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RESEARCH ARTICLE

EXAMINATION OF THE RELATIONSHIP BETWEEN BODY MASS INDEX AND THE SKIN-EPIDURAL SPACE DISTANCE MEASURED BY ULTRASOUND IN THE LUMBAR REGION

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ABSTRACT

Purpose: The aim of the study; to investigate whether there is a relationship between body mass index (BMI), abdominal subcutaneous adipose tissue, waist circumference, and the skin-epidural space distance measured by USG.
Material and Methods: The research was carried out in the block room in the preoperating room of Dokuz Eylul University Practice and Research Hospital and with 42 volunteer operating room workers aged between 18-59 years. Height, weight and waist circumference measurements were made with standard measuring instruments, and other measurements were completed by ultrasonography (USG). For the examination of the skin-to-epidural space distance, a convex probe was used with the transverse median approach in ultrasonography. Abdominal subcutaneous fat thickness measurements were made with a linear probe in the supine position. The statistical correlations of all measurements were examined.
Results: The BMI of the volunteers included in the study was found to be 18-29.9 kg/m2, waist circumference 70-115 cm, and abdominal subcutaneous fat thickness 0.55-4.69 cm. It has been observed that the epidural space distance varies between 3.35-5.47 cm at the L2-L3 level and 3.56-6.09 cm at the L3-L4 level in the sitting position. There was a moderate correlation between BMI and skin-epidural space distance, while a high correlation was found with waist circumference and subcutaneouse abdominal fat distance. It has been observed that people with very similar BMI may have different skin-epidural thicknesses.
Conclusion: It is observed that the skin-to-epidural space distance does not always show high or very high levels of correlation with anthropometric measurements in individuals. Therefore, if epidural anesthesia is required for individuals with higher weight, the assumption that the skin-to-epidural space distance will also be significantly greater should be avoided.
Keywords: Epidural fat, epidural, neuroaxial anesthesia, waist circumference, ultrasound, epidural ultrasound, abdominal subcutaneous fat

INTRODUCTION

According to the World Health Organization (WHO), obesity is a disease defined in ICD-10, which is the accumulation of fat to a degree that can harm health. The BMI unit is kg/m2 and if it is below 18.5 it is classified as underweight; 18.5-24.9 is considered

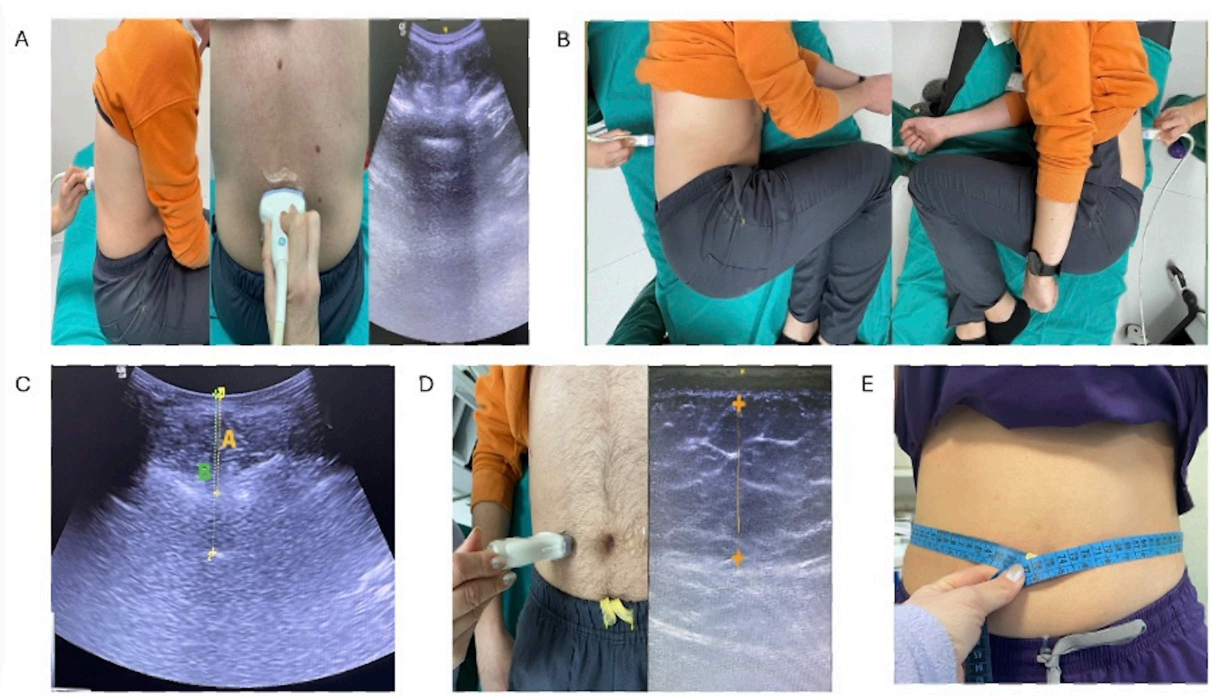

Figure 1. (A) The measurement of skin-epidural space distance in the lumbar region using ultrasound-guided transverse median approach. (B) The measurement of skin-epidural space distance in the right lateral and left lateral decubitus positions. (C) Measurement of skin-epidural space distance A: Skin-Dural Composite Distance (SDCD) B: Skin-Vertebral Body Dura Anterior Complex Distance, Distance B minus A: Intrathecal space. (D) Measurement of subcutaneous abdominal fat thickness. (E) Measurement of waist circumference with a standard measuring tape.

normal weight; 25-29.9 is classified as overweight, and over 30 is classified as obesity (1).

According to BMI, patients classified as obese may exhibit variability in subcutaneous fat tissue at the lumbar level, influenced by age, gender, abdominal fat thickness, and sometimes even race (2). It's observed that in some cases, a patient's adiposity is centralized around the abdomen or hip area, not affecting the lumbar region, while at times, the back region may display fatty tissue accumulation. This situation might differ in pregnant patients. In pregnancy, owing to hormonal fluctuations affecting the entire body, there's an increase in edema affecting the connective tissue in the perivertebral area. These alterations could pose challenges during the application of neuroaxial anesthesia due to this edema (3).

In a study conducted by R.W. Watts et al.(4) (1993), a total of 248 patients, 69% of whom were in the lateral lying position during pregnancy and 31% were in a sitting position while not pregnant, underwent epidural insertion at the L3-L4 level to determine depth. A moderate correlation between BMI and skin-to-epidural space distance was observed in patients with a BMI below 25 kg/m2, both obstetric and non-obstetric, whereas in patients with a BMI >25 kg/m2, a weak correlation was found.

Awasthi et al.'s study (5) (2021) examined 100 female patients aged 40-65, ASA I-II, with a BMI range of 18.5-30 kg/m2. In the group evaluated using ultrasound in the para-sagittal oblique plane, epidural depth demonstrated a weak correlation with BMI ($r^2 = 0.367$, $P = 0.01$).

Based on both the aforementioned studies and similar studies, as well as our own clinical experience and observations, BMI should not always bias neuraxial blocks applied to the lumbar region (spinal or epidural). The aim of our study is to reveal the relationship between BMI, waist circumference, abdominal fat tissue thickness and skin-epidural space distance.

MATERIAL AND METHODS

This methodological trial was registered at clinicaltrials.gov (NCT06316622) on March 16, 2024. After obtaining ethical approval from Non-Interventional Research Ethics Committee of Dokuz Eylul University (Date: 08.03.2021, Decision No: 2021/08-42), study commenced. The first patient enrollment is dated October 1, 2021, and the last patient enrollment is dated January 15, 2022. It is a methodological study conducted at the Block Room of LOGIQ-E, GE Medical Systems® USG at Dokuz Eylul University Training and Research Hospital,

Table 1. Anesthesiologist and radiologist measurement values

	ANESTHESIOLOGIST			RADIOLOGIST		
	L3-4 skin-epidural distance (cm)	L4-5 skin-epidural distance (cm)	Subcutaneous abdominal fat (cm)	L3-4 skin-epidural distance (cm)	L4-5 skin-epidural distance (cm)	Subcutaneous abdominal fat (cm)
1	3.71	3.82	0.87	3.79	3.79	0.88
2	4.25	4.53	2.49	4.64	4.50	2.35
3	4.92	5.15	3.53	4.27	4.98	3.51
4	4.29	4.56	3.23	4.77	5.24	3.18
5	4.56	5.00	1.84	4.71	5.00	2.02
6	4.80	5.75	4.47	4.77	5.29	4.43
7	3.49	3.85	2.20	3.38	4.20	1.98
8	5.73	6.12	3.37	5.56	5.74	3.36
9	4.39	4.55	2.38	4.25	4.56	2.29
10	4.61	4.55	1.70	4.51	4.75	1.85
11	4.72	4.50	1.33	4.23	4.42	1.40
12	5.42	5.72	4.69	5.19	6.06	5.17
13	4.41	4.64	1.83	3.77	4.60	1.60
14	4.36	4.69	1.37	3.77	4.34	1.93
15	4.57	4.52	0.55	4.57	4.55	0.69
16	4.29	4.31	2.70	4.04	4.33	2.79
17	4.45	4.50	2.59	4.62	4.57	2.85
18	4.59	4.36	2.11	4.53	4.59	2.11
19	4.41	4.84	3.55	4.16	4.75	3.86
20	4.34	4.41	1.73	4.23	4.64	1.63
21	3.65	3.81	0.52	3.74	3.79	0.78
22	3.79	4.37	0.89	3.99	3.74	1.01
23	5.26	5.34	3.21	5.21	5.32	3.17
24	3.77	3.77	0.96	3.57	3.74	1.01
25	4.29	4.22	0.84	4.02	4.07	0.81
26	3.89	4.12	3.24	3.82	3.87	3.11
27	4.98	5.00	2.53	4.67	4.94	2.72
28	3.74	4.09	1.12	3.79	4.17	1.08
29	3.83	4.04	0.78	4.09	4.16	0.84
30	3.51	3.83	2.26	3.54	3.79	2.09
31	4.36	4.62	2.79	4.50	4.71	2.71
32	3.35	3.79	3.28	3.42	3.86	3.47
33	4.11	4.34	1.57	4.23	4.33	1.74
34	4.22	4.69	2.82	4.28	4.36	2.97
35	4.20	4.70	1.79	4.30	4.68	2.15
36	4.62	4.91	3.03	4.47	4.81	3.24
37	5.10	5.68	3.56	5.10	5.20	3.78
38	4.32	4.34	1.77	4.30	4.02	2.04
39	3.49	4.04	1.32	3.40	3.93	1.23
40	3.48	3.68	1.97	3.33	3.81	2.14
41	3.33	3.95	2.28	3.33	3.89	2.35
42	4.92	5.07	1.81	4.80	5.10	1.65

Izmir. This research is in accordance with the CONSORT statement.

The study sample consists of volunteers working at Dokuz Eylul University Hospital who do not meet the exclusion criteria. Since the initiation of the study, individuals aged between 18 and 59 were asked whether they agreed to undergo lumbosacral spine ultrasonography (USG) and participate in our study. Those who consented were included in the study based on their arrival order at the operating room. Three volunteers were excluded from the study as proper USG imaging couldn't be obtained, and measurements couldn't be taken. After reaching the required number of 42 eligible volunteers, the study was concluded.

Inclusion Criteria: 1) Age between 18 and 59 years old. 2) ASA I-II classification. 3) Body Mass Index (BMI): 18.5-29.9 kg/m2.

Table 2. Paired samples test

Paired Samples Test										
		Paired Differences					t	df	p
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Radiolog-Anesthesiolog Abdominal Subcutaneous Fat	,06071	,22333	,03446	-,00888	,13031	1,762	41	,086
Pair 2	Radiolog-Anesthesiolog L3-4 Skin-Epidural Distance	-,06810	,24128	,03723	-,14328	,00709	-1,829	41	,075
Pair 3	Radiolog-Anesthesiolog L4-5 Skin-Epidural Distance	-,03762	,23822	,03676	-,11185	,03662	-1,023	41	,312

Exclusion Criteria: 1) Individuals under 18 or over 59 years old. 2) Those with a history of vertebral surgery. 3) Patients diagnosed with spinal deformities (excluding scoliosis ≤10 degrees, kyphosis <30 or >80 degrees). 4) Individuals with rheumatologic diseases affecting skeletal structure such as ankylosing spondylitis, rheumatoid arthritis. 5) Presence of wounds or infections in the lumbar region. 6) Volunteers who underwent epidural or spinal interventions in the lumbar region within the last month. 7) Individuals with bone implants affecting posture, such as hip or knee prostheses. 8) Pregnant women. 9. Individuals with conditions like Cushing's syndrome, hypothyroidism, acromegaly causing lumbar edema. 10) Volunteers using corticosteroids. 11) Obese individuals (BMI: >29.9kg/m2). Consent was obtained from the volunteers included in the study, and their weight and height measurements were taken using calibrated standard Mechanical Scale and Mesilife JSA-180® Height-Measuring Scale and recorded. The study was conducted on volunteers working in the operating room.

Measurements of the skin-epidural space distance were performed using the LOGIQ-E, GE Medical Systems® convex ultrasound probe by an anesthesiologist with over five years of experience and a radiologist with over five years of experience. Each patient was positioned in the left lateral, right lateral, and then sitting positions, approached with a transverse-median approach by an anesthesiologist followed by a radiologist, targeting the intended space.

The sitting position involved the patient's legs hanging off the edge of the bed, with feet placed on an immobile stool. The patient's back leaned towards the investigator on the other side of the bed, with the backs of the knees against the edge of the bed as much as possible. Patients were asked to symmetrically 'hunch' over their shoulders on the hips to allow flexion of the lumbar spine. As shown in Figure 1A, patients usually positioned their arms with elbows bent, forearms, and hands resting lightly on their thighs. The lateral position during epidural and spinal anesthesia in the operating room involved the patient's back towards the edge of the table, close to the clinician, with the bed edge parallel and vertical, and the hips stacked on top of each other. Thighs were pulled in maximum flexion, and the patient was asked to 'push out' or 'roll' their lower back. Patients instructed to 'curve' typically arch their upper backs, causing rotation of the spine as the lower shoulder remains fixed on the mattress. As shown in Figure 1B, dependent shoulder may need to be pulled forward by an assistant. During measurements, data recording forms captured the palpable spinal level points: superior to the anterior superior iliac spine (ASIS) (estimated L3-L4) and inferior to the ASIS (estimated L4-L5). Skin-dural composite (SDC) and skin-vertebral body, anterior complex (posterior longitudinal ligament) distance measurements were separately recorded by both experts. Since the primary objective was to measure the skin-to-epidural distance, only the SDC measurements were used for statistical analysis. As shown in Figure 1A, determination of intervals was ensured by counting palpable points from the sacrum parasagittally towards the cephalad direction in difficult-to-palpate areas.

Additionally, the measurement of subcutaneous abdominal fat thickness for all volunteers was conducted using the linear probe of the ultrasound machine (LOGIQ-E, GE Medical Systems, China) to ensure consistency. As shown in Figure 1D, measurements were taken 2 cm away from the umbilicus at two points (right lateral, left lateral) and averaged then recorded. Individuals were instructed to hold their breath after expiration and release

Table 3. Measurement and demographic data

		Age	Weight (kg)	Height (cm)	BMI	Waist Circumference (cm)	WC/W	Subcutaneous Fat (cm)	L3-4 Skin-Epidural (cm)	L4-5 Skin-Epidural (cm)
Man N:20 (%47.6)	Mean	31.0	81.83	175.45	26.56	96.50	0.55	2.64	4.69	4.86
	Median	28.0	81.50	176.00	26.85	95.50	0.55	2.56	4.68	4.85
	Std. Deviation	8.07	8.85	6.763	2.12	8.16	0.04	0.96	0.48	0.51
	Minimum	22.0	68.00	166	22.53	79	0.47	1.33	3.66	3.79
	Maximum	58.0	100.00	185	29.75	115	0.62	4.69	5.74	5.65
Woman N:22 (%52.4)		Age	Weight (kg)	Height (cm)	BMI	Waist Circumference (cm)	WC/W	Subcutaneous Fat (cm)	L3-4 Skin-Epidural (cm)	L4-5 Skin-Epidural (cm)
	Mean	33.7	60.94	162.68	23.13	82.36	0.50	1.81	4.02	4.26
	Median	33.0	62.00	163.00	22.80	81.50	0.49	1.81	3.91	4.35
	Std. Deviation	8.93	7.41	6.04	2.91	9.54	0.06	0.95	0.40	0.46
	Minimum	21.0	49.00	155	18.00	70	0.42	0.52	3.35	3.10
	Maximum	58.0	71.00	174	29.91	100	0.67	3.53	4.77	4.99
Total N:42 (%100)		Age	Weight (kg)	Height (cm)	BMI	Waist Circumference (cm)	WC/W	Subcutaneous Fat (cm)	L3-4 Skin-Epidural (cm)	L4-5 Skin-Epidural (cm)
	Mean	32.45	70.89	168.76	24.76	89.10	0.52	2.21	4.34	4.55
	Median	30.00	69.50	168.50	24.92	91.00	0.53	2.15	4.39	4.47
	Std. Deviation	8.548	13.266	9.031	3.069	11.33	0.05	1.03	0.55	0.56
	Minimum	21.00	49.00	155	18.00	70	0.42	.52	3.35	3.10
	Maximum	58.00	100.00	185	29.91	115	0.67	4.69	5.74	5.65

Values are shown as mean ± SD (median)

abdominal muscles during measurement. Waist circumference was measured in all volunteers using a standard measuring tape at the level of the umbilicus. As shown in Figure 1E, during measurement with the tape, patients were asked to stand upright, hold their breath after expiration, and relax abdominal muscles.
During data collection in the preoperative assessment room, while the anesthesiologist conducted measurements, there was no radiologist present, and vice versa when the radiologist performed the measurements. Because, since objectivity was desired during these precise measurements, it was also aimed to objectively demonstrate that the radiologist, who is more experienced in ultrasonography, and the anesthesiologist provided consistent measurements.

Statistical Analysis

SPSS 24.0 statistical software package was utilized for data analysis. Data were summarized using percentage distribution, mean, standard deviation, median, minimum and maximum values. For categorical variables, dependent group analysis employed Chi-square test and Kappa agreement test. In the case of measurement variables, dependent group analysis utilized either t-test or Wilcoxon test based on the normality distribution of the data. Correlation analysis was conducted using either Pearson correlation test or Spearman correlation test. A significance level of $p<0.05$ was considered. Volunteers aged 18-59, working in the operating room of Dokuz Eylul University Hospital and willing to undergo lumbar vertebral ultrasonography, were

Table 4. Pearson correlation analysis

		1	2	3	4	5	6	7	8	9	10
1	Weight										
2	Height	.753**									
		0									
3	BMI	.822**	0.253								
		0	0.105								
4	Waist Circumference	.900**	.507**	.887**							
		0	0.001	0							
5	Waist/Height	.651**	0.074	.898**	.894**						
		0	0.643	0	0						
6	Abd Subc Fat (Radio)	.672**	0.302	.724**	.762**	.719**					
		0	0.052	0	0	0					
7	Abd Subc Fat (Anesth)	.642**	0.248	.729**	.753**	.733**	.985**				
		0	0.113	0	0	0	0				
8	L3-4 skin-epidural (Radio)	.754**	.647**	.548**	.670**	.437**	.606**	.574**			
		0	0	0	0	0.004	0	0			
9	L3-4 skin-epidural (Anesth)	.742**	.684**	.508**	.630**	.376*	.572**	.602**	.892**		
		0	0	0	0	0.029	0	0	0		
10	L4-5 skin-epidural (Radio)	.716**	.566**	.544**	.594**	.373*	.603**	.590**	.855**	.851**	
		0	0	0	0	0.015	0	0	0	0	
11	L4-5 skin-epidural (Anesth)	.692**	.574**	.526**	.602**	.370**	.639**	.628**	.784**	.850**	.862**
		0	0	0	0	0.01	0	0	0	0	0

* Correlation is significant at the 0,05 level (2-tailed). ** Correlation is significant at the 0,01 level (2-tailed). Abd Subc Fat: Abdominal Subcutan Fat, Anesth: Measurements performed by the anesthesiologist, Radio: Measurements performed by the radiologist

included in the sample of this study. Using G Power 3.1.9.7 free version software, a minimum of 42 individuals were determined for inclusion in the research, considering a medium effect size at 0.05 alpha level and 95% power. Three individuals were excluded from the study due to inadequate imaging and measurement possibilities via ultrasonography. As the required number of volunteers was attained, the study was concluded upon reaching 42 participants.

RESULTS

A total of 42 volunteers, comprising 23 females and 19 males, within the age range of 18-59, were enrolled in the study conducted in the central operating room of Dokuz Eylul University Hospital. No volunteers were excluded from the study, and data from all 42 individuals were utilized in the analysis. The measurement values of the anesthesiologist and radiologist are shown in Table 1.

Our study revealed no significant difference between measurements performed by the radiologist and the anesthesiologist (p >.05). This paired samples test analysis are shown Table 2. Measurement and demographic data are shown in Table 3. The normality of the data (n=42) was assessed using the Kolmogorov-Smirnov test, and it was determined that the data were normally distributed. For data conforming to normal distribution, Pearson correlation analysis was applied (2-tailed, p<.01, r=.00-.20: No or very low correlation; r=.20-.40: Low correlation; r=.40-.60: Moderate correlation; r=.60-.80: High correlation; r=.80-1.00: Very high correlation). The results of the statistical analysis are shown in Table 4 and Table 5.

The interpretation of the table below is based on the anesthesiologist's measurements.

There was identified a significantly positive high-level correlation between weight and parameters indicating skin-epidural space distance. As weight increases, these parameters show a significant increase. The correlation in the L3-L4 level (r: 0.742) is stronger than the correlation in the L4-L5 level (0.692).

There was identified a significantly positive high-level correlation between height and parameters indicating skin-epidural space distance at the L3-L4 level (r: 0.684), and a moderately high-level correlation at the L4-L5 level (r: 0.574).

There was identified a significantly positive moderately high-level correlation between body mass index (BMI) and parameters indicating skin-epidural space distance at both L3-L4 and L4-L5 levels (r: 0.508, r: 0.526).

There was identified a significantly high-level positive correlation between waist circumference and parameters indicating skin-epidural space distance at both L3-L4 and L4-L5 levels (r: 0.630, r: 0.602).

There was identified a significantly positive low-level correlation between the waist-to-height ratio and parameters indicating skin-epidural space distance at both L3-L4 and L4-L5 levels (r: 0.376, 0.370).

There was identified a significantly high-level positive correlation between subcutaneous abdominal fat tissue thickness and parameters indicating skin-

Table 5. Pearson correlation analysis (simplyfied)

Skin-Epidural Distance	Weight	Height	BMI	Waist Circumference	Waist/Height	Abdominal Subcutan Fat
L3-L4	0,742	0,684	0,508	0,630	0,376	0,602
L4-L5	0,692	0,574	0,526	0,602	0,370	0,628

epidural space distance at both L3-L4 and L4-L5 levels (r: 0.602, r: 0.628).

In summary, when examining the correlations with skin-epidural distance, it can be observed that waist circumference and subcutaneous abdominal fat thickness have a higher correlation than BMI. As shown in figure 2A and 2B, from the data, when examining the correlation distribution graphs of skin-epidural space distance with BMI and subcutaneous abdominal fat thickness, it can be seen that patients with similar fat thickness or similar BMI exhibit variability in skin-epidural space distance. Furthermore, although the results indicate that abdominal subcutaneous fat thickness and waist circumference are better indicators than body mass index (BMI), none of the parameters showed a very high degree of correlation (r:0.8-1.0). In other words, it cannot be definitively stated that the skin-to-epidural space distance is also increased based solely on body anthropometric measurements.

DISCUSSION

The escalating body weight, fat percentage, and the distribution of this fat tissue in body composition not only impact health problems such as cardiac risks, diabetes mellitus, sleep apnea but also affect intubation difficulties, general anesthesia complications, and regional anesthesia challenges from an anesthetic perspective. The notion that foreseeing these difficulties and risks solely through BMI may not yield entirely accurate results is being supported by recent studies (6).

In a study conducted by Erika and colleagues (7) (2020) on 246 males and 357 females, body composition was assessed using DXA, and visceral fat mass was measured using Corescan. It was observed that individuals with similar BMI had significantly different body compositions in terms of internal organ fat percentage and lean body masses. The main premise of this study is that BMI does not reflect body fat distribution, and an increase in BMI does not always correspond to an increase in the skin-to-epidural space distance (8).

In addition, there is a biased approach to regional interventions in overweight patients due to increased skin-epidural fat deposition and in pregnant individuals due to increased edema. In fact, contrary to the assumption that the skin-epidural fat deposition increases uniformly in every overweight or pregnant patient, clinical observations and our experiences indicate that it does not increase to the same extent in all cases, despite the encountered difficulties (3).

The reason for using ultrasound (USG) is its practical and easy applicability, as well as the ability to achieve a large sample size quickly without radiation risk and without causing stress to the patients (9).

A study conducted by Sprung and colleagues (10) involving 595 patients recorded spinal/epidural anesthesia procedures. A low-degree correlation was found between the success of the interventions and BMI. It was concluded that BMI may only pose challenges in identifying anatomical landmarks. Therefore, focusing on measurements such as abdominal fat thickness and waist circumference may lead to more accurate results. In a study conducted by Mauad and colleagues (11) in 2017, the correlation between CT and USG in abdominal fat measurement was examined. The probe was placed 1 cm above the umbilical level at the midclavicular line, and the deep fat tissue was measured using a convex probe, while the subcutaneous fat tissue was measured using a linear probe with ultrasound. A higher correlation was found between body fat measurements obtained by CT and ultrasound. In this study, the reason for measuring the skin-epidural space distance only in the transverse-median (TM) plane is that in clinical practice, anesthetists usually perform epidural needle insertion in the TM plane. After imaging, the needle entry to reach the epidural space at the same skin-epidural distance should mimic the angle of the probe in this imaging (12). In a study conducted by Gnaho and colleagues (2012) on 31 patients, measurements of skin-dura with transverse median, L3-L4 level USG imaging performed by an anesthetic specialist correlated with the actual needle depth of another

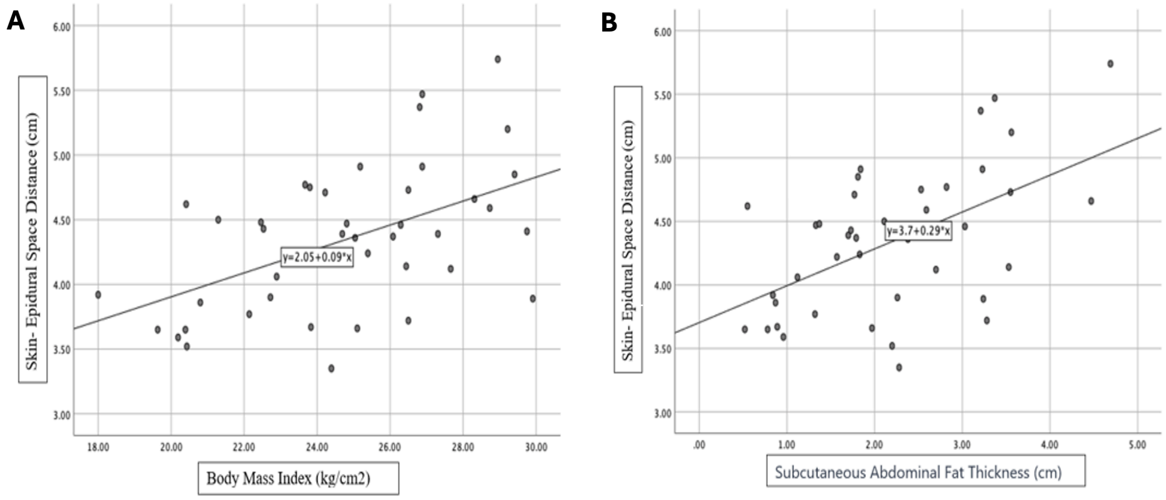

Figure 2. (A) Correlation distribution graphic of skin- epidural space distance with BMI. (B) Correlation distribution graphic of skin-epidural space distance with subcutaneous abdominal fat thickness

anesthetist who was unaware of the measurements (13).

In a study conducted by Eley and colleagues (14) on pregnant women beyond 37 weeks, published in 2019, the relationship between increased BMI and abdominal subcutaneous fat thickness with the skin-epidural space distance was investigated. There was a strong correlation between abdominal subcutaneous fat thickness and BMI, a moderate correlation between subcutaneous fat thickness and skin-epidural space distance, and a moderate correlation between BMI and skin-epidural space distance. BMI does not necessarily increase the difficulty of placement but is a more valuable indicator than subcutaneous fat measurement.

While similar studies have been predominantly conducted on pregnant women (15) and obese patients, at the initiation of this study, there were very few examples in the normal population, mostly involving magnetic resonance imaging (16). A very similar study was conducted by Harshvardhan and colleagues in 2021. This study included 100 individuals aged 40-65 with ASA I/II, a BMI between 18.5 and 30 kg/m2, who were scheduled for surgery with lumbar epidural block. In contrast to this study, only female patients were selected, and measurements were taken in only the sitting position, with parasagittal oblique and transverse median approaches. Consistency was assessed by performing the procedure with an epidural needle (5).

Due to the limited number of volunteers, groupings could not be made according to age, occupational groups, ethnicities, and gender differences. Measurements could only be taken from the L3-L4 and L4-L5 levels. However, since there are clinical situations where applications need to be made from higher and lower levels, the levels of measurements can be expanded. Verification measurements can be performed not only in the transverse median but also in the parasagittal oblique plane to minimize skin-fat compression. While the measurement of visceral abdominal fat is of great importance in determining body fat, our study only measured subcutaneous fat. Furthermore, by evaluating the entire body composition and determining the fat percentage, more advanced examination tools such as MRI, DXA, CT can be used.

To support the findings, it is recommended to increase the number of prospective randomized studies in individuals with different anthropometric measurements and to evaluate these individuals separately based on factors such as occupational groups or gender, which may affect the fat-muscle composition in the lumbar region.

CONCLUSION

In conclusion, this study demonstrates that excess weight does not always significantly affect the skin-to-epidural space distance. While the results indicate that abdominal subcutaneous fat thickness and waist circumference are better indicators than body mass index (BMI), none of the parameters showed a very high degree of correlation. Therefore, each patient should be evaluated individually, and the assumption that patients with higher weight will have a greater skin-to-epidural space distance should be avoided. Ultrasound-guided pre-assessment can facilitate interventions and help mitigate the risks of anesthesia, particularly in situations where general anesthesia may pose disadvantages (e.g., difficult intubation, respiratory comorbidities, cardiac issues).

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