Section: Anaesthesiology

Original Research Article

A COMPARATIVE STUDY OF EFFECTIVENESS OF SUBCOSTAL TRANSVERSUS ABDOMINIS PLANE BLOCK VERSUS INJECTION DEXMEDITOMIDINE FOR MAINTAINIG HEMODYNAMIC STABILITY FOR UPPER GI LAPAROSCOPIC SURGERIES

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ABSTRACT

Background: We aimed to compare the efficacy of ultrasound guided bilateral subcostal transversus abdominis plane block(TAP) with inj dexmeditomidine for the patients undergoing upper gastrointestinal (GI) laparoscopic surgeries for maintaining hemodynamic stability during intraoperative period. **Materials and Methods:** We conducted a study involving 60 patients undergoing laparoscopic upper GI surgeries under general anaesthesia, randomly divided into two groups. Group B received ultrasound guided bilateral subcostal TAP block with 15 ml of 0.25% of inj ropivacaine after induction of general anaesthesia. Group D received inj dexmeditomidine intravenously at the rate of 0.2 to 0.4 mcg/kg/hr after induction of general anaesthesia. All patients received inj paracetamol 1 g intravenously. Hemodynamic parameters heart rate (HR) & mean arterial pressure (MAP) were recorded prior to induction, 5 minutes after intubation, at insufflations, later every 15 minutes, at desufflation and extubation. Chi-square test and independent *t*-test were used to compare qualitative and quantitative data respectively. **Results:** we found no statistically significant difference in both the groups in heart rate except at exsufflation where it was 86.77 ±8.96 in group B & 92.5 ±9.85 in group D ($p<0.022$) . In comparison of MAP between the two groups, there was statistically significant difference noted at15minutes and 30 minutes after insufflation with p value 0.007 and 0.024 respectively. **Conclusion:** We conclude from our study that subcostal transverses abdominis plane block is more effective in achieving hemodynamic stability than inj dexmeditomidine during laparoscopic surgeries.

INTRODUCTION

Surgical trauma leads to release of neuroendocrine mediators which elicits profound physiological changes during perioperative period. The overall effect is commonly referred to as the stress response to surgery. The response of patients towards surgical pain may result in unstable hemodynamics and this excessive stress can have adverse effects in the postoperative period.[1] Recently laparoscopic surgeries have gained popularity because of its many benefits such as small surgical incisions, less postoperative pain which would result in early ambulation and early discharge. In spite of these advantages surgical stress responses in laparoscopic surgery may be as strong as in open surgery due to creation of pneumoperitoneum. Various pharmacological agents like α-2agonists, β-Blockers, opioids are used to provide hemodynamic stability during laparoscopic surgeries.[2] In our institute we routinely use dexmeditomidine for this purpose.

USG guided Subcostal transversus abdominis plane [TAP] block is an emerging regional anaesthesia technique which can provide efficient analgesia by blocking the regulations of sensory nerves at anterior abdominal wall.[3] Various authors have observed effectiveness of this block for postoperative analgesia in laparoscopic surgeries. There are no studies found in the literature who have observed its effectiveness for maintaining hemodynamic stability in laparoscopic surgeries during intraoperative period. Hence we conducted a study comparing subcostal TAP block with dexmeditomidine in laparoscopic surgeries during intraoperative period. Primary outcome of our study was to observe intraoperative hemodynamic stability and secondary outcome was to observe requirement of vasoactive drugs & assessment of sedation score with a hypothesis that subcostal TAP block and inj dexmeditomidine are

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equally effective in maintaining hemodynamic stability.

MATERIALS AND METHODS

It was a prospective, single blind randomised comparative study done on patients undergoing elective laparoscopic upper GI surgery in tertiary care teaching hospital during 2022–2024 after getting institutional research and Ethical Committee approval. Prior to enrollment of the patient, the study has been registered with the Clinical Trials Registry-India (CTRI) with the registration number CTRI/2023/02/049400. Sixty patients with the American Society of Anesthesiologists (ASA) physical status I/II, aged between 20 and 70 years with a body mass index (BMI) of 18–35 kg/m2 scheduled for elective laparoscopic upper GI surgeries were recruited and randomized into two groups of 30 each using sealed envelope method. An informed written consent was obtained from each patient with respect to the nature of anaesthesia. Patients with allergy to local anaesthetics, infection at the site of injection, on B blockers, coagulopathy were excluded from the study.

Prior to surgery, all patients underwent comprehensive preoperative evaluation and investigations. They were instructed to fast for six hours. Upon arrival in the operating theatre, standard monitors such as ECG, SPO2, and NIBP were attached. An intravenous line was established using a 20G IV cannula and IV fluids were started. Premedication was administered with injection glycopyrrolate 0.005mg/kg, injection midazolam 0.02mg/kg and injection fentanyl 2mcg/kg. General anesthesia was induced with injection propofol 2mg/kg and succinylcholine 1.5mg/kg and patients were intubated with an appropriate sized endotracheal tube. Anaesthesia was maintained with oxygen, air, vecuronium0.08mg/kg & isoflurane (0.4%to 0.8%). Intraoperative monitors included electrocardiogram, non-invasive blood pressure, pulse oximeter and end-tidal carbon dioxide. Hemodynamic parameters heart rate (HR) & mean arterial pressure (MAP) were recorded prior to induction, 5 minutes after intubation, at insufflations, later every 15 minutes, at desufflation and extubation. Significant deviations from baseline values triggered appropriate interventions: an increase in MAP by 30% was managed with nitroglycerin (NTG) infusion 1mcg/kg & titrated accordingly while elevated HR above 100 beats per minute (bpm) was treated with injection esmolol 0.5 mg/kg and bradycardia,<50 was treated with inj.atropine 0.6mg . Hypotension, MAP <30% of baseline necessitated administration of injection mephenteramine 3mg. Injection fentanyl 0.5 mcg/kg repeated hourly in each group. Group B received ultrasound-guided subcostal TAP block bilaterally using 15ml of 0.25% injection ropivacaine bilaterally after induction of anesthesia using M Turbo ultrasound machine high-frequency (6–13 MHz) linear transducer. Group D received infusion of injection dexmedetomidine at a rate of 0.2 to 0.4 mcg/kg/hr. Additionally, all patients received paracetamol 1gm before pneumoperitoneum. After extubation sedation score was assessed.

Statistical Analysis

Keeping a power at 80% and alpha error at 0.05, a sample size of 23 would be required in each group. Hence, we recruited 30 patients in each group to compensate for the dropouts if any. Qualitative data such as sex, ASA physical status and adverse effects were compared using Chi-square test. Quantitative data such as age, height, weight, BMI were used using independent t-test. $P < 0.05$ was taken as statistically significant. All statistical analysis was done by using SPSS 20.

RESULTS

A total of 60 patients were recruited for the study and all patients completed the study [Figure 1]. Both groups were comparable with respect to age, sex, weight & ASA physical status & duration of surgery. [Table 1]

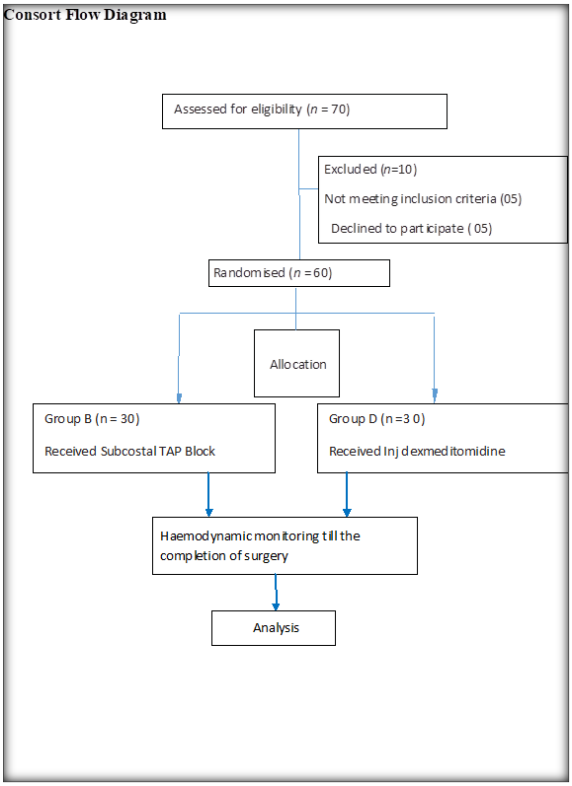

Figure 1: consort Flow Diagram

There was no statistically significant difference in heart rate between the two groups at various time interval ($p>0.05$), but at exsufflation statistically significant difference was noted in group B which was 86.77±8.96 and in group D it was 92.5±9.85 in relation to heart rate($p<0.022$) [Figure 2]

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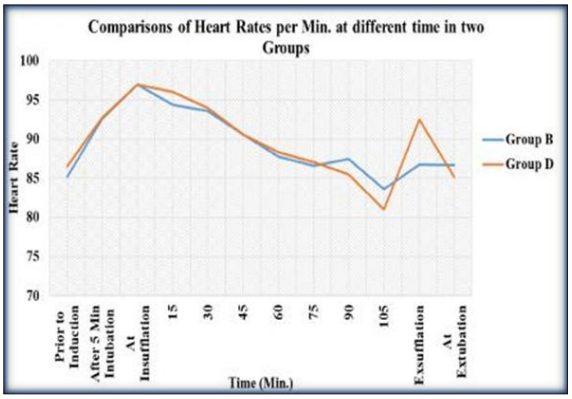

Figure 2: comparison of heart rate

There was no statistically significant difference in Mean arterial pressure between the two groups at various time interval except at 15 minutes and 30 minutes after insufflation with p-0.007 and p-0.024 respectively [Figure 3]

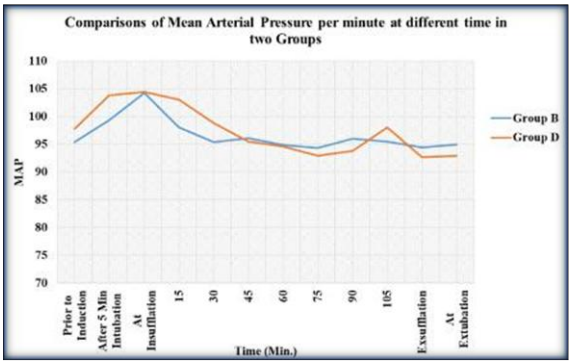

Figure 3: comparison of MAP

There was statistically significant difference in sedation score post operatively in group B and group D with $p<0.05$

In group B, 21 patients had sedation score of 1 and 9 patients had sedation score of 2. In group D, 7 patients had sedation score of 1 and 23 patients had sedation score of 2.

Table 1: Demographic data

Variables	Category	Mean +SD	P
Age (yrs)	Group B Group D	42.1±15.3 42.5±13.8	0.916
sex	Group B male Female Group D male female	23 07 21 09	0.71
Weight(kg)	Group B Group D	69.1±10.9 67.3±11.6	0.53
ASA grade	Group B I 16.67 II 83.33 Group D I II	16.67 83.33 13.33 86.67	0.71
Duration of surgery	Group B Group D	107.3±14.7 104.5±13.6	0.44

Table 2: sedation score

Sedation Score	Group B		Group D		X^{2-} Value	p - Value
	N	%	N	%		
1	21	70	07	23.33	13.125	0.000 Sig.
2	09	30	23	76.67		
Total	30	100%	30	100%		

DISCUSSION

Laparoscopic cholecystectomy is a commonly performed surgery known for its benefits over traditional open procedures, such as reduced trauma, faster recovery times and shorter hospital stay leading to lower healthcare costs. However, managing anaesthesia during laparoscopic surgeries presents challenges due to significant hemodynamic changes caused by factors like pneumoperitoneum, patient positioning, and the absorption of CO2.[4]

Pneumoperitoneum triggers various physiological responses. These include increased plasma-renin activity and elevated levels of nor-epinephrine and epinephrine, which lead to increased heart rate, MAP, and systemic and pulmonary vascular resistance. These hemodynamic changes necessitate a careful, multimodal approach to anaesthesia management to mitigate their impact on patient stability and recovery.[3] One effective technique in this regard is the TAP block, a regional anaesthesia method targeting the sensory nerves supplying the anterior abdominal wall. By injecting local anaesthetic between the internal oblique and transversus abdominis muscles under ultrasound guidance, TAP block effectively reduces parietal pain, which is a primary component of postoperative discomfort following abdominal surgeries. Importantly, TAP blocks spare motor function, enabling early mobilization and enhancing overall recovery.[5]

There are different approaches to performing TAP blocks, such as subcostal, lateral, and posterior approaches. The subcostal approach, described by Hebbard et al6], targets the T6 to T9 thoracolumbar

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nerves, providing analgesia for upper abdominal surgeries. This method has been shown to offer continuous pain relief, crucial for managing postoperative pain effectively in upper GI laparoscopic surgeries.[5]

The choice of local anaesthetic is critical in TAP blocks to achieve optimal postoperative analgesia. Ropivacaine, a long-acting amino-amide local anaesthetic, has gained popularity due to its potency, extended duration of action, and reduced side effects compared to its predecessor, bupivacaine. Ropivacaine's lower lipid solubility and decreased volume of distribution contribute to its safer profile, offering adequate pain relief while minimizing systemic toxicity risks.[7,8] The study entitled comparison of Effectiveness of subcostal transversus abdominis plane block versus injection dexmedetomidine in maintaining hemodynamic stability for upper GI laparoscopic surgeries, aimed at evaluating the intraoperative hemodynamic parameters like heart rate, MAP, Sedation score post operatively, requirement of vasoactive agents between two groups. The results obtained from our study showed that, there was no statistically significant difference in heart rate between both the groups except at the time of exsufflation where in group B it was 86.77±8.96 & in group D it was 92.50±9.85.This difference was statistically significant with p value <0.022

Narendra P Varma et al,[3] conducted a study comparing TAP block with control group for intraoperative hemodynamic stability with the other group which received only general anaesthesia. Both the groups received inj. paracetamol 1 gm before start of pneumoperitoneum. They observed that there was no statistically significant difference in heart rate between the two groups & decrease in heart rate seen during exsufflation than baseline value in block group which is similar to our study. Ruizhu Liu et al,[1] did a study on TAP block for reducing the perioperative stress response in patients undergoing radical gastrectomy. In their study control group received general anaesthesia and TAP group received general anaesthesia with TAP block. They observed that the level of norepinephrine, epinephrine, cortisol and glucose were reduced by TAP block during perioperative period and heart rate was significantly lower compared to control group. Çağdaş Baytar et al,[9] performed a study by comparing ultrasound guided subcostal TAP block and Quadratus lumborum block in laparoscopic cholecystectomy. In their study there was no statistically significant difference between the groups in regard to heart rate. Avneesh Khare et al,[9] conducted a study on effects of dexmedetomidine on intraoperative hemodynamics in patients undergoing laparoscopic cholecystectomy. In their study, for group A inj dexmedetomidine was administered in the dose of1 mcg/kg prior to induction and infusion started at the rate of 0.6 mcg/kg/hr during the surgery. Group B received normal saline. There was significant decrease in heart rate in group A throughout the study when compared to that of group B. In our study heart rate started to decrease from 45 mins to till extubation in group D as compared to the baseline. The fall in heart rate throughout their study may be due to administration of loading dose of dexmeditomidine.

The results obtained from our study showed statistically significant difference in MAP at 15 mins and 30 mins which was 98.03 ±7.88 & 95.43 + 6.31 in group B & 103.07 ±5.84 and 98.83 ±4.98 in group respectively. This could be attributed to the creation of pneumoperitoneum, which causes increase in peripheral vascular resistance thus leading to rise in MAP. Narendra P Varma et al,[3] study is comparable with our study where they observed statistically significant difference at 15 min in MAP in TAP block group. Ruizhu Liu et al,[1] in their study, they observed significantly lower MAP in block group as compared to control group throughout the study period. This difference in their study could be attributed to the TAP block given with 40 ml of 0.375 % inj ropivacaine where as we used 15 ml of inj ropivacaine in our study. Avneesh Khare et al,[9] did a study on effects of dexmedetomidine on intraoperative hemodynamics in patients undergoing laparoscopic cholecystectomy. MAP values in dexmeditomidine group were lower than group B and significant differences were observed just after intubation, after insufflations, 30 mins after insufflation, after exsufflation and just after extubation. This significant difference at all these intervals might be due to administration of bolus dose of inj dexmedetomidine where as we observed rise in MAP at 15 & 30 min after insufflation from baseline in dexmeditomidine group.

In our study 3 patients in group B and 5 patients in group D received NTG infusion with no statistically significant difference. While comparing sedation score, patients in group D had more sedation score than that patient in group B with statistically significant difference. Qin Ye et al,[26] have found in their study that dexmeditomodine administered in the dose of 0.6 mcg/kg/hr has reduced the incidence of agitation

Limitations

As a result of its limited sample size, the study's conclusions cannot be generalized. Higher sample size would have proven significant difference between block & dexmeditomidine group. Furthermore, postoperative pain and total analgesic score were not assessed.

CONCLUSION

From our study we concluded that subcostal TAP block is more effective in attenuating haemodynamic responses than inj dexmedetomidine during laparoscopic surgeries. Hence we recommend making a use of facial plane block in the form of subcostal TAP block for upper gastrointestinal surgeries.

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