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Ultrasound guided rhomboid Intercostal and subserratus plane block versus subcostal transversus abdominis block in open upper abdominal surgeries

Bloqueo intercostal romboide y subserrato guiado por ultrasonido versus bloqueo subcostal del transverso del abdomen en cirugías abiertas del abdomen superior

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ABSTRACT

Background: Upper abdominal operations are very well known for their severe postoperative pain levels. A range of complications may arise, when this pain is not controlled increasing as slowing the patient's overall recovery and increasing morbidity and mortality. The RISS block has recently emerged as a promising regional technique for providing analgesia to the upper abdominal region and chest wall. **Aim:** To compare the analgesic performance of US-guided RISS block with that of the subcostal TAP block in cases undergoing open upper abdominal surgery (UAS). **Methods:** This prospective, randomized comparative study lasted one year and included 74 cases scheduled to undergo open UAS. Subjects were randomized into two equal groups: RISS block group and subcostal TAP block group. Morphine consumption in the 24 hours after surgery was recorded and pain level was measured using the VAS during movement and at rest at 2, 4, 6, 12, and 24 hours after surgery. **Results:** At the 24-hour mark, morphine consumption in the RISS group was substantially lower than in the subcostal TAP group. However, there were no marked intergroup variations in total intraoperative fentanyl use; intraoperative or postoperative hemodynamic parameters; postoperative VAS scores at rest or during movement at 2, 4, 6, 12, and 24 hours; incidence of adverse effects; patient satisfaction; or hospital stay length. **Conclusion:** The US-guided RISS block may also serve as an effective alternative to the subcostal TAP block, providing satisfactory postoperative pain control in cases undergoing open UAS.

Keywords: Subcostal transversus abdominis block, open upper abdominal surgeries, rhomboid Intercostal and subserratus plane block.

RESUMEN

Antecedentes: Las intervenciones en la parte superior del abdomen son bien conocidas por los elevados niveles de dolor posoperatorio que generan. Cuando este dolor no se controla adecuadamente, puede dar lugar a diversas complicaciones, retrasar la recuperación global del paciente e incrementar la morbilidad y la mortalidad. El bloqueo intercostal romboideo y subserrato han surgido recientemente como una técnica regional prometedora para proporcionar analgesia en la región abdominal superior y la pared torácica. **Objetivo:** Comparar el rendimiento

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analgésico del bloqueo intercostal romboideo y subserrato guiado por ecografía con el del bloqueo TAP subcostal en pacientes sometidos a cirugía abierta del abdomen superior. **Métodos:** Este estudio prospectivo, aleatorizado y comparativo se llevó a cabo durante un año e incluyó a 74 pacientes programados para cirugía abierta de abdomen superior. Los participantes se distribuyeron aleatoriamente en dos grupos iguales: grupo de bloqueo intercostal romboideo y subserrato y grupo de bloqueo TAP subcostal. Se registró el consumo de morfina durante las primeras 24 h tras la cirugía y se evaluó el nivel de dolor mediante la escala EVA durante el movimiento y en reposo a las 2, 4, 6, 12 y 24 h posteriores a la intervención. **Resultados:** A las 24 h, el consumo de morfina fue significativamente menor en el grupo intercostal romboideo y subserrato en comparación con el grupo TAP subcostal. Sin embargo, no se observaron diferencias notables entre los grupos en cuanto al consumo intraoperatorio total de fentanilo; los parámetros hemodinámicos intraoperatorios o posoperatorios; las puntuaciones EVA en reposo o en movimiento a las 2, 4, 6, 12 y 24 h; la incidencia de efectos adversos; la satisfacción del paciente; o la duración de la estancia hospitalaria. **Conclusión:** El bloqueo intercostal romboideo y subserrato guiado por ecografía puede constituir una alternativa eficaz al bloqueo TAP subcostal, ofreciendo un control satisfactorio del dolor posoperatorio en pacientes sometidos a cirugía abierta del abdomen superior.

Palabras clave: Bloqueo transverso del abdomen subcostal, cirugías abiertas del abdomen superior, bloqueo del plano romboidal intercostal y subserrato.

Introduction

Effective postoperative pain management facilitates optimal recovery, reduces the physiological stress response, and improves overall surgical outcomes. Local anesthesia (LA) techniques-particularly abdominal wall anesthesia-are valuable and widely accepted options for managing pain associated with surgical incisions[1].

UAS typically refers to procedures performed through an incision above or extending above the level of the umbilicus[2]. Surgery involving the upper abdomen is typically associated with considerable postoperative pain. Inadequate pain control may lead to postoperative atelectasis, shallow breathing, increased respiratory infections susceptibility, and impaired airway secretion clearance-all of which can elevate postoperative complications risk and delay recovery[3].

Sensory innervation of the anterior abdominal wall arises from the lower six thoracic nerves along with the upper lumbar nerves. These afferent pathways form the main focus of LA blocks designed to achieve analgesia for abdominal operative wounds[4].

The TAP block represents a peripheral nerve block in which local anesthetic (LA) is deposited in the intermuscular plane located between the internal oblique and transversus abdominis muscles[5]. The US-guided subcostal TAP block, originally introduced by Hebbard and colleagues, has been shown to offer effective analgesia for cases undergoing upper abdominal surgical procedures[6],[7]. This anatomical plane represents a neurofascial layer situated between the rectus abdominis and transversus abdominis muscles. LA injection within this space commonly results in blockade of the T6-T10 dermatomes, with possible extension to T12, while consistently sparing the L1 segment[8].

A novel analgesic technique, the RISS block, was introduced by Elsharkawy et al., in 2018 for analgesia of the upper abdomen and chest wall. Later studies have further detailed the technique and confirmed its effectiveness in different clinical settings. The RISS block has also been utilized in multiple abdominal surgeries and in the management of pain associated with rib fractures and chest tube placement. Clinical assessments indicated that the RISS block reliably produced sensory coverage extending from T5 to T8. Cadaveric studies reported that the injectate spread along the intercostal layers and extended beneath the rhomboid and serratus anterior muscles, staining the lateral cutaneous branches of the intercostal nerves spanning T4 to T9[9].

This study aimed to evaluate the analgesic effect of US-guided RISS block compared to subcostal TAP in cases undergoing open upper abdominal surgeries.

Patients and Methods

This prospective, randomized comparative study was carried out over a one-year period, from January 2023 to January 2024, at the Gastroenterology Center of Mansoura University. A total of 74 cases, aged 40 to 65 years, with an ASA physical status of I or II, of either sex, were enrolled. All participants were scheduled for elective open upper abdominal surgical procedures.

Ethical approval

This study was approved by the IRB, Faculty of Medicine, Mansoura University, Egypt (MD.22.06.852.R1), and was registered in PACTR under the identifier PACTR202207699902119. Written consent was secured. The study adhered to the Helsinki Declaration and complied with all relevant regulations governing research involving human participants.

Exclusion criteria: We excluded the cases with prior opioid narcotics use, cases on chronic pain medications, cases with neuromuscular diseases, cases with bleeding or coagulation disorders, cases with psychiatric disorders, pregnant women, cases with BMI more than 35 kg/m^2, cases with infection at the site of injection, and cases who have allergy to any of medications used in this study.

Randomization: A total of 74 eligible participants were randomized into two equal groups using a permuted block randomization method, with block sizes of 4 and 6 chosen in a random sequence. Group assignments were concealed in sequentially numbered, opaque, sealed envelopes, which were opened only after confirming eligibility and obtaining informed consent: 1- RISS group (n = 37 cases): Cases received RISS block. 2- Subcostal TAP group (n= 37 cases): Cases received subcostal TAP block.

On the day before surgery, the investigator met each case

to obtain a detailed medical history and perform a full physical examination. The laboratory tests: CBC, blood glucose measurement, international normalized ratio, liver functions, and renal functions, were all performed. Cases were also given in depth briefing on the study protocol and the characteristics of the nerve block to be performed.

All cases fasted for 8 hours before surgery and were given 8 mL/kg of lactated Ringer's solution to compensate for fasting-related fluid losses. During transfer to the pre-anesthesia area, routine monitoring-including five-lead ECG, pulse oximetry, and noninvasive BP measurement-was initiated. Baseline HR and BP values were recorded before continuous monitoring was maintained. In the operating room, after induction and stabilization under general anesthesia, cases received their designated abdominal wall block (either RISS or subcostal TAP).

Techniques of block

In the context of the RISS group, the researcher applied the approach of Elsharkawy et al.,[9]. Cases were placed in the lateral decubitus position with the upper limbs abducted and internally rotated to shift the inferior angle of the scapula laterally. After skin sanitization, a high-frequency linear US probe (GE LOGIQ, 6-13 MHz) was positioned sagittally just medial to the scapula's medial border, with the probe marker oriented cranially. The transducer was then gently adjusted-cranially toward the midline and caudally outward-to obtain a paramedian sagittal oblique image about 1-2 cm medial to the scapular margin.

US scanning revealed a layered arrangement consisting-superficially to deeply-of the trapezius muscle, the rhomboid major muscle, the intercostal muscles between the ribs, and subsequently the pleura with the lung beneath it. The fascial plane between the intercostal muscles and the rhomboid major was clearly delineated. A 22-gauge spinal needle was advanced using an in-plane craniocaudal trajectory, traversing the trapezius and rhomboid major muscles. After hydrodissection confirmed the correct position, 10 mL of 0.25% bupivacaine was injected into the rhomboid–intercostal plane.

To obtain a view of the subserratus plane, the US probe was repositioned caudally and laterally to a point just below the scapula's inferior angle. In this sonographic window, the structures appeared from superficial to deep as the latissimus dorsi, serratus anterior, the intercostal muscles between the ribs, and then the pleura with the underlying lung. Using the same skin puncture site as for the rhomboid intercostal injection, the needle was redirected caudally and laterally to pass beneath the inferior angle of the scapula.

If the needle tip could not be advanced beyond the scapula's inferior margin-often encountered in obese or tall cases -a second entry point was selected just medial to the lower scapular angle and close to the posterior axillary line. Through this site, 20 mL of 0.25% bupivacaine was injected into the fascial space between the serratus anterior and the external intercostal muscle, creating hydrodissection along the attachments of the serratus to the ribs. The same sequence of steps was subsequently performed on the contralateral side.

Regarding (Subcostal TAP) group, a technique described by Hebbard et al., was used[6]. Cases were positioned supine, and after skin sanitization, a high-frequency linear US transducer was oriented obliquely over the upper abdominal wall at the subcostal border near the midline. Visualization began with the rectus abdominis muscle, followed by gradual lateral and oblique movement of the probe along the subcostal line until the transversus abdominis muscle appeared posterior to the rectus muscle.

Once the neurofascial TAP was clearly identified between the rectus abdominis and the transversus abdominis muscles, a 22-gauge spinal needle was advanced from an anterior approach under real-time US guidance. The needle was guided toward the TAP, and after confirming correct placement with negative aspiration, 30 mL of 0.25% bupivacaine was injected. Hydrodissection created a distinct, dark, oval-shaped separation within the plane on the US image. The same technique was then repeated on the contralateral side.

After block was completed, SBP and HR were assessed at 15 and 30 minutes, and then at 30-minute intervals until the end of the operation. After completion of the surgical procedure, inhalational anesthesia was discontinued, and neuromuscular blockade was reversed using IV atropine (0.02 mg/kg) and neostigmine (0.04 mg/kg). The endotracheal tube was removed, and the patient was transferred to the recovery unit, where routine postoperative monitoring continued. Surgical duration was documented from the initial incision to final suture placement.

All cases received the same standardized postoperative analgesic regimen, consisting of IV ketorolac (30 mg) and IV paracetamol (1 g) administered every 8 hours beginning immediately after surgery. IV morphine was also administered through a PCA system. No continuous background infusion was used; instead, the PCA device delivered on-demand bolus doses. Each bolus provided 1 mg of morphine with a 15-minute lockout interval, and the system was programmed to limit total administration to a maximum of 6 mg within any 4-hour period.

Pain intensity was measured at rest and during movement such as hip flexion or coughing at 2, 4, 6, 12, and 24 hours after surgery, and was assessed using the VAS scoring system, which ranges from 0 (no pain) to 10 (worst pain imaginable).

The timings of the first morphine dose and the total morphine used during the first 6 hours, 12 hours, and 24 hours post-surgery were recorded. Any instances of nausea, vomiting, and pruritus that the patient mentioned at any time point was noted. Some of the other recorded complications were pneumothorax and signs of LA toxicity. Satisfaction concerning managing pain during the first 24 hours post-surgery was measured using a 5 category scale, from 1 being 'very unsatisfied' to 5 being 'very satisfied'[10].

The total morphine consumed in the first day after the operation was the primary outcome of the study. Secondary outcomes included the time of first morphine demand, VAS pain scores either at rest or in motion at 2, 4, 6, 12, and 24 hours after the operation, any postoperative adverse events (nausea, vomiting, itching, pruritus, pneumothorax, symptoms of LA toxicity), and overall patient satisfaction.

Sample size calculation

Data from earlier work which established average cumulative morphine consumption were utilized as a reference point to ascertain how many participants were needed from each

study group and determine sample size[11]. Using G*Power 3.1.9.4 to estimate sample size, a two-tailed test with an effect size of 0.689, a 0.05 alpha, and 90% power were entered. It resulted in an estimate of 34 cases in each group. Given a projected 10% dropout rate, final sample sizes were adjusted to 37 cases in each group.

Statistical analysis

Statistical examination was conducted using v26 SPSS software produced by Chicago's PASW Windows Statistics SPSS Inc. In this regard, categorical variables were shown in frequencies and percentage. For quantitative data, mean ± SD was used when the distribution was normal, whereas median values with their minimum and maximum ranges were reported for non-normally distributed variables, after evaluation of normality using the Kolmogorov-Smirnov test. Between-group differences were analyzed with Chi-square test for qualitative data, the Mann-Whitney U test for non-parametric numerical variables, and the independent Student's t-test for variables following a normal distribution. Statistical significance was defined as p = 0.05.

Results

A total of 90 cases were screened for eligibility. Sixteen were excluded for not meeting the inclusion criteria: seven were classified as ASA III or IV, five had a prior history of opioid use, and four had a BMI greater than 35. A total of 74 eligible cases proceeded to enrollment, as depicted in Figure 1.

Demographic and clinical characteristics were comparable between studied groups (Table 1).

There were no marked variations between two groups concerning the duration and type of surgery, type of surgical incision, and length of hospital stay (Table 2). Also, no marked variations were detected between both groups regarding total intraoperative fentanyl consumption, time of first post-operative morphine dose, patient satisfaction, cumulative morphine consumption at 6 and 12 hours. A substantial reduction in 24-

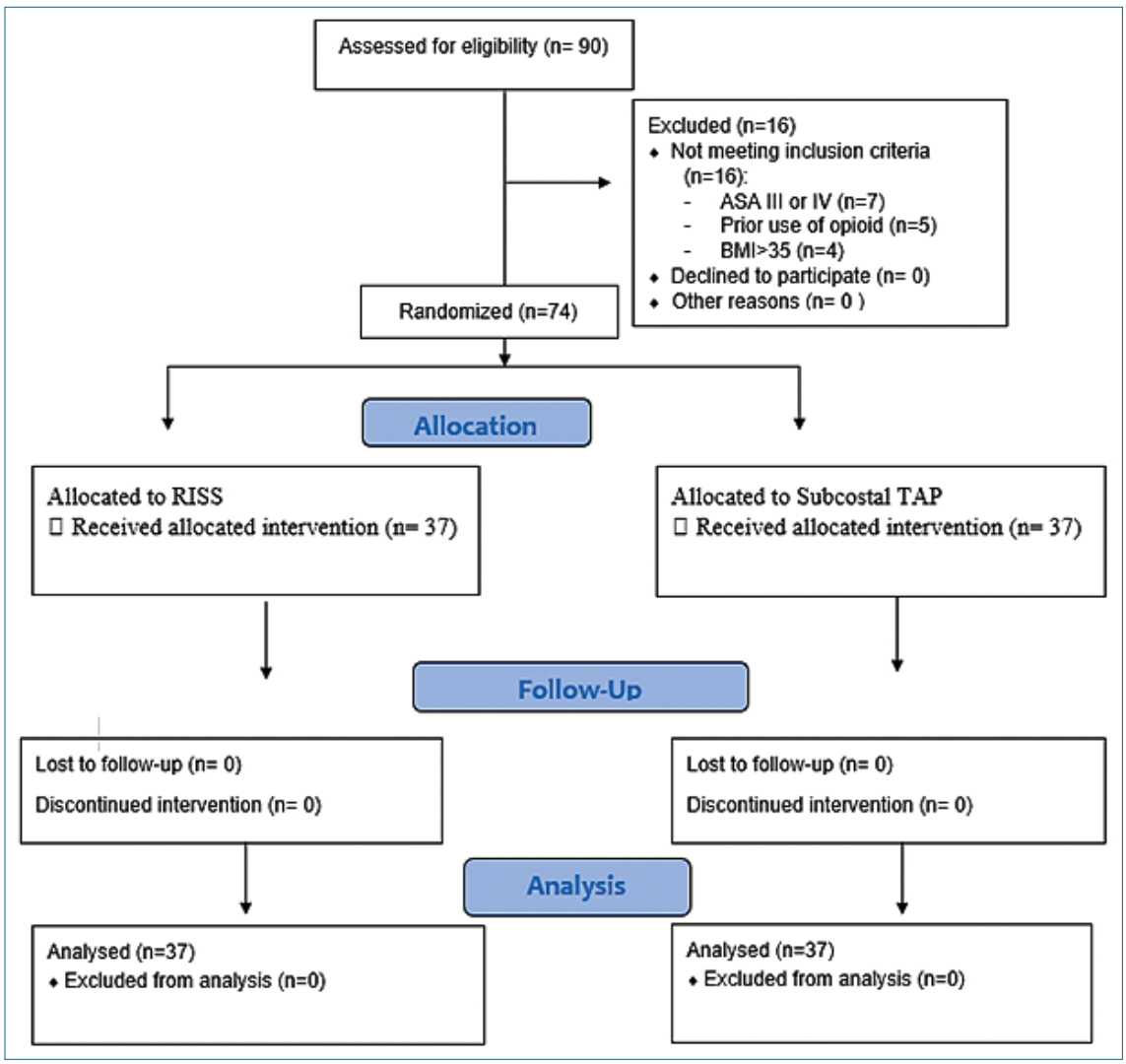

Figure 1. Consort flow chart of the enrolled cases.

Table 1. Demographic and clinical characteristics between the studied groups			
	RISS n = 37	**Subcostal TAP n = 37**	**P-value**
Age (years)	55.59 ± 8.54	54.32 ± 9.13	P = 0.539
Sex Male Female	 23 (62.2%) 14 (37.8%)	 23 (62.2%) 14 (37.8%)	 P =1.0
BMI (kg/m^2)	28.54 ± 3.55	28.90 ± 4.05	P = 0.682
ASA status I II	 17 (45.9%) 20 (54.1%)	 19 (51.4%) 18 (48.6%)	 P = 0.642
Side of the block: - Unilateral - Bilateral	 8 (21.6%) 29 (78.4%)	 10 (27%) 27 (73%)	 P = 0.588
Time taken to perform the block (min)	8.79 ± 2.50	4.42 ± 1.14	P = 0.001*

*: Significant.

Table 2. Operative characteristics and hospital stay length between the studied groups			
	RISS n = 37	**Subcostal TAP n = 37**	**P-value**
Duration of surgery (min)	218.92 ± 76.44	206.89 ± 76.57	P = 0.501
Type of surgery - Hepatectomy - Jejunal mass resction - Incisional hernia - Choledochoduodenostomy - Gastrectomy - Open fundoplication - Splenectomy - Pancreatectomy - Whipple - Hepaticojejunostomy	 10 (27%) 1 (2.7%) 5 (13.5%) 4 (10.8%) 9 (24.3%) 1 (2.7%) 0 (0%) 3 (8.1%) 4 (10.8%) 0 (0%)	 11 (29.7%) 0 (0%) 5 (13.5%) 6 (16.2%) 7 (18.9%) 1 (2.7%) 1 (2.7%) 3 (8.1%) 2 (5.4%) 1 (2.7%)	 P = 0.886
Type of surgical incision - Right subcostal incision - Right subcostal and midline incision - Midline incision - Left subcostal incision - Extended right subcostal incision	 8 (21.6%) 10 (27.0%) 15 (40.5%) 0 (.0%) 4 (10.8%)	 9 (24.3%) 11 (29.7%) 14 (37.8%) 1 (2.7%) 2 (5.4%)	 P = 0.771
Length of hospital stay (days)	6 (3-28)	4 (1-39)	P = 0.190

hour cumulative morphine consumption was detected in RISS group relative to subcostal TAP group (Table 3).

Post-operative VAS score at different time points was insignificant between the groups (Table 4).

As regards intraoperative and post-operative HR, systolic BP, and diastolic BP, there were no substantial variations between studied groups (Tables 5 and 6).

Discussion

This study compared the analgesic effect of US guided RISS block with subcostal TAP on cumulative morphine consumption at 24 hours in cases undergoing open upper abdominal surgeries.

The current study demonstrated that cumulative morphine consumption at 24 hours was lower in RISS group than subcostal TAP group. Also pain intensity as indicated by VAS, time of first post-operative morphine dose, total intraoperative fentanyl consumption, hemodynamic responses, patient satisfaction, and length of hospital stay were comparable in both groups. In view of these results and the absence of major adverse events, the RISS block appears to be a viable substitute for the subcostal TAP block in open UAS. Its opioid-sparing effect may contribute to smoother recovery and allow cases to regain mobility sooner after the operation.

Several factors support considering the RISS block as an alternative to the subcostal TAP block in open upper abdominal procedures. The RISS block is theoretically able to achieve sensory coverage extending from the third to the 12th thorac-

Table 3. Total intraoperative fentanyl consumption, time of first post-operative morphine dose, cumulative morphine consumption, and patient satisfaction of the studied groups			
	RISS n = 37	**Subcostal TAP n = 37**	**P-value**
Total intraoperative fentanyl consumption (µg)	133.24 ± 27.49	139.72 ± 26.08	P = 0.301
Time of first post-operative morphine dose (hours)	6 (1-24)	5 (1-24)	P = 0.500
Cumulative morphine consumption (mg)			
At 6 h	3.71 ± 0.98	3.45 ± 0.76	P = 0.379
At 12 h	4.67 ± 1.81	5.27 ± 1.83	P = 0.207
At 24 h	5.97 ± 2.39	7.32 ± 2.48	P = 0.034*
Patient Satisfaction			
Very unsatisfied	1 (2.7%)	1 (2.7%)	P = 0.963
Unsatisfied	4 (10.8%)	6 (16.2%)	
Fair	6 (16.2%)	5 (13.5%)	
Satisfied	21 (56.8%)	21 (56.8%)	
Very satisfied	5 (13.5%)	4 (10.8%)	

*: Significant.

Table 4. VAS Score at rest and at movement at different time points between the studied groups			
	RISS n = 37	**Subcostal TAP n = 37**	**P-value**
VAS Score at rest			
2 h	2 (0-7)	2 (1-8)	P = 0.690
4 h	2 (0-8)	3 (2-7)	P = 0.481
6 h	3 (0-5)	3 (2-6)	P = 0.902
12 h	3 (0-6)	4 (2-6)	P = 0.338
24 h	3 (2-6)	4 (2-6)	P = 0.269
Visual analogue Score at movement			
2 h	2(0-8)	2 (1-9)	P = 0.646
4 h	3(0-8)	3 (2-7)	P = 0.734
6 h	4(0-6)	4 (2-6)	P = 0.668
12 h	4(0-6)	5 (2-7)	P = 0.400
24 h	4(5-6)	4 (2-7)	P = 0.09

ic dermatomes, which is broader than the conventional T6-T9 coverage associated with the subcostal TAP block. It also blocks the lateral branches of both ventral and dorsal rami of the intercostal nerves from T3 to T12, whereas the subcostal TAP block mainly anesthetizes the ventral rami between T6 and T9[12],[13].

As far as the authors are aware, this represents the first clinical study to assess and compare RISS with subcostal TAP for perioperative analgesia in cases undergoing open upper abdominal surgical procedures. Moreover, this is the first comparison between them in different types of surgeries.

Yet, there are multiple researches on RISS block. It was used for control of post thoracotomy pain[14], thoracoscopic pain[15]-[17], post mastectomy pain[18],[19], and pain after laparoscopic cholecystectomy[20]. Also one case series evaluated its efficacy in open abdominal surgeries[21].Subcostal TAP blocks have been used in multi-modal analgesic regimes for upper abdominal surgeries[22].

Consistent with our findings, Ökmen et al., assessed the use of a unilateral RISS block after laparoscopic cholecystectomy. Their study included fifty cases randomized equally into two groups: a RISS group receiving the block in addition to IV patient-controlled analgesia tramadol, and a control group managed with IV-PCA tramadol alone. They reported a significant reduction in 24-hour tramadol consumption in the RISS group. Pain scores at rest were also lower at 2 and 6 hours in the RISS group, while movement-related NRS values were substantially reduced at 2, 6, and 12 hours post-operatively compared to controls[20].

In a case series performed by Elsharkawy et al., 22 cases

Table 5. Intraoperative hemodynamics among studied groups			
	RISS n = 37	**Subcostal TAP n = 37**	**P-value**
Heart rate			
Basal preoperative	86.59 ± 15.94	80.38 ± 13.56	P = 0.08
after 15 min	74.57 ± 14.09	76.84 ± 16.72	P = 0.530
after 30 min	75.43 ± 11.84	80.65 ± 17.17	P = 0.133
after 60 min	76.89 ± 13.42	80.68 ± 13.65	P = 0.233
after 90 min	79.03 ± 12.52	79.46 ± 13.14	P = 0.885
after 120 min	80.22 ± 12.52	79.13 ± 13.63	P = 0.717
after 150 min	77.7 ± 10.62	81.50 ± 13.47	P = 0.236
after 180 min	78.76 ± 10.82	83.23 ± 11.28	P = 0.155
after 210 min	77.09 ± 14.18	82.31 ± 10.76	P = 0.225
after 240min	78.56 ± 15.38	84.23 ± 13.39	P = 0.294
after 270 min	82.0 ± 10.4	90.6 ± 8.99	P = 0.76
after 300 min	77.56 ± 16.31	92.5 ± 11.18	P = 0.073
after 330 min	72.33 ± 8.39	83.5 ± 6.03	P = 0.093
after 360 min	74.0 ± 11.31	87.67 ± 6.66	P = 0.176
Systolic blood pressure			
Basal preoperative	138 ± 13.25	135.54 ± 13.54	P = 0.432
after 15 min	121.86 ± 11.59	119.41 ± 14.55	P = 0.424
after 30 min	115.95 ± 15.67	117.51 ± 20.72	P = 0.715
after 60 min	117.7 ± 16.41	117.89 ± 12.82	P = 0.956
after 90 min	119.92 ± 15.95	115.57 ± 15.59	P = 0.239
after 120 min	120.03 ± 15.46	115.19 ± 17.39	P = 0.217
after 150 min	117.67 ± 13.50	112.18 ± 11.35	P = 0.101
after 180 min	111.8 ± 14.43	114.50 ± 13.15	P = 0.488
after 210 min	118.82 ± 11.32	113.25 ± 12.05	P = 0.154
after 240min	108.5 ± 17.53	118.08 ± 12.27	P = 0.102
after 270 min	114.93 ± 16.84	125.5 ± 9.24	P = 0.119
after 300 min	119.33 ± 20.27	119.83 ± 14.92	P = 0.960
after 330 min	108.67 ± 16.92	119.25 ± 5.12	P = 0.279
after 360 min	113.5 ± 7.78	127 ± 5.19	P = 0.096
Diastolic blood pressure			
Basal preoperative	82.97 ± 11.23	82.41 ± 9.19	P = 0.813
after 15 min	77.95 ± 9.88	73.08 ± 11.35	P = 0.053
after 30 min	71.19 ± 11.34	70.78 ± 12.67	P = 0.885
after 60 min	72.22 ± 12.29	70.16 ± 10.60	P = 0.444
after 90 min	73.49 ± 12.60	68.68 ± 10.41	P = 0.08
after 120 min	72.61 ± 10.41	67.51 ± 11.38	P = 0.051
after 150 min	71.37 ± 9.98	69.39 ± 10.18	P = 0.459
after 180 min	67.84 ± 10.11	68.96 ± 9.83	P = 0.690
after 210 min	71.50 ± 9.04	69.06 ± 8.23	P = 0.400
after 240 min	64.44 ± 10.07	69.46 ± 11.44	P = 0.206
after 270 min	66 ± 13.61	72.38 ± 13.15	P = 0.298
after 300 min	70.44 ± 10.68	74.83 ± 13.96	P = 0.502
after 330 min	58.33 ± 7.64	76.25 ± 11.87	P = 0.073
after 360 min	60.50 ± 2.12	76.33 ± 9.24	P = 0.108

Table 6. Post-operative hemodynamics among studied groups			
	RISS n = 37	**Subcostal TAP n = 37**	**P-value**
Heart rate			
2 h	75 ± 12.53	77.95 ± 12.19	P = 0.309
4 h	74.3 ± 10.86	79.14 ± 11.81	P = 0.071
6 h	77.11 ± 9.98	81.95 ± 11.93	P =0.062
12 h	76.08 ± 12.15	81.46 ± 11.32	P = 0.053
24 h	76.35 ± 11.63	81.54 ± 11.52	P = 0.058
SBP			
2 h	130.11 ± 13.48	126.43 ± 13.92	P = 0.252
4 h	131.0 ± 12.48	126.57 ± 14.63	P = 0.165
6 h	131.65 ± 11.83	127.73 ± 14.76	P = 0.212
12 h	129.81 ± 10.98	129.11 ± 13.96	P = 0.811
24 h	130.19 ± 12.71	128.03 ± 12.84	P = 0.469
DBP			
2 h	79.62 ± 9.57	77.81 ± 10.52	P = 0.441
4 h	78.03 ± 8.72	77.95 ± 10.29	P = 0.971
6 h	79.35 ± 6.54	78.03 ± 9.61	P = 0.490
12 h	77.73 ± 8.36	80.08 ± 8.22	P = 0.226
24 h	80.05 ± 9.55	81.54 ± 9.61	P = 0.507

underwent major abdominal surgeries and underwent bilateral RISS block either by single shot injection or continuous infusion. The results demonstrated that the RISS block provided consistent post-operative analgesia, with dermatomal coverage ranging from T3 to T12. Participants reported satisfactory pain control, and no instances of LA toxicity or block-related complications were found[21].

In the same line, Kozanhan et al., studied the RISS block and its effect in postoperative analgesia in thoracic surgeries. There were 40 cases in total who were split to 2 equal groups in a random fashion. Group R had IV PCA along with a continuous RISS block, and Group C had IV PCA with no other pain control. Results showed that the use of tramadol and NRS pain scores were significantly lower both at rest and with cough, and at 24 and 48 hours post pain assessment in the RISS group relative to controls. No participant in Group R had to utilize rescue analgesics, and the satisfaction scores of Group R were markedly elevated compared to Group C[14].

Wang et al., performed a comparison of the analgesic effectiveness of RISS blocks and thoracoscopic intercostal nerve blocks with 98 cases who underwent video-assisted thoracic surgery. They reported that the RISS group had notably lower intraoperative and post-operative sufentanil and remifentanil consumption. Furthermore, cases who received RISS blocks also had significantly lower rest-and-cough VAS pain scores at 12, 24, and 48 hours post-operatively as compared to participants who received ICNB[23].

Similarly, Wahdan et al. conducted an RCT involving 60 cases undergoing gynecomastia surgery. Participants were allocated into two groups: the RISS group and the controls. Cases in the RISS group received bilateral US-guided RISS blocks using 40 mL of 0.25% levobupivacaine, whereas controls received routine IV analgesia without regional anesthesia. RISS group required notably less morphine, and rescue analgesia was administered less frequently compared to the controls[24].

Neither group experienced any complications attributable to the block. The study, however, has several limitations. The study was limited by its single-center design and small sample size. Sensory dermatomal mapping and imaging of LA spread were not performed. Catheters use, which could potentially prolong the block duration, was not incorporated. Also surgical variability in type, incision, and procedure length may have influenced block characteristics. Post-operative pulmonary function was not also evaluated. No additives were added to the LA to prolong its effect, and the impact on chronic postsurgical pain was not assessed.

Conclusion

US-guided RISS is safe and can provide post-operative analgesia comparable in effectiveness to the subcostal TAP block when used in open upper abdominal surgeries.

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