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在线全文

2019–2023年6 428例肿瘤患者病原菌分布与耐药性监测报告*

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【摘要】 **目的** 报告近五年某医院从肿瘤患者样本分离的病原菌特征和多重耐药菌检出率，为感染防控提供参考。**方法** 回顾性收集四川大学华西医院2019年1月–2023年12月期间6 428例肿瘤患者样本的病原学培养及菌株体外敏感性结果，总结数据趋势。**结果** 从80 386份样本中分离到病原菌16 393株，检出率为20.4%；剔除从同一患者分离的重复菌株，7 951株（81.1%）细菌菌株中以大肠埃希菌（14.5%）、肺炎克雷伯菌（13.2%）、金黄色葡萄球菌（9.4%）、鲍曼不动杆菌复合群（9.3%）和铜绿假单胞菌（7.7%）为主；1 857株（18.9%）真菌菌株中以白色念珠菌（56.5%）、热带念珠菌（9.0%）和近平滑念珠菌（8.0%）最常见。主要菌种的样本来源不同，不同肿瘤来源的菌种分布也不同（P<0.05）。耐碳青霉烯大肠埃希菌和肺炎克雷伯菌的检出率分别为2.5%（29/1 152）和12.3%（129/1 050）；耐甲氧西林金黄色葡萄球菌的检出率为22.0%（165/749），近四年的检出率呈上升趋势（P<0.01）；耐碳青霉烯鲍曼不动杆菌和铜绿假单胞菌的检出率分别为40.3%（298/739）和8.8%（54/612）。**结论** 肿瘤患者病原菌以革兰阴性菌为主，多重耐药菌的检出率较高，耐甲氧西林金黄色葡萄球菌的检出率呈上升趋势。

【关键词】 肿瘤 病原 耐药 多重耐药菌

Distribution of the Pathogens Isolated from 6 428 Tumor Patients in 2019-2023 and the Relevant Drug Resistance Surveillance Report

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【**Abstract**】 **Objective** To investigate the characteristics of the pathogens isolated from the specimens of tumor patients and detection rates of multidrug-resistant bacteria in a hospital in the past five years, so as to provide references for infection prevention and control. **Methods** The results of pathogenic culture and *in vitro* susceptibility of the strains isolated from the specimens collected between January 2019 and December 2023 from tumor patients were retrospectively collected, and the trends of the data were analyzed and summarized. **Results** A total of 16 393 strains were isolated from 80 386 specimens, producing a detection rate of 20.4%. After excluding the duplicate strains isolated from the same patients, *Escherichia coli* (14.5%), *Klebsiella pneumoniae* (13.2%), *Staphylococcus aureus* (9.4%), *Acinetobacter baumannii* complex (9.3%), and *Pseudomonas aeruginosa* (7.7%) predominated the 7 951 (81.1%) bacterial strains. Among the 1 857 (18.9%) fungal strains, *Candida albicans* (56.5%), *Candida tropicalis* (9.0%), and *Candida parapsilosis* (8.0%) were the most common ones. The specimen sources differed among the prevalent species, and the species distribution varied among specimens from different types of tumors (P<0.05). The detection rates of carbapenem-resistant *Escherichia coli* and *Klebsiella pneumoniae* were 2.5% (29/1 152) and 12.3% (129/1 050), respectively. The detection rate of methicillin-resistant *Staphylococcus aureus* was 22.0% (165/749), maintaining an upward trend in the last four years (P<0.01). The detection rates of carbapenem-resistant *Acinetobacter baumannii* and *Pseudomonas aeruginosa* were 40.3% (298/739) and 8.8% (54/612), respectively. **Conclusion** Gram-negative bacteria were the prevalent pathogens of tumor patients. The detection rate of multidrug-resistant bacteria was relatively high, and the detection rate of methicillin-resistant *Staphylococcus aureus* showed an upward trend.

【**Key words**】 Tumor Pathogen Resistance Multidrug-resistant bacteria

肿瘤患者往往免疫力低下，抗御病原能力下降，容易并发感染，例如肺癌患者并发肺部感染[1]，结直肠癌、肝癌和胃癌患者并发腹腔感染[2]。已有研究结果显示，不同肿瘤来源分离株的主要菌种存在差异，多重耐药菌的检出率较高，给感染的防控带来严峻挑战，例如：乳腺癌患者术后感染病原菌中金黄色葡萄球菌占比高，耐甲氧西林菌株占6.0%[3]；实体瘤患者血液样本分离株以大肠埃希菌和克雷伯菌属为主，多重耐药菌占15.5%[4]；血液系统肿瘤患者血液样本分离株中铜绿假单胞菌较多，耐碳青霉烯类菌株占59.3%[5]。了解本地区肿瘤患者的病原菌特征，关注多重耐药菌检出率变化趋势，对于感染防控具有重要临床意义。因此，本研究回顾性分析近五年肿瘤患者样本的病原学培养及菌株体外敏感性结果，监测多重

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耐药菌的检出率变化, 为该类患者并发感染的防控提供参考, 整理报道如下。

1　资料与方法

1.1　对象

纳入四川大学华西医院2019年1月–2023年12月期间送检样本进行病原学培养且临床诊断感染性疾病的肿瘤患者6 428例。本研究获四川大学华西医院生物医学伦理审查委员会批准(2023年审1461号)。

1.2　菌种分布及体外药物敏感性

从实验室信息系统回顾性收集患者样本(尿液、血液、分泌物、呼吸道样本及其他体液等)中病原菌分离情况以及主要菌种的体外药物敏感性检测结果, 药敏结果判定参照CLSI M100文件[6]和专家共识[7]。多重耐药菌定义为对3类或3类以上抗菌药物同时耐药的细菌[8]。

1.3　统计学方法

分类变量以频数(n)和百分比(%)表示, 采用WHONET 5.6分析菌种分布(构成比)以及菌株对抗菌药物的耐药率(R%)和敏感率(S%); 采用SPSS20.0软件进行卡方检验或Fisher确切概率法分析组间多个构成比/率的差异或趋势, α= 0.05。

2　结果

2.1　菌株检出率

2019年1月–2023年12月, 从80 386份样本中分离到16 393株菌, 检出率为20.4%; 各年度送检样本的病原菌检出率依次为20.4%(2 819/13 843)、19.5%(2 695/13 818)、20.9%(3 454/16 540)、25.6%(4 406/17 210)和15.9%(3 019/18 975), 差异有统计学意义(χ^2= 531.625, P< 0.01)。

2.2　菌种分布和来源

剔除从同一患者分离的重复菌株, 合计分离到细菌7 951株(81.1%)和真菌1 857株(18.9%), 各年度的主要菌种分布差异有统计学意义(χ^2= 132.758, P< 0.01), 见表1。细菌菌株以大肠埃希菌(14.5%)、肺炎克雷伯菌(13.2%)、金黄色葡萄球菌(9.4%)、鲍曼不动杆菌复合群(9.3%)和铜绿假单胞菌(7.7%)为主; 真菌菌株以白色念珠菌(56.5%)、热带念珠菌(9.0%)和近平滑念珠菌(8.0%)常见。

表 1　2019–2023年肿瘤患者分离菌株的主要菌种分布

Table 1　The distribution of prevalent species of the strains isolated from tumor patients in 2019 to 2023

Organisms	2019 (n=1 652)		2020 (n=1 544)		2021 (n=2 028)		2022 (n=2 614)		2023 (n=1 970)		Total (n=9 808)	
	Types of isolates	%	Types of isolates	%	Types of isolates	%	Types of isolates	%	Types of isolates	%	Types of isolates	%
Bacteria	1 277	77.3	1 255	81.3	1 605	79.1	2 102	80.4	1 712	86.9	7 951	81.1
Escherichia coli	211	16.5	198	15.8	236	14.7	271	12.9	236	13.8	1 152	14.5
Klebsiella pneumoniae	177	13.9	152	12.1	201	12.5	288	13.7	232	13.6	1 050	13.2
Staphylococcus aureus	125	9.8	109	8.7	153	9.5	196	9.3	166	9.7	749	9.4
Acinetobacter baumannii complex	89	7.0	110	8.8	158	9.8	193	9.2	189	11.0	739	9.3
Pseudomonas aeruginosa	106	8.3	103	8.2	111	6.9	144	6.9	148	8.6	612	7.7
Enterobacter cloacae complex	59	4.6	56	4.5	77	4.8	94	4.5	77	4.5	363	4.6
Enterococcus faecium	46	3.6	39	3.1	53	3.3	77	3.7	63	3.7	278	3.5
Staphylococcus epidermidis	36	2.8	38	3.0	59	3.7	74	3.5	49	2.9	256	3.2
Hemophilus influenzae	57	4.5	30	2.4	54	3.4	64	3.0	40	2.3	245	3.1
Enterococcus faecalis	31	2.4	31	2.5	34	2.1	79	3.8	68	4.0	243	3.1
Fungi	375	22.7	289	18.7	423	20.9	512	19.6	258	13.1	1 857	18.9
Candida albicans	194	51.7	171	59.2	256	60.5	289	56.4	140	54.3	1 050	56.5
Candida tropicalis	35	9.3	32	11.1	28	6.6	51	10.0	21	8.1	167	9.0
Candida parapsilosis	28	7.5	27	9.3	42	9.9	36	7.0	16	6.2	149	8.0

如图1所示, 主要菌种的样本来源不同, 差异有统计学意义(χ^2= 2 507.564, P< 0.001)。不同肿瘤来源分离菌株的菌种分布不同, 差异有统计学意义(χ^2= 1 851.041, P< 0.01), 具体见表2。

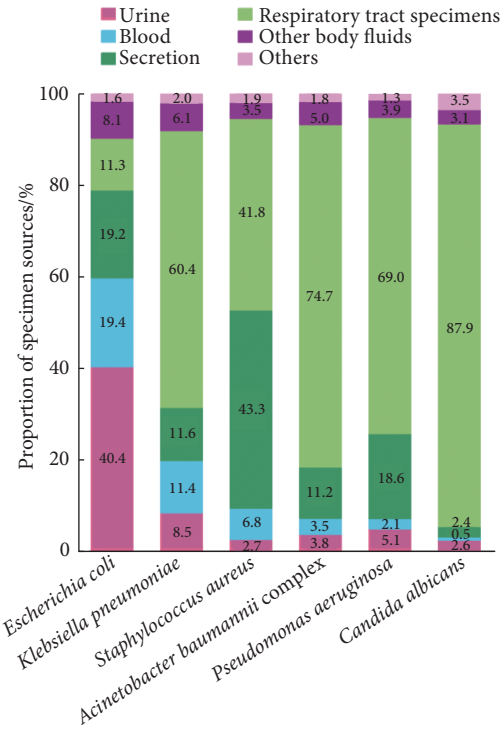

图 1 2019–2023年肿瘤患者主要分离菌种的样本来源

Fig 1 Specimen sources of the prevalent species isolated from tumor patients in 2019 to 2023

χ^2=2 507.564, P<0.001. Others: other types of specimens.

2.3 主要菌种对抗菌药物的体外敏感性

2.3.1 大肠埃希菌

分离到的1 152株大肠埃希菌中产超广谱β内酰胺酶(extended-spectrum β-lactamases, ESBL)菌株占50.1%, 耐碳青霉烯菌株占2.5%。各年度分离菌株对头孢唑林、头孢吡肟、头孢哌酮-舒巴坦、氨苄西林-舒巴坦、环丙沙星和左氧氟沙星的耐药率差异有统计学意义(P< 0.05), 具体见表3。

2.3.2 肺炎克雷伯菌

分离到的1 050株肺炎克雷伯菌中产ESBL菌株占23.4%, 耐碳青霉烯菌株占12.3%。各年度分离菌株对头孢唑林、头孢哌酮-舒巴坦和环丙沙星的耐药率差异有统计学意义(P< 0.05), 具体见表4。

2.3.3 金黄色葡萄球菌

分离到的749株金黄色葡萄球菌中耐甲氧西林菌株占22.0%, 各年度耐甲氧西林菌株的检出率差异有统计学意义(P< 0.05), 近四年的检出率呈上升趋势, 具体见表5。

2.3.4 鲍曼不动杆菌复合群

分离到的739株鲍曼不动杆菌复合群中耐碳青霉烯菌株占40.3%。各年度分离菌株对阿米卡星、头孢吡肟、哌拉西林、头孢哌酮-舒巴坦和替加环素的耐药率差异有统计学意义(P< 0.05), 具体见表6。

2.3.5 铜绿假单胞菌

分离到的612株铜绿假单胞菌中耐碳青霉烯菌株占8.8%。各年度分离菌株对头孢他啶、头孢吡肟和多粘菌素B的耐药率差异有统计学意义(P< 0.05), 具体见表7。

表 2 2019–2023年不同肿瘤来源分离菌株的菌种分布

Table 2 Species distribution of the strains isolated from specimens of different types of tumors in 2019 to 2023

Organisms	Lung cancer (n=1 806)		Colorectal cancer (n=1 073)		Liver cancer (n=1 071)		Esophageal cancer (n=924)		Urinary system cancer (n=873)		Gastric cancer (n=735)		Oral cancer (n=546)		Breast cancer (n=467)		Pancreatic cancer (n=411)		Nasopharyngeal cancer (n=307)	
	Types of isolates	%	Types of isolates	%	Types of isolates	%	Types of isolates	%	Types of isolates	%	Types of isolates	%	Types of isolates	%	Types of isolates	%	Types of isolates	%	Types of isolates	%
Escherichia coli	262	14.5	147	13.7	136	12.7	149	16.1	112	12.8	86	11.7	55	10.1	23	4.9	57	13.9	34	11.1
Klebsiella pneumoniae	206	11.4	150	14.0	160	14.9	112	12.1	107	12.3	76	10.3	49	9.0	13	2.8	52	12.7	28	9.1
Candida albicans	178	9.9	72	6.7	105	9.8	98	10.6	99	11.3	48	6.5	166	30.4	32	6.9	24	5.8	24	7.8
Enterobacter cloacae complex	154	8.5	34	3.2	41	3.8	40	4.3	17	1.9	18	2.4	3	0.5	7	1.5	17	4.1	15	4.9
Staphylococcus aureus	122	6.8	90	8.4	68	6.3	67	7.3	55	6.3	46	6.3	35	6.4	111	23.8	28	6.8	64	20.8
Pseudomonas aeruginosa	117	6.5	76	7.1	81	7.6	90	9.7	52	6.0	46	6.3	26	4.8	15	3.2	31	7.5	16	5.2
Stenotrophomonas maltophilia	50	2.8	22	2.1	20	1.9	45	4.9	15	1.7	14	1.9	31	5.7	5	1.1	7	1.7	9	2.9
Enterococcus faecium	29	1.6	64	6.0	36	3.4	11	1.2	51	5.8	16	2.2	6	1.1	4	0.9	25	6.1	2	0.7
Staphylococcus epidermidis	24	1.3	26	2.4	40	3.7	15	1.6	24	2.7	13	1.8	14	2.6	50	10.7	10	2.4	9	2.9
Acinetobacter baumannii complex	4	0.2	5	0.5	10	0.9	0	0	11	1.3	160	21.8	35	6.4	29	6.2	0	0	4	1.3

表 3　2019–2023年1 152株大肠埃希菌对抗菌药物的耐药率和敏感率

Table 3　Resistance and susceptibility rates of 1 152 *Escherichia coli* isolates to antimicrobial agents in 2019 to 2023

Antimicrobial agents	2019		2020		2021		2022		2023		χ^2/P
	R/%	S/%	R/%	S/%	R/%	S/%	R/%	S/%	R/%	S/%	
Amikacin	2.5	97.5	1.6	98.4	3.4	96.6	2.2	97.8	0.9	99.1	3.454/0.485
Gentamicin	34.5	63.5	42.9	56.6	32.9	66.7	29.8	69.8	34.7	65.3	15.144/0.056
Imipenem	2.5	97.5	2.2	97.8	3.4	96.6	2.2	97.8	1.4	98.6	1.951/0.745
Meropenem	2.5	97.5	2.2	97.8	3.4	96.6	2.2	97.3	1.4	98.6	5.466/0.707
Ertapenem	2.5	97.5	2.2	97.8	3.9	96.1	2.7	97.3	1.4	98.6	2.703/0.609
Cefazolin	55.5	44.5	57.1	42.9	54.5	45.5	61.6	38.4	79.1	20.9	30.984/0.000
Cefuroxime	55.0	40.0	57.5	38.7	51.2	43.4	52.0	42.7	60.7	36.9	7.137/0.522
Ceftazidime	28.5	69.0	22.1	76.8	22.7	76.3	21.8	77.3	27.6	69.7	9.133/0.331
Cefotaxime	51.0	47.6	55.2	43.6	51.2	48.8	49.3	49.8	57.7	41.8	6.991/0.538
Cefepime	27.0	71.5	26.8	72.0	26.5	72.5	28.0	70.1	33.6	63.7	15.736/0.046
Piperacillin	79.0	18.0	82.3	17.7	83.4	16.1	79.9	19.2	84.4	15.1	13.154/0.107
Ampicillin	82.5	17.0	83.5	14.8	84.5	13.5	82.2	17.8	84.9	14.2	7.478/0.486
Cefoperazone-Sulbactam	5.6	88.3	4.4	86.8	6.2	80.7	4.8	80.1	6.9	67.4	35.933/0.000
Piperacillin-Tazobactam	17.7	81.8	11.2	86.6	18.4	79.6	10.8	86.5	12.5	84.0	13.108/0.108
Ampicillin-Sulbactam	57.3	42.7	47.8	52.2	48.8	51.2	42.0	57.1	45.9	51.4	25.436/0.001
Ciprofloxacin	61.5	24.5	65.4	29.1	65.2	29.5	60.4	32.4	69.2	28.0	25.100/0.001
Levofloxacin	56.5	17.0	64.1	16.6	58.0	30.0	54.7	36.9	63.0	32.9	76.304/0.000
Trimethoprim-Sulfamethoxazole	48.7	51.3	58.8	41.2	57.0	43.0	47.3	52.7	53.2	46.8	8.119/0.087
Nitrofurantoin	3.2	89.8	0	91.9	0	91.7	1.1	97.7	0.8	96.1	14.505/0.070

R: resistant; S: susceptible.

表 4　2019–2023年1 050株肺炎克雷伯菌对抗菌药物的耐药率和敏感率

Table 4　Resistance and susceptibility rates of 1 050 *Klebsiella pneumoniae* isolates to antimicrobial agents in 2019 to 2023

Antimicrobial agents	2019		2020		2021		2022		2023		χ^2/P
	R/%	S/%	R/%	S/%	R/%	S/%	R/%	S/%	R/%	S/%	
Amikacin	6.4	93.6	8.1	91.9	12.6	87.4	8.0	92.0	12.5	87.0	10.644/0.223
Gentamicin	19.8	79.1	16.2	83.8	19.7	79.2	11.9	86.4	18.5	81.5	11.857/0.158
Imipenem	9.9	90.1	10.8	89.2	14.2	85.8	9.2	90.8	14.9	85.1	5.140/0.273
Meropenem	9.9	90.1	10.8	89.2	14.2	85.8	9.2	90.8	15.4	84.6	10.011/0.265
Ertapenem	9.5	90.5	11.0	89.0	14.8	85.2	10.1	89.9	15.4	84.6	5.056/0.282
Cefazolin	90.2	9.8	29.1	70.9	31.2	68.8	43.7	56.3	81.3	18.7	118.446/0.000
Cefuroxime	30.6	67.6	28.4	67.6	29.9	68.5	27.4	68.4	29.8	69.2	7.532/0.363
Ceftazidime	15.1	83.1	16.2	83.1	23.1	76.9	17.4	81.7	20.1	77.5	10.800/0.117
Cefotaxime	22.8	74.3	23.5	75.0	27.2	72.1	21.2	78.1	25.0	72.8	4.708/0.788
Cefepime	22.7	76.2	19.2	80.2	23.8	74.4	19.2	79.7	21.5	77.3	2.918/0.939
Piperacillin	45.0	45.0	44.6	34.5	43.5	44.0	42.6	39.7	40.7	43.1	11.561/0.172
Cefoperazone-Sulbactam	11.2	85.3	10.6	88.2	14.7	80.0	9.4	80.6	13.6	84.0	21.691/0.006
Piperacillin-Tazobactam	18.8	74.1	16.2	79.1	23.0	73.2	17.7	77.2	20.1	78.4	10.212/0.250
Ampicillin-Sulbactam	34.3	65.7	28.4	71.6	30.6	68.9	28.6	70.2	27.5	71.0	7.086/0.527
Ciprofloxacin	25.7	62.6	25.7	69.6	29.3	68.5	23.9	72.3	28.8	68.8	25.687/0.001
Levofloxacin	20.3	68.0	18.9	68.2	21.7	71.2	16.4	74.4	22.1	69.2	6.990/0.538
Trimethoprim-Sulfamethoxazole	19.4	80.6	15.9	84.1	25.7	74.3	19.7	80.3	23.3	76.7	5.863/0.210

R: resistant; S: susceptible.

表5 2019–2023年749株金黄色葡萄球菌对抗菌药物的耐药率和敏感率

Table 5 Resistance and susceptibility rates of 749 *Staphylococcus aureus* isolates to antimicrobial agents in 2019 to 2023

Antimicrobial agents	2019		2020		2021		2022		2023		χ^2/P
	R/%	S/%	R/%	S/%	R/%	S/%	R/%	S/%	R/%	S/%	
Penicillin G	91.7	8.3	91.3	8.7	93.0	7.0	93.2	6.8	96.1	3.9	3.187/0.527
Oxacillin	21.5	78.5	17.5	82.5	20.2	79.8	24.9	75.1	32.7	67.3	10.385/0.034
Gentamicin	6.6	90.1	10.7	86.4	9.4	84.4	7.3	88.1	3.8	93.6	8.811/0.359
Clindamycin	30.6	69.4	27.2	71.8	33.9	65.4	25.6	73.3	25.2	74.8	6.604/0.580
Erythromycin	52.9	45.5	48.5	49.5	53.1	46.1	52.5	45.2	43.9	56.1	8.471/0.389
Vancomycin	0	100	0	100	0	100	0	100	0	100	–
Linezolid	0	100	0	100	0	100	0	100	0	100	–
Tigecycline	0	100	0	100	0	100	0	100	0	100	–
Rifampin	0	100	0	100	0	99.2	0	98.9	0.6	99.4	7.348/0.500
Levofloxacin	11.6	88.4	10.7	88.3	20.2	78.3	12.4	87.6	16.7	82.7	11.020/0.201
Trimethoprim-Sulfamethoxazole	10.7	89.3	15.5	84.5	16.3	83.7	16.3	83.7	12.2	87.8	2.943/0.567

–: not applicable; R: resistant; S: susceptible.

表6 2019–2023年739株鲍曼不动杆菌复合群对抗菌药物的耐药率和敏感率

Table 6 Resistance and susceptibility rates of 739 *Acinetobacter baumannii* complex isolates to antimicrobial agents in 2019 to 2023

Antimicrobial agents	2019		2020		2021		2022		2023		χ^2/P
	R/%	S/%	R/%	S/%	R/%	S/%	R/%	S/%	R/%	S/%	
Amikacin	34.5	61.9	38.1	61.9	37.7	62.3	32.5	67.5	34.7	65.3	22.287/0.004
Gentamicin	39.3	60.7	41.5	58.5	43.5	55.8	33.1	66.9	37.3	62.7	8.037/0.430
Imipenem	41.2	58.8	43.4	56.6	43.5	55.8	36.1	63.9	38.5	61.5	6.486/0.593
Meropenem	41.2	58.8	43.4	56.6	43.9	56.1	36.1	63.9	38.5	61.5	2.662/0.616
Ceftazidime	40.5	53.6	41.5	50.0	42.8	50.7	36.7	60.9	38.7	58.9	11.748/0.163
Cefepime	42.4	57.6	44.3	54.7	44.2	52.9	36.7	63.3	37.9	62.1	15.589/0.049
Piperacillin	41.2	56.5	43.4	43.4	43.2	50.4	36.7	58.6	42.0	55.6	20.796/0.008
Cefoperazone-Sulbactam	11.6	48.7	21.7	50.0	25.2	57.0	28.6	61.3	39.2	59.6	92.788/0.000
Piperacillin-Tazobactam	41.2	57.6	46.2	51.0	45.2	51.1	38.1	58.9	44.0	56.0	9.031/0.340
Ampicillin-Sulbactam	42.4	54.1	48.1	48.1	45.9	50.4	40.5	52.4	44.8	51.6	6.380/0.605
Ciprofloxacin	42.4	57.6	43.4	55.7	43.5	55.8	36.7	63.3	39.5	59.9	4.282/0.831
Levofloxacin	41.2	57.6	44.3	55.7	43.5	55.8	35.7	63.7	37.9	61.5	4.300/0.829
Minocycline	18.9	56.6	20.0	51.4	19.0	42.9	9.0	51.7	16.1	43.7	9.705/0.286
Trimethoprim-Sulfamethoxazole	28.2	71.8	33.7	66.3	29.1	70.9	27.5	72.5	28.1	71.9	1.253/0.869
Polymyxin B	0	100	1.5	88.5	0	100	0	100	0	100	3.614/0.461
Tigecycline	1.2	91.8	1.9	95.2	1.4	97.1	0.6	98.8	0	99.4	19.194/0.014

R: resistant; S: susceptible.

2.4 多重耐药菌的检出情况

5种主要细菌菌株中耐甲氧西林金黄色葡萄球菌(methicillin-resistant *Staphylococcus aureus*, MRSA)、耐碳青霉烯大肠埃希菌(carbapenem-resistant *Escherichia coli*, CREC)、耐碳青霉烯肺炎克雷伯菌(carbapenem-resistant *Klebsiella pneumoniae*, CRKP)、耐碳青霉烯鲍曼不动杆菌(carbapenem-resistant *Acinetobacter baumannii*, CRAB)和耐碳青霉烯铜绿假单胞菌(carbapenem-resistant *Pseudomonas aeruginosa*, CRPA)的总检出率依次为22.0%(165/749)、2.5%(29/1 152)、12.3%(129/1 050)、40.3%(298/739)和8.8%(54/612),这些多重耐药菌的年度检出率变化如图2所示,MRSA的检出率差异有统计学意义($P=0.034$),近四年的检出率呈上升趋势;CREC、CRKP、CRAB和CRPA的检出率差异无统计学意义。

表 7　2019–2023年612株铜绿假单胞菌对抗菌药物的耐药率和敏感率

Table 7　Resistance and susceptibility rates of 612 *Pseudomonas aeruginosa* isolates to antimicrobial agents in 2019 to 2023

Antimicrobial agents	2019		2020		2021		2022		2023		χ^2/P
	R/%	S/%	R/%	S/%	R/%	S/%	R/%	S/%	R/%	S/%	
Amikacin	1.0	98.0	1.1	98.9	1.1	97.8	0	100	0.8	99.2	4.754/0.784
Gentamicin	1.0	98.0	1.1	96.7	1.1	96.7	0	98.3	0.8	98.4	2.410/0.966
Imipenem	7.8	90.2	7.7	91.2	10.0	88.9	11.0	87.3	7.6	92.4	3.497/0.899
Meropenem	7.0	89.0	3.2	93.5	8.9	91.1	9.3	87.3	7.0	93.0	10.905/0.207
Ceftazidime	11.9	80.2	4.4	94.4	11.0	87.9	8.5	89.8	6.7	91.7	18.407/0.018
Cefepime	12.9	87.1	7.6	89.1	12.1	79.1	8.5	89.8	7.3	90.2	17.675/0.024
Piperacillin	13.9	80.2	12.1	82.4	15.4	79.1	14.4	79.7	9.8	88.6	5.928/0.655
Cefoperazone-Sulbactam	14.9	70.3	15.2	73.9	13.3	75.6	13.4	71.4	11.6	67.9	5.425/0.711
Piperacillin-Tazobactam	5.1	88.9	8.8	87.9	10.0	85.6	10.3	87.1	8.8	91.2	9.110/0.333
Ciprofloxacin	8.0	89.0	7.6	88.0	8.8	87.9	5.9	88.1	1.7	90.8	9.039/0.339
Levofloxacin	13.1	81.8	11.2	83.1	13.2	80.2	16.7	78.9	13.8	81.3	1.828/0.986
Polymyxin B	0	100	0	100	0	100	0	100	14.3	85.7	18.422/0.001

R: resistant; S: susceptible.

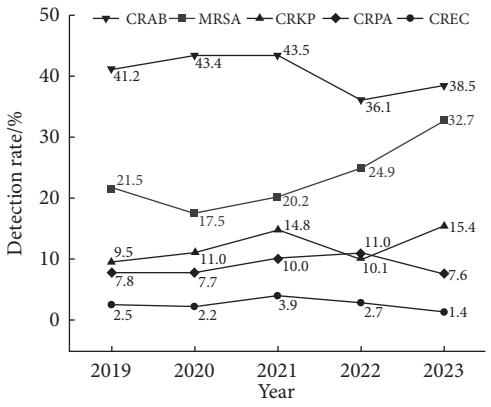

图 2　2019–2023年肿瘤患者样本中多重耐药菌的检出率

Fig 2　Detection rates of multidrug-resistant bacteria isolated from the specimens of tumor patients in 2019 to 2023

CRAB: carbapenem-resistant *Acinetobacter baumannii* (χ^2=2.613, P=0.625); MRSA: methicillin-resistant *Staphylococcus aureus* (χ^2=10.385, P=0.034); CRKP: carbapenem-resistant *Klebsiella pneumoniae* (χ^2=5.056, P=0.282); CRPA: carbapenem-resistant *Pseudomonas aeruginosa* (χ^2=1.467, P=0.832); CREC: carbapenem-resistant *Escherichia coli* (χ^2=2.703, P=0.609).

3　讨论

细菌耐药性监测结果是感染性疾病防控的重要依据。世界卫生组织发布的最新报告指出: 全球细菌分离株的耐药性增加, 各国家及地区应长期开展耐药性监测工作, 提供高质量数据用于制定干预措施[9]。研究显示, 不同地域及患者人群的主要检出菌种及耐药性存在差异[10-11]。肿瘤患者往往免疫力低下, 对病原的抵抗力下降, 并发感染的风险高。因此, 本研究回顾性分析我院近五年肿瘤患者病原菌特征, 关注多重耐药菌检出趋势, 为该类患者并发感染的防控提供依据。

本研究纳入2019年1月–2023年12月期间我院收治的6 428例肿瘤患者80 386份样本中分离的病原菌16 393株(检出率为20.4%); 剔除同一患者的重复菌株后进一步分析发现: 细菌菌株以大肠埃希菌(14.5%)、肺炎克雷伯菌(13.2%)、金黄色葡萄球菌(9.4%)、鲍曼不动杆菌复合群(9.3%)和铜绿假单胞菌(7.7%)为主; 真菌菌株以白色念珠菌(56.5%)、热带念珠菌(9.0%)和近平滑念珠菌(8.0%)为主。2020年10月–2021年9月全国肿瘤患者样本分离菌株以大肠埃希菌(22.8%)、肺炎克雷伯菌(16.2%)和金黄色葡萄球菌(9.2%)为主[12]。提示肿瘤人群病原菌特征可能与地区流行病学、人群分布和疾病严重程度等相关, 有待进一步研究证实。

本研究纳入的肿瘤患者主要分离菌种的样本来源存在差异, 例如: 大肠埃希菌主要分离于尿液(40.4%)、血液(19.4%)和分泌物(19.2%), 肺炎克雷伯菌主要分离于呼吸道样本(60.4%)、分泌物(11.6%)和血液(11.4%)。2015–2021年中国细菌耐药监测网CHINET监测报告显示: 儿童患者样本中大肠埃希菌主要分离自尿液(39.6%)、脓液(21.0%)和呼吸道样本(19.2%), 克雷伯菌属细菌主要分离自呼吸道样本(50.1%)、尿液(23.2%)和血液(10.5%)[13]。提示肿瘤患者与非肿瘤患者的主要分离菌种可能相同, 但分离来源存在差异, 可能与人群的疾病特征相关。

并且, 本研究发现不同肿瘤患者样本分离株的主要

菌种分布不同,肺癌、食管癌、泌尿系统肿瘤和胰腺癌分离菌株中大肠埃希菌占比高,结直肠癌和肝癌分离菌株中肺炎克雷伯菌最多,乳腺癌和鼻咽癌分离菌株中金黄色葡萄球菌最常见,提示可进一步研究不同肿瘤人群主要病原的感染危险因素、制定策略、评估感染防控干预效果等。

多重耐药菌引起的感染可能导致患者住院时间延长、治疗成本增加和死亡率增高等,是世界关注的公共卫生问题。本研究关注了从纳入肿瘤患者分离的5种常见菌种中多重耐药菌的检出率变化趋势,结果显示:近五年,MRSA、CREC、CRKP、CRAB和CRPA的总检出率依次为22.0%(165/749)、2.5%(29/1 152)、12.3%(129/1 050)、40.3%(298/739)和8.8%(54/612),CREC、CRKP、CRAB和CRPA各年度检出率差异无统计学意义,但特别值得关注的是MRSA的检出率近四年从17.5%快速上升到32.7%。2014–2019年全国细菌耐药监测网报告显示:MRSA检出率从36.0%下降至30.2%;CREC检出率为1.4%~1.9%;CRKP检出率从6.4%上升至10.9%;CRAB检出率从57.0%下降至56.0%;CRPA检出率从25.6%下降至19.1%[14]。针对目标病原菌,可实施手卫生、接触隔离和合理选用抗菌药物等[15]进行预防干预,针对分离菌株进行遗传学分析可利于干预措施的精准实施和调整[16]。

综上所述,肿瘤患者病原菌以革兰阴性菌为主,主要菌种的样本来源不同,不同肿瘤来源的主要分离菌种也存在差异;多重耐药菌株的检出率较高,耐甲氧西林金黄色葡萄球菌的检出率呈上升趋势。

* * *

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