Editorial

Dear Colleagues,

It is with great pleasure that we present the inaugural issue of the Yedikule Journal of Medical Sciences. This journal has been founded with the vision of fostering high-quality scientific exchange across all fields of medicine, from basic research to clinical practice.

Medicine is evolving at an unprecedented pace, and the need for rigorous, accessible, and multidisciplinary knowledge has never been greater. Our aim is to provide a platform where clinicians, researchers, and scholars can share original findings, discuss emerging concepts, and contribute to the advancement of medical science for the benefit of patients and society.

We are committed to upholding the highest standards of editorial integrity, peer review, and transparency. Submissions will be evaluated not only for scientific merit but also for their potential to inform practice, inspire further research, and promote collaboration among diverse disciplines.

As we embark on this journey, we warmly invite you-our colleagues, mentors, and future contributors—to join us in shaping the growth of this journal. Your critical insights, scholarly contributions, and constructive feedback will be essential in ensuring that the Yedikule Journal of Medical Sciences becomes a trusted and enduring voice in the global medical community.

With gratitude and anticipation,

Celal SATICI
Celal Bugra SEZEN
Editor Chief

Author Information & Guidelines

1. About Yedikule Journal Medical Sciences

Yedikule Journal Medical Sciences is a peer-reviewed English journal aiming to publish original research, current review articles, case reports, and letters related to all medical fields. The journal is published quarterly as an e-journal. Accepted articles are freely available in PDF format immediately after peer review. The journal adheres to the guidelines of the International Committee of Medical Journal Editors (ICMJE), World Association of Medical Editors (WAME), Council of Science Editors (CSE), Committee on Publication Ethics (COPE), European Association of Science Editors (EASE), and National Information Standards Organization (NISO). It complies with the Principles of Transparency and Best Practice in Scholarly Publishing.

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Studies involving human subjects or animals must comply with the Helsinki Declaration (2013) and include ethical committee approvals and informed consent statements. Patient anonymity must be preserved, and written consent is required for identifiable information. Animal studies must follow the "Guide for the Care and Use of Laboratory Animals." Conflicts of interest must be declared, and plagiarism is checked using iThenticate software.

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5.1. General Guidelines

Language: American English (abstracts in both English)

File Format: Microsoft Word (.docx).

Formatting: Double-spaced, 2.5 cm margins, numbered pages.

Submission: Via the journal's online system, including a cover letter, Copyright Transfer Form, Author Contribution Form, and ICMJE Form for Conflicts of Interest.

5.2. Blind Manuscript Requirements

The blind (anonymous) manuscript must not contain any information that could reveal the identity of the authors or their institutions. The following rules should be strictly followed: The title page containing author names, affiliations, and acknowledgements should be uploaded as a separate file and must not be included in the blinded manuscript. Throughout the text, references to the authors' own previous work should be written in the third person to avoid self-identification (e.g., replace "In our previous study…" with "In a previous study…"). Names of institutions, cities, or countries that may reveal the authors' identity should not appear in the text, figures, or tables. If necessary for clarity, generic descriptions should be used (e.g., "a tertiary care center" instead of the actual hospital name). Figures and tables must be free of any institutional logos, watermarks, or identifiable patient information. All metadata (file properties) should be checked and cleared of author names before submission. The blinded manuscript should contain the following sections in order:

Abstract- Keywords

Main Text (Introduction, Methods, Results, Discussion, Conclusion)

References (formatted according to journal style)

Figure legends and table legends (without author or institution names) Failure to comply with the blind manuscript requirements may result in the manuscript being returned to the authors for correction prior to peer review.

5.3. Manuscript Structure

Manuscripts should include:

Title Page: Full author names, affiliations, corresponding author's contact details, and acknowledgments.

Abstract: Up to 500 words (structured for original research: Objective, Methods, Results, Conclusions).

Keywords: 3-10, per MeSH, in English

Main Text: Introduction, Materials and Methods, Results, Discussion, Conclusion.

References: Vancouver style, numbered in order of appearance.

Tables/Figures: Numbered, with legends, cited in text.

5.4. Manuscript Types

Original Research: Structured as Abstract, Keywords, Introduction, Materials and Methods, Results, Discussion, Conclusion, References, Tables/Figures. No word limit.

Brief Research: Similar to original research but for smaller-scale studies.

Case Reports: unstructured abstract, keywords, introduction, case report, discussion, references, tables and legends.

Reviews: Unstructured abstract, methods for data synthesis, no word limit.

Letters to the Editor: Up to 1000 words, no tables/figures, signed by all authors.

6. Review Process

Manuscripts undergo double-blind peer review by at least two referees. Editors ensure confidentiality and objectivity, and reviewers must disclose conflicts of interest. Plagiarism or ethical misconduct results in rejection and potential notification of relevant institutions.

7. Submission Checklist

Cover letter specifying manuscript category and originality., Copyright Transfer Form, Author Contribution Form, ICMJE Form for Conflicts of Interest.

Ethical approval and informed consent statements.,Title page, abstracts (English and Turkish), keywords, main text, references, tables/figures.

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8. References

Follow the Vancouver style, numbered in order of appearance. Examples:

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Book: McKnight TL. Obesity Management in Family Practice. 1st ed., NewYork: Springer, 2005:47-51.

Online article: Kaul S, Diamond GA. Good enough: a primer on the analysis and interpretation of noninferiority trials. Ann Intern Med. [Internet]. 2006 Jul 4 [cited 2007 Jan 4];145(1):62-9. Available from: http://www.annals.org/cgi/reprint/145/1/62.pdf

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Article Review

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Workforce Planning in Chest Diseases-2024

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Abstract

Effective healthcare workforce planning is essential for ensuring the timely, equitable, and quality delivery of medical services. This paper presents a structured framework for workforce planning in chest diseases, focusing on aligning healthcare personnel resources with current and future demands. The process begins with identifying institutional goals and assessing the current workforce. Subsequently, future needs are forecasted using workload and workforce analyses. Critical variables considered in planning include population growth, chronic disease prevalence, health system requirements, medical education outputs, and budget allocations. Performance metrics such as physician productivity and bed occupancy rates are also evaluated. Implementation involves strategic actions such as recruitment, career development, performance evaluation, and appropriate placement of healthcare workers. In the context of pulmonary medicine, where demand is increasing due to the growing burden of chronic respiratory diseases and aging populations, effective workforce planning is crucial. The integration of accurate demand forecasting with flexible implementation strategies can enhance the responsiveness and resilience of healthcare systems. This paper emphasizes the need for data-driven, adaptable planning processes to ensure adequate pulmonology staffing and meet long-term public health needs.

Keywords: Workforce Planning, Chest Diseases, Healthcare Workforce

Health workforce planning is defined as “employing healthcare workers in sufficient quantity, with high quality, distributed evenly, at the right time, and in the right way to deliver the healthcare services provided to society today and in the future” (1).

Main Stages of Workforce Planning

1. Institution’s Goals and Plans
2. Current Workforce Resources
3. Forecasting the Future Workforce
4. Implementation Programs

Workload Analysis (Workforce Demand)

Workforce Analysis (Workforce Supply)

- Recruitment, selection, placement
- Performance evaluation
- Career development
- Promotion, transfer, dismissal

Variables considered in workforce planning include

- Population growth rate
- Annual number of visits per capita
- Rate of chronic disease

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- Average life expectancy
- Requirements of the health system in use
- Budget allocated to health
- Medical school quotas
- Specialist/general practitioner ratio
- Physician performance
- Number of actively working physicians
- Actual bed count and bed occupancy rate

Methods Of Calculatıng Health Workforce (2)

1. **Needs-based methods:** Calculations based on the results of National Burden of Disease and cost-effectiveness studies.
2. **Employment method:** Norm staff studies.
3. **Utilization method:** Focused on the number of visits per capita.
4. **Target method:** Based on targets set by the Ministry of Health.
5. **Workforce-to-population ratio method:** Calculations based on the ratio to population.
6. **Workload Indicators of Staffing Need (WISN) (3)**

In 2023, the population aged 65 and over was 8.7 million (10.2%), and it is expected to reach 12 million (12.9%) by 2030, an increase of 38% (4). Although the current average age of our chest disease patients is around 50, the number of patients and physician visits will increase in proportion to the aging population.

In the projection of population ratios by age groups in our country, the population aged 65 and over was 10.2% in 2023, and will equal the 0–14 age group as of 2040.

Respiratory system diseases rank 3rd among causes of death with 13.2%. Turkey's population is aging, with an average life expectancy of 77 years. Therefore, chronic diseases, especially chronic respiratory system diseases, are increasing due to smoking and environmental pollution (5). The crude death rate in 2023 was 6.2 per thousand (5). For those aged 65 and over, it exceeds 30 per thousand. Tobacco-related deaths in low- and middle-income countries are expected to double by 2030 compared to 2002 (6).

- Among men, 20 out of every 100 deaths, and among women, 14 out of every 100 deaths were due to diseases of the respiratory system.

In 2019, according to Ministry of Health data, there were nearly 100 million visits recorded with ICD-10 codes for respiratory system diseases, corresponding to over 42 million patients. In secondary and tertiary care, more than 24 million (58%) of annual visits were chest disease patients. The hospitalization rate for chest diseases is also 25% higher than the general average. Additionally, since most hospitalized patients have multiple comorbidities, their average length of stay is about twice the general average (around 10 days).

Two-thirds of chest disease outpatient visits consist of asthma and chronic obstructive lung disease (COPD) patients, a group that is steadily increasing, with an annual growth rate of 5.6%. In 2023, the number of hospital visits per person was 6.5, and it is increasing every year. Every year, an average of 400 chest diseases residents start training in our training hospitals and universities through the medical specialty exam, but 15–20% leave during the year for various reasons. Between 2022 and 2023, the number of resident positions in chest diseases, as in other specialties, increased by up to 100% compared to previous years. In 2013, there were 3.21 pulmonologists per 100,000 people (1 per ~30,000) compared to 3.46 in 2023. By 2030, with a target of 1 pulmonologist per 25,000 people, at least 2,940 specialists will be needed. In 2002, the number of residents recruited was nearly half the number of specialists; however, over the years, the number of residents gradually decreased to 20% of the number of specialists. Consequently, despite the increasing patient load, the proportion of chest disease specialists has declined. In 2022 and 2023, the aim was to close the gap by recruiting the required number of residents. It should also be taken into account that at least 2.5% of specialists will complete 40 years of service and retire annually. Additionally, 15–20% of residents who start specialization through the Medical Specialization Examination resign.

When we compare with European countries, there are approximately 4.4 adult chest disease specialists per 100,000 population on average, whereas in our country, the number of pulmonologists is about half of that. According to population, the highest rates of chest disease specialists are seen in Greece, Italy, Poland, Hungary, Bulgaria, and Lithuania, with 6 or more per 100,000. Since the population aged 15 and over in 2023 was 67,060,744, based on a target of 4 chest disease specialists per 100,000 population (1 specialist per 25,000 people), the required number of specialists was calculated as 2,682. As there were 2,226 actively working chest disease specialists in 2023, there was a shortage of 456 specialists.

Considering that 2.5% retire each year, the expected number of specialists to retire in 2023 was 56. On the other hand, from the 983 residents in 2023, at best only 200 would become specialists. Therefore, by the end of 2023, the shortage of specialists would be around 300–350. There is a surplus of chest disease specialists in only 5 provinces (Ankara 64, İzmir 60, İstanbul 15, Edirne 2, Isparta 1), while a shortage of 598 specialists has been identified in 76 provinces.

Conclusion

In Turkey, there are 3.46 chest disease specialists per 100,000 people, compared to 4 in EU countries. The population of Turkey was 85,372,377 in 2023 and is expected to reach 88,188,221 by 2030. In 2009, there was 1 chest disease specialist per 22,725 people in EU count-

ries, compared to 1 per 42,582 in Turkey. Turkey is aging, with life expectancy reaching 77 years. The total disease burden in Turkey is 10,802,494 cases. Respiratory system diseases account for 675,876 cases (6.26%). In the national DALY ranking, lower respiratory tract infections are fifth (3.8%), and COPD is eighth (2.8%). The number of chest disease specialists is below the required level according to all calculation methods.

Both the increase in chronic diseases (COPD, cancer) and the rise in average life expectancy are increasing the need for chest disease specialists. Subspecialties within chest diseases such as intensive care, allergy, and sleep medicine, which require close collaboration with other departments, also face increasing patient loads. Additionally, a significant portion of chest disease patients are managed by internal medicine, general practitioners, thoracic surgeons, and other specialties. However, planning must be long-term and take into account all relevant variables.

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Original Article

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Evaluation of Early Surgical Outcomes in NSCLC Patients Who Underwent VATS Complex Segmentectomy

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Abstract

Non-small cell lung cancer (NSCLC) is the most common form of lung cancer, and early-stage tumors are increasingly detected thanks to advanced imaging and screening programs. While lobectomy has long been the standard surgical approach, recent studies have shown that segmentectomy may offer comparable oncologic outcomes in selected patients with small, peripheral tumors. Complex segmentectomy, a more technically demanding procedure, has become more feasible with the development of video-assisted thoracoscopic surgery (VATS). However, its safety and short-term outcomes remain under debate. This study aims to evaluate the early surgical results of complex segmentectomy performed via VATS in patients with early-stage NSCLC. Conclusion: VATS complex segmentectomy appears to be a safe and feasible surgical option for selected patients with early-stage NSCLC. Low complication and mortality rates support its use in experienced centers, especially for tumors smaller than 2 cm.

Keywords: NSCLC, VATS, complex segmentectomy, early-stage lung cancer, minimally invasive surgery, surgical outcomes, sublobar resection.

Introduction

Surgical resection of early-stage NSCLC, particularly clinical stages T1A and T1B, has traditionally been performed through lobectomy, which is considered the gold standard in terms of therapeutic efficacy (1,2). However, the emergence of minimally invasive techniques, particularly Video-Assisted Thoracoscopic Surgery (VATS), has revolutionized the surgical approach to NSCLC and introduced alternatives such as complex segmentectomy (3,4). Following the publication of the JCOG 0802 study in 2021, which significantly illuminated the outcomes of segmentectomy versus lobectomy for small-sized peripheral NSCLC, the number of performed segmentectomies has markedly increased (1,2). This pivotal study suggested that segmentectomy may offer survival outcomes comparable to lobectomy in certain patient groups, particularly those with small (≤2 cm), peripheral tumors, thereby significantly contributing to the ongoing debate on the optimal surgical approach for early-stage NSCLC (5, 6, 10).

However, complex segmentectomies remain a controversial issue due to unclear anatomical parenchymal boundaries and surgical technical challenges (3,4). There is no consensus in the literature regarding whether complex segmentectomies and simple segmentectomies are equivalent in terms of early and late postoperative outcomes (3-8). For these reasons, our study aimed to evaluate the early outcomes of patients

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with non-small cell lung cancer (NSCLC) who underwent complex segmentectomy using VATS.

Methods

A retrospective analysis was conducted on 129 NSCLC patients who underwent VATS surgery for clinical stages T1A and T1B between 2020 and 2023. Patients who underwent lobectomy and simple segmentectomy were excluded from the study. The surgical team consisted of a single team. Tumors beyond clinical stage IA and those with benign pathology or requiring conversion to thoracotomy were also excluded. A total of 36 patients who underwent complex segmentectomy for T1A-T1B NSCLC were included in the study. Complex segmentectomy was defined as all surgical procedures excluding S6 segmentectomy, lingulectomy (S4-5), and trisegmentectomy (S1-3). Patient data were obtained from medical records without any additional testing or imaging. Demographic data, early and late postoperative data, and survival data were recorded. The data were analyzed using SPSS 27.00 software. Ratios, means, standard deviations, minimum, and maximum values were analyzed. The primary outcomes of our study were early surgical results, complications within the first 30 days, and mortality within the same period.

Results

Among the patients, 28 were male (77.8%) and 8 were female (22.2%). The mean age was 60.8±9.0 years (range 44–74), and 33.3% were over the age of 65. Of the patients, 47.2% underwent right-sided surgery and 52.8% left-sided. According to the Charlson Comorbidity Index, 72.2% of the patients had a score of 4 or higher. Final pathology revealed adenocarcinoma in 72.2%, squamous cell carcinoma in 22.2%, and other pathologies in 5.6%. The mean postoperative hospital stay was 5.5 days (range 3–13). Postoperative complications were observed in 4 patients: prolonged air leak and subcutaneous emphysema in 1 patient, prolonged air leak and wound infection in 1 patient, prolonged air leak in 1 patient, and pneumonia in 1 patient. An air leak lasting 5 days or longer was considered a prolonged air leak.

Patients diagnosed with prolonged air leak underwent hemopleurodesis, and none required revision surgery. In patients with prolonged air leak, the duration was 9 days in one case and 10 days in the other. In the patient with wound site infection, daily dressing changes and antibiotic therapy were administered.

The patient who developed pneumonia was managed with antibiotic therapy and inhalation treatment.

Table-1: Comparison of Patients' Demographic Characteristics

Variables		Segmentectomy (n=36)	
		n	(%)
Gender	Male	28	77,8
	Female	8	22,2
Age (Year)	(mean±Std)	60,8±9.0	
Age (Year)	<65	24	66,7
	>65	12	33,3
Side	Right	17	47,2
	Left	19	52,8
Charlson Comorbidity Index	2-3	10	27,8
	>4	26	72,2
Histopathology	Adenocarcinoma	26	72,2
	Squamous cell carcinoma	8	22,2
	Other	2	5,6
Postoperative Hospital Stay (IQR)	3-13 min-max		5,5 (3-13)
Complication	Total PAL- pneumoderm PAL-WSI PAL Pneumonia	4 1 1 1 1	1,08 0,27 0,27 0,27 0,27

PAL: Prolonged Air Leak,WSI:Wound Site infection

None of the patients with complications required additional surgical intervention. All patients with complications had a Charlson Comorbidity Index score of 4 or higher. There was no 30-day mortality, while 90-day mortality was observed in 1 patient.

Discussion

In our study, the early surgical outcomes of complex segmentectomy performed using the VATS method in stage I non-small cell lung cancer (NSCLC) patients were evaluated. Although complex segmentectomy is anatomically

Table-2: Segmentectomy Distributions

	n	%
S1	8	%22
S1+S2	10	%28
S1+S2+S6	1	%3
S1+S3	2	%5
S2	9	%25
S3	2	%5
S7+S8	2	%5
S7+S8+S9	1	%3
S9+S10	1	%3

more challenging and requires technical expertise, the results indicate that it can be performed with low complication rates (3,4,9). The fact that all patients with postoperative complications had high Charlson Comorbidity Index scores suggests that complications are more related to the patient's underlying pulmonary reserve than to the type of resection performed.

The absence of 30-day mortality in our study indicates that complex segmentectomy is a safe surgical method. Additionally, the low incidence of postoperative complications such as prolonged air leak and wound infection in the complex segmentectomy group supports the feasibility of this surgical approach.Given that complex segmentectomies often require fissure and parenchymal dissection, concerns have been raised regarding the risk of prolonged air leaks.. However, the low incidence of this complication in our study is important and contributes to the literature.

There is growing evidence in the literature that segmentectomy is oncologically equivalent to lobectomy and better preserves functional lung reserve in peripheral NSCLC tumors smaller than 2 cm (1-4). The mean tumor size of 1.5 cm in our study supports the applicability of this surgical strategy in selected patients. The limitations of this study include its retrospective nature, the relatively small number of patients, and the lack of long-term oncologic outcomes. Nevertheless, our findings indicate that complex segmentectomy can be a safe alternative in experienced centers based on early surgical safety and complication profile data. We have demonstrated that complex segmentectomy is feasible and safe in the early postoperative period for patients undergoing surgical resection for NSCLC smaller than 2 cm.

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Original Article
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Knowledge and Awareness Of Head and Neck Cancer Among Pulmonologists in Turkey

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Abstract

Background : Head and neck cancers (HNCs) constitute a significant public health burden globally. Pulmonologists often encounter symptoms that overlap with HNC presentations, yet their role in early detection is under-explored. This study aimed to assess the knowledge and awareness of head and neck cancers among pulmonologists in Turkey.

Methods: A cross-sectional, questionnaire-based online survey was distributed to practicing pulmonologists across Turkey. The questionnaire consisted of 23 items evaluating knowledge of HNC risk factors, signs and symptoms. Data were analyzed using descriptive statistics and logistic regression to identify factors associated with higher knowledge scores.

Results: A total of 136 pulmonologists participated in the study. Of the participants, 64.7% were female, and 62.5% had less than 10 years of professional experience. The mean objective knowledge score was 16.05 ± 2.44 out of a maximum of 23, while the mean self-reported knowledge level was 2.68 ± 0.93 on a 5-point scale. Awareness of classical risk factors such as smoking (98%) and alcohol (55%) was high. However, only 51% of participants correctly identified HPV infection as a risk factor. Key symptoms like neck mass (93%), dysphagia (90%), and hoarseness (89%) were widely recognized, whereas others—such as non-healing ulcer in the oral cavity (63%) and unpleasant taste in the mouth (43%)—were under-recognized. No significant differences in knowledge scores were found across experience levels. Only 27.6 % routinely inform their patients who smoke that they may have HNC.

Conclusions: Turkish pulmonologists exhibit moderate awareness of head and neck cancer, with notable deficiencies in recognizing modern risk factors like HPV and less typical symptoms. Structured educational interventions and inclusion of HNC-focused content in pulmonology training and CME programs are warranted to enhance early recognition and referral.

Keywords:
Head and neck cancer, pulmonology, awareness, HPV, early diagnosis, Turkey

Introduction

Head and neck cancers (HNCs) are a significant cause of cancer-related morbidity and mortality worldwide (1). They are frequently diagnosed at an advanced clinical stage, which usually require combined treatment, often resulting in significant aesthetic and functional consequences. Early detection and appropriate treatment improve the prognosis and lead to better cosmetic and functional outcomes. In addition, patients diagnosed at an advanced stage of HNC have a much lower 5-year survival rate than those diagnosed in early stages of the disease (2).

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Tobacco and alcohol use are the most prominent risk factors, though in recent years, the incidence of HPV-related oropharyngeal cancers has been increasing (3,4). Tobacco users have a proven higher risk of lung malignancies as well as non-malignant pulmonary disorders. (5,6) As most of patients seen by pulmonologists are smokers. Therefore, being familiar with the signs and symptoms of HNC is very important for early diagnosis.
The symptoms of head and neck cancers often overlap with those of respiratory diseases. Persistent cough, hoarseness, dysphagia, hemoptysis, and neck masses are common presenting complaints in both groups. Consequently, these overlapping symptoms may lead to delayed or missed diagnoses of head and neck cancers, particularly when patients are first evaluated in respiratory or pulmonary clinics.

Pulmonologists play a critical role in the early assessment of such patients. Therefore, their level of awareness and knowledge regarding head and neck cancers is vital for timely diagnosis and appropriate referral. However, data on awareness of HNC among pulmonologists are lacking. This report addresses this gap by presenting the results of a survey evaluating pulmonologists' knowledge about HNC. The findings may also serve as a benchmark for future studies and provide insight into the potential of educational activities to reduce the disease burden of HNC through early diagnosis.

Methods

A short, web-based questionnaire assessing basic knowledge of HNC among pulmonologists in Turkey was conducted online for 3 months. Demographic information included age, sex, work position (resident, specialist, academician), workplace (university hospital, state hospital, private hospital) and years in profession. The survey was entirely anonymous and designed specifically for the study. We calculated HNC knowledge scores by adding the correct answers to all 23 items in the questionnaire, which covered HNC risk factors, signs and symptoms.(Table 1) Sample questions are provided in Supplementary File 1. To evaluate the effect of demographic factors on mean HNC knowledge scores, we constructed a multivariable model using ordinary least squares regression analysis. The Fisher exact test was used to determine the association between demographic characteristics. All participants completed the survey voluntarily. The study was conducted in full accordance with the Declaration of Helsinki and was approved by the Ethics Committee (Approval number: 2021/36).

Results

A total of 136 pulmonologists participated in the study. Of the respondents, 64.7% (n = 88) were female and 35.3% (n = 48) were male. Most participants had less than 10 years of experience in the profession: 31.6% had 0–5 years and 30.9% had 6–10 years. A smaller proportion had 11–15 years (6.6%), 16–20 years (11.0%), or more than 20 years of professional experience (19.9%). The mean total knowledge score out of a maximum of 23 was 16.05 ± 2.44 (Table 2). Self-reported knowledge levels were lower, with a mean of 2.68 ± 0.93 on a 5-point Likert scale. There was a statistically significant, albeit weak, correlation between self-perceived and actual knowledge scores ($r = 0.23$, $p = 0.0066$), suggesting that participants who believed they had better knowledge did tend to score slightly higher, although this perception was not always aligned with performance.

When knowledge scores were compared across experience groups, participants with 0–10 years of experience had slightly higher mean scores (16.28 and 16.33, respectively) compared to those with 11–20 years of experience. However, these differences were not statistically significant (ANOVA $p = 0.4741$) (Table 2).

Table -1: Head and Neck Knowledge Questions and Correct Response Rates

Subject	Responses, %
Risk Factors	
Smoking	98
Genetics	84
Old age	74
EBV	65
Sex	64
Alcohol	55
HPV	51
Sun exposure	35
Fatty foods	14
Frequent URTI	13
Signs and Symptoms	
Lump in neck	93
Difficulty swallowing	90
Hoarseness/change in voice	89
Weight loss	85
Blocked nose on side ± epistaxis	70
Chronic sore throat	66
Non-healing ulcer in oral cavity	63
Difficulty breathing	63
Headache	53
Unpleasant taste in mouth	43
Dizziness	37
Loosening of teeth	33
Lack of saliva	29

Note: correct response. % Percentage answering "yes" to each item.

Awareness of Risk Factors

Participants demonstrated high awareness of traditional risk factors for HNC. Smoking was correctly identified by 98%, followed by genetics (84%), old age (74%), and EBV (65%). Surprisingly, only 51% of respondents recognized HPV infection as a risk factor, despite its now well-established role as a leading cause of oropharyngeal squamous cell carcinoma. Awareness was considerably lower for less conventional or non-causal factors: sun exposure (35%), fatty foods (14%), and frequent upper respiratory tract infections (URTI) (13%) were incorrectly endorsed as risk factors by a notable number of participants, reflecting potential confusion regarding etiological distinctions (Table 1).

Table -2: Mean Knowledge Score by Years of Professional Experience

Years in Profession	n	Mean Knowledge Score	SD
years 5–0	43	16.28	2.48
years 10–6	42	16.33	2.73
years 15–11	9	15.22	1.72
years 20–16	15	15.27	2.09
years 20<	27	15.96	2.28

Awareness of Symptoms

Most participants were able to correctly identify hallmark symptoms of HNC. The most recognized signs included neck mass (93%), dysphagia (90%), and hoarseness or voice changes (89%). Other frequently identified symptoms were weight loss (85%), chronic sore throat (66%), and non-healing oral ulcers (63%). In contrast, several relevant symptoms were under-recognized. Only 43% of respondents marked unpleasant taste in the mouth as a possible warning sign. Additionally, dizziness (37%) and headache (53%), which are generally nonspecific, were incorrectly attributed by some participants as signs of HNC. This highlights a need for better differentiation between core and incidental symptoms in clinical practice (Table 1).

Referral Preferences and Clinical Practice

When asked about referral preferences for a patient suspected of having HNC, the vast majority selected otolaryngology (ENT) as the preferred specialty. A smaller proportion mentioned medical oncology, plastic reconstructive surgery, or dentistry. Most participants (over 80%) indicated that they would refer the patient immediately, reflecting an appropriate sense of urgency. In daily clinical practice, the majority of participants reported that more than 40% of their patients were active smokers, yet only a minority consistently discussed the risk of head and neck cancer with these individuals. Responses to this question varied, with a notable proportion stating they “rarely” or “sometimes” provide such information.

Discussion

Head and Neck Cancers (HNC) are a significant clinical challenge due to their diverse histological subtypes, complex anatomical location, and multimodal treatment approaches.(7) The role of pulmonologists in the early recognition and referral of these malignancies is critical—particularly because of the anatomical proximity and symptom overlap between the respiratory system and head and neck region, and the shared risk factors, most notably tobacco use.

This study provides important insights into the knowledge and awareness levels of pulmonologists in Turkey regarding HNC. While the overall knowledge score was moderate (mean 16.05 ± 2.44), and most participants reported encountering high-risk patients—particularly smokers—significant deficiencies were observed in recognizing modern etiological factors, especially HPV infection, and certain less typical clinical symptoms.

Although awareness of traditional risk factors such as smoking (98%) and genetics (84%) was high, only 51% of participants correctly identified HPV infection as a risk factor. This is especially concerning given the global rise of HPV-positive oropharyngeal cancers, which often present in non-smoking, younger individuals outside the classic risk profile. Several studies emphasize the distinct epidemiologic and prognostic behavior of HPV-related HNCs, which, if unrecognized, may lead to delayed diagnoses in atypical patient populations (8,9).

These tumors are typically more responsive to treatment but may be overlooked if clinicians do not maintain a high index of suspicion. To address this, incorporating HPV-focused content into continuous medical education (CME) and training programs could enhance early recognition and referral accuracy, improving outcomes in this distinct subgroup of patients.

Recognition of major symptoms—such as neck mass (93%), dysphagia (90%), and hoarseness (89%)—was high; however, less obvious signs such as non-healing oral ulcers (63%) and taste disturbances (43%) were under-recognized. The overlap of HNC symptoms with those of chronic respiratory conditions—like persistent cough or hemoptysis—can further obscure timely suspicion. Kassirian emphasized that such diagnostic ambiguity contributes to referral delays and advanced-stage presentation at diagnosis (10). Despite most participants reporting that they would refer patients immediately to ENT upon suspicion, only a minority routinely counsel smoking patients about HNC risk. This disconnect between knowledge and preventive practice may hinder early detection efforts. Several studies have shown that delayed referral in patients with glottic or laryngeal symptoms not only shifts presentation toward stage IV disease but is also associated with significantly worse survival outcomes (11,12). Similarly, Schichtel demonstrated that educational interventions targeting pulmon-

ologists led to an increase in timely referrals and early diagnoses (13). Our findings align with previous literature suggesting that pulmonologists often exhibit stronger knowledge of lung cancer than HNC, which may undermine interdisciplinary management of patients presenting with dual or ambiguous symptomatology (14).

However, when appropriately integrated into multidisciplinary care teams, pulmonologists play an indispensable role—particularly in evaluating pulmonary function prior to treatment, managing treatment-related respiratory complications, and identifying coexisting pulmonary diseases among head and neck cancer patients (15). The lack of significant differences in knowledge across years of experience in our study suggests that seniority alone does not compensate for educational gaps.

Meert emphasized the need for integrating structured HNC modules into thoracic oncology training programs to foster familiarity and facilitate collaboration (16). Furthermore, CME activities aimed at non-ENT clinicians, such as primary care physicians, have been demonstrated to improve recognition of potential HNC symptoms and increase urgent referral rates, highlighting their value in facilitating earlier diagnosis and specialist involvement (17).

This study has several limitations. The data were collected via an online survey, which may introduce selection bias, as participants who are more academically inclined or interested in oncology may have been more likely to respond. Furthermore, the study relied on self-reported knowledge, which may not directly reflect clinical practice behavior. Although pulmonologists in Turkey demonstrate a reasonable understanding of classical risk factors and hallmark symptoms associated with HNC, significant knowledge gaps remain-particularly regarding HPV-related oropharyngeal cancer and atypical symptomatology. Moreover, there appears to be a disconnect between clinical knowledge and preventive communication with high-risk patients, particularly smokers. Given the shared risk factors and overlapping symptom profiles between pulmonary and head and neck diseases, pulmonologists are ideally positioned to contribute to early cancer detection.

Enhancing their awareness through targeted educational interventions, updating training curricula, and promoting interdisciplinary collaboration with ENT specialists could help bridge this gap. These strategies may ultimately lead to earlier diagnosis, more timely referrals, and improved patient outcomes.

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Does the Uniportal VATS Approach Affect Patient Safety and Oncologic Principles? Analysis of Anatomic Resections and Recent Results

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Abstract

Background and Objectives

Minimally invasive techniques have revolutionized lung cancer surgery by reducing morbidity while preserving oncologic principles. Uniportal Video-Assisted Thoracoscopic Surgery (U-VATS) has gained prominence for its balance of surgical precision and enhanced recovery. This study presents the outcomes of patients who underwent anatomic lung resection via U-VATS for primary lung cancer.

Materials and Methods

A retrospective review was conducted on patients undergoing U-VATS anatomical lung resections at our center between May 2020 and December 2022. Demographic data, tumor characteristics, surgical details, and postoperative outcomes were analyzed. Survival analysis and prognostic factors affecting survival were also evaluated.

Results

A total of 115 patients were included (mean age: 65±8.5 years; 78.3% male). Lobectomy was performed in 81.7% and segmentectomy in 11.3% of cases. R0 resection was achieved in all, with a median of 5 lymph node stations and 9 lymph nodes dissected. The complication rate was 15.7%, most commonly prolonged air leak. Adenocarcinoma was the most frequent histology (56.5%). Pathological staging revealed 1A in 23.5%, 1B in 36.5%, 2A in 5.2%, 2B in 25.2%, and 3A in 8.7%. Thirty-day mortality was 0.87%. The mean follow-up was 35.1±10.7 months, and overall survival was 87%. T stage (p=0.046) and lymphovascular invasion (p=0.002) were significant prognostic factors.

Conclusions

U-VATS anatomic lung resection is a safe and effective approach that provides oncologic adequacy with low complication and mortality rates. Our findings support its utility in achieving minimally invasive lung cancer surgery goals.

Keywords: anatomical resection, lung cancer, uniportal, video-assisted thoracoscopic surgery.

Introduction

Minimally invasive surgery aims to achieve less pain, faster recovery, and shorter hospitalization. In line with this principle, video-assisted thoracoscopic surgery (VATS) has become a routine approach for thoracic surgeons worldwide. VATS is now widely utilized not only for routine procedures and early-stage lung cancer but also for the most complex intrathoracic surgeries. Consequently, current guidelines recommend that lung cancer surgery should be performed using VATS by experienced surgeons while adhering to oncologic principles (1). Although VATS anatomical lung resection for lung cancer lacks a standardized technique, the approach has evolved significantly

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over the years—from the conventional two- to four-port method to the uniportal approach (2). Since 2004, uniportal VATS (U-VATS) has gained increasing importance in thoracic surgery units, including our center (3). The development of specialized instruments has further facilitated the widespread adoption of this technique. The fundamental geometric concept of U-VATS enables a sagittal approach to intrathoracic lesions, resembling the exposure achieved through open thoracotomy, while simultaneously providing enhanced visualization for hand-eye coordination (4). However, unlike conventional VATS, some studies suggest that U-VATS may present challenges regarding safety and oncologic efficacy (5). In this study, we aimed to present our recent outcomes of U-VATS anatomical lung resections for lung cancer and compare them with the current literature. In addition, we aimed to evaluate them in terms of patient safety and oncologic principles.

Material And Methods

Patient Selection

This retrospective, single-center study was conducted at the Department of Thoracic Surgery, XXX University Faculty of Medicine, between May 2020 and December 2022. A total of 137 patients who underwent U-VATS anatomical lung resection in our clinic were retrospectively analyzed. Patients aged 18 years or older with a diagnosis of primary lung malignancy were included in the study. Patients diagnosed with secondary lung malignancy or benign tumors based on histopathological examination, as well as those who underwent conversion to open thoracotomy due to intolerance to single-lung ventilation, were excluded from the study. After applying the inclusion criteria, 115 patients (90 males, 25 females; mean age: 65 ± 8.48 years; IQR: 58–70 years) were included in the final analysis (Figure 1). Informed consent was obtained preoperatively from all patients.

The data of the patients included in the study were retrospectively obtained from the hospital's digital information system, including demographic and medical records. A comprehensive review of the records was conducted to collect demographic data (age, sex, etc.), etiology, tumor size, lesion localization, harvested lymph node localization and count, histopathological findings, pathological staging, intraoperative complications, chest tube removal time, length of hospital stay, survival, and malignancy recurrence status. Prolonged air leakage (PAL) was defined as air leakage lasting more than five days. Early postoperative complications included atrial fibrillation, PAL, and surgical site infection, while late complications consisted of moderate to severe dyspnea, empyema, and bronchopleural fistula. The safety of the surgical technique was evaluated based on perioperative complications, chest tube duration, and length of hospital stay. Compliance with oncologic principles was assessed by R0 resection status, mediastinal lymph node dissection, number of harvested lymph nodes, locoregional recurrence, and survival outcomes.

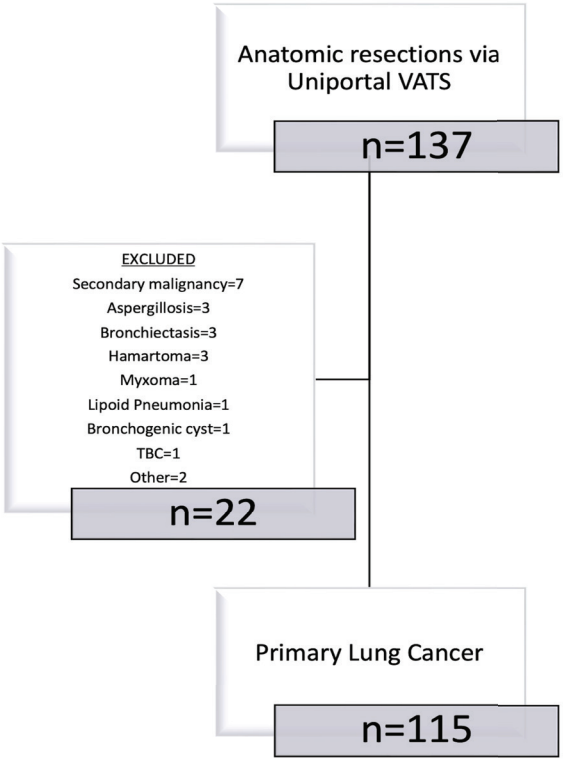


Figure -1: Flowchart of the study.

Surgical Technique

The patient was intubated with a double-lumen endotracheal tube for single-lung ventilation and placed in the lateral decubitus position. Although there are differing opinions in the literature regarding the optimal incision site and intercostal entry, we determined our incision approach based on the technique previously described in our study (6). A single 3–4 cm incision was made in the predetermined intercostal space, and a wound protector was used to facilitate instrument manipulation. A 10-mm, 30° thoracoscope (HOPKINS® Forward-Oblique 30° Telescope, Karl Storz, Tuttlingen, Germany) was used for visualization, while a LigaSure™ Maryland Jaw (Minneapolis, MN, USA) endoscopic sealing and dissection device was utilized for tissue dissection. Following a 360° dissection of the hilum, systematic mediastinal lymph node dissection (LND) was performed, and lobe-specific lymph nodes were analyzed using frozen section histopathology. For vascular and bronchial dissection, the preferred surgical instruments included a node grasper, dissector clamp, endovascular clamp, right-angled clamp, and suction device. Dissected vascular and bronchial structures were either transected using an endostapler or ligated with Hem-o-Lock clips and sealed with an energy device. Fissure separation was performed using either staplers or an energy device. In cases completed with the fissure-last technique, an average of four to five staplers was used for parenchymal division. For right upper lobecto-

mies and left upper lobectomies with complete fissures, the fissure-first technique was preferred. At the end of the procedure, a 28Fr chest tube was placed through the same incision, and negative pressure was established using a closed underwater drainage system.

Statistical Analysis

Statistical analyses were performed using SPSS version 26.0 for Windows. Data were presented as mean ± standard deviation (SD), median (interquartile range, IQR), and frequency (%). The Shapiro-Wilk test was used to assess the normality assumption of quantitative variables. For non-normally distributed data, the Mann-Whitney U test was applied. Pearson's chi-square test, continuity correction chi-square test, and Fisher's exact test were used for frequency comparisons. Survival analyses were conducted using the Kaplan-Meier method and Cox regression analysis. A p-value < 0.05 was considered statistically significant.

Results

In this study, the clinical and surgical data of 115 patients were analyzed. The mean age of the patients was 65 ± 8.48 years, with male patients comprising 78.3% (n=90) of the study population. The Charlson Comorbidity Index (CCI), which was used to assess the comorbidity burden, had a mean score of 4.78 ± 1.54. Additionally, the Morbidity Risk Score, which evaluates postoperative mortality risk, was calculated as 35.63 ± 29.18. Regarding surgical procedures, lobectomy was the most commonly performed operation (81.7%), followed by segmentectomy (11.3%) and bilobectomy (3.5%). In terms of laterality, 59.1% (n=68) of the procedures were performed on the right lung, while 40.9% (n=47) involved the left lung. Lymph node dissection data revealed that an average of 5.28 ± 1.92 lymph node stations were dissected, with a mean of 9.73 ± 5.69 lymph nodes harvested. The median postoperative chest tube removal time was 2 days (IQR: 1–4 days), while the median length of hospital stay was 4 days (IQR: 3–5 days). The intraoperative complication rate was 4.34% (n=5), with bleeding being the most common complication. Conversion to open thoracotomy due to bleeding was required in two patients (1.8%). The postoperative complication rate was 15.7% (n=18), with prolonged air leakage (13.04%) being the most frequently observed complication. Only one patient experienced

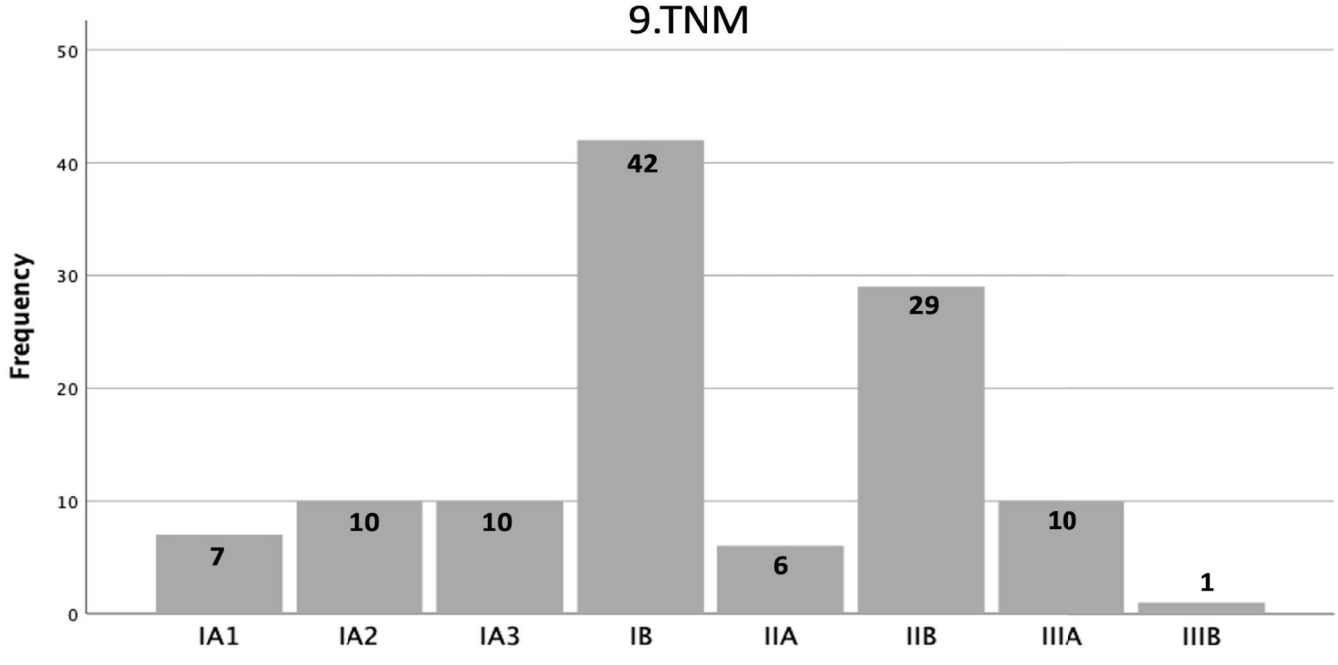
Table-1: Descriptive analysis of demographic and surgery-related variable

Variables	Total (n=115)
Age (mean±SD) year	65±8.48
Sex, n (%) Male Female	 90 (78.3) 25 (21.7)
Resection, n (%) Lobectomy Bilobectomy Segmentectomy Lobectomy+Segmentectomy Pneumonectomy Lobectomy+TWR	 94 (81.7) 4 (3.5) 13 (11.3) 2 (1.7) 1 (0.9) 1 (0.9)
Side, n(%) Right Left	 68 (59.1) 47 (40.9)
Charlton Comorbidity Score	4.78±1.54
Mortality Risk Score	35.63±29.18
Number of Lymph Node Station (mean±SD)	5.28±1.92
Number of Lymph Node, (mean±SD)	9.73±5.69
Tube removal [median(IQR)] day	2 (1-4)
Postoperative LOS [median(IQR)] day	4 (3-5)
Intraoperative complication, n(%) No Yes	 110 (95.66) 5 (4.34)
Postoperative complication, n(%) No Yes	 97 (84.3) 18 (15.7)
Follow-up (mean±SD) month	35.1±10.7
Malignancy (Recurrens/Seconder) n(%) No Yes	 100 (87) 15 (13)
Survival, n(%) Alive Death	 100 (87) 15 (13)

(IQR: Interquartiler range; LOS: Lenght of stay; SD: Standart deviation; TWR: Thoracic Wall resection)

30-day mortality due to COVID-19. The mean postoperative follow-up period was 35.1 ± 10.7 months. At the last follow-up, 87% of patients (n=100) remained event-free, whereas 13% (n=15) developed malignancy (recurrence or secondary organ involvement). The overall survival rate during the follow-up period was 87% (n=100), and the total mortality rate was 13% (n=15). A detailed descriptive analysis of demographic and surgical variables is presented in Table 1.

According to the 9th TNM classification of the World Health Organization (WHO), the distribution of cases based on the T factor and disease stage is presented in Figures 2 and 3. The most frequently observed T stage was T2a (40%, n=46), followed by T3 (24.3%, n=28). Among the cases, Stage IB was the most common disease stage (36.5%), followed by Stage IIB (25.2%). Early-stage tumors (IA1, IA2, IA3) were observed at lower frequencies (6.1% to 8.7%).

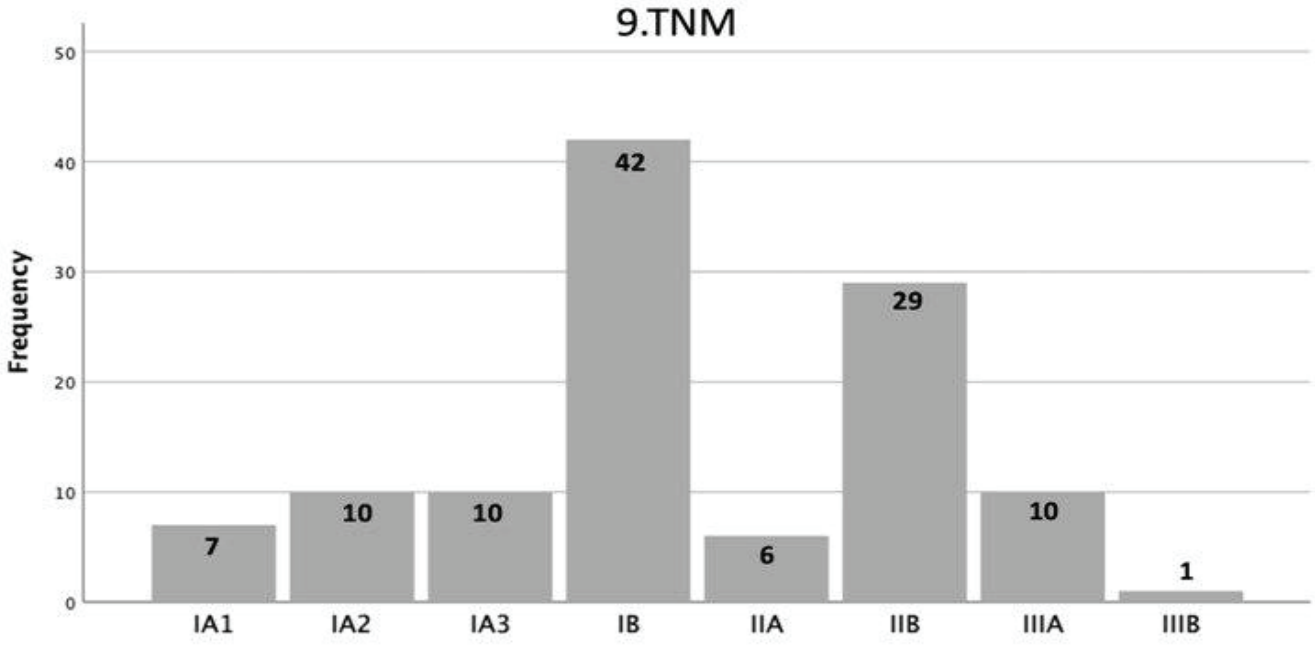


Stage	%	Stage	%
IA1	6,1	IA2	8,7
IA3	8,7	IB	36,5
IIA	5,2	IIB	25,2
IIIA	8,7	IIIB	0,9

Figure -2: Distribution of patients according to T stage.

In this study, the most frequently identified histopathological tumor type was adenocarcinoma (56.5%, n=65). Squamous cell carcinoma was detected in 35.7% (n=41) of cases, while neuroendocrine tumors were identified in 7.8% (n=9). The mean tumor diameter was 31.16 ± 17.43 mm. Lymphovascular invasion was detected in 10.4% (n=12) of patients, and perineural invasion was observed in 7% (n=8) of cases. Regarding visceral pleural invasion (VPI), PL0 was identified in 45.2% (n=52) of patients, indicating no pleural invasion. PL1, PL2, and PL3 were observed in 29.6% (n=34), 20.9% (n=24), and 4.3% (n=5) of cases, respectively. Spread through air spaces (STAS) was found in 11.3% (n=13) of patients. An analysis of lymph node involvement revealed that 81.7% (n=94) of patients had no lymph node metastasis, while 18.3% (n=21) exhibited lymph node involvement (Table 2).

In this study, the relationship between survival status and clinical and histopathological variables is presented in Table 3. No statistically significant difference in survival was observed in terms of sex or surgical procedures. Similarly, survival did not differ significantly among histopathological subgroups. Among patients with adenocarcinoma, 86.2% (n=56) survived, while the mortality rate was 13.8% (n=9). The survival rate for squamous cell carcinoma (SCC) was 85.4% (n=35), whereas all patients with neuroendocrine tumors (100%, n=9) survived. No



Stage	%	Stage	%
IA1	6,1	IA2	8,7
IA3	8,7	IB	36,5
IIA	5,2	IIB	25,2
IIIA	8,7	IIIB	0,9

Figure -3: Distribution of patients according to the 9th TNM staging system.

Table-2: Descriptive analysis of tumor histopathology results of the patients.

Histopathologic Results	**Total (n=115)**
Pathology, n(%)	
Adenocarcinoma	65 (56.5)
Squamous Cell Carcinoma	41 (35.7)
Neuroendocrine Carcinoma	9 (7.8)
Tumor size (mean±SD) mm	31.16±17.43
Lymphovascular invasion, n (%)	
No	103 (89.6)
Yes	12 (10.4)
Perineural invasion, n (%)	
No	107 (93)
Yes	8 (7)
Pleural invasion, n (%)	
PL0	52 (45.2)
PL1	34 (29.6)
PL2	24 (20.9)
PL3	5 (4.3)
STAS, n(%)	
No	102 (88.7)
Yes	13 (11.3)
Lymph Node Metastasis, n (%)	
No	94 (81.7)
Yes	21 (18.3)

(PL: Pleural layer; SD: Standart deviation; STAS: Tumor spread through air spaces)

statistically significant difference was found in survival analysis based on the 9th TNM staging system. In general, Stage IA patients had the highest survival rates, while patients with advanced-stage disease showed an increase in mortality. The poorest survival outcome was observed in Stage IIIB patients, with no survivors recorded in this group.

Table -3: The effect of clinical, histopathologic and surgical factors on survival.

	Survival		p
	Alive	Death	
Sex			
Male	77	13	0.397
Female	23	2	
Resection			
Lobectomy	83	11	
Bilobectomy	10	3	
Segmentectomy	4	0	0.108
Lobectomy+Segmentectomy	1	0	
Pneumonectomy	2	0	
Lobectomy+TWR	0	1	
Pathology			
Adenocarsinoma	56	9	0.477
SCC	35	6	
NEC	9	0	
9.TNM Staging			
IA1	6	1	
IA2	9	1	
IA3	8	2	
IB	40	2	0.123
IIA	5	1	
IIB	23	6	
IIIA	9	1	
IIIB	0	1	
T Stage			
Tis	1	0	
1mi	1	0	
1a	4	2	
1b	11	1	0.046
1c	8	2	
2a	44	2	
2b	7	2	
3	22	6	
4	2	0	
Lymph Node Metastasis			
No	83	11	0.366
Yes	17	4	
Pleural invasion			
PL0	47	5	
PL1	30	4	0.254
PL2	20	4	
PL3	3	2	
Lymphovascular invasion			
No	93	10	0.002
Yes	7	5	
Perineural invasion			
No	94	13	0.298
Yes	6	2	
STAS			
No	90	12	0.254
Yes	10	3	
Complication			
No	85	12	0.619
Yes	15	3	
Malignancy at follow-up			
No	88	12	0.391
Yes	12	3	

(PL: Pleural layer; SD: Standart deviation; STAS: Tumor spread through air spaces; Tis: Insitu tumor; TWR: Thoracic Wall resection; 1mi: histopathology of minimally invasive tumor)

A statistically significant difference was found in T-stage survival analysis (p=0.046). Patients with T1-stage tumors had better survival rates, whereas mortality increased significantly in T3 and T4-stage patients. The presence of lymph node metastasis negatively impacted survival; however, the difference was not statistically significant. Among patients without lymph node metastasis, 88.3% (n=83) survived, whereas the survival rate in patients with metastasis was 81.0% (n=17). No significant association was found between visceral pleural invasion (VPI) and survival. However, among TPL-3 patients, the survival rate was the lowest, with a mortality rate of 40.0% (n=2).

The presence of lymphovascular invasion (LVI) significantly affected survival (p=0.002). In patients without LVI, the survival rate was 90.3% (n=93), whereas in patients with LVI, the survival rate dropped to 58.3% (n=7). No significant relationship was found between survival and perineural invasion, STAS presence, or postoperative complications. Additionally, no statistically significant difference was observed between malignancy recurrence and survival (p=0.391).

The survival rate in patients without malignancy recurrence was 88.0% (n=88), while it was 80.0% (n=12) in those with recurrence. In the Kaplan-Meier survival analysis of T-stage, presented in Figure 4, a significant difference in survival rates among different T-stages was observed (Log-rank: 18.118, degrees of freedom (df): 9, p=0.034).

Similarly, in the Kaplan-Meier survival analysis based on lymphovascular (LV) invasion, shown in Figure 5, LV invasion was found to have a significant impact on survival rates (Log-rank: 8.596, df: 1, p=0.003). Notably, during the first 20–30 months of follow-up, a sharp decline in the survival curve was observed in patients with LV invasion.

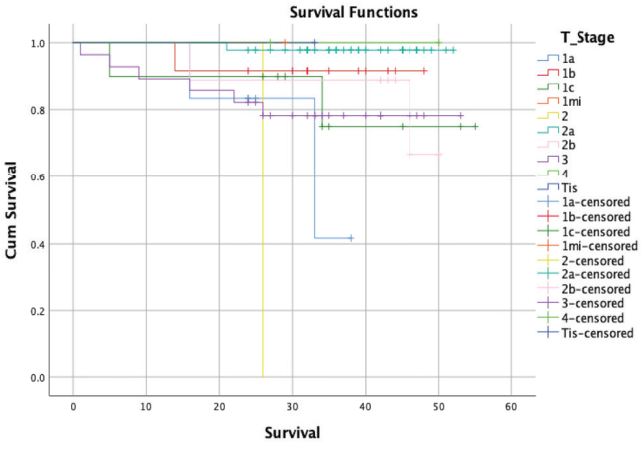


Figure -4: Survival analysis of patients included in the study according to T stage (Log-rank: 18.118, df: 9, p=0.034)

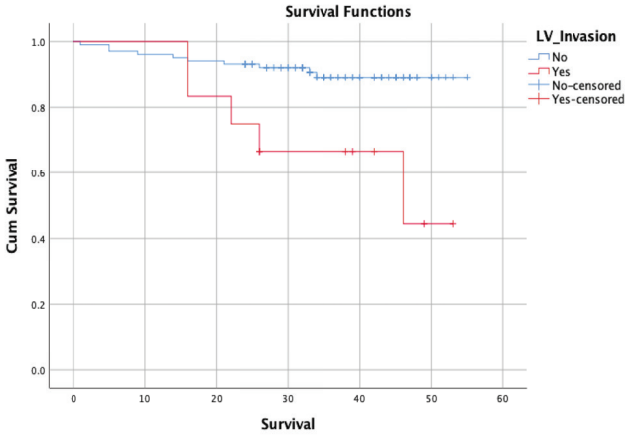


Figure-5: Survival analysis of patients included in the study according to lymphovascular invasion status (Log-rank: 8.596, df: 1, p=0.003)

Discussion

This retrospective, single-center study comprehensively analyzed the early postoperative outcomes and survival of patients who underwent anatomical resection via U-VATS for primary lung cancer. Surgical safety was assessed based on perioperative complications, chest tube duration, and length of hospital stay, while oncologic principles were evaluated using intraoperative staging criteria, histopathological characteristics, and survival analysis. With acceptable complication rates, this study highlights that U-VATS can be safely utilized in the surgical treatment of lung cancer. Additionally, a detailed evaluation of prognostic factors influencing survival after surgery has been emphasized, providing valuable clinical insights for future prospective studies.

Compared to open surgery and conventional VATS, U-VATS has been shown to be at least as safe as other techniques. Drevet et al. reported that U-VATS is a safe and feasible approach for both standard and complex lung surgeries (7). Similarly, AlShimali et al. reported that U-VATS provides comparable safety and postoperative outcomes to triportal VATS (8). The common aspect of these studies is that they evaluated perioperative parameters, morbidity, and mortality outcomes to assess surgical safety. In contrast, Nachira et al. focused on oncologic parameters, including lymph node dissection, R0 resection, and survival outcomes, and concluded that U-VATS is comparable to other techniques while offering advantages such as reduced postoperative pain and shorter hospital stays (9). In our study, we compared perioperative parameters and survival outcomes of anatomical resections performed with U-VATS to the existing literature. Harris et al., in a meta-analysis comparing U-VATS and M-VATS, reported an average conversion to open thoracotomy rate of 3.6% and 2.6%, respectively. Additionally, they found chest tube duration to be 4.5/5.3 days and hospital stay to be 6.2/6.7 days. Similarly, Savoie-White et al., in a systematic review of 12 studies, reported that chest tube duration and hospital stay were similar between U-VATS and other approaches, while U-VATS was associated with less intraoperative bleeding (10).

Furthermore, two different studies investigating surgical treatment of lung cancer demonstrated that U-VATS was associated with fewer complications and less postoperative pain (11, 12). In our study, the intraoperative complication rate was 4.34% and the conversion to open thoracotomy rate was 1.8%. Despite a postoperative complication rate of 15.7%, the median chest tube duration was 2 days, and the median hospital stay was 4 days. These findings, which indicate shorter durations compared to the literature, further support the safety of U-VATS in surgical treatment. Adherence to oncologic principles is the most critical factor influencing treatment success for all surgeons involved in cancer surgery (13). Tumor characteristics, lymph node involvement, and distant organ metastasis directly impact survival and serve as key determinants for disease staging (14). In addition to these oncologic factors, surgical parameters that directly influence survival include complete microscopic tumor resection, adequate lymph node dissection, and accurate pathological staging.

The Uniportal VATS Interest Group (UVIG) consensus of the European Society of Thoracic Surgery (ESTS) has endorsed the use of U-VATS in the surgical treatment of early-stage lung cancer (2). In lung cancer surgery, the extent of anatomical resection is determined based on the T factor. U-VATS has been shown to be a safe approach for all types of lung resections, including pneumonectomy and other complex procedures (15-18). In our study, the predominance of T2a-stage patients suggests that most cases were surgically operable. The low proportion of early-stage tumors (Tis, T1a, T1b, T1c) was attributed to restrictions imposed during the COVID-19 pandemic, which led to delays in surgery for early-stage disease or the preference for non-surgical treatment op-

tions. Furthermore, our study confirms, through T-stage-based survival analysis, that survival rates are significantly higher in early T-stages, whereas they decline substantially in advanced stages.

Adequate lymph node evaluation is crucial for accurate staging, which directly impacts treatment decisions. Several studies have demonstrated that VATS is an effective method for mediastinal lymph node dissection, achieving outcomes comparable to, or even superior to, those of thoracotomy (11, 19).

Moreover, studies comparing lymph node dissection performed via U-VATS and conventional VATS have reported no significant differences between the two techniques. Some studies have even suggested that U-VATS may be superior in terms of the number of harvested lymph nodes (20-23). In addition, Buz et al. stated that tumors involving lymph nodes may be associated with poor outcomes (24). Therefore, ipsilateral lymph node dissection is recommended during surgical treatment of lung cancer (2). In our study, systematic lymph node dissection was performed using the U-VATS approach, with an average of five lymph node stations dissected and a mean of nine lymph nodes harvested. The lymph node metastasis rate was 18.3%, yet no statistically significant association with survival was observed. However, among histopathological characteristics, lymphovascular invasion (LVI) was identified as a factor directly associated with survival. Lymphovascular invasion is a key prognostic factor, indicating the aggressive biological behavior of tumors. This study suggests that patients with LVI are at higher risk for disease recurrence and should be closely monitored. The presence of LVI may increase the need for adjuvant therapy and should be carefully considered in postoperative management. This study has several limitations. First, it has a retrospective design, which may introduce selection bias. Additionally, as a single-center study, the generalizability of the findings to larger patient populations is limited. The sample size was relatively small, which may have reduced the statistical power of survival analyses, particularly in advanced-stage tumors. The mean follow-up period was 35.1 ± 10.7 months, which may not be sufficient to evaluate long-term oncologic outcomes. Lastly, certain confounding factors, such as smoking status and pulmonary function, which could potentially influence survival, were not fully controlled. Considering these limitations, the findings of this study should be further validated through multi-center, prospective studies with larger patient cohorts.

In conclusion, U-VATS is a safe and feasible surgical approach for lung cancer treatment, adhering to oncologic principles while maintaining acceptable perioperative complication rates. A more comprehensive understanding of prognostic factors affecting survival after lung surgery requires large-scale, multi-center studies with long-term follow-up. This study highlights the effectiveness of U-VATS in lung cancer surgery and provides valuable clinical insights for future surgical strategies.

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Informed Consent Statement
Informed consent was obtained from all subjects involved in the study.

Ethics Committee Approval:
The study was conducted in accordance with the Declaration of Helsinki and approved by the Ondokuz Mayıs University Clinical Research Ethics Committee (approval number: 2025/146; approval date: 12 March 2025).

Peer-review: Externally peer-reviewed.

Conflict Of Interest: The authors declare that there are no conflicts of interest.

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The Cost-Effectiveness of Inpatient and Outpatient Physical Therapy Programs in Knee Osteoarthritis

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Abstract

Background: Physical therapy and exercise are frequently used therapies for knee osteoarthritis (KOA) patients. This study aims to evaluate inpatient and outpatient physical therapy programs' cost-effectiveness in KOA patients.
Methods: This randomized trial consists of sixty KOA patients who were randomly divided into two groups. The same combined physical therapy program was given to Group 1 (n=30) in the inpatient setting, and Group 2 (n=30) in the outpatient setting. Pain intensity was evaluated by Visual Analog Scale (VAS), functional activity with Stair Climb, Chair Stand Tests, and Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC), fall risk with Hendrich II Fall Risk Scale, and quality of life with ShortForm-36 (SF-36). Direct and indirect costs were calculated five times during the entire study.
Results: After the six-month follow-up period, Group 1 showed a significant improvement in all parameters ($p<0.05$). Group 2 improved in all parameters ($p<0.05$), except for Chair Stand Test, WOMAC stiffness subscale, and SF-36 physical and emotional role functioning ($p>0.05$). The total inpatient treatment cost (€1182.36) was higher than the outpatient group (€547.07). The utility was higher in the outpatient therapy group (1.80 vs. 1.97 in the inpatient and outpatient groups, respectively).
Conclusions: Our study results show that both therapy programs are effective, although the outpatient program is more cost-effective. Outpatient physical therapy program is encouraged, unless there are comorbid conditions requiring hospitalization.
This study is registered at ClinicalTrials.gov (retrospectively registered; date. 27.01.2021; NCT04736069).
Keywords: osteoarthritis, knee, physical therapy, cost-effectiveness

Introduction

Knee osteoarthritis (KOA) is a major public health concern with a heavy economic burden. According to a regional study conducted in Turkey, the prevalence of KOA among individuals over the age of 40 is 20.9% (1). In KOA patients, pain emerges as the primary symptom, resulting in physical, psychological dysfunction and, eventually, impaired quality of life (QoL) (2). Osteoarthritis (OA) is related with a high rate of work loss (3,4). Considering the high prevalence of KOA, it is not difficult to estimate the costs to both patients and society, which underlines the urgent need for cost-effective treatment strategies. Modifiable risk factors for KOA include obesity, dietary exposures, comorbidities, occupational factors, physical activity, and biomechanical factors (5). The therapeutic approach of KOA patients should be considered individually, and management should be based on evaluation from patient-basis combined measures. The non-pharmacological interventions in KOA include nutritional counseling for weight loss and exercise, management of comorbidities, and biomechanical support (5). The

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pharmacological treatments consist of basic analgesics or non-steroidal anti-inflammatory drugs, intra-articular glucocorticoids and, glucosamine/chondroitin sulfate in case of an inadequate response to oral analgesics (6). Pharmacological treatments are effective for both preventative and symptom-relieving goals (7,8). However, they are well known for their side effects. In particular, integrated rehabilitation programs are frequently used to improve patients' symptoms and QoL in the elderly population. Exercise programs and physical therapy programs are separately shown to have considerable benefits on pain and disability (9,10). However, the costs of these interventions are increasingly considered in the current health care policies for a more efficient utilization of resources. To date, several cost-effectiveness studies have been carried out for weight loss and exercise programs (11,12). A limited number of studies have investigated the cost-effectiveness of physical therapy and rehabilitation programs; however, conflicting results have been reported and, in these studies, different designs and outcome measures used prevent direct comparisons (12).

To the best of our knowledge, there is no head-to-head study comparing the effectiveness and costs of an integrated physical therapy program in the inpatient and outpatient settings. Estimating the rehabilitation programs' costs and utility may help clinicians to decide optimal treatment strategies with proper resource utilization. In the present study, therefore, we aimed to estimate the costs of both outpatient and inpatient rehabilitation programs and to assess the utility of those programs and compare the cost-effectiveness of both programs. This study addresses a significant gap in the literature by directly comparing the cost-effectiveness of identical physical therapy protocols in both inpatient and outpatient settings; an area that has not been previously evaluated in a head-to-head randomized design.

Materials and methods

Patients

A total of 60 consecutive KOA patients who referred to the physical therapy and rehabilitation outpatient clinic of our center between March 2011 and January 2013 and fulfilled the eligibility criteria were included in this prospective randomized study. The diagnosis of KOA was made based on the 2010 American College of Rheumatology (ACR) criteria (13). Exclusion criteria were uncontrolled hypertension, visual disturbances, pregnancy, malignancy, advanced cardiovascular, liver or kidney pathologies, having lower extremity injuries, inflammatory rheumatic diseases and prior total hip or knee arthroplasty surgery. The patients were randomized into two intervention groups. Basic randomization model was used for randomization. Each patient was instructed to select one of two sealed envelopes, each containing an identical therapy program, but differing in whether the intervention would be delivered in an inpatient or outpatient setting. Group 1 (n=30) received 21 inpatient physical therapy sessions, including superficial-deep heat applications, electrotherapy, and a basic knee exercise program. Group 2 (n=30) received the same rehabilitation program in the outpatient setting. A written informed consent was obtained from each patient. The study protocol was approved by the local Ethics Committee (Date: 4.10.2010-No: 08043). The study was conducted in accordance with the principles of the Declaration of Helsinki. This study is registered at ClinicalTrials.gov (retrospectively registered; date. 27.01.2021; NCT04736069).

Physical Therapy interventions

The physical therapy program consisted of 20 min of hot pack, 20 min of transcutaneous electrical nerve stimulation (TENS; 30 to 40 Hz), and six min of ultrasound (US; 1 MHz, 1 to 1.5 Watt/cm2) therapy. A combined range of motion and strengthening exercises were performed by two groups two times a day. The rehabilitation program was administered to both groups under the supervision of physical therapists.

Outcome Measures

Pain and physical function were the primary outcomes of this study. The secondary outcome was the patients' QoL.

Pain: Pain intensity was measured with the Visual Analog Scale (VAS). The patients were asked to mark their pain level on a 10-cm horizontal line with terminal ends of 'No pain' and 'The worst pain.' The VAS was also used for the Patient Global Assessment (PGA) and Physician Global Assessment (MDGA). Physical function: Functional activity was evaluated with Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) (14,15). This questionnaire includes five items for pain, two for stiffness, and 17 for functional limitation (score range 0–68). All the items are scored on a scale of 0-4, with higher scores indicating a greater level of symptoms or physical disability. To measure the leg strength and endurance, we used the Chair Stand Test and Stair Climb Tests. During the Chair Stand Test, the patient is instructed to sit in a chair with arms crossed over his/her chest and stand up as quickly as possible without using arms (16). The patient is instructed to ascend and descend the stairs as fast, but as safe as possible for the Stair Climb Test, and the total time is recorded (17).

Fall risk assessment: The Hendrich II Fall Risk Scale was used to evaluate the fall risk. This scale consists of seven items including gender, depression, dizziness, confusion & disorientation, change in excretion, antiepileptic & benzodiazepine use, and get up and walk test. Patients having a score of ≥5 are considered at high risk (18).

QoL: The QoL was assessed using the ShortForm-36 (SF-36), which consists of eight multi-item scales: bodily pain, social functioning, physical functioning, role-emotional, role-physical, general health, mental health and vitality. Each score of these subscales ranges from 0 to 100. Higher scores indicate better QoL. The validation and reliability studies of the SF-36 were conducted in the Turkish population (19).

Costs

Costs covered by health resources and individual payments by patients during a six-month follow-up were calculated. The patients' outpatient services, diagnostic tests, and therapy expenses were calculated as direct healthcare costs, transportation expenses as direct non-medical costs, and work-loss days as indirect costs. The Turkish Social Security Institution (SGK) reimbursement rates were used to measure the cost per unit of tests and treatments. All measurements and all expenditures were assessed five times during the entire study: at before treatment (baseline), immediate post-treatment period, and post-treatment follow-up (at one, third, and six months). As the physical therapy interventions were conducted under the supervision of a physical medicine and rehabilitation specialist and a physiotherapist, treatment adherence was complete in both groups. However, eight patients were excluded from the final analysis due their inability to attend follow-up visits during the 6-month monitoring period.

Statistical and Cost-Effectiveness Analysis

Statistical analysis was performed using the SPSS for Windows version 20.0 software (IBM Corp., Armonk, NY, USA). Descriptive data were expressed in mean ± standard deviation (SD), median (min-max) or number and frequency, where applicable. The independent samples t-test or Mann-Whitney U test was used to compare input and output patient characteristics, depending on the distribution of data set. The Pearson chi-square test was used to compare independent groups according to categorical variables. Differences between pre- and post-treatment values within each group were evaluated using the Wilcoxon signed-rank test. P value <0.05 was considered statistically significant.

The cost-effective analysis results were given as costs, total utility (TU), and incremental cost-effectiveness ratio (ICER). Total utilities were calculated from the VAS scores. To evaluate both patient- and physician-reported VAS scores, two VAS scores were weighted. A total of 40% of patient-reported VAS scores and 60% of physician-reported VAS scores were taken, and TU was calculated according to the weighted VAS score. Costs and total utilities of treatments were sorted in an ascending order. The least costly treatment was assigned as the baseline treatment. The ICER for each treatment was calculated, considering the treatment coming after itself. In cost-effectiveness analysis, ICER is calculated for comparing non-dominated options. If a treatment has a greater TU and acceptable total cost, the ICER is obtained using the following formula: "ICERTreatment-1/Treatment-2=(CostTreatment-1-CostTreatment-2)/TUTreatment-1-TUTreatment-2)" To get TU over time for each patient, a specific utility estimator described by Yuksel et al. (20) was used. The MS Office Excel version 2018 software (Microsoft Corp., WA, USA) was used to calculate TU values.

Results

Of 60 patients, 52 completed the study. Of these patients, the mean age was 64.4±13.3 years. Both groups had similar baseline characteristics including age, sex, marital status, comorbidities, occupation, trauma history and Kellgren Lawrence grade; except for body mass index (BMI) and education status. Radiologic scale of osteoarthritis was graded accordingly with the Kellgren Lawrence Scale as grade 0: No radiographic features of osteoarthritis are present; grade 1: Doubtful joint space narrowing and possible osteophytic lipping; grade 2: Definite osteophytes and possible joint space narrowing; grade 3: Moderate multiple osteophytes, definite joint space narrowing, some sclerosis, and possible deformity of bone ends; grade 4: Large osteophytes, marked joint space narrowing, severe sclerosis, and definite bone end deformity) (21). Baseline characteristics of the patients are summarized in Table 1.

At the end of the six-month follow-up period, the inpatient physical therapy group had a significant improvement in all parameters (VAS, PGA, MDGA, Stair Climb Test, Chair Stand Test, all WOMAC subscale scores, Hendrich II Fall Risk Score, and all SF-36 subscale scores) ($p<0.05$). The outpatient physical therapy group had a significant improvement in all parameters ($p<0.05$), except for the Chair Stand Test, WOMAC stiffness subscale, and SF-36 physical role functioning and emotional role functioning subscales ($p>0.05$) (Table 2). There were no significant differences in the medication, medical equipment, intra-articular injections, complementary treatments, and laboratory and imaging expenses between the groups ($p<0.05$). However, the initial costs and transportation costs were significantly different between the groups ($p<0.05$) (Table 3).

The estimated total inpatient treatment cost was higher than the outpatient treatment group (inpatient=€1182.36; outpatient=€547.07). TU was higher in the outpatient treatment group (1.80 vs. 1.97 in the inpatient and outpatient groups, respectively). The ICER was calculated as 234.65 for outpatient rehabilitation program and 1714.89 for inpatient rehabilitation program, indicating that inpatient treatment was dominated by the outpatient treatment. According to the

Table- 1: Patient characteristics of the groups

		Group 1 (n=30) (inpatient therapy)	Group 2 (n=22) (outpatient therapy)	p value
Age (year) (Mean± SD)		66.8±12.2	61.0±14.1	**0.120**
Sex - female n (%)		27 (90)	16 (72.7)	0.144
Marital status - married n (%)		28 (93.3)	20 (90.9)	**0.999**
Education n (%)	**Elementary School**	25 (83.3)	11 (50.0)	0.042
	Middle School	2 (6.7)	3 (13.6)	
	High School	1 (3.3)	6 (27.3)	
	University	2 (6.7)	2 (9.1)	
BMI (kg/m2) (Mean± SD)		30.2±4.0	26.8±4.3	0.006
Comorbidities (Hypertension, diabetes, thyroid diseases) n(%)		16 (53.3)	12 (54.5)	**0.931**
Occupation - working n (%)		1 (3.3)	4(18.2)	0.149
Occupational intensity n (%)	**Heavy**	0 (0)	1 (4.5)	**0.202**
	Moderate	2 (6.7)	4 (18.2)	
	Light	28 (93.3)	17 (77.3)	
Present Trauma history n (%)		6 (20.0)	5 (22.7)	0.999
Kellgren- Lawrence grading n (%)	**Grade 1-2**	10 (33.4)	14 (63.7)	**0.143**
	Grade 3	14 (46.2)	5 (22.7)	
	Grade 4	6 (20.0)	3 (13.6)	

n: number, BMI: body mass index, SD: standard derivation

cost-effective analysis, outpatient treatment program was more cost-effective.

Discussion

In the present study, we compared inpatient and outpatient physical rehabilitation programs for KOA. As our objectives were to compare the utility of the programs and analyze the overall expenses of a KOA patient for six months, no limitations were applied to the use of health resources. According to our results, both treatment strategies were effective in terms of improvement in the pain, physical function, and QoL scores; however, there was only a slight difference in the utility of each strategy. The cost-utility analysis showed that the physical therapy in the outpatient setting was more cost-effective, suggesting that the inpatient physical therapy program was effective, but was more costly.

The non-pharmacological treatment of OA consists of therapeutic exercise programs and lifestyle modifications (22). The main goals are to educate patients about the disease's course and its consequences, reduce joint pain and stiffness, improve joint mobility, prevent further damage, and increase QoL. According to Hurley et al. (23), intervention programs should carry several characteristics such as being safe, acceptable, and useful for patients, whereas being implantable and affordable for healthcare providers. Previous studies have addressed on the cost-effectiveness of physical activity and exercise programs, compared to usual care. The studies investigating the cost-effectiveness of physical activity and exercise programs showed that these interventions provided better health outcomes at lower costs (24-26). According to the data from the United Kingdom National Health Service (NHS) and the social services sector, the class-based exercise program resulted in lower costs and incremental quality-adjusted life-year (QALY) gains than home-based exercise alone (24,25).

The class-based program was under the supervision of a physiotherapist and consisted of stretching, balance training, and strengthening with functional and isometric exercises. In another study including 439 participants, the authors evaluated three months of aerobic exercise program and resistance exercise program at two centers and compared them with health education (26). Both programs resulted in lower costs and improved disability scores. Incremental improvement in self-reported disability scores was found to be of 0.18 and 0.16 for aerobic and resistance exercise, respectively, indicating that aerobic exercise had lower costs and a more significant benefit than resistance exercise. According to a recent study by Silva et al. (27), inactive KOA patients' attendance to a physical activity program could save 200 cases of cardiovascular disease, 400 cases of diabetes, and 6,800 QALYs. Until now, physical therapy interventions have been assessed regarding their cost-effectiveness in a limited number of studies with conflicting results. According to the study of Pinto et al. (28), manual therapy, exercise, and combined programs were cost-effec-

Table -2: Analysis of outcomes within the groups

		Group 1 (n=30) (inpatient therapy) median (min-max)						Group 2 (n=22) (outpatient therapy) median (minmax)					
		Pre-treatment	Post-tre-atment	1st month	3rd month	6th month	p	Pre-treat-ment	Post-treat-ment	1st month	3rd month	6th month	p value
VAS		8 (4-10)	5 (1-8)	4 (1-8)	4 (1-8)	3 (0-6)	<0.001	7 (3-10)	5 (0-8)	3 (0-8)	3 (0-7)	2 (0-8)	<0.001
Stair climb test		33 (9-134)	31 (10-132)	31 (13-129)	30 (11-132)	28 (9-127)	<0.001	46 (12-134)	42 (12-135)	44 (10-135)	41 (11-128)	40 (11-125)	<0.001
Chair stand test		4 (2-8)	4 (2-7)	4 (2-7)	4 (2-6)	4 (2-7)	0.007	5 (2-8)	4 (2-6)	4 (3-6)	4 (2-5)	4 (2-5)	NS
WOMAC Index	Pain	12 (7-18)	9 (3-16)	7 (3-15)	6 (1-16)	6 (1-12)	<0.001	14 (5-20)	10 (0-16)	9 (0-14)	8 (0-14)	9 (0-14)	<0.001
	Stiffness	2 (0-6)	2 (0-6)	2 (0-6)	2 (0-6)	2 (0-4)	0.019	3 (0-6)	3 (0-6)	2 (0-6)	2 (0-4)	2 (0-5)	NS
	Disability	21 (10-35)	16 (5-33)	14 (4-31)	12 (3-27)	11 (3-26)	<0.001	18 (9-36)	16 (0-30)	12 (0-30)	12 (0-20)	12 (0-20)	<0.001
	Function	20 (8-31)	14 (4-26)	12 (3-24)	10 (2-25)	10 (2-21)	<0.001	19 (8-31)	15 (0-27)	12 (0-24)	11 (0-19)	11 (0-17)	<0.001
	Total	55.5(26-88)	39.5 (16-77)	36.5 (12-76)	28.5 (7-71)	28(7-60)	<0.001	51 (23-93)	42(0-76)	35(0-74)	35 (0-53)	33 (0-57)	<0.001
Hendrich II Fall Risk Score		3 (0-6)	3 (0-5)	2 (0-4)	2 (0-4)	2 (0-4)	<0.001	3 (0-6)	1 (0-5)	1 (0-4)	1 (0-4)	1 (0-4)	0.008
SF-36	Bodily Pain	60 (0-80)	50 (0-90)	30 (0-90)	30 (0-70)	25 (0-70)	<0.001	60 (20-90)	50 (0-70)	30 (0-60)	30 (0-50)	20 (0-70)	<0.001
	General health	60 (0-80)	60 (0-80)	55 (0-80)	55 (0-80)	65 (35-100)	0.029	55 (25-75)	55 (40-75)	55 (40-85)	55 (40-75)	65 (40-90)	0.031
	Physical functioning	25 (0-75)	33 (0-90)	70 (0-90)	70 (0-90)	75 (15-95)	<0.001	65 (15-100)	75 (20-100)	80 (30-100)	80 (25-100)	80 (30-100)	0.010
	Vitality	50 (5-75)	55 (25-70)	55 (10-70)	55 (10-80)	63 (25-75)	<0.001	48 (20-85)	55 (35-70)	45 (30-70)	50 (35-70)	63 (40-70)	0.008
	Physical role functioning	88 (0-100)	0 (0-100)	88 (0-100)	88(0-100)	100 (0-100)	0.025	100 (0-100)	0 (0-100)	50 (0-100)	100 (0-100)	100 (0-100)	NS
	Emotional role functioning	0 (0-100)	33 (0-100)	100 (0-100)	100 (0-100)	100 (0-100)	0.001	67 (0-100)	100 (0-100)	100 (0-100)	100 (0-100)	100 (0-100)	NS
	Social role functioning	50 (13-75)	50 (13-75)	50 (13-75)	50 (0-75)	50 (13-100)	0.043	50 (25-100)	50 (38-75)	50 (25-75)	50 (25-75)	63 (25-100)	0.007

n: number, VAS: visual analog scale, min: minimum, max: maximum, WOMAC: Western Ontario and McMaster Universities, SF-36: Short Form-36, NS: non-significant (p>0.05)

tive, compared to usual care in the treatment of KOA. On the contrary, according to the study conducted by the Enabling Self-management and Coping with Arthritic Pain using Exercise (ESCAPE) knee pain group, the patients receiving a rehabilitation program had increased WOMAC function scores by 12% compared to baseline (22). The program was not cost-effective, when evaluated with QALYs, and the results did not differ whether the program was performed individually or in a group format. Shortly after, a modified rehabilitation program was evaluated by the ESCAPE-knee pain group, in which they added a booster session at four months to make the program more feasible and promote long-term adherence to exercise e[28]. The modified ESCAPE-knee pain program was cost-saving, compared to usual physiotherapy; however, the benefits in the QALY and the increment in the WOMAC subscale scores did not reach a statistical significance. Two-year results of the Management of Osteoarthritis (MOA) trial also revealed that the exercise and manual physiotherapy interventions dominated usual care programs, whereas combined and exercise physiotherapy did not, as assessed by the incremental net benefit (30).

Our study differs from the aforementioned studies in terms of objective and methodology. In the current study, we compared the cost-effectiveness of the same rehabilitation program given at in- and outpatient settings. Our study showed that both inpatient and outpatient combined physiotherapy rehabilitation programs effectively decreased pain and increased functional status, while the costs were lower in the outpatient rehabilitation program.The therapeutic benefits were sustained over the six-month follow-up in both groups. Notably, the inpatient group had a higher body mass index (BMI). As demonstrated by Waimann et al. (31), BMI is a strong predictor of treatment costs six months after total knee arthroplasty, surpassing even comorbidities in its impact. Similarly, in our study, the higher BMI levels might have contributed to the increased costs of the inpatient treatment group. In our study, the rate of comorbidities was similar between the groups. However, since we excluded advanced stages of comorbidities, we

Table-3: Comparison of direct and indirect costs between the groups

		Group 1 (n=30) (inpatient therapy)		Group 2 (n=22) (outpatient therapy)		p value
		Median	Min-Max	Median	Min-Max	
Direct medical costs	Physical therapy	473.8	473.8-901.3	180.3	180.3-227.5	<0.001
	Medication	8.9	0-16.3	9.2	0-17.0	NS
	Medical Equipment	0	0-49.8	0	0-51.1	NS
	Intra-articular injections	0	0-163.9	0	0-163.9	NS
	Complementary treatment	0	0-429.2	0	0-429.2	NS
	Laboratory & Imaging tests	0	0-25.7	0	0-6.0	NS
Direct non-medical costs	Transportation	5.1	1.3-33.5	43.8	13.3-76.8	<0.001
Indirect costs	Work loss	0	0-600.9	0	0-639.5	NS
Total costs		552.4	497.2-1372.5	276.3	218.0-1023.6	<0.001

* Values are expressed in Euros

cannot conclude its effect on expenses. Still, outpatient programs may be unsuitable for individuals with unstable clinical conditions. Therefore, patients with chronic conditions, who require a close follow-up, should be encouraged to attend to inpatient clinic programs. In our study, adherence to therapy was lower in the outpatient setting and a higher number of patients were lost during the follow-up. The high adherence rates in the inpatient setting can be attributed to the higher motivation of these patients.

Undoubtedly, the inpatient program would cost more than the outpatient program. However, the definition of cost-effectiveness differs according to several authors (32,33). In a systematic review, an intervention was accepted as cost-effective, if it was cheaper than the standard treatment; however, a more expensive intervention was also acceptable, if additional costs were not too high (12). Although the inpatient program was found to be costly in our study, significant effects were observed in all outcome parameters at six months of follow-up. Therefore, in our opinion, our study contributes to the literature in terms of showing the approximate expenses and profits of both approaches for health resource consumption in the mid- and long-term and may be a useful guide to decide on the most optimal physical therapy option for physicians.

In our study, although outpatient physical therapy program was more cost-effective, it was less effective in some parameters, such as Chair Stand Test, WOMAC stiffness subscale, and SF-36 physical and emotional role functioning subscales. Inpatient physical therapy program has certain advantages, such as treating physician visits two times a day and better patient adherence to the rehabilitation program. Learning self-directed exercises and medical device use under intense supervision might have resulted in better education, self-care, and patient compliance to the OA therapy program in the long-term. Performing adequate, self-directed exercises may be ended with a more significant improvement in the muscle strength and endurance of the lower extremities, resulting in a better improvement in stiffness. Also, higher self-awareness of the patients may be helpful in the adaptation of their occupational and social roles. However, not all patients have access to inpatient facilities, particularly those living in rural areas. We believe that modification of risk factors, education of the patients about the disease, and well-designed exercise programs with adequate physical therapies in the outpatient clinics may be considered to be the optimal treatment strategy for most KOA patients, consistent with our results. Nonetheless, there are several limitations to this study. First, the sample size is relatively small and is not representative for a larger population. Second, although we used the blinded randomization model, working and less disabled patients refused hospitalization.

Thus, probably the randomization model did not completely prevent the bias. The main strength of this study is that the costs were calculated as an individualized patient-based method and, therefore, we could estimate the actual costs for every individual. According to previous studies, using the reimbursement method as a measure of cost, as in our study, is the preferred method. Second, the follow-up period was sufficient to interpret both treatment strategies' effects in the long-term in KOA patients. Also, there is no study available in the literature comparing cost-effectiveness of outpatient and inpatient physical therapy programs.

Conclusion

In conclusion, both inpatient and outpatient physical

therapy programs yielded significant improvements in pain, physical function, and quality of life in patients with knee osteoarthritis. However, the outpatient setting offered a more favorable cost-effectiveness profile. While inpatient care may benefit individuals with higher clinical complexity or adherence challenges, outpatient programs should be considered the first-line option for the majority of patients. This study provides novel evidence to guide efficient allocation of rehabilitation resources based on patient needs and health system constraints.

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Ethical approval: This study was conducted in accordance with the principles of the Declaration of Helsinki. Ethical approval was obtained from the local Ethics Committee (Date: 4.10.2010-No: 08043)
Informed consent: A written informed consent was obtained from each patient included in the study.
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Case Report

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Pulmonary Actinomycosis Mimicking Lung Malignancy: A Case Report

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Abstract

Pulmonary actinomycosis is an uncommon chronic infection that can closely mimic primary lung malignancy. A 53-year-old immunocompetent woman presented with daily hemoptysis for one week. Chest imaging revealed a consolidated lesion in the left upper lobe with pleural contact. Microbiological tests, including acid-fast bacilli staining and cultures from sputum and bronchoalveolar lavage, were negative. PET/CT demonstrated intense FDG uptake in the lesion and a mediastinal lymph node, raising suspicion for lung cancer with metastasis. Transthoracic needle aspiration was non-diagnostic. Due to persistent hemoptysis and cavitation, the patient underwent left upper lobectomy. Histopathology confirmed pulmonary actinomycosis. She received six months of oral amoxicillin, resulting in complete recovery without recurrence. Pulmonary actinomycosis should be considered in the differential diagnosis of lung masses, even in immunocompetent individuals, to prevent unnecessary surgery, as prolonged antibiotic therapy is usually curative.

Keywords: pulmonary actinomycosis, lung mass, hemoptysis

Introduction

Actinomyces species are Gram-positive, filamentous, pleomorphic, anaerobic or microaerophilic bacteria, most commonly found in the oral cavity and gastrointestinal tract (1). In the lungs, they may form mass-like or cavitary lesions, mimicking malignancy. Here, we present a rare case of pulmonary actinomycosis presenting with hemoptysis in an immunocompetent patient without predisposing factors.

Case Presentation

A 53-year-old woman with no history of chronic disease presented to our outpatient clinic with a one-week history of daily hemoptysis (approximately three tablespoons per day). Physical examination was unremarkable, but infection markers were elevated. Posteroanterior chest radiography revealed an irregularly marginated, non-homogeneous opacity in the middle zone of the left lung. She had been treated empirically with antibiotics for presumed pneumonia for one week, but no radiographic regression was observed. Contrast-enhanced thoracic computed tomography (CT) demonstrated a consolidated area in the upper lobe of the left lung extending to the pleura. Vasculitis markers and sputum acid-fast bacilli (AFB) were negative, and cultures showed no growth. Bronchoscopy revealed no endobronchial lesions. Bronchoalveolar lavage fluid was negative for AFB, showed no growth in culture, and cytology was negative for malignant cells. Positron emission tomography/computed tomography (PET/CT) demonstrated an intensely hypermetabolic, pleura-parallel consolidation in the anterior subpleural region of the anterior segment of the left upper lobe, sug-

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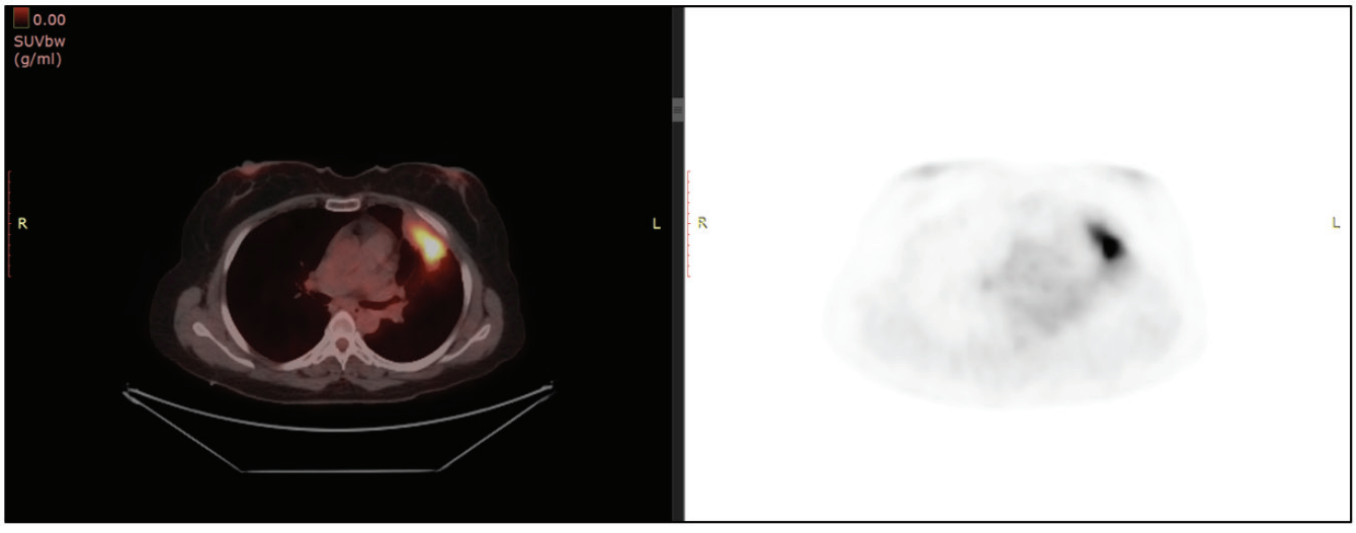

Figure -1: PET/CT scan showing hypermetabolic consolidation in the left upper lobe.

gestive of primary lung malignancy. Additionally, increased FDG uptake was observed in a subaortic mediastinal lymph node, raising suspicion for metastasis (Figure 1).

A transthoracic needle aspiration biopsy (TTNA) was performed, and pathology revealed no malignant cells. As hemoptysis persisted and cavitation developed within the lesion, the patient underwent a left upper lobectomy performed by the thoracic surgery team (Figure 2). Histopathological examination confirmed Actinomyces infection. Infectious diseases specialists initiated oral amoxicillin 1000 mg twice daily for six months. No recurrence of hemoptysis was observed during follow-up.

Conclusion

Pulmonary actinomycosis is a rare infection caused by Actinomyces species that may closely mimic lung malignancy and should therefore be considered in the differential diagnosis of pulmonary masses. Although it is more frequently associated with immunosuppression, poor oral hygiene, or a history of dental procedures, it may also occur in immunocompetent individuals without predisposing factors, as in our case.

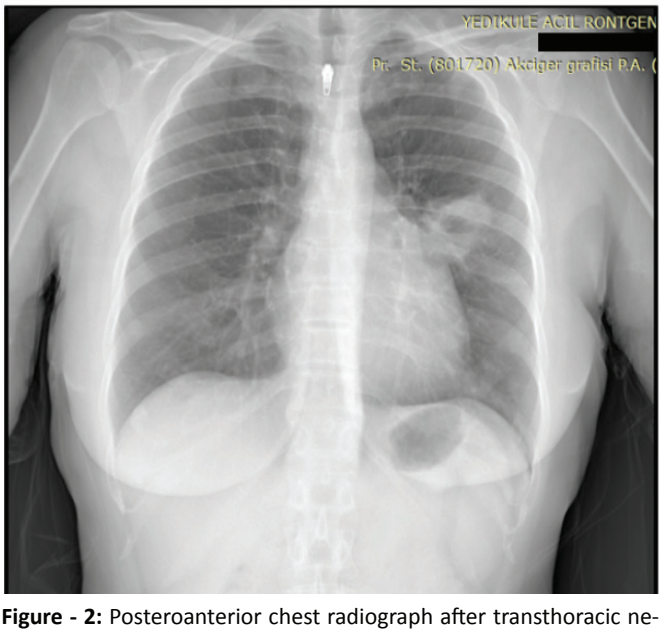

Figure - 2: Posteroanterior chest radiograph after transthoracic needle aspiration biopsy.

The most frequent clinical symptoms include chest pain, fever, fatigue, and weight loss; hemoptysis is relatively uncommon. Penicillin remains the first-line treatment, often initiated with 2–6 weeks of parenteral therapy followed by oral amoxicillin or penicillin for 6–12 months (2). Our findings are consistent with the recent 10-year experience reported by Sökücü et al., which emphasized both the clinical diversity and the diagnostic challenges of pulmonary actinomycosis (3).

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Case Report

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Sternal Pre-lifting Procedure During the Minimally Invasive Repair of Pectus Excavatum-Case Report

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Abstract

Background

Pectus excavatum (PE) is the most common congenital chest wall deformity. While mild cases may cause cosmetic concerns, severe deformities can lead to cardiopulmonary symptoms, including chest pain, palpitations, and decreased exercise tolerance. Surgical correction with the Nuss procedure has become the standard, but deep deformities, especially in underweight patients, pose significant risks during retrosternal dissection.

Case

We report the case of a 23-year-old female patient who presented with complaints of chest pain, particularly while eating solid foods. On physical examination, her height was 168 cm and her weight was 42 kg. A deep, asymmetric pectus excavatum deformity of the anterior chest wall was noted. Her Haller index was calculated as 5.67. Pulmonary function tests revealed a forced vital capacity (FVC) of 74 %. Cardiological evaluation did not show any evidence of cardiac compression. The patient received six months of nutritional support prior to surgery. A minimally invasive Nuss procedure with the placement of three bars was performed. Due to limited intraoperative visualization, a modified sternal elevation technique based on Park's method was utilized, involving CT-guided placement of a sternal screw. The perioperative course was uneventful, with no complications observed.

Conclusion:

This case highlights the importance of individualized planning and a multidisciplinary approach in deep PE cases. Preoperative nutritional support and modified surgical techniques-particularly sternal elevation-contribute significantly to safe and effective outcomes.

Keywords

Pectus excavatum, Nuss procedure, Sternal elevation, Sternal screw, Chest wall deformity

Introduction

Pectus excavatum (PE) is the most prevalent congenital chest wall deformity, occurring in about 1 in every 300–400 live births (1,2). Though mild deformities are asymptomatic in childhood, severe deformities can lead to aesthetic issues, cardiopulmonary symptoms, and decreased exercise tolerance in adolescence and young adulthood. Repair in patients with low body mass index (BMI) and deep deformities is technically demanding and needs careful preoperative and intraoperative planning. To minimize the risk of cardiac injury with retrosternal dissection, various techniques of sternal elevation have been described. Vacuum bell elevation allows for gradual external

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elevation but can be anatomically limited, especially in female patients. The crane technique, as first described by Park, involves a sternal screw to directly apply mechanical elevation, with enhanced visualization and safety during dissection. Additional modifications involve traction sutures or external retractors with variable effectiveness and applicability based on the severity of the deformity and individual patient factors. Here we report the case of a female patient with severe, asymmetric PE deformity and low BMI, who was successfully treated with preoperative nutritional supplementation and a modified Park sternal elevation method via a minimally invasive Nuss procedure.

Case

A 23-year-old female patient presented with chest pain, particularly when consuming solid food. She had no history of chronic illness or previous surgeries. On physical examination, her height was 168 cm and her weight was 42 kg. A deep, asymmetric pectus excavatum deformity was observed on the anterior chest wall. Posteroanterior chest radiograph and thoracic computed tomography (CT) revealed a Haller index of 5.67 (Figure 1). Pulmonary function test showed a forced vital capacity of 74%. Cardiological evaluation did not reveal any cardiac compression.

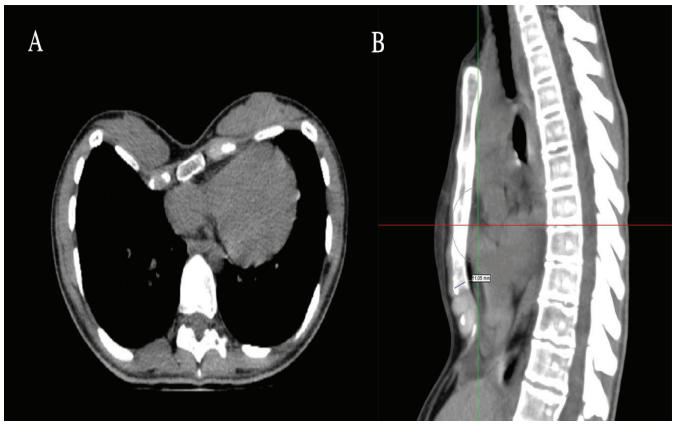

Figure 1- A. Preoperative Chest CT Axial Scene B. Preoperative Chest CT

The patient received nutritional support with oral liquid dietary supplements in addition to her regular diet for six months. Surgery was scheduled after her weight increased to 48 kg. Under general anesthesia, following single-lumen endotracheal intubation, the patient was placed in the supine position with the right arm suspended. No bladder catheter was inserted. Arterial monitoring was performed, but no central venous or epidural catheter was used. After marking the intercostal spaces while standing, bilateral incisions were made from the submammary skin folds. A 305 mm bar was placed into the intercostal space where the deformity began. A stabilizer was applied to the right side. Although intrathoracic carbon dioxide was used during this step, the visual field remained insufficient. Therefore, sternal pre-lifting using a specially designed screw, as described by Park, was performed. The screw size was selected based on preoperative sagittal CT measurements of the sternum, and a 10 mm screw was chosen. After placing the first bar, the visual field improved significantly (Figure 2). Due to the short sternum, banana-shaped deformity, and flaring of the bilateral costal arches, the decision was made to place crossed bars.

Two 280 mm bars were inserted in a crosswise configuration with their stabilizers positioned superiorly. Intraoperatively, 100 mg of bupivacaine was administered to five intercostal spaces bilaterally. No intraoperative complications occurred. No chest drain was placed. Multimodal analgesia (paracetamol, NSAIDs, and tramadol if necessary) was provided. The patient resumed oral intake 6 hours after surgery, began in-bed exercises at 8 hours, and was mobilized at 24 hours. She was discharged on postoperative day 4 without complications.

Discussion

Although pectus excavatum is often associated with cosmetic concerns, severe cases can exert significant pressure on the heart and great vessels, leading to symptoms such as chest pain, palpitations, and exercise intolerance. In this case, postprandial palpitations and pain were likely due to such mechanical compression.

While the Nuss procedure is the standard of care for minimally invasive correction of PE, deep deformities increase the risk of cardiac injury during retrosternal dissection. The real prevalence of life-threatening complications related to the minimally invasive repair of pectus excavatum (MIRPE) is unknown. Major complications with MIRPE are infrequent. Awareness of the risk of life-threatening complications is essential to ensure optimal safety. Factors such as operative technique, patient age, pectus severity and asymmetry, previous chest surgery, and the surgeon's experience play a role in the overall incidence of such events (3).

Peroperative vacuum elevation is commonly used. However, in female patients like ours, difficulties may arise due to breast positioning. Although intrathoracic CO_2 insufflation was used in our patient, Park's sternal elevation screw was utilized to proceed more safely with the operation (4). The screw size was selected by measuring the sternum thickness in the sagittal section of the preoperative thoracic CT, and a 10 mm screw was chosen. During the procedure, the screw should be inserted into the sternum at a 90-degree angle, taking into account the slope of the deformity. Intrathoracic video thoracoscopic visualization must be ensured during screw insertion. In cases where the sternum is

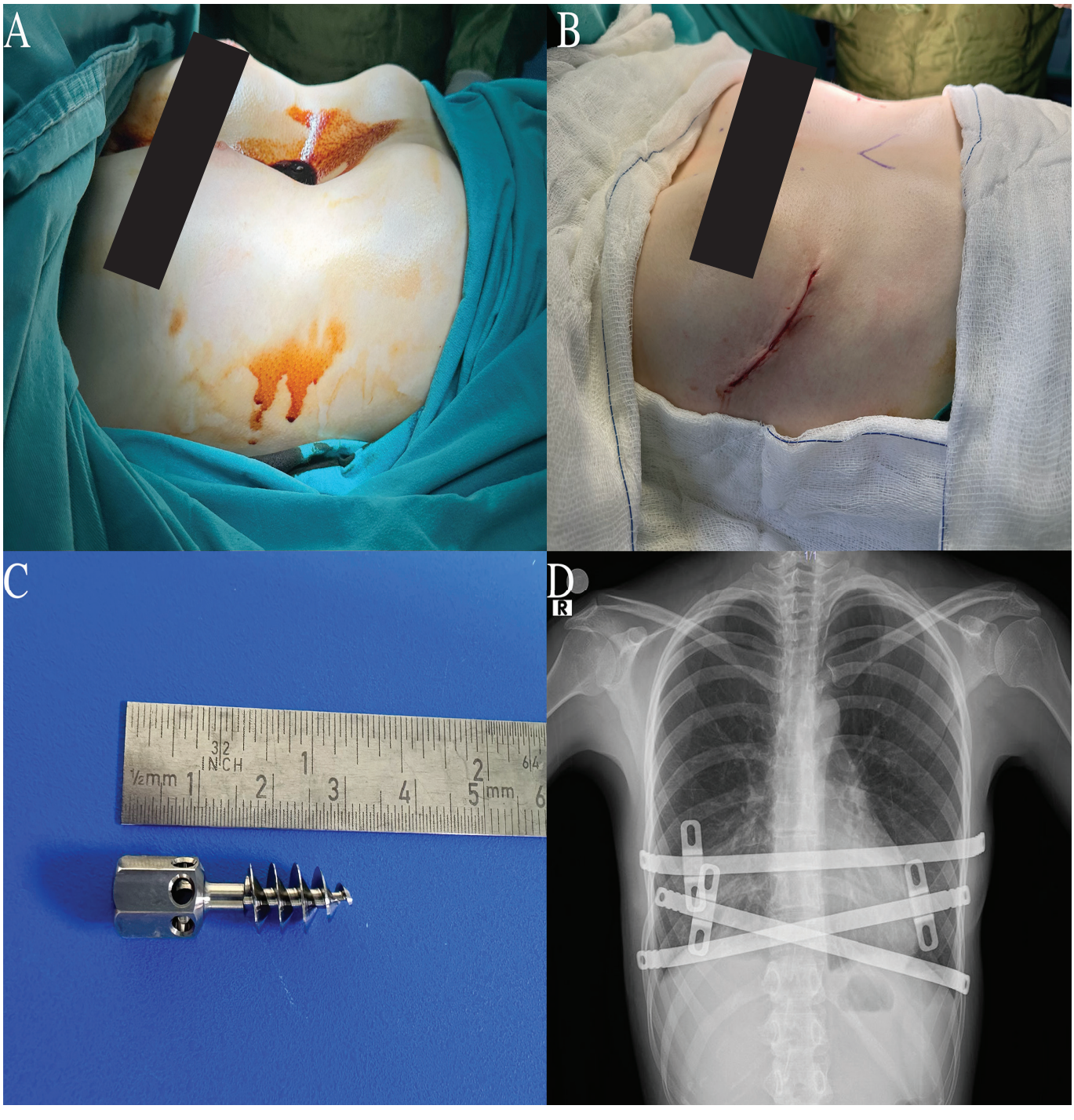

Figure 2- A. Patient preoperative view, B. Postoperative view of the patient. C.Park sternal elevation screw. D. Postoperative X-Ray of the patient

highly rigid, placement of a second screw should not be avoided. In our patient, a single 10 mm screw was sufficient. Elevation with the crane system can be applied until all bars are in place. However, in our patient, for procedural practicality, manual elevation was performed only during the placement of the first bar. The team's experience becomes crucial at this point, allowing secure bar placement without complications.

Additionally, preoperative nutritional support is vital in underweight patients. Malnutrition can impair wound healing and increase infection risk. In this case, weight gain and improved nutritional status likely contributed to the smooth postoperative course. This report highlights the importance of a multidisciplinary approach and the use of modified surgical techniques in managing complex PE cases safely and effectively.

Conclusion

In cases of deep pectus excavatum with low BMI, individualized preoperative preparation, including nutritional support and surgical technique modification, is essential for safe and effective outcomes. The combination of the Nuss procedure and Park's sternal elevation technique significantly enhances intraoperative safety. This case underscores the value of a multidisciplinary strategy in complex thoracic deformities.

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