

Retrospective analysis of quality of life after trans-sacral epiduroscopic laser neural decompression for chronic back pain

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Abstract

Objective: Low back pain is a common health problem that most adults experience at least once in their lifetime and significantly impacts healthcare costs, workforce productivity, and overall quality of life. Trans-Sacral Epiduroscopic Laser Neural Decompression (ELND) is a minimally invasive technique often used for patients with lumbar disc herniation. ELND offers advantages such as shorter operation times, faster recovery, and continuous communication with the patient during the procedure which reduces the risk of accidental nerve damage. We aimed to analyze the effects of ELND on pain and quality of life.

Materials and Methods: A cohort of 89 patients diagnosed with lumbar disc herniation underwent the ELND procedure. The Medical Outcomes Study 36-item Short-Form Health Survey (SF-36) was used to evaluate the quality of life of 89 patients before and six months after the ELND procedure.

Results: The analysis established a statistically significant increase in general health perception, physical functioning, physical role limitation, social functioning, vitality, pain, and general mental health subscales of the SF-36 questionnaire. However, the score for role limitation due to emotional problems decreased post-procedure. The median scores for general health perception increased from 54.3 to 68.3, physical functioning from 45.0 to 65.0, and pain from 10.6 to 63.0, among other subscales. The greatest improvement was observed in the physical role difficulty subscale.

Conclusion: As a result, the ELND procedure is an effective treatment for patients with chronic low back pain, as demonstrated by significant reductions in pain scores and improvements in patient-reported quality of life. Specifically, the study found statistically significant enhancements in general health perception, physical functioning, physical role limitation, social functioning, vitality, and general mental health six months after the procedure. These findings indicate that ELND not only alleviates pain but also contributes to better physical mobility, daily functioning, and overall well-being.

Keywords: low back pain, quality of life, psychological well-being, failed back surgery syndrome, YAG lasers, health survey

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Introduction

Low back pain (LBP) is among the most prevalent musculoskeletal disorders worldwide and represents the leading cause of disability across age groups. Most adults experience LBP at least once in their lifetime, and a substantial proportion develop chronic symptoms. Globally, more than 600 million individuals are affected by activity-limiting LBP, resulting in significant healthcare costs, reduced productivity, and impaired quality of life [1,2]. The etiology of LBP is multifactorial, encompassing mechanical and non-mechanical causes. Mechanical sources include lumbar disc herniation, facet joint disease, spinal stenosis, spondylosis, and discogenic pain, while non-mechanical causes include inflammatory conditions, infection, and malignancy. Despite extensive diagnostic evaluation, most of the patients are classified as having “non-specific LBP” [3]. Among identifiable causes, lumbar disc pathology remains a major contributor to chronic LBP and associated disability [4]. Chronic LBP is frequently recurrent and persistent, substantially limiting physical function, social participation, and overall well-being [5]. Conservative management, including pharmacological therapy, physical rehabilitation, and lifestyle modification remains the first-line approach and is effective for many patients. However, a subset of individuals with refractory symptoms may benefit from interventional pain management strategies tailored to the underlying pathology. These interventions include epidural injections, transforaminal approaches, facet joint procedures, radiofrequency ablation, intradiscal therapies, and neuromodulation techniques.

Epiduroscopy is a minimally invasive percutaneous procedure that enables direct visualization of the epidural space and targeted treatment of pathological findings. With advancements in endoscopic and laser technologies, epiduroscopy has evolved from a diagnostic tool to a therapeutic modality. Trans-sacral epiduroscopic laser neural decompression (ELND) allows decompression of disc pathology and epidural adhesiolysis via a caudal approach. The technique offers several advantages, including avoidance of general anesthesia, shorter procedural and recovery times, and continuous patient feedback during the intervention, which may reduce the risk of neural injury [6]. Reported clinical success rates for ELND in lumbar disc herniation range from 60% to 80% [7,8].

Given the multidimensional burden of chronic LBP, evaluation of treatment outcomes should extend beyond pain intensity to encompass health-related quality of life. The 36-Item Short Form Health Survey (SF-36) is a validated and widely used instrument assessing physical, emotional, and social health domains [9-11], with established reliability and validity in the Turkish population [12-14]. The present study aimed to evaluate the impact of ELND on health-related quality of life by comparing SF-36 subscale scores before and six months after the procedure in patients with chronic low back pain, including selected cases of failed back surgery syndrome.

MATERIALS AND METHODS

In this retrospective study, SF-36 quality of life survey was utilized in 89 patients who were diagnosed with lumbar disc herniation and underwent ELND procedure to evaluate the changes before and 6 months after the procedure, and their quality of life was evaluated.

This study was conducted at Hacettepe University Faculty of Medicine, Department of Anesthesiology and Reanimation, Pain Clinic, Ankara. Permission from Hacettepe University Clinical Research Ethics Committee was obtained with project registration GO 16/312 and number 16969557-587 for the study.

Interventional procedures for low back pain are routinely performed in the institution. Patients who underwent the ELND procedure for chronic low back pain after examination, and who answered the SF-36 survey with a face-to-face interview technique before and 6 months after the procedure, were included in the study. The parts that the patients did not understand about the questions were explained to them by the interviewer. The answers were filled in by the patients.

Patients were included in the study if they were diagnosed with lumbar disc herniation associated with chronic low back pain, were deemed suitable candidates for trans-sacral epiduroscopic laser neural decompression after comprehensive clinical and radiological evaluation and underwent the ELND procedure at the study institution. Eligible patients were required to have chronic symptoms refractory to conservative management, including pharmacological treatment and physical therapy, and

to have completed the SF-36 questionnaire through face-to-face interviews both before the intervention and at six months post-procedure. Patients with failed back surgery syndrome (FBSS) were included in the study provided that they met the predefined clinical and procedural eligibility criteria. In the context of this study, FBSS was defined as the persistence or recurrence of chronic low back pain and/or radicular lower extremity pain following one or more lumbar spine surgical interventions, in the absence of a clear indication for repeat open surgery and after failure of adequate conservative management. Patients with a history of lumbar spine surgery who continued to experience symptoms attributable to epidural adhesions, recurrent or residual disc pathology, or nerve root irritation were considered eligible for ELND and therefore included in the cohort. Conversely, patients with postoperative pain caused by conditions requiring revision surgery, such as gross spinal instability, progressive neurological deficits, active infection, or malignancy, were excluded. This operational definition allowed FBSS patients to be evaluated alongside surgery-naïve patients with chronic lumbar disc herniation, reflecting real-world clinical practice in which ELND is used as a minimally invasive treatment option for selected cases of refractory pain, including FBSS.

Patients were also excluded if they had incomplete SF-36 data, declined follow-up assessment, or had conditions that could confound quality-of-life evaluation, such as active spinal infection, malignancy, severe spinal instability requiring open surgery, or significant neurological deficits necessitating urgent surgical intervention. Additional exclusion criteria included inability to comprehend or reliably complete the questionnaire and the presence of severe psychiatric disorders that could independently impair emotional or functional assessment. These criteria were applied to ensure a relatively homogeneous cohort and to allow a focused evaluation of the impact of ELND on pain and health-related quality of life.

The quality-of-life scores of each subscale were compared before and 6 months after the procedure.

Intervention Technique

The patients were in supine position, monitored anesthesia care was utilized during the interventions. Under sterile setting, a guide needle was inserted through the sacral hiatus and local anesthesia of the

sacral hiatus was achieved. With the help of fluoroscopic imaging, a guide wire was sent through the needle, the needle was withdrawn, and the wire was removed after sending a 9F introducer trocar over the guide wire. A fiberoptic endoscope was projected through the introducer, and the target disc was approached with fluoroscopic guidance. The level of adhesion was determined by administering radiopaque (Figure 1). The protruded discs were degraded with Yttrium-Aluminum oxide Garnet (YAG) laser which was inserted through the endoscope. YAG laser was tested by 0.5 joule 0.5 Hz, and protruded disc was shrunk by a YAG laser of 0.8 J, 0.8 Hz until the sufficient decompression of the nerve root was achieved. Adhesions were removed both mechanically and with YAG laser. Direct visualization of the widening of the epidural space through the epiduroscope was observed and finally, the radiopaque

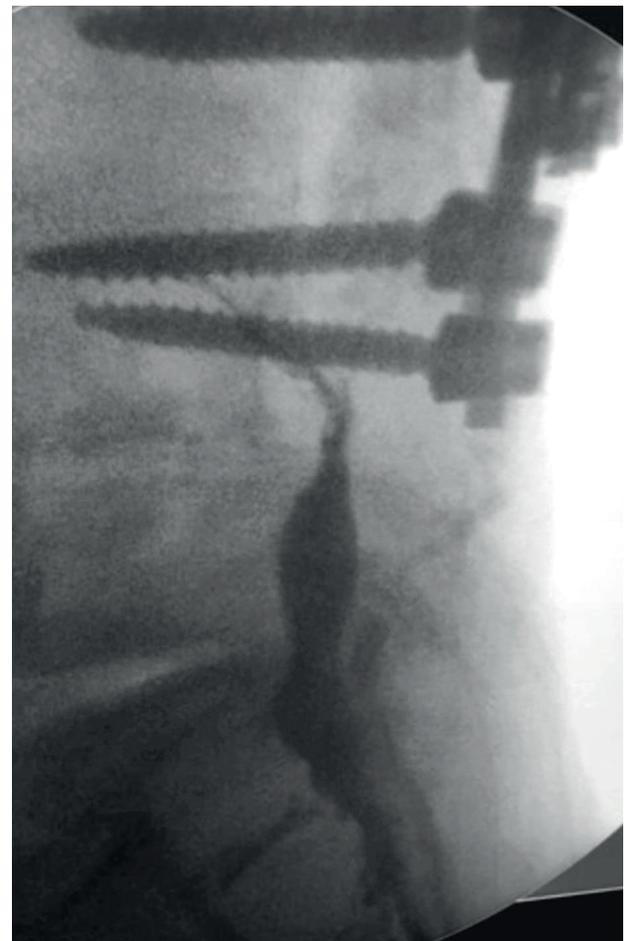


Figure 1. Determining the point at which the contrast cannot access past adhesion before performing adhesiolysis

substance was administered once more, before the procedure was terminated. The passage of the contrast substance across the adherent area and further caudal passage was visualized (Figure 2). A 10 mL of solution mixture of normal saline and dexamethasone, was injected into the epidural space at the end of the procedure. Patient screening, assesment, inclusion and exclusion criteria and follow-up is demonstrated in the flow diagram (Figure 3).

Statistical Analysis

The data obtained from the patient surveys were analyzed utilizing IBM-SPSS Statistics program (version 23.0 IBM International Business Machines Inc. Armonk, NY, USA). Frequency and percentages were used for presenting categorical variables, and median with range were used for non-categorical variables in descriptive statistics. The Wilcoxon Signed Rank Test was used to compare the changes of quantitative parameters that do

not present normal distribution. In statistical decisions, $p < 0.05$ was considered as significant. All hypotheses were established and tested bi-directionally.

RESULTS

The cohort consisted of 89 patients (63 female and 26 male). The mean age of the patients was 54.7 ± 16.4 years. The oldest patient participating in the study was 96 years old and the youngest was 17 years old.

The difference between pre- and post-procedure scores in all subscales was found to be statistically significant. When comparing the mean SF-36 scores before and after the procedure across all subscales, the following average increases were observed: 14 points in general health perception, 15.4 points in physical functioning, 41 points in physical health - role limitation, 44 points in social functioning, 16 points in vitality, 52.4 points

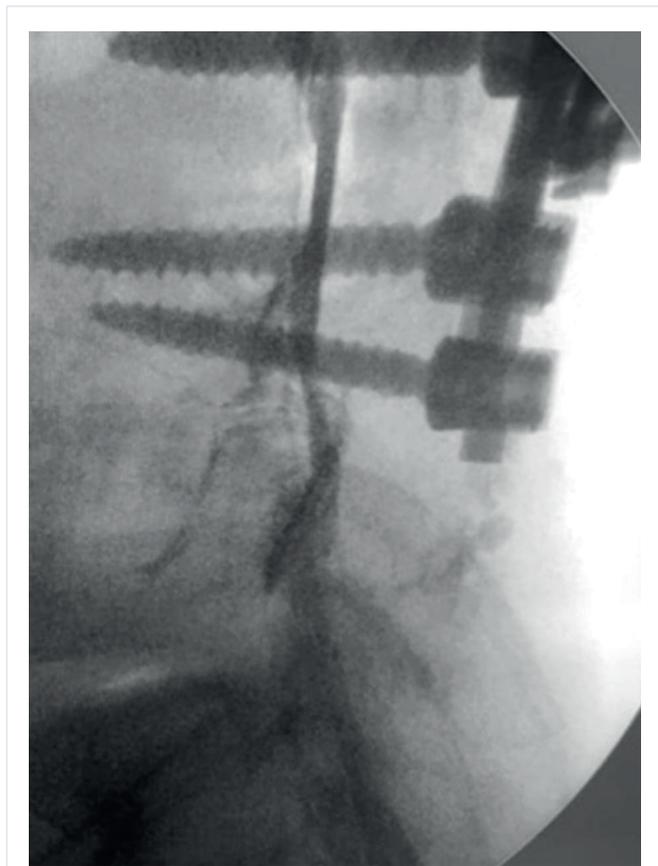


Figure 2. Visualization of the opaque rising to higher levels after adhesiolysis

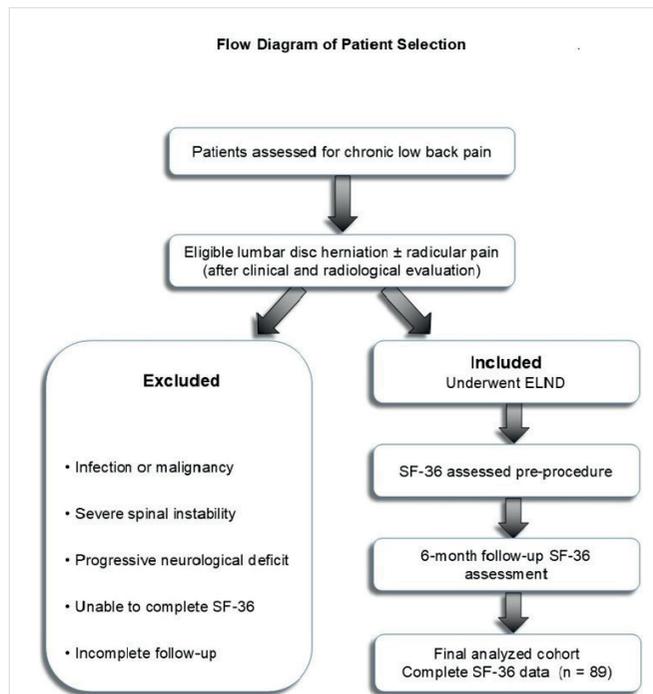


Figure 3. Flow diagram illustrating patient screening, eligibility assessment, inclusion and exclusion criteria, follow-up, and final analysis.

Patients with chronic low back pain, including selected cases of failed back surgery syndrome (FBSS), were evaluated for eligibility for trans-sacral epiduroscopic laser neural decompression (ELND). Only patients with complete pre- and post-procedural SF-36 data at six months were included in the final analysis.

in pain, 24.7 points in general mental health. The pre-intervention median general health perception score was 54.3, which increased to 68.3 after the procedure. Physical functioning scores significantly increased from 45.0 to 65.0, and physical role limitation scores rose remarkably from 11.0 to 52.0. Improvements were also noted in social functioning (from 27.9 to 71.9), vitality (from 19.0 to 60.0), pain (from 10.6 to 63.0), and general mental health (from 50.6 to 75.3). Interestingly, emotional role limitation scores decreased from 67.7 to 60.0, which was the only subscale that did not show post-intervention improvement. Overall, a 5-point decrease in SF-36 score was observed (Table 1).

DISCUSSION

Low back pain is a notable health problem that may affect 85% of society at least once in their lifetime and may lead to increased expenditures in terms of diagnosis and treatment costs, as well as the workforce losses [15]. Usually, low back pain that lasts more than 3 months is considered chronic. Chronic low back pain, which is the second most common complaint of pain in people under the age of 45, significantly affects the quality of life due to its persistent and debilitating nature.

Instability occurs after lumbar spine procedures due to decompression and facet resection, even in simple discectomy operations without fusion. Therefore, as in failed back syndrome, recurrent surgeries involve higher risks [16]. As a result of the widespread use of imaging systems and the development of smaller endoscopes, epiduroscopy has begun to take its place among the treatment methods as a minimally invasive procedure.

Although the epiduroscope was used initially only for imaging and opening epidural adhesions, with the development of laser probes, it can now also be used for epiduroscopic discectomy. Trans-Sacral Epiduroscopic Laser Decompression (ELND) procedure is being performed in our institution on eligible patients with chronic low back pain and unsuccessful back surgery.

This study aimed to evaluate the impact of the ELND procedure on the quality of life of patients suffering from chronic low back pain through the SF-36 survey, which assesses various health-related quality of life dimensions. In this study, the SF-36 quality of life survey was administered to 89 patients who underwent the ELND procedure to assess changes in their quality of life before and six months after the procedure. The demographic data of the participants show that 63 of the 89 patients (71%) were female and 26 (29%) were male. Other studies demonstrate that women are more likely than men to seek primary or tertiary care for chronic low back pain, indicating that men are less likely to use healthcare services and more likely to engage in negative health behaviors, such as ignoring pain and other health-related symptoms, compared to women [17]. For example, Lee et al. performed epiduroscopic laser decompression on patients with lumbar spinal stenosis and found that 53% were female [18]. Similarly, a study by Jo et al. reported a female rate of 61% [8].

The SF-36 quality of life survey, administered to patients, evaluates 8 subscales. In a study by Járomi et al., patients with chronic low back pain showed low scores across all subscales of the SF-36 test [19]. Similarly, Derby et al. found that patients with chronic low back pain had low scores on the SF-36 test [20]. In our study, patients also

Table 1. Short Form-36 subscales before and after ELND intervention

SF-36 Subscales	Pre-Intervention	Post-Intervention 6th week	Significance
General Health Perception	54.3 (40-70)	68.3 (55-85)	p<0.05
Physical Functioning	45.0 (5-80)	65.0 (15-90)	p<0.001
Role Limitation - Physical Health	11.0 (0-25)	52.0 (0-100)	p<0.001
Role Limitation - Emotional Problems	67.7 (0-100)	60.2 (33-100)	p<0.01
Social Functioning	27.9 (12.5-37.5)	71.9 (37.3-87.5)	p<0.01
Vitality	19.0 (0-35)	60.0 (35-85)	p<0.001
Pain	10.6 (0-22)	63.0 (41-80)	p<0.001
General Mental Health	50.6 (36-72)	75.3 (64-84)	p<0.001

Scores, Mean (range)

received low scores in all subscales of the SF-36 test conducted before the procedure. These results indicate that chronic low back pain significantly reduces quality of life.

Several studies have evaluated the outcomes of patients who underwent ELND for chronic low back pain, but none of these studies used the SF-36 scale. Instead, they utilized measures such as the Visual Analog Score (VAS) and the Oswestry Disability Index (ODI) [8,21]. For instance, in the study by Mumcu et al., it was reported that the VAS and ODI scores of patients with lumbar disc herniation decreased on the first postoperative day following the ELND procedure [21]. Similarly, in the study by Lee et al. involving patients with lumbar spinal stenosis, VAS scores were evaluated at 1, 3, and 6 months, as well as one and two years after the procedure, revealing a decrease in VAS scores over time. [18].

In the study by Jo et al., the symptoms of patients who underwent epiduroscopic laser decompression were evaluated using a 5-point scale: 5 (very good), 4 (good), 3 (no change), 2 (bad), and 1 (very bad). The survey was administered before the procedure, and then again at 2 weeks and 1-month post-procedure. It was reported that patients experienced symptom relief after the procedure [8]. These findings suggest that the ELND procedure for chronic low back pain is an effective and reliable treatment method that not only reduces pain but also improves the functional and psychological status of patients. In our study, we observed an increase in all subscales of the SF-36 quality of life scale following the ELND procedure.

In the general health perception subscale, efforts were made to determine patients' personal perception of their overall health. Recognizing that diseases are intertwined with personal and social contexts, which influence every aspect of health, we utilized quality-of-life measures to contextualize this understanding. Our study revealed a notable enhancement in patients' health perception within this subscale.

The physical functioning subscale primarily addresses daily physical activities. Our study indicated a significant improvement in patients' daily life dynamics and, consequently, their quality of life as reflected in this subscale. This data gains further significance when we consider the role of chronic low back pain contributing to overall workforce impairment [15]. The physical health role limitation subscale assesses the impact of

physical issues on tasks like work or school. Given the relevance of chronic low back pain to workforce loss, our study found a marked increase in physical role limitation score.

Emotional role limitation examines whether emotional issues affect work or daily activities. Although our study showed an average decrease in emotional role difficulties, overall scores saw a general increase.

Social functioning scores significantly improved post-procedure compared to pre-procedure levels, indicating enhanced social integration following treatment. Vitality, measuring a person's energy and passion for life, notably increased in our study, indicating enhanced vitality among participants.

The pain subscale assesses the presence and impact of pain. Higher scores on the SF-36 pain subscale indicate reduced pain perception and, consequently, an improved quality of life for patients. Participants reported an increase in pain scores post-procedure in our study. An increase in SF-36 pain scores, indicating reduced pain perception, was observed following the ELND procedure. This finding aligns with findings from Mumcu et al., who utilized VAS and ODI scores to document significant pain reduction [21]. A decrease in pain was observed in various other studies utilizing different scoring systems [8,18].

The general mental health subscale evaluates feelings of calmness, happiness, and comfort. Our study observed a statistically significant improvement in mental health indicators.

In our study, although there was an average decrease in emotional role difficulties, there was an overall increase in SF-36 scale following the ELND procedure indicating an increase in the overall quality of life of patients with chronic low back pain. The findings of this study align with previous research indicating that minimally invasive procedures, such as ELND, provide substantial improvements in patients' quality of life. The significant enhancements in physical functioning, general health perception, and social functioning suggest that ELND not only addresses the physical pain but also positively affects patients' overall well-being.

One notable finding was the decrease in the emotional role limitation subscale, indicating that while physical

aspects of health improved, some emotional challenges remained or worsened post-intervention.

An unexpected finding of the present study was the modest but statistically significant decrease in the SF-36 emotional role limitation subscale despite clear improvements in pain, physical functioning, social functioning, vitality, and general mental health. This apparent contradiction may reflect the complex and multifactorial nature of emotional well-being in patients with chronic low back pain. Although ELND effectively alleviates nociceptive input and improves physical capacity, emotional role functioning is strongly influenced by persistent psychosocial stressors, such as work-related pressures, financial concerns, caregiving responsibilities, and long-standing maladaptive coping strategies that may not be resolved in parallel with pain reduction. In addition, patients may experience heightened emotional awareness or increased expectations for rapid psychosocial recovery following a successful intervention; when these expectations are unmet, perceived emotional role functioning may transiently decline. Previous studies evaluating chronic low back pain populations have emphasized that emotional and psychological outcomes are less directly correlated with procedural pain relief than physical domains and are often shaped by depression, anxiety, pain catastrophizing, and social context [19,20]. Similarly, studies of minimally invasive spinal interventions using measures other than SF-36 have reported substantial pain and functional improvements without uniform gains in emotional outcomes. Clinically, these findings underscore the importance of adopting a biopsychosocial approach: interventional pain procedures such as ELND may need to be complemented by psychological assessment, patient education, and, when appropriate, targeted psychosocial or behavioral interventions to optimize emotional role functioning and achieve more holistic recovery.

The limitations of this study include its retrospective design and the lack of a control group, which may affect the generalizability of the findings. Future research with larger sample sizes and randomized controlled designs are recommended to further validate these findings and explore the long-term outcomes of ELND on quality of life.

Low back pain is a significant health problem that most adults experience at least once in their lifetime. It is common and can result in increased costs due to

diagnosis and treatment, as well as a decline in quality of life and productivity.

There was a statistically significant improvement in all subscales of the SF-36 quality of life survey after the ELND procedure, except for emotional problems.

In conclusion, the ELND procedure appears to be an effective minimally invasive treatment option improving the quality of life in patients with chronic refractory low back pain and/or lower extremity pain, comprising conditions such as lumbar disc herniation, lumbar stenosis, and failed back surgery syndrome that do not respond to conservative treatment. Our study indicates that the ELND procedure not only alleviates pain but also enhances the quality of life for patients with chronic low back pain. The significant improvements in various SF-36 subscales indicate that ELND may enhance physical, social, and mental health aspects. However, the observed decline in the emotional role limitation subscale suggests the necessity of addressing emotional health in conjunction with physical treatment to achieve holistic patient care.

Author contributions

Conception: İ.K., N.Ç., A.Ş.; Design: İ.K., Ç.Y., M.A.S., N.Ç., A.Ş.; Data acquisition: İ.K., Ç.Y.; Data analysis: M.A.S.; Data interpretation: İ.K., Ç.Y., M.A.S., N.Ç., A.Ş.; Drafting of the manuscript: İ.K., M.A.S., A.Ş.; Critical revision of the manuscript: Ç.Y., M.A.S., A.Ş. All authors reviewed the results, approved the final version of the manuscript, and agreed to be accountable for all aspects of this study.

Ethical approval

This study was approved by the Hacettepe University Clinical Research Ethics Committee (Date: March 22, 2016, Decision/Protocol No: project registration GO 16/312 and number 16969557-587). Informed consent was obtained from all participants involved in this study.

Data availability statement

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

Conflict of interest

The authors declare that this study was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Generative AI statement

The authors declare that no generative AI or AI-assisted technologies were used in the writing or preparation of this study.

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