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Intensive care utilization in COPD and advanced-stage lung cancer

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ABSTRACT

Aims: Patients with terminal lung cancer and chronic obstructive pulmonary disease (COPD) frequently require intensive care unit (ICU) care; however, survival benefit of ICU admission remains uncertain. This study aimed to evaluate ICU outcomes and the impact of palliative care service integration in a tertiary chest diseases hospital among patients with COPD and malignancy.

Methods: Between 2013-2019, 731 patients transferred to ICU were evaluated retrospectively. Outcomes were compared before and after the establishment of a palliative care unit in 2016.

Results: Lung cancer accounted for 33.5% of cases, while COPD represented 66.5%. ICU mortality was 91.7% in lung cancer patients and 82% in COPD patients. Overall ICU survival was only 10.5%. In addition, 4.1% of patients died shortly after ICU discharge. Mean ICU stay was 7.8 days for lung cancer and 11.6 days for COPD patients. The establishment of a palliative care unit did not significantly reduce ICU referral rates.

Conclusion: ICU treatment for end-stage COPD and lung cancer is associated with very poor survival outcomes. Strengthening palliative care services and establishing structured end-of-life decision-making policies supported by legal regulations may help optimize ICU utilization.

Keywords: COPD, intensive care unit, lung cancer

INTRODUCTION

Advanced lung cancer and chronic obstructive pulmonary disease (COPD) constitute a major proportion of admissions to tertiary chest diseases hospitals. The global burden of both diseases continues to increase. The World Health Organization estimates that newly diagnosed cancer cases will reach 29.4 million by 2040.[1,2] COPD is also among the leading causes of mortality and healthcare costs worldwide, particularly in low- and middle-income countries.[3,4]

Recent advances in oncological treatment have prolonged survival in lung cancer patients. Targeted therapies, in particular, have demonstrated significant improvements in both survival outcomes and quality of life, even in malignancies associated with poor prognoses, such as ovarian cancer, gliomas, and small cell lung carcinoma. Hospital admissions among patients with malignancies occur not only during the terminal or end-of-life stages of disease but also other treatment or disease-related complications.[5,6] The clinical heterogeneity of cancer patients presenting to the ED poses significant challenges in accurately predicting survival outcomes during ICU stay. Despite improvements in supportive therapies, predicting prognosis in critically ill cancer patients remains difficult. ICU admission decisions are particularly challenging because of limited healthcare resources and the poor prognosis associated with advanced malignancy.[7-11]

Similarly, patients with advanced COPD experience frequent exacerbations, respiratory failure, pulmonary hypertension, recurrent infections, and repeated hospital admissions, all of which substantially reduce quality of life and increase healthcare utilization.[12-15] Prognostic estimation in severe COPD is also difficult, particularly during acute exacerbations requiring ventilatory support. Previous studies demonstrated discrepancies between predicted and actual survival outcomes in critically ill COPD patients. A study conducted in the UK showed a significant discrepancy between clinical estimates and actual outcomes: clinicians predicted a 180-day survival rate of only 3% for COPD patients admitted to the ICU, whereas the observed survival rate was 36%.[16,17]

Palliative care is recommended to be integrated early in the course of chronic diseases such as cancer and COPD.[18] Initiating palliative care in the early stages of illness influences the attitudes and decisions of both patients and their families throughout the disease course. Early palliative care may reduce unnecessary ICU admissions and prevent futile end-of-life interventions.

Due to limited palliative care resources and the absence of clear legal regulations regarding end-of-life decision-making and do-not-resuscitate practices, making ICU

decisions remains challenging for clinicians. Scoring systems and algorithms designed to support prognostic decisions regarding transfer to palliative care or the ICU remain insufficient. Physicians have limited legal protection regarding withholding or withdrawing life-sustaining treatment, which may contribute to increased ICU utilization among terminally ill patients.

This study aimed to evaluate ICU outcomes, survival, ICU stay duration, and the impact of palliative care implementation on ICU referral rates in patients with advanced lung cancer and COPD in a tertiary chest diseases hospital.

METHODS

This study was conducted with the approval of the Clinical Researches Ethics Committee of the Yedikule Chest Diseases and Thoracic Surgery Training and Research Hospital (Date: 29.07.2021, Decision No: 2021-138). All procedures were carried out in accordance with the ethical rules and the principles of the Declaration of Helsinki. Due to the retrospective design of the study, informed consent could not be obtained.

This single-center, retrospective and cross-sectional study included patients with malignancy or COPD who were transferred to ICU between January 2013 and January 2019. The relevant data were retrieved from the hospital's electronic medical records system.

Our study focused on the pre-COVID-19 period, as ICU utilization increased significantly during the pandemic, rendering it a distinct and atypical phase. Therefore, the pandemic period was excluded because patient characteristics and ICU utilization patterns substantially differed from the study population. Additionally, patients referred to the ICU for pneumonia, acute respiratory distress syndrome (ARDS) or other pandemic-related conditions were excluded.

A total of 731 patients were included (**Figure 1**). Our hospital is a tertiary referral center specializing in chest diseases and thoracic surgery. During the study period, the hospital had approximately 300 beds and a 14-bed ICU. Because ICU capacity was limited, some patients requiring intensive care were transferred to external centers. A 14-bed palliative care unit was established in November 2016. Patients are admitted to the inpatient clinics following an initial observation period in the ED.

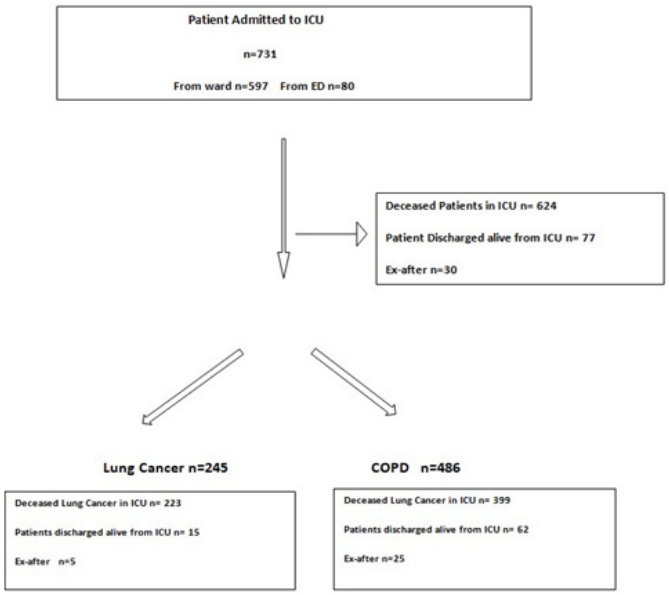


Figure 1. Flowchart of the patients
ICU: intensive care unit, COPD : Chronic obstructive pulmonary disease

During the study period, annual ED visits ranged between 50.000 and 60.000. The average number of patients admitted to inpatient wards was approximately 11.000 per year. Among these, 45-50% were diagnosed with COPD, while 20-25% had accompanying malignancies, most commonly lung cancer. Annual mortality rates in inpatient wards outside the ICU ranged between 450 and 470. In November 2016, a 14-bed palliative care unit was established in our hospital to provide specialized support for patients in advanced stages of illness.

Recorded Data and Study Design

For all cases, demographic and clinical data, including age, sex, primary diagnosis, comorbidities, dates of hospitalization, ICU admission and discharge, and date of death, were systematically recorded. Mortality outcomes for patients discharged from the ICU were verified through the national death notification system and incorporated into our dataset. Patients were classified according to ICU outcome as: survived, died in the ICU or died after ICU discharge (ex-after). To assess the impact of the establishment of the palliative care unit on ICU transfers, monthly and annual ICU transfer rates before and after the establishment of the unit were compared.

Statistical Analysis

Continuous variables were presented as mean±standard deviation, median, minimum, and maximum values. Categorical variables were summarized as frequencies and percentages. Independent samples t-tests were used to compare ICU referral rates before and after the establishment of the palliative care unit. A p-value <0.05 was considered statistically significant.

RESULTS

Of all 731 patients, the mean age was 70.1±11.3 (Min: 19, Max: 99) and 81.7% (n=597) were male. Among all patients, 33.5% had lung cancer (n=243) and 66.5% had COPD (n=486). Most ICU transfers occurred during inpatient follow-ups (89%, n=651) while the others were transferred directly from the ED.

Patients' comorbidity rates was 14.1% (n=103), most commonly due to concurrent malignancies in other organs (9.7%, n=71) (**Table 1**). Malignancies other than lung cancer presented with either pleural effusion or parenchymal involvement in the lungs. The spectrum of primary cancers included breast, stomach, prostate, brain, pancreas, ovary, and liver cancers. Additionally, 11 patients had cancer of unknown primary origin.

The mean duration of ICU stay was 10.2±12.8 (min: 0-max: 95, median: 6) days. The mean ICU stay was 7.8±9.6 days in lung cancer patients and 11.6±14.2 days in COPD patients. Among patients diagnosed with lung cancer, 91.8% (n=223) died during their ICU stay, 5 patients were classified as ex-

Table 1. Patients and comorbidities

ICU transfer		Frequency	Percent
	Service	651	89.0
	Emergency department	80	11.0
	Total	731	100.0
	Female	134	18.3
	Male	597	81.7
	Total	731	100.0
Lung cancer		245	33.5
COPD		486	66.5
Total		731	100.0
Comorbidity			
Congestive heart failure		8	1.1
Renal failure		14	1.9
Other malignancies		71	9.7
No comorbidity		638	87.3
Total		731	100.0

ICU: Intensive care unit, COPD: Chronic obstructive pulmonary disease

after and only 6.1% (n=15) survived. In COPD patients, ICU mortality was 82% (n=399), 5.1% (n=25) were classified as ex-after and 12.7% were discharged alive (**Table 2**). Among cancer patients who were discharged from the ICU to the ward and later died during hospitalization, 2 had initially been admitted to the ICU due to chemotherapy and radiotherapy-related complications related to, 3 due to heart failure, and 1 due to a cerebrovascular event. Two patients admitted because of postoperative respiratory failure and hypotension were still alive at the time of data collection. Seven patients admitted to the ICU due to respiratory failure and infection were discharged alive to the ward but subsequently died during the same hospitalization period. These cases were distinguished from ex-after mortality cases because death occurred shortly after ICU discharge during ward follow-up. The mean age of patients who later died was 67.0±10.9 years.

Table 2. Outcome of patients at ICU

Outcome of patients		Frequency	Percent
	Alive	77	10.5
	Ex	624	85.4
	Ex after ICU	30	4.1
	Total	731	100.0

ICU: Intensive care unit

Ex-after cases were excluded from the statistical analysis and only in-hospital mortality analysis were performed (**Table 3**). The mean survival time of the patients were 16.6±21.8 days (range: 0-391; median: 11 days) (**Table 4**).

The palliative care unit in our hospital was established in November 2016. he monthly distribution of ICU admissions according to the time of first hospital admission is shown in **Figure 2A**. Comparison of the two-year periods before and after the establishment of the palliative care unit showed no significant difference in ICU referral rates. Similarly, the monthly and yearly distributions of ICU admissions according to disease groups remained comparable throughout the study period (**Table 5**, **Figures 2-4**).

Table 3. Outcome of Patients at ICU according to diseases

		Alive	Ex	Ex after ICU	Total
Disease	Lung cancer	15	225	5	245
	COPD	62	399	25	486
Total		77	624	30	731
	Mean	**SD**	**Min**	**Max**	**Median**
Age	70.50	11.30	19	99	71
Days in ICU	10.22	12.84	0	95	6
Survival	16.58	21.35	0	391	11

COPD: Chronic obstructive pulmonary disease, ICU: Intensive care unit, SD: Standard deviation, Min: Minimum, Max: Maximum

Table 4. ICU stay duration and survival according to disease (days)

ICU days	Lung cancer	Mean	7.8161
		Standard deviation	9.56567
		Minimum	.00
		Maximum	73.00
		Range	73.00
	COPD	Mean	11.5714
		Standard deviation	14.19743
		Minimum	.00
		Maximum	95.00
		Range	95.00
Survival days	Lung cancer	Mean	16.2915
		Standard deviation	29.08190
		Minimum	.00
		Maximum	391.00
		Range	391.00
	COPD	Mean	16.7393
		Std. Deviation	15.51680
		Minimum	.00
		Maximum	101.00
		Range	101.00

ICU: Intensive care unit, COPD: Chronic obstructive pulmonary disease

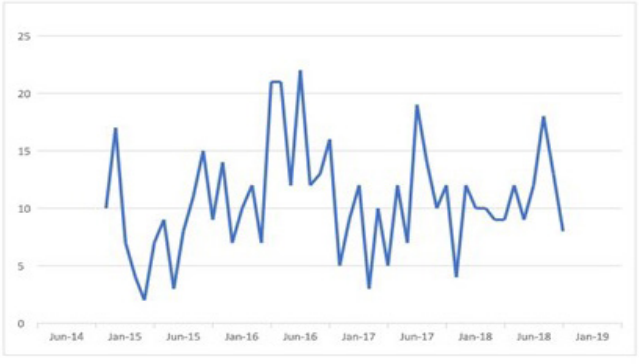


Figure 2A. The monthly distribution of intensive care patients according to the time of first admission to the hospital

DISCUSSION

The present study reveals high ICU transfer rates with a significantly high mortality rate in patients with malignancy and COPD. However, the establishment of palliative care services did not significantly reduce mortality or ICU transfer rates.

Table 5. The monthly and annual distribution of patient admission to hospital according to disease

Disease		2013	2014	2015	2016	2017	2018	2019	
Lung cancer	Jan	1	2	4	3	4	2	1	17
	Feb	0	5	1	2	2	3	0	13
	Mar	0	5	0	2	6	4	0	17
	Apr	0	2	3	7	4	3	0	19
	May	0	8	2	8	2	3	0	23
	Jun	0	3	1	6	2	3	0	15
	Jul	0	3	3	4	3	7	0	20
	Aug	0	0	5	3	7	8	0	23
	Sep	0	4	4	6	5	6	0	25
	Oct	0	0	8	9	2	4	0	23
	Nov	5	6	4	3	1	5	0	24
	Dec	3	4	1	5	3	4	0	20
	Total	9	42	36	58	41	52	1	239
COPD	Jan	0	23	3	7	8	8		49
	Feb	1	18	3	10	1	7		40
	Mar	0	11	2	5	4	5		27
	Apr	0	13	4	14	1	6		38
	May	1	11	7	13	10	9		51
	Jun	0	11	2	6	5	6		30
	Jul	0	9	5	18	16	4		52
	Aug	0	5	6	9	7	9		36
	Sep	0	8	11	7	5	7		38
	Oct	1	7	1	7	10	4		30
	Nov	11	4	10	2	3	7		37
	Dec	19	13	6	4	9	7		58
	Total	33	133	60	102	79	79		486

COPD: Chronic obstructive pulmonary disease

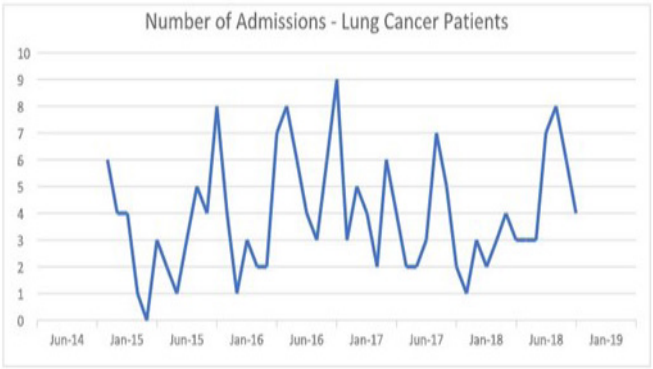


Figure 2B. The monthly distribution of intensive care patients according to the time of first admission to the hospital

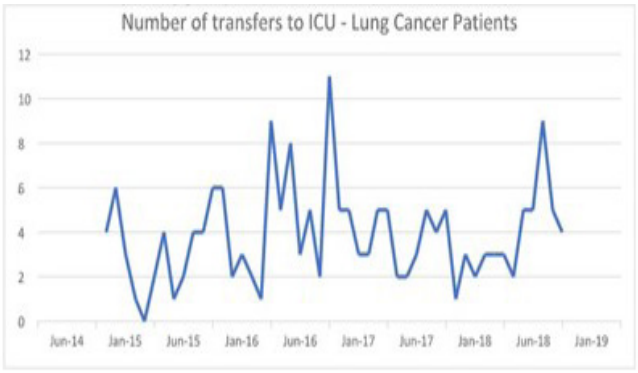
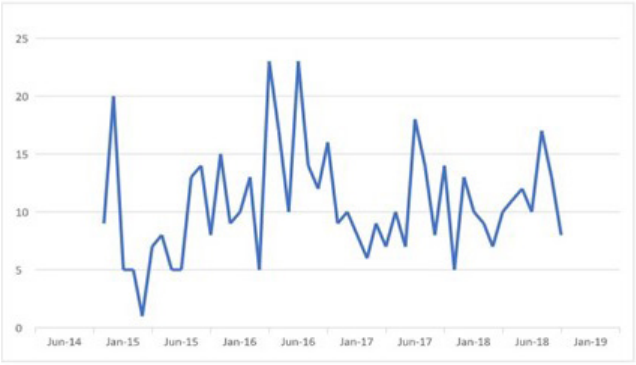


Figure 3B. The distribution of patients according to the transfer date to ICU
ICU: Intensive care unit



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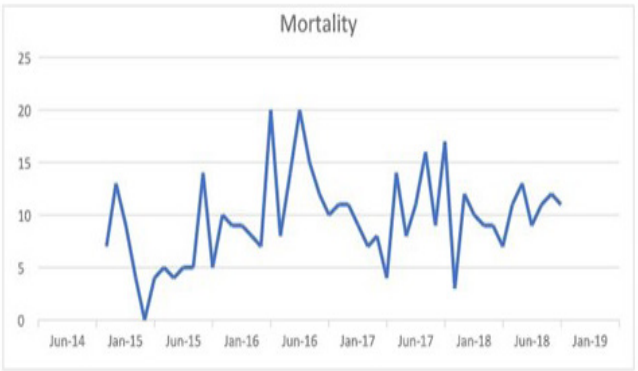

Figure 4. Mortality of the patients according to 6-months periods

In our study, irrespective of disease type, 89.5% of patients died during their ICU stay, while 10.5% survived. The patients who survived the ICU and were discharged from the hospital exhibited significantly longer survival times. In their meta-analysis involving cancer patients who underwent in-hospital cardiopulmonary resuscitation (CPR), Reisfield et al.[19] reported an overall survival of hospital discharge of 6.2%, and survival rates were 9.5% in patients with localized disease and 5.6% in metastatic disease cases. While the meta-analysis by Reisfield et al.[19] encompassed all cancer types, our study focused specifically on lung cancer and revealed comparable ICU survival rates. However, a notable distinction emerged: Even after ICU discharge, the majority of our patients died within less than two months. Champigneulle et al.[20] conducted a study involving cancer patients who received cardiopulmonary resuscitation (CPR) either in-hospital or out-of-hospital and were subsequently admitted to the ICU. They reported an ICU mortality rate of 74%, with a six-month survival rate of 14%. These six-month survival rates did not significantly vary based on cancer type or the location of resuscitation. The patients in our cohort experienced a high mortality rate during their ICU stay.

In their 23-year study evaluating lung cancer patients, Al-Dorzi et al.[21] observed a decline in ICU mortality rates after 2015. Although they reported that the mortality rate was between 55.6-66.7% in the period before 2015 and decreased by 28.0% after 2015, with variations over the years. We did not detect a meaningful bifurcation of decline/fall over the years; the rather short duration covered in our study may be the reason why. The aforementioned study also included patients with non-invasive use in the ICU. Moreover, in their study, according to hospital policy, patients whose treatment limitations were determined by three specialist physicians, the patient and their guardian and those with do-not-resuscitate (DNR) orders were not intubated. In contrast, all of our cases are intubated. Furthermore, the ICU mortality rate for intubated lung cancer patients was 79.1%, while 87.0% of patients with DNR died in hospital wards. On the other hand, our study revealed a higher ICU mortality rate of 91.7% among lung cancer patients. The relatively lower ICU mortality rate reported by Al-Dorzi et al.[21] may be attributed to structural and procedural improvements, including the establishment of a dedicated cancer center with inpatient beds, early observation and management of patients prior to ICU admission, the use of non-invasive mechanical ventilation even in end-stage cases and the practice of not intubating patients with DNR orders.

In Turkiye, there are no specialized centers dedicated to the continuous monitoring of cancer patients throughout all stages of their disease. Additionally, inpatient oncology services capacity remain insufficient. Patients are hospitalized across multiple centers. Recently, as respiratory problems have increased, our hospital, a referral center for chest diseases, is assigned more advanced-stage cases. Prior to intubation, we already have experience with non-invasive mechanical ventilation in the chest diseases ward. The intubated patients in our study had significant disability, underwent non-invasive ventilation, and began symptomatic and curative treatments upon admission.

In Turkiye, end-of-life decision-making remains legally and ethically challenging. Current healthcare regulations do not provide a clear legal framework regarding withholding or withdrawing life-sustaining treatment or formal DNR practices. This situation may contribute to increased ICU admissions and invasive interventions in terminally ill patients. Furthermore, limited palliative care infrastructure and insufficient public awareness may delay appropriate end-of-life planning. Contributing factors such as limited public health education, insufficient grief counseling resources and the prevalence of violence against healthcare professionals have led to increased intubation rates among terminally ill patients and increased reliance on intensive care services. National policies and institutional regulations supporting palliative care integration and physician-guided end-of-life decision-making are needed to reduce futile ICU utilization and improve quality of care.

In our cohort, the overall survival time for cancer patients was 16.5 days. In the study by Al-Dorzi et al.,[21] 87% of DNR cases died in the ward.The mean age of our cancer patients who died in the ICU was determined to be 70.5. At our hospital, a significant number of end-stage cancer patients are hospitalized in the ED and clinical services. Both in-patient and ICU deaths are quite high among these patients. Moreover, our cohort exhibited a high rate of metastatic involvement. Given this context, decisions regarding the transfer of terminally-ill patients to the ICU are guided by consultation with a board of specialists as well a professional consultation with their families. There is a pressing need for comprehensive legal and institutional regulations in Turkiye to address this issue. Intensive care should be a priority for cancer patients in the early stages of disease, those newly diagnosed or individuals experiencing acute complications related to chemotherapy or radiotherapy. Furthermore, possibilities should be discussed with the patient from the moment of diagnosis. The relatives who may serve as legal guardians or primary caregivers should be actively involved in the decision-making process.

Among the 486 patients admitted to the ICU with terminal-stage COPD, 82% (n=399) died during their ICU stay, while 12.7% (n=62) were discharged alive. While 5.1% (n=25) of the surviving cases died later, many of them died in the early period (n=37). In some studies, deaths in ICU (25%) of COPD patients were reported at a lower rate than in our study. In studies examining COPD exacerbations in all stages, it was determined that the high acute physiology score (APACHE III) was associated with decreased survival in intensive care.[22]

The decision to initiate mechanical ventilation in patients with terminal-stage COPD presents a significant challenge for physicians. In our study, COPD patients demonstrated a higher likelihood of being discharged alive from the ICU compared to cancer patients. However, because COPD patients were terminally ill, their ICU mortality rate was higher (82% mortality) compared to other studies. Gadre et al.[22] reported that mechanically ventilated patients with acute exacerbation of COPD had significantly lower ICU mortality (27%) and hospital mortality (17%) compared to patients admitted for other causes of respiratory failure.

Detailed evaluation of our patients admitted to the ICU demonstrates that they were patients with advanced stage COPD, who had frequent ED admisions and hospitalizations due to exacerbations, who were transferred to intensive care due to respiratory failure and who were receiving non-invasive mechanical ventilation during their treatment. These characteristics likely account for the shorter survival times observed in our cohort compared to other studies.

Our analysis revealed no statistically significant difference between the intervals with palliative care service establishment. Such lack of variation may be due to the rather small number of beds in our palliative service. However, Romano et al.[23] emphasize in their study that early initiation and continued palliative care in cancer patients reduce intensive care admissions. As noted above, the absence of clear legal regulations in Turkiye to protect healthcare professionals in end-of-life decision-making contributes to the frequent transfer of terminally ill patients to ICU due to last-minute evaluations with patients and their relatives and the inability to complete the grieving process. We also observed a notable lack of palliative care awareness across our hospital during the study period. This reflects a broader national shortage of dedicated palliative care services and trained specialists, as well as insufficient education in primary palliative care principles among physicians. The absence of legal regulations again appears as an obstacle here. A more clear legal policy could incentivize larger adoption of palliative care both by hospital management/staff and the public.

In a study conducted at another center in Turkiye, researchers developed a statistical model to identify candidates for early transfer from ICU to palliative services. Using parameters such as duration of hospital stay, history of cancer, previous hospitalizations and sequential organ failure, they calculated a probability score (>0.5). Patients with a score greater than 0.5 were classified as candidates for palliative transfer. In this way, the unnecessary use of ICU can be prevented.[24-26] Another study also reported that an effective palliative evaluation was cost-effective.[18] In a previous study we conducted with our patients in the palliative service, a positive correlation was detected between short life expectancy and the ratio of CRP, leukocytes, neutrophils, and the ESAS (Edmonton Symptom Scale) showing symptom burden and the presence of liver, brain and distant metastases. In that study, the application of artificial neural networks demonstrated that 30-day survival could be predicted with an accuracy of 89.3% using these parameters.[25]

In our study, the mean age of patients who survived was 68.4 years. Among those who died during the study period, the mean age was 70.5 years, while patients who died at a later stage had a mean age of 67 years. As demonstrated in multiple studies, age alone is not significantly associated with mortality or weaning outcomes in the ICU. Therefore, age should not be considered a limiting factor when evaluating candidates for ICU admission. However, COPD, pulmonary hypertension, and the presence of malignancy in pulmonary fibrosis are factors that make extubation difficult in elderly patients.[26,27]

Limitations

Accessing sufficient data was a challenge for the research due to the distribution of patients across multiple ICU. The retrospective design of our study caused methodological limitations. Furthermore, the availability of biochemical data within ICU was limited and the information regarding whether cancer patients received chemotherapy prior to or during their ICU stay was incomplete. We also observed that documentation of pre-existing comorbidities was inconsistently recorded. However, cancer patients who survived intensive care were examined individually and meticulously.

CONCLUSION

In conclusion, our study revealed that our hospital, serving a large population of patients with high mortality risk, continues to experience a high rate of ICU transfers. ICU admissions in malignancy and COPD were associated with extremely high mortality and limited long-term survival. The establishment of a palliative care unit alone did not significantly reduce ICU transfer rates. We believe a structured decision-making framework involving specialist physicians, patients, and their families should be established to guide ICU transfer decisions. Development of effective palliative care systems, structured end-of-life decision-making strategies, and clear legal regulations protecting both patients and healthcare professionals may help reduce unnecessary ICU utilization and improve quality of care in terminally ill patients.

ETHICAL DECLARATIONS

Ethics Committee Approval

This study was conducted with the approval of the Clinical Researches Ethics Committee of the Yedikule Chest Diseases and Thoracic Surgery Training and Research Hospital (Date: 29.07.2021, Decision No: 2021-138).

Informed Consent

As this was a retrospective study, formal written informed consent was not required and was therefore not obtained. This retrospective study used pre-existing anonymized patient data. No additional intervention was performed, and there was no direct patient contact. The study was approved by the Ethics Committee, and the requirement for written informed consent was waived by the ethics committee.

Peer Review Process

This manuscript was subject to external peer review.

Conflict of Interest

The authors declare no conflicts of interest related to this study.

Financial Disclosure

The authors received no financial support for the conduct or publication of this research.

Author Contributions

Conceptualization: GA, TMZ, DK, FTA; Methodology: GA, TMZ; Data Collector: GA, TMZ, DK, FTA; Statistical Analysis: GA, DK; Writing Original Draft: GA, TMZ;

Supervision: GA, TNZ, DK, FTA; Writing Review and Editing: GA, TMZ, TMZ, DK.

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