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Risk factors of severe abnormal hemogram in patients undergoing chronic hemodialysis

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Objectives : Anemia and changes in hematologic profile were common for patients with end-stage renal disease (ESRD) after entering hemodialysis. Identifying associated factors with abnormalities in hemogram is pivotal since they may be related to overall survival and hematologic disorders.
Methods : A total of 478 patients with ESRD undergoing hemodialysis were enrolled from National Taiwan University Hospital, including Bei-Hu and Jinshan branch, in March, 2021. Severe abnormal hemogram in this study was defined as having at least two abnormal hemogram parameters, including anemia, leukopenia, thrombocytopenia, and macrocytosis. Multivariate analyses were conducted to identify factors associated with hemogram abnormalities. Additionally, patients were divided into subgroups based on age and dialysis vintage, and multivariate analyses were performed to identify risk factors for severe abnormal hemogram within these subgroups.
Results : The dialysis vintage, erythropoietin resistance index (ERI), and the percentage of liver cirrhosis were significantly higher in group of severe abnormal hemogram. Multivariate analyses demonstrated that severe abnormal hemogram was associated with higher ERI, heart failure, and liver cirrhosis. Anemia was associated with lower dialysis adequacy, hypoalbuminemia, and higher ERI. Leukopenia was associated with autoimmune disease and liver cirrhosis. Thrombocytopenia was associated with various clinical factors, while macrocytosis was associated with only liver cirrhosis. In subgroup analysis, a severe abnormal hemogram was associated with patients older than 80 years old, while being associated with a higher ERI in patients with a dialysis vintage of over 5 years.
Conclusions : Severe abnormal hemogram in patients undergoing chronic hemodialysis was associated with higher ERI, heart failure, and liver cirrhosis. Older patients and those with a longer dialysis vintage exhibited distinct risk factors for abnormal hemogram. The prevention or correction of these identified risk factors could potentially avert adverse outcomes related to severe abnormal hemogram.

Table 1.png

Table 1. Demographic data		
Characteristic	Non-severe Abnormal (n=381)	Severe abnormal (n=69)
Age, yr, mean (SD)	67.9 (14.4)	71.2 (14.9)
Sex ratio (M:F)	1.31	1.3
Weight, kg, mean (SD)	62.2 (14.3)	58.1 (12.5)
Kt/V, mean (SD)	1.58 (0.28)	1.57 (0.27)
Vintage, yr, mean (SD)*	6.43 (5.57)	8.37 (6.09)
ERI, U/wk/g/dL/kg, mean (SD)*	7.13 (5.37)	9.75 (7.13)
Underlying diseases-No. of patients (%)		
Autoimmune disease	19 (5.0)	6 (8.7)
Hypertension*	298 (78.2)	45 (65.2)
Diabetes mellitus*	168 (44.1)	20 (29.0)
COPD	17 (4.5)	3 (4.4)
Heart failure	154 (40.4)	39 (56.5)
Cirrhosis*	7 (1.84)	8 (11.6)
Malignancy	58 (15.2)	16 (23.2)
Biochemistry profile-Mean (SD)		
Albumin, g/dL*	3.99 (0.36)	3.88 (0.37)
Ferritin, ng/mL*	497.4 (410.1)	733.1 (753.8)
TSAT, %	31.1 (13.4)	36.6 (22.9)
Calcium, mg/dL	9.25 (0.80)	9.23 (0.90)
Phosphorus, mg/dL	5.19 (2.46)	4.88 (1.22)
iPTH, pg/mL	504.2 (499.0)	520.7 (507.9)

ERI: Erythropoietin resistance index; * $P < 0.05$

Table 1.png

Table 2 Risk factors of severe abnormal hemogram and different lineages				
	Adjusted OR Model 1 (95% CI)	p value	Adjusted OR Model 2 (95% CI)	p value
Severe abnormal hemogram				
ERI	1.07 (1.02-1.13)	0.006	1.06 (1.01-1.12)	0.019
Hypertension	0.53 (0.29-0.97)	0.039	0.54 (0.29-1.00)	0.051
Heart failure	2.21 (1.25-3.92)	0.007	2.28 (1.25-4.16)	0.007
Liver cirrhosis	6.24 (2.01-19.4)	0.002	5.37 (1.68-17.2)	0.005
Ferritin	1.001 (1.000-1.001)	0.045	1.00 (1.000-1.001)	0.072
Anemia				
Kt/V	0.16 (0.04-0.60)	0.007	0.21 (0.05-0.78)	0.021
ERI	1.23 (1.14-1.32)	<0.0001	1.24 (1.16-1.33)	<0.0001
Albumin	0.32 (0.13-0.79)	0.014	0.30 (0.11-0.80)	0.016
Ferritin	1.002 (1.001-1.002)	<0.0001	1.002 (1.001-1.002)	<0.0001
Leukopenia				
AID	3.99(1.46-10.9)	0.007	4.20 (1.45-12.2)	0.008
Liver cirrhosis	6.27 (1.99-19.8)	0.002	5.84 (1.80-18.9)	0.003
Thrombocytopenia				
Age	1.02 (1.00-1.03)	0.034	1.02 (1.00-1.04)	0.039
HD Vintage	1.04 (1.01-1.08)	0.025	1.05 (1.01-1.09)	0.016
AID	4.66 (1.87-11.6)	0.001	4.99 (1.97-12.7)	0.0007
Heart failure	1.62 (1.07-2.46)	0.023	1.76 (1.15-2.69)	0.009
Liver cirrhosis	5.06 (1.52-16.8)	0.008	4.48 (1.33-15.1)	0.016
Macrocytosis				
Liver cirrhosis	3.88 (1.10-13.6)	0.035	3.88 (1.10-13.6)	0.035