS ABDOMINIS PLANE BLOCK ON PERIOPERATIVE HEMODYNAMIC STATUS AND POST OPERATIVE ANALGESIC REQUIREMENT IN PATIENTS UNDERGOING LAPAROSCOPIC ABDOMINAL SURGERIES

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ABSTRACT **BACKGROUND:** Transversus Abdominis Plane (TAP) block produces more effective postoperative analgesia and significantly reduces consumption of postoperative opioids after various abdominal surgeries. It can be performed either preoperatively or postoperatively. Furthermore, studies investigating the ideal period for TAP block administration are few. The objective of our study was to investigate, which period is more effective for administration of TAP block on perioperative hemodynamic and postoperative analgesia in patients undergoing laparoscopic abdominal surgeries **METHODS:** This prospective randomized controlled double-blind study was conducted with 80 patients between the ages of 18-65 and ASA class I-II who were scheduled to undergo laparoscopic surgeries. Patients who received ultrasound guided bilateral TAP block with Bupivacaine 0.25% 20mL each prior to the surgical procedure were referred to as Group 1, the TAP block procedure after surgery made up Group 2. The variations of the heart rate (HR) and mean arterial blood pressure (MABP) and intraoperative fentanyl consumption and Visual Analog Score (VAS), sedation score, nausea, vomiting and the need for additional analgesics were recorded at 2, 4, 6, 12 and 24 hours postoperatively. **RESULTS:** When Group 1 was compared with group 2, there was no statistically significant difference in heart rate and mean arterial pressure preoperatively or before surgical incision. After surgical incision, both the heart rate and mean arterial blood pressure were significantly higher in the Group B. Postoperatively, When Group 1 was compared with Group 2, the rest period pain scores were significantly lower in Group 2 at 2 and 4 hours ($p<0.05$). **CONCLUSION:** Pre-operative TAP block attenuates hemodynamic responses to surgical stress but Post-operative TAP block significantly decreased pain scores and also reduced 24-hour analgesic requirement.

KEYWORDS : Transversus abdominis plane block, perioperative hemodynamic, Post-Operative Analgesia

INTRODUCTION

From the last 2 decades abdominal surgeries has undergone major changes with shift from open, invasive surgeries to closed, minimally invasive laparoscopic surgeries. Even though these surgeries are classified as minimally invasive, Pain is quite significant and needs to be addressed appropriately[1].

The benefit of adequate analgesia includes –
1- Reduction in stress response of surgery.
2- Effective pain control and accelerates recovery. Therefore, reducing perioperative morbidity[2].
3- minimize the opioid consumption perioperatively and hence decreasing its side effects[3].

Transversus abdominis plane blocks (TAP) are great alternative to multimodal analgesic regimen. It was 1st described by Rafi[4], TAP block provides analgesia to parietal peritoneum as well as skin and muscle of anterior abdominal wall. With the introduction of ultra sound guided TAP block, procedure has been highly effective and easy to perform with good safety profile[5].

TAP block can be performed either at the beginning or at the end of surgery. The single shot TAP block provides analgesia with reduction of pain scores and opioid consumption during initial 24-48 hours post-operatively[6].

Several studies have shown the efficacy of TAP block given pre or post operatively. However few studies have cited its Intra-operative effects. In present study we assessed the effect of pre-operative vs post-operative ultrasound-guided TAP block using plain 0.25% bupivacaine on perioperative hemodynamic status and post operative analgesic requirement.

OBJECTIVES

To compare the outcome and efficacy of preoperative versus post-operative ultrasound guided transversus abdominis plane block,

1.By monitoring intraoperative hemodynamic status.
2.Post-operative analgesic requirement and recovery profile.

METHEDOLOGY

SOURCE OF DATA

Patients undergoing laparoscopic abdominal surgeries admitted to hospital attached to Bangalore medical college and research institute during period of November 2019 to September 2020.

STUDY DESIGN:

Randomized control trial, single blind study.

DURATION OF STUDY:

10months -from November 2019 to September 2020.

PLACE OF STUDY:

Done in Hospitals attached to Bangalore Medical College and Research Institute, Bangalore.

SAMPLE SIZE:

Based on previous study conducted by B Dirican, M Erdogan, M Ucar et al[7], by assessing equal mean difference and equal standard deviation.

$n = 2(Z\alpha + Z1\text{-}\beta)2\sigma 2 \div d2$
$n=2(1.96+0.84)2 *(1.1)2 \div 0.72$
$n=38.72$

where, $Z\alpha$ = standard table value for 95% CI = 1.96
$Z1\text{-}\beta$ = Standard table value for 80% Power = 0.84
σ= standard deviation (1.1)
d= minimum expected difference b/w means of 2 groups (0.7)
n= Sample size

Therefore, by considering confidence interval as 95% and power 80%. The minimum sample size required is 38.72 in each group. We have included 40 patients in each group for better validity of results. So, n=40.

INCLUSION CRITERIA:

1. Patients giving informed written consent.
2. Patients undergoing laparoscopic abdominal surgeries.
3. Patients age between 20 – 60 years.
4.Patients belonging to ASA I, II

EXCLUSION CRITERIA

1. Patients who refused to give informed written consent.
2. Emergency surgeries
3. Allergy for local Anesthetic and confirmed local anesthetic toxicity.

A thorough pre anesthetic evaluation done on the previous day. Informed written consent was taken. Procedure and use of visual analogue score (VAS) for pain was explained to the patient.

All patients were advised nil per orally for 8 hours. Tab Ranitidine 150mg and Tab Alprazolam 0.5mg per orally will be given night before the day of surgery.

Patients will be randomly grouped by computer generated numbers and assigned to one of the two groups:

1. Group I (n=40) – would receive ultrasound guided transversus abdominis plane block prior to surgical procedure (starting with skin incision after Intubation)

2. Group II (n=40) – would receive ultrasound guided transversus abdominis plane block after surgery (following skin suture and closure before Extubation.)

On arrival to the operating room, patients were monitored with ECG, NIBP, SpO2, MAP were recorded throughout the surgery. Group I (n=40) –will receive ultrasound guided transversus abdominis plane block prior to surgical procedure (starting with skin incision)

All the patients were premedicated with Inj. Glycopyrrolate 0.005mg/kg IV, Inj midazolam 0.05mg/kg IV and Inj Fentanyl 2mcg/kg IV. After preoxygenation for 3 minutes with 100% oxygen, anaesthesia induction was carried out with Inj Propofol 2mg/kg and Inj Vecuronium 0.1mg/kg and anesthesia was maintained with 50:50 mixtures of air and oxygen with isoflurane 1-1.5% and intermittent intravenous boluses of vecuronium 1mg as needed.

Transversus abdominis plane block:
All transversus abdominis plane blocks are performed bilaterally with real-time ultrasound-guide using a 6-13MHz linear probe and 23g 90mm spinal needle, in-plane technique. Ultrasound probe is placed transversely in the flank between anterior superior iliac spine and the costal margin. The external oblique muscle, internal oblique muscle and transversus abdominis muscle are identified using ultrasound.

Two 20mL syringes are prepared with local anaesthetic concentration of 0.25% bupivacaine. The local anesthetic solution injected after confirming with ultrasound that solution is spreading in the plane between the internal oblique and transversus abdominis muscles to the right and left abdominal walls.

Group I (n=20) – received ultrasound guided transversus abdominis plane block prior to surgical procedure (starting with skin incision) and Group II (n=20) – received ultrasound guided transversus abdominis plane block after surgery (following skin suture and closure).

Hemodynamic variables were monitored and recorded at every 5-minute interval for first 30 minutes, then at every 10 minutes for next 60 minutes and then at every 15 minutes up to completion of surgery and anesthesia.

After completion of surgery, patients were extubated transferred to the post-anesthesia care unit (PACU).

Patients were familiarized with visual analogue score (VAS) a day before surgery. VAS </= to 4 is considered as adequate pain relief. Patient first analgesic dose requirement is recorded and complications such as postoperative nausea and vomiting, respiratory depression (respiratory rate <10beats/min or oxygen saturation <95%) are noted. Postoperative monitoring recorded every 15 min for the first 1 h, hourly for next 6 h and 2 hourly for the 12-h period and then at 24h period.

A patient with VAS score of more than 4 will be treated with inj. tramadol 100mg intravenous (I.V.). Further and subsequent doses of tramadol will be given and after assessing VAS of more than 4. The total dose of analgesia utilized will be recorded.

PARAMETERS ASSESSED –
Hemodynamic variables like HR, NIBP, MAP, SPO2
Assessment of pain by Visual analogue scale.
Assessment of opioid requirement in the post operative period.
Monitoring for side effects if any.

RESULTS

Demographic distribution –
80 patients were included in this study and demographic parameters like Age and sex were comparable between 2 groups and there was no significant statistical significance (age – p value – 0.872).

PARAMETERS	Group 1	Group 2
Age in years	33.5+/-10.2	33.9+/-11.9
Gender distribution	1:1	1:1

Intra-operative Hemodynamics
After obtaining Informed written consent, patients were shifted to operating room and vital parameters as Heart rate, blood pressure saturation were recorded. Patients were induced with general anesthesia with ET tube and controlled ventilation.

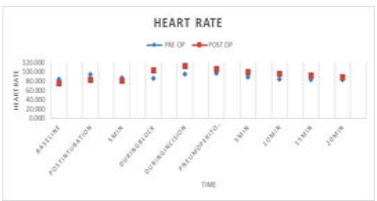
Group 1 received TAP block before incision and Group 2 received TAP block after surgery following skin closure prior to extubation. All vital parameters were recorded throughout surgery.

Heart Rate:
Table 1: Comparison of intra-operative HR in 2 groups

HEART RATE	GROUP 1	GROUP 2	p value
BASELINE	84.9+/-13.5	87.39+/-8.3	.169
POSTINTUBATION	96.2+/-10.2	82+/-10.7	.000
5MIN	87.25+/-10.25	81.1+/-9.85	.005
DURINGBLOCK	86.3+/-12.06	102.4+/-11.62	.000
DURINGINCISION	95.3+/-15.0	112.5+/-12.2	.000
PNEUMOPERITONEUM	96.625+/-9.8	106.5+/-8.6	.000
5MIN	89.2+/-6.0	99.8+/-5.77	.000
10MIN	84.2+/-8.22	96.2+/-6.99	.000
15MIN	83.2+/-7.3	92.2+/-6.8	.000
20MIN	82.4+/-10.9	88.9+/-6.5	.005
30MIN	78.9+/-9.7	86.5+/-7.6	.000
40MIN	79.8+/-11.03	84.5+/-6.06	.021
50MIN	77.9+/-11.2	84+/-7.2	.006
60MIN	84.9+/-13.5	87.39+/-8.3	.169
90MIN	86.5+/-11.03	86.76+/-9.22	.935

Here, we observed that there was statistically significant increase in heart rate in group 2 compared to Group 1 following surgical incision and creation of pneumoperitoneum and throughout the surgery.

Fig 1: Comparison of intra-operative HR in 2 groups

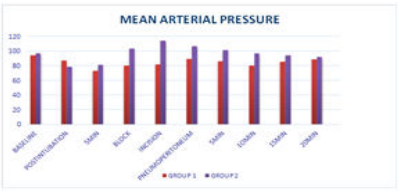


Blood Pressure:
Table 2: Comparison of intra-operative MAP in 2 groups

MAP	GROUP 1	GROUP 2	p value
BASELINE	94.2+/-12.7	96.9+/-10.3	.301
POSTINTUBATION	87+/-24.3	78.4+/-13.9	.056
5MIN	73.1+/-7.9	81+/-13.2	.002
BLOCK	79.9+/-12.5	103.1+/-11.7	.000
INCISION	81.8+/-12.2	114.1+/-11.9	.000
PNEUMOPERITONEUM	89.1+/-10.2	106.8+/-10.4	.000
5MIN	86.2+/-12.1	101.4+/-8.1	.000
10MIN	80.1+/-12.3	96.6+/-8.2	.000
15MIN	85.6+/-10.6	94.4+/-9.7	.000
20MIN	88.6+/-7.5	92.2+/-10.1	.075
30 MIN	85.4+/-11.4	96.8+/-13.8	.000
40 MIN	88.7+/-9.4	95.5+/-9.5	.002
50 MIN	84.6+/-11.2	93.9+/-8.3	.000
60 MIN	90.7+/-10.3	94.18+/-8.3	.126
90 MIN	90.45+/-15.4	95.03+/-10.06	.187

Here, we observed that there was statistically significant increase in mean arterial pressure (MAP) in Group 2 compared to Group 1 following surgical incision and creation of pneumoperitoneum and almost throughout the surgery.

Fig 2: Comparison of intra-operative MAP in 2 groups



Visual Analogue Score:
Post Extubation:

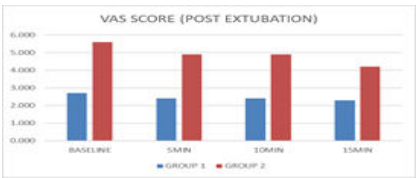
Table 3: Comparison of VAS score between 2 groups (Post-extubation)

VAS score	GROUP 1	GROUP 2	p value
BASELINE	2.7+/-0.64	5.6+/-0.49	.000
5MIN	2.4+/-0.67	4.9+/-0.7	.000
10MIN	2.4+/-0.46	4.9+/-0.67	.000
15MIN	2.3+/-0.46	4.2+/-0.40	1.000

VAS score had been explained to the patient pre-operatively, once patient has extubated and conscious and obeying commands VAS score assessed.

Here we observed pain score following emergence from anesthesia in Group 1 patients are less compared to Group 2 patients.

Fig 3: Comparison of VAS score between 2 groups (Post-extubation)

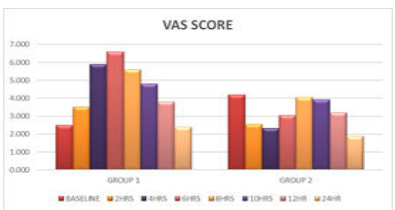


VAS score:
Table 4: Comparison of VAS score between 2 groups

	GROUP 1	GROUP 2	p value
BASELINE	2.5+/-0.50	4.2+/-0.40	.000
2HRS	3.5+/-0.50	2.55+/-0.50	.000
4HRS	5.9+/-0.70	2.32+/-0.47	.000
6HRS	6.6+/-0.49	3.05+/-1.15	.000
8HRS	5.6+/-0.49	4.05+/-0.90	.000
10HRS	4.8+/-0.4	3.9+/-0.57	.000
12HR	3.8+/-0.40	3.2+/-1.01	.001
24HR	2.4+/-0.49	1.87+/-0.33	.000

VAS score recorded for the next 24-hour duration in both the groups. Here we found that VAS score was initially lesser in Group 1 compared to Group 2 patients (till 4-6hours). But longer duration of lesser VAS score had been documented in Group 2 Patients when compared to Group 1 Patients. i.e 24-hours rest period pain is significantly lower in group 2 in 2nd, 4th and 6th hour compared to Group 1.

Fig 4: Comparison of VAS score between 2 groups



Post-operative Hemodynamics
Table 5: Comparison of HR and MAP between 2 groups

	HEART RATE			MAP		
	GROUP 1	GROUP 2	p value	GROUP 1	GROUP 2	p value
2 HOUR	81.3+/-10.2	83.3+/-6.9	0.13	83.4+/-9.4	92.2+/-9.7	2.48
4 HOUR	80.6+/-7.0	79.9+/-6.5	0.92	83.4+/-12.8	96.8+/-10.1	2.90
6 HOUR	79.5+/-8.5	86.3+/-7.8	0.14	89.5+/-13.8	95.5+/-12.4	3.50
8 HOUR	82.2+/-7.9	84.5+/-6.06	0.91	90.5+/-9.5	93.9+/-9.7	0.80
12 HOUR	81.9+/-7.06	86.1+/-8.5	0.06	84.6+/-8.3	84.5+/-8.4	0.33
24 HOUR	81.1+/-11.5	83+/-10.5	0.44	97.4+/-8.5	95.7+/-6.5	0.70

We have found there is no significant changes in post cooperative hemodynamics between Group 1 and Group 2 with respect to Heart rate and MAP.

Analgesic request (24 hour)
Post-operatively 17 patients from Group 1 received additional dose of Inj tramadol 50mg compared to Group 2 along with Inj paracetamol which has been given to all 80 patients in both the groups.

Table 6: Comparison of analgesic request between 2 groups

STATUS		Number of patients	Mean	p Value
INJ PARACETAMOL DOSES	GROUP 1	40	2.500	.179
	GROUP 2	40	2.350	
INJ TRAMADOL DOSES	GROUP 1	17	1.118	.000
	GROUP 2	0	0.000	

DISCUSSION

The introduction of ultra sound guided block technique has made TAP block an interesting option as apart of multimodal post-operative pain management mainly because of it is easy to perform[8].

Ultrasound guided TAP blocks are commonly performed with high frequency linear USG probe and an in-plane technique[9].

As this block is easy to perform and not time consuming this can be performed either pre-operatively or post-operatively, each of which as their individual advantages over one other. And our study aims to assess the effect of pre-operative vs post-operative TAP block with respect to peri-operative hemodynamics and post-operative analgesia.

Based on the study conducted by Richard kalu10 et al where they studied the effect of pre-operative vs post-operative TAP block with 20mL plain 0.25% bupivacaine on post-operative opioid use and study conducted by T.Karman et al11 on effect of TAP block on analgesic and anesthetic consumption during TAH using 20ml of 0.25% plain bupivacaine, for our study we fixed patients in both the group would receive bilateral ultrasound guided TAP block 20mL 0.25% plain bupivacaine but time frame would be different as Group 1 would receive pre-operatively and Group 2 would receive block post-operatively.

In our study we noted patients receiving TAP block prior to surgery i.e Group 1 better intraoperative hemodynamics compared to Group 2 (Table 1 and 2) (fig 1 and 2). Here we have observed attenuation of hemodynamic response to surgical stimuli and pneumoperitoneum in Group 1 compared to Group 2. These results concur with those of Owono Etoundi Paul et al12, who observed pre-incisional TAP block attenuates hemodynamic response to surgical stress and decreased fentanyl consumption when compared to post-incisional TAP block.

Other parameter like SpO2 and respiratory rate were similar between 2 groups.

Pain score
VAS score has been assessed in 2 sets. One being followed by emergence from anesthesia and other 24-hour rest pain

VAS score in Group 1 patients immediately following extubation were significantly lower compared to Group 2 patients rendering to the effect of pre-emptive analgesia (Table 3 and Fig 3). These results had also been seen in study conducted by Yasser Mohamed Amr13 et al on Comparative study between effect of pre- versus post-incisional transversus abdominis plane block on acute and chronic post abdominal hysterectomy pain where they concluded that pre-incisional TAP block reduced acute pain, analgesic requirements and

incidence of chronic pain when compared to a block performed before emergence from anesthesia.

When VAS score was recorded for 24-hour duration we had observed that VAS score was significantly lower in Group 2 patients compared to Group 1 patients (Table 4 and Fig 4). These results were compared with study conducted by Dircian B7 et al, where they concluded post-operative administration of ultrasound guided TAP block decreases pain score in early periods and also reduced 24-hour morphine consumption compared to pre-operative administration of TAP block.

All patients in our study both the groups received regular Inj.Paracetamol 1g for post-operative pain relief and patients who required additional rescue analgesia received Inj.Tramadol 50mg, here we saw patients in Group 1 received additional analgesics compared to Group 2 patients (Table 6). These results were comparable with the study conducted by Richard kalu10 et al, TAP block administered postoperatively was associated with significantly lower need for postoperative PCA and discharge opioid medications. Post-operative hemodynamics were comparable between 2 Groups (Table 5). Side effects were insignificant and comparable between 2 groups.

Our study had several limitations, there were different operations which were performed by different surgeons, but the surgeons used the same technique. TAP block had been performed by different anesthetist under supervision. There are multiple approaches for TAP block but here we have only considered mid axillary approach. We have measured the blunting of hemodynamic response with respect to HR and BP but could not measure level of anesthesia intra-operatively. VAS score was used to measure pain score and its subjective and hence subjective bias to be considered.

Conclusion:

Transversus abdominis plane block given preoperatively reduces stress response to surgical incision and pneumoperitoneum compared to post-operative administration of TAP block.

Pre-operative TAP block reduces pain during emergence but post-operative TAP decreases 24 hrs pain period and also reduces 24 hrs analgesic requirements compered to pre-operative TAP block.

Therefore, considering shorter duration of action of plain bupivacaine timing of its administration for TAP block can be planned to provide optimal analgesia.

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