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*Department of Anesthesiology and Reanimation, Ankara Atatürk Sanatorium Training and Research Hospital, University of
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The efficacy of lumbar epidural steroid injections in “failed back surgery syndrome” and lumbar radiculopathy

 Saadettin Sevim,  Semih Aydemir,  Emine Nur Tozan

Department of Intensive Care, Ankara Atatürk Sanatorium Training and Research Hospital, University of Health Sciences, Ankara, Türkiye

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Corresponding Author: Semih Aydemir, drsemihaydemir@gmail.com

ABSTRACT

Aims: Lumbago is one of the common conditions in our present community. Definite periods of human's life people encountered in the form of usually regressing attacks that 10-15% of this important condition requires surgical therapy. Cause of wrong diagnosis and treatment Spinal surgery may not always give favourable result. Patients undergone one or more back surgery exist back and/or leg pain which does not improve, is called failed back surgery syndrome. Epidural steroid administration is one of the most invasive method which is used in back pain. Effects and application results are controversial. In this study we aimed to compare the effects of steroid and local anesthetic solutions which administered by epidural way on pain controlling between the patients that have chronic back pain because of lomber radiculopathy, undergone surgery and not surgery.

Methods: It was evaluated retrospectively pain controlling effect of administered steroid and local anesthetics by interlaminar epidural way to ASA 1-2-3, between 18-80 aged 40 patient which undergone piror one or plural back surgery and have no surgery between May 2009-December 2009 apply with back pain complaint to İstanbul Training and Research Hospital Algology Department. Patient's visuel analog scala (VAS) and severity of back pains, before procedure, second week after procedure, fourth week after procedure, sixth week after procedure in either two groups out of ten points was estimated.

Results: Totally of 7 ml solution which contains 1 ml triamsinolon asetonid 40 mg/ml (Sinakort-A ampul, İ.E. Ulugay), 3 ml levobupivacaine 5 mg/ml (Chirocaine ampul, Abbott) and 3 ml serum phsiyologic (0.9% NaCl) administered by epidural way into either two group patients. There were no significant difference between two groups by mean of age, weight, height, BMI and back pain durations. Evaluating the groups into themselves, opioid requirements and VAS scores before injection was markedly higher than 2nd, 4th and 6th week scores in either two groups ($p < 0.05$). There was no statistically significant difference when we compare into groups of 2nd, 4th and 6th week opioid requirements and VAS scores in either two groups. All patient manifested their pleasure and there was no complication occured.

Conclusion: Consequently; it was thought that epidural administration of steroid (triamsinolon), local anesthetics (levobupivacaine) and serum physiologic solution was effective especially on early back pain treatment, also safe method and beneficial to patient satisfaction in the patients who has failed back surgery and chronic back pain.

Keywords: Radicolopaty, pain, steroid

INTRODUCTION

It has been determined that 70-90% of individuals in contemporary society experience lower back pain at least once in their lives. While 75-85% of acute lower back pain cases can be self-resolving within 6-8 weeks without the need for any treatment, 38% of these cases may experience a second attack within a year, and new acute attacks can occur in 41% of subacute lower back pain cases and 81% of chronic lower back pain cases within the same year.¹

The lack of a developed algorithmic, multidisciplinary approach in the diagnosis and treatment of back pain may be one of the main reasons for unsuccessful and incorrect treatments. Surgical treatment is required in only 10-15% of patients with disc herniation.² While the rate of disc herniation in patients with low back pain is given as 5%, one of the leading causes among back operations is lumbar disc herniation; This makes us think about the conditions

under which disc surgery is actually indicated.^{3,4} The presence of persistent back and/or leg pain in patients who have undergone one or more back surgeries is called failed back surgery syndrome (FBSS). It is one of the problems that spinal surgeons frequently encounter. The most common causes include misdiagnosis, operating at the wrong level, and inadequate surgery.⁵ Regardless of the cause of low back pain, the treatment should be arranged in accordance with the algorithm and conservative treatment methods should be applied initially. First of all, the patient's symptoms are controlled and the dysfunctions caused by pain are tried to be reduced as much as possible.⁶ Epidural steroid injection is one of the non-surgical treatment methods for neck and low back pain. Bed rest may be preferred for disc-related waist, leg, neck and arm pain that does not improve with conservative methods such as medication and physical therapy and does not have neurological deficit.⁷

This study aims to compare the effectiveness of epidurally administered steroids and local anesthetic solutions in controlling pain between patients who have undergone surgery for chronic back pain due to lumbar radiculopathy (FBSS) and those who have not undergone surgery.

METHODS

This study was produced from a thesis done in 2010 with the approval of the institution. All procedures were carried out in accordance with the ethical rules and the principles of the Declaration of Helsinki. This retrospective study included 40 consecutive patients aged 18-80, classified as ASA 1-2-3, who had previously undergone one or more back surgeries and had not undergone surgery, and who presented to the Algology outpatient clinic of a university hospital with complaints of back pain between May 2009 and December 2009. The participants were divided into two groups: the Failed Back Surgery Syndrome (FBSS) Group, consisting of 20 patients who had previously undergone one or more back surgeries but continued to experience back and/or leg pain, and the Chronic Back Pain (CBP) Group, consisting of 20 consecutive patients with back pain for at least 3 months, with radicular symptoms in the examination, unresponsive to medical treatment, and with magnetic resonance imaging (MRI) findings consistent with their clinical symptoms.

Inclusion Criteria

Patients fasting for 8 hours before the procedure. Patients with recorded cardiac rhythm, pulse-oximeter, and non-invasive blood pressure measurements in the operating room. Patients with recorded VAS scores routinely taken in our clinic before the procedure, and complete VAS records at pre-procedure, post-procedure, and at the 2nd, 4th, and 6th weeks. Patients in whom a 22G intravenous cannula was inserted into the dorsum of the hand and 500 ml of 0.9% isotonic NaCl solution was administered for premedication before the operation. Patients who received a total of 3 mg of midazolam intravenously for premedication purposes before the operation. Patients included in the study received a combination of interlaminar epidural steroids and local anesthetic components: 1 ml of triamcinolone acetamide

40 mg/mL (Sinacort-A ampule, İ.E. Ulagay), 3 mL of levobupivacaine 5 mg/mL (Chirocaine ampule, Abbott), and 3 mL of physiological saline (0.9% NaCl).

VAS

A 10-point horizontal line was used to indicate pain intensity, with the left side of the line indicating no pain (0 points) and the right side indicating unbearable pain (10 points). Patients were asked to mark their pain level on this line. VAS values of 3 and below were considered to provide effective analgesia.

Exclusion Criteria

Patients who refused to participate in the study. Patients with bleeding diathesis, local infection, or allergy to the drugs used. Pregnant or lactating women. Patients using anticoagulant drugs or platelet aggregation inhibitors. Patients with a history of psychiatric illness. Patients with conditions that may interfere with the evaluation of treatment effectiveness, such as known allergy to steroids. Patients with clinically significant spinal stenosis that may cause neurological deficits. Patients with known systemic diseases (such as diabetes mellitus, chronic renal failure, chronic obstructive pulmonary disease, etc.) that may cause peripheral neuropathy. Patients who received psychological therapy within the last year or planned to receive therapy during the study. Patients who had undergone surgery in the last 6 months. Patients with malignant tumors. Patients with suspected somatic diseases.

Procedure

Visual analog scale (VAS) scores were routinely recorded before the procedure in our clinic. After premedication and a 10-minute wait, patients were placed in the lateral decubitus position with the side where radiculopathy complaints were prominent facing downward. After cleaning the skin with an appropriate antiseptic solution, infiltration anesthesia was applied by injecting 3 ml of 2% lidocaine subcutaneously from the level of the vertebra causing radicular pain. The epidural space was reached with an 18 G Touhy needle using a midline approach and loss of resistance. After confirming the absence of blood or cerebrospinal fluid, the prepared standard solution was injected into the epidural space. Patients were observed for 3 hours, and those without any complications were discharged.

All patients were called for follow-up visits at the 2nd, 4th, and 6th weeks after the injection. During the follow-ups, records were kept regarding VAS scores, opioid use, side effects, patient satisfaction, and recommendations to others.

Statistical Analysis

Statistical analyses were performed using the Statistical Package for the Social Sciences (SPSS) version 18.0 software program. Categorical variables were expressed as percentages, and continuous variables were expressed as mean±standard deviation. The chi-square test was used to compare categorical variables between groups, while independent samples t-test was used to compare continuous variables. Related sample one-way analysis of variance (ANOVA) was used for intra-

group comparisons, and chi-square test and Fisher's exact chi-square test were used for comparison of qualitative data. Benferroni correction was made for intra-group comparisons and the p significance value was taken as 0.008 and corrected to 0.05. Repeated-measures (ANOVA) was used to evaluate changes in VAS scores over time within each group. P-values less than 0.05 were considered statistically significant.

RESULTS

A total of 40 patients were included in the study, with 20 patients in each group. The demographic characteristics of the patients are presented in (Table 1). There were no statistically significant differences between the two groups in terms of age, sex, body-mass index (BMI), and duration of pain.

Table 1. Demographic data and pain characters

	FBSS group	CBP Group	p
Age, mean±SD	51.65±12.39	55±13.92	0.426
Sex, n (%)			
Male	8 (40)	6 (30)	
Female	12 (60)	14 (70)	0.507
Height (cm), mean±SD	164.75±9.73	163.75±7.69	0.720
Weight (kg), mean±SD	63.8±12.34	68.85±8.74	0.144
BMI (kg/m ²), mean±SD	23.47±3.89	25.81±3.84	0.063
Back pain duration(month), mean±SD	6.25±7.12	9.55±9.37	0.218
Pain location			
Right leg, n(%)	6 (30)	3 (15)	
Left leg, n(%)	6 (30)	5 (25)	0.389
Both right and left leg, n(%)	8 (40)	12 (60)	
VAS			
Before drug administration, mean±SD	7.35±0.75	7.15±1.04	0.489
2 nd week, mean±SD	2.7±2.25	2.7±2.01	1
4 th week, mean±SD	3.75±2.17	3.1±1.65	0.294
6 th week, mean±SD	4.2±2.02	3.65±1.69	0.356

FBSS: Failed back surgery syndrome, CBP: Chronic back pain, SD: Standard deviation, BMI: Body mass index, VAS: Visual analog scale

Between the two groups, there is no statistically significant difference in VAS values before injection, at 2nd, 4th, and 6th weeks ($p>0.05$). When evaluated within each group, pre-injection VAS values were significantly higher than the 2nd, 4th, and 6th week VAS values in both groups ($p<0.001$). In Group FBSS, the measured VAS values at the 2nd week were significantly lower than the 6th week VAS values ($p=0.035$). Other than this, there was no statistically significant difference in VAS values at 2nd, 4th, and 6th weeks in intra-group comparisons (FBSS group 2nd/4th week VAS: $p=0.208$, 4th/6th week VAS: $p=0.423$. CBP group 2nd/4th week VAS $p=1$, 2nd/6th week VAS $p=0.321$, 4th/6th week VAS $p=0.365$) (Table 2).

When evaluated within each group, pre-injection opioid requirements were significantly higher than the 2nd, 4th and 6th week VAS values in both groups ($p<0.05$) (Table 3). Other than this, there was no statistically significant difference in opioid requirements at 2nd ($p=0.478$), 4th ($p=0.34$), and 6th ($p=0.759$) weeks between the two groups (Table 4).

None of the patients who participated in the study experienced any of the possible side effects, including nausea,

vomiting, tremors, hypotension, hypertension, allergy, bleeding, and urinary incontinence.

Table 2. VAS values of patients are updated according to the weeks within their group

Opioid requirements	FBSS Group		CBP Group	
	mean	P	mean	P
Before injection/2 nd week	7.35±0.75/2.70±2.25	0.000	7.15±1.04/2.70±2.01	0.000
Before injection/4 th week	7.35±0.75/3.75±2.17	0.000	7.15±1.04/3.10±1.65	0.000
Before injection/6 th week	7.35±0.75/4.20±2.02	0.000	7.15±1.04/3.65±1.69	0.001
2 nd week/4 th week	2.70±2.25/3.75±2.17	0.208	2.70±2.01/3.10±1.65	1.000
2 nd week/6 th week	2.70±2.25/4.20±2.02	0.035	2.70±2.01/3.65±1.69	0.321
4 th week/6 th week	3.75±2.17/4.20±2.02	0.423	0.30±0.47/3.65±1.69	0.365

FBSS: Failed back surgery syndrome, CBP: Chronic back pain

Table 3. Distribution of patients' opioid needs within the groups based on days

Opioid requirements	FBSS Group		CBP Group	
	mean	P	mean	P
Before injection/2 nd week	1±0/0.20±0.41	0.000	1±0/0.30±0.47	0.000
Before injection/4 th week	1±0/0.45±0.51	0.001	0.30±0.47	0.000
Before injection/6 th week	1±0/0.50±0.51	0.002	1±0/0.45±0.51	0.001
2 nd week/4 th week	0.20±0.41/0.45±0.51	0.338	0.30±0.47/0.30±0.47	1.000
2 nd week/6 th week	0.20±0.41/0.50±0.51	0.179	0.30±0.47/0.45±0.51	1.000
4 th week/6 th week	0.45±0.51/0.50±0.51	1.000	0.30±0.47/0.45±0.51	0.497

FBSS: Failed back surgery syndrome, CBP: Chronic back pain

Table 4. Distribution of patients' opioid needs by group

Opioid requirements	FBSS Group		CBP Group		P
	mean	SS	mean	SS	
Before injection	1	0.00	1	0.00	
2 nd week	0.20	0.41	0.30	0.47	0.478
4 th week	0.45	0.51	0.30	0.47	0.340
6 th week	0.50	0.51	0.45	0.51	0.759

FBSS: Failed back surgery syndrome, CBP: Chronic back pain

DISCUSSION

When groups were evaluated internally, pre-injection VAS values were significantly higher than the 2nd, 4th, and 6th-week VAS values in both groups ($p<0.001$). Apart from this, there was no statistically significant difference in intra-group comparisons of VAS values at 2nd, 4th, and 6th weeks. When groups were evaluated internally, pre-injection opioid requirements were significantly higher than the 2nd, 4th, and 6th-week VAS values in both groups ($p<0.05$). There was no statistically significant difference in opioid requirements between the two groups at the 2nd ($p=0.478$), 4th ($p=0.34$), and 6th ($p=0.759$) weeks.

Epidural steroid injection (ESI) is used in the treatment of symptoms of lumbosacral radicular or axial pain caused by spinal stenosis or disc herniation.⁸ Epidural steroid injection is used for secondary neuroradicularitis caused by abnormal nociceptive and inflammatory mediators around lumbosacral disc herniation.⁹ Administered corticosteroids inhibit prostaglandin synthesis, stabilize membranes, block the transmission of nociceptive C fibers, suppress the immune response, increase neuronal blood flow, and accelerate the removal of inflammatory mediators from tissues.¹⁰⁻¹³ The success rate of ESI in patients with low back pain lasting less

than 3 months has been shown to be between 83% and 100% in various studies.¹⁴

Although the success rates of ESI for acute and chronic back pain are initially similar, they decrease to 34% for acute pain and up to 12% for chronic pain at 6 months.¹⁵ In our studies, we found a high success rate in the early period, consistent with the literature. ESI applications should be made at the level where the painful dermatome is closest to the root. The most commonly used steroids are methylprednisolone and triamcinolone. Local anesthetic is added to the combination to be injected, which prevents muscle spasm associated with back pain and also has an effect on root irritation by creating sympathetic blockage.¹⁶ In addition, reflex sympathetic dystrophy that may occur can also be prevented. In our studies, we used a combination of triamcinolone, levobupivacaine, and saline. Studies show that the success rates of surgeries performed for lumbar discopathy exceed 80%. And, after discectomy, up to 70% of patients develop resistant back pain to varying degrees over the years.¹⁷ As the number of surgeries performed increases, the success rate decreases to 5%.¹⁸ Because the etiology of FBSS is very diverse, treatment should be directed towards the cause with a multidisciplinary approach. The success rate of surgical intervention for recurrence or residual disc herniation is close to the success rate of the initial surgery.¹⁹ Back pain is one of the significant causes of workforce loss. According to studies conducted in the United States, the cost of a patient being treated lying down for chronic back pain is estimated to be \$17,225 per year, while outpatient treatment is between \$7,000 and \$10,000. Guo et al.²⁰ found that in the United States, back pain caused 150 million workdays and a loss of \$14 billion annually. They stated that even if improvement is achieved in 1% of these patients, millions of dollars in losses could be prevented. ESI application is both an effective and inexpensive treatment method from this perspective.

One of the biggest challenges faced by those dealing with spinal surgery is the treatment of patients with chronic back pain and/or leg pain. In this case, the most important and effective approach is to surgically remove pathologies that can be removed after examinations, and if there are no indications for decompression, to use other treatment methods.⁵ At this stage, if short-term and rapid recovery is desired, epidural steroid application can be applied.⁶ In the chronic period after spinal surgery, recurrence of disc herniation, scar tissue, pseudofusion, instability, spinal stenosis, and secondary gain should be investigated in patients complaining of pain.⁵

Adhesions in the epidural space can be seen due to various etiologies such as surgical disc herniation, disc fragmentation, infection, vertebral body fracture, arachnoiditis, mechanical instability, pseudomeningocele, and trauma. Studies have suggested that adhesions in the epidural region may prevent the steroid from reaching the target area, leading to inadequate pain control.²¹ They added hyaluronidase to the solution prepared to eliminate these adhesions.^{21,22} Although some studies show effectiveness, in some studies, no significant difference has been found. The sole cause of epidural adhesions is not surgical interventions. Epidural adhesions can also be observed in non-operated patients. In studies related to ESI, patients with back pain generally

caused by the same etiology are preferred. In this thesis study, we aimed to compare the effectiveness of ESI application in patients with FBSS who underwent surgery and patients with CBP who did not undergo surgery.

When each group was evaluated internally, opioid requirements before injection were significantly higher than opioid requirements at 2nd, 4th and 6th weeks. This led us to the conclusion that ESI provided effective analgesia in both groups. There was no statistically significant difference in terms of opioid requirements at 2nd, 4th and 6th weeks both within groups and between groups.

Carette et al.²³ reported in their studies that they performed the 2nd injection to 49% of patients with back pain for 1 month to 1 year, the 3rd injection to 29%, and at the end of the 3rd month, there was no difference between the ESI group and the Placebo group, and 55% of patients were successfully treated. Buchner et al.²⁴ reported a success rate of 41.5% in their studies. In our study, we achieved a high success rate in the early period with ESI application in patients with chronic back pain lasting more than 3 months.

The effectiveness of steroids administered epidurally varies from 18% to 100% in various publications. Saal et al.²⁵ investigated the possible reasons for this and suggested factors such as the presence of serious pathology, failure to deliver the corticosteroid to the target area, decreased activity after the block, and non-injection factors such as not suppressing the pain generator as reasons for the failure of steroid injection.

Riew et al.²⁶ investigated the effectiveness of epidural corticosteroids in a randomized, prospective, controlled double-blind study. Patients were followed up at 2-4-8 weeks after injection and 1 year. Steroid and local anesthetic or local anesthetic alone were given to patients who had previously undergone surgery, and improvement in back and leg pain was less observed in patients who had undergone surgery compared to patients who had not undergone surgery. Both acute and chronic complaints regressed with ESI application. In patients treated with corticosteroids, surgery was not necessary in 71%, while in the local anesthetic group, it was not necessary in 33%.

In our study, there was no statistically significant difference in VAS values between the FBSS group, consisting of surgically treated patients, and the CBP group, consisting of patients with chronic back pain who did not undergo surgery. Although the average VAS values of Group FBSS at 4th and 6 weeks were slightly larger than those of group CBP, this is not statistically significant. No major complications have been reported in large series studies published. The most commonly observed complication is accidental puncture. In our study, we investigated possible complications and side effects, such as nausea, vomiting, tremors, hypotension, hypertension, allergy, bleeding, accidental puncture, and urinary incontinence with spinal block. We did not encounter any complications or side effects in our study.

We have some limitations in this study. First of all, the study is retrospective and single-center. Number of patients in our study Since it is a limited and single-center study, the

results cannot be generalized to a wider population. For this, prospective studies including more patients are needed.

CONCLUSION

It has been concluded that the application of epidural space to steroid (triamcinolone), local anesthetic (levubupivacaine), and saline solution is an effective, reliable method in the treatment of early-stage back pain, especially in patients who have undergone unsuccessful back surgery and in patients with chronic back pain. It has been found to be beneficial in terms of patient satisfaction.

ETHICAL DECLARATIONS

Ethics Committee Approval

This study was produced from a thesis done in 2010 with the approval of the institution.

Informed Consent

Because the study was designed retrospectively, no written informed consent form was obtained from patients.

Referee Evaluation Process

Externally peer-reviewed.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

Financial Disclosure

The authors declared that this study has received no financial support.

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.

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Preoperative patients' knowledge level regarding anesthesia procedures and anesthesiologist responsibilities

 Ruslan Abdullayev¹,  Ömer Ekinci²,  Muhammet Emin Taştan²,  Ömer Saltukalp Uluç²,  Berfin Yavaş²
 Mustafa Berkтуğ Zengin²,  Nurhan Bakır Keser³,  Seyhan Hıdıroğlu³

¹Department of Anesthesiology and Reanimation, Faculty of Medicine, Marmara University, İstanbul, Türkiye

²Medical Student, Faculty of Medicine, Marmara University, İstanbul, Türkiye

³Department of Public Health, Faculty of Medicine, Marmara University, İstanbul, Türkiye

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Corresponding Author: Ruslan Abdullayev, ruslan_jnr@hotmail.com

ABSTRACT

Aims: Anesthesiology plays a pivotal role in modern surgical interventions, yet there remains a lack of public awareness regarding the duties of anesthesiologists. This study aimed to evaluate the knowledge level of preoperative patients regarding anesthesia procedures and anesthesiologists' responsibilities, alongside assessing patient satisfaction with anesthesia polyclinic services.

Methods: A descriptive study was conducted at Marmara University Pendik Training and Research Hospital's Anesthesia Outpatient Clinic. A total of 164 preoperative patients were surveyed using a questionnaire comprising socio-demographic questions, health status inquiries, knowledge assessment regarding anesthesia, and satisfaction evaluation of anesthesia polyclinic services.

Results: Results showed inadequate knowledge levels among participants regarding anesthesiologists' duties, despite high satisfaction scores. Educational status correlated positively with knowledge levels, with university-educated individuals exhibiting better understanding. However, no significant differences in demographic characteristics were found between groups with low and high knowledge levels. Moreover, a weak positive correlation was observed between knowledge level and patient satisfaction.

Conclusion: The findings underscore the importance of providing comprehensive information during preoperative assessment to enhance patient awareness and satisfaction. Organizational adjustments in anesthesia clinics and media involvement are suggested to raise public awareness about anesthesiologists' roles. This study highlights the need for tailored patient education strategies to bridge the knowledge gap and optimize perioperative care outcomes.

Keywords: Anesthetist, education, polyclinic, preparation, satisfaction, surgery

INTRODUCTION

Anesthesiology and reanimation, officially recognized as a separate specialty in Türkiye since 1956, has been increasingly contributing to surgical successes with the integration of technological advancements into the field of medicine.^{1,2} Anesthesia specialists not only work in operating rooms but also in preoperative evaluation clinics, pain management clinics, outpatient sedation units, and intensive care units. However, it cannot be said that the public is well-informed about this, as supported by both national and international studies.^{3,4} This is a significant issue because initiatives to increase health literacy affect patient outcomes.⁵⁻⁷ Patients

scheduled for surgery experience significant anxiety, which negatively impacts surgical outcomes. Studies have shown an inverse relationship between knowledge levels and anxiety levels, indicating that efforts should be made to increase knowledge levels.⁸⁻¹⁰

The aim of our study was to assess the level of knowledge about anesthesia procedures and the duties of an anesthetist among patients undergoing surgery at a university hospital, as well as to measure patient satisfaction with outpatient clinic services.

METHODS

Our study is descriptive for which ethical approval was obtained from Marmara University Faculty of Medicine Clinical Researches Ethics Committee (Date: 06.01.2023, Decision No: 09.2023.97). All procedures were carried out in accordance with the ethical rules and the principles of the Declaration of Helsinki. Preoperative patients aged between 18-65 years who applied to the Anesthesia Outpatient Clinic of Marmara University Pendik Training and Research Hospital and had no communication barriers constituted the population of the study. Accordingly, after providing necessary information about the research to the patients through face-to-face interviews and obtaining voluntary consent forms, the required data were collected. The data collection process was conducted between February-May 2023. The collected data were transferred to Microsoft Excel program. Permission was also obtained from the Chief Physician of the hospital.

During the data collection process, a specific scale was not used. The survey questions were developed by the researchers based on a literature review. The survey consists of 30 questions (Appendix) to measure patients' health status, knowledge level about anesthesia, and satisfaction level with the services provided at the anesthesia outpatient clinic. Three socio-demographic questions, three questions related to health status, 17 questions to measure the knowledge level about anesthesia in true-false and multiple-choice formats, and seven questions in five-point Likert scale format to measure satisfaction level were asked. For the section of the survey aimed at measuring patients' knowledge about anesthesia procedures and the anesthesiologist's duties, each correct answer in the 17-item section was scored as 1, while each incorrect answer was scored as 0. In the section of the survey measuring satisfaction with outpatient clinic services, which included seven questions in a 5-point Likert scale format, each response was calculated to receive a score ranging from 1 to 5. Consequently, the highest possible score that could be obtained from this section of the survey was 35.¹¹

Jamovi 2.3 software (www.jamovi.org) was used for data analysis. First, a normality test was conducted for data evaluation. Since the data did not show normal distribution, t-tests could not be performed. Mann-Whitney U test was used for the analysis of two independent variables, and ANOVA test for the analysis of more than two independent variables with Tukey post-hoc test for pairwise group comparisons. Spearman test was used for correlation analysis. The statistical significance level was accepted as $p < 0.05$. No power analysis was conducted for the study.

RESULTS

A total of 430 patients were selected for our study. Among these patients, 175 agreed to participate. Due to inadequate communication with 11 patients, the survey could not be completed, resulting in a final sample size of 164 patients. The flow chart of the study is presented in Figure 1. Of the analyzed patients, 110 were female (67.1%), and the median age was 45 years. The demographic and clinical characteristics of the patients are presented in Table 1.

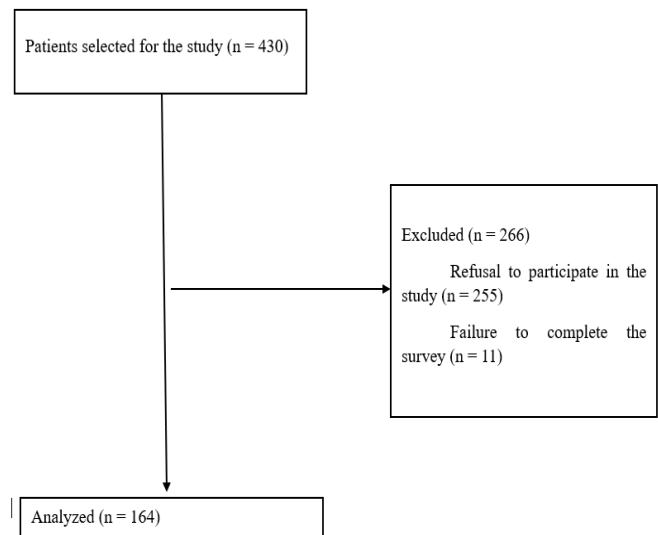


Figure 1. Study flow diagram

Table 1. Demographic and clinical characteristics of preoperative patients

Age (year)	45 (35-54)
18-34	39 (23.8)
35-49	60 (36.6)
50-65	65 (39.6)
Gender	
Male	54 (32.9)
Female	110 (67.1)
Education status	
No	5 (3.0)
Primary school	53 (32.3)
Middle school	19 (11.6)
High school	38 (23.2)
University	44 (26.8)
Above university	5 (3.0)
Number of chronic diseases	
0	89 (54.3)
1	40 (24.4)
2	17 (10.4)
3	10 (6.1)
≥4	8 (4.8)
Number of medications used	
0	81 (49.4)
1	37 (22.6)
2	18 (11.0)
3	10 (6.1)
≥4	18 (10.9)
Previous surgery	
Yes	111 (67.7)
No	53 (32.3)
Note: Numerical data are given as median (25th-75th percentiles) and categorical data as number (%)	

Regarding their educational status, 58 participants (35.3%) had primary school or below level of education, 57 (34.8%) had middle or high school level of education, and 49 (29.8%) had university or higher-level education. Among the patients, 75 (45.7%) had chronic illnesses, and 83 (50.6%) were using at least one medication.

For the section of the survey aimed at measuring patients' knowledge about anesthesia, the minimum score that was obtained was 2, and the maximum score observed was 17. Of the participants, 89 (54.3%) were categorized as having "high knowledge levels" as they scored above the median value, as shown in.

In the section of the survey measuring satisfaction with outpatient clinic services, the minimum and maximum observed scores were 7 and 35, respectively. Of the participants, 84 (51.2%) were categorized as having "high satisfaction levels" as they scored above the median value, as shown in Table 2.

Table 2. Patients' level of knowledge about anesthesia and anesthesiologist's duties and outpatient clinic satisfaction levels

Knowledge level	n (%)
Low level of knowledge	11 (9-12)
High level of knowledge	75 (45.7)
Satisfaction level	30 (26-34)
Low satisfaction level	80 (48.8)
High satisfaction level	84 (51.2)

Note: Numerical data are given as median (25th-75th percentiles) and categorical data as number (%)

Regarding the section of the survey related to anesthesia and the anesthesiologist's duties, participants provided the highest percentage of correct answers (82.3%) to the question "Who administers anesthesia during surgery?" The lowest percentage of correct answers (7.9%) was observed for the question "Who manages your early postoperative pain?" For true/false questions, the lowest percentage of correct answers (29.3%) was observed for the question "An anesthesiologist monitors blood loss during surgery and administers blood, if necessary," as shown in Table 3.

In the satisfaction section of the survey, satisfaction scores were generally high for most questions, with some exceptions. For questions 1, 5, 6, and 7 of the survey (see Appendix), participants' responses of "agree" or "strongly agree" were 94.5%, 90.2%, 89.6%, and 90.3%, respectively. However, only 64% of participants were satisfied with the statement "Adequate information was provided about the anesthesia procedures to be performed and their possible side effects," and 69.5% were satisfied with the statement "Adequate information was provided about the medications you need to stop or take before surgery." The lowest satisfaction rate (54.2%) was observed for the statement "You were informed about how long you should refrain from consuming liquids/solid foods before surgery."

Significant differences were observed in the variability of knowledge level scores according to the categorized education levels of the participants; For "Elementary school and below," "Middle and high school," and "University and above," the mean knowledge level scores were 9.93 ± 2.56 , 10.5 ± 2.67 , and 11.4 ± 2.23 , respectively (ANOVA, $p=0.008$). In pairwise comparisons between the groups, it was determined that this difference existed between the "Elementary school and below" and "University and above" groups (Tukey post-hoc test, $p=0.009$) No significant differences were found in demographic data, educational level, and history of previous surgeries

Table 3. Descriptive statistics of the knowledge level questions of the questionnaire about anesthesia and anesthesiologist's duties

Questions and answers	n (%)
Who is an anesthesiologist	
Nurse	5 (3.0)
Technician	16 (9.8)
General practitioner	11 (6.7)
Assistant doctor	25 (15.2)
Specialist doctor*	107 (65.2)
How anesthesia is administered	
By intravenous medication	49 (29.9)
By sniffing gas	9 (5.5)
Only the surgical area is anesthetized	13 (7.9)
All*	93 (56.7)
Who administers anesthesia during surgery	
The doctor who performs the surgery	9 (5.5)
Assistant of the doctor who performs the surgery	5 (3.0)
Anesthesiologist*	135 (82.3)
Nurse	9 (5.5)
Technician	6 (3.7)
Who monitors your breathing, blood pressure and pulse during surgery?	
The doctor who performs the surgery	21 (12.8)
Assistant of the doctor who performs the surgery	30 (18.3)
Anesthesiologist*	60 (36.6)
Nurse	44 (26.8)
Technician*	9 (5.5)
Who intervenes if there is a problem with breathing or circulation during surgery	
The doctor who performs the surgery	101 (61.6)
Assistant of the doctor who performs the surgery	19 (11.6)
Anesthesiologist*	33 (20.1)
Nurse	8 (4.9)
Technician	3 (1.8)
Who takes care of your pain in the early postoperative period	
The doctor who performs the surgery	66 (40.2)
Assistant of the doctor who performs the surgery	37 (22.6)
Anesthesiologist*	13 (7.9)
Nurse	46 (28.0)
Technician	2 (1.2)
SUGGESTIONS	
The anesthesiologist decides whether the patient is suitable for surgery (T)	144 (87.8)
The anesthesiologist decides how long before surgery the patient will stop eating and drinking (T)	117 (71.3)
The anesthesiologist decides on the medications the patient should take and discontinue before surgery (T)	125 (76.2)
The anesthesiologist administers the drugs needed for anesthesia before and during surgery (T)	139 (84.8)
An anesthesiologist performs the patient's surgery (F)	157 (95.7)
Anesthesiologist performs regional anesthesia (T)	137 (83.5)
Anesthesiologist monitors parameters such as blood pressure, pulse, respiration during surgery (T)	99 (60.4)
The anesthesiologist monitors blood loss during surgery and gives blood if necessary (T)	48 (29.3)
Anesthesiologist can work in intensive care (T)	97 (59.1)
The anesthesiologist organizes all treatment of the patient on the ward (F)	140 (85.4)
An anesthesiologist resuscitates patients by applying life support when necessary (T)	88 (53.7)

Note: Data are given in numbers and percentages. *Correct answer. T, true; F, false

between the groups categorized by low and high knowledge level scores, as shown in Table 4, Figure 2 and Figure 3.

Table 4. Distribution of parameters in low and high knowledge groups

	Low level of knowledge (n = 75)	High level of knowledge (n = 89)	P
Age (year)			
18-34	17 (43.6)	22 (56.4)	0.171
35-49	33 (55.0)	27 (45.0)	
50-65	25 (38.5)	40 (61.5)	
Gender			
Male	28 (51.9)	26 (48.1)	0.270
Female	47 (42.7)	63 (57.3)	
Education status			
Primary school and below	32 (55.2)	26 (44.8)	0.063
Middle and high school	27 (47.4)	30 (52.6)	
University and above	16 (32.7)	33 (67.3)	
Previous surgery			
Yes	51 (45.9)	60 (54.1)	0.936
No	24 (45.3)	29 (54.7)	

Note: Data are given in numbers and percentages

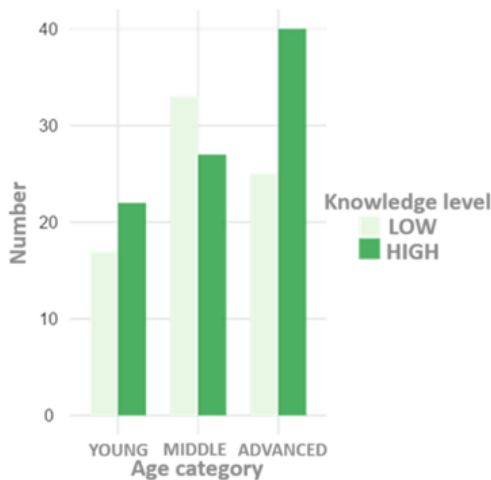


Figure 2. Distribution of knowledge level ratings by age categories
* Young: 18-34 years, middle: 35-49 years, advanced: 50-65 years. p = 0.171

Finally, correlations were examined between age, educational level, number of chronic diseases, number of medications used, total knowledge level, and total satisfaction scores. A weak positive correlation was found between educational level and total knowledge level (Spearman rho=0.240, p=0.002). Similarly, a weak positive correlation was found between total knowledge level and total satisfaction score (Spearman rho=0.285, p<0.001), as shown in Table 5.

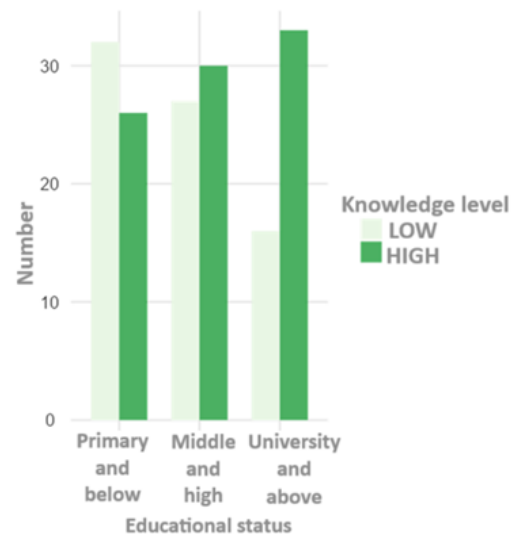


Figure 3. Distribution of knowledge level ratings according to educational status categories
* p = 0.063

Table 5. Correlation table between age, education level, number of chronic diseases, number of medications used, total level of knowledge and total satisfaction scores

	Age	Education	Number of chronic diseases	Number of medications used	Level of knowledge	Satisfaction score
Age						
Education	rho:0.442 p <0.001*					
Number of chronic diseases	rho: 0.434 p <0.001*	rho: 0.273 p <0.001*				
Number of medications used	rho: 0.384 p <0.001*	rho: 0.217 p = 0.005*	rho: 0.720 p <0.001*			
Level of knowledge	rho: 0.055 p = 0.483	rho: 0.240 p = 0.002*	rho: 0.022 p = 0.777	rho: 0.073 p = 0.352		
Satisfaction score	rho: 0.053 p = 0.497	rho: 0.109 p = 0.163	rho: 0.049 p = 0.535	rho: 0.057 p = 0.466	rho: 0.285 p <0.001*	

Note: Spearman test was used. *p <0.05

DISCUSSION

The main finding of our study was that patients attending the anesthesia clinic for preoperative assessment had insufficient knowledge about the duties of anesthetists, yet most patients reported high satisfaction scores. The median score obtained for the section of our survey regarding the duties and responsibilities of anesthetists, which consisted of a total of 17 points, was 11. While some patients answered all questions correctly in this section, there were also those who scored only 2 points. In the literature, there are varying results from different countries regarding the public's knowledge about the duties of anesthetists. In a study by Gottschalk et al.,³ it was found that in the United States, Australia, and Germany, the rates of knowing that anesthetists work in intensive care

units (ICUs) ranged from 42 to 71%. Looking at various studies conducted in our country, in the study by Türkyılmaz et al.,² this rate was 22%, while in the study by Sagün et al.,¹² it was 4%. In our study, 59% of the participants stated that anesthetists could work in ICUs.

One of the least known areas regarding anesthetists is their responsibility for acute postoperative pain management. The rates of having an idea about this issue in the literature vary between 3.5-67%.^{1,13-17} In our study, only 7.9% of the patients had correct knowledge about this, which was the question with the lowest correct response rate in our survey. Another question with a low rate of correct responses in our survey was about the responsibilities of anesthetists in perioperative bleeding monitoring and¹ transfusion management. In a recent study, Kayaaltı¹ found this rate to be around 14%. It's worth considering that his study was conducted in a district state hospital, which she also emphasized in her article. In the study by Türkyılmaz et al.,² this rate was around 29%, which was consistent with the numbers in our study.

Despite the disappointingly low rates of knowledge, participants' satisfaction scores were quite high. In our survey, nearly 90% of the participants indicated satisfaction in four out of the seven questions we prepared regarding satisfaction. However, there were still areas where they were not satisfied, and we would like to draw attention to these. Participant satisfaction rates regarding information about the anesthesia procedures and possible side effects, medications that should or should not be taken preoperatively, and preoperative fasting duration were around 50-70%. Especially regarding preoperative fasting, it is an important issue that requires attention due to potential serious morbidities such as postponement of the elective surgery or vomiting-aspiration if not adhered to. Due to limited time in preoperative assessment units, communication difficulties with patients, and uncertainty about the surgery date, unfortunately, we anesthetists often delegate the responsibility of informing patients about preoperative fasting to surgeons, and sometimes even to ward nurses. Considering issues that may arise in patients with comorbidities like diabetes mellitus or prolonged fasting duration, it would be more appropriate for anesthetists to provide detailed information on this matter. Instead of applying a rule like "no eating or drinking after midnight" to all patients, implementing personalized protocols would be a more accurate approach. The proportion of individuals in the community who are aware of the anesthetist's role in preoperative fasting duration ranges from around 32 to 54% in our national studies.^{1,2} In our study, this rate was 54.2%, which was consistent with the literature.

In our study, participants were categorized into three educational levels: 1) Primary school or below, 2) Middle and high school, 3) university and above. When comparing these three educational categories, it was found that individuals with primary school education or below had significantly lower levels of knowledge about the duties of anesthetists compared to those with university or above-level education (9.93±2.56 and 11.4±2.23, respectively, p=0.008). Moreover,

we had identified a weak but significant positive correlation between educational level and total knowledge level. Frankly speaking, it is ambiguous whether this difference in numbers would be significant enough in reality or whether it would have a considerable impact on patients' clinical outcomes. Indeed, when patients were grouped as having low or high levels of knowledge, no significant differences were found between them in terms of age, gender, education level, or surgical history. In studies by Yoldaş et al.,¹⁰ more than half of the patients had a high level of education, yet a significant portion stated that they did not even know why they were referred to the anesthesia clinic. Studies show significant differences between countries. In the literature, the percentage of individuals who know that an anesthetist is a physician varies between 20-95% in different countries.¹⁸⁻²² It is not entirely correct to attribute this issue solely to education. Allocating sufficient time for preoperative patient preparation and informing them by an anesthetist during the polyclinic visit would largely address this issue. It is important to organize the workflow and personnel of anesthesia clinics accordingly. National press and media can also play an important role in raising public awareness about the duties of anesthetists.

Having a high level of knowledge about anesthesia and anesthetists can increase patient satisfaction. In our study, we had identified a weak but positive correlation between knowledge level and satisfaction. A high level of knowledge not only affects subjective measures like satisfaction but also influences the patient's anxiety. There are studies in the literature demonstrating a significant relationship between knowledge level and anxiety.^{23,24} As knowledge level increases, anxiety decreases. While some anxiety is normal in the preoperative period, excessive anxiety can lead to dysfunction of the autonomic nervous system, tachycardia, hypertension, arrhythmia, and increased need for anesthetic drugs.²⁵⁻³⁰ High levels of anxiety have been associated with high postoperative pain scores, increased incidence of nausea and vomiting, and prolonged recovery.³¹

Limitations

We had some limitations in our study. First, the participants largely came from a specific region, representing only the geography they live in. Data obtained from regions with different sociocultural levels may yield different results. Second, we did not use a scale for anxiety in our study. Therefore, we could not objectively examine the relationship between knowledge level and anxiety.

CONCLUSION

Our study revealed that patients visiting the anesthesia clinic had insufficient knowledge about the duties of anesthetists, yet their satisfaction scores were high. Although there was a numerical difference between education and knowledge levels, it is uncertain whether these values are significant enough to be reflected in clinical outcomes. It is crucial for patients undergoing preoperative preparation to be adequately informed by an anesthetist with sufficient time

allocated in the polyclinic. It may be beneficial to organize the logistics of anesthesia clinics accordingly and involve the national press and media in raising awareness in the public.

ETHICAL DECLARATIONS

Ethics Committee Approval

The study was carried out with the permission of Marmara University Faculty of Medicine Clinical Researches Ethics Committee (Date: 06.01.2023, Decision No: 09.2023.97).

Informed Consent

All patients signed and free and informed consent form.

Referee Evaluation Process

Externally peer-reviewed.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

Financial Disclosure

The authors declared that this study has received no financial support.

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.

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Acupuncture in critically ill patients

 Nevzat Mehmet Mutlu¹,  Özlem Balkız Soysal²,  Ayşe Pınar Titiz³,  Emine Nilgün Zengin²,  Zeynep Nur Akçaboy⁴

¹Department of Critical Care, Ankara Bilkent City Hospital, Ankara, Türkiye

²Department of Anesthesiology and Reanimation, Ankara Bilkent City Hospital, Ankara, Türkiye

³Department of Neurology, Ankara Bilkent City Hospital, Ankara, Türkiye

⁴Department of Anesthesiology and Reanimation, Ankara Bilkent City Hospital, Ankara, Türkiye

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Corresponding Author: Nevzat Mehmet Mutlu, mutlunm@gmail.com

ABSTRACT

Acupuncture has been used in Eastern medicine for thousands of years for a variety of conditions and illnesses. However, there is very little literature on the use of acupuncture in intensive care. In this review, we examine the role of acupuncture in intensive care, pain, stress, anxiety, sleep quality, treatment support, reduction of side effects, respiratory problems, circulatory shock, immune system and nutritional support, and functional recovery after critical illness.

Keywords: Acupuncture, critical care, critically ill, traditional Chinese medicine, review

INTRODUCTION

Acupuncture has been used in traditional Chinese medicine for more than 2000 years.¹ According to this traditional approach, health is maintained by the regular flow of energy in the body, and disease is caused by the internal imbalance of Yin and Yang. The mechanism of action of acupuncture is not clear. It is accepted that there are 12 primary and 8 secondary meridians in the human body, and when internal imbalance occurs, the flow of Qi (life energy) along the meridians is blocked. It is believed that there are more than 400 acupuncture points on the meridians and by stimulating them, the blood flow to certain parts of the body increases and the imbalance improves.^{2,3}

While the Chinese often use traditional Chinese medicine and western medicine together, combined use is less common in Europe, America and in our country.⁴ Many published studies have demonstrated the efficacy of acupuncture in critical or non-critical diseases.⁵⁻⁸

Research on the use of acupuncture in intensive care unit (ICU) patients is still scarce. In this review, we aimed to summarize the use of acupuncture in critically ill patients.

The use of acupuncture in critically ill patients was evaluated under 8 main topics.

1-Pain Management

Patients in the ICU often experience severe pain. Acupuncture can help reduce this pain and minimize the use of medication.⁶

2-Anxiety and Stress Relief

Intensive care is associated with high levels of stress and anxiety for patients. Acupuncture can help alleviate these conditions by providing relaxation.⁶

3-Improving Sleep Quality

Critically ill patients in the ICU patients often experience insomnia. Acupuncture can improve sleep patterns and help patients to rest better.⁶

4-Supportive Treatment and Reduction of Side Effects

Acupuncture can help treat some diseases and accelerate the healing process.⁹⁻¹¹ Acupuncture can reduce medications and minimize the risk of side effects.¹²

5-Respiratory Problems

Intensive care patients often experience respiratory problems. Acupuncture can help improve respiratory function.^{7,8}

6-Treatment of Circulatory Shock and Immune System Support

It has been suggested that it can be used in the treatment of hypertension, cardiovascular failure, chronic cardiovascular diseases. The immune systems of intensive care patients may be weakened. Acupuncture can also be used to support the immune system.^{13,15}

7-Nutritional Support

Acupuncture may be effective in regulating nutrition by facilitating gastric emptying and preventing nausea and vomiting.¹³

8-Functional Recovery After Critical Illness

It can be used in the treatment of Intensive Care Unit Acquired Weakness (ICUAW) that may develop after critical illness.¹³

PAIN MANAGEMENT

Research shows that acupuncture has potential benefits in pain management. The insertion of an acupuncture needle stimulates pain receptors, which are free nerve endings, causing the release of endogenous opioids known to be involved in pain control. The pain control system is activated. Neurotransmitters such as beta endorphins, enkephalins and serotonin are involved in the analgesic system. Enkephalins are released from most of the fibers originating from the periaqueductal gray matter and periventricular nuclei and terminating in the nucleus raphe magnus. Enkephalins have a high affinity for mu1 and delta receptors among opioid receptors¹⁶ and enkephalins released by painful stimuli bind to mu1 receptors to produce supraspinal analgesia and to delta receptors to produce spinal analgesia. The painful stimulus causes the release of serotonin from nerve fibers originating in the raphe nuclei and terminating in the dorsal horn of the spinal cord, and of enkephalins from local spinal cord neurons. The released enkephalins are thought to cause presynaptic and postsynaptic inhibition where C and A-delta nerve fibers synapse in the dorsal horn.¹⁷

It has been reported that the analgesic effect of electroacupuncture (EA) may be due to the secretion of beta endorphin from the pituitary gland¹⁸ and the increase in its concentration in plasma and the central nervous system.^{19,20} An increase in the secretion of beta endorphin and ACTH from the anterior lobe of the pituitary by EA application²¹ and an increase in plasma levels have been observed.²² In particular, it has been observed that the analgesic effect induced by EA is associated with beta endorphin concentration in brain tissue, and EA application is more effective than needle acupuncture application in terms of analgesic effect.²³

Acupuncture has been shown to be effective in reducing pain, especially in conditions such as chronic pain,

migraines, and low back pain. Intensive care patients can also experience severe pain, so acupuncture may be an option for pain relief. Acupuncture may be used in certain types of patients to treat pain in the ICU.

Treatment of Postoperative Pain

Acupuncture can be used to treat postoperative pain. Postoperative pain can be severe, and acupuncture, in addition to traditional pain management methods, can help reduce pain. Acupuncture points commonly used in the treatment of postoperative pain:

- **Hegu (LI-4)**: This point is located between the thumb and forefinger of the hand. It is effective in relieving pain such as headache and facial pain.²⁴
- **Zusanli (ST-36)**: This point is located on the front of the leg, just below the knee. It can help relieve generalized pain and strengthen the immune system.²⁵
- **Sanyinjiao (SP-6)**: This point is located on the inside of the leg, just above the ankle. It is used to relieve abdominal and pelvic pain.^{24,25}
- **Quchi (LI-11)**: This point is located on the outside of the elbow, just above the elbow crease. It can help relieve inflammation and muscle pain.²⁵
- **Fengchi (GB-20)**: This point is located on both sides of the neck, in the nape of the neck. It is used to treat headache and neck pain.¹⁵
- **Taichong (LV-3)**: This point is located on the foot, between the big toe and the second toe. It is used to relieve pain associated with the liver.²⁶
- **Huantiao (GB-30)**: This point is located on the outside of the hip, just above the hip bone. It is effective in treating hip and leg pain.^{27,28}

Treatment of Chronic Pain

Acupuncture may be preferred in chronic pain conditions, especially in cases such as migraines, low back pain, and fibromyalgia. Acupuncture can be effective in relieving such pain.

Acupuncture Points for Migraines

- **Yintang (EX-HN3)**: Located in the center of the forehead, this point can help relieve migraines.²⁵
- **Taiyang (EX-HN5)**: May be effective in relieving pain around the eyes.²⁵
- **Hegu (LI4)**: May be used to relieve headache.²⁵

Acupuncture Points for Back Pain

- **Weizhong (BL40)**: Helps relieve lower back pain, this point can reduce tension in the legs and lower back.²⁸
- **Shenshu (BL23)**: May be effective in relieving low back pain.²⁸

Acupuncture Points for Fibromyalgia

- **Ashi points**: Points applied to the most sensitive areas for common aches and pains such as fibromyalgia.
- **Sanyinjiao (SP6)**: May help relieve muscle pain.^{24,26}

Sensitivity to Pain Medications

Some patients may be sensitive or unable to take pain medication. In this case, acupuncture may be an alternative for pain management.

Combined Treatment

Acupuncture can be used in combination with other treatments. Treatment plans for ICU patients usually include multiple approaches, so acupuncture can be used in combination with other treatments.^{15,24}

ANXIETY AND STRESS RELIEF

Acupuncture can help manage stress and anxiety in the ICU. Intensive care patients have a high tendency to experience stress and anxiety because the treatment processes are stressful and worrisome. Serotonin and enkephalin levels in the central nervous system and plasma are increased with acupuncture causing regulation of the mental and psychological state. Acupuncture can contribute to the treatment of stress, anxiety and depression in these patients.¹⁵

Some studies show that acupuncture reduces stress and anxiety levels in intensive care patients. In particular, it is thought that acupuncture may help patients sleep better and experience a general sense of well-being due to its relaxing effects.⁶

Zheng et al.²⁹ showed that EA can reduce the dose of midazolam required for sedation in mechanically ventilated patients, while Feeney et al.³⁰ reported that acupuncture provided benefits in pain and anxiety and a significant reduction in morphine use after treatment.

Delirium is recognized as a common and serious problem in the ICU, as it is strongly associated with ICU length of stay, organ dysfunction, and mortality.³¹ Although there is insufficient evidence to support the routine use of non-pharmacological strategies for the treatment and prevention of delirium, acupuncture has been reported in the literature as an alternative approach to delirium prevention. Compared with standard care in hospitalized patients, acupuncture has been shown to achieve faster remission of delirium and significantly more delirium-free days in those who received acupuncture.³² In conclusion, acupuncture appears to be an effective part of a non-pharmacologic strategy to manage agitation, pain, and delirium in the ICU.

Some important acupuncture points used for this purpose include:

- **Yin Tang (Third Eye):** Located in the center of the forehead, this point can help reduce stress and anxiety with its calming effect.²⁶
- **Shen Men (Spirit Gate):** Located in the ear, this point has the potential to bring calm and relaxation. It can help reduce stress.²⁶
- **Neiguan (Gate of Insight):** Located on the wrist, this point can help relieve stress and reduce anxiety.²⁶
- **Zusanli (Three Mile Stone):** Located below the knee, this point can help balance energy and promote tranquility.²⁶
- **Sanyinjiao (Three Yin Combination):** Located on the

inside of the legs, this point can help reduce stress and promote relaxation.²⁶

- **Hegu (Open Passage):** Located on the wrist, this point can help calm and reduce anxiety.²⁶
- **Taixi (Great Stream):** Located on the ankle, this point has the potential to bring calm and relaxation.²⁶
- **Fengchi (Wind Pool):** Located on the back of the neck, this point can help reduce stress.¹⁵

IMPROVING SLEEP QUALITY

54 pressure points are used to alleviate sleep problems. The Shen Men point, the 7th acupuncture point (HT7) of the heart meridian, is one of the most commonly used points.^{34,35} Studies have shown that acupuncture improves sleep quality in people with sleep problems.³⁶⁻³⁹

In the ICU patient, acupuncture reduces stress, anxiety, and pain; increases blood circulation; contributes to healing and relaxation in the body; and provides relaxation by increasing the release of endorphins, a natural painkiller. All of these effects help to improve sleep quality by reducing sleep disturbances.^{6,24}

SUPPORTIVE TREATMENT AND REDUCTION OF SIDE EFFECTS

Acupuncture can help treat some diseases and speed up the healing process. When acupuncture is used as a supportive treatment in addition to standard treatments, it can positively contribute to the treatment and healing process by reducing symptoms such as pain, nausea and vomiting.⁹⁻¹¹

Acupuncture can reduce dependence on medications and minimize the risk of side effects. It has been shown to reduce side effects such as nausea, pruritus, dizziness, sedation, urinary retention, and delayed gastric emptying that can occur with postoperative opioid use. It has been shown to reduce the need for narcotic use in the perioperative and intensive care settings.⁹⁻¹²

RESPIRATORY PROBLEMS

Critical care patients often have respiratory problems and may require mechanical ventilation. These patients may be difficult to wean from mechanical ventilation. Prolonged mechanical ventilation can lead to morbidity and mortality due to ventilator-associated pneumonia and muscle weakness.^{40,41}

Acupuncture may help improve respiratory function. In particular, patients with respiratory problems such as lung disease, asthma or chronic obstructive pulmonary disease have been reported to experience beneficial effects of acupuncture. These beneficial effects are thought to be clinically related to a decrease in dyspnea, an increase in respiratory muscle strength, functional respiratory indices, improvement in chest wall mobility, and an increase in beta endorphin levels. The number of articles investigating the effects of acupuncture in critically ill patients on mechanical ventilation in the ICU is still insufficient.

Matsumoto-Miyazaki et al.⁸ retrospectively evaluated the effect of acupuncture on respiration in intensive care patients undergoing long-term MV. They found that respiratory rate, heart rate, and rapid shallow breathing index decreased significantly immediately after acupuncture, while tidal volume and dynamic compliance of the respiratory system increased significantly. They also found that the increase in dynamic compliance was greater in the successful weaning group.

Two studies compared the effect of acupuncture with conventional therapy in the treatment of pneumonia. One study showed that acupuncture plus the classic herbal formula Da Cheng Qi decoction (Da Huang 12 g, Mang Xiao 8 g, Hou Pu 24 g, Zhi Shi 5 g) was effective in improving clinical symptom scores, shortening mechanical ventilation times, and reducing antibiotic use. Patients were randomly divided into an acupuncture treatment group and a control group. In this investigation, ST36 (Zusanli) was selected bilaterally for the patients in the treatment group. The needles were manipulated using the Ping Bu Ping Xie (mild tonifying and attenuating) technique. Another study showed how the administration of conventional drug therapy with acupuncture and herbs increased the rate of favorable patient outcomes. The treatment group received acupuncture at CV10 (Xiawan), ST25 (Tianshu), RN4 (Guanyuan), ST36 (Zusanli). The study found that patients who received acupuncture plus drug therapy had significantly better outcomes than patients in the drug monotherapy control group.⁴²

In conclusion, the addition of acupuncture to standard care can positively regulate respiratory parameters and support successful weaning from long-term mechanical ventilation in patients followed in the ICU.^{7,8}

Acupuncture is thought to help regulate the flow of energy in the body and can relieve spasms in the airways. Here are some common acupuncture points used to improve respiratory function:

- **Renzhong (GV26):** Located at the junction of the upper lip and nose, this point can help relax the airways and facilitate breathing.^{43,44}
- **Fengchi (GB20):** This point is located on the back of the head, just above the neck. It can be used to relieve breathing problems.¹⁵
- **Feishu (BL13):** Located in the middle of the back, this point is associated with the lungs and can relieve respiratory problems.⁴⁵
- **Pishu (BL20) and Shenshu (BL23):** These points can help strengthen the kidneys and the immune system, which can have a positive effect on breathing.⁴⁶
- **Tiantu (CV22):** Located in the center of the throat, this point can be used to relieve respiratory problems.⁴⁷
- **Quchi (LI11):** This point is located on the outside of the arm near the elbow. It can help relieve breathing problems.^{48,49}

TREATMENT OF CIRCULATORY SHOCK AND IMMUNE SYSTEM SUPPORT

Although complementary therapies for shock resuscitation

and intensive care remain current, acupuncture is still not included in standard treatment protocols for cardiovascular failure.⁵⁰ The number of studies on this topic is small and based on animal experimental results. One of these is the animal study by Li et al.⁵¹ in which EA stimulated the median nerve to increase cardiac oxygen demand via the sympathetic pathway and decrease regional myocardial ischemia. Despite these studies, it is still unclear whether acupuncture can be beneficial in shock. The results of only one case report suggest the hypothesis that acupuncture may be useful in shock resuscitation. The hypothesis in this case was that LR3 (Taichong) stimulation would affect peripheral artery and ST36 (Zusanli) stimulation would affect macrocirculatory hemodynamics and have a beneficial effect.⁵²

Another mechanism of action is that acupuncture prevents sepsis by acting on the immune system, thereby ameliorating sepsis-induced shock. This has been demonstrated in experimental studies by showing that electrical stimulation of ST36 improves the functions of natural killer cells and macrophages, and increases lymphocyte counts and T-cell functions.⁵²⁻⁵⁷

The effect of acupuncture on the immune system is thought to be due to the effects of the endogenous opioids beta endorphin, leucine enkephalin and methionine enkephalin on this system. It has been shown that leukocytes possess proopiomelanocortin mRNA and can therefore synthesize ACTH and beta endorphins from these precursors. Endogenous opioid receptors have also been found on B lymphocytes, T lymphocytes, natural killer cells, granulocytes, monocytes, platelets, and the terminal complex of complement. It has been reported that there are biochemical and physical similarities between opioid receptors of the neuroendocrine system and opioid receptors of the immune system.¹⁵

In a prospective randomized controlled trial, 60 patients with sepsis were divided into two groups. The control group received conventional treatment, and the other group received bilateral EA at ST36 (Zusanli) and RN4 (Guanyuan) in addition to conventional treatment. The combined treatment group showed a decrease in sepsis score and an increase in lymphocyte count, but no difference in mortality was found. As a result, it was concluded that the combined treatment was much more effective and had positive results.⁵⁸

NUTRITIONAL SUPPORT

Compared to Western medicine, acupuncture is a traditional Chinese medical practice that also aims to regulate nutrition. Its main goal is to achieve balance and harmony in the body through nutrition. Early enteral nutrition is recommended in intensive care patients to reduce the severe catabolic process. Especially in mechanically ventilated patients, nutritional difficulties may occur due to delayed gastric emptying. There are few studies on the effect of acupuncture on nutrition. It has been reported that acupuncture may regulate gastric emptying by affecting both lower esophageal sphincter relaxation and gastric myoelectric activity by acting on autonomic nervous system activity. Zou et al.⁵⁹ showed that stimulation of the electrical acupuncture point at PC6 (Neiguan) inhibited the frequency of lower esophageal

sphincter relaxation in healthy subjects. Acupuncture has also been shown to regulate gastric motility in experimental animal studies.^{60,61} However, there are not many studies evaluating the effects of acupuncture on gastric emptying in ICU patients. Pfab et al.⁶² reported an effective protocol for the treatment of delayed gastric emptying in critically ill patients. Kao et al.⁶³ also showed that transcutaneous electrical stimulation of bilateral PC6 (Neiguan) points was more effective in gastric emptying than traditional motility agents in critical neurosurgical patients. They also showed that electroacupuncture combined with prokinetic drugs is an effective treatment for gastric emptying in adult critically ill patients. They reported that the gastric residual volume gradually decreased until the fourth day and decreased below 200 ml/day on the fifth day when electroacupuncture treatment was combined with intravenous metoclopramide. In this study, electrical stimulation was applied to bilateral points PC6 (Neiguan), TE8 (Sanyanglou), ST36 (Zusanli) and SP3 (Taibai). In addition, ST37 (Shangjuxu) and ST39 (Xiajuxu) points were needled only without electrical stimulation. Another double-blind randomized controlled trial reported that postoperative feeding intolerance could be reduced in patients with hypopharyngeal cancer. In this study, patients in the treatment group received acupuncture at ST36 (Zusanli), ST37 (Shangjuxu), ST39 (Xiajuxu), PC6 (Neiguan) and LI4 (Hegu) points in the first three days in addition to routine intensive care. Patients in the treatment group reached 80% of target energy intake significantly earlier than the control group. This was associated with higher caloric intake in the first postoperative week. It was also highlighted that the treatment group required less prokinetics.^{64,65}

FUNCTIONAL RECOVERY AFTER CRITICAL ILLNESS

Another pathological condition that occurs after recovery from critical illness is intensive care unit acquired weakness (ICUAW).⁶⁶ This condition includes critical illness myopathy and polyneuropathy or a mixture of both (myopathy is usually more predominant). It is most commonly seen in mechanically ventilated patients. The incidence of 25-60% has been reported in patients on MV for more than 7 days.⁶⁷ There is no specific treatment yet, but acupuncture has been found to correct muscle wasting and mass by increasing nerve function.⁶⁸⁻⁷⁰ In one study, acupuncture was found to be effective against muscle wasting by increasing IGF-1 levels and stimulating muscle regeneration. This study suggested acupuncture points such as LI15 (Jianyu), LI11 (Quchi), ST36 (Zusanli), GB34 (Yanglingquan), and ST31 (Biguan).⁶⁹

There may be conditions that prevent the use of acupuncture in the ICU. These conditions may vary depending on the specific health status and needs of the patient. Here are some conditions that prevent the use of acupuncture in the ICU⁶²⁻⁶⁷

- **Skin problems:** Inserting acupuncture needles into the skin can be risky if the skin has an infection, open wound, or skin disease.
- **Bleeding disorders:** Patients with blood clotting problems may be at risk for bleeding from acupuncture.
- **Drug Interactions:** Acupuncture may interact with some medications, so the patient's medications should be taken into account.

- **Immune problems:** Acupuncture may not be recommended for patients with immune system problems because of the risk of infection.
- **Mental state:** Patients with mental health problems or under extreme stress may require special attention as acupuncture can have a relaxing effect.
- **Fear of needles:** For patients with a fear of needles, acupuncture may be uncomfortable and therefore not preferred.
- **Tissue damage:** Patients in the ICU may have tissue damage or deformities in their bodies that can make it difficult to insert needles accurately.

Each patient is different, and the appropriateness of acupuncture should be determined by a healthcare professional based on the patient's assessment. Treatment plans for critical care patients often involve multiple approaches, and acupuncture may be used in combination with other treatment modalities or, in some cases, excluded. Therefore, a professional's opinion and assessment is necessary to determine whether acupuncture is appropriate for a patient in the ICU.⁶²⁻⁶⁷

CONCLUSION

This review shows that acupuncture in the ICU is an acceptable and feasible treatment modality for the management of various aspects of critical illness. The fact that acupuncture can be used in relatively common patient populations suggests that acupuncture can be used in critically ill patients in the ICU, taking into account the balance of benefits and harms. However, more randomized controlled trials are needed to investigate the efficacy of acupuncture as an adjunct to standard care in critically ill patients.

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Referee Evaluation Process

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Conflict of Interest Statement

The authors have no conflicts of interest to declare.

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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.

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Bedside management of massive pulmonary embolism: a case report

Seyyid Furkan Kına, Savaş Altınsoy, Yusuf Özgüner, Gizem Avcı, Jülide Ergil

Department of Anesthesiology and Reanimation, Ankara Etlik City Hospital, Ankara, Türkiye

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Corresponding Author: Seyyid Furkan Kına, kinafurkan@gmail.com

ABSTRACT

Pulmonary thromboembolism can lead to a clinical syndrome that can be confused with acute myocardial infarction, aortic dissection, tamponade, acute valvular dysfunction, cancer and pneumonia. In this report, we present a case of acute massive pulmonary embolism with a possible chronic background who was followed and treated in various centers.

Keywords: Acute pulmonary embolism, echocardiography, thrombolytic therapy

INTRODUCTION

Massive pulmonary embolism (MPE) is a severe form of venous thromboembolism in which large blood clots occlude the pulmonary arteries and disrupt ventilation/perfusion ratios.¹ Despite advances in diagnosis and treatment, the correct approach is still a matter of debate.² Many diseases predispose to MPE and make the diagnosis difficult.² The treatment of this fatal disease with low diagnosis rates may also vary on a patient basis. Heparin is an indispensable agent for MPE to prevent the spread of blood clots and their movement to other parts of the body. However, thrombolytic agents have reduced the high mortality rates to remove the formed clot.³ Although thrombolytic agents reduce high mortality rates, they should be used with caution because they predispose to bleeding.

In this case report, we would like to describe the diagnosis and successful management of a case of MPE characterized by atypical symptoms using only bedside methods under emergency conditions.

CASE

A 68 year old man with hypertension, insulin dependent diabetes mellitus and Pulmonary thromboembolism (PTE) (3 years ago). He presented to the hospital with intermittent hemoptysis, increasing exertional dyspnea and typical chest pain while on apixaban treatment. Echocardiographic (EKO) evaluation revealed an ejection fraction (EF) of % 50 and no

overt valvular disease. Myocardial perfusion scintigraphy was planned for his complaints. The patient was re-evaluated in another center due to persistent hemoptysis. After D-dimer and deep venous doppler, hemoptysis was attributed to apixaban treatment and apixaban was discontinued and acetylsalicylic acid treatment was started. Two weeks after this treatment change, the patient was evaluated in another emergency department due to increased dyspnea. Troponin-I follow up showed a course of 19/40/50 ng/L. Diagnostic coronary angiography was planned considering myocardial infarction without ST segment elevation. Coronary angiography revealed a 70% lesion in the left anterior descending coronary artery (LAD) ostial (Figure 1).

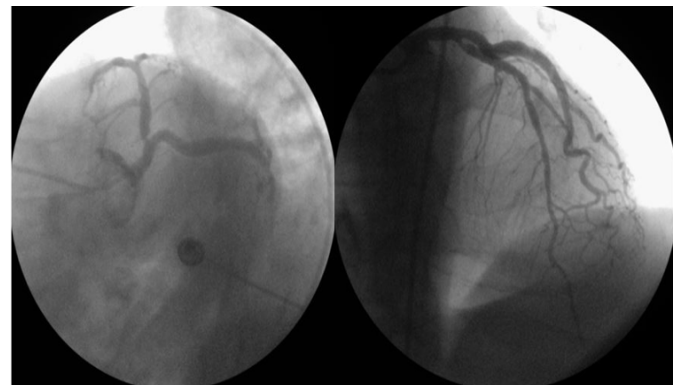


Figure 1. The angiographic image displays a severe lesion at the ostium of the left anterior descending coronary artery (LAD), despite which the flow is maintained at TIMI 3 level

One day later, LAD- left internal mammary artery (LIMA) bypass was performed in the working heart and the patient was discharged with clopidogrel treatment. The patient was admitted to different centers within a two-week period after his complaints did not improve. Furosemide and levofloxacin were started considering atypical pneumonia and heart failure. The patient was admitted to our center on the 20th day after coronary artery bypass graft (CABG) due to increased dyspnea.

Initial examination revealed overt lobar pneumonia and signs of mild overload. Laboratory values; C reactive protein (CRP) 167 mg/L, troponin-I 26 ng/L and renal function tests were normal. EKO showed EF 45%, anterolateral wall was mildly hypokinetic, grade 1 tricuspid valve insufficiency and systolic pulmonary artery pressure was 45 mmHg. These findings were considered as sequelae of old PTE. Chest radiography showed bilateral basal infiltrations. Considering atypical pneumonia and mild overload with the current findings, intravenous antibiotherapy and diuretic treatment were planned and the patient was hospitalized in the intensive care unit.

On admission, 1x0.8 mg enoxaparin was started at a prophylaxis dose. Ramipril and sprinolactone were started at low doses for left ventricular dysfunction and signs of overload. Clopidogrel and metoprolol treatment was continued. On the 2nd day, CRP decreased to 100 mg/L and the patient's fever was under control. On physical examination, wheezing and rhonchi regressed. On the 3rd day of follow up, sudden hypotension and tachycardia developed starting with presyncope. Dopamine was initially started for hypotension and noradrenaline was added in the follow up.

Type 5 myocardial infarction, acute left ventricular failure, septic shock, acute renal failure and PTE which may be LAD-LIMA related were considered as differential diagnosis. Serial electrocardiography (EKG) monitoring was performed, but no evolutive changes were observed except sinus tachycardia, troponin monitoring showed moderate elevation and the diagnosis of myocardial infarction was ruled out. D-dimer resulted as 7141 ng/ml.

Arterial blood gas samples taken at 15 minute intervals showed deepening hypocarbia. EKO follow up revealed progressive deterioration of right ventricular function, dilated right ventricle and severe tricuspid regurgitation. Pulmonary artery pressure was measured as 65 mm Hg at this stage. Upon documentation of typical findings such as "D" finding in the left ventricle and right ventricular failure with preserved apical function, the patient was diagnosed with acute massive pulmonary embolism (Figure 2). Acute renal failure was considered because the patient had severe orthopnea and anuria. Pulmonary angiography could not be planned under these conditions. The patient was clinically and echocardiographically accepted as pulmonary embolism and Alteplase treatment was planned.

Alteplase was administered as 5 mg bolus and 45 mg 1 hour infusion at a total dose of 50 mg. Serial EKG and neurologic monitoring were performed during administration.

The patient had no symptoms except mild chest burning. Alteplase treatment was completed without complications.

In approximately one hour, noradrenaline support was discontinued and dopamine dose was reduced to 3 mcg/kg/min. Alteplase treatment was not completed to 100 mg considering possible hemorrhagic complications due to the onset of significant improvement in hemodynamics. Meanwhile, right ventricular failure regressed, the "D" sign disappeared and pulmonary artery pressure started to decrease (Figure 3).

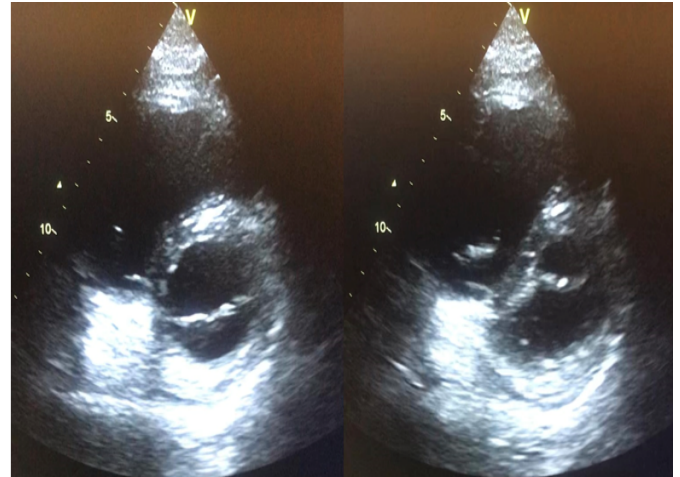


Figure 2. The "D" sign is evident in diastole on short-axis images

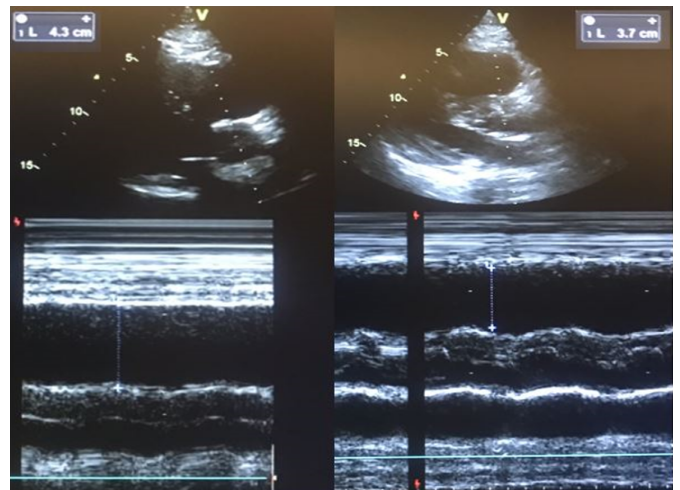


Figure 3. On the left, RV dilatation is depicted in the parasternal long axis view. On the right, a reduction in RV size is observed at 2 hours following thrombolytic treatment

Within four hours, the patient's urine output started and oxygen requirement decreased. One hour after alteplase treatment, respiratory rate and effort also decreased markedly. Hypocapnia improved on EKG follow up. Lactate level decreased from 8 mmol/L to 1.6 mmol/L.

Heparin infusion was started 12 hours after the alteplase dose and infusion was maintained for 72 hours with an activated partial thromboplastin time of 45 seconds. Treatment was continued with warfarin due to impaired renal function. The patient was successfully discharged without complications.

DISCUSSION

The European Society of Cardiology recommends >3 months of anticoagulation therapy in all PTE's.⁴ If the embolism is related to an identifiable transient condition, anticoagulation

may be discontinued after 3 months of treatment with a class 1-B recommendation. However, lifelong anticoagulation therapy is recommended in PTE's associated with recurrent deep vein thrombosis or antiphospholipid syndrome, which are not related to a transient secondary condition. In lifelong treatment, after 6 months of full dose, reduced doses are recommended with class 2-A recommendation (such as apixaban 2.5 mg BID, rivaroxaban 10 mg).⁵

When we retrospectively analyzed our patient, exertional dyspnea 2 months ago could be attributed to the 70% lesion in the LAD and hemoptysis could be attributed to apixaban 5 mg BID treatment since D-dimer was normal at that time. At this stage, in line with guideline recommendations, instead of discontinuing apixaban completely, it may be preferable to taper the dose and plan diagnostic coronary angiography.

On angiography images, coronary flow can be interpreted as Thrombolysis in Myocardial Infarction (TIMI) 3 despite a severe lesion with 70% stenosis of the LAD ostial. This may account for the mild troponin elevation and explain the patient's symptoms. However, persistence of hemoptysis despite discontinuation of anticoagulation should be a warning that there may be another underlying etiology. In such cases, instead of attributing the symptoms to a single cause, investigating other possible conditions and in this case, bringing PTE to mind may provide an earlier diagnosis.

CONCLUSION

PTE, which is frequently confused with coronary artery disease and heart failure in terms of symptoms, has a poor prognosis with sudden hemodynamic collapse when left untreated. A European epidemiologic study showed that only 7% of patients who died of PTE were started on time. Treatment could not be initiated in 34% of patients and the diagnosis could only be made by autopsy in 59%.⁶ These epidemiologic data show that PTE is an insidious disease.

Although the gold standard diagnostic methods of pulmonary embolism are computed tomography, pulmonary angiography, ventilation/perfusion scintigraphy or pulmonary arteriography, it is not technically possible to apply these methods in cases where hemodynamics are impaired. Concomitant renal failure limits the use of radiopaque material. In our case, profound hypotension, anuria and severe orthopnea developed within minutes and only bedside methods were used for diagnosis. In such an unstable patient population, thrombolytic therapy can be administered after confirmation of the diagnosis with serial arterial blood gas and ECO follow up.

ETHICAL DECLARATIONS

Informed Consent Form

The patient signed and free and informed consent form.

Referee Evaluation Process

Externally peer-reviewed.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

Financial Disclosure

The authors declared that this study has received no financial support.

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.

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Difficult airway due to acute necrotizing mediastinitis: a case report

 Ramazan Baldemir¹,  Gülay Ülger¹,  Şevki Mustafa Demiröz²,  İlteriş Türk³,  Musa Zengin⁴,  Ali Alagöz¹

¹Department of Anesthesiology and Reanimation, Ankara Atatürk Sanatorium Training and Research Hospital, University of Health Sciences, Ankara, Türkiye

²Department of Thoracic Surgery, Faculty of Medicine, Gazi University, Ankara, Türkiye

³Department of Thoracic Surgery, Ankara Atatürk Sanatorium Training and Research Hospital, University of Health Sciences, Ankara, Türkiye

⁴Department of Anesthesiology and Reanimation, Ankara Etlik City Hospital, Ankara, Türkiye

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Corresponding Author: Ramazan Baldemir, baldemir23@yahoo.com

ABSTRACT

Descending necrotizing mediastinitis due to odontogenic or oropharyngeal infections can change the airway anatomy and cause difficult intubation. A 56-year-old female patient, who was followed up for dental abscess, was taken to emergency surgery due to descending necrotizing mediastinitis. The patient with widespread edema on the face could only be intubated with a gamma elastic bougie. It should be kept in mind that patients with oropharyngeal infection and mediastinitis may have intubation difficulties and tendency to airway trauma, and it is important to use airway instruments carefully in these patients.

Keywords: Mediastinitis, oropharyngeal infection, difficult intubation

INTRODUCTION

The spread of odontogenic or oropharyngeal infections to the mediastinum is identified as descending cervical mediastinitis (DCM) or descending necrotizing mediastinitis (DNM).¹ In DNM cases, providing a safe airway is important to perform a surgery with general anesthesia. However, extensive abscess in the region from mouth to mediastinum; narrows airway, changes anatomy of the airway and causes tissues to be intervened for intubation to become vulnerable to trauma due to infection. This situation makes the endotracheal intubation very difficult. In this case report, we present difficulties in intubation and anesthesia management as a result of DNM.

CASE

Our case, a 56-year-old woman; during followed up for a dental abscess, admitted with complaints of pain in the throat, swelling of the face and shortness of breath for the last week. In the neck and thorax computed tomography (CT) of the patient; a lesion was detected starting from the right maxilla and mandibular neighborhood to the oropharynx, right side of the neck, retropharyngeal area, suggesting abscess formation extending to mediastinum and diaphragm, narrowing the air passage and pushing the trachea to the left.

The patient admitted for emergency surgery with a diagnosis of acute mediastinitis. The patient's preoperative evaluation determined that the patient had diabetes mellitus, hypertension, hypothyroidism, and coronary artery disease. Widespread edema was observed during physical examination on the face. The mouth opening was 2 cm, and the mallampati score was 3. The patient was planned to be processed with ASAIVE risk assessment.

After preoxygenation was reached with 100% oxygen; 1 mg/kg 2% lidocaine and 2 mg/kg propofol were administered intravenously. 40 mcg remifentanyl and 1.2 mg/kg rocuronium were given as intravenous (IV) to the patient who had no problem with mask ventilation. After mask ventilation, intubation was initiated.

After performed direct laryngoscopy; the patient's Cormack-Lehane score was identified as 4 and intubation could not be achieved. With fiberoptic bronchoscopy (FOB) and video laryngoscopy adequate image clarity could not be attained due to intense secretion, and intubation could not be performed, also mask ventilation could not be done effectively anymore. Considering the intense inflammation in the tissues of the patient, who underwent direct laryngoscopy urgently,

a gum_elastic bougie was directed towards the trachea. The patient was intubated by sliding the 8 mm internal diameter tube over the bougie. After capnographically confirmed intubation, FOB was performed rapidly, and trachea and bronchi were evaluated for possible complications.

Right thoracotomy and mediastinal abscess drainage were performed. After the operation, the patient was transferred to the intensive care unit while intubated. The patient was intubated for 24 hours and then she was extubated in a planned manner. The patient was discharged after 17 days.

DISCUSSION

In DNM cases the non-specific symptoms delays the diagnosis, and this is the most important reason for high mortality.¹ The diagnosis of dental abscess in our case, which is made during first evaluations, did not suggest the diagnosis of mediastinitis. Increased swelling in the face and neck region, dysphagia and shortness of breath suggest pre-diagnosis of mediastinitis.

CT is the golden standard of the diagnosis in DNM.¹ Antibiotic therapy and surgical intervention are cornerstones of the treatment with DNM.² The current literature do not present cases where has narrowed airway, and restricted mouth opening due to oropharyngeal infection, and has changed airway anatomy due to displacement of the mediastinum, and therefore has difficulty in intubation.

Measurements such as mallampati classification, mouth opening distance, thyromental and sternomental distance should be evaluated preoperatively in terms of possible difficult airway and difficult intubation.³ In our case, the presence of hypothyroidism and diabetes mellitus, the Mallampati score of 3, the swelling of the oral tissues and the abscess narrowing the airway, and the restricted mouth opening of the patient up to 2 cm suggested a difficult airway. In direct laryngoscopy, the Cormack-Lehane score was also determined as.⁴

The presence of abscess formation has also caused these tissues to become susceptible to trauma. Therefore, the pressure applied to the tissues during direct laryngoscopy and the insertion of the intubation tube can cause injury such as puncture of the hypopharynx or trachea can easily occur. In our case intubation could not be performed with direct laryngoscopy then we used FOB and video laryngoscopy. But we could not obtain images due to intense purulent discharge. After two consecutive laryngoscopies, mask ventilation became ineffective due to increase in edema in the pharynx. Immediately, a second anesthesiologist performed intubation by a direct laryngoscopy with guidance of gamma elastic bougie. Due to the intubation tube or gamma-elastic bougie, the presence of injury and perforation in the tissues was quickly evaluated with FOB.

In the difficult intubation algorithm, supraglottic airway devices and interventions such as tracheostomy or cricothyroidotomy are also included.⁴ However, we did not consider applying supraglottic devices and tracheostomy or cricothyroidotomy in our case because of the presence of

intraoral infection and the possibility of infection around the trachea.

When there is a possibility of difficult airway, the use of muscle relaxants is very important, such as rocuronium. They can act quickly; and in case of failure of the algorithms, their effect can be reversed with sugammadex within a few minutes.⁵

The patient's surgery was successfully completed, however the patient was not extubated immediately because of possible a decrease in the postoperative airway edema. After 24 hours, the patient' edema decreased and she was extubated.

CONCLUSION

We think that in patients with oropharyngeal infection and risk factors for mediastinitis; the diagnosis of mediastinitis should not be delayed and urgent interventions should be performed as soon as possible. It is important that patients who require intubation may have difficulty in intubation due to oropharyngeal infection.

DM and hypothyroidism diagnosis, and patients with severe airway infection may be susceptible to airway trauma. It is important to use airway instruments carefully in these patients and intubation should be done very carefully without damaging the tissues. Finally, it is important to perform FOB after intubation to evaluate possible injuries.

ETHICAL DECLARATIONS

Informed Consent Form

The patient signed and free and informed consent form.

Referee Evaluation Process

Externally peer-reviewed.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

Financial Disclosure

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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.

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