慢性肾衰竭尿毒症期患者血液透析维持治疗发生重症感染的危险因素及不良心血管事件影响因素分析 *

师　帅 [1]　李秀文 [1]　赵伊婷 [2]　常帅军 [2]　赵　婷 [1△]

（新疆医科大学第六附属医院　1肾内科;2检验科　新疆 乌鲁木齐 830000）

摘要 目的:探讨慢性肾衰竭尿毒症期患者血液透析维持治疗发生重症感染的危险因素及不良心血管事件影响因素。方法:选取我院 2021 年 10 月到 2023 年 10 月收治的 60 例慢性肾衰竭尿毒症期患者作为研究对象,所有患者均采取维持性血液透析治疗。分别依照患者重症感染及不良心血管事件发生人数进行分组。即感染组(n=20),非感染组(n=40)与不良心血管事件组(n=22)、非不良心血管事件组(n=38)。分析所有患者一般临床情况,并以重症感染及不良心血管事件分别作为因变量,纳入 logistics 回归模型,分析重症感染的及不良心血管事件的独立影响因素。结果:感染组与非感染组患者年龄、合并糖尿病、透析时间、合并心力衰竭、留置静脉导管、血红蛋白、Hs-CRP、血白蛋白、空腹血糖水平对比差异显著($P<0.05$);年龄、合并糖尿病、留置静脉导管、Hs-CRP、空腹血糖为慢性肾衰竭尿毒症期患者血液透析维持治疗发生重症感染的独立危险因素($P<0.05$);不良心血管事件组与非不良心血管事件组患者原发疾病、合并高血压、糖尿病、高脂血症、吸烟史、高磷血症、透析时间、Hs-CRP、LDL-C 对比差异显著($P<0.05$);合并高血压、合并高脂血症、高磷血症、Hs-CRP、透析时间为慢性肾衰竭尿毒症期患者血液透析维持治疗发生不良心血管事的独立危险因素($P<0.05$)。结论:年龄、合并糖尿病、留置静脉导、Hs-CRP、空腹血糖为慢性肾衰竭尿毒症期患者血液透析维持治疗发生重症感染的独立危险因素,合并高血压、合并高脂血症、高磷血症、Hs-CRP、透析时间为不良心血管事件的独立影响因素。
关键词:慢性肾衰竭;尿毒症期;维持性血液透析治疗;重症感染;不良心血管事件;影响因素
中图分类号:R692;R459.5　文献标识码:A　文章编号:1673-6273(2024)14-2666-06

Risk Factors for Severe Infection and Influencing Factors of Adverse Cardiovascular Events in Patients with Chronic Renal Failure and Uremia Undergoing Hemodialysis Maintenance Therapy*

SHI Shuai[1], LI Xiu-wen[1], ZHAO Yi-ting[2], CHANG Shuai-jun[2], ZHAO Ting[1△]

(1 Department of Nephrology; 2 Department of Laboratory Medicine, The Sixth Affiliated Hospital of Xinjiang Medical University, Urumqi, Xinjiang, 830000, China)

ABSTRACT Objective: To explore the risk factors for severe infection and the influencing factors of adverse cardiovascular events in patients with chronic renal failure in the uremic stage undergoing hemodialysis maintenance therapy. Methods: Sixty patients with chronic renal failure and uremia admitted to our hospital from October 2021 to October 2023 were selected as the study subjects, and all patients received maintenance hemodialysis treatment. Group patients according to the number of severe infections and adverse cardiovascular events. The infection group (n=20), non infection group (n=40), and adverse cardiovascular event group (n=22), non adverse cardiovascular event group (n=38). Analyze the general clinical situation of all patients, with severe infection and adverse cardiovascular events as dependent variables, and incorporate them into a logistic regression model to analyze the independent influencing factors of severe infection and adverse cardiovascular events. Results: There were significant differences in age, diabetes, dialysis time, heart failure, indwelling venous catheter, hemoglobin, Hs CRP, albumin and fasting blood glucose between the infected group and the non infected group ($P<0.05$); Age, diabetes, indwelling venous catheter, Hs CRP and fasting blood glucose were independent risk factors for severe infection in patients with chronic renal failure in uremic stage undergoing hemodialysis maintenance treatment ($P<0.05$); There were significant differences in primary disease, hypertension, diabetes, hyperlipidemia, smoking history, hyperphosphatemia, dialysis time, Hs-CRP, LDL-C between the adverse cardiovascular event group and the non adverse cardiovascular event group ($P<0.05$); Hypertension, hyperlipidemia, hyperphosphatemia, Hs CRP, and dialysis time are independent risk factors for adverse cardiovascular events in patients with chronic renal failure in the uremic stage undergoing hemodialysis maintenance therapy ($P<0.05$). Conclusion: Age, diabetes, indwelling venous catheter, Hs CRP, and fasting blood glucose are independent risk factors for severe infection in patients with chronic renal failure

in uremic stage undergoing hemodialysis maintenance treatment. Hypertension, hyperlipidemia, hyperphosphatemia, Hs CRP, and dialysis time are independent risk factors for adverse cardiovascular events.

Key words: Chronic renal failure; Uremic phase; Maintenance hemodialysis treatment; Severe infection; Adverse cardiovascular events; Influence factor

前言

对于慢性肾衰竭来说,早期症状轻而隐匿,常忽略疾病治疗,一般发现时已进展为晚期,引发尿毒症,严重降低患者生活质量[1]。尿毒症不是一个独立的疾病,而是各种晚期的肾脏病共有的临床综合征,是慢性肾功能衰竭进入终末阶段时出现的一系列临床表现所组成的综合征[2]。重症感染、不良心血管事件为尿毒症患者出现的严重并发症,发生率均较高,流行病学统计[3,4],不良心血管事件为维持性血液透析治疗患者第一大死亡原因,而重症感染为第二大死亡原因。对于重症感染来说,部分学者认为其发生多由长期透析治疗免疫功能紊乱导致,但针对其具体影响因素的研究较少,且说法不一[5]。而针对不良心血管事件虽然目前对其发生原因尚无确切定论,但针对其影响因素分析研究较多,但研究结果具有一定差异。因此,为了进一步提升慢性肾衰竭尿毒症期患者生存期,降低重症感染与不良心血管事件发生率,本研究探讨慢性肾衰竭尿毒症期患者血液透析维持治疗发生重症感染的危险因素及不良心血管事件影响因素,具体报道如下。

1 资料与方法

1.1 一般资料

选取我院 2021 年 10 月到 2023 年 10 月收治的 60 例慢性肾衰竭尿毒症期患者作为研究对象。所有患者男 41 例,女 19 例;年龄为 52~85 岁,平均(65.34± 3.53)岁;病程 5~14 年,平均(9.31± 1.08)年。本研究经我院伦理委员会批准。

1.2 纳排标准

纳入标准:符合慢性肾衰竭诊断标准[6],且需维持性血液透析治疗;慢性肾衰竭尿毒症期;年龄 18 岁以上者;透析时间≥6个月;临床资料完整;知情同意。

排除标准:无法配合研究或中途退出者;合并精神类、免疫类、严重脏器功能类、恶性肿瘤等疾病者。

1.3 方法

通过查看以往文献与临床经验相结合,分别确定种种感染及补不良心血管事件的相关影响因素进行汇纳总结,最终收集所有患者相关临床资料,其中包括性别、年龄、BMI、原发疾病、合并基础疾病、透析时间、吸烟史、高磷血症、合并心力衰竭、留置静脉导管、血红蛋白、Hs-CRP、血白蛋白、空腹血糖、TP、TG、HDL-C 及 LDL-C 表达水平。

1.4 统计学方法

采取统计学软件 SPSS 23.0 对本研究数据进行分析,计数资料以例数/百分比(n/%)表示,进行 x^2 检验;符合正态分布的计量资料用均数± 标准差($\bar{x}$± s)表示,采用 t 检验;采用 logistics 回归模型分析重症感染与不良心血管事件的独立影响因

素;以 $P<0.05$ 为差异有统计学意义。

2 结果

2.1 重症感染单因素分析

感染组与非感染组患者年龄、合并糖尿病、透析时间、合并心力衰竭、留置静脉导管、血红蛋白、Hs-CRP、血白蛋白、空腹血糖水平对比差异显著($P<0.05$),见表 1。

2.2 重症感染多因素分析

以并发重症感染为因变量(并发重症感染 =1,未并发重症感染 =0)纳入 logistics 回归模型,结果显示,年龄、合并糖尿病、留置静脉导、Hs-CRP、空腹血糖为慢性肾衰竭尿毒症期患者血液透析维持治疗发生重症感染的独立危险因素($P<0.05$),见表2。

2.3 不良心血管事件单因素分析

不良心血管事件组与非不良心血管事件组患者原发疾病、合并高血压、糖尿病、高脂血症、吸烟史、高磷血症、透析时间、Hs-CRP、LDL-C 对比差异显著($P<0.05$),见表 3。

2.4 不良心血管事件多因素分析

以并发不良心血管事件为因变量（并发不良心血管事件 =1,未并发不良心血管事件 =0)纳入 logistics 回归模型,结果显示,合并高血压、合并高脂血症、高磷血症、Hs-CRP、透析时间为慢性肾衰竭尿毒症期患者血液透析维持治疗发生不良心血管事的独立危险因素($P<0.05$),见表 4。

3 讨论

维持性血液透析(MHD)主要指应用半透膜原理,通过超滤、对流和扩散等不同质量分离机将血液中的溶质和水分离,多被应用于慢性肾衰竭患者的维持治疗,可增加患者生存期[7]。研究发现[8,9],尽管随着血液透析技术的发展,使慢性肾脏病患者生存期得到延长,但在 MHD 治疗过程中,大量患者会出现重症感染、不良心血管事件等并发症,缩短患者生存期。因此,本研究针对慢性肾衰竭尿毒症期患者血液透析维持治疗患者重症感染、不良心血管事件的影响因素展开分析,以期为临床提供参考意见。

本研究结果表明,感染组与非感染组患者年龄、合并糖尿病、透析时间、合并心力衰竭、留置静脉导管、血红蛋白、Hs-CRP、血白蛋白、空腹血糖水平对比差异显著($P<0.05$),与 Khanh VC 等[10]研究结果部分一致。Khanh VC 等研究显示,年龄、合并糖尿病、血红蛋白为维持性血液透析治疗患者重症感染的影响因素。分析原因为,高龄作为多种疾病发生医院获得性感染的相关影响因素,其多与老年患者脏器功能衰退、生理防御屏障及免疫功能下降有关[11,12]。另外,针对合并糖尿病与高血糖患者机体会处于但截至高分解状态,导致机体代谢紊乱,容易出现营养不良,造成血红蛋白、血白蛋白水平降低的同时,

表 1 重症感染单因素分析

Table 1 Single factor analysis of severe infections

Factor	Infection group(n=20)	Non infected group(n=40)	x^2/t	P
Gender (n)				
Male	13	28	0.120	0.729
Female	7	12		
Age (year)	67.85± 8.49	61.55± 5.84	11.559	0.001
BMI(kg/m²)	23.19± 2.29	24.14± 2.34	1.606	0.112
Primary disease				
Hypertensive nephropathy	3	8	4.300	0.368
Diabetic nephropathy	7	5		
Glomerulonephritis	6	16		
Chronic pyelonephritis	3	9		
Other	1	2		
Merge underlying diseases				
Diabetes	8	5	5.940	0.015
Hypertension	4	10	0.190	0.666
Hyperlipidemia	3	7	0.060	0.807
Hyperphosphatemia				
Yse	4	6	0.240	0.624
No	16	34		
Dialysis time(year)	10.06± 2.74	8.53± 2.68	2.551	0.013
Combined heart failure(n)				
Yse	11	10	5.270	0.022
No	9	30		
Indwelling venous catheter				
Yse	13	14	4.850	0.028
No	7	26		
Related serum indicator levels				
Hemoglobin(g/L)	71.13± 7.52	92.32± 8.67	8.329	0.001
Hs-CRP(mg/L)	12.56± 3.52	7.95± 1.52	13.646	0.001
Blood creatinine(μmol/L)	1037.30± 151.09	1013.52± 132.73	0.625	0.535
Blood albumin(g/L)	21.47± 7.84	35.02± 6.79	11.952	0.001
Fasting blood glucose(mmol/L)	6.13± 0.75	5.42± 1.22	6.474	0.001

表 2 重症感染多因素分析

Table 2 Multivariate analysis of severe infections

Variable	β	SE(β)	Wald x^2	OR	95%CI	P
Age	3.241	0.642	4.636	2.845	1.726~4.361	<0.001
Combined diabetes	2.457	0.584	5.265	2.791	1.457~5.745	<0.001
Dialysis time	1.346	0.331	1.757	2.146	1.534~3.693	0.451
Combined heart failure	1.313	0.652	1.135	1.389	1.247~2.682	0.216
Indwelling venous catheter	1.645	0.554	5.642	1.726	1.321~3.564	<0.001
Hemoglobin	1.314	0.597	1.241	2.526	1.873~4.547	0.352
Hs-CRP	2.583	0.635	3.683	2.462	1.353~5.782	<0.001
Blood albumin	1.231	0.438	2.354	1.324	0.687~1.564	0.567
Fasting blood glucose	2.654	0.565	4.321	2.789	1.658~4.687	<0.001

表 3 不良心血管事件单因素分析

Table 3 Univariate analysis of adverse cardiovascular events

Factor	Adverse Cardiovascular Events Group (n=22)	Non adverse cardiovascular events group (n=38)	x^2/t	P
Gender (n)				
Male	15	26	0.010	0.985
Female	7	12		
Age (year)	63.67± 6.06	63.77± 7.38	0.395	0.625
BMI (kg/m^2)	23.57± 1.57	23.46± 2.11	0.454	0.651
Primary disease				
Hypertensive nephropathy	7	4	23.890	0.001
Diabetic nephropathy	10	2		
Glomerulonephritis	3	19		
Chronic pyelonephritis	1	11		
Other	1	2		
Merge underlying diseases				
Diabetes	10	3	11.580	0.001
Hypertension	9	5	6.000	0.014
Hyperlipidemia	8	2	9.700	0.002
Smoking history				
Yse	15	11	8.730	0.003
No	7	27		
Hyperphosphatemia				
Yse	7	3	5.740	0.017
No	15	35		
Dialysis time (year)	11.53± 2.66	7.44± 2.17	9.210	0.002
Related serum indicator levels				
TP (g/L)	66.36± 8.80	65.24± 5.85	1.219	0.227
Blood creatinine (μmol/L)	1035.75± 168.47	1021.67± 175.24	0.547	0.433
Hs-CRP (mg/L)	11.53± 2.56	8.15± 2.31	25.257	0.001
TC (mmol/L)	4.38± 1.07	4.31± 1.06	0.246	0.807
TG (mmol/L)	1.82± 0.46	1.81± 0.24	0.454	0.651
HDL-C (mmol/L)	1.02± 0.25	0.99± 0.23	1.463	0.236
LDL-C (mmol/L)	3.75± 0.42	2.73± 0.38	19.634	0.001
Fasting blood glucose (mmol/L)	5.78± 1.53	5.65± 1.24	0.654	0.327

表 4 不良心血管事件多因素分析

Table 4 Multivariate analysis of adverse cardiovascular events

Variable	β	SE (β)	Wald x^2	OR	95%CI	P
Primary disease	1.354	0.387	1.145	1.241	0.784~1.756	0.551
Combined hypertension	2.987	0.576	4.634	3.645	1.265~6.879	<0.001
Combined diabetes	1.042	0.245	1.053	1.245	0.944~1.684	0.327
Combined hyperlipidemia	3.587	0.642	5.645	2.978	1.657~5.648	<0.001
Smoking history	1.353	0.424	1.235	1.222	0.846~1.858	0.467
Hyperphosphatemia	2.754	0.629	4.254	2.142	1.352~3.362	<0.001
Dialysis time	3.146	0.658	6.366	1.735	1.246~2.677	<0.001
Hs-CRP	1.224	0.315	1.245	2.687	1.324~4.235	0.007
LDL-C	1.231	0.412	1.787	0.857	0.542~1.536	0.425

患者易出现营养不良,免疫力持续降低,增加重症感染发生率[13,14]。另外,由于尿液高糖环境会促进细菌的繁殖与生长,也会增加感染发生率。研究显示[15],循环系统障碍为维持性血液透析患者院内获得性感染的一项重要因素。当静脉留置导管和心力衰竭发生后会对机体循环系统造成影响,增加感染机会[15]。另外,对于静脉留置导管还会增加机体与细菌、病毒接触机会,进一步增加感染发生率[16]。笔者认为,胃肠道吸收障碍与机体血白蛋白、血红蛋白水平息息相关,从而进一步反应患者营养吸收水平,及时发现患者机体抵抗力降低情况,进一步预测重症感染的发生。而 Hs-CRP 作为敏感性较高的促炎因子,研究显示[17],其与重症感染的发生与发展具有重要价值,同时可预测肺炎患者重症感染的发生,与本研究结果相符。本研究进一步分析表明,年龄、合并糖尿病、留置静脉导管、Hs-CRP、空腹血糖为慢性肾衰竭尿毒症期患者血液透析维持治疗发生重症感染的独立危险因素($P<0.05$),与 Varikasuvu 等[18]研究结果部分一致。也提示需针对慢性肾衰竭尿毒症期患者在维持性血液透析治疗期间,针对年龄较大、合并糖尿病、留置静脉导管、Hs-CRP、空腹血糖升高的患者要警惕重症感染的发生,及时采取相关措施预防。本研究结果表明,不良心血管事件组与非不良心血管事件组患者原发疾病、合并高血压、糖尿病、高脂血症、吸烟史、高磷血症、透析时间、Hs-CRP、LDL-C 对比差异显著($P<0.05$),与 Burlacu A 等[19]、Tan Z 等[20]研究结果相符。Burlacu A 等研究显示,合并高血压、糖尿病、高脂血症等基础疾病为维持性血液透析治疗患者不良心血管事件发生的独立危险因素。Tan Z 等研究也发现,由糖尿病、高血压等引起的慢性肾病为尿毒症患者不良心血管事件的相关影响因素。分析原因为,针对高血压、高血脂、糖尿病等慢性疾病人群,其动脉粥样硬化程度发生率增加,随之导致维持性血液透析患者不良心血管事件发生率增加[21]。本研究还发现,吸烟史、高磷血症、透析时间、Hs-CRP、LDL-C 同样为慢性肾衰竭尿毒症期患者维持性血液透析治疗不良心血管事件的相关影响因素。分析原因为,吸烟会对血管内皮细胞造成损害,增加末梢血管阻力,进而增加不良心血管事件发生率[22,23]。另外研究发现[24,25],吸烟、饮酒为心血管事件发生的重要因素,但是否可预测其预后情况尚无确切定论。高磷血症是维持性血液透析治疗的常见并发症,会加重动脉粥样硬化与血管钙化过程,进一步增加不良心血管事件发生风险[26]。而针对透析时间来说,由于长期透析的影响,对患者机体营养水平、整体健康情况造成影响,也可能会增加患者不良心血管事件发生率。近年来虽然研究发现,不良心血管事件的发生与发展伴随炎症反应情况,而 Hs-CRP 作为炎症评价因子,可能与维持性血液透析患者不良心血管事件的发生与发展造成一定影响[27]。研究发现[28],年龄为血液透析患者合并心血管事件死亡发生的独立影响因素,与本研究结果具有一定差异。本研究进一步分析表明,合并高血压、合并高脂血症、高磷血症、Hs-CRP、透析时间为慢性肾衰竭尿毒症期患者血液透析维持治疗发生不良心血管事的独立危险因素($P<0.05$)。提示临床上针对慢性肾衰竭尿毒症期患者血液透析维持治疗中合并高血压、高脂血症、高磷血症、Hs-CRP 升高、透析时间较长的患者要警惕不良心血管事件的发生。

综上所述,年龄、合并糖尿病、留置静脉导、Hs-CRP、空腹血糖为慢性肾衰竭尿毒症期患者血液透析维持治疗发生重症感染的独立危险因素,合并高血压、合并高脂血症、高磷血症、Hs-CRP、透析时间为不良心血管事件的独立影响因素。

参 考 文 献(References)

[1] Rui Z, Wang Y, Wang N, et al. Efficacy and safety of Corbrin Capsule on malnutrition, inflammation, and atherosclerosis syndrome in patients with uremia: systematic review and meta-analysis [J]. Ann Palliat Med, 2022, 11(4): 1431-1440.

[2] Saar-Kovrov V, Zidek W, Orth-Alampour S, et al. Reduction of protein-bound uraemic toxins in plasma of chronic renal failure patients: A systematic review [J]. J Intern Med, 2021, 290 (3): 499-526.

[3] Holmar J, de la Puente-Secades S, Floege J, et al. Uremic Toxins Affecting Cardiovascular Calcification: A Systematic Review [J]. Cells, 2020, 9(11): 2428.

[4] Rydzewska-Rosołowska A, Sroka N, Kakareko K, et al. The Links between Microbiome and Uremic Toxins in Acute Kidney Injury: Beyond Gut Feeling-A Systematic Review[J]. Toxins (Basel), 2020, 12(12): 788.

[5] Almeida BM, Moreno DH, Vasconcelos V, et al. Interventions for treating catheter-related bloodstream infections in people receiving maintenance haemodialysis [J]. Cochrane Database Syst Rev, 2022, 4 (4): CD013554.

[6] 中华中医药学会. 慢性肾衰竭诊疗指南[J]. 中国中医药现代远程教育, 2011, 9(9): 132-133.

[7] Hargrove N, El Tobgy N, Zhou O, et al. Effect of Aerobic Exercise on Dialysis-Related Symptoms in Individuals Undergoing Maintenance Hemodialysis: A Systematic Review and Meta-Analysis of Clinical Trials[J]. Clin J Am Soc Nephrol, 2021, 16(4): 560-574.

[8] Wang H, Liu J, Xie D, et al. Elevated serum uric acid and risk of cardiovascular or all-cause mortality in maintenance hemodialysis patients: A meta-analysis[J]. Nutr Metab Cardiovasc Dis, 2021, 31(2): 372-381.

[9] Yan F, Yan S, Wang J, et al. Association between triglyceride glucose index and risk of cerebrovascular disease: systematic review and meta-analysis[J]. Cardiovasc Diabetol, 2022, 21(1): 226.

[10] Khanh VC, Fukushige M, Chang YH, et al. Wharton's Jelly Mesenchymal Stem Cell-Derived Extracellular Vesicles Reduce SARS-CoV2-Induced Inflammatory Cytokines Under High Glucose and Uremic Toxin Conditions [J]. Stem Cells Dev, 2021, 30 (15): 758-772.

[11] Wang J, Zeng J, Liu B, et al. Outcomes after transfer from hemodialysis to peritoneal dialysis vs peritoneal dialysis as initial therapy: A systematic review and meta-analysis[J]. Semin Dial, 2020, 33(4): 299-308.

[12] Kaka N, Sethi Y, Patel N, et al. Endocrine manifestations of chronic kidney disease and their evolving management: A systematic review [J]. Dis Mon, 2022, 68(12): 101466.

[13] van den Bosch CH, Jeremiasse B, van der Bruggen JT, et al. The efficacy of taurolidine containing lock solutions for the prevention of central-venous-catheter-related bloodstream infections: a systematic review and meta-analysis[J]. J Hosp Infect, 2022, 123(8): 143-155.

[14] Natale P, Palmer SC, Jaure A, et al. Hypoxia-inducible factor

stabilisers for the anaemia of chronic kidney disease [J]. Cochrane Database Syst Rev, 2022, 8(8): CD013751.

[15] Sheng KX, Zhang P, Li JW, et al. Comparative efficacy and safety of lock solutions for the prevention of catheter-related complications including infectious and bleeding events in adult haemodialysis patients: a systematic review and network meta-analysis [J]. Clin Microbiol Infect, 2020, 26(5): 545-552.

[16] Cobo-Sánchez JL, Blanco-Mavillard I, Mancebo-Salas N, et al. Early identification of local infections in central venous catheters for hemodialysis: A systematic review[J]. J Infect Public Health, 2023, 16 (7): 1023-1032.

[17] Sadeghi M, Behdad S, Shahsanaei F. Infective Endocarditis and Its Short and Long-Term Prognosis in Hemodialysis Patients: A Systematic Review and Meta-analysis [J]. Curr Probl Cardiol, 2021, 46(3): 100680.

[18] Varikasuvu SR, Sulekar H, Aloori S, et al. The association of non-invasive skin autofluorescence measurements with cardiovascular and all-cause mortality in hemodialysis patients: a meta-analysis[J]. Int Urol Nephrol, 2020, 52(9): 1757-1769.

[19] Burlacu A, Brinza C, Popa IV, et al. Influencing Cardiovascu lar Outcomes through Heart Rate Variability Modulation: A Systematic Review[J]. Diagnostics (Basel), 2021, 11(12): 2198.

[20] Tan Z, Ke G, Huang J, et al. Effects of Carvedilol on Cardiovascular Events and Mortality in Hemodialysis Patients, A Systematic Review and Meta-Analysis[J]. Iran J Kidney Dis, 2020, 14(4): 256-266.

[21] Cao H, Rao X, Jia J, et al. Effects of sodium-glucose co-transporter-2 inhibitors on kidney, cardiovascular, and safety outcomes in patients with advanced chronic kidney disease: a systematic review and meta-analysis of randomized controlled trials[J]. Acta Diabetol, 2023,

60(3): 325-335.

[22] Gan T, Guan H, Li P, et al. Risk prediction models for cardiovascular events in hemodialysis patients: A systematic review [J]. Semin Dial, 2023, 24(2): 1052-1056.

[23] Gonzáles-Rubianes DZ, Figueroa-Osorio LK, Benites-Zapata VA, et al. Utility of TG/HDL-c ratio as a predictor of mortality and cardiovascular disease in patients with chronic kidney disease undergoing hemodialysis: A systematic review [J]. Hemodial Int, 2022, 26(2): 137-146.

[24] Wathanavasin W, Banjongjit A, Avihingsanon Y, et al. Prevalence of Sarcopenia and Its Impact on Cardiovascular Events and Mortality among Dialysis Patients: A Systematic Review and Meta-Analysis[J]. Nutrients, 2022, 14(19): 4077.

[25] Karimi Z, Raeisi Shahraki H, et al. Erythropoiesis-stimulating agents and cardiovascular mortality: A systematic review and meta-analysis of 17 studies and 372,156 hemodialysis patients [J]. Int J Cardiol Cardiovasc Risk Prev, 2023, 19(1): 200220.

[26] Tella A, Vang W, Ikeri E, et al. β-Blocker Use and Cardiovascular Outcomes in Hemodialysis: A Systematic Review [J]. Kidney Med, 2022, 4(5): 100460.

[27] Gao S, Xu J, Zhang S, et al. Meta-Analysis of the Association between Fibroblast Growth Factor 23 and Mortality and Cardiovascular Events in Hemodialysis Patients[J]. Blood Purif, 2019, 47 Suppl 1(Suppl 1): 24-30.

[28] Wang H, Liu J, Xie D, et al. Elevated serum uric acid and risk of cardiovascular or all-cause mortality in maintenance hemodialysis patients: A meta-analysis[J]. Nutr Metab Cardiovasc Dis, 2021, 31(2): 372-381.

[22] Tang W, Rong Y, Zhang H, et al. The correlation between a Th1/Th2 cytokines imbalance and vitamin D level in patients with early chronic obstructive pulmonary disease (COPD), based on screening results[J]. Front Physiol, 2023, 14: 1032786.

[23] Eriksson Ström J, Pourazar J, Linder R, et al. Airway regulatory T cells are decreased in COPD with a rapid decline in lung function[J]. Respir Res, 2020, 21(1): 330.

[24] 马小玉,安福成,李鹏飞.AECOPD 患者肺部感染病原学特点及辅助性 T 细胞亚群检测价值分析 [J]. 热带医学杂志, 2022, 22(12): 1692-1695, 1710.

[25] Han S, Meng X. Prediction of risk for secondary lower respiratory

tract fungal infection during the acute exacerbation phase of COPD [J]. J Infect Dev Ctries, 2023, 17(2): 268-275.

[26] 俞方浩,刘延苏,黄舟莹.慢性阻塞性肺疾病伴急性下呼吸道感染患者感染影响因素分析[J].中国现代医生, 2022, 60(28): 67-70.

[27] Johnsen RH, Heerfordt CK, Boel JB, et al. Inhaled corticosteroids and risk of lower respiratory tract infection with Moraxella catarrhalis in patients with chronic obstructive pulmonary disease[J]. BMJ Open Respir Res, 2023, 10(1): e001726.

[28] 黄娟,张华根,温雅.慢性阻塞性肺疾病急性加重期继发下呼吸道真菌感染风险模型的构建[J].中国医刊, 2023, 58(8): 873-878.

[29] 封辰叶,康健.重症下呼吸道感染病原学及临床特点研究现状[J].国际呼吸杂志, 2017, 37(3): 210-215.