Subcostal TAP Block Versus Lateral TAP Block for Postoperative Analgesia in Patients Undergoing Total Abdominal Hysterectomy

Original Article

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ABSTRACT

Background: Patients experience severe postoperative pain after total abdominal hysterectomy surgeries. Effective pain management reduces the incidence of postoperative cardiac and pulmonary complications, decreases risk of postoperative deep venous thrombosis through early mobilization, provides patient satisfaction and reduces cost of hospital stay. Multiple analgesic strategies have been used to reduce postoperative pain following abdominal surgeries. Studies suggest that abdominal wall blocks are more effective modalities to achieve pain relief and enhance postoperative rehabilitation than systemic analgesia. The aim of this study is to compare the effectiveness of subcostal versus lateral TAP blocks for post-operative pain management after total abdominal hysterectomy surgery.

Results: The results showed that postoperative bilateral subcostal TAP block in group (A) was associated with significant increase in heart rate, mean arterial blood pressure, pain scores and pethidine requirements compared to bilateral lateral TAP block in group (B) which provided more effective analgesia than subcostal approach.

Conclusions: In patients undergoing total abdominal hysterectomy, postoperative analgesia of lateral TAP block was more effective than that of subcostal TAP block regarding hemodynamic changes, pain scores, doses of pethidine required for pain relief and postoperative mobilization.

Key Words: Abdominal hysterectomy, lateral TAP Block, postoperative analgesia, subcostal TAP Block.

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BACKGROUND

The majority of patients endure postoperative pain following surgical procedures. It is crucial to effectively control postoperative pain to promote patient's recovery after surgery and avoid physiological and psychological complications of poorly controlled pain. As opioids were the mainstay of pain management modalities, their misuse in the postoperative period has recently increased mortality and morbidity and increased the need to develop pain treatment strategies using a multi-modal approach[1].

While acute postoperative pain was reported by approximately 75% of patients after surgeries, only 50% of them reported adequate analgesic therapy to effectively control their postoperative pain. This high percentage may increase the incidence of immediate postoperative adverse effects and place the patients at ongoing risk of developing chronic pain[2].

Hysterectomy is the second most frequently performed major surgical procedures all over the world next only to Cesarean sections. Moderate to severe postoperative pain associated with abdominal hysterectomy may result in prolonged hospitalization, chronic pain development and increased risks of venous thrombosis[3].

As regard various types of abdominal surgeries, transversus abdominis plane block was found to be a regional anesthetic technique that effectively reduces narcotics consumption and postoperative pain score[4].

Recently, there are concerns towards the fact that variable approaches of each regional anaesthetic technique may be associated with different analgesic outcomes. Accordingly, different approaches of TAP block are now used such as subcostal, lateral and posterior approaches[5].

METHODS

This study is a prospective randomized controlled clinical trial. It was conducted from October 2021 till October 2022.

All patients were instructed about the study protocol and after obtaining written informed consent from the participants, they were preoperatively evaluated for their medical status and were educated about visual analogue score.

Inclusion criteria were Patients with ASA I and II classification electively scheduled for total abdominal

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hysterectomy through pfannenstiel incision under general anesthesia with normal coagulation profile.

Exclusion criteria were Refusal of the patient, intraoperative hemodynamic instability, history or evidence of coagulopathy, infection or abdominal wall masses at injection site, morbid obesity, midline incision hysterectomy and known allergy to local anesthetics.

Sample size calculation

Sample size was calculated using PASS 11.0 sample size calculation program, setting the type-1 error *(α)* at 0.05. Results from a previous similar study Elbagoury *et al*.,[6] showed that the mean total pethidine consumption in the subcostal TAP block group study was 130.4±43.06, while for lateral TAP block group study it was 194±48.26, based on this, a group sample size of 50 patients per group (100 total) achieves 100% power to detect a difference in the outcome between the 2 groups.

Preoperative

Preoperative assessment was done including: full detailed history, clinical examination (full vital data, chest examination and abdominal examination to exclude the presence of any local causes in the abdominal wall that may be risky with performing TAP blocks) and preoperative laboratory investigations (CBC – PT – INR – PTT – liver profile – renal profile).

Operative day

After the patient arrived to the induction room, baseline vital data was recorded and a suitable IV access was inserted, a dose of midazolam (10-30 mcq/kg) was given.

Induction of general anesthesia was done with propofol 2–2.5mg/kg, atrcurium 0.5mg/kg and fentanyl 0.5-1ug/kg .An endotracheal tube was inserted, and sufficient mechanical ventilation to maintain normocapnia (end tidal 30-35mmHg) was started. GA was maintained with sevoflurane inhalation, fentanyl 0.5–1µg/kg/h and atracurium 0.1mg/kg/20min

Hemodynamics were recorded before skin incision, one minute after skin incision and then recorded regularly every 10 minutes. Infusion of ringer solution was given as required.

Study interventions

Group A (Subcostal): While the patient was still under GA in supine position, a SonoSite ultrasound device with a sterile sheathed 5-12MHz linear probe was used to demonstrate the plane between transversus abdominis muscle posteriorly and internal oblique muscle or rectus muscle anteriorly by placing the probe inferior and parallel to the costal margin. An echogenic needle was inserted in-plane until the tip reached this fascial plane. After negative aspiration, 20ml of bupivacaine 0.25% solution was injected on each of the right and left sides under full hemodynamics monitoring.

Group B (Lateral): While the patient was still under GA in supine position, a SonoSite ultrasound device with a sterile sheathed 5-12MHz linear probe was used to demonstrate the plane between transversus abdominis muscle posteriorly and internal oblique muscle anteriorly by placing the probe at the mid axillary line midway between the subcostal margin and iliac crest. An echogenic needle was inserted in-plane until the tip reaches this fascial plane. After negative aspiration, 20ml of bupivacaine 0.25% solution was injected on each of the right and left sides under full hemodynamics monitoring.

After full recovery and reversal of muscle relaxation, endotracheal tube was removed and patient was transferred to PACU.

In the ward On the first postoperative 24 hours, patients were assessed every 4 hours. Haemodynamic parameters, pain score according to Visual Analogue Scale (VAS), time of mobilization and the required pethidine doses for effective pain control were all recorded. (Patients received 25mg pethidine IV if their visual analogue scale for pain exceeds 3. The dose was repeated on patient's demand with 2 hours minimal time interval between doses).

Measured outcomes

The primary outcome was to calculate the total pethidine doses needed in the first 24 hours postoperatively for effective pain control (VAS>4) in the first postoperative 24 hours.

The secondary outcomes were to assess the postoperative pain score according to visual analogue scale every 4 hours, associated hemodynamic changes and time of postoperative mobilization.

Statistical analysis

Using (SPSS) version 22.0.

RESULTS

Demographics

Regarding demographic data (age, sex, weight, height and ASA) and duration of surgery, no statistically significant differences were found (*p*-value >0.05) (Table 1).

Table 1: Comparison between groups as regard demographic data:

Demographic data		Group A (*n*=50)	Group B (*n*=50)	t/x^2	*p*-value
Age (years)		55.4±8.3	57.08±8.2	1.0^t	0.31
Height (cm)		165.44±8.1	164.26±8.0	1.2^t	0.47
Weight (Kg)		77.82±11.1	80.58±11.0	0.7^t	0.22
Duration of surgery (minutes)		102.9±17.1	103.9±18.2	0.3^t	0.78
ASA	I	25(50%)	32(64%)	1.98^{x2}	0.16
	II	25(50%)	18(36%)		

Data expressed as mean±SD; proportion; group A= subcostal TAP block; group B= lateral TAP block.

Intraoperative vital data

Regarding intraoperative vital data in terms of mean blood pressure (MBP) and heart rate (HR) at times of (T0,1, 2, 3, 4) no statistically significant differences were found (*p*-value >0.05) (Table 2, Figure 1).

Table 2: Comparison between groups as regard intraoperative vital data:

	Group A (*n*=50)	Group B (*n*=50)	*t*	*p*-value
MBP T_0	92.1±4.3	91.26±9.0	0.6	0.55
MBP T_1	92.5±4.4	92.9±6.7	0.4	0.72
MBP T_2	94.58±4.0	96.14±6.2	1.5	0.14
MBP T_3	94.28±4.4	94.88±7.3	0.5	0.62
MBP T_4	93.36±5.0	92.64±8.2	0.5	0.60
HR T_0	90.26±9.9	86.9±9.6	1.7	0.09
HR T_1	88.24±5.3	87±10.2	0.8	0.45
HR T_2	81.26±6.3	79.94±5.8	1.1	0.28
HR T_3	83.94±10.7	80.92±10.9	1.4	0.17
HR T_4	85.66±11.8	87.82±9.7	1.0	0.32

Data expressed as mean±SD; proportion; group A= subcostal TAP block; group B= lateral TAP block.

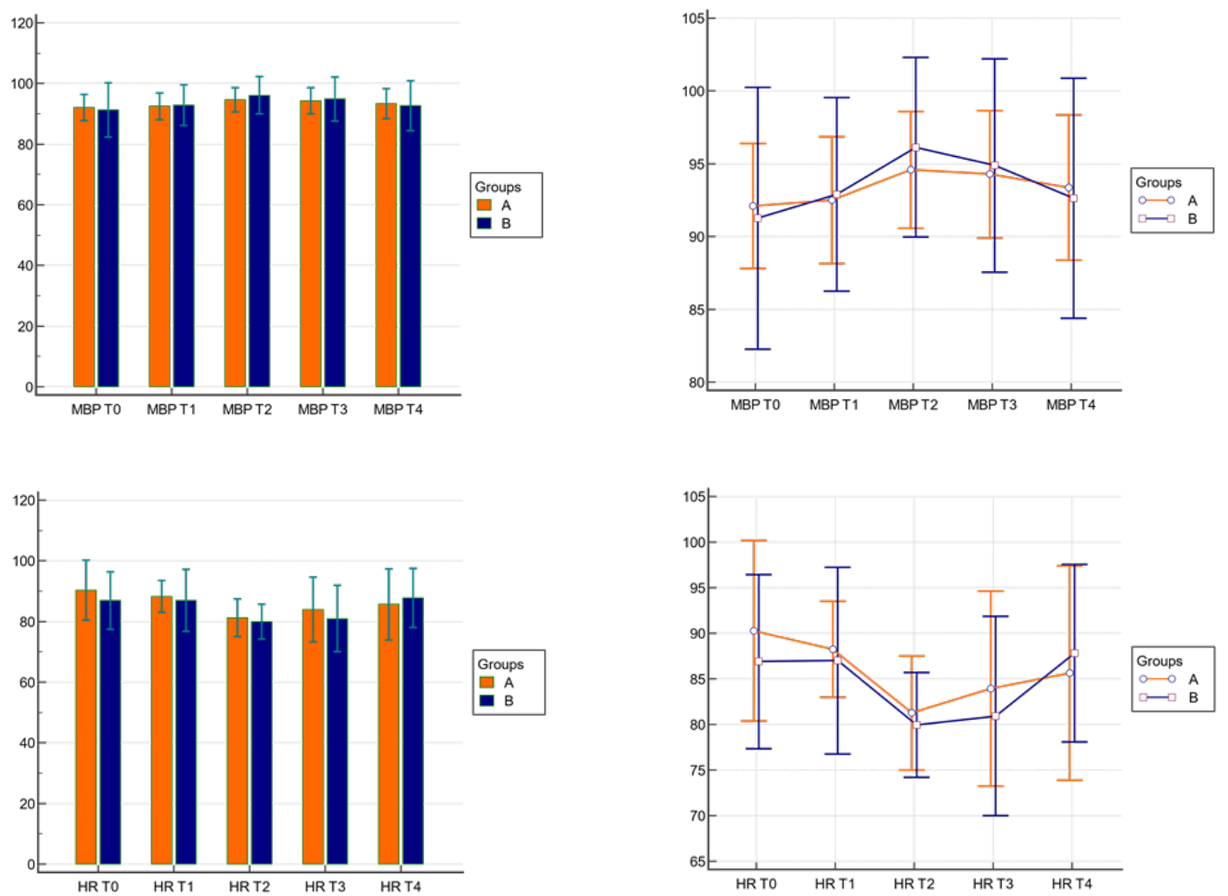

Fig. 1: Bar graph between groups as regard intraoperative vital data.

Postoperative vital data:

Regarding postoperative vital data in terms of mean blood pressure (MBP) and heart rate (HR) at times of (PACU,4h, 8h, 12h, 16h, 20h, 24h), statistically significant difference was found at MBP at 4, 8, 12, 16h and HR at 4, 8 (*p*-value >0.001) (Table 3, Figure 2).

Table 3: Comparison between groups as regard postoperative vital data:

	Group A (*n*=50)	Group B (*n*=50)	*t*	*p*-value
MBP T PACU	89.54±4.1	90.48±7.6	0.8	0.44
MBP D1(4hrs)	99.74±5.7	87.76±7.2	9.2	<0.001
MBP D1(8hrs)	99.3±5.2	87.34±4.8	11.9	<0.001
MBP D1(12 hrs)	94.16±4.3	86.3±4.9	8.5	<0.001
MBP D1(16 hrs)	92.8±4.7	87.04±4.4	6.3	<0.001
MBP D1(20 hr)	88.1±4.7	86.62±5.1	1.5	0.13
MBP D1(24 hr)	87.42±3.5	88.7±3.9	1.7	0.09
HR T PACU	84.44±10.3	84.64±10.2	0.1	0.92
HR D1(4hrs)	90.1±8.4	82.28±7.0	5.0	<0.001
HR D1(8hrs)	88.04±7.8	81.26±7.8	4.3	<0.001
HR D1(12 hrs)	82.6±7.3	79.96±6.1	2.0	0.053
HR D1(16 hrs)	79.72±6.7	79.5±7.0	0.2	0.87
HR D1(20:00)	80.96±6.0	79.96±7.9	0.7	0.48
HR D1(24 hr)	84.38±7.8	81.9±8.6	1.5	0.14

Data expressed as mean±SD; proportion; group A= subcostal TAP block; group B= lateral TAP block.

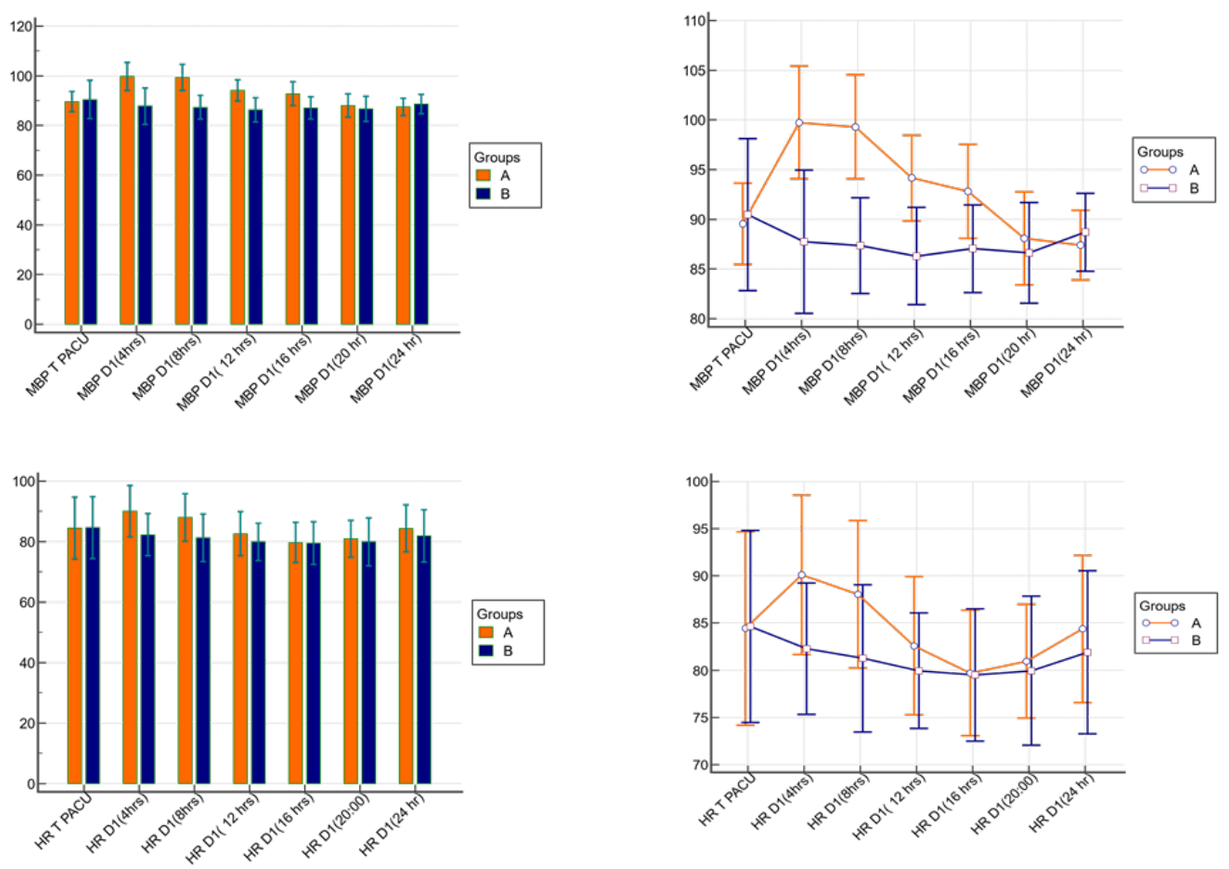

Fig. 2: Bar graph between groups as regard Postoperative vital data.

Postoperative pain

Groups were compared regarding postoperative pain in terms of VAS at times of (4h, 8h, 12h, 16h, 20h, 24h) and pethidine consumption, statistically significant differences between groups at 4, 8, 12h and pethidine consumption were found (*p*-value >0.001) (Tables 4,5, Figures 3,4).

Table 4: Comparison between groups as regard postoperative VAS:

VAS	Group A (*n*=50)			Group B (*n*=50)			*p*-value
	Range	Median	IQR	Range	Median	IQR	
P D1(4hrs)	0-7	4	3-5	0-6	1	0-2	<0.001
P D1(8hrs)	0-6	3	2-4	0-5	1	0-1	<0.001
P D1(12hrs)	0-5	1	1-2	0-5	0.5	0-1	0.001
P D1(16hrs)	0-4	1	0-2	0-3	0	0-1	0.11
P D1 (20hr)	0-4	1	0-2	0-4	0.5	0-1	0.25
P D1 (24hr)	0-5	1.5	1-3	0-5	1	0-2	0.09

Data expressed as range; median and IQR; *p* by Mann-Whitney test; Group A= subcostal TAP block; Group B= lateral TAP block.

Table 5: Comparison between groups as regard pethidine consumption:

	Group A (*n*=50)			Group B (*n*=50)			*p*-value
	Range	Median	IQR	Range	Median	IQR	
pethidine consumption	0-100	50	25-50	0-100	25	0-50	=<0.0039

consumption Data expressed as range; median and IQR; *p* by Mann-Whitney test; Group A= subcostal TAP block; group B= lateral TAP block.

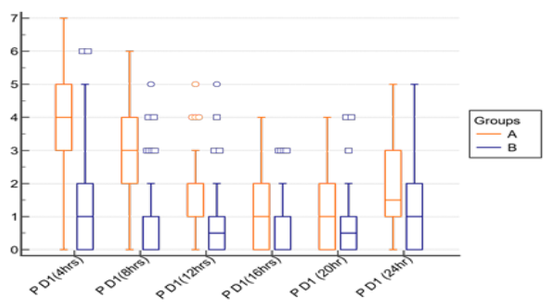

Fig. 3: Box and whisker graph between groups as regard Postoperative VAS.

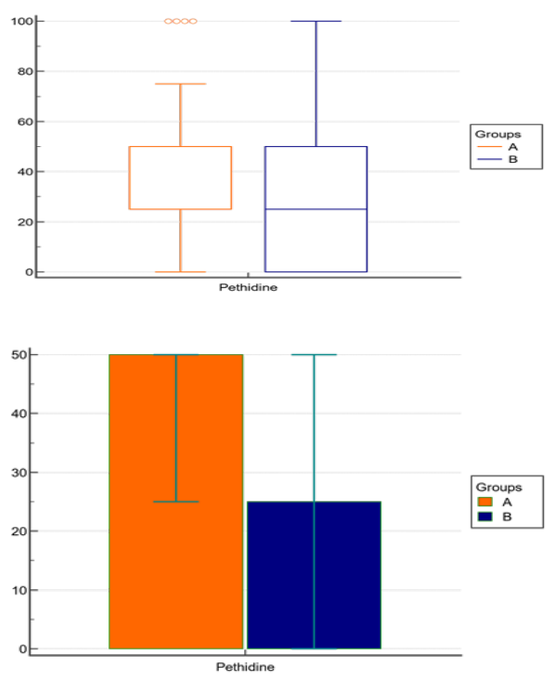

Fig. 4: Box and whisker/bar graph between groups as regard pethedine.

Groups were compared regarding time of mobility, statistically significant difference between groups was found (*p*-value >0.001) (Table 6, Figure 5).

Table 6: Comparison between groups as regard time of mobility:

	Group A (*n*=50)	Group B (*n*=50)	*t*	*p*-value
Time of mobility (hours)	3.16±1.7	2.1±1.2	3.6	<0.001

Data expressed as mean±SD; proportion; group A= subcostal TAP block; group B= lateral TAP block.

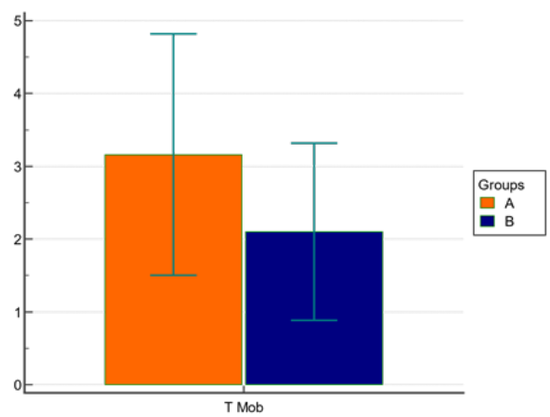

Fig. 5: Bar graph between groups as regard time of mobility.

DISCUSSION

This study was performed to compare efficacy, hemodynamic effects, pethidine consumption, and postoperative mobility between group (A) receiving subcostal TAP block versus group (B) receiving lateral TAP block for postoperative pain management.

Regarding postoperative hemodynamics, there was statistically significant difference in the mean arterial blood pressure measured at 4h, 8h, 12h and 16h postoperatively with more increase of the mean arterial pressure in group A than group B {(99.74±5.7), (99.3±5.2), (94.16±4.3) and (92.8±4.7)} versus {(87.76±7.2), (87.34±4.8), (86.3±4.9) and (87.04±4.4)} respectively with a *P* value <0.001. Also there was a statistically significant difference in heart rate at 4h and 8h postoperatively with more increase of the heart rate in group A than group B {(90.1±8.4) and (88.04±7.8)} versus {(82.28±7.0) and (81.26±7.8)} respectively with a *P* value <0.001.

There was significant increase of pain scores at 4h, 8h and 12h postoperatively in group (A) compared to group (B). This is also consistent with increased pethidine consumption {median 50mg versus 25mg} respectively and delayed time of postoperative mobility {(3.16±1.7) versus (2.1±1.2)} respectively in group (A) compared to group (B).

These results agree with Ripollés *et al.,*[7] who found that lateral TAP block was an effective modality to reduce postoperative narcotics requirements in patients undergoing variable abdominal surgeries.

This goes in concordance with Lee *et al.,*[8] who found that the distribution of the sensory block in the subcostal approach extends to the upper dermatomes of the abdominal wall making the subcostal approach more appropriate for the upper abdominal incisions above the umbilicus.

Also the results agree with Bhattacharjee *et al*.,[9] who compared between pre-incisional TAP block using bupivacaine 0.25% versus normal saline after total abdominal hysterectomy and found that pre-incisional TAP block reduced intraoperative narcotics requirements, improved hemodynamic response to surgical stimulus and provided effective postoperative analgesia.

Carney *et al*.,[10] also found significantly reduced postoperative pain scores and with required doses of morphine postoperatively in patients undergoing TAP block done through the lateral approach compared to placebo TAP block with normal saline.

These results go in concordance with Atim *et al*.,[11] who compared the efficacy of TAP block with bupivacaine versus control group received TAP block with normal saline versus bupivacaine infiltration of the wound in patients undergoing hysterectomy and found lower total tramadol consumption and much lower rest and movement pain scores in the TAP group compared to control and infiltration groups.

On the contrary, Yoshida *et al*.,[12] found that bilateral continuous oblique subcostal TAP blocks in patients undergoing laparotomy for gynecological cancers were effective for reduction of postoperative cumulative morphine consumption while comparing bilateral oblique subcostal TAP infusions using ropivacaine 0.1% to normal saline. The difference in the results may be explained by the midline laparotomy incision with supra-umbilical extension depending on the surgical procedure in 43 of the 80 patients in their study with higher dermatomes involved T_6–T_{12} that can be achieved through the subcostal approach of TAP block meanwhile the surgical incision in our study was pfannenstiel incision that lies typically in L_1 dermatome which is blocked more effectively with the lateral rather than subcostal TAP block.

Also the results in this study disagree with a study done by Simsek and Kemal[13] who found that total tramadol consumption and visual analogue scale values were significantly lower in the subcostal TAP block group compared to the control group in patients undergoing laparoscopic hysterectomy. Also, the subcostal TAP block group showed longer time for first postoperative analgesic request. However, in our study, the different type of incision (pfannenstiel) of total abdominal hysterectomy rather than the laparoscopic approach with lower targeted dermatomal coverage may contributed to the better response to the lateral TAP block rather than the subcostal approach.

The results of this study also disagree with the study done by Dai *et al*.,[4] who compared the analgesic efficacy of postoperative bilateral TAP block in the 1st group with conventional postoperative analgesia in the 2nd group. They found no significant differences regarding the analgesic efficacy and postoperative hospital stay. However as mentioned in their study, the relatively small sample size (total 63 patients for both groups) may contributed to the statistically insignificant results between the 2 groups regarding the pain scores and hospital stay.

Rojskjaer *et al*.,[14] found contradictory results while comparing a group received bilateral TAP block with ropivacaine 0.75% with a control group received 0.9% normal saline in the same plane after total abdominal hysterectomy. They found lower pain scores at 1st and 2nd postoperative hours in TAP block group with similar morphine requirements in both groups in the 1st 24 hour postoperatively.

CONCLUSIONS

Regarding patients undergoing total abdominal hysterectomy, the postoperative analgesia was more effective in patients received postoperative lateral TAP block than those received postoperative subcostal TAP block as regards recorded hemodynamic changes, pain scores, doses of pethidine required for pain relief and starting time for postoperative mobilization.

ABBREVIATIONS

(ASA): American Society of Anesthesiologists, **(CBC):** Complete Blood Count, **(GA):** General Anesthesia, **(INR):** International Normalized Ratio, **(IV):** Intravenous, **(PACU):** Post-anesthesia Care Unit, **(PT):** Prothrombin Time, **(PTT):** Partial Thromboplastin Time, **(TAP):** Transversus Abdominis plane, **(VAS):** Visual Analogue Scale.

CONFLICT OF INTERESTS

There are no conflicts of interest.

REFERENCES

1. Horn R, Kramer J. (2020). Postoperative pain control, Mclaren Oakland, Michigan State University.
2. Suner ZC, Kalayci D, Sen O, Kaya M, Unver S, Oguz G. (2019). Postoperative analgesia after total abdominal hysterectomy: Is the transversus abdominis plane block effective? Niger J Clin Pract; 22(4):478-484.
3. Perniola A, Gupta A, Crafoord K, Darvish B, Magnuson A, Axelsson K. (2009). Intraabdominal local anaesthetics for postoperative pain relief following abdominal hysterectomy: a randomized, double-blind, dose-finding study. European Journal of Anaesthesiology EJA; 26(5):421-9.
4. Dai C, Zhang K, Huang J. (2018). The efficacy of transversus abdominis plane block for abdominal hysterectomy postoperative analgesia; 10:e3131.
5. Tsai H, Yoshida T, Chuang T, Yang S, Chang C, Yao H *et al*., (2017). Transversus Abdominis Plane Block: An Updated Review of Anatomy and Techniques. BioMed research international, 8284363.
6. Elbagoury M, Okab M, Amin S, Eltatawy H. (2019). The effect of ultrasound guided rectus sheath block versus transversus abdominis plane block for pain relief after total abdominal hysterectomy. The Medical Journal of Cairo University 87. 2967-2975.
7. Ripolles J, Mezquita SM, Abad A, Calvo J. (2015). Analgesic efficacy of the ultrasound-guided blockade of the transversus abdominis plane-a systematic review. Braz. J. Anesthesiol., 65: 255-80.
8. Lee THW, Barrington MJ, Tran TMN, Wong D, Hebbard PD. (2010). Comparison of extent of sensory block following posterior and subcostal approaches to ultra-sound guided transversus abdominis plane block. Anaesthesia and intensive care, 38(3), 452-460.
9. Bhattacharje S, Ray M, Ghose T, Maitra S, Layek A. (2014). Analgesic efficacy of transversus abdominis plane block in providing effective perioperative analgesia in patients undergoing total abdominal hysterectomy: A randomized controlled trial. J Anaesthesiol Clin Pharmacol.
10. Carney J, McDonnell JG, Ochana A, Bhinder R, Laffey JG. (2008). The transversus abdominis plane block provides effective postoperative analgesia in patients undergoing total abdominal hysterectomy. Anesth Analg. Dec;107(6):2056-60.
11. Atim A, Bilgin F, Kilickaya O, Purtuloglu T, Alanbay I, Orhan ME, Kurt E. (2011). The efficacy of ultrasound-guided transversus abdominis plane block in patients undergoing hysterectomy. Anaesth Intensive Care. Jul;39(4):630-4.
12. Yoshida T, Furutani K, Watanabe Y, Ohashi N, Baba H. (2016). Analgesic efficacy of bilateral continuous transversus abdominis plane blocks using an oblique subcostal approach in patients undergoing laparotomy for gynaecological cancer: a prospective, randomized, triple-blind, placebo-controlled study. Br J Anaesth.
13. Simsek T, Kemal TS. (2022). Ultrasound-Guided Oblique Subcostal Transversus Abdominis Plane Block For Patients Undergoing Laparoscopic Hysterectomy: A Prospective Randomized Controlled Study Southern Clinics of Istanbul Eurasia, vol. 33, no. 1, Mar. 2022.
14. Rojskjaer JO, Gade E, Kiel LB, Lind MN, Pedersen LM, Kristensen BB, Rasmussen YH, Foss NB. (2015). Analgesic effect of ultrasound-guided transversus abdominis plane block after total abdominal hysterectomy: a randomized, double-blind, placebo-controlled trial. Acta Obstet Gynecol Scand. 2015 Mar;94(3):274-8.