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The effects of body mass index on postoperative pain in patients undergoing thoracic paravertebral block after video-assisted thoracoscopic surgery: A retrospective analysis

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ABSTRACT

Aim: Postoperative pain is an important problem in patients undergoing video-assisted thoracic surgery (VATS). Thoracic paravertebral block (TPVB) is among the commonly used techniques for pain control after VATS. Despite the analgesic methods applied, the desired level of pain control can not be achieved in all patients. Therefore, clinicians and researchers are interested in factors affecting postoperative pain. One factor is the relationship between postoperative pain and body mass index (BMI). Although it has been reported that acute or chronic pain is more common in the general population with a BMI, the relationship between postoperative pain and BMI is still controversial. This study aims to investigate the effects of BMI on postoperative pain in patients who underwent TPVB in the treatment of pain after VATS.

Material and Method: Patients who had elective VATS and TPVB were included in the study. Patients who underwent TPVB with ultrasonography (USG) and postoperative intravenous (iv) morphine patient-control-analgesia (PCA) for postoperative analgesia were divided into three groups according to BMI. Group-I BMI: 18-24.99 kg/m², Group-II BMI: 25-29.9 kg/m², Group-III BMI: 30-40 kg/m².

Results: 146 patients were included in the study. There was no significant difference between the postoperative 30th minute, 1st hour, 6th hour, 12th hour, and 24th-hour VAS values of the patients in Group-I, Group-II, and Group-III. There was no statistically significant difference in terms of morphine consumption, additional analgesic requirement, and complications in all three groups.

Conclusion: It was determined that there was no relationship between BMI and postoperative pain scores in the first 24 hours in patients who underwent TPVB after VATS. In addition, it was determined that postoperative morphine consumption and additional analgesic needs were not associated with BMI. Effective pain control can be achieved in all patients, regardless of BMI, with effective peripheral nerve blocks and analgesics using practical imaging techniques such as USG.

Keywords: Body mass index, postoperative pain, thoracic paravertebral block, visual analog scale, video-assisted thoracic surgery

INTRODUCTION

Video-assisted thoracic surgery (VATS), a less invasive technique, has become a popular method of choice in thoracic surgery (1). Although not as much as thoracotomy, postoperative pain is an important problem in patients undergoing VATS. Postoperative pain arises from the nociceptive stimulation induced on tissues by surgery and is at its highest intensity in the first 24 hours (2,3). Especially in the first 24-hour period, patients who underwent VATS are tried to provide postoperative pain control by applying different techniques. Thoracic paravertebral block (TPVB) is a common technique for pain control after VATS (4). Despite the analgesic methods applied, the desired level of pain control can not be achieved in all patients. However, prevention of postoperative pain is very important in terms of patient comfort, patient satisfaction and in preventing postoperative complications. Therefore, clinicians and researchers are always interested in the topics such as the factors affecting postoperative pain. One of these factors is the relationship between postoperative pain and BMI. Although it has been reported that acute or chronic pain is more common in the general population with a high body mass index (BMI), the relationship between postoperative

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pain and BMI is still not clear (2,5-8). However, the studies in the literature state that adipose tissue and BMI affect the distribution of the analgesic drug in the area where the local anesthetic agent is applied, and the effect differs according to the age, gender, and weight of the patients (9-14). Therefore, the effectiveness of the analgesia method applied after thoracic surgery may vary in patients with different BMIs, regardless of the success of the method. This may enable us to predict the postoperative pain level in patients based on BMI and to intervene early, before pain occurs. Thus, patient satisfaction can be increased, hospital stays can be shortened, and medication expenditures can be reduced by enabling personal postoperative pain management (15,16).

This study aims to investigate the relationship between BMI and postoperative pain in patients who underwent TPVB during the treatment of pain after VATS.

MATERIAL AND METHOD

Our study was carried out in a 3rd-level thoracic surgery center after the approval of the Ankara Keçiören Training and Research Hospital Ethics Committee (Date: 12.04.2022, No: 2012-KEAK-15/2493). All procedures were carried out in accordance with the ethical rules and the principles of the Declaration of Helsinki.

The operating room receipts and postoperative pain forms of the patients who underwent elective VATS and TPVB between June 2021 and December 2021 were reviewed retrospectively. It was checked that informed consent was obtained from the patients. Patients who underwent TPVB with ultrasonography (USG) and postoperative intravenous (iv) morphine patient-control-analgesia (PCA) for postoperative analgesia were divided into three groups according to BMI. Group-I BMI: 18-24.99 kg/m², Group-II BMI: 25-29.9 kg/m², Group-III BMI: 30-40 kg/m².

Following patients are included in our study: Aged between 18 and 80 years, in the American Society of Anesthesiologists (ASA) I-II-III risk group, BMI between 18 and 40 kg/m², had elective VATS and TPVB and postoperative iv PCA with morphine for analgesia treatment.

Following patients were excluded from the study: Under the age of 18 and over the age of 80, ASA score IV and above, BMI below 18 kg/m², BMI over 40 kg/m², operated under emergency conditions, had chronic pain before the operation, were treated with analgesics other than TPVB and PCA with iv morphine.

Patients' age, height, body weight, BMI, gender, applied surgery, complications (such as hypotension, bradycardia, nausea, vomiting, sweating, itching) if any, postoperative 30th minutes, 1st hour, 6th hours, and 24th hours visual analog scale (VAS) values, postoperative 30th minutes, 1st hour, 6th hours, and 24th hours hearth rate, postoperative 30th minutes, 1st hour, 6th hours, and 24th hours mean arterial pressures (MAP), morphine consumption during the postoperative 24 hours were recorded.

Thoracic Paravertebral Block Analgesia Protocol

TPVB application in our clinic is as follows. After cleaning and covering the skin in the lateral decubitus position, following the rules of antisepsis, in the operating room, TPVB was applied using 20 ml of bupivacaine 0.25% 2-3 cm lateral to the T5 spinous process with USG. Intravenous morphine PCA was administered to these patients for 24 hours postoperatively. The PCA pump was limited to administering a bolus dose of 1 mg/2ml of morphine and delivering a maximum dose of 12mg/24ml of morphine over 4 hours with 15-minute lock-in intervals.

In addition to the routine clinical practice, a different analgesic protocol can be applied to patients who have problems in their renal and hepatic functions, have allergies to the drugs, and do not accept the analgesia method to be applied. For analgesia, 20 minutes before the end of the operation 50 mg iv dexketoprofen and 100 mg iv tramadol are administered and, 10 mg iv metoclopramide is administered for antiemetic purposes.

All patients receive paracetamol 1 g every 8 hours and 50 mg dexketoprofen every 12 hours for multimodal analgesia.

Statistical Analysis

Data analyses were performed with SPSS for Windows, version 22.0 (SPSS Inc., Chicago, IL, United States). Whether the distribution of continuous variable was normal was determined by the Kolmogorov Smirnov test. Levene test was used for the evaluation of homogeneity of variances. Unless specified otherwise, continuous data were described as mean±SD and median (interquartile range). Categorical data were described as the number of cases (%). The chi-square test or Fisher's exact test was used to compare qualitative data between groups. Statistical analysis differences in normally distributed variables between three independent groups were compared by the One-Way ANOVA test. Kruskal Wallis test was applied for comparisons of not normally distributed data. When a difference was detected, the post-hoc Tukey HSD test or Conover Inman test was used to identify the origin of the difference. p-value <0.05 is accepted as a significant level in all statistical analyses.

RESULTS

A total of 146 patients were included in the study. The demographic data of the patients, their ASA scores, applied surgery, and the duration of the anesthesia are given in **Table 1**.

Table 1. The demographic data of the patients, their ASA scores, applied surgery, and the duration of the anesthesia

	Mean±SD	Median (IQR)
Gender		
Female	46	31.5%
Male	100	68.5%
Age	47.11±15.74	49.50 (26)
BMI	26.02±5.29	25.33 (7.08)
Group-I: BMI: 18-24.99 kg/m²	71	48.6%
Group-II: BMI: 25-29.9 kg/m²	48	32.9%
Group-III: BMI: 30-40 kg/m²	27	18.5%
ASA		
ASA II	87	59.6%
ASA III	59	40.4%
Operation		
Wedge Resection	71	48.6%
Segmentectomy / Lobectomy	39	26.7%
Decortication	36	24.7%
Duration of the anesthesia/ minute	192.79±78.25	180 (105)

SD: Standart deviation, IQR: interquartile range, BMI: body mass index, ASA: American Society of Anesthesiologists

1st hour, 12th hour, and 24th hour MAP values of Group-III were statistically significantly higher than Group-I and Group-II. There was no significant difference between the groups in terms of postoperative heart rates.

VAS values at 30 minutes, 1 hour, 6 hours, 12 hours, and 24 hours postoperatively did not differ significantly between Group-I, Group-II, and Group-III patients. (**Table 2**). The change in VAS according to BMI is shown in **Figure 1**.

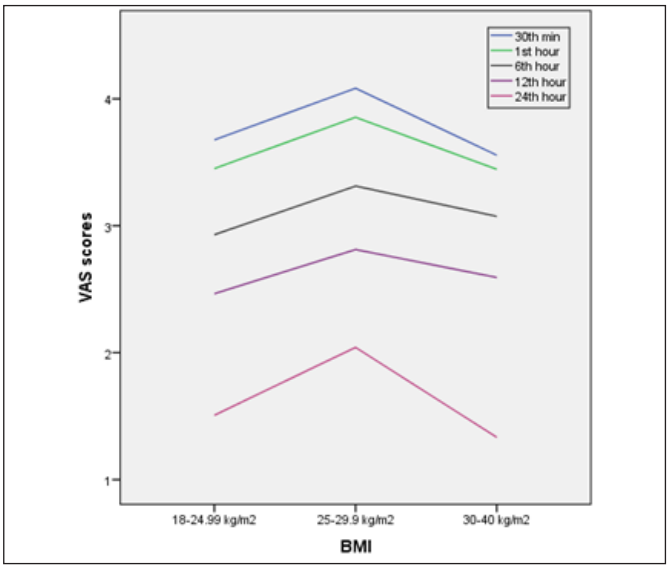

Figure. VAS Changes according to BMI

There was no statistically significant difference in terms of morphine consumption, additional analgesic requirement, and complications in all three groups (**Table 3**).

Table 2. VAS values of groups

	Group-I Mean±SD	Group-II Mean±SD	Group-III Mean±SD	p
VAS 30th min	3.68±1.71	4.08±1.80	3.56±2.08	0.320 β
VAS 1st hour	3.45±1.73	3.85±1.58	3.44±2.01	0.409 β
VAS 6th hour	2.93±1.57	3.31±1.64	3.07±1.71	0.442 β
VAS 12th hour	2.46±1.27	2.81±1.41	2.59±1.19	0.384 β
VAS 24th hour	1.51±1.22	2.04±1.53	1.33±0.96	0.099 β

Kruskal Wallis β. VAS: visual analog scale, SD: Standart deviation, min: minute

Table 3. Morphine consumption, additional analgesic need, and complications

	Group-I (n:71)	Group-II (n:48)	Group-III (n:27)	p
Morphine consumption, ml*	43.51±26.92	41.40±21.40	37.33±24.01	0.542
Additional analgesia				0.194
No	33 (46.5%)	15 (31.3%)	13 (48.1%)	
Yes	38 (53.5%)	33 (68.8%)	14 (51.9%)	
Complications				
Nausea/vomiting	1 (1.4%)	3 (6.3%)	-	0.313
Hypotension	1 (1.4%)	-	1 (3.7%)	0.449
Bradycardia	-	-	-	-
Sweating	1 (1.4%)	-	-	0.999
Itching	-	-	-	-

One-Way ANOVA*, Post hoc Tukey HSD or Conover-Inman test was performed for the binary comparisons among the groups and the p value was set at 0.05. ml: milliliter

DISCUSSION

According to our findings, there was no significant relationship between BMI and postoperative 30th minute, 1st hour, 6th hour, 12th hour, and 24th hour pain scores in patients who underwent TPVB after VATS. There was no difference between the groups in terms of postoperative morphine consumption and additional analgesic needs.

Pain after VATS is a common condition and adequate control of postoperative pain in patients undergoing VATS is very important for the prevention of pulmonary complications (17). Adequate management of postoperative pain provides early mobilization, lowers hospital stay, lowers costs, and increases patient satisfaction (18-21). It is also important to protect the lung, which has already suffered tissue damage after thoracic surgery, from complications such as postoperative pneumonia and atelectasis. For the early mobilization of patients after surgery, coughing should be ensured so that lung secretions can be cleared. This can only be possible by providing adequate analgesia to the patient (17,22). However, with using more opioids than necessary while providing postoperative pain control, side effects, such as respiratory depression and

low saturation, may be encountered (23). Here, it may be necessary to provide patients with invasive mechanical ventilator support again. This may cause additional complications, such as ventilator-associated pneumonia, barotrauma, and volutrauma in patients (24). Therefore, providing analgesia with adequate doses of agents is especially important in thoracic surgery. In short, predicting pain is important to prevent unnecessary drug administration and the side effects of these drugs while providing effective control of pain (25).

Postoperative pain can be affected by behavioral and emotional changes as well as nerve damage, tissue inflammation, genetic factors and, physiological factors (26). Many factors that can affect pain have been the area of interest of researchers. One of them is BMI. However, the relationship between postoperative pain and BMI has not been identified. There are studies that highlight different relationships between postoperative pain and BMI in different surgeries.

In a study conducted on patients who underwent thoracotomy and underwent epidural catheterization, it was stated that an increase in BMI increased VAS (27). Again, it has been reported in the literature that patients with higher BMI have higher pain scores and more narcotic requirements (28,29). Unlike the results obtained in these studies, it was revealed that there is no relationship between BMI and postoperative pain in a study conducted on patients who underwent ankle fracture surgery (30). Similarly, in another study conducted with patients undergoing general surgery, it was found that high BMI was not associated with a higher pain score (2). A positive relationship between BMI and postoperative pain was not seen in another study of breast cancer patients (31). Similarly, in a study conducted on patients who underwent tubular gastrectomy, no relationship was found between BMI and postoperative pain (7). In our study, no correlation was found between BMI and VAS in patients who underwent VATS and TPVB. This result can be considered as the result of effective analgesia applied to the patients. Because when we look at the VAS values of our patients, it was determined that the VAS averages in all groups (Group-I, Group-II, and Group-III) were below 4 in the first 12 hours postoperatively, and below 3 after the 12th hour. Only the mean VAS at the 30th minute in Group-II was found to be 4.08. However, this is not statistically significant.

There are studies showing that obese patients have different opioid needs in the postoperative period (28,29). However, in our study, it was determined that there was no difference between the groups in terms of morphine consumption amounts and additional analgesic needs.

In a study, it was stated that the VAS value of the patients increased as the BMI increased in patients who underwent thoracotomy and provided analgesia with an epidural catheter (27). Because BMI affects the adipose tissue in the epidural region, it may reduce the effectiveness of medications or result in epidural catheter application failure (32). Often, epidural catheterization is not performed using imaging techniques. Therefore, besides to the failure of catheter application, situations such as lateralization or displacement of the catheter to different levels cannot be noticed. This may cause insufficient analgesia in patients with high BMI. However, since the TPVB was performed with USG in our study, we can say that the success rate was high and effective analgesia was provided in all patients. Studies have reported that peripheral nerve blocks are technically more difficult and have lower success rates in patients with a BMI greater than 25 kg/m² (32,33). The paravertebral block has high failure rates according to other blocks (33). However, with introducing USG in peripheral block applications, the failure rates have decreased considerably (34,35). In our study, TPPV was performed under the guidance of USG. We can state that the applied block is effective and provides effective analgesia. However, studies have shown that the fat ratio in the area where the local anesthetic is administered may affect the distribution and pharmacokinetics of the agent (27,11-14). As a result, the transport of drugs to target tissues and the duration of anesthesia are affected (27, 36). These studies are mostly focused on the epidural area. In our study, a local anesthetic agent applied to the paravertebral area. Unlike these studies, similar analgesic effects were observed in all groups in our study and the VAS values of all groups were similar regardless of BMI, which may indicate a difference in adipose tissue between the epidural area and the paravertebral area. However, we think this situation should be supported by different studies.

The limitation of our study is that the study is retrospective and single-centered. More comprehensive information about the results of the study can be obtained with prospective and large series.

CONCLUSION

In conclusion, we found that there was no relationship between BMI and postoperative pain scores in the first 24 hours in patients who underwent TPVB after VATS. Postoperative morphine consumption and additional analgesic need were not associated with BMI. We think that effective pain control can be achieved in all patients, regardless of BMI, with analgesics and effective peripheral nerve blocks using practical imaging techniques such as USG.

ETHICAL DECLARATIONS

Ethics Committee Approval: The study was initiated with the approval of the Ankara Keçiören Training and Research Hospital Ethics Committee (Date: 12.04.2022, No: 2012-KEAK-15/2493).

Informed Consent: All patients were informed about the application and their informed consent was obtained.

Referee Evaluation Process: Externally peer-reviewed.

Conflict of Interest Statement: The authors have no conflicts of interest to declare.

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Author Contributions: All of the authors declare that they have all participated in the design, execution, and analysis of the paper and that they have approved the final version.

REFERENCES

1. Sugiyama T, Kataoka Y, Shindo K, et al. Retrolaminar block versus paravertebral block for pain relief after less-invasive lung surgery: a randomized, non-inferiority controlled trial. Cureus 2021; 13: e13597.
2. González-Callejas C, Aparicio VA, De Teresa C, Nestares T. Association of body mass index and serum markers of tissue damage with postoperative pain. The role of lactate dehydrogenase for postoperative pain prediction. Pain Med 2020; 21: 1636-43.
3. Santeularia Vergés MT, Català Puigbò E, Genové Cortada M, Revuelta Rizo M, Moral García MV. Nuevas tendencias en el tratamiento del dolor postoperatorio en cirugía general y digestiva. Cir Esp 2009; 86: 63-71.
4. Bigand T, Wilson M, Bindler R, Daratha K. Examining risk for persistent pain among adults with overweight status. Pain Manag Nurs 2018; 19: 549-56.
5. Janke EA, Collins A, Kozak AT. Overview of the relationship between pain and obesity: What do we know? Where do we go next? J Rehabil Res Dev 2007; 44: 245-62.
6. Wright LJ, Schur E, Noonan C, Ahumada S, Buchwald D, Afari N. Chronic pain, overweight, and obesity: findings from a community-based twin registry. J Pain 2010; 11: 628-35.
7. Hartwig M, Allvin R, Bäckström R, Stenberg E. Factors associated with increased experience of postoperative pain after laparoscopic gastric bypass surgery. Obes Surg 2017; 27: 1854-58.
8. Torres K, Szukała M, Torres A, Pietrzyk Ł, Maciejewski R. Assessment of the correlation between gender, age, body mass index and the severity of postoperative pain, nausea and vomiting in patients undergoing laparoscopic cholecystectomy. Pol Merkur Lekarski 2015; 39: 9-13.
9. Taivainen T, Tuominen M, Rosenberg PH. Influence of obesity on the spread of spinal analgesia after injection of plain 0.5% bupivacaine at the L3-4 or L4-5 interspace. Br J Anaesth 1990; 64: 542-6.
10. Hood DD, Dewan DM. Anesthetic and obstetric outcome in morbidly obese parturients. Anesthesiology 1993; 79: 1210-8.
11. Saryazdi HHG, Khalili G, Talakoub R, Shahbazi M, Abbasi S. Distribution of bupivacaine in epidural space. J Cell Mol Anesth 2018; 3: 60–5.
12. Lee I, Yamagishi N, Oboshi K, Yamada H. Distribution of new methylene blue injected into the lumbosacral epidural space in cats. Vet Anaesth Analg 2004; 31: 190-4.
13. Lee I, Yamagishi N, Oboshi K, Yamada H. Eliminating the effect of epidural fat during dorsolumbar epidural analgesia in cattle. Vet Anaesth Analg 2004; 31: 86-9.
14. Gorgi AA, Hofmeister EH, Higginbotham MJ, Kent M. Effect of body position on cranial migration of epidurally injected methylene blue in recumbent dogs. Am J Vet Res 2006; 67: 219-21.
15. Lovich-Sapola J, Smith CE, Brandt CP. Postoperative pain control. Surg Clin North Am 2015; 95: 301-18.
16. Imani F. Postoperative pain management. Anesth Pain Med 2011; 1: 6-7.
17. Ülger G, Baldemir R, Zengin M, Sazak H, Alagöz A. Is there a correlation between preoperative neutrophil-to-lymphocyte, platelet-to-lymphocyte, and lymphocyte-to-monocyte ratios and postoperative pain in video-assisted thoracoscopic surgery? Medicine (Baltimore) 2022; 101: e29472.
18. Canbolat N, Buget MI, Sivrikoz N, Altun D, Kucukay S. Relação entre a proporção neutrófilo/linfócito e a dor pós-operatória em artroplastia total de joelho e quadril. Braz J Anesthesiol 2019; 69: 42-7.
19. Akter N, Ratnayake B, Joh DB, Chan SJ, Bonner E, Pandanaboyana S. Postoperative pain relief after pancreatic resection: systematic review and meta-analysis of analgesic modalities. World J Surg 2021; 45: 3165-73.
20. Chou R, Gordon DB, de Leon-Casasola OA, et al. Management of postoperative pain: a clinical practice guideline from the American Pain Society, the American Society of Regional Anesthesia and Pain Medicine, and the American Society of Anesthesiologists' Committee on Regional Anesthesia, Executive Committee, and Administrative Council. J Pain 2016; 17: 131-57.
21. Rawal N. Current issues in postoperative pain management. Eur J Anaesthesiol 2016; 33: 160-71.
22. Gao W, Yang XL, Hu JC, et al. Continuous serratus anterior plane block improved early pulmonary function after lung cancer surgical procedure. Ann Thorac Surg 2022; 113: 436-43.
23. Bavullu EN, Aksoy E, Abdullayev R, Göğüş N, Dede D. Comparison of dexmedetomidine and midazolam in sedation for percutaneous drainage of hepatic hydatid cysts. Turk J Anaesthesiol Reanim 2013; 41: 195-9.
24. Zengin EN. Research trends and global productivity on mechanical ventilation with the impact of COVID-19: a bibliometric analysis in the period 1980-2021. J Health Sci Med 2022; 5: 1051-61.
25. Kalkman JC, Visser K, Moen J, Bonsel JG, Grobbee ED, Moons MKG. Preoperative prediction of severe postoperative pain. Pain 2003; 105: 415-23.
26. Kehlet H, Jensen TS, Woolf CJ. Persistent postsurgical pain: risk factors and prevention. Lancet 2006; 367: 1618-25.
27. Zengin M, Ulger G, Baldemir R, Sazak H, Alagoz A. Is there a relationship between body mass index and postoperative pain scores in thoracotomy patients with thoracic epidural analgesia? Medicine (Baltimore) 2021; 100: e28010.
28. Yen CR, Tsou MY, Mandell MS, et al. An analysis of patient variables that influence intravenous patient-controlled analgesic use of morphine with quantile regression. Anesthesiology 2010; 112: 688-95.
29. Lloret-Linares C, Lopes A, Declèves X, et al. Challenges in the optimisation of post-operative pain management with opioids in obese patients: a literature review. Obes Surg 2013; 23: 1458-75.
30. Grodofsky SR, Sinha AC. The association of gender and body mass index with postoperative pain scores when undergoing ankle fracture surgery. J Anaesthesiol Clin Pharmacol 2014; 30: 248-52.
31. Oliveira RR, Nascimento SL, Amaral MTPd, Silva MPPe, Oliveira MMF. Influence of body mass index on the frequency of lymphedema and other complications after surgery for breast cancer. Fisioterapia e Pesquisa 2016; 23: 84–90.

32. Ingrande J, Brodsky JB, Lemmens HJ. Regional anesthesia and obesity. Curr Opin Anaesthesiol 2009; 22: 683-6.

33. Cotter JT, Nielsen KC, Guller U, et al. Increased body mass index and ASA physical status IV are risk factors for block failure in ambulatory surgery - an analysis of 9,342 blocks. Can J Anaesth 2004; 51: 810-6.

34. Chantzi C, Saranteas T, Zogogiannis J, Alevizou N, Dimitriou V. Ultrasound examination of the sciatic nerve at the anterior thigh in obese patients. Acta Anaesthesiol Scand 2007; 51: 132.

35. Schwemmer U, Papenfuss T, Greim C, Brederlau J, Roewer N. Ultrasound-guided interscalene brachial plexus anaesthesia: differences in success between patients of normal and excessive weight. Ultraschall Med 2006; 27: 245-50.

36. Hogan QH. Lumbar epidural anatomy. A new look by cryomicrotome section. Anesthesiology 1991; 75: 767-75.