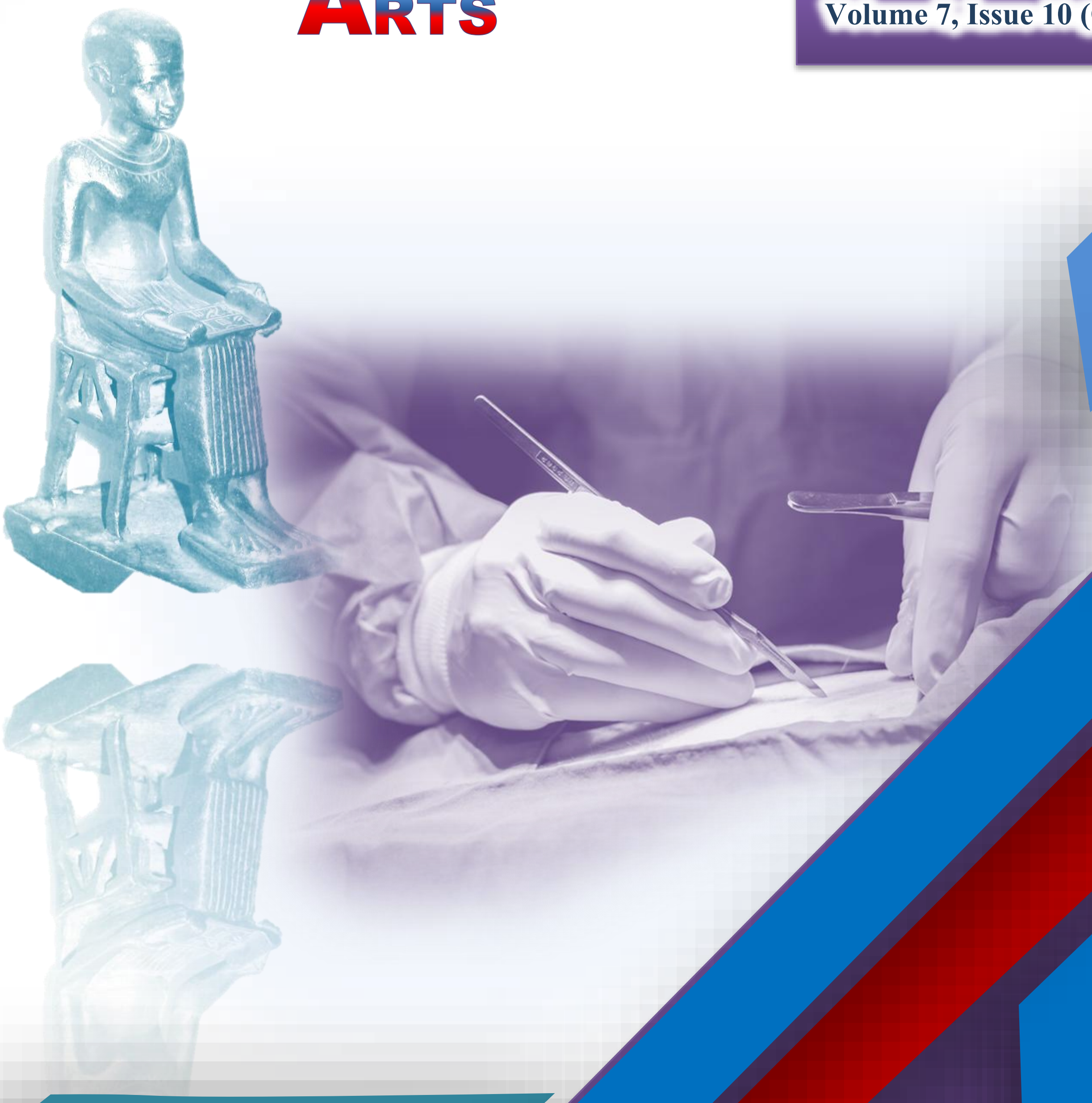
IJMA

International Journal of Medical Arts

Volume 7, Issue 10 (October 2025)



http://ijma.journals.ekb.eg/

P-ISSN: 2636-4174

E-ISSN: 2682-3780

Available online on Journal Website
https://ijma.journals.ekb.eg
Main Subject [Anesthesiology]

Original Article

The Additive Analgesic Effects of Oblique Subcostal Transversus Abdominis Plane Block in Abdominoplasty under Spinal Anaesthesia: A Randomized Controlled Study

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Article information

Received: 06-05-2025

Accepted: 9-08-2025

DOI: 10.21608/ijma.2025.382188.2180

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Citation: Abdelsalam TAA, Hassan AA, Salama MA, Ahmed SG, Bakr DM. The Additive Analgesic Effects of Oblique Subcostal Transversus Abdominis Plane Block in Abdominoplasty under Spinal Anaesthesia: A Randomized Controlled Study. IJMA 2025 Oct; 7 [10]: 6135-6140. doi: 10.21608/ijma.2025.382188.2180

Abstract

Background: General anesthesia is the conventional anesthetic method for abdominoplasty; however, spinal anesthesia can be utilized successfully in abdominoplasty procedures that do not involve liposuction.

Aim of the Work: This study sought to assess the analgesic effectiveness of oblique subcostal transversus abdominis plane block [OSTAP block] administered immediately after giving spinal anesthesia in abdominoplasty, with an emphasis on extending postoperative analgesia and reducing the number of cases converted to general anesthesia.

Patients and Methods: Sixty-six patients were randomly selected to have elective abdominoplasty without liposuction. They were randomly allocated into two groups of comparable sizes, each comprising 33 patients. The first group received spinal anesthesia with no block. The second group received oblique subcostal TAP block just after giving spinal anesthesia.

Results: The findings indicated a significant difference between the two groups regarding postoperative analgesic consumption, the number of patients converted to general anesthesia, and the time of the initial request for rescue analgesia. No significant difference was seen between the groups for postoperative VAS scores and complications

Conclusion: We advocate the incorporation of oblique subcostal TAP block immediately after giving spinal anesthesia, since it yields superior postoperative analgesic results and reduces the number of patients requiring conversion to general anesthesia.

Keywords: Oblique Subcostal Transversus Abdominis Plane Block; Spinal Anaesthesia; Abdominoplasty.

INTRODUCTION

Abdominoplasty employs an abdominal skin flap to rectify adipose tissue, dermal laxity, and surplus skin. It is an invasive extraperitoneal procedure that may or may not include liposuction. The prevalence of office-based abdominoplasty treatments has lately increased due to reduced costs, the widespread availability of plastic surgeons, and advancements in safer anesthetic techniques [1].

General anesthesia is frequently utilized for abdominoplasty; however, the technique can also be effectively conducted under subarachnoid or epidural anesthesia. Subarachnoid anesthesia is safer, easier to administer, more predictable, and less costly than general or epidural anesthesia [2-5].

Spinal anesthesia provides several benefits, such as preemptive analgesia, superior pain management, reduction of the stress response of surgery, preservation of perioperative immunological function, maintenance of oxygenation and the functional residual capacity of lung and enhanced visceral vascular circulation. Furthermore, it diminishes the occurrence of venous thrombo-embolic illness and, subsequently, pulmonary embolism by facilitating early ambulation [6-8].

Considering that pulmonary embolism is the leading cause of mortality and morbidity in abdominoplasty, the decrease in its incidence with spinal anesthesia greatly advantages the patient. Procedures lasting over three hours should preferably conducted under regional anesthesia, as general anesthesia is linked to increased incidences of deep vein thrombosis during prolonged surgeries [9].

The incorporation of adjuvant medications into local anesthetics and the enhancement of spinal anesthesia with peripheral nerve blocks and fascial plane blocks as oblique subcostal TAP block would provide extended surgical durations, making it the optimal approach for interventions below T3–T4. We hypothesized that the administration of oblique subcostal TAP block immediately after giving spinal anesthesia in abdominoplasty would extend postoperative analgesia and reduce the number of cases converted to general anesthesia compared to spinal anesthesia alone.

PATIENTS AND METHODS

This randomized controlled clinical trial was conducted from May 28th, 2024, to April 1st, 2025, at Egyptian Liver Hospital [approval code CT2024-001] and Mansoura University Hospital [approval code R.24.07.2696] with ethical committee approval, registered in the clinical trial registry [ID: NCT06550180], and with written patient consent obtained.

The inclusion criteria comprised American Society of Anesthesiologists physical status grades I to III, persons aged over 18 and under 65 years, elective abdominoplasty without liposuction, and both sexes.

The exclusion criteria included refusal of patient, coagulation or bleeding disorders, local skin infections and sepsis at the site of the block, known hypersensitivity to the study medications, and a body mass index [BMI] above 50 kg/m².

The primary outcome was the time until the first request for postoperative opioid analgesia. The secondary objectives were the number of patients shifted to general anesthesia, the total opioid dosage within the first twenty-four hours, visual analogue scale [VAS] scores at 2, 6, 12, and 24 hours postoperatively, and the occurrence of postoperative complications [vomiting, hypotension, and bradycardia]

Sample Size calculation:

G Power calculates sample size. Prior research [10] determined that the mean ± SD for the initial analgesic request in individuals undergoing spinal anesthesia was 1.86 ± 0.87. We anticipate the TAP block to enhance this value by 35%. Sixty patients are required to attain an effect size of 0.75, assuming 80% statistical power and a significant level of 5%. Considering possible withdrawals, 66 patients were enrolled, reflecting a 10% increase. A closed envelope method randomly allocated 66 suitable patients into two equal groups: the spinal anesthesia group [S] comprising 33 participants and the oblique subcostal TAP block group [OSTAP] consisting of 33 individuals.

Technique

All patients received preoperative examinations, which included medical history, physical examination, baseline laboratory tests [complete blood count, INR, liver function tests, and renal function tests], ECG, and echocardiography when necessary. On the day preceding the surgery, all patients were acquainted with the visual analogue scale, where 0 denoted no discomfort and 10 signified the most intense pain, while demographic information such as age, sex, and BMI was recorded.

Upon entering the operating theatre, a peripheral intravenous cannula [18–20 G] was inserted. Subsequently, 500 ml of Acetated Ringer's solution was administered intravenously, and standard monitoring commenced, including ECG, non-invasive blood pressure, and pulse oximetry.

All patients in both the [S] and [OSTAP] groups had spinal anesthesia, administered with 20 mg of 0.5% hyperbaric bupivacaine and 25 mcg of fentanyl. Immediately after giving spinal anesthesia, individuals in the OSTAP group received 35 ml of 0.25% isobaric bupivacaine on each side. An independent anesthetist, proficient in neuraxial and regional blocks, administered the spinal anesthesia and the OSTAP block without further participation in the study, while the outcome assessor remained blinded.

Intravenous fluids were administered based on body weight and in accordance with intraoperative fluid loss and surgical length. Bradycardia [heart rate < 50 beats per minute] is managed with intravenous atropine at a dosage of 0.01 mg/kg, while hypotension [a reduction in mean blood pressure exceeding 20% from baseline] is addressed with intravenous fluids and/or ephedrine at a dosage of 0.1 mg/kg.

Provided that the spinal anesthesia was effective, the patient was administered intravenous fluid infusion and oxygen at a rate of 2-4 L/min using a nasal cannula. In cases of severe pain or ongoing patient discomfort, general anesthesia was delivered, and the number of patients who received general anesthesia was recorded and these cases were excluded from postoperative follow up.

Postoperatively, conventional analgesia consisting of a 30 mg ketorolac ampoule was administered by slow IV infusion to all patients every 8 hours upon their admission in the PACU.

Morphine boluses [0.05 mg/kg] were administered if the VAS was ≥ 4 and could be repeated after 30 minutes until the VAS fell below 4. The total administered dose of morphine was documented. The duration until the initial request to postoperative analgesia was recorded. VAS scores were evaluated at 2, 6, 12, and 24 hours following the operation.

The occurrence of vomiting or other consequences such as hypotension and bradycardia were documented.

The OSTAP patient cohort was positioned supine while a linear 6-13 MHz ultrasound transducer was positioned at the midline of the abdomen, 2 cm inferior to the xiphisternum, and subsequently maneuvered laterally along the subcostal border.

In relation to the Rectus abdominis, the transversus abdominis muscle was situated laterally and inferiorly. The procedure involves the insertion of a 100 mm, 22-gauge spinal needle in plane with the probe, directed parallel to the costal margin but oblique to the sagittal plane.

During the initial administration of the local anesthetic, the needle was placed adjacent to the xiphoid process, targeting the plane between transversus and rectus abdominis muscles.

The needle was meticulously inserted inferiorly to progressively expand the transversus abdominis plane parallel to the costal margin, obstructing the trajectory of the intercostal nerves from the xiphoid process to the anterior iliac crest [11].

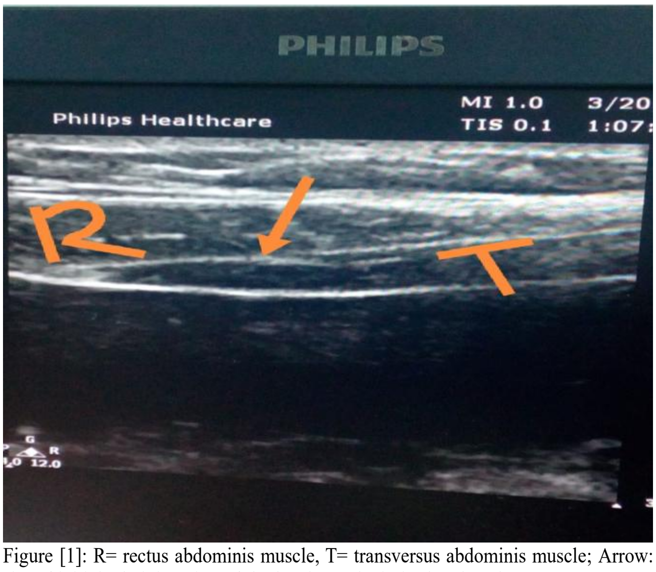

Figure [1]: R= rectus abdominis muscle, T= transversus abdominis muscle; Arrow: site of initial administration of the local anesthetic in the plane between transversus and rectus abdominis muscles.

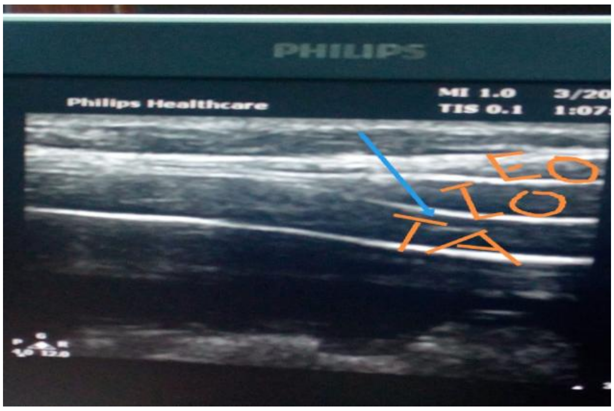

Figure [2]: EO: external oblique muscle, IO: internal oblique muscle, TA: transversus abdominis muscle; Arrow: site of local anesthetic injection in the plane between internal oblique muscle and transversus abdominis muscle.

Statistical Analysis:

The data was analyzed using Windows SPSS 24. The one-sample Kolmogorov-Smirnov test evaluated the normality of the data. Quantifying qualitative data using numerical values and percentages. The Chi-square test was employed to analyze categorical data; however, Fisher's exact test was utilized when the expected cell count fell below five. Continuous variables were presented as mean ± SD [standard deviation] for normally distributed data and as median [Min-Max] for non-normally distributed data. Both groups underwent evaluation using a parametric independent t-test and a non-parametric Mann-Whitney U test. Results were deemed significant at $p < 0.05$. Results with a decreased p-value exhibit more significance.

RESULTS

This prospective, randomized trial involved 66 patients aged 18 to 65 years, scheduled for elective abdominoplasty without liposuction **[Figure 3].** The demographics of the patients and the length of operation did not differ significantly between the two groups **[Table 1]**.

Morphine usage within a 24-hour period was markedly reduced in group 2 [OSTAP] compared to group 1 [S] [9.39±1.82 in S versus 5.43±1.28 in OSTAP, p = ≤0.001]. The duration until the initial analgesic request was markedly prolonged in group 2 [OSTAP] compared to group 1 [S] [1.85±0.74 in S versus 3.35±0.78 in OSTAP, $p < 0.001$]. The number of patients transitioned to general anesthesia was considerably lower in group 2 [OSTAP] compared to group 1 [S] [10 patients [30.3%] in S vs. 3 patients [9.1%] in OSTAP, p = 0.03] **[table 2].**

Postoperative VAS data **[table 3]** indicated no significant difference between the two groups. No significant difference was observed between the two groups concerning postoperative complications **[table 4]**.

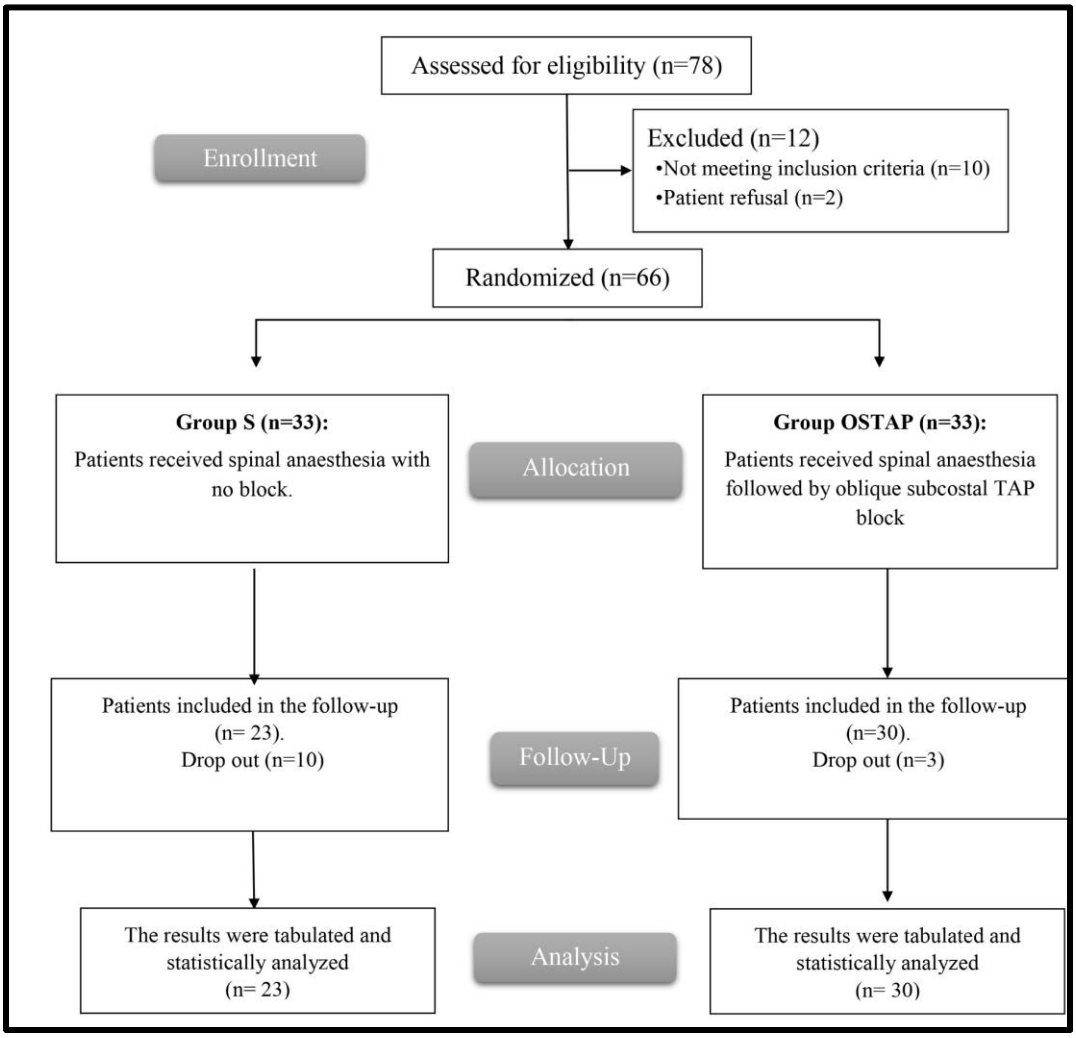

Figure [3]: CONSORT flow chart.

Table [1]: Demographic data among the studied groups

Demographic data		Group [S] [no=33]	Group [OSTAP] [no=33]	Test of significance	p value
Age [Years]	**Mean ± SD**	41.06±6.20	40.61±6.56	t=0.289	0.773
Sex [n,%]	**Male** **Female**	6 [18.2%] 27 [81.8%]	5 [15.2%] 28 [84.8%]	χ^2=0.11	0.741
BMI [kg/m^2]	**Mean ± SD**	35.85±2.99	34.75±3.02	t=1.49	0.142
Duration of surgery [min]	**Mean ± SD**	145.16±22.87	138.03±16.48	t=1.44	0.154

t: Independent t test, χ^2 : Chi square test,*significant p≤0.05

Table [2]: Postoperative morphine consumption and time of first request to postoperative analgesia

	Group [S] [no=23]	Group [OSTAP] [no=30]	Test of significance	p value
Postoperative morphine consumption mg [Mean ± SD]	9.39±1.82	5.43±1.28	t=9.28	≤0.001*
Time of 1st request to postoperative analgesia [h] [Mean ± SD]	1.85±0.74	3.35±0.78	t=7.09	≤0.001*
Patients converted to general anesthesia [Yes; No]	10 [30.3%]; 2 [69.7%]	3 [9.1%]; 30 [90.9%]	χ2=4.69	0.03*

t: Independent t test, χ2: Chi square test, *significant p≤0.05

Table [3]: Visual analog scale among the studied groups

VAS	Group [S] [no=23]	Group [OSTAP] [no=30]	Test of significance	p value
Vas 2 hour	2.0 [0.0-4.0]	1.0 [0.0-3.0]	Z=1.13	0.260
Vas 6 hour	3.0 [2.0-5.0]	3.0 [1.0-5.0]	Z=1.69	0.09
Vas 12 hour	4.0 [3.0-6.0]	4.0 [2.0-6.0]	Z=0.272	0.786
Vas 24 hour	5.0 [3.0-7.0]	5.0 [3.0-7.0]	Z=0.969	0.333

Data expressed as Median [Min-Max] , Z: Mann Whitney test, *significant p≤0.05

Table [4]: postoperative complications among the studied groups

	Postoperative complications	Group [S] [no=23]	Group [OSTAP] [no=30]	Test of significance	p value
Vomiting	Yes No	4 [17.4%] 19 [82.6%]	6 [20.0%] 24 [80.0%]	χ2=0.058	0.81
Hypotension	Yes No	3 [13.0%] 20 [87.0%]	5 [16.7%] 25 [83.3%]	FET	1.0
bradycardia	Yes No	0 [0%] 23 [100%]	0 [0%] 30 [100%]	-	-

FET: Fisher exact test, χ2: Chi square test, *significant p≤0.05

DISCUSSION

Abdominoplasty is a prevalent cosmetic operation aimed at removing surplus skin and soft tissue from the lower abdomen to enhance abdominal contour [12]. Abdominoplasty is one of the most painful surgeries due to the huge operative field, substantial tissue dissection, abdominal wall muscle plication, and intensive liposuction [13].

Effective postoperative analgesia facilitates early mobilization and sufficient deep breathing, which have been demonstrated to considerably diminish the incidence of postoperative problems. Furthermore, minimizing postoperative opioid usage [14]. TAP block is a trusted analgesic technique following abdominal procedures that allows early mobilization and recovery [13].

This study sought to assess the adjunctive analgesic effectiveness of ultrasound-guided OSTAP Block during abdominoplasty procedures conducted under spinal anesthesia. The findings of this study indicated that dual OSTAP block combined with spinal anesthesia resulted in a delayed commencement of the first analgesic request, diminished consumption of post-operative rescue analgesics and rate of conversion to general anesthesia.

El Sayed *et al.* substantiated our findings by assessing the effectiveness of a combined subcostal and posterior TAP Block compared to systemic opioids for postoperative analgesia in patients undergoing abdominoplasty. The study determined that bilateral combined subcostal and posterior TAP block provides an extended postoperative analgesic effect and decreases postoperative opioid consumption [15].

Sforza *et al.* investigated the impact of bilateral transversus abdominis plane [TAP] block on postoperative pain following abdominoplasty in adults, observing that patients receiving the TAP block required significantly less morphine in the postoperative period compared to the control group, and achieved adequate analgesia for 12 hours following major abdominoplasty [16].

Vonu PM *et al.* conducted a comprehensive evaluation of several nerve blocks post-abdominoplasty to determine their efficacy in reducing pain scores, analgesic usage, time to ambulation, and length of recovery room stay. Research found that transversus abdominis plane [TAP] blocks exhibited the greatest efficacy [17]. The transversus abdominis plane [TAP] block is a method that blocks the somatic nerves of the abdominal wall which are located between the transversus abdominis and internal oblique muscles. The oblique subcostal TAP block is a recent variation of TAP block ensuring consistent distribution of local anesthetic in both the upper [T6-T9] and lower [T10-T12] abdomen producing supraumbilical and infraumbilical analgesia for the somatic pain which is the main type of pain in abdominoplasty [18].

Our study demonstrated that the implementation of ultrasound-guided Oblique Subcostal TAP block alongside spinal anesthesia led to a postponed initiation of the first analgesic request and decreased postoperative rescue analgesic usage relative to the spinal anesthesia group.

The advantages of regional anesthesia over general anesthesia in abdominoplasty extend beyond pain control. Patients with too tight abdominoplasties may experience dyspnea, which could prompt the surgeon to alleviate the tension. Also, patients were alert and orientated, experiencing fewer postoperative problems. Spinal anesthesia, particularly when combined with peripheral nerve blocks and fascial plane blocks, offers better hemodynamic stability, reduces the incidence of thromboembolic events, and minimizes postoperative cognitive dysfunction. Additionally, avoiding general anesthesia lowers the risk of airway-related complications and facilitates faster postoperative recovery [6-9].

Our results were validated by Metry et al., who compared spinal and general anesthesia for abdominoplasty, observing that sedation with spinal anesthesia aids patients in tolerating the procedure and diminishes its perceived time. The postponement of the initial postoperative analgesic dose may have affected overall analgesic needs within a 12-hour period; thus, spinal anesthesia may be an effective anesthetic technique for abdominoplasty, leading to less postoperative complications compared to general anesthesia [10].

Leal et al. performed a case study on combined spinal-epidural [CSE] anesthesia for abdominoplasty and liposuction in patients with Limb-Girdle Muscular Dystrophy, illustrating that CSE anesthesia is recommended for individuals with myopathies due to its lower complication risk and support for spontaneous ventilation. Its advantages include a more rapid onset of sensory and motor blockade, as well as a reduction in postoperative opioid consumption [19].

Regarding postoperative complications, our study found no significant differences between groups in terms of hypotension, vomiting, or bradycardia. While hypotension was slightly more frequent with spinal anesthesia, it was managed effectively with fluid administration and vasopressors. This study confirms the viability of subarachnoid anesthesia for abdominoplasty surgeries. Certain literature indicates that the abdominoplasty surgery is associated with significantly greater incidence of deep vein thrombosis [DVT] compared to other plastic surgeries [20]. This study mitigated the risk of DVT by ensuring adequate hydration of patients before, during, and after the treatment, as well as by utilizing sequential compression devices for all patients. Neither group exhibited any cases indicative of DVT.

The study found that using OSTAP block with spinal anesthesia for abdominoplasty reduces the conversion rate to general anesthesia. This is due to enhanced and prolonged analgesia reducing upper abdominal wall pain and suffering that spinal anesthesia does not have adequate pain control on it if given alone in prolonged surgeries. OSTAP block reduces intraoperative pain in cases where spinal anesthesia is insufficient if surgery lasts longer than expected providing additional layer of analgesia and subsequently decreasing conversion to general anesthesia.

Limitations: Although our research was performed at two centers, the small sample size limits the generalization of our results. It is recommended that future study utilize a bigger sample size. We preferred to give OSTAP block after spinal anesthesia so that the patient not felt any pain, but this didn't allow us to assess the success of the OSTAP block which would explain the cases that were converted to general anesthesia in the OSTAP group.

Conclusion: We recommend the implementation of oblique subcostal TAP block just after giving spinal anesthesia, since it provides enhanced postoperative analgesia and diminishes the likelihood of patients needing conversion to general anesthesia. We also recommend future studies to give oblique subcostal TAP block before spinal anesthesia to assess the success of the block.

Financial and Non-Financial Relationships and Activities of interest: None**.**

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IJMA

International Journal of Medical Arts

Volume 7, Issue 10 (October 2025)

http://ijma.journals.ekb.eg/

P-ISSN: 2636-4174

E-ISSN: 2682-3780