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Comparative Study between Subcostal Transversus Abdominis Plane Block Analgesia and Epidural Analgesia in Upper Abdominal Surgeries

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ABSTRACT

Background: Subcostal transversus abdominis plane [TAP] block is a peripheral nerve block that provide effective analgesia after upper abdominal surgery. Epidural analgesia is considered the gold standard of analgesia but not suitable for all patients.

The Aim of The Work: In this study we compared the efficacy of subcostal TAP analgesia, to epidural analgesia in major upper abdominal surgeries.

Patients and Methods: Eighty-four patients allocated into two groups [42 patients in each]: epidural group [Group E] and subcostal TAP group [group S]. Patients in both groups received preoperative bolus dose of 10 ml bupivacaine 0.5% plus 100 mg magnesium sulphate in 20 ml normal saline and received postoperative infusion of 20 ml bupivacaine 0.5% plus 100 mg magnesium sulphate in 50ml saline at a rate 6 ml/hour for 72 hours. The primary outcome was the total postoperative morphine consumption. Secondary outcomes were time to the first rescue analgesia, pain score at rest and cough, hemodynamic changes, postoperative sedation score and adverse effects.

Results: There was significant increase in total postoperative morphine consumption in group S [9.51 ± 6.46] compared to group E [4.77 ± 3.74] [$P < 0.001$]. There was significant increase in pain score in group S compared to group E during rest and cough postoperatively at all time periods. Sedation score is significantly higher in group E rather than group S.

Conclusion: Epidural analgesia and subcostal TAP catheter infusion analgesia, both provide adequate postoperative analgesia in favor of epidural analgesia, but subcostal TAP avoids major drawbacks of epidural analgesia. Hence, subcostal TAP catheter may be an effective alternative to epidural catheter for providing postoperative analgesia after major upper abdominal surgeries.

Keywords: Epidural Analgesia; Subcostal Transversus Abdominis Plane Block, Abdominal Surgeries.

INTRODUCTION

There is lack of clarity about the ideal technique for providing analgesia following abdominal surgeries**.** Epidural analgesia, once considered the gold standard, but associated complications and contraindications may limit its use. [1].

A substantial component of the pain experienced by patients during and after abdominal surgery is derived from the abdominal wall incision. The abdominal muscular wall is innervated by sensory neurons derived from the anterior rami of spinal nerves T6 to L1, which include the intercostal nerves [T6 – T11], the subcostal nerve [T12] and the ilioinguinal and iliohypogastric nerves [2]**.**

A promising approach to the provision of postoperative analgesia after abdominal incision is to block the sensory nerve supply to the anterior abdominal wall. Transversus abdominis plane [TAP] approach is aimed to access the nerves in this neuro-facial plane between internal oblique muscle and transversus abdominis through the lumbar triangle of Petit. This bounded posteriorly by the latissimus dorsi muscle and anteriorly by the external oblique, with the iliac crest forming the base of the triangle [3]**.**

TAP block has been shown to reduce perioperative opioid use in elective abdominal surgery. However, its efficacy is reported reliable in providing analgesia below the umbilicus. The ultrasound-guided subcostal TAP block is a recently described variation on the TAP block which produces reliable supra-umbilical analgesia [4]**.**

Subcostal TAP block, first described by Hebbard et al., has been reported to provide analgesia for incisions extending above the umbilicus [5]**.** Single-shot subcostal TAP blocks have gained popularity, but seem unable to provide durable analgesia [6]. So, we describe a novel technique of initiating and providing continuous subcostal TAP analgesia.

To the best of our knowledge, this one of the first trials to examine the effect of magnesium sulphate administered continuously through subcostal TAP catheters as an adjuvant to bupivacaine for postoperative analgesia.

We, therefore, have conducted this randomized clinical study to compare subcostal TAP analgesia with magnesium sulphate added to bupivacaine with epidural analgesia in major upper abdominal surgeries.

PATIENTS AND METHODS

This randomized clinical trial has been carried out in the Gastroenterology Surgical Center, Mansoura University from May 2019 to March 2020. The study was approved by the Institutional Research Board [code number: MD/17.12.104] of Mansoura University and was registered at clinical trials.gov [registry ID: NCT03949452]. A written informed consent was taken from each patient. This work has been carried out in accordance with The Code of Ethics of the World Medical Association [Declaration of Helsinki] for studies involving humans.

Inclusion criteria:

Eighty-four patients of both sexes, aged 18 - 60 years, ASA physical status I, II and III and patients undergoing major upper abdominal surgeries with subcostal incision [pancreatectomy, hepatectomy**,** hilar cholangio-carcinoma, CBD exploration, and splenectomy] were included in the study.

Exclusion criteria:

Patients with a history of relevant drug allergy, chronic pain or chronic drug abuse, patients with Body Mass Index > 35 Kg/m2, patients with local skin infection at the site of the block, and patients refused to participate in the study, were excluded. Patients were excluded if the lower end of the surgical incision extended below T10 [umbilicus] or extended laterally beyond the anterior axillary line.

Randomization:

Eligible 84 patients were randomly divided into two equal groups [42 patients in each], using computer-generated randomization table: Epidural Group [group E] and Subcostal TAP Group [group S]. Patients in both groups received the following protocol:

Preoperatively**:** Epidural or Subcostal TAP bolus dose of 10 ml bupivacaine 0.5% plus 100 mg magnesium sulphate in 20 ml normal saline.

Postoperatively**:** Epidural or Subcostal TAP infusion 20 ml bupivacaine 0.5% plus 100 mg magnesium sulphate in 50 ml normal saline. This solution was infused at a rate of 6 ml/hour for 72 hours postoperatively.

Sample size calculation: Sample size was calculated using Power Analysis and Sample Size software program [PASS] version 15.0.5 for windows [2017] using the results obtained by a pilot study conducted on 10 patients with the total postoperative morphine consumption during the first 72 hours as the primary outcome. It was 4.8± 5.22 mg in group E versus 8.4 ± 3.58 mg in group S. The null hypothesis was defined as absence of difference between both groups regarding the total postoperative morphine consumption during the first 72 hours. A sample of 34 patients in each group is needed to achieve 90% power [1-β or the probability of rejecting the null hypothesis when it is false] and detect a mean difference of 3.6 mg in the proposed study using two-tail unequal-variance t-test with a significance level [α or the probability of rejecting the null hypothesis when it is true] of 0.05. A 20% drop-out of 8 patients is expected in each group so a total of 42 patients will be recruited in each group.

Methods:

Patients assessed preoperatively by History taking, clinical examination, Basal laboratory investigations [complete blood picture, INR, liver function, and kidney function tests], basal serum magnesium [mg/dl], ECG and ECHO if needed.

In epidural group: thirty minutes before starting general anesthesia, the patient was placed in the sitting position. Skin was sterilized and subcutaneous tissue was infiltrated with local anesthetic. Tuohy needle [18G, 80mm, B. Braun; Melsungen AG, Germany] was inserted at T7-T9 region. Mid line approach was used and the epidural space was identified by "loss of resistance" technique using air and epidural catheter was threaded.

In subcostal TAP group: thirty minutes before starting anesthesia, US guided subcostal TAP block was applied on the same side of the surgical incision. Abdominal skin was sterilized, and then a high frequency [5–10 MHz] linear US probe [Philips, Konan-Tokyo, Japan] was placed obliquely on the upper abdomen, along the subcostal margin near the midline. After identifying the rectus abdominis muscle, the US probe was gradually moved laterally along the subcostal margin until the transversus abdominis muscle has been identified. Using In-plane approach, two injection points were done through 22-G block needle to ensure that local anesthetic was deposited along the whole plane. The local anesthetic is initially deposited between transversus abdominis and the rectus abdominis muscles medial to linea semilunaris, and then between transversus abdominis and internal oblique lateral to the linea semilunaris. Thirty minutes after injection, the extent of sensory block was evaluated in all patients by another blinded anesthetist not involved in the study using the pin prick and touch test [7]: 2 = normal sensation [no block],1 = loss of pinprick sensation [Analgesia], and 0 = loss of sensation to light touch [Anesthesia].

Successful block means sensory block grade 1, or 0 extending from T6-T9. Any patient with a failed block [grade 2 = no sensory block] or insufficient dermatomal block were excluded from the study. General anesthesia was then induced using IV propofol 2 mg/kg, fentanyl 1 microgram/kg, atracurium 0.5 mg/kg to facilitate endotracheal intubation. Patients were mechanically ventilated to maintain end tidal CO2 around 35 mmHg. Anesthesia maintained using isoflurane 1%, in 40-60% oxygen in air mixture and top up doses of atracurium. HR, MAP and oxygen saturation were monitored every 5 minutes intraoperatively. Paracetamol 1gm was infused and fentanyl boluses [0.5 µg.kg] given if intraoperative MAP or HR > 20% of basal for longer than 5 minutes and total intraoperative fentanyl consumption was recorded.

At the end of surgery, during closure of surgical wound, 20 G epidural catheter [B Braun Medical Polyamide Catheter 20 G x 100 cm] was inserted and threaded 8-10 cm by the surgeon into the subcostal transversus abdominis plane [8] with its tip directed towards the lateral end of the wound. After wound closure, the catheter exits from the medial end of wound, attaching it to the filter. Patients were extubated at the end of surgery after neuromuscular reversal and the duration of surgery was recorded. Then patients were transferred to post anesthesia care unit [PACU].

In PACU:

Assessment and follow up of the patients were done by an observer, blinded to study protocol**.** All Patients received infusion solution in Epidural or TAP space through syringe pump [Injectomat ®-Fresenius Kabi France]. Patients in both groups received a standard postoperative analgesic regimen consisting of 1 gm Paracetamol/6 hours for 72 hours. Pain was assessed using visual analogue scale [VAS] at rest and on coughing just after arrival into PACU and thereafter at 1, 2, 4, 8, 12, 24, 36, 48, 60, 72 hours postoperatively. Intravenous morphine 0.05 mg/kg given if VAS score > 30 mm and can be repeated after 15 minutes till VAS score ≤ 30 mm and total postoperative morphine consumption was calculated and recorded. All patients received regular ondansetron 4 mg every 8 hours.

Time to the first request for analgesia [morphine] in the PACU had been recorded. Hemodynamics [HR & MAP] were recorded at the same times of pain assessment postoperatively. Degree of sedation was assessed by Culebras sedation scale [1- awake and alert, 2-sedated, responding to verbal stimulus; 3-sedated, responding to mild physical stimulus; 4-sedated, responding to moderate or severe physical stimulus] at the same times of assessment of pain score postoperatively [9]**.** Serum levels of magnesium sulphate after 1, 24, 48, 72 hours postoperatively was recorded. Postoperative complications such as respiratory depression, hypotension, tingling or numbness in the lower limbs were recorded.

Statistical Analysis:

Data were analyzed using SPSS program [version 22] for Windows. Normality of numerical data distribution was tested by Kolmogorov-Smirnov test. Normally distributed numerical data [mean ± SD] were compared with the unpaired student`s t test. Non-normally distributed data [median and range] were compared with the Mann-Whitney U test. Categorical data [number and percentage] were compared with the Chi-square test. All data were considered statistically significant when P value was ≤ 0.05.

RESULTS

Ninety-two patients who underwent major upper abdominal surgery were assessed for eligibility. Five patients with BMI > 35kg/m^2 and 3 patients refusing the procedure, all were excluded from the study. A total of 84 patients were ultimately included to the study and the recruitment was halted once the desired patients were enrolled in the study **[Figure 1]**.

Demographic data [age, sex, BMI and ASA status], duration of surgery and types of surgeries showed no statistically significant differences between the studied groups **[Table1].** Regarding Hemodynamics, there was significant decrease in HR & MAP in group E compared with group S intraoperatively and in the postoperative period [**Tables 2** & **3**]. There was significant increase in postoperative VAS score in group S compared with group E during rest and cough at all time periods **[Table 4].**

Intraoperative fentanyl consumption was significantly higher in group S [118.57 ± 10.49] compared with group E [73.57 ± 8.21] [P < 0.001]. There was significant increase in total postoperative morphine consumption in group S [9.51 ± 6.46] in comparison to group E [4.77 ± 3.74] [P < 0.001]. The daily postoperative morphine consumption was larger in group S compared with group E during the first and second postoperative days but no significant difference between both groups in the third day. The time to the first postoperative request for rescue analgesia was significantly longer in group E [4.47 ± 2.54] compared with group S [3.76 ± 1.62] [P = 0.010] **[Table 5].**

Sedation score is significantly higher in group E rather than group S **[Table 6].** There were no statistically significant differences between both groups regarding serum magnesium level preoperatively and at 1, 24, 48 and 72 hours postoperatively, and serum magnesium remains within the safe normal level [1.7 - 2.4 mg/dl] within the two groups through the whole 72 hours postoperatively **[Table 7].**

In group E two patients developed postoperative unilateral lower limb patchy tingling, numbness and one patient complaint of postoperative nausea and vomiting. Three patients in group S complaint of hypoesthesia and tingling at the site of wound one month postoperatively that was improved later on.

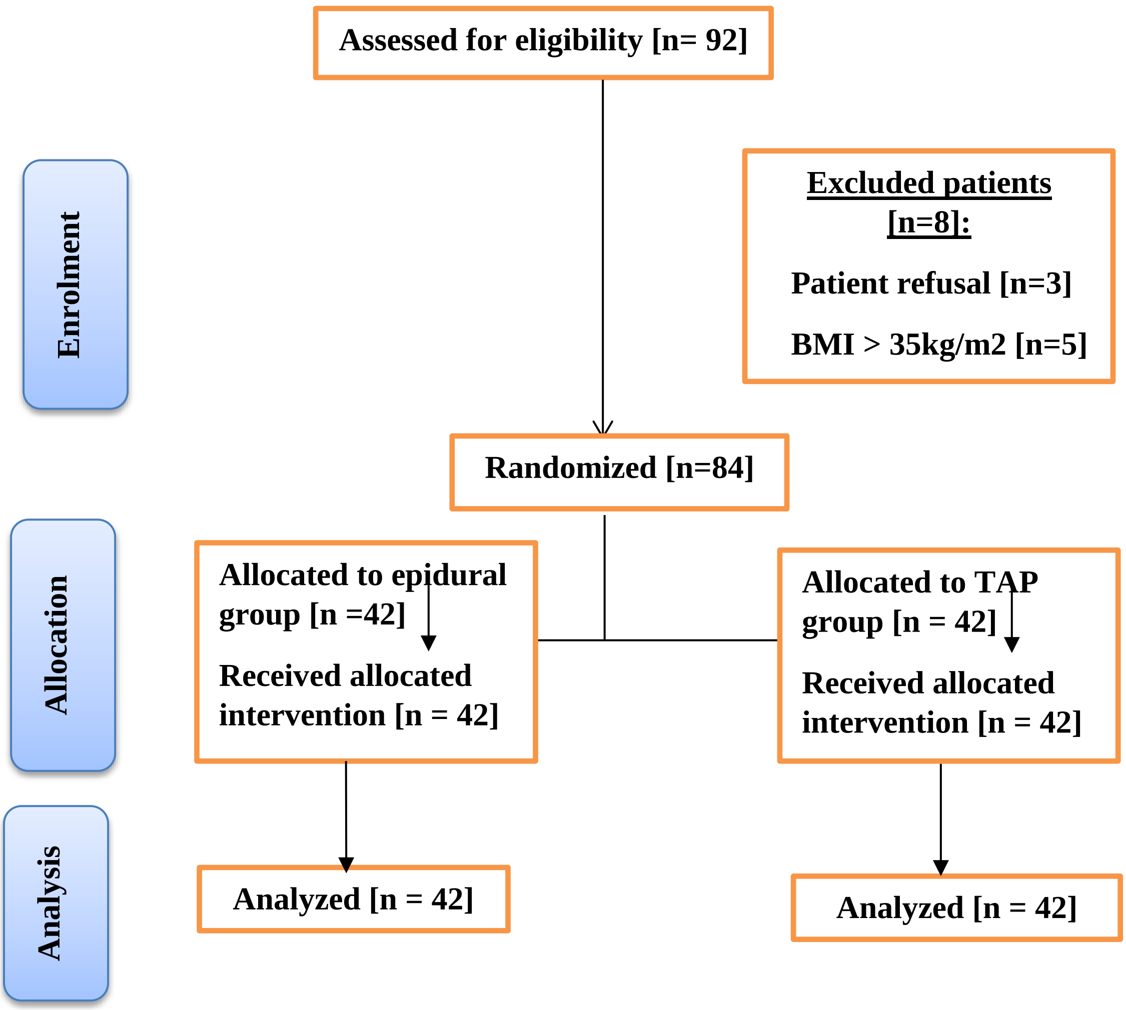

Figure [1]: CONSORT flow diagram.

Table [1]: Demographic data, surgery duration and type of surgery in the studied groups. Data are expressed as mean ± SD, number and percentage.

Variable	Group E [n = 42]	Group S [n = 42]	P-value
Age [years]	48.88 ± 8.57	52.31 ± 8.04	0.062
Sex:			
Male	29 [69%]	26 [61.9%]	0.491
Female	13 [31%]	16 [38.1 %]	
BMI [kg/m^2]	26.6 ± 4.29	26.94 ± 3.88	0.327
ASA:			
I	15 [35.7 %]	9 [21.4 %]	0.054
II	20 [47.6 %]	22 [52.4 %]	
III	7 [16.7%]	11 [26.2 %]	
Surgery duration	4.36 ± 1.19	4.24 ± 0.88	0.603
Type of surgery:			
Pancreatic surgery	8[19%]	9[21.4%]	0.786
CBD exploration	12[28.6%]	10[23.8%]	0.620
GB tumors	9[21.4%]	8[19%]	0.786
Ligated CBD	7[16.7%]	6[14.3%]	0.763
Splenectomy	4[9.5%]	5[11.9%]	0.724
Ampullary tumors	2[4.8%]	4[9.5%]	0.397

Group E: Epidural group, Group S: Subcostal Transversus abdominis plane group. BMI: Body mass index. ASA: American society of anesthesiologists. * Significant [< 0.05] compared to the other group.

Table [2]: Perioperative heart rate [beat/min] in the studied groups.

Time	Group E [n = 42]	Group S [n = 42]	P-value
Basal	85.95 ± 11.44	90.36 ± 14.31	0.123
10 min. intraoperative	80.88 ± 11.95	88.00 ± 13.91*	0.014
20 min.	78.07 ± 11.68	86.00 ± 14.2*	0.006
30 min.	76.48 ± 10.54	86.21 ± 12.86*	<0.001
40 min.	74.71 ± 10.39	83.50 ± 13*	0.001
60 min.	72.67 ± 9.24	81.57 ± 12.58*	<0.001
90 min.	71.33 ± 10.12	82.21 ± 12.22*	<0.001
120 min.	72.31 ± 10.14	81.17 ± 12.39*	0.001
150 min.	74.12 ± 10.15	81 ± 12.07*	0.006
180 min.	77.88 ± 9.93	85.26 ± 11.59*	0.002
1 h Postoperative	71.69 ± 8.43	82.81 ± 14.27*	<0.001
2 h	77.10 ± 5.90	82.83 ± 13.34*	0.014
4 h	77.71 ± 5.84	84.67 ± 12.62*	0.002
8 h	77.52 ± 7.32	87.26 ± 11.88*	<0.001
12 h	77.24 ± 7.28	89.86 ± 15.23*	<0.001
24 h	78.81 ± 9.07	89.83 ± 12.22*	<0.001
36 h	79.05 ± 10.16	91.29 ± 13.18*	<0.001
48 h	79.31 ± 11.17	90.69 ± 11.86*	<0.001
60 h	80.1 ± 10.15	91.38 ± 13.37*	<0.001
72 h	77.86 ± 9.24	90.86 ± 13.15*	<0.001

Group E: Epidural group, Group S: Subcostal Transversus abdominis plane group, * Significant [< 0.05] compared to the other group.

Table [3]: Perioperative mean arterial pressure [MAP] [mm Hg] in the studied groups.

Time	Group E [n = 42]	Group S [n = 42]	P-value
Basal	96.26 ± 18.43	99.5 ± 17.3	0.409
10 min. intraoperative	90.62 ± 17.93	96.62 ± 15.11	0.101
20 min.	85.05 ± 14.34	94.07 ± 15.53*	0.007
30 min.	82.12 ± 15.72	92.43 ± 14.47*	0.002
40 min.	85.79 ± 14.37	92.31 ± 15.08*	0.046
60 min.	84.98 ± 16.28	92.4 ± 14.97*	0.032
90 min.	83.45 ± 12.97	92.17 ± 15.25*	0.006
120 min.	83.69 ± 14.97	92.71 ± 11.53*	0.003
150 min.	83.95 ± 14.62	92.98 ± 9.33*	0.001
180 min.	85.74 ± 12.47	96.48 ± 10.86*	<0.001
1 h Postoperative	86.12 ± 9.31	94.6 ± 8.34*	<0.001
2 h	87.05 ± 8.36	96.74 ± 8.87*	<0.001
4 h	88 ± 8.02	98.07 ± 7.72*	<0.001
8 h	88.86 ± 7.36	95.43 ± 9.59*	0.001
12 h	88.5 ± 7.14	95.88 ± 9.07*	<0.001
24 h	87.07 ± 9.15	94.9 ± 8.8*	<0.001
36 h	87.9 ± 7.98	94.79 ± 9.81*	0.001
48 h	87.93 ± 8.67	92.86 ± 9.17*	0.013
60 h	88.33 ± 7.01	93.71 ± 8.8*	0.003
72 h	89.74 ± 6.8	93.93 ± 10.25*	0.030

Group E: Epidural group, Group S: Subcostal Transversus abdominis plane group. * Significant [< 0.05] compared to the other group.

Table [4]: Postoperative visual analogue scale [VAS] score [0-100 mm] at rest and cough in the studied groups.

Time	Group E [n = 42]	Group S [n = 42]	P-value
VAS at rest at 1h	14 [7 – 27]	23 [14 – 29]*	<0.001
2h	18 [11 – 28]	26 [19 – 29]*	<0.001
4h	35 [8 – 47]	41 [24 – 46]*	0.036
8h	19 [9 – 41]	35 [17 – 48]*	<0.001
12h	18 [10 – 36]	27[19 – 46]*	<0.001
24h	15 [7 – 38]	26 [16 – 45]*	<0.001
36h	17 [6 – 39]	34 [18 – 44]*	0.008
48h	16 [4 – 38]	27 [17 – 40]*	0.044
60h	12 [5 – 36]	24 [15 – 39]*	<0.001
72h	10 [3 – 24]	21 [13 – 27]*	<0.001
VAS at cough 1h	23 [21 – 34]	35 [32 – 38]*	<0.001
2h	25 [21 – 37]	37 [32 – 42]*	<0.001
4h	43 [18 – 54]	54 [27 – 63]*	0.004
8h	28 [16 – 51]	47 [29 – 58]*	0.003
12h	26 [12 – 42]	39 [25 – 57]*	<0.001
24h	24 [11 – 42]	38 [27 – 53]*	<0.001
36h	26 [13 – 52]	47 [30 – 56]*	<0.001
48h	23 [11 – 47]	37 [27 – 57]*	<0.001
60h	23 [9 – 43]	35 [27 – 54]*	<0.001
72h	21 [8 – 37]	32 [20 – 38]*	<0.001

Group E: Epidural group, Group S: Subcostal Transversus abdominis plane group. * Significant [< 0.05] compared to the other group.

Table [5]: Intraoperative fentanyl consumption [ug], daily and total postoperative morphine consumption [mg], and time to the first analgesia request [hours].

Variable	Group E [n = 42]	Group S [n = 42]	P- value
Intraoperative fentanyl consumption [ug]	73.57 ± 8.21	118.57 ± 10.49*	< 0.001
1st day postoperative morphine consumption [mg]	3.04 ± 2.27	5.76 ± 3.48*	<0.001
2nd day postoperative morphine consumption [mg]	1.65 ± 2.29	3.45 ± 3.69*	0.009
3rd day postoperative morphine consumption [mg]	0.08 ± 0.5	0.31 ± 1.12	0.229
Total postoperative morphine consumption[mg]	4.77 ± 3.74	9.51 ± 6.46*	<0.001
Time to the first postoperative analgesic request [hours]	4.47 ± 2.54	3.76 ± 1.62*	0.010

Group E: Epidural group, Group S: Subcostal Transversus abdominis plane group. * Significant [< 0.05] compared to the other group.

Table [6]: Postoperative sedation score [Culebras] [1- 4] in the studied groups.

Time	Group E [n = 42]	Group S [n = 42]	P- value
1h	1 [1 – 2]*	1 [1 – 2]	<0.001
2h	1 [1 – 2]*	1 [1 – 2]	<0.001
4h	1 [1 – 2]*	1 [1 – 2]	0.004
8h	1 [1 – 2]*	1 [1 – 2]	0.004
12h	1 [1 – 2]*	1 [1 – 2]	0.003
24h	1 [1 – 2]*	1 [1 – 2]	0.001
36h	1 [1 – 3]*	1 [1 – 2]	0.032
48h	1 [1 – 3]*	1 [1 – 2]	0.003
60h	1 [1 – 3]*	1 [1 – 2]	0.013
72h	1 [1 – 3]*	1 [1 – 2]	0.007

Group E: Epidural group, Group S: Subcostal Transversus abdominis plane group. * Significant [< 0.05] compared to the other group.

Table [7]: Serum magnesium level [mg/dl] in the studied groups.

Time	Group E [n = 42]	Group S [n = 42]	P-value
Basal Magnesium	1.75 ± 0.2	1.72 ± 0.18	0.487
1 hr Post-operative	1.77 ± 0.19	1.74 ± 0.15	0.402
24 hrs	1.79 ± 0.17	1.77 ± 0.14	0.482
48 hrs	1.83 ± 0.17	1.81 ± 0.14	0.526
72 hrs	1.85 ± 0.16	1.84 ± 0.13	0.653

Group E: Epidural group, Group S: Subcostal Transversus abdominis plane group, * Significant [< 0.05] compared to the other group.

DISCUSSION

Optimal analgesia is one of the corner stones of enhanced recovery after upper abdominal surgery. This study is a comparison between continuous thoracic epidural infusion and subcostal TAP catheter infusion for providing analgesia during and after upper major abdominal surgeries. This study has demonstrated that there was significant increase in total postoperative morphine consumption and higher VAS pain scores in group S compared with group E during rest and cough postoperatively at all time periods.

Several reasons may account for these findings; 1- Subcostal TAP catheter technique provide somatic analgesia to the parietal peritoneum as well as the skin and muscles of the anterior abdominal wall but unable to cover visceral pain while epidural analgesia can provide both somatic and visceral analgesia and potentially more flexible in providing analgesia for the relevant dermatomes [10]. 2- Epidural analgesia can reduce the intraoperative consumption of opioids, reducing opioid tolerance after surgery [11]. 3- Local anesthetics after epidural injection are deposited mainly in CSF, blood vessels, especially the epidural venous plexus, and epidural fat, the rate of absorption and disposition in these three sites affects the duration and potency of epidural analgesia [12].

These finding are in correlation with Niraj and his coworkers who compared the analgesic efficacy of boluses subcostal TAP block with epidural infusion following upper abdominal surgeries and observed higher tramadol consumption in TAP group rather than epidural group [6].

Also, Wu and his colleagues had proved higher cumulative morphine consumption in single shot subcostal TAP group than continuous infusion Epidural group [13]. However, our findings are in contrary to Niraj *et al.* [14] who compared analgesic efficacy of four-quadrant bolus TAP block and continuous posterior TAP analgesia with epidural analgesia in patients undergoing laparoscopic colorectal surgery. They observed that is no significant differences between two groups regarding tramadol consumption and VAS scores that may be attributed to; 1-Patients in TAP group received four quadrant TAP block [bilateral subcostal and bilateral posterior TAP], 2- Intensity of laparoscopic pain is less than intensity of open surgical wound pain that can be covered by four quadrant TAP.

In the current study, magnesium sulphate was used as a local anesthetic adjuvant in both studied groups to avoid administration of opioids as local anesthetic adjuvant, to avoid its harmful effects as respiratory depression, pruritus, nausea, vomiting and tolerance. Also, addition of Mg So_4 to local anesthetic drugs for neuro-axial block has a sedating, relaxing, anesthesia enhancing effect and produce marked prolongation of anesthesia duration and improved the quality of analgesia [15].

This coincides with multiple previous studies that used $MgSo_4$ as an adjuvant to various regional techniques such as brachial, intra-articular, epidural, or even intrathecal blocks where $MgSo_4$ had a beneficial effect on post-operative analgesia and analgesics requirement [16]**.**

Magnesium is a noncompetitive antagonist of N-methyl D-aspartate [NMDA] receptor, blocking ion channels in a voltage dependent fashion. This receptor is found in many parts of the body, including the nerve endings, and plays a well-defined role in modulating pain [17]**.** The analgesic effects of magnesium are primarily based on antagonism of calcium influx into nerve fiber, and NMDA receptor blocking activity, thus interfering with the release of neurotransmitter substances at synaptic junctions and potentiate the action of local anesthetics [18]**.**

Another suggested mechanism for TAP magnesium is systemic absorption. Serum magnesium levels are strongly associated with reduced postsynaptic activity of unmyelinated C-fibers which are conveying the input signals from the periphery to central nervous system. [19]. Epidural magnesium analgesic effect occurred at the supra-spinal level and might be related to its systemic absorption.

It can act by different mechanisms: [1] Antagonism of the spinal cord NMDA receptors [20]; [2] Regulation of calcium influx into the cell; [3] Interaction between NMDA receptor complex and opioids anti-nociception help analgesic effect of opioids and decrease tolerance to opioids [20]; [4] magnesium changes the pH of the bupivacaine solution which caused a delayed uptake of bupivacaine from the epidural space and prolonged the period of sensory and motor blockade [21].

In the present study, there was significant increase in sedation score in group E rather than group S. This can be explained by epidural anesthesia has a sedating effect. This can be due to three mechanisms: [1] systemic general anesthetic effects of absorbed epidural local anesthetic, [2] direct epidural sensory blockade of the noxious stimuli, and [3] sub-anesthetic levels of epidural local anesthetic depressing spinal cord motor function [22].

There were no patients with chronic wound pain reported 3 months postoperatively in both groups that may be due to several factors: 1- Preemptive analgesia and administration of bolus epidural and bolus TAP preoperatively in both groups to prevent the development of central sensitization and limit subsequent pain experience [23]. 2- Preventive analgesia, both techniques of epidural and subcostal TAP can provide long-term reduction of postsurgical pain. 3- Administration of Mg So_4 as adjuvant to bupivacaine perioperatively which is NMDA receptor antagonist, thus preventing central sensitization caused by peripheral nociceptive simulation. 4- Perioperative infusion of paracetamol have been shown to improve postoperative outcomes [24].

Epidural analgesia has been considered as the gold standard after abdominal surgeries as it provides excellent analgesia. However, well known side effects and potential risks of epidural limits its use. While continuous TAP analgesia does not cause hemodynamic imbalance and the motor and sensory function of the lower limbs is spared [25].

Also, TAP analgesia does not require intensive nursing care. These characteristics could enhance patient ambulation and speed of recovery after major surgery. However, TAP analgesia does not cover visceral pain with dermatomal limitation. So, Subcostal TAP analgesia can provide adequate static and dynamic analgesia when compared to Epidural analgesia in major upper abdominal surgeries but avoids harmful side effects of epidural.

One limitation of this study was that we have excluded the patients with BMI ≥ 35 kg/m^2 which limit the number of patients. Another limitation was inability to fix one surgeon in all operations in both groups. Also, continuous postoperative infusion in both groups limits the patient mobility essential for early ambulation after surgery.

One recommendation is comparing the analgesic and sedative effect of epidural and TAP magnesium with that of intravenous magnesium in another studies. Also, we recommend evaluation of postoperative stress response indicators like serum cortisol and blood sugar in future studies. Finally, increasing number of patients for a wider study and increasing postoperative follow up duration is the most important recommendation.

Conclusion:

Epidural analgesia and subcostal TAP catheter infusion analgesia, both provide adequate postoperative analgesia in favor of epidural analgesia, but subcostal TAP avoids major drawbacks of epidural analgesia as hemodynamic instability, affection of sensory and motor functions of the lower limbs. Hence, subcostal TAP catheter may be an effective alternative to epidural catheter for providing postoperative analgesia after major upper abdominal surgeries.

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REFERENCES

1. Dieu A, Huynen P, Lavand'homme P, Beloeil H, Freys SM, Pogatzki-Zahn EM, Joshi GP, Van de Velde M; PROSPECT Working Group of the European Society of Regional Anesthesia and Pain Therapy [ESRA]. Pain management after open liver resection: Procedure-Specific Postoperative Pain Management [PROSPECT] recommendations. Reg Anesth Pain Med. 2021 May; 46 [5]: 433-445. doi: 10.1136/rapm-2020-101933

2. Sakai-Tamura A, Murata H, Ogami-Takamura K, Saiki K, Manabe Y, Tsurumoto T, Hara T. Course of the thoracic nerves around the umbilicus within the posterior layer of the rectus sheath: a cadaver study. J Anesth. 2020 Dec; 34 [6]: 953-957. doi: 10.1007/s00540-020-02863-y

3. Jadon A, Jain P, Chakraborty S, Motaka M, Parida SS, Sinha N, Agrawal A, Pati AK. Role of ultrasound guided transversus abdominis plane block as a component of multimodal analgesic regimen for lower segment caesarean section: a randomized double blind clinical study. BMC Anesthesiol. 2018 May 14; 18[1]:53. doi: 10.1186/s12871-018-0512-x.

4. Kishore K, Agarwal A. Ultrasound-guided continuous transverse abdominis plane block for abdominal surgery. J Anaesthesiol Clin Pharmacol. 2011 Jul; 27[3]:336-8. doi: 10.4103/0970-9185.83677.

5. Hebbard P. Subcostal transversus abdominis plane block under ultrasound guidance. Anesth Analg. 2008 Feb; 106 [2]: 674-5; author reply 675. doi: 10.1213/ane. 0b013e318161a88f.

6. Niraj G, Kelkar A, Jeyapalan I, Graff-Baker P, Williams O, Darbar A, Maheshwaran A, Powell R. Comparison of analgesic efficacy of subcostal transversus abdominis plane blocks with epidural analgesia following upper abdominal surgery. Anaesthesia. 2011 Jun; 66[6]: 465-71. doi: 10.1111/j.1365-2044.2011.06700.x.

7. Alfred VM, Srinivasan G, Zachariah M. Comparison of Ultrasound with Peripheral Nerve Stimulator-guided Technique for Supraclavicular Block in Upper Limb Surgeries: A Randomized Controlled Trial. Anesth Essays Res. 2018 Jan-Mar; 12[1]:50-54. doi: 10.4103/aer.AER_211_17.

8. Venkatraman R, Saravanan R, Dhas M, Pushparani A. Comparison of laparoscopy-guided with ultrasound-guided subcostal transversus abdominis plane block in laparoscopic cholecystectomy-A prospective, randomised study. Indian J Anaesth. 2020 Dec; 64[12]: 1012-1017. doi: 10.4103/ija.IJA_528_20.

9. Culebras X, Van Gessel E, Hoffmeyer P, Gamulin Z. Clonidine combined with a long acting local anesthetic does not prolong postoperative analgesia after brachial plexus block but does induce hemodynamic changes. Anesth Analg. 2001 Jan; 92 [1]: 199-204. doi: 10.1097/00000539-200101000-00038.

10. Charlton S, Cyna AM, Middleton P, Griffiths JD. Perioperative transversus abdominis plane [TAP] blocks for analgesia after abdominal surgery. Cochrane Database Syst Rev. 2010 Dec 8;[12]:CD007705. doi: 10.1002/14651858.CD007705.pub2. Update in: Cochrane Database Syst Rev. 2020 Apr 9; 4:CD007705.

11. Albrecht E, Grape S, Frauenknecht J, Kilchoer L, Kirkham KR. Low- versus high-dose intraoperative opioids: A systematic review with meta-analyses and trial sequential analyses. Acta Anaesthesiol Scand. 2020 Jan; 64[1]:6-22. doi: 10.1111/aas.13470.

12. Viscusi ER, Candiotti KA, Onel E, Morren M, Ludbrook GL. The pharmacokinetics and pharmacodynamics of liposome bupivacaine administered via a single epidural injection to healthy volunteers. Reg Anesth Pain Med. 2012 Nov-Dec; 37[6]:616-22. doi: 10.1097/AAP.0b013e318269d29e

13. Wu Y, Liu F, Tang H, Wang Q, Chen L, Wu H, Zhang X, Miao J, Zhu M, Hu C, Goldsworthy M, You J, Xu X. The analgesic efficacy of subcostal transversus abdominis plane block compared with thoracic epidural analgesia and intravenous opioid analgesia after radical gastrectomy. Anesth Analg. 2013 Aug; 117[2]:507-13. doi: 10.1213/ANE.0b013e318297fcee.

14. Niraj G, Kelkar A, Hart E, Horst C, Malik D, Yeow C, Singh B, Chaudhri S. Comparison of analgesic efficacy of four-quadrant transversus abdominis plane [TAP] block and continuous posterior TAP analgesia with epidural analgesia in patients undergoing laparoscopic colorectal surgery: an open-label, randomised, non-inferiority trial. Anaesthesia. 2014 Apr;69[4]:348-55. doi: 10.1111/anae.12546.

15. Soave PM, Conti G, Costa R, Arcangeli A. Magnesium and Anaesthesia. Curr Drug Targets. 2009 Aug; 10[8]:734-43. doi: 10.2174/138945009788982487.

16. Ghatak T, Chandra G, Malik A, Singh D, Bhatia VK. Evaluation of the effect of magnesium sulphate vs. clonidine as adjunct to epidural bupivacaine. Indian J Anaesth. 2010 Jul; 54[4]:308-13. doi: 10.4103/0019-5049.68373.

17. Bottiger BA, Esper SA, Stafford-Smith M. Pain management strategies for thoracotomy and thoracic pain syndromes. Semin Cardiothorac Vasc Anesth. 2014 Mar; 18[1]:45-56. doi: 10.1177/1089253213514484.

18. Goyal P, Jaiswal R, Hooda S, Goyal R, Lal J. Role of magnesium sulphate for brachial plexus analgesia. Internet J Anesthesiol. 2008; 21: 1-6. Available at: http://ispub.com/IJA/21/1/9826#, last accessed January 2022

19. Herroeder S, Schönherr ME, De Hert SG. Magnesium--essentials for anesthesiologists. Anesthesiology. 2011; 114 [4]:971-93. doi: 10.1097/ ALN.0b013e 318210483d.

20. Benevides ML, Fialho DC, Linck D, Oliveira AL, Ramalho DHV, Benevides MM. Intravenous magnesium sulfate for postoperative analgesia after abdominal hysterectomy under spinal anesthesia: a randomized, double-blind trial. Braz J Anesthesiol. 2021 Sep-Oct;71[5]:498-504. doi: 10.1016/j.bjane.2021.01.008.

21. Sun J, Wu X, Xu X, Jin L, Han N, Zhou R. A comparison of epidural magnesium and/or morphine with bupivacaine for postoperative analgesia after cesarean section. Int J Obstet Anesth. 2012 Oct; 21[4]:310-6. doi: 10.1016/j.ijoa.2012.05.006.

22. Xiang Y, Chen CQ, Chen HJ, Li M, Bao FP, Zhu SM. The effect of epidural lidocaine administration on sedation of propofol general anesthesia: a randomized trial. J Clin Anesth. 2014 Nov; 26[7]:523-9. doi: 10.1016/j.jclinane.2014.03.016.

23. Ong CK, Lirk P, Seymour RA, Jenkins BJ. The efficacy of preemptive analgesia for acute postoperative pain management: a meta-analysis. Anesth Analg. 2005 Mar; 100 [3]:757-773. doi: 10.1213/01.ANE.0000144428.98767.0E.

24. Kaluzny BJ, Kazmierczak K, Laudencka A, Eliks I, Kaluzny JJ. Oral acetaminophen [paracetamol] for additional analgesia in phacoemulsification cataract surgery performed using topical anesthesia Randomized double-masked placebo-controlled trial. J Cataract Refract Surg. 2010 Mar; 36[3]:402-6. doi: 10.1016/j.jcrs.2009.09.035.

25. Allcock E, Spencer E, Frazer R, Applegate G, Buckenmaier C 3rd. Continuous transversus abdominis plane [TAP] block catheters in a combat surgical environment. Pain Med. 2010; 11[9]:1426-9. doi: 10.1111/j.1526-4637.2010.00894.x. PMID: 21050380.

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