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Research Article

Assessment of Symptom Burden Using the ESAS in Patients with Hypercapnic Respiratory Failure Receiving Noninvasive Mechanical Ventilation

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Abstract

Aim: The success of noninvasive mechanical ventilation (NIV), which is used in the treatment of hypercapnic respiratory failure (HRF), largely depends on patient adherence. One of the key components of adherence is effective symptom control. Therefore, it is recommended that symptoms other than dyspnea be systematically assessed in patients requiring NIV. This study was designed to evaluate the symptom burden of such patients using the Edmonton Symptom Assessment Scale (ESAS).

Material and Method: This study, conducted between January 2025 and March 2025, included patients undergoing NIV. The demographic characteristics and comorbidities of the patients were assessed. Symptoms and their severity were evaluated using the ESAS. Additionally, patients were divided into two groups: those with prior NIV experience and those undergoing NIV for the first time, and their symptom burden was analyzed accordingly.

Results: The mean age of the patients included in the study was 69±12 years, with 68.4% being male. According to the ESAS results, the most frequently reported symptoms were dyspnea (6.21±1.05), overall well-being (5.65±2.49), and fatigue (5.03±1.74). When comparing symptom burden based on NIV experience, dyspnea scores were significantly higher in patients with prior NIV use ($p<0.001$), whereas abdominal bloating and drowsiness were more pronounced in first-time NIV users ($p<0.001$, $p=0.049$). Gender-based analysis revealed that pain scores were significantly higher in female patients compared to males ($p=0.030$). Regarding age groups, older patients exhibited more pronounced dyspnea and appetite loss, while younger patients had higher scores for pain, anxiety, and overall well-being ($p<0.05$).

Conclusion: This study demonstrated that symptom burden is significant in patients undergoing NIV and that age, gender, and prior NIV experience influence symptom presentation. These findings highlight the importance of comprehensive assessment approaches to personalize symptom management and enhance patient adherence.

Keywords: Edmonton Symptom Assessment Scale, noninvasive mechanical ventilation, compliance, adherence

INTRODUCTION

Respiratory failure is a severe clinical condition frequently encountered in intensive care units and significantly impacts patients' quality of life (1). To provide respiratory support in these patients, noninvasive mechanical positive pressure ventilation (NIV) can be administered (2). While the effectiveness of NIV largely depends on patient adherence to treatment, the emergence of various symptoms during the application process can negatively affect treatment outcomes (3). During NIV, patients may experience not only physical discomforts such as facial discomfort due to the mask, pressure ulcers, dry mouth, nasal congestion, headache, and ear pain but also psychosocial symptoms such as dyspnea, fatigue, depression, and anxiety (4). This highlights the importance of symptom management and the necessity of systematically screening for other symptoms.

The Edmonton Symptom Assessment Scale (ESAS) was developed to objectively and systematically evaluate symptom burden. Initially designed for use in cancer patients, it is now widely utilized in various patient populations (5-7). ESAS allows patients to rate their symptoms on a scale from 0 to 10, enabling the identification of the most burdensome symptoms.

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This study was designed to evaluate the most common symptoms and the severity of these symptoms in patients undergoing NIV in the intensive care unit due to hypercapnic respiratory failure (HRF) using ESAS. Additionally, it aimed to determine the relationship between these symptoms and prior NIV use, as well as patients' demographic characteristics.

MATERIAL AND METHOD

This prospective study was conducted between January and March 2025 in the Pulmonary Diseases Intensive Care Unit of our hospital on patients undergoing NIV due to HRF. The study was approved by the Clinical Research Ethics Committee of Ankara Atatürk Sanatorium Training and Research Hospital on January 22, 2025 (Approval No: 212) and conducted in accordance with the ethical principles outlined in the Declaration of Helsinki. The medical treatment of the patients was planned based on national and international guidelines. NIV was primarily administered using an oronasal mask.

Initially, the overall symptom profile identified by the ESAS was described for the entire patient population. Subsequently, the relationships between symptom scores and variables such as age, gender, and previous NIV experience were statistically analyzed.

Data Collection Method

In the study, the patients' age, gender, concomitant diseases and other demographic characteristics were examined in detail. The most frequently observed symptoms in patients undergoing NIV and their severity were assessed using the ESAS. ESAS data were collected through a survey-based method.

ESAS is a validated tool designed to measure symptom burden, rating symptom severity on a scale from 0 to 10. The scale evaluates nine core symptoms: pain, fatigue, nausea, depression, anxiety, appetite loss, sleep disorder, dyspnea, and overall well-being. Additionally, the "other symptoms" section of the ESAS questionnaire allows patients to report any additional predominant symptoms they experience. In this study, dry mouth and abdominal bloating were the most frequently reported additional symptoms. Through this structured survey approach, patients' symptoms and their severity were systematically evaluated.

Patient Selection

This study was designed to include patients who received NIV due to hypercapnic respiratory failure (pCO_2>45 mmHg) secondary to a chronic obstructive pulmonary disease (COPD) exacerbation during the specified period.

Patients with prior use of NIV at home were classified as the "previous NIV experience" group, while those who had never used NIV before were considered the "no prior NIV experience" group.

After assessing the symptom burden in the included patients, they were divided into two groups based on NIV usage: patients who had previously used NIV (previous NIV Users) and patients who were undergoing NIV for the first time (First-time NIV Users). Based on this classification, potential differences between symptom burdens and symptom profiles of the two groups were comparatively assessed.

Inclusion Criteria:

- Patients diagnosed with HRF in the emergency department and subsequently treated with NIV in the intensive care unit,
- Patients with hypercapnic respiratory failure secondary to COPD exacerbation,
- Patients aged 18 years or older,
- Patients who provided informed consent and agreed to participate in the study.

Exclusion Criteria:

- Patients with hypercapnic respiratory failure due to causes other than COPD exacerbation,
- Patients who did not agree to participate in the study,
- Patients with incomplete data,
- Patients younger than 18 years old,
- Patients diagnosed with hypoxic respiratory failure,
- Patients with a history of any malignancy,
- Patients unable to provide reliable data due to dementia or cognitive impairment,
- Patients with communication barriers or inability to cooperate.

Statistical Analysis

The data obtained in the study were analyzed using the SPSS 27.0 statistical software. Descriptive statistics were presented as mean±standard deviation (Mean±SD). The normality of data distribution was assessed using the Kolmogorov-Smirnov test and histogram-graph methods. For comparisons between groups, the independent samples t-test was used for parametric data, while the Mann-Whitney U test was applied for non-parametric data. Categorical variables were analyzed using the Chi-square (χ^2) test. To evaluate the effects of age, gender, and prior NIV experience on symptom scores, Mann-Whitney U analysis was performed. In all analyses, a p-value <0.05 was considered statistically significant.

RESULTS

A total of 136 patients were included in the study. The mean age of the patients was 69±12 years, and 68.4% of the participants were male. At least one comorbidity was present in 87.5% (n=119) of the patients, with COPD being the most common comorbidity, observed in 64% (n=87) of cases.

Analysis of the ESAS scores revealed that the most prominent symptoms were dyspnea (6.21±1.05), overall well-being (5.65±2.49), and fatigue (5.03±1.74). A summary of the ESAS results for the study population is presented in Table 1.

The patients included in the study were divided into two groups based on their NIV experience, and their ESAS scores were compared. A statistically significant difference was observed in dyspnea (p<0.001), drowsiness (p=0.049), and abdominal bloating (p<0.001) scores. Dyspnea scores were found to be higher in patients with prior NIV experience, whereas drowsiness and abdominal bloating were more pronounced in first-time NIV users. No significant difference was detected between the two groups in terms of other symptoms (p>0.05). The symptom scores based on NIV experience are presented in Table 1.

Table 1. Edmonton Symptom Assessment Scale (ESAS) results of the study population and comparison based on prior NIV experience

Symptom	All patients (N=136) Mean±SD	Previous NIV users (N=73) Mean±SD	First-time NIV users (N=63) Mean±SD	p-value
Pain	2.12±1.59	1.89±1.62	2.39±1.54	0.057
Fatigue	5.03±1.74	4.86±1.85	5.24±1.61	0.108
Nausea	0.82±0.30	0.84±0.57	0.79±0.16	0.482
Depressive feeling	2.05±1.10	1.88±1.11	2.25±1.08	0.138
Anxiety	2.57±1.77	2.38±1.83	2.79±1.71	0.138
Drowsiness	2.04±0.94	1.88±1.08	2.23±0.75	**0.049**
Loss of appetite	1.12±0.81	1.36±1.05	0.84±0.45	0.402
General well-being	5.65±2.49	5.50±1.54	5.82±1.44	0.399
Dyspnea	6.90±1.15	7.62±0.77	6.06±0.94	**<0.001**
Dry mouth	2.60±1.49	2.33±1.44	2.90±1.53	0.253
Abdominal bloating	4.43±1.70	3.63±1.58	5.35±1.34	**<0.001**

The symptoms of the patients included in the study were analyzed based on gender. The pain score was found to be 1.92±0.56 in male patients and 2.53±0.60 in female patients, with a statistically significant difference between the two groups (p=0.030).

The patients were divided into two groups based on the median age of 69 years as a reference. A statistically significant difference was observed between the two groups in terms of pain (p=0.030), nausea (p=0.035), anxiety (p=0.033), overall well-being (p=0.014), dyspnea (p=0.023), and loss of appetite (p<0.001) scores. Pain, anxiety, and overall well-being scores were found to be higher in younger patients, whereas dyspnea and loss of appetite were more pronounced in older patients. No significant difference was detected between the groups for other symptoms (p>0.05). The symptom scores of the included patients based on age groups are presented in Table 2.

Table 2. Edmonton Symptom Assessment Scale (ESAS) results based on the age groups of the patients

Symptom	≤69 years (N=62) Mean±SD	>69 years (N=75) Mean±SD	p-value
Pain	2.39±1.54	1.89±1.62	**0.030**
Fatigue	5.24±1.61	4.86±1.85	0.108
Nausea	0.79±017	0.84±0.57	0.035
Depressive feeling	2.27±1.09	1.88±1.11	0.109
Anxiety	2.81±1.73	2.38±1.82	**0.033**
Insomnia	2.23±0.75	1.88±1.08	0.064
Loss of appetite	0.85±0.45	1.36±1.05	**<0.001**
General well-being	5.83±2.46	5.50±2.54	**0.014**
Dyspnea	6.06±0.95	7.62±077	**0.023**
Dry mouth	3.95±1.52	3.32±1.44	0.618
Abdominal bloating	5.37±1.34	3.63±1.58	0.095

To evaluate the relationship between age and symptoms, univariate and multivariate logistic regression analyses were performed for each symptom with age as the independent variable. According to the results of the multivariate analysis, the appetite loss score was found to be significantly and positively associated with age (HR: 1.576; 95% CI: 1.170–2.124; p=0.003). In addition, the dyspnea score was negatively associated with age. No significant associations were observed between age and the other symptoms. These results are summarized in Table 3.

Table 3. Evaluation of the relationship between age and symptoms using logistic regression analysis

	Univariate logistic regression		Multivariate logistic regression	
Symptom	**HR (95% CI)**	**p-value**	**HR (95% CI)**	**p-value**
Pain	1.286 (1.023–1.616)	0.031	1.084 (0.817–1.439)	0.576
Fatigue	1.154 (0.945–1.410)	0.161	–	–
Nausea	1.045 (0.815–1.338)	0.730	–	–
Depressive feeling	1.043 (0.886–1.227)	0.614	–	–
Anxiety	1.123 (0.989–1.276)	0.073	0.926 (0.744–1.152)	0.489
Insomnia	1.107 (0.922–1.324)	0.278	–	–
Loss of appetite	1.452 (1.122–1.879)	0.005	1.576 (1.170–2.124)	**0.003**
General well-being	1.203 (1.042–1.389)	0.012	1.180 (0.932–1.494)	0.169
Dyspnea	0.703 (0.517–0.956)	0.025	0.587 (0.402–0.858)	**0.006**
Dry mouth	1.041 (0.908–1.193)	0.563	–	–
Abdominal bloating	1.195 (0.974–1.466)	0.088	1.077 (0.845–1.372)	0.551

DISCUSSION

In this study, a high overall symptom burden was observed among patients receiving NIV. Using the ESAS, we evaluated whether symptom burden differed according to clinical variables such as age, gender, and prior NIV experience. According to the findings, the most frequently reported symptoms were dyspnea, impaired well-being, and fatigue. The results indicate that symptom burden is substantial in patients undergoing NIV and that age, gender, and previous NIV experience significantly influence symptom profiles. These findings highlight the need for individualized symptom management strategies and underscore the importance of closely monitoring symptom burden to improve patient adherence to NIV.

In patients with advanced respiratory disease, severe dyspnea is often the predominant symptom; however, additional symptoms are frequently reported (8). In addition to dyspnea, various symptoms such as pain, fatigue, dry mouth, cough, depression, and anxiety have been documented in this patient population (9,10). This underscores the necessity of systematically evaluating a broader range of symptoms rather than solely focusing on dyspnea (11). In our study, although dyspnea was the most prominent complaint, symptoms such as fatigue, overall well-being, dry mouth, and anxiety were also commonly observed. These findings highlight the importance of a multidimensional approach to symptom management.

Rantala et al. reported that symptoms such as dyspnea, dry mouth, and loss of appetite were prominent in patients with chronic respiratory failure and that these symptoms varied depending on the underlying etiology of the disease (8). In the present study, patient symptoms were compared based on prior NIV experience. Our findings demonstrated that first-time NIV users exhibited lower dyspnea scores but experienced significantly higher levels of abdominal bloating. This observation suggests that patients who are unfamiliar with NIV may be more prone to developing abdominal discomfort. These results underscore the necessity of implementing individualized approaches in symptom management.

Several studies have demonstrated that women have a higher perception of pain and are more susceptible to chronic pain syndromes compared to men (12). It has been suggested that the increased frequency and severity of pain reported by female patients may be associated with the interaction of hormonal, genetic, neurophysiological, and psychosocial factors (13). Consistent with these findings, our study also revealed that female patients had higher pain scores than their male counterparts. This finding suggests that pain perception may be more pronounced in women during the NIV process and underscores the need to consider gender-specific differences in symptom management strategies.

Significant differences in symptom profiles may be observed between older and younger patient groups (14). In the study by Johannessen et al., symptoms such as dyspnea, appetite loss, and constipation were more prominent in older patients, whereas younger patients more frequently reported fatigue, nausea, and anxiety (15). In our study, according to multivariate logistic regression analysis, appetite loss was significantly more common in older patients, while dyspnea scores were higher among younger individuals. These findings suggest that symptom perception and physiological responses may differ across age groups. The higher prevalence of appetite loss in older adults may be attributed to more common nutritional issues in this population, whereas the heightened sensitivity to dyspnea in younger patients may explain their higher scores. In conclusion, the impact of age-related physiological and psychological changes on symptom burden should be considered, and symptom management should be tailored to the specific needs of each age group.

This study has several limitations. First, it was conducted as a single-center study with a limited sample size. Additionally, the follow-up period and long-term clinical outcomes of the patients could not be evaluated. The

fact that data were obtained from a single center limits the generalizability of the results to broader patient populations. Moreover, the use of subjective assessment tools such as ESAS carries the risk of measurement bias due to patient perception variability.

CONCLUSION

This study demonstrated that symptom burden is significant in patients undergoing NIV and that age, gender, and prior NIV experience influence symptom profiles. Specifically, certain symptoms were found to be more pronounced in women, elderly patients, and first-time NIV users. These findings highlight the importance of comprehensive assessment approaches to personalize symptom management and enhance patient adherence. Future multicenter studies may contribute to the development of more comprehensive strategies for optimizing symptom management in patients receiving NIV.

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Conflict of interest: *The authors have no conflicts of interest to declare.*

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