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Correlation analysis of mortality risk and hemoglobin detection frequency in hemodialysis patients

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Abstract

Objective To investigate the correlation between the risk of death and the frequency of hemoglobin detection in hemodialysis patients.Methods the clinical data of 86 hemodialysis patients in our department of Nephrology were analyzed retrospectively. The effect of hemoglobin frequency [1 tests every 3 months (March 2013 to March 2014) and 1 tests every 1 months (April 2014 to July 2014)] on the variability of hemoglobin level, hemoglobin variability and hemoglobin target range was analyzed. The patients were followed up for 1 years. According to the survival of the patients, the patients were divided into the dead group (15 cases) and the survival group (71 cases). The data of the patients were analyzed by univariate and logistic regression analysis. To explore the correlation between the risk and mortality risk. Result The patient's hemoglobin tested every 1 months for 1 times higher than every 3 months testing for 1 times, standard deviation and coefficient of variation less than every 3 months testing for 1 times ($P < 0.05$). Both hemoglobin target range variability was statistically significant ($P < 0.05$). The variability in hemoglobin values and hemoglobin target ranges was associated with risk of death ($P < 0.05$). Logistic multivariate regression analysis showed that the variability of hemoglobin value and hemoglobin target range was the independent risk factor of mortality risk ($P < 0.05$). Conclusion Compared to 1 hemoglobin tests every 3 months, 1 tests every 1 months can significantly increase hemoglobin values and reduce haemoglobin variability. There was no significant correlation between hemoglobin variability and mortality. However, the variability of hemoglobin values and hemoglobin target range was an independent risk factor for mortality risk.

Keywords

hemodialysis; risk of death; hemoglobin; detection frequency; correlation

1. Introduction

Renal anemia occurs to a certain extent when chronic kidney disease progresses to end-stage renal disease. The main reason is that renal dysfunction may lead to the lack of endogenous erythropoietin in the body, leading to anemia, and the severity of the disease is positively correlated with the severity of anemia [1]. According to statistics, the incidence of renal anemia in maintenance hemodialysis patients is > 90%[2]. Low hemoglobin in the body can weaken the oxygen carrying capacity of the blood, but also lead to the occurrence of hypoxia, ischemia and other pathophysiological changes in the organs, damage the immune function of the body.Previous studies have confirmed that high or low hemoglobin level is associated with increased risk of death [3]. A study shows [4], the frequency of the detection of hemoglobin is associated with maintaining the stability of hemoglobin, but current research clinical less hemoglobin test the effects of frequency variation of hemoglobin and risk of

death in patients receiving hemodialysis, therefore, the study retrospective analysis the clinical data of 86 cases of renal medicine hemodialysis patients, and explore hemoglobin test frequency of hemoglobin test frequency, the influence of and analyze its relationship with the patient's risk of death.

2. Material and method

2.1. Material

86 patients with renal medicine hemodialysis patients were retrospectively analyzed including clinical data, hemoglobin test frequency [all patients test every 3 months 1 time (March 2013 to March 2014) and the test once every 1 months (between April 2014 and July 2014)], with 1 year sucessful follow-up. On the basis of survival situation, the patients is divided in to death group (15 cases) and survival group (71 cases). This study was approved by the hospital ethics committee. There were 40 males and 46 females. Age: 25-76, average (54.26±8.65) years old; BMI 18.02-30.25kg/m2, average (23.35±4.12) kg/m2; The dialysis duration ranged from 8 months to 16 years, with an average of (3.65±1.20) years. Primary disease includes: 59 cases of primary glomerulonephritis, 6 cases of hypertensive nephropathy, 13 cases of diabetic nephropathy; Other causes were unknown in 8 cases.

1.2 Inclusion criteria

(1) age 18-80 years;
(2) > for 6 months;
(3) dialysis 3 times a week;
(4) complete clinical data.

1.3 Exclusion criteria

(1) other severe organ dysfunction;
(2) complicated with malignant tumor;
(3) complicated with active bleeding and uncontrolled active systemic disease;
(4) anemia caused by diseases of the blood system;
(5) severe infection;
(6) adrenocortical hormone therapy.

1.4 Treatment method

All patients received hemodialysis treatment in accordance with the "clinical practice guidelines for dialysis in chronic kidney disease pathogenesis" : arteriovenous internal fistula was used, oposite 3000 dialysis machine was used, dialysis time was 4h/ time, 3 times/week, bicarbonate dialysate was used, and low-molecular weight heparin was used for anticoagulation.

1.5 Hemoglobin detection method

venous blood 2ml was collected in a biochemical tube, temperature bath 0.5h, 3000r centrifugation 10min, supernatant was transferred to EP tube, MINDRAY automatic biochemical analyzer (bs-400) was used for detection, the kit was purchased from Beijing zhongshan-jinqiao biotechnology co., LTD., and the data was directly read after 30min on the machine. The target range of hemoglobin is 110-120g/L[5]。

1.6 Hemoglobin variation criteria

Hemoglobin variability was evaluated according to the following criteria [6-7].(1) hemoglobin variation was represented by hemoglobin standard deviation and coefficient of variation.Standard deviation: residual deviation between hemoglobin value and mean value;Coefficient of variation: the ratio of the standard deviation of hemoglobin to the mean value of hemoglobin.

1.7 Hemoglobin fluctuation pattern

Hemoglobin fluctuation pattern is divided into four categories around the target range of hemoglobin: continuously lower than the target range (CL), hemoglobin detection value < 110g/L;Fluctuation around the lower limit of target range (LAL), hemoglobin detection value < 110g/L or between 110-130g/L at least once, all of which are > 130g/L.Fluctuation around the upper limit of target range (LAH), hemoglobin detection value was between 110-130g/L or > 130g/L at least once, and no < 110g/L occurred.Consistently above target range (CH), hemoglobin detection value > 130g/L.

1.8. Statitsic analysis

SPSS19.0 was used to analyze and process the statistical data. Percentage (%) of enumeration data was adopted and chi-square test was conducted.According to the measurement data line (±s), t value test was conducted for comparison between groups, and the factors related to the risk of death were screened out by univariate analysis, and variables with P<0.05 were included in logistic multivariate regression analysis. P < 0.05 was considered as significant and statistically significant.

3. Results

Different hemoglobin test frequency variation and the value of hemoglobin and hemoglobin target range of variation degree of the influence of the test once every 1 months of patient hemoglobin value is higher than tests every 3 months of patients, while standard deviation, coefficient of variation is lower than test every 3 months of the patients (P < 0.05), and both hemoglobin target range variation are of statistical significance (P < 0.05)(table 1).

Table 1 the influence of different detection frequencies on the variation degree of hemoglobin value, hemoglobin variation and target range

group	Hemoglobin value (g/l)	standard deviation	variable coefficient	Variation in the target range of hemoglobin			
				CL	LAL	LAH	CH
Test every 3 months（*n*=86）	95.34±13.24	13.12±2.49	0.15±0.03	14（16.28）	55（63.95）	2（2.33）	15（17.44）
Tested every 1 month（*n*=86）	102.61±14.28	8.87±2.14	0.08±0.01	5（5.81）	75（87.21）	3（3.49）	3（3.49）
χ^2/t	3.462	12.004	20.528	15.540			
P	0.001	0.000	0.000	0.001			

Single-factor analysis of mortality risk showed that hemoglobin value and variation of hemoglobin target range were c orrelated with mortality risk ($P < 0.05$). Other general information was not associated with risk of death ($P > 0.05$)(ta ble 2).

Table 2 single factor analysis of death risk

	Death group（*n*=15）	Survival group（*n*=71）	χ^2/t	*P*
male/female	4/11	35/36	2.559	0.110
age（year）	55.72±9.62	53.17±8.97	0.988	0.326
Duration of dialysis（year）	3.12±1.15	3.34±1.20	0.650	0.518
BMI（kg/m^2）	23.65±6.79	23.46±6.25	0.105	0.916
protopathy			0.368	0.947
primary glomerulonephritis	10（14.08）	49（69.01）		
hypertensive nephropathy	1（6.67）	5（7.04）		
Diabetic Nephropathy	2（13.33）	11（15.49）		
others	2（13.33）	6（8.45）		
Hemoglobin（g/l）	96.87±8.43	101.34±9.62	3.241	0.001
standard deviation	11.34±1.69	10.90±1.35	1.096	0.276
variable coefficient	0.13±0.05	0.12±0.03	1.030	0.306
Variation in the target range of hemoglobin			8.459	0.037
CL	8（53.33）	14（19.72）		

LAL	5（33.33）	47（66.20）
LAH	2（13.33）	7（9.86）
CH	0（0.00）	3（4.23）

The above variables with P < 0.05 were included in logistic multivariate regression analysis, and the hemoglobin value and the variation degree of the target range of hemoglobin were independent influencing factors affecting the risk of death of patients (P < 0.05)(table 3).

Table 3 multi-factor analysis

variable	*β*	*S.E*	*Wald*	*P*	*OR*	95%CI
Hemoglobin	0.827	0.331	6.242	0.000	2.286	1.130-4.349
Variation in the target range of hemoglobin	1.135	0.420	7.303	0.000	3.111	1.462-7.159

4. Disucssion and conclusion

Anemia is the most common complication of hemodialysis patients, which mainly refers to the reduction of peripheral blood red blood cell capacity, which is lower than the lower limit of normal range [8].Studies have reported that the lack of erythropoietin in patients with renal diseases is likely to lead to renal anemia, and such patients will lose blood during blood drawing and hemodialysis, further exacerbating anemia [9]. The main clinical treatment method for renal anemia is to adjust the use frequency and dosage of erythrocyte generation stimulant according to the hemoglobin level detected, and set the target range based on the patient's own situation [10]. Therefore, to improve the monitoring frequency of hemoglobin can timely adjust the level of hemoglobin in the body, avoid drug withdrawal or increase in sight, is conducive to correct anemia.

The study showed that 1 time per 1 month test hemoglobin values of patients can improve the level of haemoglobin, lower hemoglobin, and hemoglobin target range of variation and 3 months have obvious difference, detection 1 times increase hemoglobin test frequency patients nutritional status can be adjusted in a timely manner, improve hemoglobin value, is advantageous to the correction of renal anemia, and then to lower hemoglobin variation, has important significance to stabilize the hemoglobin [11].The logistic multiple factor regression analysis in this study showed that there was no significant correlation between the hemoglobin variation and the risk of death of patients, which may be because the sample size of this study was too small, and it needs to be further confirmed by expanding the sample size.Hemoglobin value and variation of the target range of hemoglobin are independent factors affecting the risk of death of patients. Hemoglobin is an important component of oxygen transport in human body, which can ensure the continuous and stable oxygen supply of the body and avoid hypoxia of tissues and organs, and is closely related to the risk of death of patients [12].The research results of sun jing et al. [13] on 198 patients with maintenance hemodialysis showed that lower or higher hemoglobin levels could increase the incidence of cardiovascular events in patients.When the body is in normal physiological state, the fluctuation range of

hemoglobin is generally < 10g/L.Fluctuations in hemoglobin can lead to periodic fluctuations in oxygen supply to tissues and organs, leading to ischemia and hypoxia, organ injury or organ dysfunction, and increasing incidence of adverse clinical events [14].If myocardial hypoxia occurs and cardiac output increases, cardiac cells will be stimulated and their volume will increase, which will further activate myocardial growth signals and cause pathological changes such as ventricular enlargement. Moreover, self-resident nerve injury is often accompanied by increased risk of death of patients.In addition, local hypoxia may also cause renal tubular interstitial fibrosis, promote renal deterioration, hemoglobin fluctuations will also cause iron imbalance in patients, causing adverse reactions.Therefore, the prognosis of hemodialysis patients is related to hemoglobin and hemoglobin fluctuation.

In conclusion, once every 1 month is beneficial to improve the hemoglobin value and reduce the variation of hemoglobin. There is no significant correlation between the variation of hemoglobin value and the risk of death, while the variation of hemoglobin value and the target range of hemoglobin can provide certain guidance for clinical treatment.

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