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Effect of Dexmedetomidine as an Adjuvant to Ropivacaine in Ultrasound Guided Subcostal Transversus Abdominis Plane Block on Stress response and Postoperative pain relief in LaparoscopicCholecystectomy

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Abstract:
Background: *Laparoscopic cholecystectomy is considered to be associated with moderate intensity pain and intense stress response[1]. Transversus abdominis plane (TAP) block is a fascial plane block providing postoperative analgesia in patients undergoing abdominal surgery. As a multimodal strategy, TAP Block effectively reduces postoperative pain and decrease opiod consumption. I.V. Dexmedetomidine[17]isknown to attenuate stress response in patients undergoing Laparoscopic surgery.*
Aim:*Wehypothesised that addition of dexmedetomidine to Ropivacaine will prolong the duration of postoperative analgesia as well as attenuate the stress response during laparoscopic cholecystectomy.*
Methods:*Sixty American society of Anaesthesiologists(ASA)I/II patients undergoing Laparoscopic cholecystectomy under General Anaesthesia were enrolled in this controlled, prospective, double blind study. They were randomly allocated into two groups. Group I (n=30) receiving Ropivacaine and Group 2 (n=30) receiving Ropivacaine with Dexmedetomidine for TAP Block. The patients in the two groups were compared for age, BMI, ASAI/II, duration of surgery, Time for rescue analgesia , requirement of analgesia and hemodynamic parameters for stress response.*
Results:*Dexmedetomidine added to ropivacaine significantly reduced MAP and HR (p<.05) . Time for rescue analgesia was prolonged and Mean requirement of Tramadol (in the first 24 hrs) was reduced in study group compared to the control group.*
Conclusion:*The addition of Dexmedetomidine to Ropivacaine during TAP Block reduces the analgesic requirement in the first 24 hrs, prolongs the postoperative analgesia and decreases stress response associated with Laparoscopic surgery.*
Keywords: *Subcostal Transversus Abdominis Plane(TAP)Block,Ropivacaine, Dexmedetomidine,Stress Response, Laparoscopic Cholecystectomy.*

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I. Introduction

Postoperative analgesia is important as it reduces various complications such as patient discomfort, prolonged immobilisation, extended hospital stay, venous thromboembolism and respiratory complications. Although laparoscopic surgery is considered to be minimally invasive, it induces moderate intensity pain and strong stress response during pneumoperitoneum[15] which may cause cardiovascular complications.

The Transversus abdominis plane[16] is a fascial plane between the Internal oblique and Transversus abdominis muscle containing the thoracolumbar nerves T6 to L1.Instillation of local anaesthetic in this plane blocks these nerves. With the introduction of ultrasound, TAP block has been used as a part of multimodal strategy to alleviate Postoperative pain. This block was first described by Rafi [6]in 2001.

The duration of TAP block is limited by the duration of Local anaesthetic.Adjuvants added to Local anaesthetic prolong the effect of TAP Block. Dexmedetomidine added to Ropivacaine in peripheral nerve blocks was associated with prolonged effect. Dexmedetomidine is a highly selective $\alpha 2$ adrenergic agonist[2] with analgesic, sedative, sympatholytic and hemodynamic stabilising properties. IV Dexmedetomidine[19] is known to reduce stress response during Laparoscopic surgery and maintain hemodynamic stability. It is unclear if Dexmedetomidine used as an adjuvanttoRopivacaine in TAP block can reduce stress response during laparoscopiccholecystectomy.

II. Aim

The primary aim of this study was to compare the efficacy of combination of Dexmedetomidine and Ropivacaine to Ropivacaine alone in subcostal TAP Block for Laparoscopic cholecystectomy in terms of stress responses during surgery and postoperative analgesia.

III. Materials And Methods

After obtaining approval from the institutional ethics committee and written informed consent,SixtyASA physical status I and II patients of either sex aged 18 – 65 yrs posted for elective Laparoscopic cholecystectomy were included in a prospective, randomized, double blind, controlled clinical trial which was completed over a period of six months.

Exclusion criteria included patient refusal,psychologicaldisorders,allergy to drugs,obesity,localinfection,coagulationdisorders,History of cardiac respiratory,renal,or hepatic disease.

Patients were randomised by sealed envelope technique into two groups.The allocation sequence was generated by random number table. The Patients, Anaesthesiologists and Staff were blinded to the allotment.

On arrival at the operating room,IV cannula was inserted.ECG,NIBPand Pulse oximetry was connected and baseline parameters recorded.

After sterile preparation of skin, a single shot bilateral subcostal TAP block was performed using ultrasound.(Mindray,13MHz,Linear probe)Following identification of 3 different layers of abdominal wall,22gauge block needle was insertedin plane until its tip was located between Internal oblique and Transversus abdominis muscles.After careful aspiration, injection of drug was performed and a hypoechoic layer was detected on ultrasound.Group I(n=30)patients received TAP block on each side with 20 mlof solution containing 18 mlof .3%Ropivacaine and 2ml of normal saline.Group II(n=30) patients received TAP block on each side with 20 ml of solution containing 18 ml of .3%Ropivacaine and Dexmedetomidine .5mcg/kg dissolved in 2ml of normal saline.After block placement, sensory function was assessed for successful TAP block.

After a successful TAP block, General Anaesthesia was induced and standardized for all patients in both groups.Systolic BP, Diastolic BP, MAP and Heart rate were recorded prior to induction (T_0), prior to pneumoperitoneum(T_1),end of pneumoperitoneum (T_2), and end of surgery(T_3).At the end of surgery,patients were shifted to Postanaesthetic care unit. Pain was assessed at 1, 3, 6. 12, 18, 24 hrs using visual analogue scale(VAS) (0= no pain and10= worst possible pain).Rescue analgesia was given on demand or when VAS was more than 4 in the form of IV Tramadol 2mg/kg.Time to first analgesic request was recorded from completion of TAP block which gave the duration of TAP block.

IV. Statistics

Statistical analysis was done using SPSS software version18.0. Demographic data was analysed using Student's t-test. The categorical data was compared by using paired t test.Confidence level was 95% .$p < .05$ was considered statistically significant.

V. Results

Sixty patients were recruited in the study and were randomly allocated into two groups.Group I (n=30) receiving Ropivacaine and Group II (n=30) receiving Ropivacaine with Dexmedetomidine for TAP block. The two groups were comparable in terms of age, body mass index, ASA I/II and duration ofsurgery.(Table 1).Time for rescue analgesia was prolonged in Group II (8.8±2.29hrs) as compared to Group I (5.47±1.27 hrs).($p<.001$). Mean Tramadol requirement in 24 hrs for Group II(7.5±2.6) was significantly lower as compared to Group I(47.5±5.2).($p<.001$).(Table 2).MAP and Heart rate from prior to pneumoperitoneum(T_1) to the end of surgery (T_3) was significantly reduced in Group II as compared to Group I.(Table 3)

Table 1: Demographic parameters of the two groups

	GROUP I	GROUP II	P
Age	57.5±11.7	53.2±13.4	0.54
BMI	28.4±4.3	28.9± 5.2	0.71
ASA I/II	8/12	7/13	0.8
Operative time	58.3±13.2	61.2±14.1	0.41

Mean±SD

Table 2: Postoperative rescue analgesia

PARAMETERS	GROUP I	GROUP II	P
Total Rescue dose received	19	3	<0.001
Time to first dose(hrs)	5.47±1.27	8.8±2.29	<0.001
Total Tramadol consumed(mg)	47.5±5.2	7.5±2.6	<0.001

Mean±SD

Table 3: Intraoperative hemodynamic changes

VARIABLES	TIMEPOINTS	GROUP I	GROUP II	P
MAP(mm Hg)	T_0	81±10	80±7	0.184
	T_1	85±10	69±6	0.001
	T_2	82±9	71±5	0.001
	T_3	82±8	72±4	0.002
HR (bpm)	T_0	68±8	71±9	0.166
	T_1	70±11	61±7	0.001
	T_2	69±10	59±8	0.001
	T_3	68±9	59±6	0.001

Data are presented as mean±SD; MAP mean arterial pressure, HR heart rate, DEX dexmedetomidine, T0 prior to induction, T1 prior to pneumoperitoneum, T2 prior to the end of pneumoperitoneum, T3 at the end of surgery

VI. Discussion

In Laparoscopic surgeries, pneumoperitoneum induces co_2 peritoneal absorption resulting in hypercarbia that results in sympathetic nerve stimulation and catecholamine secretion.This enhances the systemic vascular absorption, mean arterial pressure,andheart rate and hence the risk of arrythmias[17].Generally opiods,α or β blockers are used to control stress response.As a preanaesthetic medication and intraoperative infusion Dexmedetomidine[16] was found to be effective in suppressing metabolic stress response to major abdominal surgeries.In the present study,Perineural Dexmedetomidine significantly reduced the levels of stress indicators.

TAP block is a fascial plane block that has been used as a part of multimodal protocol[13] to reduce the postoperative pain and decrease opiodconsumption.WhenDexmedetomidine is combined with Ropivacaine for TAP block it can prolong the duration of the block due to local vasoconstriction [12] in peripheral nerves or direct inhibition in peripheral nerve action.

In the present study,we investigated the effects of Dexmedetomidine combined with Ropivacaine for ultrasound guided subcostal TAP block in patients undergoing Laparoscopic cholecystectomy. The important outcome of our study is that addition of Dexmedetomidine to Ropivacaine in TAP block resulted in decreased stress response during Laparoscopic surgery and prolonged duration of postoperative analgesia than Ropivacaine alone.

Various researches have been conducted to study the effect of adjuvants added to Local anaesthetics in TAP block. Almarakbi[7] and kaki have reported that the addition of of Dexmedetomidine to Bupivacaine in TAP block achieves better local anaesthesia and better pain control. Sharma[8] et al have reported that addition of Dexamethasone to Ropivacaine in TAP block prolongs postoperative analgesia and reduces analgesia consumption. Metwally[9] et al have reported that addition of Fentanyl to Local anaesthetic in TAP block prolongs analgesia.

Prabha[10] et al have reported that addition of Dexmedetomidine to Ropivacaine in TAP block prolongs analgesia, lowers postoperative pain score when compared to Ropivacaine alone. Luan[11] et al have reported that Dexmedetomidine as an additive to Ropivacaine in TAP block potentiated the analgesic properties of Ropivacaine.

Masuki[12] et al suggested that Dexmedetomidine induces vasoconstriction in peripheral nerves through its action on α adrenergic receptors that contributes to the prolonged duration of the block.

Zhaojun qin[20] et al in their study on Impact of Dexmedetomidine added to Ropivacaine for TAP block on stress response in Laparoscopic surgery have concluded that addition of Dexmedetomidine as an adjunct to Ropivacine inhibits the stress response in patients undergoing Laparoscopic gynaecological surgery.

This study has some limitations. Obese patients were excluded from the study due to technical difficulty.The assessment was limited to only 24 hrspostoperatively.Another limitation to our study was that the plasma concentrations of stress hormones was not measured as it was not feasible in our Institutional setup.

VII. Conclusion

The addition of Dexmedetomidine to Ropivacaine in Ultrasound guided bilateral Subcostal TAP block during Laparoscopic cholecystectomy reduces the stress response during the surgery as well as achieves prolonged postoperative analgesia.

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CONFLICT OF INTEREST -Nil.

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