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## 腹膜透析相关性多重感染性腹膜炎的临床分析

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**[摘要]** **目的** 探讨腹膜透析相关性多重感染性腹膜炎的临床分析多重感染性腹膜炎的致病菌、抗生素敏感性及转归, 为防治多重感染性腹膜炎提供参考。**方法** 回顾性分析 2008 年 1 月至 2010 年 9 月间第二军医大学长海医院收治的 81 例腹膜透析相关性多重感染性腹膜炎的临床分析腹膜炎住院患者共 151 例次感染中多重感染性腹膜炎的致病菌、抗生素敏感性及转归。**结果** 151 例次腹膜透析相关性腹膜炎培养阳性 98 例次, 培养阳性率 64.9%。多重感染性腹膜炎 20 例次, 占腹膜透析相关性腹膜炎的 13.2%, 其中单纯 2 种及以上 G<sup>+</sup> 菌感染 3 例次(15%); 单纯 2 种 G<sup>-</sup> 菌感染 1 例次(5%); G<sup>+</sup> 菌和 G<sup>-</sup> 菌混合感染 6 例次(30%); 细菌和真菌混合感染 9 例次(45%), G<sup>+</sup> 菌和真菌混合感染 6 例次(30%); 单纯 2 种真菌感染 1 例次(5%)。多重感染性腹膜炎中 G<sup>+</sup> 菌抗生素敏感性为万古霉素 100%、左氧氟沙星 61%、头孢唑林 52%; 多重感染性腹膜炎中 G<sup>-</sup> 菌抗生素敏感性为美罗培南 100%、头孢哌酮/舒巴坦 100%、庆大霉素 70%、头孢他啶 60%。多重感染性腹膜炎 20 例次, 治愈的 15 例次继续腹膜透析(75%), 4 例拔除腹膜透析管改永久血液透析(20%), 1 例死亡(5%)。**结论** 本腹膜透析中心多重感染性腹膜炎主要由 G<sup>+</sup> 菌和 G<sup>-</sup> 菌混合感染、G<sup>+</sup> 菌和真菌混合感染引起; 多重感染性腹膜炎 G<sup>+</sup> 菌敏感抗生素为万古霉素, G<sup>-</sup> 菌敏感抗生素为美罗培南、头孢哌酮/舒巴坦, 可作为多重感染性腹膜炎经验用药参考。对于真菌性腹膜炎或难治性腹膜炎, 需及时拔除腹膜透析管。

**[关键词]** 腹膜透析; 腹膜炎; 多重感染; 致病菌**[中图分类号]** R 656.41 **[文献标志码]** A **[文章编号]** 0258-879X(2012)06-0646-04

### Clinical analysis of dialysis-associated polymicrobial peritonitis

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**[Abstract]** **Objective** To investigate pathogens, antibiotics sensitivity and prognosis of dialysis-associated polymicrobial peritonitis, so as to provide evidence for prevention and treatment of polymicrobial peritonitis. **Methods** A total of 151 peritoneal peritonitis episodes in 81 patients, who received dialysis in our department between January 2008 and September 2010, were analyzed in the present study. The causative pathogens, antibiotics sensitivity and prognosis of polymicrobial peritonitis were retrospectively reviewed in these patients. **Results** Pathogenic culture of effluent peritoneal dialysate was positive in 98(64.9%) of the 151 peritoneal peritonitis episodes, and 20(13.2%) episodes were polymicrobial peritonitis. The organisms isolated from the effluent peritoneal dialysate included mixed Gram-positive and Gram-negative organisms (30%), mixed Gram-positive and fungi (30%), mixed Gram-negative and fungi (15%), pure Gram-positive organisms (15%), pure Gram-negative organisms infection (5%), and pure fungi (5%). The sensitive rates of Gram-positive organisms in the polymicrobial peritonitis were 100% to vancomycin, 61% to cefazolin sodium, and 52% to levofloxacin; and those of Gram-negative organisms were 100% to meropenem, 100% to cefoperazone-sulbactam, 70% to gentamycin, and 60% to ceftazidime. Fifteen (75%) of the 20 polymicrobial peritonitis episodes were cured and continuously received peritoneal dialysis. One (5%) patient died and 4 (20%) were converted to permanent hemodialysis. **Conclusion** Polymicrobial peritonitis in our group has been mainly caused by mixed infection of Gram-positive and Gram-negative organisms, mixed infection of Gram-positive organisms and fungi. The Gram-positive organisms are sensitive to vancomycin, and Gram-negative organisms are sensitive to meropenem and cefoperazone-sulbactam. Earlier catheter removal is necessary for fungal peritonitis or refractory peritonitis.

**[Key words]** dialysis; peritonitis; polymicrobial; bacteria

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腹膜透析(peritoneal dialysis, PD)是终末期肾病的主要替代治疗方法之一,腹膜透析相关性腹膜炎(以下简称腹膜炎)是腹膜透析治疗的重要并发症。腹膜炎大部分由单一病原微生物感染引起,而由多种病原微生物引起的多重感染性腹膜炎(polymicrobial peritonitis)较为少见,占腹膜透析相关性腹膜炎的6%~16%<sup>[1-4]</sup>,但临床表现更为严重,预后更差,因此受到越来越多的关注。本研究回顾性分析多重感染性腹膜炎的发生率、致病菌、抗生素敏感性及其转归,为临床防治提供参考。

## 1 资料和方法

1.1 一般资料 收集2008年1月至2010年9月间第二军医大学长海医院收治的81例腹膜炎住院患者共151例次临床资料,其中男性54人共97例次,女性27人共54例次,发生腹膜炎时年龄28~85岁,中位年龄为63.0岁。基础疾病:良性小动脉肾硬化44例,糖尿病肾病15例,慢性肾小球肾炎11例,痛风性肾病5例,常染色体显性遗传性多囊肾病3例,梗阻性肾病2例,紫癜性肾炎1例。

1.2 腹膜炎诊断标准 根据2005年国际腹膜透析学会指南<sup>[5]</sup>诊断腹膜透析相关性腹膜炎。由2种或2种以上病原微生物引起的腹膜炎被称为多重感染性腹膜炎。多重感染性腹膜炎分为以下类型:(1)单纯多种革兰阳性菌(G<sup>+</sup>)或多种革兰阴性菌(G<sup>-</sup>)感染;(2)G<sup>+</sup>和G<sup>-</sup>菌混合感染;(3)真菌和细菌混合感染;(4)多种真菌混合感染。

1.3 治疗方法 一旦怀疑腹膜炎,及时经验性地使用覆盖G<sup>+</sup>菌和G<sup>-</sup>菌的广谱抗生素,临床上常经验性应用头孢唑林(或万古霉素)和庆大霉素(或头孢他啶),待病原微生物培养结果出来后依据病原微生物抗生素敏感性行个体化抗生素治疗。根据2005年国际腹膜透析学会指南<sup>[5]</sup>确定疗效;对于治疗2周疗效不佳或合并真菌感染患者,拔除腹膜透析管改血液透析治疗。

## 2 结果

2.1 致病菌 81例患者发生了151例次腹膜炎,培养阳性98例次,阳性率64.9%,其中多重感染性腹膜炎20例次,占所有腹膜炎患者例次的13.25%,培养阴性36例次(23.8%);培养结果不详17例次(未能随访)。多重感染性腹膜炎2种的致病菌混合感染中,单纯2种及以上G<sup>+</sup>菌感染3例次(15%);单纯2种G<sup>-</sup>菌感染1例次(1/20,5%);G<sup>+</sup>菌和G<sup>-</sup>菌混合感染6例次(6/20,30%);细菌和真菌混合感染9例次(9/20,45%),其中G<sup>+</sup>菌和真菌混合感染6

例次(6/20,30%);单纯2种真菌感染1例次(1/20,5%)。3种及以上致病菌混合感染4例次(4/20,20%)。结果详见表1。

表1 引起多重感染性腹膜透析相关性腹膜炎的致病菌  
Tab 1 Pathogenic organisms isolated from polymicrobial peritonitis in peritoneal dialysis patients

Pathogenic organisms	Number of episodes
G <sup>+</sup> , G <sup>-</sup>	6
<i>Streptococcus mitis</i> ,	1
<i>Corynebacterium propinquum</i>	
<i>Streptococcus viridans</i> ,	1
<i>Klebsiella pneumoniae</i>	
<i>Staphylococcus epidermidis</i> ,	1
<i>Bordetella bronchiseptica</i>	
<i>Staphylococcus capitis</i> ,	1
<i>Corynebacterium urealyticum</i>	
<i>Staphylococcus aureus</i> ,	1
<i>Acinetobacter baumannii</i>	
<i>Staphylococcus warneri</i> ,	1
<i>Escherichia coli</i>	
G <sup>+</sup> , fungus	6
<i>Staphylococcus caprea</i> , <i>Aflatoxin</i>	1
<i>Staphylococcus aureus</i> ,	1
<i>Candida albicans</i>	
<i>Staphylococcus epidermidis</i> ,	1
<i>Candida parapsilosis</i>	
<i>Staphylococcus haemolyticus</i> ,	1
<i>Candida famate</i>	
<i>Staphylococcus epidermidis</i> ,	1
<i>Candida tropicalis</i>	
<i>Corynebacterium matruchotii</i> ,	1
<i>Candida parapsilosis</i>	
G <sup>+</sup> , G <sup>+</sup>	2
<i>Staphylococcus epidermidis</i> ,	1
<i>Staphylococcus simulans</i>	
<i>Staphylococcus warneri</i> ,	1
<i>Corynebacterium matruchotii</i>	
G <sup>-</sup> , G <sup>-</sup>	1
<i>Pseudomonas stutzeri</i> ,	1
<i>Pseudomonas fluorescens</i>	
Fungi, fungi	1
<i>Candida glabrata</i> ,	1
Yeast-like fungi	
G <sup>+</sup> , G <sup>-</sup> , fungus	2
<i>Citrobacter amalonaticus</i> ,	1
<i>Staphylococcus capitis</i> ,	
<i>Penicillium</i>	
<i>Corynebacterium matruchotii</i> ,	1
<i>Klebsiella pneumoniae</i> ,	
<i>Candida glabrata</i>	
G <sup>+</sup> , G <sup>+</sup> , G <sup>+</sup>	1
<i>Staphylococcus capitis</i> ,	1
<i>Staphylococcus epidermidis</i> ,	
<i>Staphylococcus aureus</i>	
G <sup>+</sup> , G <sup>+</sup> , fungi, fungi	1
<i>Staphylococcus caprea</i> ,	1
<i>Streptococcus viridians</i> ,	
<i>Candida parapsilosis</i> ,	
Yeast-like fungi	

G<sup>+</sup>: Gram-positive organisms; G<sup>-</sup>: Gram-negative organisms

2.2 抗生素敏感性 多重感染性腹膜炎中 G<sup>+</sup> 菌抗生素敏感性较强的为万古霉素(100%)、加替沙星(96%)、利福平(96%)、常规经验性使用的左氧氟沙星、头孢唑林敏感性分别为 61%、52%。多重感染性腹膜炎中 G<sup>-</sup> 菌抗生素敏感性较强的为美罗培南(100%)、头孢哌酮/舒巴坦(100%)、常规经验性使用的庆大霉素、头孢他啶敏感性分别为 70%、60%。真菌对抗生素敏感性均较高。结果详见表 2。

表 2 多重感染性腹膜炎中致病菌的抗生素敏感性

Table 2 Antibiotic sensitivities of Gram-positive organisms, Gram-negative organisms and fungi of polymicrobial peritonitis

Antibiotics	SS	RS	S(%)
<b>G<sup>+</sup></b>			
Vancomycin	23	0	100
Gatifloxacin	22	1	96
Rifampicin	22	1	96
Moxifloxacin	19	4	83
Levofloxacin	14	9	61
Ethambutol	14	9	61
Clindamycin	14	9	61
Cefazolin	12	11	52
Ampicillin/Sulbactam	11	12	48
Penicillin G	7	16	30
<b>G<sup>-</sup></b>			
Meropenem	10	0	100
Cefoperazone/Sulbactam	10	0	100
Amikacin	8	2	80
Imipenem	8	2	80
Aztreonam	8	2	80
Gentamicin	7	3	70
Amoxicillin/clavulanic acid	7	3	70
Ciprofloxacin	7	3	70
Levofloxacin	6	4	60
Piperacillin	6	4	60
Cefepime	6	4	60
Ceftazidime	6	4	60
Compound sulfamethoxazole	5	5	50
Ceftriaxone	4	6	40
Ampicillin	1	9	10
<b>Fungi</b>			
Amphotericin B	12	0	100
Voriconazole	12	0	100
Flucytosine	12	0	100
Fluconazole	11	1	92
Itraconazole	10	2	83

SS: Sensitive strains; RS: Resistant strains; S: Sensitivity rate

2.3 转归 151 例次腹膜炎,治愈 137 例次,退出腹膜透析 14 例(拔除腹膜透析管改永久血液透析 11 例,死亡 3 例)。多重感染性腹膜炎 20 例次,15 例次继续腹膜透析(75%),4 例拔除腹膜透析管改为永久血液透析(20%),1 例死亡(5%)。单一微生物感染腹膜炎 78 例次,69 例继续腹膜透析(69/78, 88.46%),7 例拔除腹膜透析管改永久血液透析(7/78,8.98%),2 例死亡(2/78,2.56%)。11 例改永久

血液透析患者中多重感染 4 例次(4/11,36.4%),反复感染 6 例次(6/11,54.5%),单次感染 5 例(5/11, 45.5%);拔除腹膜透析管前为真菌感染或合并真菌感染 8 例(8/11,72.7%),结果详见表 3。

### 3 讨论

多重感染性腹膜炎近年来发生率不断上升,且临床表现严重,细菌耐药率高,预后较差<sup>[1-4]</sup>,常需拔除腹膜透析管改血液透析治疗,导致腹膜透析失败,甚至死亡。单一 G<sup>+</sup> 菌感染多经腹膜透析管感染或由操作技术污染引起,多重感染多由腹部疾病(如合并腹腔脏器炎症、穿孔、疝嵌顿、肠道憩室、结肠炎、脓肿等)、早期使用广谱抗生素引起肠道菌群失调等多种因素共同引起<sup>[1,6-7]</sup>。遗憾的是本研究所收集的腹膜炎患者均未行腹部疾病及肠道菌群等相关检查,推测多重感染腹膜炎的发生可能与患者多累患糖尿病及高血压病等基础疾病<sup>[3-4]</sup>、相对高龄、家庭卫生条件相对有限以及预防感染意识差、常合并肺炎、隧道口炎等疾病相关。

从致病菌看,研究所收集的多重感染性腹膜炎中致病菌种类多,G<sup>+</sup> 菌仍为多重感染主要致病菌,细菌真菌混合感染比例大,占多重感染性腹膜炎的 45%。本腹膜透析中心腹膜炎腹透液培养阴性率达 23.8%,考虑与院前使用抗生素、特殊病原体感染及培养技术相关<sup>[1,3-4]</sup>。

临床上,一旦怀疑腹膜炎,常经验性使用头孢唑林(或万古霉素)和庆大霉素(或头孢他啶)<sup>[5]</sup>;本研究结果显示,多重感染性腹膜炎中 G<sup>+</sup> 菌抗生素敏感性万古霉素为 100%、头孢唑林为 52%;多重感染性腹膜炎中 G<sup>-</sup> 菌抗生素敏感性庆大霉素为 70%、头孢他啶为 60%。因此,腹膜炎治疗过程中常需根据细菌培养抗生素敏感性试验结果调整抗生素的使用。

真菌感染或 G<sup>-</sup> 菌感染往往预后较差,其中真菌、细菌混合性感染的预后最差<sup>[2, 8-10]</sup>。本研究中多重感染腹膜炎患者改永久血液透析的 11 例拔管前多为真菌感染或合并真菌的多重性感染(72.7%),抗感染疗效差,也支持这一观点。但有文献报道,真菌、细菌混合感染性腹膜炎和单纯真菌感染性腹膜炎的预后并没有明显差异<sup>[8,11]</sup>。对于治疗 2 周疗效不佳或伴真菌感染的腹膜炎患者,如不及时拔除腹膜透析管,可能导致感染加重,甚至危及患者生命,故需根据国际腹膜透析学会指南及时拔除腹膜透析管<sup>[1,8-10,12]</sup>。需要强调的是保护生命重于保护腹膜透析管。

表3 拔管患者情况

Tab 3 Catheter removal in patients

Sex	Age (year)	Protopathy	Complication	Infection type	Pathogens <sup>a</sup>	Time <sup>b</sup> t/d
M	30	CGN	Intestinal infection	Single	<i>Mucor</i>	16
M	50	CGN	None	Single	<i>Aspergillus fumigatus</i>	18
M	63	ADPKD	Pneumonia	Single	<i>Candida albicans</i>	79
F	78	BAN	None	Single	<i>Pseudomonas aeruginosa</i>	76
M	78	ON	None	Repeated	—	88
M	67	BAN	Ileus	Repeated	<i>Candida albicans</i>	23
F	46	CGN	Tunnel infection <sup>1</sup>	Repeated	<i>Staphylococcus</i>	21
M	59	BAN	None	Repeated, polymicrobial <sup>2</sup>	<i>Candida famate</i>	26
M	73	BAN	Tunnel infection	Polymicrobial	<i>Klebsiella pneumoniae</i> <sup>3</sup>	16
M	75	DN	Pneumonia <sup>4</sup>	Repeated, polymicrobial	<i>Yeast-like fungi</i> <sup>5</sup>	20
F	73	BAN	None	Repeated, polymicrobial	<i>Penicillium</i> <sup>6</sup>	11

<sup>a</sup>: Before tunnel removal; <sup>b</sup>: From peritonitis onset to tunnel removal. M: Male; F: Female; CGN: Chronic glomerulonephritis; ADPKD: Autosomal dominant polycystic kidney disease; BAN: Benign arteriolar nephrosclerosis; ON: Obstructive nephropathy; DN: Diabetic nephropathy. <sup>1</sup>: With intestinal obstruction and lung infection; <sup>2</sup>: Polymicrobial peritonitis occurred before; <sup>3</sup>: With *Corynebacterium matruchotii*, *Candida glabrata*; <sup>4</sup>: With type II respiratory failure; <sup>5</sup>: With *Staphylococcus caprea*, *Streptococcus viridans*, *Candida parapsilosis*; <sup>6</sup>: With *Citrobacter amalonaticus*, *Staphylococcus capitis*

总之,本研究中多重感染性腹膜炎主要由G<sup>+</sup>菌和G<sup>-</sup>菌混合感染、真菌和G<sup>+</sup>菌混合感染引起;尽管其发生率较低,但临床表现严重,预后差,需积极治疗;万古霉素、美罗培南、头孢哌酮/舒巴坦等抗生素敏感性高,可作为多重感染性腹膜炎的经验用药。对于真菌性腹膜炎或难治性腹膜炎,需及时拔除腹膜透析管改血液透析治疗。由于本研究多重感染性腹膜炎例次较少、随访时间较短,研究结果仍有待多中心、大样本的研究来证实。

#### 4 利益冲突

所有作者声明本文不涉及任何利益冲突。

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