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Research / Araştırma

Laparoscopic Transversus Abdominal Plane Block is Effective in Multimodal Analgesia for Laparoscopic Sleeve Gastrectomy

Laparoskopik Transversus Abdominis Plan Bloğu Laparoskopik Sleeve Gastrektomi için Multimodal Analjezide Etkilidir

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ABSTRACT

Objective: Multimodal pain management combined with epidural analgesia and transversus abdominal plane (TAP) block after obesity surgery, reduces side effects of opioids by decreasing its usage and ensuring effective postoperative pain control in obese patients with expanded fat mass. But performing both epidural and TAP block in obese patients is technically difficult, and sometimes it is impossible. Performing the TAP block laparoscopically may be a solution to this technical difficulty. In this study, technical success and efficacy of laparoscopic transversus abdominis plane block in the laparoscopic sleeve gastrectomy was assessed.

Methods: This study was designed as prospectively randomized, double-blinded and placebo-controlled. Laporoscopic sleeve gastrectomy (LSG) patients underwent TAP infiltration of 30 cc bupivacaine (Group T) or saline (Group S) was administered to bilateral petit and subcostal area in patients underwent laparoscopic sleeve gastrectomy. One hundred sixty five patients were included in the study. All patients were administered with postoperative patient-controled analgesia device and dosed with tenoxicam 20 mg IV at postoperative 1st and 8th hours. The analgesic requirement, mean pain score, vital parameters of all patients and if any of the patients presented with nausea and vomiting were assessed by an objective observer at postoperative 1st, 6th and 24th hours.

Results: There was no statistically significant difference between age, body maas index, mean duration of operation and gender, laparoscopic TAP block groups (p>0.05). When the visual analogue scale score was evaluated, the mean scores of the 1st, 6th, and 24th hours in the control group (Group S) were found as statistically significantly higher than Group T (p=0.009, p=0.002).

Conclusion: It is noteworthy that reduction of opioid-related side effects by the usage of multimodal analgesic technique, particularly in morbidly obese patients undergoing surgery. In this study, it was projected that laparoscopic TAP block can be applied with high rate of success and reduces postoperative opioid consumption in LSG operations.

Keywords: Morbid obesity, sleeve gastrectomy, analgesia, transversus abdominis plane block

ÖZ

Amaç: Obezite cerrahisinde, epidural analjezi ve transversus abdominal plan (TAP) blok ile yapılan multimodal ağrı yönetimi postoperatif etkili bir analjezi sağlayarak, opioidlerin kullanım sıklığını azaltır ve opioid kullanımına bağlı oluşan yan etkileri en aza indirir. Fakat obez hastalarda hem epidural hem de TAP bloğunu uygulamak teknik olarak zordur, bazen imkansızdır. TAP bloğunun laparoskopik olarak yapılması bu teknik zorluğa bir çözüm olabilir. Bu çalışmada laparoskopik sleeve gastrektomide laparoskopik TAP bloğunun teknik başarısı ve etkinliği değerlendirildi.

Yöntemler: Bu çalışma prospektif olarak randomize, çift kör ve plasebo kontrollü olarak dizayn edildi. Laparoskopik sleeve gastrektomi (LSG) uygulanan hastalarda iki taraflı petit ve subkostal alana 30 cc bupivakain (Grup M) veya salin (Grup S) TAP infiltrasyonu uygulandı. Çalışmaya 165 hasta dahil edildi. Tüm hastalara postoperatif hasta kontrollü analjezi cihazı uygulandı ve postoperatif 1. ve 8. saatlerde iv tenoxicam 20 mg IV uygulandı. Çalışmaya katılan bütün hastaların; analjezik gereksinimi, ortalama ağrı skoru, vital parametreleri ve bulantı, kusma durumları postoeratif 1., 6. ve 24. saatte objektif bir gözlemci tarafından kayıt edildi.

Bulgular: Yaş, vücüt kitle indeksi, ortalama ameliyat süresi, cinsiyet açısından gruplar arasında fark saptanmadı (p>0,05). Görsel analog ölçeği skoru değerlendirildiğinde, kontrol grubunda (Grup S) 1., 6. ve 24. saatlerin ortalama puanları, Grup S'den istatistiksel olarak anlamlı derecede yüksek bulundu (p=0,009, p=0,002).

Sonuç: Morbid obez hastalarda multimodal analjezi kullanılarak opioid ilişkili yan ekilerin azalması dikkat çekicidir. Bu çalışmada, LSG operasyonlarında laparoskopik TAP bloğun yüksek oranda başarı ile uygulanabileceği ve postoperatif opioid tüketimini azalttığı gösterilmiştir.

Anahtar Kelimeler: Morbid obezite, sleeve gastrektomi, analjezi, transversus abdominis düzlemi

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INTRODUCTION

Inadequate post-op pain management is an important factor which negatively affects patient recovery and duration of hospital stay. Post-op pain leads to inability to cough, reduction in deep inspiration and pulmonary complications such as atelectasis (1). In addition, it may cause cardiac arrhythmia, hypertension (HT) and myocardial ischemia. With the use of appropriate analgesia methods, reduced morbidity and mortality rates were seen.

The most important advantage of minimally invasive surgery is rapid physical recovery and less post-op pain (2). Thus, laparoscopy is first choice in obesity surgery and laparoscopic sleev gastrectomy (LSG) is a commonly used method. In obese patients; altered pathophysiology, comorbid diseases, particularly presence of sleep apnea syndrome makes post-op pain management more difficult in these patients. Moreover, because of the narcotic analgesics used post-operatively leads to sedation and this in turn leads to hypoventilation and immobilization (3-5). The choice of postoperative pain management method is based on the location of surgery, the surgical procedure, patients general medical condition, patients preference and previous pain experience. For this reason, multimodal analgesia methods were described for a better post-op pain control (6).

In this study; we aimed to demonstrate effectiveness of transversus abdominal plane (TAP) block in post-op analgesia management in American Society of Anaesthesiologists (ASA) III risk group patients who have undergone laparoscopic sleeve gastrectomy in our clinic.

METHOD

After the approval of hospital ethics committee, informed consent was taken from every single patient who are going to take place in this study. In a randomised, double blind way patients were dividet in two groups as; patients who were undergone laparascopi assisted TAP block and who were not, marcaine group (Group M) and salin infusion group (Group S) as control group respectively. Randomization was achieved with short-long rod withdrawal.

Patients who are 18-65 years old, ASA III risk group, with a body mass index (BMI) >40 and who have signed written informed consent form were included into the study. Exclusion criteria were alcohol or drug abuse, presence of contraindication to peripheral nerve block (i.e. allergy against local analgesics, coagulopathy and skin infection) and previous abdominal surgery.

Anaesthesia Protocol: After the patients were placed on the operation table in ramp position, with the use of three-way electrocardiography, pulse oximeter and blood pressure cuff monitorization was performed. Before induction, premedication was performed with 1 g paracetamol, 100 mg tramadol and 3 mg midazolam IV, if there is no contraindication. According to ideal body weight 2-5 mg/kg propofol and according to actual weight 0.5 mg rocuronium was administered. Effectiveness of intubation was evaluated by end-tidal CO^2 as respiratory sounds couldn't be evaluated effectively because of obesity. Fentanyl 150 mcq, tramadol 100 mg, ranitidine 50 mg and andosterone 8 mg were routinely administered after intubation. Anaesthesia was maintained by sevoflurane and remifentanil. Pressure-regulated volume control mode was used in ventilation. The patients were transferred to either post-op anaesthesia care unit or to the surgical ward according to pre-existing co morbid conditions. Mobilization and respiratory physiotherapy was started 2 hours after the operation.

TAP Block Method: To Group M patients; with a bupivacaine (Marcain, Astra Zeneca, UK) 0.25% and saline mixture in 1:1 ratio, TAP block was performed in bilateral petit triangle and bilateral subcostal area with 20 mL and 10 mL respectively. To Group S patients; 20 mL and 10 mL saline was aplied to bilateral petit triangle and bilateral subcostal area respectively.

Blunt-tipped peripheral nerve block needle was used for this procedure. For the petite triangle, the solution was injected after double click was felt which is felt while passing through the fascii of m. obliqus externus and musculus obliquus internus. "Doyle's bulge sign" which is formed as musculus transversus abdominis fascia pushes the peritoneum was seen and inexistence of peritoneal penetration was observed. By this way the location of block and its safety was confirmed.

In addition, oblique subcostal block was also performed, as upper abdominal laparoscopy incision is used in LSG. After feeling the passage through the superior fascia of musculus rectus abdominis, the solution was injected. By seeing the buge sign made by the solution injected, block area and block safety was confirmed. A sharp bulging can be seen on peritoneal wall if the needle was pushed too deep and by this way peritoneal infiltration was prevented.

Post-op Period: Vital signs including mean arterial pressure (MAP) measurements were monitored during post-op period. During post-op period patient-controled analgesia (PCA) pump was used o all patients. By adding 300 mg tramadol (Contramal, Abdi İbrahim, TR) in 100 mL 0.9% Sodium Chloride Solution PCA solution was prepared. PCA pump was adjusted as 10 mg bolus, 12 min lock out time and no basal infusion. At first hour, 20 mg IV Tenoksikam was administered. Oral intake (water) was started in every patient at 24th hour postoperatively and early mobilization was started. Second dose of iv tenoxicam was administered at 8th hour post-operatively. Post operatively, a bed side visit by anaesthesia specialist was done for every patient at 1st, 6th and 24th hours. In each visit post-op pain level and analgesia requirement was detected by observing consumed Tramadol dose (by observing PCA pump's bolus administration dose) and visual analogue scale (VAS) scores, described as horizontal or vertical line starting with "no pain" and ending with "unbearable pain" were recorded. Moreover, presence of nausea and vomiting was also questioned. University of Health Sciences Bakırköy Sadi Konuk Training and Research Hospital approval was obtained from the ethics committee of clinical trials (Decision no: 2014/17/01).

Statistical Analiys

NCSS (Number Cruncher Statistical System) 2007 (Kaysville, Utah, USA) program was used for statistical analysis. For assessment of study data descriptive statistical methods (mean, standard deviation, median, frequency, percentage, minimum, maximum) were used and additionally for comparison of quantitative data for parameters showing normal distribution Student-t test was used for comparison of two groups, for parameters with non-normal distribution Mann-Whitney U test was used for comparison of two groups. For comparison of qualitative data Fisher's exact test and Yates' continuity correction test (Yates' corrected chi-square) were used. Intragroup comparison of parameters with normal distribution repeated measures test (repeated measures analysis of variance) was used and for assessment of binary comparisons Bonferroni correction test was used. For intragroup comparison of parameters with non-normal distribution Friedman Test was used and for binary comparisons Wilcoxon Signed Rank test was used. Significance was evaluated at $p<0.01$ and $p<0.05$ levels. Power analysis by using G* Power (v3.1.9) program was performed in order to determine sample size. A pilot study was done at the beginning of the study by 15 patients from both groups. In these groups VAS pain score change at the last follow up compared to baseline was 3.85 for group S and 1.83 for group M. Effect size was calculated as W=0.7 26 by using these data and for achieving G 80% power at α=0.05 level 31 patients were needed in both groups. 85 patients were included into the study in group S and 80 patients in group M with a total of 165 patients.

RESULTS

Totally, 165 patients were included in the study; eighty-five patients in group S and 80 patients in group M. Demographic characteristics of patients are found as; mean age was 37.88/y (±10.14) in group S and 37.97 (±10.61) in group M and no meaningful statistical difference was found (p=0.974). There were 33 men (38.8%) and 52 (61.1%) women in group S. In group M, there was 30 (37.5%) men and 50 (62.5%) women. There was no statistical difference between both groups (p=1.000) (Table 1). In both groups there was no death, anastomotic leaks or bleeding.

BMI was 50.96 (±8.73) kg/m^2 for group S and 48.03±6.77 kg/m^2 for group M and was not statistically significant (p=0.138). In group S, 33 (38.8%) and in group M, 20 (25%) patients were diabetes mellitus and was not statistically significant (p=0.421). There was 15 (17.6%) patients in group S and 10 (12.5%) patients in group M with HT and was not statistically significant (p=0.853) (Table 2).

MAP was measured as 110.45±17.68 mmHg for group S and 99.59±17.73 mmHg for group M at 1st hour (p=0.016), 106.72±13.69 mmHg for group S and 95.81±13.34 mmHg

Table 1: Demographic characteristics of patients

		Group S (n=85)	Group M (n=80)	p
Age (year)	Mean ± SD	37.88±10.14	37.97±10.61	[a]0.974
Sex; n (%)	Male	33 (38.2)	30 (37.5)	[b]1.000
	Female	52 (61.1)	50 (62.5)	

[a]: Student t-test, [b]: Yates' continuity correction test, SD: Standard deviation

Table 2: Co-morbidity

		Group S (n=34)	Group M (n=31)	p
BMI (kg/m^2)	Mean ± SD	50.96±8.73	48.03±6.77	**[a]0.138**
DM; n (%)		33 (38.8)	20 (25.0)	**[b]0.421**
HT; n (%)		15 (17.6)	10 (12.5)	**[b]0.853**

[a]: Student t-test, [b]: Yates' continuity correction test, BMI: Body mass index, DM: Diabetes mellitus, HT: Hypertension, SD: Standard deviation

for group M at 6th hour (p=0.002), 101.82±13.91 mmHg for group S and 93.08±12.11 mmHg for group M at 24th hour (p=0.009) and found to be statistically significant (p<0.05) (Table 3).

VAS measurements of group S patients at 1st (p=0.001) and 6th hour (p=0.016) was higher than group M patients and the difference was statistically significant (p<0.05); on the other hand VAS measurements at 24th hour (p=0.489) were not statistically significant (p>0.05) (Figure 1).

There was no statistically significant difference between the groups at 1st (p=0.849), 6th (p=0.089) and 24th hours (p=0.200) when the presence of nausea was questioned (Table 4).

In our study, vomiting rates were not statistically significant between two groups at 1st, 6th and 24th hours (p>0.05) (Figure 2).

PCA pump measurements at 1st, 6th and 24th hour were not statistically different between both groups (p>0.05) (Table 5).

DISCUSSION

Abdominal wall innervations is maintained by the anterior braches of T7-L1 spinal segment nerves. These nerves move laterally between the transversus abdominis and the internal oblique muscle layers of the abdominal wall. Local anaesthetic infiltration into the petit triangle and transversus abdominis plane via oblique subcostal way blocks these nerves (7). TAP block was first described by Rafi (8) to provide analgesia for anterior and lateral walls of the abdomen, in operations carried out with an abdominal incision. However, rare complications such as intrahepatic injection, intraperitoneal injection, intestinal hematoma and transient femoral nerve injury were reported (9). Later, in 2007 Hebbard et al. (10), have developed ultrasound (USG) guided TAP block approach. However, difficulties occur regarding the USG use in obese patients due to two technical factors. Firstly; deep located

Table 3: Mean arterial pressure (MAP)

	Group S (n=85) Mean ± SD	Group M (n=80) Mean ± SD	p
MAP-1st hour	110.45±17.68	99.59±17.73	[a]**0.016***
MAP-6th hour	106.72±13.69	95.81±13.34	[a]**0.002****
MAP-24th hour	101.82±13.91	93.08±12.11	[a]**0.009****

[a]Student t-test, SD: Standard deviation, MAP: Mean arterial pressure

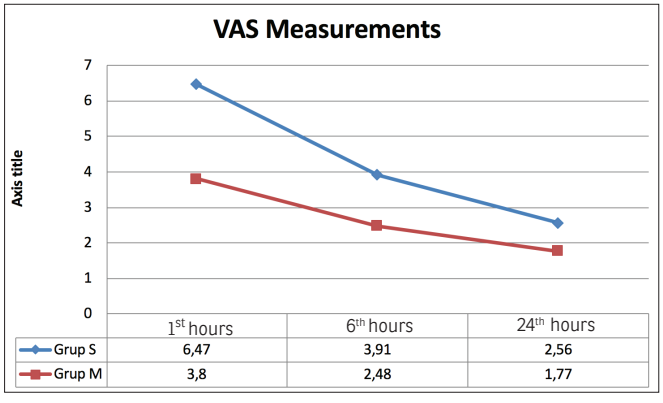

Figure 1: Distribution of visual analogue scale measurements by groups
VAS: Visual analogue scale

Table 4: Patient who nausea by time

			Group S (n=85) n (%)	Group M (n=80) n (%)	p
Nausea	1st hour	No	38 (44.7)	31 (38.7)	[b]**0.849**
		Yes	47 (55.2)	49 (61.2)	
	6th hour	No	40 (47.0)	57 (71.2)	[b]**0.089**
		Yes	45 (52.9)	23 (28.7)	
	24th hour	No	47 (55.2)	60 (75.0)	[b]**0.200**
		Yes	38 (44.7)	20 (25.0)	

[b]Yates' continuity correction tet

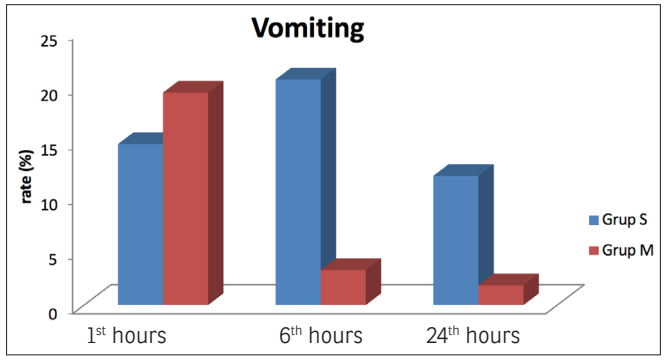

Figure 2: Distribution of vomiting by groups

Table 5: PCA pump measurements

	Group S (n=85) Mean ± SD (Median)	Group M (n=80) Mean ± SD (Median)	p
PCA-1st hour	2.26±1.48 (2)	3.13±2.01 (3)	[c]**0.990**
PCA- 6th hour	7.85±5.99 (6)	8.51±2.08 (8)	[c]**0.777**
PCA-24th hour	14.26±9.22 (12)	13.19±8.59 (12)	[c]**0.650**
[f]**p**	**0.001****	**0.001****	

[c]Mann-Whitney U Test, [f]Friedman Test, **p<0,01, PCA: Patient-controlled analgesia

nerves and vascular structures could not be seen because of thick fat tissue. Secondly; in morbid obese patients fat tissue causes irregular frequency and thus alteration in the speed of sound and worsens image quality (11). Semi-blind laparoscopy assisted technique was described by Chetwood et al. (12) in 2011. In the same period, as a new technique, pure laparoscopic TAP block was described by Magee et al. (13). In this method the procedure is carried out under direct camera visualization thus it's believed that this will prevent peritoneal penetration and abdominal organ injury. In up to date literature, TAP block has been used as a post-op analgesia method in various operations and its effectiveness has been studied. Similarly, TAP block procedure in morbid obese patients as a post-op analgesia method has also been studied (14). However, this is the first study in the literature regarding TAP block effectiveness in laparoscopic sleeve gastrectomy.

Similar to our study, Albrecht et al. (14) have compared two groups who have undergone laparoscopic gastric bypass operations with or without oblique subcostal TAP block. In both groups local anaesthetic was administered to trocar site. At the end of the study, additional analgesic use in both groups wasn't statistically significant (14). Similarly again, in a study carried out by Niraj et al. (15); comparing post op pain management on patients who have undergone laparoscopic colorectal surgery, patients were divided into three groups. Only TAP block was performed to the first group. To the second group, TAP block was performed and a catheter was placed into the petit triangle and to the third group TAP block was performed and an epidural catheter was placed. There was no statistically significant difference between those three groups regarding post-op tramadol consumption (15). However, in the study of İbrahim et al. (16) USG-guided bilateral oblique subcostal TAP block in LSG was considered as a safe and effective method when compared to port site injection and control group; since it provided significant analgesic effect and reduced side effects associated with opioid usage (16). In our study, there was no statistically significant difference between TAP block group and control group regarding to post-op tramadol consumption.

When Tihan et al. (17) reaserched the effectiveness of laparascopic TAP block on VAS scores on patients who are olther than 65 and heve undergone laparoscopic cholecystectomy, have similar results as our study. VAS scores were lower in the TAP block administered group than the control group and this was statistically significant (17). Moreover, in a study, in which 40 elective caesarean patients divided in two groups as USG guided TAP block performed and without TAP block, it was also shown that post operative VAS scores were statistically significantly lower in TAP block group than the controle group (18). In our study, we have found that post-op VAS scores at 1st and 6th hours were statistically significantly lower than the control group in TAP block group.

The relationship between post operative pain and MAP is obvious. In our study, supporting the previous sentence, VAS scores are statistically significantly higher in control group whose MAP scores were also statistically significantly higher.

The side effects, like nausea and vomitting due to opioid usage are important in bariatric surgery patients. In gastric resection surgery these side effects may lead to early postop surgical complications. In a meta-analysis including 14 studies it was reported that TAP block may increase incidence of post-op nausea and vomiting (19). Have compared TAP block with thoracic epidural analgesia in their study and have reported lower rates of post operative nausea and vomiting in TAP block group. However, in our study TAP block had no significant effect on nausea and vomiting.

There is no study found in the literature measuring blood levels of bupivacaine after its administration. However, in a study Kato et al. (20) have performed a patient's TAP block with 40 mL 1% lidocaine and stated that this amount may cause systemic toxicity. Moreover, Griffiths et al. (21) performed USG-guided TAP block after caesarean incision has been closed to a 30 patient group and emphasized that increased plasma ropivacaine concentration may be associated with neurotoxicity. In our study, a total amount of 60 mL 0.25% bupivacaine was used in group M and no complication associated with local anaesthetic was seen.

If we look at weak parts of our study, it can be seen that participant number was low, but with the use of power analysis, we think this is enough for statistical significancy. Of course different results may be obtained with a bigger group of patients. Also there was no statistically significant difference in the dose of opioid given to both groups via PCA pump, as long as the lock out time permits. Our main attention was directed to effective dose, not to total demand of the patients, which could be found by looking through total number of demand on PCA pump. In the control group whose VAS score was higher, total number

of demand may be higher. We can clearly say that TAP bloc effectiveness is significant, as our only objective data is VAS score.

CONCLUSION

In conclusion, we think that using laparoscopy assisted TAP block in laparoscopic sleeve gastrectomy operations, VAS scores can be improved significantly without causing any change on probable complications.

Ethics

Ethics Committee Approval: University of Health Sciences Bakırköy Sadi Konuk Training and Research Hospital approval was obtained from the ethics committee of clinical trials (Decision no: 2014/17/01).

Informed Consent: İnformed consent was taken from every single patient who are going to take place in this study.

Peer-review: Externally peer-reviewed.

Authorship Contributions

Concept: E.K.T., H.A., Design: H.S., İ.P., Data Collection or Processing: H.K., Analysis or Interpretation: G.D., Y.T.Ş.,

Literature Search: E.K.T., H.A., H.S., İ.P., Writing: K.D.P.

Conflict of Interest: No conflict of interest was declared by the authors.

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