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- Ezgi CAN[1]
- Gökhan YILDIZ[1]
- Ömer Taylan AKKAYA[1]
- Rasime Pelin KAVAK[2]
- Gevher Rabia GENÇ PERDECİOĞLU[1]
- Damla YÜRÜK[1]
- Hüseyin Alp ALPTEKİN[1]

CORRESPONDANCE

[1]Ezgi CAN
Phone : +905348395016
e-mail : ezgiacarcan89@gmail.com

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[1] Ankara Etlik City Hospital, Algology, Ankara, Turkey

[2] Ankara Etlik City Hospital, Radiology, Ankara, Turkey

ORIGINAL ARTICLE

COMPARISON OF THE EFFICACY OF LUMBAR ERECTOR SPINAE PLANE BLOCK FOR CHRONIC AXIAL LOW BACK PAIN IN GERIATRIC AND YOUNGER PATIENTS: RESULTS OF A RETROSPECTIVE STUDY

Abstract

Introduction: The lumbar erector spinae plane block is one of the interventional procedures for chronic low back pain. This study aimed to compare the efficacy of lumbar erector spinae plane block for chronic axial low back pain due to disc protrusion/bulging in geriatric and younger patients and to evaluate clinical, demographic, and radiological characteristics that may be associated with treatment success.

Materials and Method: The clinical and demographic data of patients who underwent ultrasound-guided lumbar erector spinae plane block for chronic axial low back pain between November 2022 and July 2023 were retrospectively evaluated. Patients were divided into two groups, ≥65 and <65 years of age, and treatment efficacy at the third month after the procedure was evaluated and compared.

Results: A total of 147 patients (75 patients aged <65 years and 72 patients aged ≥65 years) were included in the analysis, and a successful treatment response (at least 50% pain relief) was achieved in 44.4% of geriatric patients and 62.6% of younger patients (p=0.027). In addition BMI, comorbidity, opioid use, and lumbar paraspinal fatty infiltration were significantly higher in geriatric patients than in younger patients (p<0.05).

Conclusion: The results of this study demonstrate that lumbar erector spinae plane block for chronic axial low back pain provides significantly less pain relief in geriatric patients than in younger patients at three-month follow-up.

Keywords: Lower back pain; Aged; Injection; Ultrasound imaging

INTRODUCTION

With a prevalence of 21-75%, chronic low back pain (CLBP) is a common health problem in the geriatric population, frequently leading to disability and functional impairment (1). While most cases of low back pain resolve within a few months, advanced age is a significant risk factor for chronic pain (1) Herniated intervertebral discs, facet joint degeneration and spinal canal stenosis are the most common causes of CLBP in elderly patients (2). Medical treatment and physical therapy modalities are primarily employed for these patients. Interventional pain procedures and surgical treatment are required for patients who do not respond to these modalities (3).

Lumbar erector spinae plane block (ESPB) is an effective interventional pain procedure performed under ultrasound (US) guidance in patients with axial and/or radicular CLBP refractory to medical and physical therapy (4). ESPB was first defined as a treatment technique for thoracic pain in 2016 and has since been widely used for acute and chronic spinal pain, including pain in the lumbar region (5). US-guided lumbar ESPB involves injecting local anesthetic (LA) around the paraspinal muscles attached to the transverse process of the vertebrae. This method is effective for pain treatment as the drug spreads to the paravertebral planes and neural foramens (6).

The structure of the lumbar paraspinal muscles has a significant effect on the stability of the lumbar spine, and increased fat infiltration in the paraspinal muscles, which are the target sites of lumbar ESPB, has been associated with sarcopenia, low back pain, and loss of patient function (7, 8). Recent studies have associated increased fat infiltration in the lumbar paraspinal region with poor outcomes after epidural injections and surgery (8, 9).

To the best of our knowledge, the effectiveness of lumbar ESPB in the treatment of chronic axial LBP in geriatric patients compared with younger patients has not been investigated, nor have the factors influencing treatment success. This study aimed to investigate the effectiveness of lumbar ESPB in geriatric patients (≥65 years) compared with younger patients and to examine the impact of patient demographic and clinical characteristics, including the degree of paraspinal fat infiltration, on treatment success.

MATERIALS AND METHOD

Study design and participants

This study, designed retrospectively, received approval from the local ethics committee (number 2023-600) and registered at ClinicalTrials.gov (registration number NCT06208865). Medical records were retrospectively retrieved and analyzed from the hospital data of patients who underwent US-guided lumbar ESPB for axial CLBP between November 2022 and July 2023. The inclusion criteria were as follows: (1) patients aged ≥ 18 years, (2) patients with chronic axial low back pain due to lumbar disc bulging/protrusion without compression of the spinal nerve root; (3) no response to medical treatment and physical therapy for ≥ 3 months; (4) Lomber magnetic resonance imaging (MRI) within 1 year before injection, (5) no previous lumbar interventional procedure and (6) no paravertebral lumbar facet tenderness and no neurological deficit on examination (patients without sensory/motor deficit, deep tendon reflex abnormality). The exclusion criteria were as follows: (1) clinically and radiologically (patients whose MRI images or reports could not be accessed from patient records) inadequate medical records; (2) lost to follow-up within three months after the procedure; (3) history of surgery for lumbar disc herniation or interventional procedure; (4) severe spinal stenosis (vertebral canal diameter <10 mm in the sagittal plane) and/or foraminal stenosis (foraminal height <15 mm in the axial plane); (5) extruded, sequestered, or migrated hernias on lumbar MRI, (6) facet hypertrophy on lumbar MRI

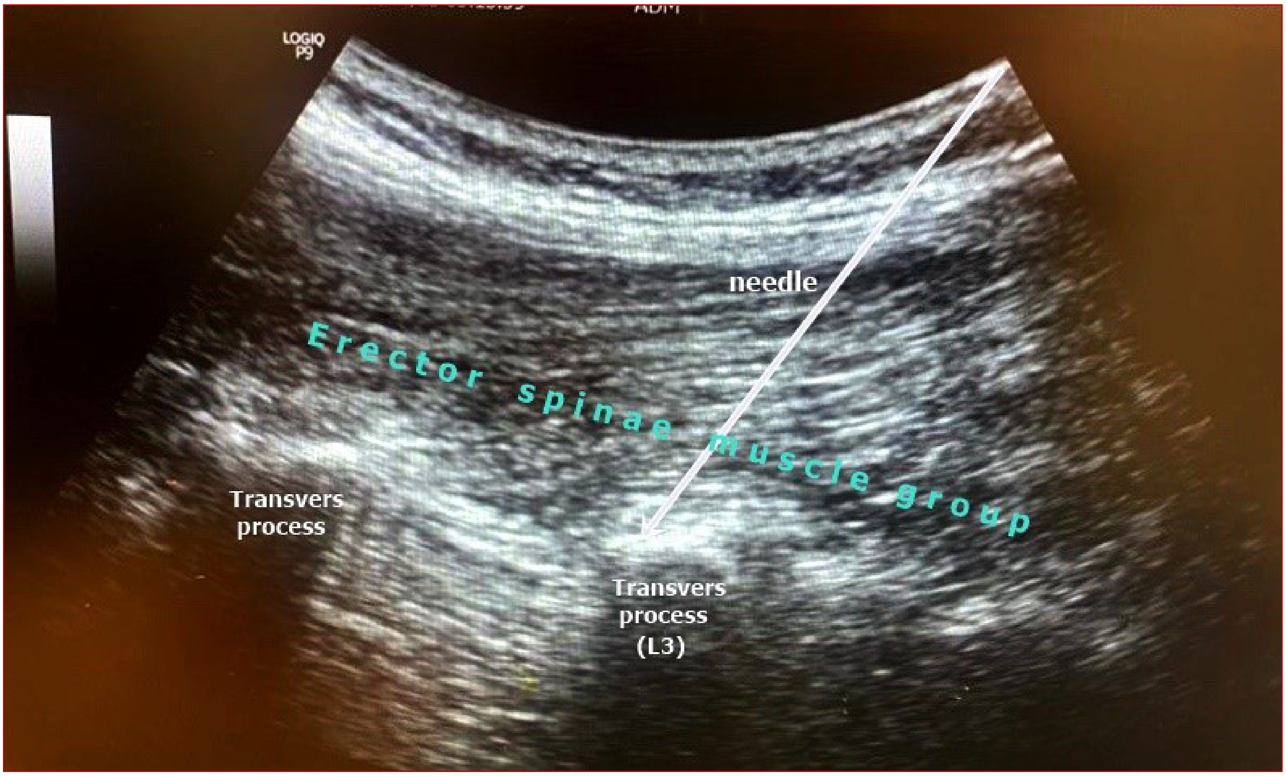
(7) radicular low back pain, (8) paravertebral lumbar facet tenderness and neurological examination findings such as sensory/motor deficit, deep tendon reflex abnormality and (8) history of malignancy.

Lumbar erector spinae plane block (ESPB)

All procedures were performed under US guidance. The patient was placed in the prone position and sterile conditions ensured. The intervention was performed by two pain specialists with similar experience of at least three years.

A 2-6 MHz convex US probe (LOGIQ P9, GE Ultrasound, Sunhwan-ro, Jungwon-gu, Seongnamsi, Gyeonggi-do, Korea) was used during the procedure. After visualizing the transverse processes of the lumbar vertebrae which are the attachment sites of the paraspinal muscles (erector spinae muscle group), a 22-gauge spinal needle was inserted into the transverse process of the L3 vertebra using the in-plane method (Figure 1). After contacting the transverse process of the L3 vertebra, 10 mL of drug containing 2 mL dexamethasone, 4 mL 0.025% bupivacaine, and 4 mL saline was injected. Lumbar ESPB was performed unilaterally in all patients using this method and drug volume. In patients with bilateral axial pain, the procedure was performed on the side with the predominant pain. The patients were followed up for possible adverse events, and no adverse events occurred in any of the patients.

Figure 1. The ultrasound section shows the visualization of the transverse process and needle in lumbar erector spinae plane block

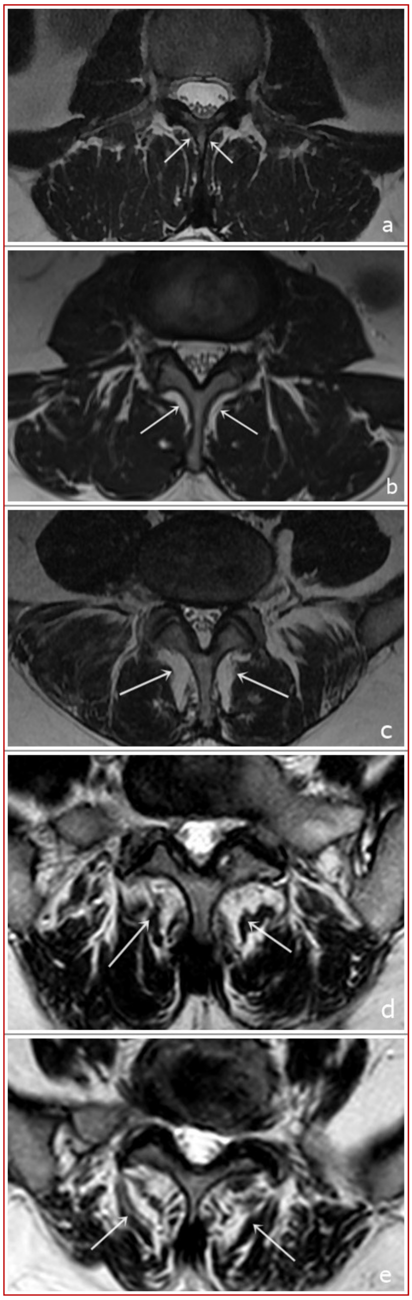


Data collection and outcome measures

The intensity of the pain was assessed using a numerical rating scale (NRS) both before and one-month and three-months after the treatments. The NRS is defined as ranging from 0 (no pain) to 10 (the worst pain imaginable). Consistent with similar studies (10), treatment was considered successful in one patient who experienced a ≥50% reduction in the NRS score at three months post-treatment. Patients were divided into two age groups, < 65 years and ≥ 65 years, and analyzed appropriately.

In addition, demographic data such as gender, comorbidities (diabetes mellitus (DM), hypertension (HT) and coronary artery disease (CAD)), body mass index (BMI)kg/m2), pain duration and opioid use were obtained from patient data. NRS scores before and 3 months after the lomber ESPB were collected from patient data and recorded. Pre-procedure lumbar magnetic resonance images were obtained from the patient's data. Lumbar pathologies causing chronic axial low back pain (lumbar disc bulging/ protrusion without spinal nerve root compression) was evaluated by a experienced radiologist. Fat infiltration in the paraspinal muscles was evaluated at the L3 vertebral level. Paraspinal fatty infiltration was evaluated using T2-weighted MRI scan, employing methodologies established in previously published studies, and the Goutallier classification was used for grading (11). The grading of fatty infiltration in the paraspinal muscles on a lumbar MRI was performed by a experienced radiologist. As we applied lumbar EPSB at the L3 level, we preferred to perform MRI evaluation at the same level. The Goutallier Classification is defined as follows: The Goutallier classification system assesses the amount of fat present in the muscle. Goutallier 0 indicates no visible fat streaks, Goutallier 1 indicates minimum fat streaks, Goutallier 2 indicates more muscle than fat, Goutallier 3 indicates equivalent amounts of fat and muscle, and Goutallier 4 indicates more fat than muscle (Fig 2).

Figure 2. Bilateral paraspinal muscles were assessed for fat infiltration on T2-weighted axial sections at the L3 level. The Goutallier grading was defined as follows: (a) Goutallier 0, no visible fat streaks; (b) Goutallier 1, minimal fat streaks; (c) Goutallier 2, more muscle than fat; (d) Goutallier 3, equal fat and muscle; (e) Goutallier 4, more fat than muscle.



Statistical analysis

All analyses were conducted using the Jamovi project (2022, Jamovi Version 2.3, Computer Software). The findings of this study are expressed as frequencies and percentages. Normality analysis was performed using the Shapiro–Wilk test, skewness-kurtosis, and histograms. Categorical variables were presented as absolute numbers with percentages. Continuous variables were compared between age groups using the Mann–Whitney U-test and Kruskal–Wallis H-test and were presented as medians with interquartile ranges. Categorical variables were compared using the chi-square test or Fisher's exact test. Statistical significance was set at $P < 0.05$.

RESULTS

A total of 196 patients underwent US-guided lumbar ESPB during the study period, and 49 patients were excluded in line with the exclusion criteria. There were 147 patients in the analysis between the ages of 20 between 77 years, including 75 patients aged <65 years and 72 patients aged ≥65 years. The treatment response at the post-procedural third month was successful in 62.6% of patients aged <65 years and 44.4% of patients aged ≥ 65 years (Fig 3) and the difference was statistically significant (p=0.027). The comparison of the NRS changes at basal and at the first and third month after the procedure is shown in Fig. 4.

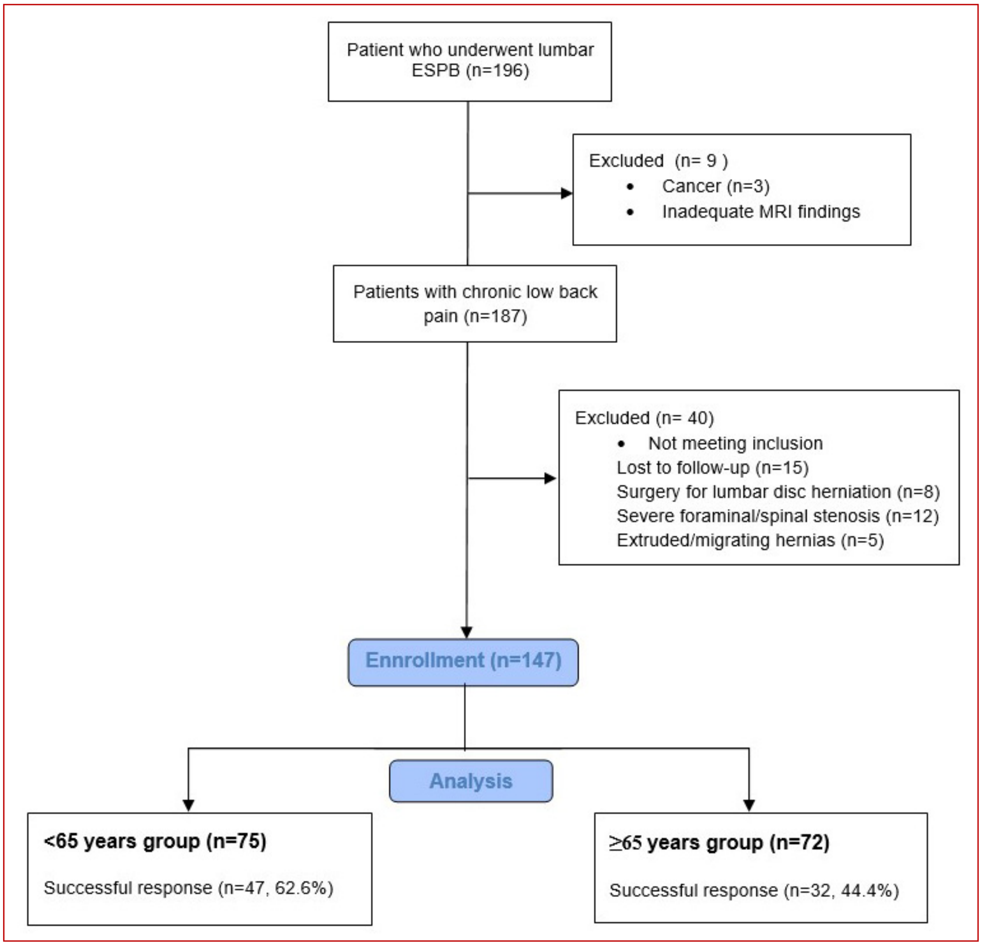


Figure 3. Study design and follow-up

Figure 4. Comparison of the effect of time on NRS in geriatric and younger patients

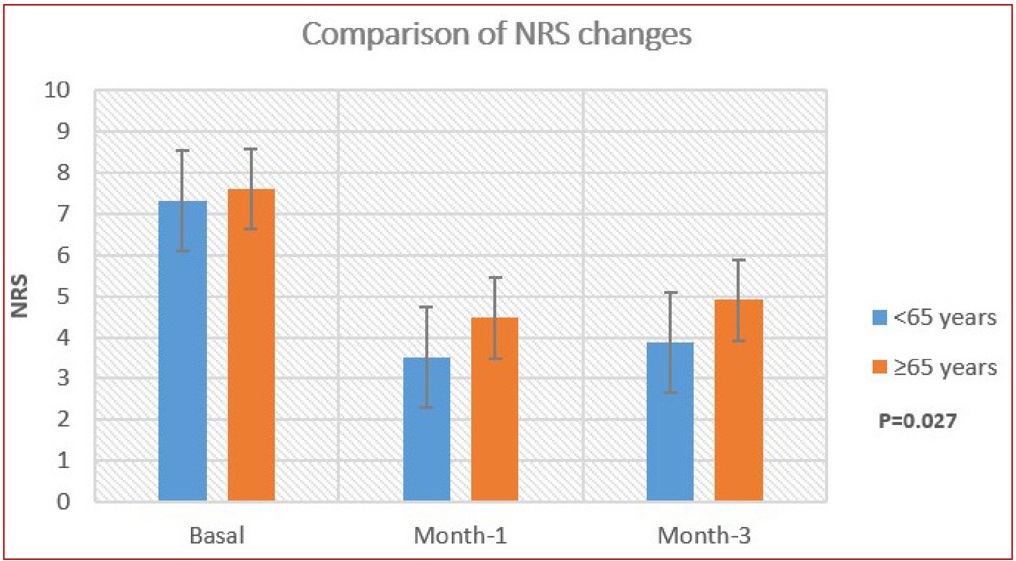


Table 1. Baseline demographic and clinical characteristics according to age groups (<65 years and ≥65 years)

Variables		<65 years (n=75)	≥65 years (n=72)	p-value
		median(min-max)	median(min-max)	
BMI (kg/m2)		27(19-37)	29(19-37)	**0.002***
Basal NRS		7(6-9)	8(5-9)	**0.020***
Three-month NRS		3(1-9)	5(1-9)	**0.030***
Duration of pain (months)		24(4-120)	27(4-120)	0.988*
		n(%)	**n(%)**	**p-value**
Sex	Female	36 (44.4)	45 (55.6)	0.077**
	Male	39 (59.1)	27 (40.9)	
Successful treatment responce	Yes	47 (59.4)	32 (40.6)	**0.027****
	No	28 (41.1)	40 (58.6)	
Comorbid medical disease	Yes	14 (21.5)	51 (78.5)	**<0.001****
	No	61 (75.3)	21 (24.7)	
Opioid use	Yes	17 (33.3)	34 (66.7)	**0.003****
	No	58 (60.4)	38 (39.6)	
Fat infiltration grade (Goutallier Classification)	Mild (Grade 0,1)	56 (83.5)	11 (16.5)	**<0.001****
	Moderate(Grade 2)	12 (29.2)	29 (70.8)	
	Severe (Grade 3,4)	7 (17.9)	32 (82.1)	

BMI: Body mass index, NRS: numerical rating scale, *: Mann Whitney U Test,**: Chi Square Test

The values are presented as median (minimum-maximum) and numbers of patients. P values that are written in bold represent statistical. P<0.05 is considered statistically significant

Table 1 presents the basic demographic and clinical characteristics and the degree of paraspinal fatty infiltration, for each patient group categorized by age. Successful treatment response was significantly lower in the geriatric patients (p=0.027). The baseline NRS scores were high in both age groups (<65 and ≥65 years; median scores of 7 and 8, respectively), indicating severe pain, and both the baseline and three-month NRS scores were significantly higher in the geriatric group (p=0.020 and p=0.030, respectively). The patients aged ≥65 years had significantly higher BMI values and more comorbid medical diseases (diabetes mellitus, hypertension, and coronary artery disease) than the younger patients (p=0.002 and p<0.001, respectively). The patients in the geriatric group used more opioids (p=0.003), and the grade of paraspinal fat infiltration, determined according to the Goutallier classification at the L3 level on lumbar MRI, was significantly higher in these patients (p<0.001). Sex (gender), and pain duration were similar between the patient groups (p>0.05)

DISCUSSION

In this study, we found significantly less pain relief with lumbar ESPB for chronic axial low back pain due to lumbar disc bulging/protrusion in geriatric patients than in younger patients. Geriatric patients also have higher BMI, comorbidity, pain severity, opioid use, and degree of lumbar paraspinal fat infiltration compared to younger patients. There is limited information in the literature regarding the outcomes of geriatric patients undergoing lumbar ESPB and these clinical characteristics.

In ESPB, LA applied to the erector spinae plane and multifidus muscle groups (paraspinal muscles) can reach the craniocaudal region, paravertebral muscles, and neural foramen (6). Therefore, lumbar ESPB is a suitable interventional procedure for the treatment of CLBP. In a study by Durmus et al., lumbar ESPB was applied to 96 patients with CLBP aged 25–79 years, and a significant decrease in pain scores was reported in the first month (4). Another study found that patients who underwent lumbar ESPB before and one month after lumbar disc surgery had significantly less persistent low back pain in the sixth postoperative month than the patients who did not undergo lumbar ESPB (12). In our study, 147 patients aged 20–77 years with chronic axial LBP underwent US-guided lumbar ESPB; 62.6% of the patients aged <65 years and 44.4% of the patients aged ≥65 years showed a significant reduction in their third-month pain scores. Our study is the first to investigate the effectiveness of lumbar ESPB in older patients compared to younger patients. Treatment success was significantly lower in the geriatric patients (p=0.027).

With aging, the number and size of muscle fibers decrease, and resulting in loss of muscle mass. Sarcopenia is characterized by age-related decreases in muscle strength and physical performance and is common in geriatric patients. This leads to loss of mobility and increases the risk of mortality (13). Sarcopenia is thought to develop through various mechanisms, including mitochondrial dysfunction, protein imbalance, and motor neuron loss (14). When our patients were analyzed according to age group, the presence of paraspinal fat infiltration, in addition to advancing age, which may facilitate the development of sarcopenia, was significantly higher in the patient group aged ≥65 years. Similarly, studies of patients undergoing lumbar epidural steroid injections for CLBP have reported that younger patients had more successful pain relief (8, 15). The lumbar paraspinal muscles consist of the multifidus, erector spinae, and psoas muscles, and their integrity ensures normal spinal function, alignment, and stability (9). Paraspinal muscles contain a high proportion of type 1 fibers, which help maintain posture and joint stability owing to their low tonicity and resistance to fatigue (16). Fatty infiltration of these muscles is a sign of atrophy and thus sarcopenia, and has been associated with low back pain (7). Several studies have examined changes in the paraspinal muscles with age in healthy adults and have found that fat infiltration increases with age (17-19). Studies have shown that increased paraspinal fat infiltration is associated with loss of muscle strength, poor functioning, and reduced mobility (16, 17). Dahloqvist et al. studied fat replacement in the paraspinal and lower limb muscles of healthy adults and found that the paraspinal muscles had significantly higher mean fat content and increased fat replacement with aging than the lower limb muscles (20). Similarly, previous research has investigated the effect of paraspinal fat infiltration on the efficacy of lumbar and cervical interventional pain treatment. Kim et al. performed fluoroscopy-guided lumbar epidural steroid injections in 245 patients aged ≥65 years with low back pain and found that severe paraspinal fat infiltration was associated with poor treatment outcomes (8). The relationship between the degree of paraspinal fat infiltration and treatment response has also been evaluated for lumbar disc surgery, and increased fat infiltration in the erector spinae muscles has been found to be associated with poor clinical outcomes following lumbar discectomy (9). In our study, we found that paraspinal fat infiltration in older patients (≥65 years) was significantly higher than that in younger patients (<65 years), consistent with existing findings. This supports the physiopathological evidence that aging reduces skeletal muscle mass and replaces it with fat and connective tissue (21).

In this study, BMI was significantly higher in the ≥65 years age group ($p=0.002$). In addition, comorbidities, such as diabetes mellitus, hypertension, and coronary artery disease, were significantly more common in the patients aged ≥65 years than in the younger patients ($p<0.001$). This may be related to the increased risk of comorbidities and metabolic syndrome with advancing age, increased sedantary life, less exercise, and increased sarcopenia due to these factors. In addition, opioid use was significantly higher in the geriatric patients ($p=0.003$). A recent study found a negative association between the analgesic efficacy of lumbar epidural steroid injections in geriatric patients and pre-injection opioid use at three months, but it is unclear whether opioid use affects the long-term analgesic efficacy of the procedure (8).

This study had several limitations. First, our study was retrospectively designed, and NRS scores three months after injection were available, so it does not fully reflect the patients' long-term clinical outcomes. In addition, no clinical data on disability, opioid use, or quality of life were available from the patient records. In addition, the degree of fatty infiltration in the paraspinal muscles was assessed only in a single multifidus muscle at the L3 level, making it impossible to draw conclusions about the degeneration of other lumbar muscles.

CONCLUSION

This study demonstrated that US-guided lumbar ESPB for chronic axial LBP due to lumbar disc bulging/protrusion is less successful in geriatric patients than in younger patients. Geriatric patients were found to have significantly higher levels of high-grade paraspinal fat infiltration associated with sarcopenia and clinical features such as high BMI, comorbidity, opioid use and high disease severity than younger patients. This is the first study to evaluate the effectiveness of lumbar ESPB in geriatric patients, and the clinical, demographic and radiological characteristics associated with treatment success. Prospective evaluation with larger participants and longer follow-up is needed to assess the long-term outcomes in geriatric patients and their associated factors.

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Conflicts of Interest: All the authors have no conflicts of interest.

Data Availability Statement: The data that support the findings of this study are available from the corresponding author upon reasonable request.

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