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住院患者发生院内感染的病原学监测及耐药性分析*

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摘要 目的:探讨住院患者院内感染的危险因素、病原学和耐药性,为加强院内感染控制提供依据。**方法:**回顾性收集 2015 年 1 月至 2016 年 7 月我院住院患者 5665 例,根据患者是否发生院内感染将患者分为感染组(n=238)和非感染组(n=5427),分析院内感染患者临床特征、危险因素、病原菌和病原菌的耐药性。**结果:**共 238 例患者发生院内感染,培养出病原菌 294 株。与非感染组比较,感染组患者糖尿病及慢性阻塞性肺疾病发生率显著升高,身体体重指数显著增加,血红蛋白、红细胞显著降低,深静脉置管显著增加,APACHE II 评分 ≥ 5 分显著增加,住院时间及长期卧床率显著增加($P<0.05$)。单因素和多因素 logistic 回归分析显示糖尿病、深静脉置管、住院时间延长和长期卧床是院内感染的危险因素($P<0.05$)。院内感染以革兰阴性菌较为常见,占 62.93%。最常见的革兰阴性菌为铜绿假单胞菌,占 13.61%。最常见的革兰阳性菌为金黄色葡萄球菌,占 4.08%。金黄色葡萄球菌对氨苄西林、链霉素和青霉素耐药率均为 100%,表皮葡萄球菌对氨苄西林、链霉素、青霉素和阿莫西林/棒酸耐药率均为 100%。铜绿假单胞菌对氯霉素、头孢曲松和亚胺培南耐药率分别为 100.00%、70.00%和 65.00%。**结论:**我院院内感染的危险因素是糖尿病、深静脉置管、住院时间延长和长期卧床,以革兰阴性菌常见,耐药率较高。

关键词:院内感染;危险因素;病原学;耐药性

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Analysis of Risk Factors, Pathogens and Drug Resistance of Nosocomial Infection in Hospital*

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ABSTRACT Objective: To investigate the risk factors, pathogens and drug resistance of nosocomial infection of in-patients, and to provide evidence for strengthening hospital infection controlling. **Methods:** 5665 patients who were treated in our hospital from July 2015 to July 2016 were divided into the infection group (n=238) and the non-infection group (n=5427). Then the clinical features, risk factors, pathogens and drug resistance of nosocomial infection in the two groups were analyzed. **Results:** There were 238 cases developed nosocomial infection and 294 strains of pathogenic bacteria were cultured. Compared with the non-infection group, the incidence of diabetes and chronic obstructive pulmonary disease in the infection group were significantly higher, the body weight index increased, the hemoglobin and red blood cells decreased, the numbers of patients with the deep venous catheterization and the APACHE score more than 5 points are increased, and the time used for hospitalization and bed-ridden were increased ($P<0.05$). Univariate and multivariate logistic regression analysis showed that the risk factors for hospital infection were diabetes, deep vein catheterization, prolonged hospital stay and long-term bed-ridden ($P<0.05$). Gram negative bacteria were common in nosocomial infection, accounting for 62.93%. The most common gram-negative bacteria were *Pseudomonas aeruginosa*, accounting for 13.61%. The most common gram positive bacteria were *Staphylococcus aureus*, accounting for 4.08% of the total. The drug resistance rate of *Staphylococcus aureus* were all 100% to ampicillin, streptomycin and penicillin; the drug resistance rate of *Staphylococcus epidermidis* were all 100% to ampicillin, streptomycin, penicillin and amoxicillin/clavulanic acid; while the drug resistance rate of *Pseudomonas aeruginosa* were 100%, 70% and 65% to chloramphenicol, ceftriaxone and imipenem. **Conclusion:** The risk factors of nosocomial infection in our hospital are diabetes, deep vein catheterization, prolonged hospital stay and long-term bed-ridden. Gram negative bacteria are common in nosocomial infection with a high drug resistance rate.

Key words: Nosocomial infection; Risk factors; Etiology; Drug resistance

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前言

院内感染是导致患者预后不良的主要危险因素,显著延长了患者住院时间、住院费用等^[1,2]。研究显示内科老年住院患者院内感染的发生率高达 19.6%^[3,4]。因此加强对院内感染的控制具有十分重要的临床意义。目前国内外公认院内感染在危险因素、病原学和耐药性等方面存在地区差异,且因抗菌素的大量使用,同一地区院内感染的危险因素、病原学和耐药性也因时间不同而异^[5]。近年来,院内感染的革兰阴性菌感染率逐年升高,多重耐药菌感染的比例逐渐加大^[6,7]。目前,已有的研究报道中临床病例数相对较少,相关研究不足,因此有必要通过进一步的临床研究为加强院内感染提供科学的依据。

1 资料与方法

1.1 一般资料

自 2015 年 1 月至 2016 年 7 月,回顾性收集我院收治的住院患者 5665 例,纳入标准:(1)住院患者;(2)临床病历资料齐全;(3)入院后 48 小时后出现的感染;(4)院内感染出院后发病。排除标准:(1)院前即存在急性或慢性感染性疾病;(2)研究期间转院或失访。研究期间,共收集住院患者 5665 例,其中共有 238 例发生院内感染,培养出 294 株病例。根据患者住院期间是否发生院内感染,将患者分为感染组和非感染组,分别为 238 例和 5427 例。本研究通过我院伦理委员会批准。

1.2 观察指标

(1)入院时患者临床特征:年龄、性别、基础病、合并症、身体体重指数、C 反应蛋白、白细胞、血红蛋白、红细胞、总胆固

醇、总胆红素、病程、外科手术、深静脉置管、免疫抑制剂使用、既往三种或以上抗菌素使用、APACHE II 评分、吸烟、嗜酒、住院时间、长期卧床;(2)在使用抗菌素前,对患者进行细菌培养,记录病原菌;(3)记录病原菌对抗菌素的耐药性。病原菌和耐药性检测:采用 Microscan 全自动微生物检测仪(美国 Dade Behring 公司)检测耐药菌和耐药性。

1.3 统计分析

使用 SPSS22.0 统计软件完成本研究所有数据分析, $P<0.05$ 则认为差异存在统计学意义。感染组和非感染组患者年龄等计量资料差异比较采用 t 检验进行统计分析;感染组和非感染组患者性别等计数资料之间的差异采用卡方检验进行统计分析;使用单因素和多因素 logistic 回归分析探讨院内感染的危险因素。

2 结果

2.1 两组患者临床特征分析

与非感染组比较,感染组患者糖尿病发生率显著增高(20.17% vs. 12.12%, $P=0.000$);慢性阻塞性肺疾病显著升高(6.72% vs. 3.85%, $P=0.026$);身体体重指数显著增加(24.82 ± 3.28 vs. 24.12 ± 3.08 kg/m², $P=0.001$);血红蛋白显著降低(126.82 ± 21.58 vs. 132.57 ± 24.86 g/L, $P=0.000$);红细胞显著降低(3.92 ± 1.26 vs. 4.12 ± 1.38 10⁹/L, $P=0.028$);深静脉置管显著增加(7.98% vs. 4.57%, $P=0.015$);APACHE II 评分 ≥ 5 分显著增加(37.39% vs. 30.55, $P=0.025$);住院时间显著延长(23.46 ± 8.82 vs. 16.54 ± 3.25 d, $P=0.000$);长期卧床率显著增加(12.18% vs. 4.66%, $P=0.000$)。见表 1。

表 1 两组患者临床特征

Table 1 Clinical characteristics of patients in the two groups

Items	Infection groups(n=238)	Non-infection groups(n=5427)	t/x ²	P
Age (years)	49.57 $\pm$ 9.65	49.21 $\pm$ 10.08	0.540	0.589
Gender (Male/ Female)	132/106	2894/2533	0.418	0.518
Basic disease				
Cardiovascular disease	112(47.06%)	2483(41.71%)	9.436	0.051
Gastrointestinal disease	65(27.31%)	1264(23.29%)		
Immunological disease	26(10.92%)	974(17.95%)		
Endocrine disease	15(6.30%)	423(12.40%)		
Hematology disease	20(8.40%)	502(4.64%)		
Complications				
Diabetes	48(20.17%)	658(12.12%)	13.522	0.000
Hypertension	12(5.04%)	347(6.39%)	0.702	0.402
COPD	8(6.72%)	209(3.85%)	4.929	0.026
Cerebral infarction	9(3.78%)	308(5.68%)	1.548	0.213
Others	23(9.66%)	549(10.12%)	0.051	0.821
BMI (kg/m ²)	24.82 $\pm$ 3.28	24.12 $\pm$ 3.08	3.422	0.001
C-reactive protein (mg/L)	7.43 $\pm$ 2.57	7.23 $\pm$ 1.98	1.504	0.133
Leukocyte (10 ⁹ /L)	8.45 $\pm$ 2.47	8.76 $\pm$ 2.65	1.504	0.133
hemoglobin (g/L)	126.82 $\pm$ 21.58	132.57 $\pm$ 24.86	3.511	0.000
Red blood cell (10 ⁹ /L)	3.92 $\pm$ 1.26	4.12 $\pm$ 1.38	2.196	0.028

total cholesterol (mmol/L)	4.37± 1.88	4.41± 1.96	0.309	0.758
TBil (mmol/L)	12.54± 3.28	12.67± 3.73	0.529	0.597
Course of disease				
Acute	88(36.97%)	2069(36.97%)	0.128	0.721
Chronic	150(63.03%)	3358(38.12%)		
Surgery	18(7.56%)	453(8.35%)	0.184	0.668
Deep vein catheterization	19(7.98%)	248(4.57%)	5.915	0.015
Use of immunosuppressor	18(8.82%)	635(11.70%)	1.843	0.175
History use of ≥ 3 antibiotics	76(31.93%)	1485(27.36%)	2.385	0.123
APACHE II score (≥ 5)	89(37.39%)	1658(30.55%)	5.007	0.025
Smoking	45(18.91%)	1047(19.29%)	0.022	0.883
Alcoholomania	37(15.55%)	998(18.39%)	1.234	0.267
Hospital stay	23.46± 8.82	16.54± 3.25	28.570	0.000
Prolonged immobilization	29(12.18%)	253(4.66%)	27.280	0.000

2.2 院内感染的危险因素分析 管、住院时间延长和长期卧床是院内感染的危险因素($P<0.05$)。单因素和多因素 logistic 回归分析显示糖尿病、深静脉置 见表 2。

表 2 院内感染的危险因素分析

Table 2 Analysis of risk factors of nosocomial infection

Risk factors	Single-variate regression analysis		Multi-variate regression analysis	
	OR(95%CI)	P	OR(95%CI)	P
Diabetes	1.67(1.43-1.91)	0.000	1.34(1.08-1.60)	
COPD	1.26(1.02-1.60)	0.000	1.12(0.92-1.32)	
BMI	1.18(0.91-1.45)	0.128	----	----
Hemoglobin	0.96(0.88-1.04)	0.259	----	----
Red blood cell	0.98(0.91-1.05)	0.328	----	----
Deep vein catheterization	1.68(1.42-1.90)	0.000	1.42(1.12-1.72)	0.000
APACHE II score	1.21(1.01-1.41)	0.003	1.08(0.93-1.23)	0.096
Hospitalization	1.45(1.37-1.53)	0.000	1.32(1.18-1.46)	0.000
Prolonged immobilization	1.66(1.42-1.90)	0.000	1.48(1.21-1.65)	0.000

2.3 病原菌来源分析 24.38%，主要感染部位为呼吸道和血液，别分占 51.70%和共送检 1206 个标本，阳性标本 294 个，阳性标本比例为 21.09%。见表 3。

表 3 病原菌来源分析

Table 3 Analysis of the source of pathogenic bacteria

Specimen kinds	Positive no	Total no	Positive ratio (%)	Pathogen distribution ratio (%)
Sputum	98	726	13.50	33.33
Throat swab	54	191	28.27	18.37
Urine	32	88	36.36	10.88
Blood	62	178	34.83	21.09
Excrement	9	108	8.33	3.06
Abscess puncture fluid	12	12	100.00	4.08
Wound secretion	13	13	100.00	4.42
Other	14	41	34.15	4.76
Total	294	1206	24.38	100.00

2.4 院内感染的病原菌分析 兰阴性菌为铜绿假单胞菌，占 13.61%。最常见的革兰阳性菌为院内感染以革兰阴性菌较为常见，占 62.93%。最常见的革 金黄色葡萄球菌，占 4.08%。见表 4。

表 4 院内感染的主要病原菌
Table 4 Main pathogenic bacteria of nosocomial infection

Gram-positive bacteria	Positive no.	Distribution ratio (%)	Gram-negative bacteria	Positive no.	Distribution ratio (%)
<i>Staphylococcus aureus</i>	12	4.08	<i>Pseudomonas aeruginosa</i>	40	13.61
<i>Staphylococcus epidermidis</i>	7	2.38	<i>Escherichia coli</i>	24	8.16
----	----	----	<i>Enterobacter cloacae</i>	5	1.70
----	----	----	<i>Klebsiella pneumoniae</i>	4	1.36
Other	90	30.61	Other	112	38.10
Total	109	37.08	Total	185	62.93

2.5 常见病原菌耐药性分析

金黄色葡萄球菌对氨苄西林、链霉素和青霉素耐药率均为 100%,表皮葡萄球菌对氨苄西林、链霉素、青霉素和阿莫西林 /

棒酸耐药率均为 100%。铜绿假单胞菌对氯霉素、头孢曲松和亚胺培南耐药率分别为 100.00%、70.00%和 65.00%。见表 5。

表 5 常见病原菌耐药性分析
Table 5 Analysis of drug resistance of common pathogenic bacteria

Antibiotics	<i>Staphylococcus aureus</i> (n=12)	<i>Staphylococcus epidermidis</i> (n=7)	Antibiotics	<i>Pseudomonas aeruginosa</i> (n=40)	<i>Escherichia coli</i> (n=24)
Ampicillin	100.00%	100.00%	Chloramphenicol	100.00%	12.50%
Streptomycin	100.00%	100.00%	Ceftriaxone	70.00%	54.17%
Penicillin	100.00%	100.00%	Imipenem	65.00%	0.00%
Amoxicillin/ Clavulanic acid	83.33%	100.00%	Levofloxacin	62.50%	75.00%
Erythromycin	75.00%	57.14%	Levofloxacin/ Clavulanic acid	32.50%	33.33%
Clindamycin	66.67%	57.14%	Ticarcillin	30.00%	29.17%
Gentamicin	58.33%	28.57%	Cefoperazone	30.00%	54.16%
Tetracycline	58.33%	14.29%	Aztreonam	27.50%	33.33%
Gatifloxacin	50.00%	57.14%	Ceftazidime	25.00%	16.67%
Ciprofloxacin	41.67%	57.14%	Piperacillin	20.00%	50.00%
Clarithromycin	41.67%	71.43%	Cefepime	17.50%	8.33%
Rifampicin	25.00%	28.57%	Gentamicin	2.50%	33.33%
Chloramphenicol	16.67%	0.00%	Tobramycin	2.50%	20.83%
KuiNuoPu butyl / Dalfopristin	0.00%	0.00%	Amikacin	0.00%	0.00%
Vancomycin	0.00%	0.00%	----	----	----

3 讨论

院内感染是延长患者住院时间、降低患者生存质量、恶化患者临床预后的主要原因之一^[8]。尤其是随着抗菌素的不合理使用,铜绿假单胞菌等革兰阴性菌等感染率逐年增高,且耐药性增加,目前泛耐药的革兰阴性菌已较为常见^[9-11]。识别院内感染的危险因素,可以针对这类患者进行针对性预防,有可能较低院内感染率^[12,13]。本研究显示糖尿病、深静脉置管、住院时间延长和长期卧床是院内感染的危险因素($P<0.05$)。糖尿病可导致患者免疫力降低,局部血液循环差,目前研究已证实糖尿病可导致手术患者切口部位感染率增加,严格控制血糖可降低术后感染率^[14]。深静脉置管是一种有创操作,如长期肠外营养、化疗的患者,往往需要长期留置深静脉管道,可导致导管相关性

感染发生率倍增,因此对于需要长期深静脉置管的患者,尽早更换或拔除深静脉管道以免发生导管相关性感染^[15]。长期卧床主要导致肺部感染,2014 年原源等研究显示长期卧床可导致患者肺部感染发生率增高,且铜绿假单胞菌等耐药性较高的革兰阴性菌感染率较高^[16,17]。本研究结果显示我所发生的院内感染以革兰阴性菌为常见,占 62.93%,与国内外相关报道一致^[18]。最常见的革兰阴性菌为铜绿假单胞菌,与苏麟等研究不同,该研究显示院内感染的革兰阴性菌以大肠埃希菌最为常见,这可能是不同医院菌群不同造成的^[19,20]。本研究显示最常见的革兰阳性菌为金黄色葡萄球菌,占 4.08%。本研究还显示金黄色葡萄球菌对氨苄西林、链霉素和青霉素耐药率均为 100%,表皮葡萄球菌对氨苄西林、链霉素、青霉素和阿莫西林 / 棒酸耐药率均为 100%。铜绿假单胞菌对氯霉素、头孢曲松和亚胺培南耐药

率分别为 100.00%、70.00%和 65.00%,整体耐药率较高。

综上所述,我院院内感染的危险因素是糖尿病、深静脉置管、住院时间延长和长期卧床,以革兰阴性菌常见,耐药率较高。临床医师在选用抗菌素时应根据药敏结果选择合适的抗菌素,且合理使用抗菌素,以提高疗效并降低细菌的耐药性。

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