Study of epidemiology and influential factors of nosocomial pulmonary infection in type 2 diabetes mellitus patients complicated with malignancies.

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Abstract

Objective: To investigate the epidemiology and influential factors of nosocomial pulmonary infection in type 2 diabetes mellitus (T2DM) patients complicated with malignancies.

Methods: 316 T2DM patients complicated with malignancies in our hospital were selected as the research objects from February 2015 to June 2017. Among them, 36 cases had pulmonary infection in the hospital. We firstly investigated the epidemiology, then Pearson correlation analysis and multivariate logistic regression analysis were adopted respectively to analyze the related factors of nosocomial pulmonary infection in T2DM patients complicated with malignancies.

Results: According to the epidemiological investigation, in T2DM patients complicated with malignancies, the nosocomial pulmonary infection rate in aged patients ($\geq$ 60 years old) was significantly higher than that in younger patients (<60 years old, P<0.05); the infection rate in male patients was significantly higher than that in female patients (P<0.05); the longer course of diabetes, the higher rate of nosocomial pulmonary infection (P<0.05); the higher of the BMI level, the higher rate of nosocomial pulmonary infection (P<0.05); the infection rate in rural patients was significantly higher than that in city patients (P<0.05); the infection rate in manual workers was significantly higher than that in mental workers (P<0.05); the higher level of education, the lower rate of nosocomial pulmonary infection (P<0.05); no significant relationship was found between fasting plasma glucose (FPG) level and nosocomial pulmonary infection rate (P>0.05). Through Pearson correlation analysis and multivariate logistic regression analysis, we finally got the related factors of nosocomial pulmonary infection in T2DM patients complicated with malignancies, including age, impaired respiratory function, and chronic diseases.

Conclusion: The nosocomial pulmonary infection in T2DM patients complicated with malignancies had a certain epidemiological characteristics and was affected by age, impaired respiratory dysfunction and chronic diseases and effective measures should be taken to prevent it.

Introduction

Malignancies and diabetes are the most common clinical diseases and intimidate the lives and health of patients. Recently, the incidences of malignancies and diabetes are increasing in clinic. Both of these two diseases are characterized by high morbidity and rapid disease development and if not treated in time, it is easy to lead to death [1]. The research data and epidemiology have confirmed the close correlation between them [2]. In clinical, malignancies complicated with diabetes are common, and they interact with each other and have complex causes. Type 2 diabetes mellitus

(T2DM) share many risk factors with malignant tumors, such as exercise, diet, obesity, gender, age, etc. In clinic, the mechanism of interaction between diabetes and malignant tumor is not clear. At present, high blood glucose, insulin, insulin-like growth factor, immune system function and trace elements are the main pathogenesis of malignancies caused by diabetes [3]. In recent years, we found that the incidence of nosocomial pulmonary infection in T2DM patients complicated with malignancies was high, and the common nosocomial infection was pulmonary infection. Pulmonary infection not only prolongs the hospitalization time of T2DM patients complicated with malignancies and increases

mortality, but also brings huge economic burden to patients, families and society as a whole. [4]. How to avoid the occurrence and prevention of pulmonary infection in T2DM patients with malignant tumors has become a hot and difficult point of clinical research. In present study, we analyzed the clinical data of 316 T2DM patients complicated with malignancies in our hospital from February 2015 to June 2017. We firstly investigated the epidemiology, then Pearson correlation analysis and multivariate logistic regression analysis were adopted respectively to confirm the related factors of nosocomial pulmonary infection in T2DM patients complicated with malignancies. The study was in order to provide a basis for the prevention of nosocomial pulmonary infection in T2DM patients complicated with malignancies and the results were as follows.

Data and Methods

General information

A total of 316 T2DM patients complicated with malignancies (solid tumors) in our hospital were selected as the research objects from February 2015 to June 2017. Baseline characteristics were: 186 male cases, 130 female cases; age was 36 to 78 y, the mean age was (63.4+2.5); the course of diabetes was 1 to 10 years, the mean course of diabetes was (5.4+1.2) years; BMI was 23 to 28 kg/m^2, the mean BMI was (25.62+1.24) kg/m^2; malignancies: 120 cases of primary liver cancer, 170 cases of breast cancer, 10 cases of pancreatic carcinoma, 6 cases of colorectal cancer, 5 cases of malignant lymphoma, 5 cases of lung cancer; 230 cases of city population, 86 cases of rural population; occupation distribution: 206 cases of manual worker, 110 cases of mental workers; education: 101 cases were in the group of education level of elementary school and below, 215 cases were in the group of education level of middle school and above; the fasting plasma glucose (FPG) level was 7.8 to 13. 5 mmol/L, the mean FPG level was (12.54+0.37) mmol/L; 36 patients were complicated with nosocomial pulmonary infection, the infection rate was 11.4% (36/316 cases). Inclusion criteria: all patients met the diagnostic criteria of type 2 diabetes mellitus (WHO) in 1999. The diagnosis of malignancies was confirmed by pathological diagnosis, and the nosocomial pulmonary infection was in line with the guideline for the treatment of hospital infection established by the Chinese respiratory Association of Chinese medical association. Exclusion criteria: type 1 diabetes, gestational diabetes and other specific types of diabetes associated with malignancies; repeatedly hospitalized patients were counted once; complicated with multiple organ dysfunction; patients with pulmonary infection before admission; patients were reluctant to enter the study.

Methods

To investigate the relationship between the rate of nosocomial pulmonary infection and the age, sex, duration of diabetes, BMI, urban and rural distribution, occupation distribution, education level and the level of FPG in T2DM patients complicated with malignancies; then Pearson correlation analysis and multivariate logistic regression analysis were adopted respectively to analyze the related factors; finally, the strategy of prevention was analyzed.

Statistical methods

The data were analyzed with SPSS21.0 software. The measurement data were expressed as mean ± SD and the t test was used. ^{2} test, Pearson correlation analysis and multivariate logistic regression analysis were adopted respectively to analyze the related factors of nosocomial pulmonary infection in T2DM patients complicated with malignancies, P<0.05 meant the difference was statistically significant.

Results

Epidemiological results

According to the epidemiological investigation, in T2DM patients complicated with malignancies, the nosocomial pulmonary infection rate in aged patients (≥ 60 years old) was significantly higher than that in younger patients (<60 years old, P<0.05); the infection rate in male patients was significantly higher than that in female patients (P<0.05); the longer course of diabetes, the higher rate of nosocomial pulmonary infection (P<0.05); the higher of the BMI level, the higher rate of nosocomial pulmonary infection (P<0.05); the infection rate in rural patients was significantly higher than that in city patients (P<0.05); the infection rate in manual workers was significantly higher than that in mental workers (P<0.05); the higher level of education, the lower rate of nosocomial pulmonary infection (P<0.05); no significant relationship was found between fasting plasma glucose (FPG) level and nosocomial pulmonary infection rate (P>0.05) (Table 1).

Table 1. Results of epidemiological investigation.

Indexes	Patient cases (n)	pulmonary infection cases (n)	Infection rate (%)	^{2}	P
Age (y)				6.715	<0.05
<60	170	8	4.71		
≥ 60	146	28	19.2		
Gender				6.038	<0.05
Male	186	26	14.0		
Female	130	10	7.7		
Course of diabetes (y)				6.192	<0.05
<5	112	11	9.8		
≥ 5	204	25	12.3		
BMI(kg/m^2)				7.004	<0.05
<25	160	7	4.4		
≥ 25	256	29	11.3		

Distribution of areas				7.263	<0.05
City area	230	20	8.7		
Rural area	86	16	18.6		
Occupation distribution					
Manual workers	195	28	12.6	4.440	<0.05
Mental workers	121	8	9.1		
Education				7.544	<0.05
Elementary school and below	101	24	23.8		
Middle school and above	215	12	5.6		
Fasting plasma glucose (FPG, mmol/L)				0.128	>0.05
7.8-11.0	109	13	11.9		
>11.0	207	23	11.1		

Analysis of related factors of nosocomial pulmonary infection in T2DM patients complicated with malignancies

Through Pearson correlation analysis and multivariate logistic regression analysis, we finally got the related factors of nosocomial pulmonary infection in T2DM patients complicated with malignancies, including age, impaired respiratory function, and chronic diseases (Tables 2 and 3).

Table 2. Pearson correlation analysis of related factors of nosocomial pulmonary infection in T2DM patients complicated with malignancies.

Factors	Non-infection groups (n=280)	Infection groups (n=36)	x^2	P
Age (y)			6.715	<0.05
< 60	162	8		
≥ 60	118	28		
Impaired respiratory function			7.145	<0.05
yes	92	30		
no	188	6		
Chronic diseases			6.182	<0.05
yes	94	27		
no	186	9		

Table 3. Multivariate logistic regression analysis of related factors of nosocomial pulmonary infection in T2DM patients complicated with malignancies.

Indexes	β	SE	Wald ^{2}	OR (95%CI)	P
Age	0.056	5.784	1.542	1.515 (1.273-1.896)	<0.05
Impaired respiratory function	0.251	0.505	0.307	1.305 (0.503-3.192)	<0.05
Chronic diseases	2.043	0.549	12.125	7.607 (2.541-20.348)	<0.05

Summary: According to the epidemiological investigation, in T2DM patients complicated with malignancies, the nosocomial pulmonary infection rate in aged patients (≥ 60 years old) was significantly higher than that in younger patients (<60 years old, P<0.05); the infection rate in male patients was significantly higher than that in female patients (P<0.05); the longer course of diabetes, the higher rate of nosocomial pulmonary infection (P<0.05); the higher of the BMI level, the higher rate of nosocomial pulmonary infection (P<0.05); the infection rate in rural patients was significantly higher than that in city patients (P<0.05); the infection rate in manual workers was significantly higher than that in mental workers (P<0.05); the higher level of education, the lower rate of nosocomial pulmonary infection (P<0.05); no significant relationship was found between fasting plasma glucose (FPG) level and nosocomial pulmonary infection rate (P>0.05). Through Pearson correlation analysis and multivariate logistic regression analysis, we finally got the related factors of nosocomial pulmonary infection in T2DM patients complicated with malignancies, including age, impaired respiratory function, and chronic diseases.

Discussion

The prevalence of diabetes is increasing year by year. Diabetes mellitus complicated with malignancies have become a high frequency disease. Patients with diabetes and malignancies are both the high risk group of nosocomial infection [5-7]. In T2DM patients complicated with malignancies, nosocomial pulmonary infection is proved to be an important factor in the death of patients. Therefore, to investigate the epidemiology and influential factors of nosocomial pulmonary infection in T2DM patients complicated with malignancies is very important for the effective prevention.

Because of the low immunity in aging population, their ability of responding to external infection and other stress factors is reduced. When they have a poor nutritional status, stay in bed for a long time or abuse of analgesic drugs or non-steroidal anti-inflammatory drugs, they are more likely to increase the probability of pulmonary infection [8,9]. If the elderly patients with T2DM and malignant tumor develop pulmonary infection, bacteremia, septicemia and septic shock are likely to occur. So we should pay much attention to this phenomenon. In present study, the nosocomial pulmonary infection rate in aged patients (≥ 60 years old) was significantly higher than that in younger patients (<60 years old, P<0.05). Thus, the elderly T2DM patients complicated with malignancies are susceptible for

nosocomial pulmonary infection. Generally speaking, the rural population has relatively low education level and low cultural quality, lacks of knowledge of diabetes complicated with malignancies, has not formed the good health habits, and is poor in economy, which make it become susceptible to pulmonary infection in the crowd [10]. In our study, the infection rate in rural patients was significantly higher than that in city patients (P<0.05). It can be inferred that the rural population is the high-risk group of T2DM malignant tumor patients complicated with nosocomial pulmonary infection. Previous studies have reported that the intensity and character of occupational labor is closely related to nosocomial pulmonary infection in T2DM patients complicated with malignancies. In our study, the infection rate in manual workers was significantly higher than that in mental workers (P<0.05). This is probably because that the physical workers tend to ignore their own diabetes as they have good physical fitness, even be in the presence of infection. In addition, due to long time work and large labor intensity, excessive eating, drinking, wasting and other symptoms can easily be mistaken for a normal phenomenon, even they are suffering from diabetes. And when they are treated, their condition is serious and complicated with a series of diseases such as malignant tumors [11,12]. This study also showed that the higher level of education, the lower rate of nosocomial pulmonary infection (P<0.05). The reason may be due to the short education, they lack of understanding of the relevant knowledge on diabetes complicated with malignant tumors and the ability of self-health care, as a consequence, the risk of pulmonary infection increases. This reminds us that improving people's cultural quality, strengthening knowledge of health education related to diabetes and cancer may have a certain significance to control hospital lung infection [13,14]. The study also showed that the higher of the BMI level, the higher rate of nosocomial pulmonary infection (P<0.05), which meant obese T2DM patients with malignant tumors were prone to develop pulmonary infection. In this regard, patients should pay attention to control weight, strengthen exercise and diets. No significant relationship was found between FPG level and nosocomial pulmonary infection rate. The reason may be due to FPG level at admission could be related to many factors, and could not fully represent the usual blood glucose level of patients.

Through Pearson correlation analysis and multivariate logistic regression analysis, we finally got the related factors of nosocomial pulmonary infection in T2DM patients complicated with malignancies, including age, impaired respiratory function, and chronic diseases. Due to the increase of age, the decrease of the body resistance and immunity and especially complication with chronic diseases, elderly patients suffered from decreasing of compensatory function of various organs and stress resistance and degenerative changes in the structure and function of the respiratory and pulmonary tissues, and they were easy to nosocomial pulmonary infection. Patients with respiratory dysfunction may easily suffer from aspiration pneumonia or hypostatic pneumonia because of their disappearance or weakening of swallowing function and cough

reflex. Strong and effective measures should be taken to prevent nosocomial infection in T2DM patients with malignancies against these risk factors [15,16]: 1) improving the patient's own immunity and resistance and correcting other organ dysfunction; 2) Most of the T2DM patients with malignancies stay in bed for a long time during the initial treatment, and they may have many chronic diseases or respiratory dysfunction. Therefore, clinicians should help patients turn back regularly and encourage them to cough and expectoration; 3) improving people's cultural quality, strengthening knowledge of health education related to diabetes and cancer; 4) controlling weight, strengthening exercise and diets.

In conclusion, the nosocomial pulmonary infection in T2DM patients complicated with malignancies had a certain epidemiological characteristics and was affected by age, impaired respiratory dysfunction and chronic diseases and effective measures should be taken to prevent it.

References

1. Koike N, Hatori T, Imaizumi T. Malignant glucagonoma of the pancreas diagnoses through anemia and diabetes mellitus. J Hepato Biliary Pancreatic Surg 2003; 10: 101-105.

2. Burghaus S, Halmen S, Gass P. Outcome and prognosis in uterine sarcoma and malignant mixed Mullerian tumor. Arch Gynecol Obstet 2016; 294: 343-351.

3. Zhang Y, Li M X, Wang H. Metformin down-regulates endometrial carcinoma cell secretion of IGF-1 and expression of IGF-1R. Asian Pacific J Cancer Prevent 2015; 16: 221-225.

4. Zhang C, Hou WH, Ding XX. Association of cytotoxic t-lymphocyte antigen-4 polymorphisms with malignant bone tumor risk: A meta-analysis. Asian Pacific J Cancer Prevent 2016; 17: 3785-3791.

5. Gjelberg HK, Hoem D, Verbeke CS. Hypoglycemia and decreased insulin requirement caused by malignant insulinoma in a type 1 diabetic patient: when the hoof beats are from a zebra, not a horse. Clin Case Rep 2017; 5: 761-768.

6. Zheng YQ. Analysis and strategy of nosocomial infections reasons in malignant tumour patients. Chinese J Nosocomiol 2010; 119: 434-438.

7. Zhou M, Hong-Yu DU, Zhang PX. Risk factors of nosocomial infections in senile patients with malignant solid tumors. Chinese J Nosocomiol 2013; 23: 2578-2580.

8. Walory J, Grzesiowski J, Hryniewicz W. The prevalence of diphtheria immunity in healthy population in Poland. Epidemiol Infect 2001; 126: 225-230.

9. Böttiger M, Christenson B, Grillner L. Hepatitis A immunity in the Swedish population. A study of the prevalence of markers in the Swedish population. Scandinavian J Infect Dis 1997; 29: 99-102.

10. Méda ZC, Somé T, Sombié I. Patients infected by tuberculosis and human immunodeficiency virus facing

their disease, their reactions to disease diagnosis and its implication about their families and communities, in Burkina Faso: a mixed focus group and cross sectional study. BMC Res Notes 2016; 29: 373.

11. Osama AJ, Aelk S. Psychological wellbeing and biochemical modulation in response to weight loss in obese type 2 diabetes patients. African Health Sci 2015; 15: 503-512.

12. Ojulong J, Mitonga KH, Iipinge SN. Knowledge and attitudes of infection prevention and control among health sciences students at University of Namibia. African Health Sci 2013; 13: 1071-1078.

13. Xiao-Lian LU, Liang LI, Cai-Xia WU. To reinforce detailed management in prevention and control of multidrug-resistant bacteria. Chinese J Nosocomiol 2013; 23: 129-131.

14. Hirth JM, Rahman M, Berenson AB. The association of posttraumatic stress disorder with fast food and soda consumption and unhealthy weight loss behaviors among young women. J Womens Health 2011; 20: 1141-1149.

15. Suto JI, Satou K. Further characterization of diabetes mellitus and body weight loss in males of the congenic mouse strain DDD.Cg-A(y.). J Veterinary Med Sci 2015; 77: 203-210.

16. Jiang Y, Li JY, Li M. Clinical analysis of nosocomial pulmonary fungal infection in patients with cancer. Chinese J Cancer 2004; 23: 1707-1709.

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