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腹膜透析和血液透析对终末期肾脏疾病患者钙磷代谢及微炎症状态的影响

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摘要 目的：探讨腹膜透析（PD）和血液透析（HD）对终末期肾脏疾病（ESRD）患者钙磷代谢及微炎症状态的影响。**方法**：选择2016年1月~2017年2月我院收治的ESRD患者94例为研究对象，采用随机数字表法分为PD组（47例）和HD组（47例），PD组给予非卧床持续性PD治疗，HD组给予HD治疗，治疗6个月后比较两组血清钙磷代谢水平和微炎症状态，并统计两组并发症的发生率。**结果**：治疗6个月后，两组血清钙水平与治疗前相比显著升高，血清磷水平显著降低（P＜0.05），但HD组与PD组比较无差异（P＞0.05）；治疗6个月后，两组血清C-反应蛋白（CRP）水平较治疗前明显升高，且HD组高于PD组，差异有统计学意义（P＜0.05），治疗6个月后，两组降钙素原（PCT）水平与治疗前相比显著降低，差异有统计学意义（P＜0.05），但HD组与PD组比较无差异（P＞0.05）；PD组感染、低蛋白血症的发生率高于HD组，HD组高血压、心律失常、充血性心衰的发生率高于PD组，差异均有统计学意义（P＜0.05）。**结论**：PD和HD治疗均可改善ESRD患者钙磷代谢紊乱，但两者都将加剧患者微炎症反应，其中HD对患者微炎症状态的影响更大。

关键词：终末期肾脏疾病；腹膜透析；血液透析；钙磷代谢；微炎症状态

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Effects of Peritoneal Dialysis and Hemodialysis on Calcium-Phosphorus Metabolism and Micro Inflammatory State in Patients with End-Stage Renal Disease

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ABSTRACT Objective: To explore the effects of peritoneal dialysis (PD) and hemodialysis (HD) on calcium-phosphorus metabolism and micro inflammatory state in patients with end-stage renal disease (ESRD). **Methods:** 94 patients with ESRD who were treated in our hospital from January 2016 to February 2017 were selected as the subjects, the patients were divided into PD group (47 cases) and HD group (47 cases) by random number table, the PD group were treated with ambulatory continuous PD treatment, the HD group were treated with HD, after 6 months treatment, the levels of serum calcium, phosphorus metabolism and micro inflammation were compared between the two groups, the incidence of complications in the two groups was also counted. **Results:** After 6 months treatment, the serum calcium levels of the two groups increased significantly, serum phosphorus levels decreased significantly (P<0.05), but there was no significant difference between the HD group and the PD group (P>0.05). After 6 months treatment, the levels of serum c-reactive protein (CRP) in two groups were significantly increased, and the HD group was higher than the PD group, the differences were statistically significant (P<0.05). After 6 months treatment, the level of procalcitonin (PCT) was lower than that at before treatment, the difference was statistically significant (P<0.05), but there was no significant difference between the HD group and the PD group (P>0.05). The incidence of infection and hypoproteinemia in PD group were higher than that in HD group, and the incidence of hypertension, arrhythmia and congestive heart failure in HD group were higher than that in PD group, the differences were statistically significant (P<0.05). **Conclusion:** The PD and HD treatment both can improve the metabolism of calcium and phosphorus in patients with ESRD, but both of them will aggravate the micro inflammatory reaction, and HD has more influence on the micro inflammatory state of the patients.

Key words: End stage renal disease; Peritoneal dialysis; Hemodialysis; Calcium-phosphorus metabolism; Micro inflammatory state

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前言

终末期肾脏疾病（End stage renal disease，ESRD）是各种慢性肾脏疾病发展的终末阶段，全球范围内ESRD的发病率约1/10万，我国由于人口基数较大，因此ESRD患者数量相对较多，且近年来其发病率呈上升趋势，已成为一种严重危害人类健康的疾病[1-3]。目前，肾脏移植术是治疗ESRD最有效的方法，

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但由于受到器官来源限制、治疗价格昂贵及患者自身病情严重程度等多种因素的影响，多数患者无法进行肾脏移植手术，因而血液净化类透析仍是临床治疗 ESRD 的主要方式，通过透析治疗可延长患者的生存期，并提高其生活质量[4-6]。然而，透析治疗是一种以纠正患者的某些生理指标为目的的有创性终身治疗，各种透析并发症也给临床及患者带来巨大的困扰[7-9]。腹膜透析（Peritoneal dialysis，PD）和血液透析（Hemodialysis，HD）是临床上最常用的血液净化治疗方式，然而不同透析方式的治疗效果不同，目前学界关于两种透析方式优劣问题的认知也存在较大的差异[10-12]。钙磷代谢紊乱是 ESRD 患者最突出的症状之一[13-15]，然而目前关于 PD 和 HD 对 ESRD 患者钙磷代谢及微炎症状态的影响的研究较少，因此本文采用随机试验就此问题进行研究，试图从钙磷代谢和微炎症状态方面证实 PD 与 HD 的优劣，以期为临床上科学选择透析方案提供参考依据。

1 资料和方法

1.1 临床资料

选择我院于 2016 年 1 月 ~2017 年 2 月收治的 94 例 ESRD 患者。纳入标准：（1）符合 ESRD 的临床诊断标准[16]；（2）患者生命体征良好，具有 PD 和 HD 适应症，无禁忌症[17]；（3）入组前未接受过相关透析治疗；（4）一般资料完整，依从性良好；（5）预计生存时间≥ 6 个月；（6）所有患者均签署知情同意书；（7）研究经医院伦理委员会批准。排除标准：（1）近 3 个月内接受过腹部手术或使用激素者；（2）近 1 个月内接受过其他大型手术者；（3）有急性心血管病史、严重精神疾病、严重传染性疾病者；（4）合并肺结核、肝硬化及肿瘤者；（5）妊娠及哺乳期妇女。采用随机数字表法分为 PD 组（47 例）和 HD 组（47 例），两组性别、年龄、糖尿病病程、体质指数（Body Mass Index，BMI）、血清白蛋白（Serum albumin，ALB）、空腹血糖（Fasting blood-glucose，FBG）、血肌酐（Serum creatinine，Scr）、血尿素氮（Blood urea nitrogen，BUN）及肾小球滤过率（Glomerular filtration rate，GFR）等一般资料比较无差异（P＞0.05），详见表 1。

表 1 两组患者的一般资料比较

Table 1 Comparison of general data between the two groups

General data	PD group（n=47）	HD group（n=47）	x^2/t	P
Gender(male/female)	27/20	25/22	0.172	0.897
Age(years)	55.78± 6.42	56.13± 6.65	0.493	0.817
Diabetic duration Age(years)	9.75± 2.14	10.36± 2.21	0.716	0.623
BMI（kg/m^2）	24.17± 2.03	24.21± 1.95	0.372	0.884
ALB（g/L）	30.14± 4.36	29.67± 4.18	0.253	0.911
FBG（mmol/L）	10.68± 3.42	10.51± 3.36	0.094	0.967
Scr（μmol/L）	936.57± 62.49	941.44± 70.68	0.177	0.930
BUN（mmol/L）	30.18± 4.67	31.27± 4.82	0.421	0.834
GFR（ml/min）	9.13± 1.45	9.06± 1.37	0.124	0.958

1.2 方法

1.2.1 治疗方法 PD 组：给予非卧床持续性 PD 治疗，采用手术切开法置管（Tenchhoff 透析管，美国 Baxter 公司），PD 液（美国 Baxter 公司）2L/ 次，一天 4 次，PD 透析液浓度与剂量调整按照腹膜平衡试验及腹透超滤量[18]。HD 组：采用碳酸氢盐透析液连续诱导透析 3 d，2 h/ 次，1 次 /d，随后改为 HD（透析液为碳酸氢盐透析液），3 次 / 周，4 h/ 次，聚砜膜透析器 F7-HPS、透析机为 Fresenius 4008s 型（德国费森尤斯医药用品有限公司），有效膜面积 1.6 m^2，透析液流量 500 mL/min，血流速度 180~240 mL/min，低分子肝素钙抗凝，开始中心置管采用临时股静脉，并行动 - 静脉内瘘吻合术，持续 30 d，后改用动 - 静脉内瘘为血管通路。两组透析期间均常规控制血压、血糖，调整贫血状态，给予营养支持、皮下注射胰岛素等对症支持治疗。

1.2.2 血液标本采集与检测 两组患者均于治疗前（透析当日）和治疗 6 个月后分别采集清晨空腹静脉血 10 mL，以 2000 r/min 离心 10 min，离心半径为 8 cm，取血清保存于 -80℃冰箱待测。采用钙离子选择性电极法测定血清钙水平，采用酶法测定血清磷水平；采用酶联免疫吸附法测定 C 反应蛋白（C-reactive protein，CRP）水平，试剂盒（购自上海康朗生物科技有限公司），严格按照试剂盒说明进行操作；采用酶联免疫荧光法测定降钙素原（Procalcitonin，PCT）水平，试剂盒购于梅里埃诊断产品（上海）有限公司，严格按照试剂盒说明进行操作。

1.3 观察指标

（1）钙磷代谢状态：比较两组治疗前及治疗 6 个月后的血清钙、血清磷水平。（2）微炎症状态：比较两组治疗前及治疗 6 个月后的血清 CRP、PCT 水平。（3）并发症：纪录两组随访期间（6 个月）并发症的发生率。

1.4 统计学方法

采用 SPSS21.0 进行统计学分析，计量资料采用均数± 标准差（$\bar{x}$± s）描述，采用 t 检验；计数资料采用率（%）描述，采用 x^2 检验；以 P＜0.05 为差异有统计学意义。

2 结果

2.1 两组钙磷代谢水平比较

治疗前、治疗 6 个月后，两组血清钙、磷水平比较无差异（P＞0.05），但治疗 6 个月后，两组血清钙水平与治疗前相比显著升高，血清磷水平显著降低，差异有统计学意义（P＜0.05），但两组比较无差异（P＞0.05）。详见表 2。

2.2 两组微炎症状态比较

治疗前两组 CRP、PCT 水平比较差异无统计学意义（P＞

0.05),治疗 6 个月后,两组 CRP 水平与治疗前相比显著升高,且 HD 组高于 PD 组,差异均有统计学意义(P<0.05),两组 PCT 水平与治疗前相比显著降低,但两组比较无差异(P>0.05)。详见表 3。

表 2 两组血清钙、血清磷比较($\bar{x}\pm s$)

Table 2 Comparison of the serum calcium and phosphorus between the two groups($\bar{x}\pm s$)

Groups	n	Serum calcium(mmol/L)		Serum phosphorus(mmol/L)	
		Before treatment	After 6 months treatment	Before treatment	After 6 months treatment
PD group	47	1.97± 0.74	2.47± 0.26*	2.68± 0.84	1.18± 0.22*
HD group	47	1.96± 0.76	2.45± 0.24*	2.63± 0.79	1.16± 0.28*
t	-	0.078	0.104	0.318	0.115
P	-	0.957	0.879	0.842	0.875

Note: compared with before treatment, *P<0.05.

表 3 两组 CRP、PCT 水平比较($\bar{x}\pm s$)

Table 3 Comparison of the levels of CRP, PCT between the two groups ($\bar{x}\pm s$)

Groups	n	CRP(mg/L)		PCT(ng/mL)	
		Before treatment	After 6 months treatment	Before treatment	After 6 months treatment
PD group	47	8.24± 0.58	10.27± 0.76*	1.77± 0.13	0.53± 0.12*
HD group	47	8.22± 0.63	13.13± 0.95*	1.76± 0.47	0.63± 0.76*
t	-	0.112	4.653	0.141	0.891
P	-	0.871	0.000	0.889	0.375

Note: compared with before treatment, *P<0.05.

2.3 两组并发症的发生率比较

PD 组感染、低蛋白血症的发生率高于 HD 组,但 PD 组高血压、心律失常、充血性心衰的发生率低于 PD 组,差异均有统计学意义(P<0.05)。详见表 4。

表 4 两组并发症的发生率比较[(n%)]

Table 4 Comparison of the incidence of complications between the two groups[(n%)]

Groups	n	Infection	Hypoproteinemia	Hypertension	Arrhythmia	Congestive heart-failure
PD group	47	12(25.53)	13(27.66)	7(14.89)	3(6.38)	6(12.77)
HD group	47	4(8.51)	3(6.38)	19(40.43)	11(23.40)	19(40.43)
x^2	-	4.521	7.532	7.656	4.113	8.675
P	-	0.036	0.009	0.008	0.042	0.002

3 讨论

既往研究表明[19,20],ESRD 患者普遍存在钙磷代谢紊乱问题,钙磷代谢紊乱可破坏患者骨骼、引起血管钙化等,长期钙磷代谢紊乱可引起甲状旁腺功能亢进、肾性骨病、心脏瓣膜病及大血管钙化等疾病,是影响 ESRD 临床治疗效果及预后的重要因素。微炎症状态是指炎症物质导致的血管内发炎,患者无全身以及局部显性临床感染征象,但机体存在持续低水平的炎症状态。微炎症反应可引起炎症性损伤,导致细胞外基质在肾脏沉积,是造成肾脏形成纤维化重要原因,可引起肾脏结构及功能受损,进而影响 ESRD 的病情进展及预后[21]。对微炎症状态的判断,主要有急性反应时相蛋白(包括 CRP、血清淀粉样蛋白 A 和纤维蛋白原)和 PCT 等指标,其中 CRP 是肝脏在炎症刺激时产生,可参与局部或全身炎症反应,能够反映机体内炎症的活动程度,是微炎症状态的一项客观、敏感的指标,当血清 CRP 水平在 8~15 mg/L 之间时说明机体处于微炎症状态[22]。PCT 是一种蛋白质,当机体受到严重细菌、真菌、寄生虫感染和多器官功能衰竭时其在血液中的浓度升高,通过检测 PCT 水平可反映机体全身炎症反应活跃程度[23]。

PD 和 HD 作为血液净化治疗的两种常用方式,其在 ESRD 治疗中孰优孰劣的问题争议较大。本研究显示,透析治疗 6 个月后,两组血清钙水平升高,血清磷水平降低,说明两种透析方式均能改善 ESRD 患者钙磷代谢紊乱情况;且治疗 6 个月后两组血清钙及血清磷水平无显著差异,说明两种透析方式对钙磷代谢的影响相近。其原因可能是 Ca^{2+} 和 P^{3+} 都是小分子物质,两种透析方式在清除 Ca^{2+} 和 P^{3+} 方面的能力无明显差别[24]。透析治疗 6 个月后,两组患者血清 CRP 水平较治疗前均明显升高,且 HD 组高于 PD 组,但两组 CRP 水平均在微炎症状态范围之内,说明 PD 和 HD 治疗均可加剧 ESRD 患者微炎症反应,但 PD 对其影响程度较小。其原因可能是:在 HD 治疗过程中,血液与透析膜、透析管路等具有不相容性,可能引起炎症因子的释放;另外,HD 治疗经动静脉内瘘穿刺或中心静脉置管可

能带有病菌侵入，侵入病菌激活单核巨噬细胞，引起炎症因子的释放，从而加剧了患者的微炎症反应[25,26]。透析治疗 6 个月后，两组 PCT 水平较治疗前均显著降低，但 PD 组与 HD 组比较差异无显著差异，说明两种透析方式均可降低 PCT 水平，且两种透析方式对 PCT 的影响程度相近。其原因可能是：PCT 水平受细菌内毒素的调控作用明显，但 PCT 水平受患者自身免疫、过敏和病毒感染的影响小[27,28]。本研究还发现，PD 组高血压、心律失常、充血性心衰的发生率低于 HD 组，其原因是 PD 能更好地维持患者体内水钠平衡[29]；PD 组感染、低蛋白血症的发生率高于 HD 组，可能是由于操作或胃肠道感染增加了腹膜感染的几率，而患者的营养状况透析中白蛋白和总蛋白丢失可增加低蛋白血症的发生率[30]。另外，本研究尚未分析 PD 与 HD 对 ESRD 患者中远期生活质量的影响，后续将进一步观察。

综上所述，PD 和 HD 治疗可改善 ESRD 患者的钙磷代谢紊乱，但二者均会加剧微炎症反应，其中 PD 对微炎症状态的影响程度较低，同时临床中需要注意预防感染、低蛋白血症等并发症的发生。

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