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Ultrasound Guided Riss v/s Rib Block for Post-Operative Analgesia in Thoracic and Upper Abdominal Surgeries

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ABSTRACT
Ultrasound (USG) guided Rhomboid Intercostal Subserratus(RISS) block and Rhomboid Intercostal Block (RIB) are two novel inter-fascial plane blocks providing satisfactory analgesia postoperatively. Our aim was to investigate the effectiveness of these blocks following thoracic and upper abdominal surgeries. 90 patients who had ASA (American Society of Anesthesiologists) Grade-I and II between age 20-80 years undergoing thoracic and upper abdominal surgeries were allocated randomly in three groups and analyzed: RIB group (20ml 0.25% bupivacaine+8mg dexamethasone, RISS group (40ml 0.25% bupivacaine+8mg dexamethasone), whereas in group C no block was administered. The primary outcomes included assessment of time to first rescue analgesia, VAS scores and fentanyl consumption for 24 h following surgery. Assessment of hemodynamic parameters, patient and surgeon satisfaction scores, sedation scores and post operative nausea and vomiting (PONV) incidence were included in the secondary outcomes. The first rescue analgesic request, VAS Scores and fentanyl consumption were lower significantly in RIB and RISS groups at 0.5, 1, 1.5, 2, 4, 6, 8, 10, 12, 18 and 24 hours postoperatively in comparison to group C (*P*-value-RISS/C- 0.00, RIB/C-0.01) whereas it is greater in RIB group in comparison to RISS group with *P* value 0.01. Both blocks effectively reduced post operative pain, but we observed that RISS more efficacious than RIB as it produced better analgesia in terms of lower VAS Scores, increased time to first rescue analgesia and reduced postoperative fentanyl consumption.

INTRODUCTION

Post-operative pain is a great concern following thoracic and upper abdominal surgeries[1,2]. Especially laparoscopic cholecystectomy and MRM. In laparoscopic cholecystectomy, due to pneumo peritoneum post operative pain is transmitted by thoracolumbar nerves (T6-L1)-cutaneous branches in antero-lateral region due to abdominal wall distension and somatic pain occurs at trocar insertion site[3]. Post operative pain in MRM is due to the disruption of the 2nd to 6th intercostal nerves and axillary dissection[4]. Multimodal analgesia (MMA) in an important component of ERAS includes regional anesthetic methods as a crucial component. Inter facial plane blocks (IFBs) are evolving as viable and safe substitutes to epidural analgesia in thoracic and abdominal surgeries due minimal hemostasis required, simplicity of procedure, reduced risk of nerve damage as well as vascular invasion, accessible puncture routes and local anesthetic dispersion promoted by sliding structure of interfascial space[5,6]. Elsharkawy *et al.* (2016,2018) described USG RIB and RISS blocks in multiple clinical scenarios of thoracic and upper-abdominal analgesia recently as two innovative analgesic techniques. Studies demonstrated that requirement of narcotic analgesics was reduced significantly during the initial 24 hours following surgery when RIB[7,8] and RISS[9] blocks were administered. We conducted a prospective double-blinded, randomized controlled trial (RCT) to compare the post-operative analgesic effects of these techniques after cholecystectomy and MRM with a primary hypothesis that USG-guided RISS block lowered the post operative fentanyl consumption and VAS scores to a greater extent in comparison to RIB in initial 24 hours and both blocks provide adequate analgesia compared to no intervention group. Moreover, limited studies are available in literature and no such study has been performed in our institute.

MATERIALS AND METHODS

Ethics: Ethics Committee of a tertiary centre in Punjab approved the study protocol after which, it was registered in the Clinical Trial Registry-India (CTRI/2023/06/053548) in June'23.

Participants and Design: After documentation of a written informed consent from 90 patients of either gender with ASA physical status I and II, 20-80 years of age undergoing thoracic and upper abdominal surgeries followed by USG guided RIB and RISS block, the study was conducted. Patients giving refusal to participate, ASA Grade III and IV, infection at the block site, deranged coagulation profile, history of opioid abuse were excluded.

Anesthesia Application: After pre-operative assessment, baseline vitals were recorded. Intravenous access was secured and RL started. Premedication-Tab. Alprazolam 0.25mg and Tab. Esomeprazole 20mg given a night before surgery orally. In the operating room, patients' vitals were monitored. Pre-medication included following IV injections-Midazolam (0.05mg/kg), Glycopyrrolate (0.005-0.01mg/kg) and Ondansetron 4mg were given before induction. After pre-oxygenation for 3 minutes IV injection Fentanyl (1µg/kg), Propofol (1-2mg/kg) and Vecuronium (0.08-0.12mg/kg) were given. Anaesthesia maintained using Isoflurane with 50% O2, N2O and injection Vecuronium (0.02-0.04mg/kg) IV. Infusion Paracetamol (1g) was given intraoperatively.

Patient Grouping and Randomization: Following endotracheal intubation, a researcher who had no involvement in the trial randomly allocated the patients into three groups.

Application of Block Intervention: After surgery was over, before endotracheal extubation patients were positioned lateral so that operative side faces superiorly. The ipsilateral arm abducted so that scapula is moved laterally. RIB was administered with a (6-12MHz) linear USG probe of high frequency positioned medial to the medial border of scapula in the oblique sagittal plane. After identifying the landmarks i.e. trapezius, rhomboid, intercostal muscles, pleura and lung, a 21-G needle inserted at T5-T6 level and 20ml 0.25% Inj. Bupivacaine and 8mg Inj. Dexamethasone were injected in the rhomboid-intercostal plane. Local anesthetic spread visualized. In RISS group, RI injection was administered as stated above. Thereafter, the probe was positioned laterally and caudally to identify the tissue plane between serratus anterior and external intercostal muscles and subserratus block with 20ml 0.25% Inj. Bupivacaine and 4mg Inj. Dexamethasone was given. An anesthesiologist with an experience of administering RIB and RISS blocks in above 30 cases before the study administered both the blocks. In control group no block was administered and only rescue post-operative analgesia was given. Patients were extubated, after block application.

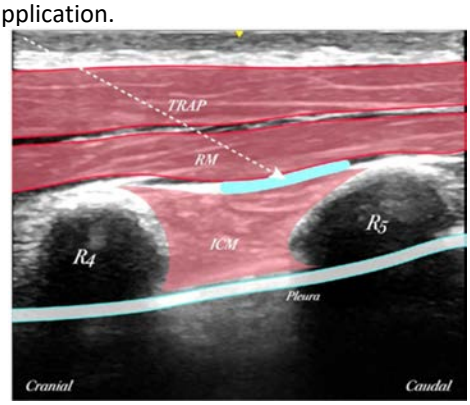

Fig. 1: USG Image -RI Injection: IM, Intercostal Muscle., LA, Local Anesthetic., RM, Rhomboid Major., TRAP, Trapezius., R4 and R5-Ribs 4 and 5

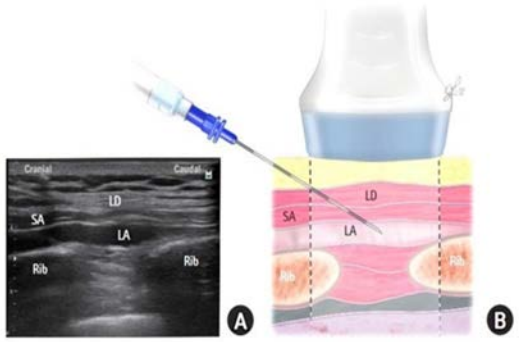

Fig. 2: (A) USG Image and (B) Illustration with Surrounding Structures, Needle Position: Sub-Serratus injection-T7 and T8 Levels. LD: Latisimus Dorsi, SA: Serratus Anterior, LA: Local Anesthetic

Pain evaluation in postoperative care unit and ward: In post anesthesia care unit, another blinded anesthesiologist evaluated pain by recording VAS score postoperatively at 30-minute intervals for the first 2 h and later on in surgical ward at 4, 6, 8, 10, 12, 18 and 24 hours postoperatively. When VAS was >3, rescue analgesia Inj. Fentanyl (1-2µg/kg) IV was supplemented. Inj Ketorolac 30mg IV was given in case of no relief and number of such doses were calculated. First analgesic request time and total dose of rescue analgesia required was noted.

Primary and Secondary Outcomes: The primary aims included assessment of time taken to perform USG-guided RISS and RI blocks, first rescue analgesia time, total opioid consumption and VAS Scores postoperatively for a duration of 24 hours. The secondary aims were to study hemodynamic parameters, patient and surgeon satisfaction score, sedation score and post-operative complications and side effects like PONV and post operative respiratory depression.

Sample Size: In order to calculate the sample size, primary outcome that was of interest was total analgesia duration. It was calculated with maximum 5% risk, minimum 85% power and 5% significance level (95% confidence interval-significant). In consultation with statistician taking into consideration studies done prior to obtain power of study >85%, minimum 28 participants were required in each group. Due to possibility of refusal, exclusion, dropouts a decision to include 30 patients per group was made.

Group I: RISS.
Group II: RIB.
Group III: Control Group-C.

Statistical Analysis: Data was recorded in a Microsoft Excel spread sheet and analyzed using statistical package for social sciences (SPSS-version 24.00 Armonk, NY: IBM Corporation). Continuous data was expressed as mean alongwith standard deviation. Categorical data was expressed in percentage. The level of significance evaluated on the basis of determined P-value. The results were analyzed and compared to studies done prior in order to draw relevant conclusions.

RESULTS AND DISCUSSIONS

Ninety patients were segregated in three groups of 30 each using computer generated randomisation.

- **Group RISS (n=30):** In this group USG guided RISS block with 40ml 0.25% bupivacaine and dexamethasone 8mg was given.
- **Group RIB (n=30)**: In this group USG guided RIB block with 20ml 0.25% bupivacaine and dexamethasone 8mg was given.
- **Group C (n=30):** In this group no block was given.

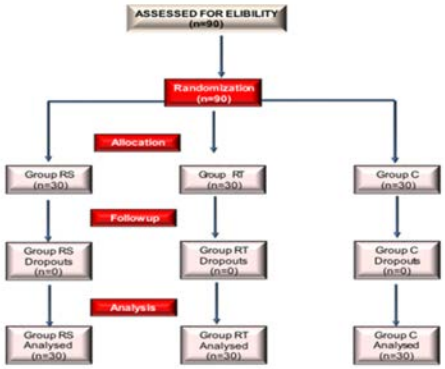

Fig. 3: Shows Consort (Consolidated Standards of Reporting Trials) Diagram

Demographic characteristics in patients of all three groups were comparable. (see table-1)

Table 1: Demographic Characteristics in Patients of all three Groups were Comparable

Characteristics	Mean (Group RS)	Mean (Group RT)	Mean (Group C)
Age	43.93 ±14.43	41.03± 13.83	47.06± 13.00
Weight (kg)	56.17± 5.67	57.33± 5.59	56.33± 5.56
Duration of surgery (minutes)	87.83± 13.938	89.83±13.802	87.50± 13.048

Patients were also comparable in terms of ASA grade and type of surgery performed in all three groups. Procedural time was defined as time after cleaning and draping of site till injection of local anesthetic drug. Procedure time noted in RISS group: 13.30±1.39 minutes, in RIB group: 10.33±1.79, the difference between the two being significant statistically with P-value >0.001. Since in group RISS, the RI component of block at T5 level and SS component of the block at T8 level was given by positioning probe more caudally and laterally thus more time was required. Whereas, in RIB group only RI component was given. The difference between procedural times in both blocks is significant statistically with P-value 0.001.

Fig. 4: Vas SCORE

(Fig. 4) shows VAS scores at different intervals after surgery. The VAS Score in both RISS and RIB groups was reduced significantly than in C group at 0.5, 1, 1.5, 2, 4, 6, 8 hours with P-value <0.05. At 10 hours VAS Score was reduced in group RISS in comparison to group RIB and C with P-value <0.05. At 24 h, the VAS Score in all three groups was comparable with P value >0.05.

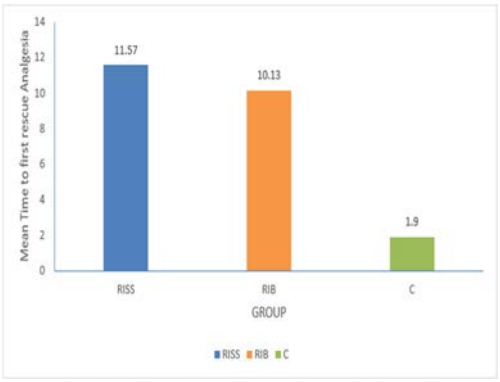

Fig. 5: Time to first Rescue Analgesia (Hours)

(Fig. 5) shows first post-operative analgesic request time in all three groups, in RISS group it was 11.57± 2.34 hours, in RIB group it was 10.13±1.994 h and in C group it was 1.90±1.37 hours. When RISS and RIB groups were compared, significant difference was present (P value- 0.012). Whereas, on comparing group RISS and RIB with C group, difference was highly significant (P-value <0.001).

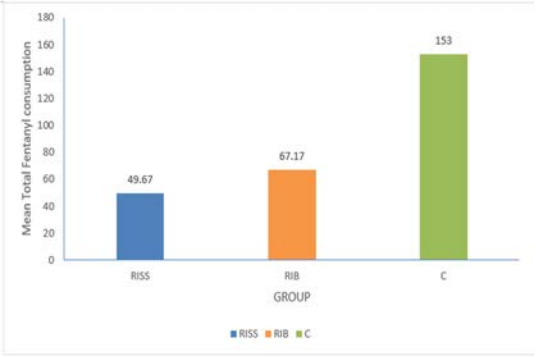

Fig. 6: Total Post Operative Fentanyl Consumption (µg) for 24 Hours

(Fig. 6) shows total fentanyl consumption in µg for 24 hours. As compared to group RISS (49.67+20.55) µg and RIB (67.17+22.807) µg it was significantly increased in C group (153+45.6) µg with P-value <0.001. On the contrary, consumption in group RISS and RIB was comparable and insignificant (P-value>0.05). Additionally, in nine patients belonging to C group who had no relief with Inj. Fentanyl, Inj. Ketorolac 30mg IV was given. Therefore, 270mg IV of Inj. Ketorolac was given in C group, whereas no such requirement was witnessed in groups RISS and RIB.

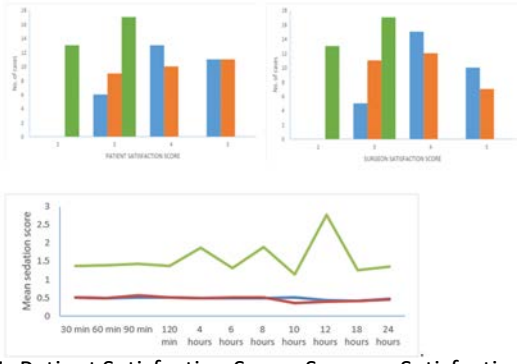

Fig. 7: Patient Satisfaction Score, Surgeon Satisfaction Score and Mean Sedation Score

Due to profound analgesia provided by both the blocks surgeons were satisfied with results in both group RISS and RIB while they were either dissatisfied or neutral in C group. Thus, surgeon satisfaction score in RISS and RIB groups is comparable and statistically non-significant with P value >0.05 whereas a significant difference was noted when both these groups were compared to C group with P-value 0.01. Patient satisfaction scores were recorded post-operatively in all three groups. Score range varied from 1 (very dissatisfied) to 5 (very satisfied). Difference between mean patient satisfaction scores was greater in RISS and RIB groups in comparison to group C with P-value RISS/RIB>0.05, RIB/C<0.001 and RISS/C <0.001. Sedation scores in groups RISS and RIB were <2 at all time intervals. On the contrary, in C group due to more consumption of fentanyl it was >2 at 12 hours. In C group due to more fentanyl consumption 9(30%) patients complained of nausea and 8(26.67%) patients had vomiting. Inj. Ondansetron 0.1mg/kg IV was administered for relief. No PONV incidence in group RISS and RIB was noted. No other post-operative procedure related complications like injection site hematoma, respiratory depression, systemic toxicity of local anesthetics, venepuncture, arrhythmias or bleeding were noted. Hemodynamic parameters were comparable in all three groups postoperatively.

Recently RISS and RIB blocks have gained popularity as good alternatives for analgesic management in thoracic and upper abdominal surgeries known to block cutaneous branches (lateral) of intercostal

nerves- T3-T9 and providing analgesia between T2-T9 dermatomes respectively. Our study investigated the post-operative analgesic effects of RIB and RISS blocks following thoracic and upper abdominal surgeries which revealed that both these blocks effectively relieved the post operative pain leading to reduced VAS scores, increased duration of pain relief and reduced post operative fentanyl consumption. RISS block was found more effective. RIB was first introduced by Elsharkawy[10]. This block provided analgesia to the anterior and posterior thorax after local anesthetic injection in rhomboid intercostal plane. It was easy to perform, produced the desired analgesia in the relevant dermatomes. Basak Altiparmak[11] performed USG-guided RIB in 2 patients for post-operative analgesia following thoracoscopic surgery. 30ml 0.25% bupivacaine was injected in rhomboid intercostal inter-fascial plane. They reported lesser NRS scores with no rescue analgesia requirement in initial 12 hours. The pin-prick test demonstrated a sensory blockade from T3-T10 at 1h postoperatively. Chen[12] did a meta-analysis on all available RCTs that were available from 2016-2021 in order to analyse analgesic efficacy and safety of RIB after thoracic and breast surgery-noted lower NRS scores in group RIB in comparison to control group in 0-1 and 6-8 hours. Post-operative fentanyl consumption, PONV incidence in RIB was also lower than control group with significant statistical difference (P<0.001) Our results are similar as we also found lower VAS scores in the RIB group than group C till 8 hours with P-value <0.05. Postoperative Fentanyl consumption in RIB group was lower than control group (67.17±22.807 µg vs 153±45.6 µg). In C group, due to more fentanyl consumption 9(30%) patients complained of nausea and 8(26.67%) patients had vomiting. No PONV incidence was noted in RIB group. In 2018, Elsharkawy[13] added a component to the previously described RIB block, termed as RISS block. RISS tissue plane was deep to erector spinae (medially) and serratus anterior (laterally). A consistent spread of injectate to the cutaneous branches (lateral) of T4-T9 intercostal nerves in cadavers and consistent analgesia in T5-T8 dermatomes in clinical case series showed promise for this block providing chest wall and upper abdominal wall analgesia. Ok men[3] evaluated analgesic efficacy of unilateral RISS block for pain relief after cholecystectomy where RISS block was administered with 20ml of 0.25% Inj. Bupivacaine, NRS scores on movement were lower till 12 hours than in C group. Post operative tramadol consumption at 24 hours was reduced in RISS group than in C group (89mg v/s 145mg). Whereas, we injected 40ml 0.25% Inj. Bupivacaine with 8mg Inj. Dexamethasone during the RISS block therefore, VAS score till 18 hours was lower significantly as compared to C group with P-value<0.01, along with reduced post-operative fentanyl consumption (49.67±20.55 µg v/s 153±45.6 µg) These results are obtained as we used additional quantity of local anesthetic and an additive that helped to prolong analgesia. In a study conducted by Wei Deng et al.10 to compare the post-operative analgesia after VATS with RISS-block with 40 ml 0.375% ropivacaine versus RIB with 20 ml 0.375% Ropivacaine. NRS scores in RIB & RISS groups till 24 hours were reduced than in C group (P-value <0.05). Also, the NRS-scores in group RISS from 12-24 hours were significantly reduced than RIB group with P-value <0.05. The sufentanil consumption at 24 hours after surgery in RIB (58.0±3.4 µg) and RISS (51.9±2.2µg) groups was highly reduced than in C group (73.5±8.2µg), P-value <0.001 and sufentanil consumption in RISS group (51.9±2.2µg) were also reduced than that in RIB group (58.0±3.4µg) at 24 hours after surgery with P-value < 0.001. Compared with C group, patient satisfaction scores in RIB and RISS groups were higher., (P<0.05), but no difference between RIB and RISS groups (P=0.054) was noted. Similarly in our study, VAS scores in group RISS were lower than in group RIB and C at all time intervals with P-value statistically significant and become comparable in all groups at 24 hours with P-value >0.05. VAS score was >3 in RIB and C groups at the 10th hour, but it was lower in RISS group Also, total fentanyl consumption in RISS group (49.67±20.55) µg and group RIB (67.17±22.807) µg is significantly less compared to C group (153±45.6) µg. Higher surgeon and patient satisfaction scores were noted in groups RISS and RIB than C group.

Limitations: Despite several advantages when we look at the flipped side of the coin there are some limitations. There have been limited trials on these blocks in concerned surgeries therefore data available is limited and require further research. Both blocks RIB and RISS were performed when patient was still under general anesthesia after surgical procedure, so nerve block coverage with a test dose of a local anesthetic agent could not be tested. As it was a single-centre study thus, more studies from different centres should have been included to test the reproducibility of our consequences. Single shot analgesia was given and catheter was not inserted to prolong the analgesic effect of local anesthetic in both groups to avoid patient discomfort. Post-operative monitoring was done for only 24 hours and analgesia duration exceeding 24 hours was not noted. Also, the sample size we took was small, so future studies should be undertaken with a large population size.

CONCLUSION

After thorough review of literature and conducting the present study, it can be concluded that both USG

guided RISS and RIB blocks are effective and easy to administer, offered better patient and surgeon satisfaction scores in thoracic and abdominal surgeries. But RISS is a better choice as though a longer time required for its application, it produced better analgesia. Thus, reduced post operative opioid consumption, greater first rescue analgesia time were noted in the patients in this group.

Conflicts of Interest: There were no conflicts of interest.

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