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Research on the Related Influencing Factors of Prognosis, Personalized Nursing, and Diversified Education Effects in Elderly Patients with COPD and Respiratory Failure

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Abstract: *In order to study the prognostic factors of elderly patients with chronic obstructive pulmonary disease (COPD) complicated with respiratory failure and the effect of personalized nursing and diversified education, the clinical data of 142 elderly patients with COPD complicated with respiratory failure admitted to our hospital from September 2021 to August 2023 were collected. According to the results of 1-year follow-up, they were divided into poor prognosis group (n=46) and good prognosis group (n=96). The clinical data of the two groups were compared to analyze the prognostic factors of elderly COPD patients with respiratory failure and the value of each factor in predicting poor prognosis of patients.The results showed age, Partial Pressure of Carbon Dioxide (PaCO2), Acute physiology and chronic health in the poor prognosis group The APACHE Ⅱ score, N-terminal pro-brain natriuretic peptide (NT-proBNP) and High-sensitivity troponin (hs-cTn) levels were higher than those in the good prognosis group. The oxygenation index of the group with good prognosis was significantly lower than that of the group with good prognosis (P < 0.05).Multivariate analysis showed that age, PaCO2, oxygenation index, NT-proBNP, hs-cTn levels and APACHE Ⅱ score were independent risk factors for poor prognosis in elderly COPD patients with respiratory failure (P < 0.05).The results of receiver operating characteristic (ROC) curve showed that: Age, PaCO2, oxygenation index, NT-proBNP, hs-cTn levels, APACHE Ⅱ score and combined prediction of poor prognosis in elderly COPD patients with respiratory failure were statistically significant (P < 0.05), and the AUC of combined prediction was 0.993, 95%CI was 0.982-1.000. The sensitivity and specificity were 0.957 and 0.979, respectively.In conclusion, the combination of age, PaCO2, oxygenation index, NT-proBNP, hs-cTn levels and APACHE Ⅱ score has a high value in predicting the poor prognosis of elderly COPD patients with respiratory failure. Therefore, it is necessary to pay close attention to the above factors and take targeted measures to improve the prognosis of patients.*

Keywords: *COPD; Respiratory failure; The prognosis is poor. Factors; Nursing care*

1. Introduction

COPD is characterized by progressive development, airflow limitation, long course of disease, and prolonged treatment [1].Reports have pointed out that the prevalence of COPD in China is increasing year by year, and patients are often accompanied by pulmonary dysfunction, which is easy to cause hypercapnia and hypoxemia, and induce respiratory failure [2]. Elderly patients with COPD have more severe lung function reduction and hypoxia, long treatment cycle, and are prone to repeated attacks, and have a high risk of respiratory failure and mortality, which seriously threaten the life safety of patients.At present, drugs and ventilator assisted ventilation are used to improve the symptoms of hypoxia in elderly patients with COPD complicated with respiratory failure, and anti-inflammatory and anti-infection are used to control the development of the disease and improve the prognosis and quality of life.Studies have shown that age, pH value, the number of exacerbations in the acute phase, PaCO2 and APACHEIIII score have important values in predicting the prognosis of elderly COPD patients with respiratory failure. Therefore, it is very important to analyze the factors related to the prognosis of COPD complicated with respiratory failure [3].Based on this, this study analyzes the prognostic factors of elderly COPD patients with respiratory failure and the effects of personalized nursing and diversified education, in order to provide a scientific basis for clinical treatment and improve the prognosis.

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2. Materials and methods

2.1 Materials Information

The clinical data of 142 elderly patients with COPD complicated with respiratory failure admitted to our hospital from September 2021 to August 2023 were analyzed. Inclusion criteria: (1) meeting the diagnostic criteria of COPD[4], PaO2 < 60mmHg, and PaCO2 > 50mmHg; (2) Complete data. Exclusion criteria: (1) combined with hypotensive shock (systolic blood pressure < 90mmHg, diastolic blood pressure < 60mmHg, accompanied by mental changes) or difficult to control infection; (2) complicated with pneumothorax and acute pulmonary infection; (3) patients with tumor. This study was approved by the ethics committee of the hospital, and informed consent was signed by the patients and their families.

2.2 Methods

2.2.1 Data COLLECTION

The clinical data of the patients were collected, including age, gender, body mass index (BMI), history of disease, smoking history, drinking history, Course of COPD, Course of Respiratory Failure. Portable arterial blood gas and biochemical analyzer (model: GSI-100; PaCO2 and oxygenation index (PaO2/ inspired oxygen concentration) were measured, and APACHEII scoring system was used to evaluate the condition.

2.2.2 Laboratory TESTING

At the time of admission, 5mL venous blood was collected from the patient, centrifuged by our hospital's disposable centrifugal plasma separator (Model: F-8001A1; Manufacturer: Shandong Zhongbaokang Medical Device Co., LTD.)(3000r/min, 10min), and the upper layer of serum was placed in the refrigerator at -80℃ for testing. Enzyme-linked immunosorbent assay was used to measure NT-proBNP and hs-cTn levels.

2.2.3 Follow-up

The patients were followed up for 1 year by telephone consultation and outpatient review. According to the occurrence of adverse events such as heart failure, sudden cardiac death, multiple organ dysfunction syndrome, and death during the follow-up period, the patients with and without any of the above adverse events were divided into the poor prognosis group and the good prognosis group, respectively.

2.3 Statistical Analysis

SPSS26.0 software was used to analyze the data. Measurement data were expressed as ($\bar{x}$±s), and t test was used between groups. Count data were described by n and %, and $\chi 2$ test was used between groups. Logistic regression model and receiver operating characteristic (ROC) curve were used to analyze the risk factors and predictive value of poor prognosis in elderly COPD patients with respiratory failure. P<0.05 was statistically significant.

3. Results

3.1 The clinical data of the poor prognosis group and the good prognosis group were compared

After 1 year of follow-up, 46 of 142 patients had poor prognosis and 96 had good prognosis, and the rate of poor prognosis was 32.39% (46/142). The age, PaCO2, NT-proBNP, hs-cTn levels and APACHEII score of the poor prognosis group were higher than those of the good prognosis group, and the oxygenation index was lower than that of the good prognosis group, and the differences were significant (P < 0.05). See Table 1.

Table 1 The clinical data of the poor prognosis group and the good prognosis group were compared

Indicators		Poor prognosis group(n=46)	Good prognosis group(n=96)	t/χ2	P
Gender	man	29(63.04)	60(62.50)	0.004	0.950
	woman	17(36.96)	36(37.50)		

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BMI(kg/m2)	23.00±1.63	23.30±1.47	1.098	0.274
age	73.26±5.19	68.32±4.07	6.176	0.000
Combined with diabetes	11(23.91)	22(22.92)	0.001	0.974
Combined with hypertension	8(17.39)	16(16.67)	0.012	0.914
Combined with hyperlipidemia	11(23.91)	22(22.92)	0.001	0.974
Smoking history	9(19.57)	18(18.75)	0.013	0.908
drinking history	10(21.74)	20(20.83)	0.015	0.902
Course of COPD(Yr)	6.72±1.24	6.41±1.14	1.474	0.143
Course of respiratory failure(Yr)	4.86±1.34	4.48±1.24	1.665	0.098
PaCO2(mmHg)	72.37±4.86	64.91±6.63	6.801	0.000
Index of oxygenatio(mmHg)	131.02±26.78	178.49±32.91	8.520	0.000
APACHEII score	10.78±2.29	8.20±1.43	8.207	0.000
NT-proBNP(pg/mL)	417.08±28.43	385.44±18.09	8.038	0.000
hs-cTn(ng/L)	140.17±17.65	125.66±9.80	6.294	0.000

3.2 Multivariate analysis of poor prognosis in elderly patients with COPD complicated with respiratory failure

The prognosis of elderly COPD complicated with respiratory failure was used as the dependent variable (good prognosis =0, poor prognosis =1). Age (continuous variable), PaCO2 (continuous variable), oxygenation index (continuous variable), NT-proBNP (continuous variable), hs-cTn level (continuous variable) and APACHEII score (continuous variable) were classified as independent variables in the Logistic regression model.Multivariate analysis showed that age, PaCO2, oxygenation index, NT-proBNP, hs-cTn levels and APACHEII score were independent risk factors for poor prognosis in elderly COPD patients with respiratory failure ($P < 0.05$). See Table 2.

Table 2 Multivariate analysis of poor prognosis in elderly patients with COPD and respiratory failure

Factors	B	SE	Wald	P	OR	95%CI
age	0.376	0.173	4.717	0.030	1.456	1.037~2.045
PaCO2	0.330	0.137	5.848	0.016	1.392	1.065~1.819
Index of oxygenatio	-0.060	0.021	7.681	0.006	0.942	0.903~0.983
NT-proBNP	0.086	0.033	6.708	0.010	1.090	1.021~1.163
hs-cTn	0.145	0.062	5.447	0.020	1.156	1.024~1.307
APACHEII score	1.250	0.424	8.705	0.003	3.491	1.522~8.012

3.3 The value of each index in predicting poor prognosis in elderly patients with COPD complicated with respiratory failure

ROC results showed that: Age, PaCO2, oxygenation index, NT-proBNP, hs-cTn levels, APACHEII score and combined prediction of poor prognosis in elderly COPD patients with respiratory failure were statistically significant ($P < 0.05$), and the AUC of combined prediction was 0.993, 95%CI was 0.982-1.000. The sensitivity and specificity were 0.957 and 0.979, respectively. See Table 3 and Figure 1.

Table 3 Value of each index in predicting poor prognosis in elderly patients with COPD complicated with respiratory failure

Indicators	AUC	Asymptotical significance	95%CI	he best cut-off value	sensitivity	specificity
age	0.782	0.000	0.695~0.869	70.235	0.804	0.667
PaCO2	0.822	0.000	0.753~0.891	67.065	0.891	0.656
Index of oxygenatio	0.865	0.000	0.803~0.926	164.230	0.688	0.913
NT-proBNP	0.826	0.000	0.743~0.910	401.345	0.761	0.833
hs-cTn	0.735	0.000	0.636~0.834	135.450	0.587	0.844
APACHEII score	0.819	0.000	0.739~0.900	9.500	0.674	0.854
collaborative forecasting	0.993	0.000	0.982~1.000	/	0.957	0.979

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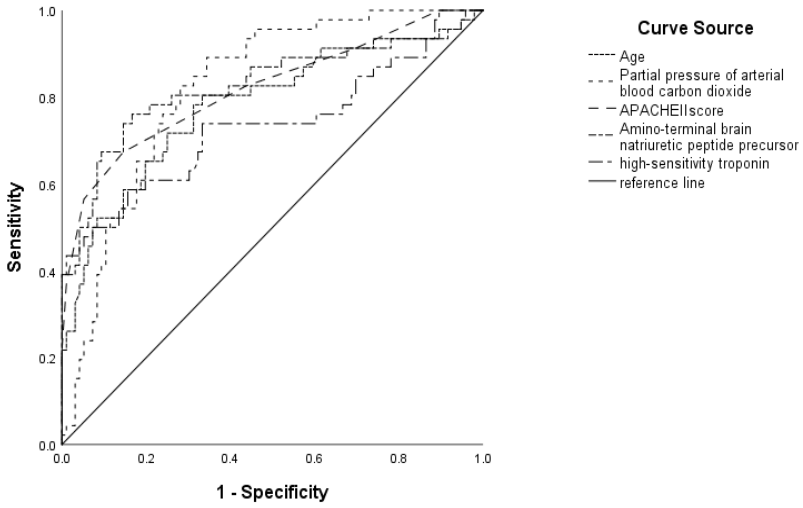

Figure a: Age, PaCO2, NT-proBNP, hs-cTn levels, and APACHEII score

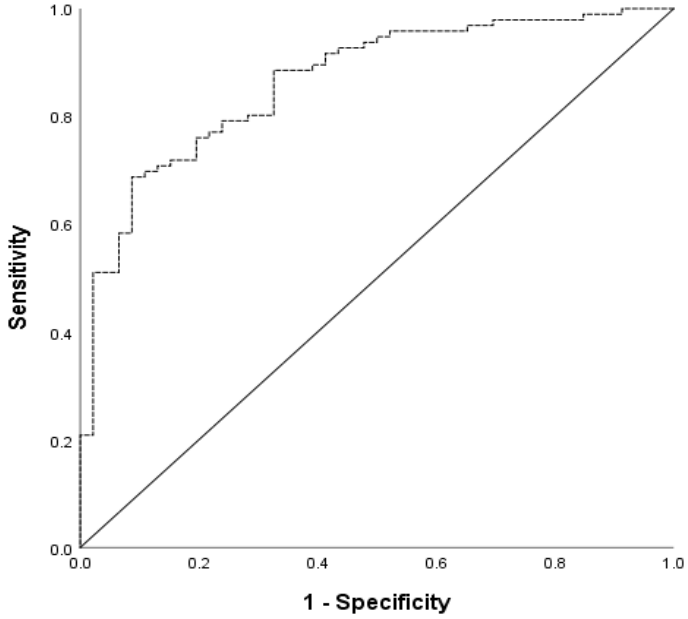

Figure b: Oxygenation index

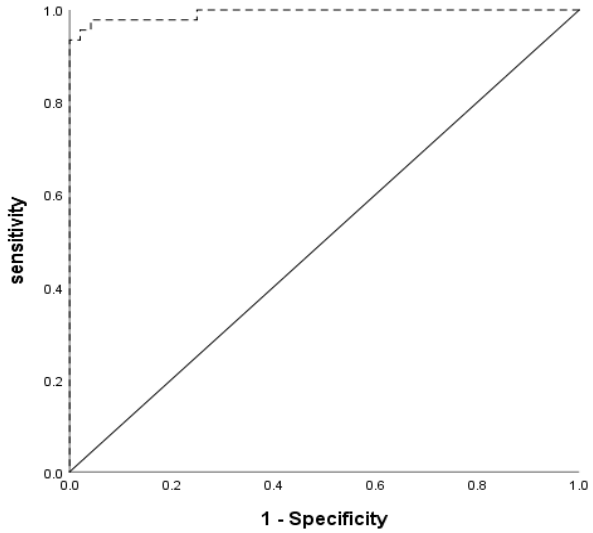

Figure c:collaborative forecasting

Figure 1 ROC curve analysis

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4. Discussion

The main pathological feature of COPD is airway and (or) alveolar abnormalities. The occurrence and development of COPD involve a variety of host factors. In addition to genetic susceptibility factors, abnormal development of the lung and persistent inflammatory response also participate in the pathological changes of the disease.Elderly patients with COPD are prone to a variety of complications, such as respiratory failure, spontaneous pneumothorax, respiratory tract infection, pulmonary heart disease, etc. Among them, respiratory failure is more common. Studies have revealed that elderly patients with COPD have degenerative changes in the anatomical structure of the respiratory system, weakened respiratory system function, decreased lung tissue elasticity, resulting in airway wall thickening and reduced gas exchange rate. It increases the risk of respiratory failure [5].nce the elderly COPD complicated with respiratory failure, its ventilation function is damaged, which is easy to cause a series of serious pathological and physiological changes, such as carbon dioxide retention, cyanosis and hypoxemia, leading to poor prognosis. Therefore, it is of great significance to identify the prognostic factors of COPD complicated with respiratory failure.

4.1 Influencing factors of prognosis in elderly patients with COPD complicated with respiratory failure

Multivariate analysis showed that age, PaCO2, oxygenation index, NT-proBNP, hs-cTn levels and APACHEII score were independent risk factors for poor prognosis in elderly patients with COPD complicated with respiratory failure.The reasons are as follows: with the increase of age, the lung reserve of the body decreases, the risk of respiratory muscle fatigue, weakened heart function, and internal environmental disorders increases, the difficulty of treatment increases, the process of the disease worsens, and the risk of death increases. With the decrease of lung function, the lung capacity and lung compliance decreased, and the prognosis became worse.Chen Yan et al. [6] showed that the age of patients with acute exacerbation of COPD complicated with respiratory failure was significantly higher than that of patients without respiratory failure, indicating that the older the age of COPD patients, the higher the risk of complicated respiratory failure and the worse the prognosis of patients.Therefore, it is necessary to pay close attention to the changes in the condition of elderly patients in clinical practice, strengthen health education, regularly monitor and follow up, formulate personalized treatment plans according to their specific conditions, ensure the safety and effectiveness of treatment, give them psychological support, and avoid poor prognosis.PaCO2 is an important indicator of respiratory function, and its level represents the pressure generated by physically dissolved carbon dioxide molecules in the blood. Elderly patients with COPD combined with respiratory failure have impaired lung function and blocked carbon dioxide excretion in the body, resulting in increased PaCO2 levels [7]. With the progress of the disease, the body shows respiratory acidosis, carbon dioxide retention, increased lung burden, decreased respiratory function, and poor prognosis. Oxygenation index is mainly used to evaluate the gas exchange function of the lungs. Elderly COPD patients with respiratory failure have impaired lung function, reduced oxygen inhalation and carbon dioxide output, and decreased oxygenation index.Generally, the lower the oxygenation index, the more severe the symptoms of hypoxemia and respiratory failure, the higher the risk of systemic symptoms and organ dysfunction, and the worse the prognosis [8]. Therefore, it is necessary to provide low flow oxygen inhalation with ventilator according to the patient's condition to increase oxygenation and avoid carbon dioxide retention. It is also necessary to conduct regular airway assessment, do a good job of airway humidification, ensure airway patency, and improve lung ventilation.The level of NT-proBNP increases when the heart is affected by pressure or volume load. The heart burden of elderly COPD patients with respiratory failure is aggravated, and the level of NT-proBNP increases. Usually, the abnormal increase of NT-proBNP level indicates that the body has the risk of cardiac insufficiency and heart failure. Patients may show dyspnea and systemic symptoms, and the prognosis is worse [9].hs-cTn is a marker of myocardial injury. Elderly COPD patients with respiratory failure are in a state of long-term hypoxia and inflammation, which causes varying degrees of damage to myocardial cells and elevated hs-cTn levels. With the increase of hs-cTn levels, the heart burden and systemic symptoms are aggravated, forming a vicious circle and the prognosis is worse. Therefore, it is necessary to pay attention to the improvement of cardiac function, reasonable oxygen therapy, avoid respiratory depression and aggravation of heart burden, rational drug use, active treatment of myocardial injury caused by infection, strengthen nutritional supplementation, and control the levels of NT-proBNP and hs-cTn.APACHEII score is mainly used to evaluate the severity of illness in intensive care unit, which integrates multiple physiological indicators and diseases. The higher the APACHEII score in elderly COPD patients with respiratory failure, the more serious the patient's condition, and even there are a

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variety of complications and organ dysfunction, resulting in increased risk of death and poor prognosis [10]. Therefore, it is necessary to closely monitor the vital signs and condition changes of patients, target treatment according to APACHEII score, prevent pulmonary infection, maintain a stable internal environment, and maintain electrolyte balance.The results of ROC showed that age, PaCO2, oxygenation index, NT-proBNP, hs-cTn levels, APACHEII score and combined prediction of poor prognosis in elderly patients with COPD complicated with respiratory failure were statistically significant, and the combined prediction value was higher. It is suggested that the combination of age, PaCO2, NT-proBNP, hs-cTn levels, oxygenation index and APACHEII score has significant value in predicting poor prognosis in elderly patients with COPD complicated with respiratory failure. Therefore, it is necessary to pay close attention to the changes of the above indicators in clinical diagnosis and treatment, consider multiple factors, and formulate targeted treatment and nursing programs to improve the prognosis of patients, improve their treatment effect and quality of life.

4.2 Individualized nursing and diversified education

Strengthening the management of COPD in the elderly can fundamentally reduce the prevalence of COPD and ensure the physical and mental health of the residents. In recent years, the nursing methods applied to elderly patients with COPD complicated with respiratory failure are more diversified. Personalized nursing and diversified education focus on the actual situation of elderly patients with COPD complicated with respiratory failure, take the patient as the center, comprehensively analyze the patient's condition, and formulate a nursing plan to improve the patient's treatment compliance and ensure the smooth implementation of the treatment plan. This method takes the patient's psychology and emotion as the starting point, which helps to relieve the patient's psychological pressure. Through careful observation of the patient's condition, it ensures that the nursing is effective and helps to reduce the adverse risk. And pay attention to patients' behavior guidance, help patients to master self-monitoring and management methods, so as to improve their self-care ability.

Diversified education based on network technology adopts the form of video and graphic text to transmit disease-related knowledge to patients, which helps them to understand the disease better and enhance their awareness of self-care. In the process of receiving relevant knowledge, patients realized the importance of following medical advice to improve the prognosis, and timely standardized their own behavior to ensure the effective treatment effect. Diversified health education pays attention to both physical and mental health of patients. Psychological counseling and psychological support can help patients build up treatment confidence and promote the improvement of prognosis. The combination of personalized nursing and diversified education ensures that the individualized nursing plan is formulated, understood and implemented, and improves the quality of life of patients. Therefore, it is necessary to pay attention to the combination of personalized nursing and diversified education in the nursing of elderly patients with COPD complicated with respiratory failure.

5. Conclusion

In conclusion, age, PaCO2, oxygenation index, NT-proBNP, hs-cTn levels and APACHEII score are the factors affecting the poor prognosis of elderly patients with COPD complicated with respiratory failure, and the combination of these indicators has a significant value in predicting the prognosis of elderly patients with COPD complicated with respiratory failure, so it is necessary to prevent them. The combination of personalized nursing and diversified education can ensure comprehensive and meticulous care, improve the quality of life of patients, and improve their poor prognosis.

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