



慢性阻塞性肺病急性加重期患者下呼吸道分离病原菌特征*

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【摘要】 目的 分析从慢性阻塞性肺病急性加重期(acute exacerbation of chronic obstructive pulmonary disease, AECOPD)患者下呼吸道分离病原菌的菌种分布及体外药物敏感性, 为该类药物患者下呼吸道感染治疗提供参考。方法 纳入2015年1月-2024年12月AECOPD疑似发生下呼吸道感染的患者, 回顾性收集从下呼吸道样本分离的病原菌菌种鉴定和体外药物敏感性检测结果, 对比分析不同类型样本的病原菌检出率、菌种分布、主要菌种体外药物敏感性和多重耐药菌检出情况。采用WHONET 5.6和SPSS 26.0软件分析数据。结果 纳入的3861例患者送检下呼吸道样本25253份, 痰液、气道分泌物和肺泡灌洗液的病原菌检出率分别为27.2%(6463/23722)、33.5%(135/403)和48.9%(551/1128), 检出率差异有统计学意义($P<0.001$)。共分离到非重复菌株3824株, 门诊患者和住院患者来源的细菌数量比为1:6, 重症监护病房和其他病房来源的细菌数量比为1:7。分离株以革兰阴性菌为主(93.1%), 鲍曼不动杆菌复合群检出率最高(23.7%), 其次为铜绿假单胞菌(21.4%)、肺炎克雷伯菌(12.6%)、嗜麦芽窄食单胞菌(11.7%)和大肠埃希菌(4.6%); 革兰阳性菌占比为6.9%, 以金黄色葡萄球菌(3.2%)为主; 苛养菌占比为6.4%, 包括流感嗜血杆菌(3.9%)、卡他莫拉菌(1.6%)和肺炎链球菌(0.9%)。耐甲氧西林金黄色葡萄球菌检出率为41.8%(51/122), 耐碳青霉烯类的大肠埃希菌、肺炎克雷伯菌、鲍曼不动杆菌复合群和铜绿假单胞菌的检出率依次为12.0%(21/175)、18.1%(87/480)、69.9%(635/908)和29.3%(240/819)。与痰样本相比, 非痰样本的多重耐药菌检出率更高($P<0.01$)。结论 AECOPD患者下呼吸道检出病原菌中绝大多数为革兰阴性菌, 苛养菌检出率较低, 非痰样本的多重耐药菌检出率较高。

【关键词】 慢性阻塞性肺病急性加重期 病原菌 体外药物敏感性

Characteristics of the Pathogenic Bacteria Isolated from the Lower Respiratory Tract of the Patients With Acute Exacerbation of Chronic Obstructive Pulmonary Disease

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[Abstract] Objective To analyze the species distribution and in vitro susceptibility of pathogenic bacteria isolated from the lower respiratory tract of the patients with acute exacerbation of chronic obstructive pulmonary disease (AECOPD), and to provide guidance for the treatment of pulmonary infections in this kind of patients. **Methods** The AECOPD patients with suspected lower respiratory tract sample infection from January 2015 to December 2024 were included. The data of species identification and in vitro drug susceptibility testing results of pathogenic bacteria isolated from the lower respiratory tract were retrospectively collected. The detection rate, species distribution, in vitro susceptibility of predominant species, and ratios of multidrug-resistant (MDR) bacteria were compared among different sample types. Data were analyzed using WHONET 5.6 and SPSS 26.0 software. **Results** A total of 25253 lower respiratory tract samples from 3861 patients were included. The pathogen detection rates in sputum, aspirates and bronchoalveolar lavage fluids were 27.2% (6463/23722), 33.5% (135/403), and 48.9% (551/1128), respectively, with a statistically significant difference of detection rate ($P<0.001$). Among the 3,824 non-repetitive strains, the ratio of the

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isolates recovered from outpatients and emergency patients to those from inpatients is 1 : 6, and the ratio of the isolates from intensive care unit patients to those from other units is 1 : 7. Gram-negative bacteria accounted for 93.1%, with the predominant species including *Acinetobacter baumannii* complex (23.7%), *Pseudomonas aeruginosa* (21.4%), *Klebsiella pneumoniae* (12.6%), *Stenotrophomonas maltophilia* (11.7%), and *Escherichia coli* (4.6%). Gram-positive bacteria accounted for 6.9%, with *Staphylococcus aureus* was the most common species (3.2%). Fastidious bacteria accounted for 6.4%, including *Haemophilus influenzae* (3.9%), *Moraxella catarrhalis* (1.6%), and *Streptococcus pneumoniae* (0.9%). The detection rate of methicillin-resistant *S. aureus* (MRSA) was 41.8%. The detection rates of carbapenem-resistant *E. coli*, *K. pneumoniae*, *A. baumannii* complex, and *P. aeruginosa* were 12.0% (21/175), 18.1% (87/480), 69.9% (635/908), and 29.3% (240/819), respectively. Compared with sputum, non-sputum specimens showed a higher detection rate of MDR bacteria ($P < 0.01$). **Conclusion** Gram-negative bacteria were the predominant pathogenic bacteria detected from the low respiratory tract of AECOPD patients, with a low isolation rate of fastidious bacteria. Non-sputum samples exhibited a higher detection rate of MDR bacteria.

[Key words] Acute exacerbation of chronic obstructive pulmonary disease Pathogenic bacteria *In vitro* drug susceptibility

慢性阻塞性肺病是一种进行性呼吸系统疾病,其特征是气流受限、肺功能受损和气道炎症,可继发呼吸衰竭、心血管疾病和肺癌等^[1]。目前全球40岁及以上人群中该病的患病率为12.6%;2020–2050年,25岁及以上人群的病例数将增加23.0%;2050年全球病例预计达到近6亿人,带来约4326万亿美元经济负担,尤以中国和美国面临负担最重^[2–4]。慢性阻塞性肺病急性加重(acute exacerbation of chronic obstructive pulmonary disease, AECOPD)是该类患者死亡的主要原因^[5]。

感染是AECOPD的重要诱因,从约80.0%的AECOPD患者样本中可分离到病原菌^[6],从呼吸道样本分离的病原菌最多^[7]。有研究发现,细菌载量增加与患者肺功能下降和病情加重呈正相关,应尽早实施抗感染治疗^[8–9]。因此,本研究回顾性分析AECOPD患者下呼吸道分离病原菌的特征,为该类药物下呼吸道感染的早期管理提供参考。

1 资料与方法

1.1 对象

纳入四川大学华西医院2015年1月–2024年12月期间送检下呼吸道样本(包括:深部合格痰,气管分泌物和肺泡灌洗液)进行细菌学培养且临床诊断为AECOPD的患者。病例纳入标准:①有COPD病史;②出现急性加重期症状体征,如:咳嗽、呼吸困难、喘息和胸部不适等,排除标准:①年龄小于18岁;②数据缺失或不完整。

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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纳入患者的下呼吸道样本细菌分离情况,分析细菌检出率、菌种分布和体外药物敏感性检测结果,药敏结果的判定参照CLSI M100文

件^[10]和专家共识^[11]。对3类或3类以上测试药物均耐药的细菌被定义为多重耐药菌^[12]。非痰样本包括肺泡灌洗液和气管分泌物。

1.3 统计学方法

分类变量以频数(%)表示。采用WHONET 5.6软件分析细菌的菌种分布(构成比)以及对测试抗菌药物的体外敏感性,以耐药率(R%)表示(单一菌种数量 ≥ 30 株)。采用SPSS26.0软件进行统计学分析,多组构成比/率的差异采用卡方检验。使用bonferroni法进行 P 值校正, $P < 0.05$ 为差异有统计学意义。

2 结果

2.1 患者基线情况

共纳入3861例患者,性别比为男:女=3.4:1,年龄中位数为73.9岁(四分位数间距为67~82岁),合并其他基础疾病的患者数量占总患者数量的8.2%(317/3861),主要基础疾病为心血管系统疾病(58.4%,185/317)、支气管扩张(25.6%,81/317)和糖尿病(6.9%,22/317)。

2.2 不同样本的细菌检出率

3861例患者共送检下呼吸道样本25253份,检出细菌的患者占比为69.4%(2679/3861)。共检出7149株细菌,检出率为28.3%(7149/25253),其中痰的检出率为27.2%(6463/23722),气道分泌物的检出率为33.5%(135/403),肺泡灌洗液的检出率为48.9%(551/1128),检出率差异具有统计学意义($P < 0.001$)。

2.3 分离细菌的菌种分布

剔除同一患者来源的重复菌株,共分离到3824株细菌,其样本来源主要为痰(71.6%,2737/3824),其次为气道分泌物(3.1%,120/3824)和肺泡灌洗液(25.3%,967/3824)。门诊患者和住院患者来源的细菌数量比为1:6,重症

监护病房(intensive care unit, ICU)患者和非ICU患者来源的细菌数量比为1 : 7。

分离株中革兰阴性菌占比为93.1%(3 561/3 824), 以鲍曼不动杆菌复合群(23.7%, 908/3 824)为主, 其次分别为铜绿假单胞菌(21.4%, 819/3 824)、肺炎克雷伯菌

(12.6%, 480/3 824)、嗜麦芽窄食单胞菌(11.7%, 446/3 824)和大肠埃希菌(4.6%, 175/3 824); 革兰阳性菌占比为6.9%(263/3 824), 以金黄色葡萄球菌(3.2%, 122/3 824)为主; 不同样本主要检出细菌的分布差异无统计学意义($\chi^2=5.70, P=0.091$), 具体见表1所示。

表 1 AECOPD患者不同下呼吸道样本的细菌检出率

Table 1 Detection rate of bacteria from different lower respiratory specimens of AECOPD patients

Organisms	Total		BALF		Sputum		Tracheal	
	n	%	n	%	n	%	n	%
<i>Acinetobacter calcoaceticus-baumannii</i> complex	908	23.7	314	29.3	576	21.6	18	22.8
<i>Pseudomonas aeruginosa</i>	819	21.4	236	22.0	566	21.2	17	21.5
<i>Klebsiella pneumoniae</i> ss. <i>pneumoniae</i>	480	12.6	122	11.4	344	12.9	14	17.7
<i>Stenotrophomonas maltophilia</i>	446	11.7	124	11.6	314	11.8	8	10.1
<i>Escherichia coli</i>	175	4.6	48	4.5	125	4.7	2	2.5
<i>Enterobacter cloacae</i>	158	4.1	43	4.0	110	4.1	5	6.3
<i>Haemophilus influenzae</i>	148	3.9	30	2.8	117	4.4	1	1.3
<i>Staphylococcus aureus</i> ss. <i>aureus</i>	122	3.2	27	2.5	92	3.4	3	3.8
<i>Corynebacterium striatum</i>	82	2.2	18	1.7	64	2.4	1	1.3
<i>Moraxella</i> (Branh.) <i>catarrhalis</i>	61	1.6	13	1.2	48	1.8	0	0.0
Other species	424	11.1	98	9.1	316	11.8	10	12.7
Total	3 824	100.0	1 073	100.0	2 672	100.0	79	100.0

BALF: Bronchoalveolar lavage fluid

苛养菌占分离株的6.4%(244/3 824), 其中流感嗜血杆菌占比为3.9%(148/3 824); 卡他莫拉菌占比为1.6%(61/3 824); 肺炎链球菌占比为0.9%(35/3 824)。

门急诊患者样本检出菌株占比为14.4%(549/3 824), 主要包括铜绿假单胞菌(25.9%, 142/549)、鲍曼不动杆菌复合群(25.0%, 137/549)、肺炎克雷伯菌(10.9%, 60/549)、嗜麦芽窄嗜单胞菌(8.2%, 45/549)和流感嗜血杆菌(7.1%, 39/549)。

住院患者样本检出菌株占比为85.6%(3 275/3 824), 主要包括鲍曼不动杆菌复合群(23.5%, 771/3 275)、铜绿假单胞菌(20.7%, 677/3 275)、肺炎克雷伯菌(12.8%, 420/3 275)、嗜麦芽窄嗜单胞菌(12.2%, 401/3 275)和大肠埃希菌(4.5%, 149/3 275)。其中ICU患者来源菌株占比为12.3%(404/3 275), 以鲍曼不动杆菌复合群(39.9%, 161/404)、铜绿假单胞菌(17.1%, 69/404)和肺炎克雷伯菌(12.1%, 49/404)为主; 非ICU患者来源菌株占比为87.7%(2 871/3 275), 以铜绿假单胞菌(21.5%, 616/2 871)、鲍曼不动杆菌复合群(21.1%, 605/2 871)和肺炎克雷伯菌(21.1%, 368/2 871)为主。

2.4 主要细菌对抗菌药物的体外敏感性

2.4.1 鲍曼不动杆菌复合群

908株鲍曼不动杆菌复合群对测试药物的耐药率大多高于60%, 对亚胺培南的耐药率为69.9%, 对美罗培

南的耐药率为62.4%, 对多黏菌素的耐药率为0.6%。除阿米卡星和妥布霉素外, 痰分离菌株对其他测试药物的耐药率低于非痰样本分离菌株的耐药率($P<0.05$), 如图1所示。

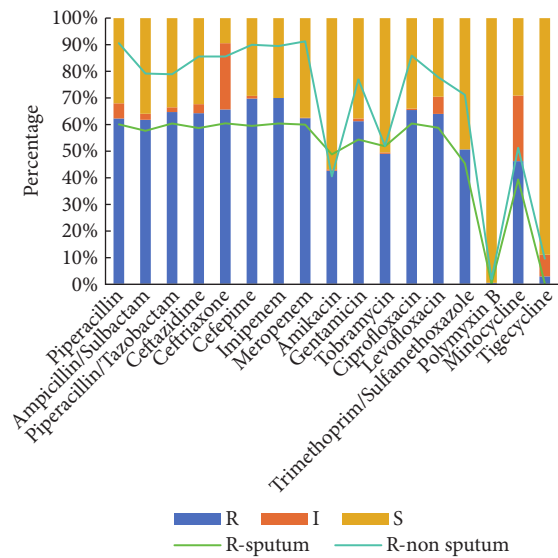


图 1 AECOPD患者下呼吸道样本分离的鲍曼不动杆菌复合群体外药物敏感性

Fig 1 In vitro susceptibility of *Acinetobacter baumannii* complex from lower respiratory specimens of AECOPD patients

R: resistant; S: susceptible; I: intermediate.

2.4.2 铜绿假单胞菌

819株铜绿假单胞菌对碳青霉烯类药物的耐药率较高,对头孢他啶的耐药率为18.2%,对亚胺培南的耐药率为29.3%,对美罗培南的耐药率为15.3%,对庆大霉素、妥布霉素、阿米卡星的耐药率分别为7.6%、4.0%和3.4%,未发现对多黏菌素B耐药的菌株。除哌拉西林/他唑巴坦和环丙沙星外,痰分离菌株对其他测试药物的耐药率低于非痰样本分离菌株的耐药率($P < 0.05$),如图2所示。

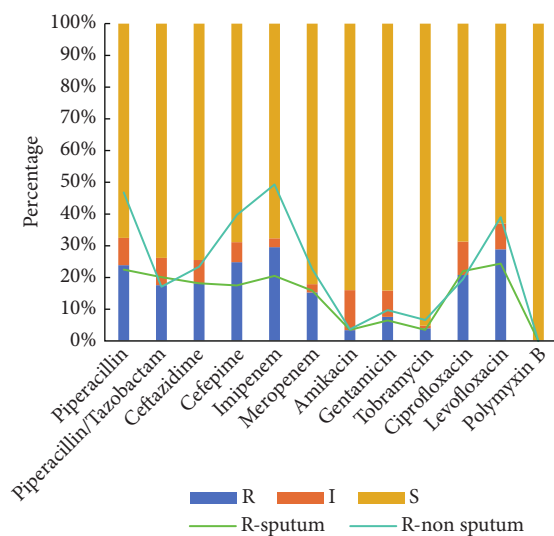


图2 AECOPD患者下呼吸道样本分离的铜绿假单胞菌体外药物敏感性
Fig 2 *In vitro* susceptibility of *Pseudomonas aeruginosa* from lower respiratory specimens of AECOPD patients

R: resistant; S: susceptible; I: intermediate.

2.4.3 肺炎克雷伯菌

480株肺炎克雷伯菌对头孢他啶的耐药率为29.1%,对亚胺培南和美罗培南的耐药率分别为18.1%和19.1%,对多黏菌素B和替加环素的耐药率分别为4.3%和1.4%。除哌拉西林/他唑巴坦、阿米卡星和多黏菌素外,痰分离菌株对其他测试药物的耐药率低于非痰样本分离菌株的耐药率($P < 0.05$),如图3所示。

2.4.4 嗜麦芽窄嗜单胞菌

446株嗜麦芽窄嗜单胞菌对头孢他啶的耐药率为38.1%,对米诺环素和替加环素的耐药率均低于10.0%。痰分离菌株对米诺环素的耐药率低于非痰样本分离菌株的耐药率($P < 0.05$),如图4所示。

2.4.5 大肠埃希菌

175株大肠埃希菌对头孢他啶、亚胺培南和美罗培南的耐药率分别为33.8%、12.0%和4.0%,未发现对多黏菌素B和替加环素耐药的菌株。除氨苄西林和哌拉西林/他唑巴坦外,痰分离菌株对其他测试药物的耐药率低于非痰样本分离菌株的耐药率($P < 0.05$),如图5所示。

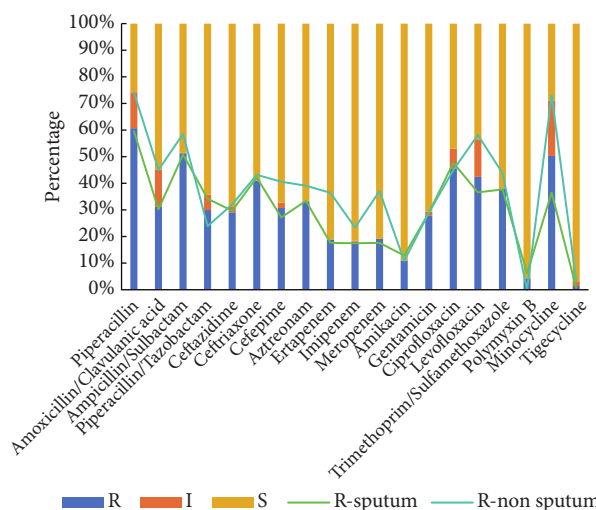


图3 AECOPD患者下呼吸道样本分离的肺炎克雷伯菌体外药物敏感性
Fig 3 *In vitro* susceptibility of *Klebsiella pneumoniae* from lower respiratory specimens of AECOPD patients

R: resistant; S: susceptible; I: intermediate.

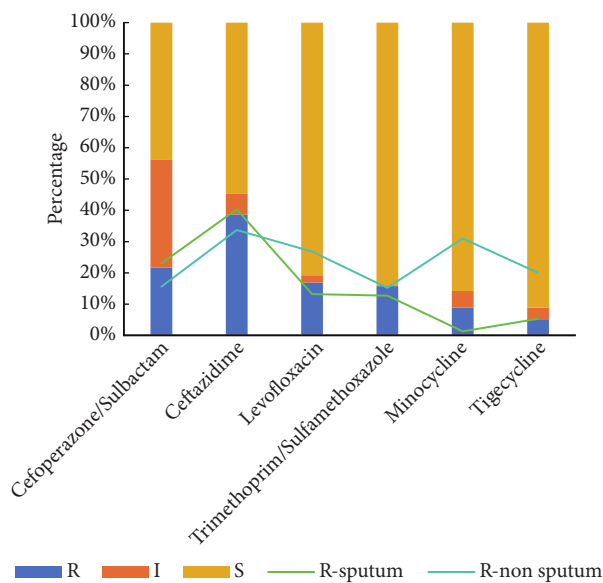


图4 AECOPD患者下呼吸道样本分离的嗜麦芽窄嗜单胞菌体外药物敏感性
Fig 4 *In vitro* susceptibility of *Stenotrophomonas maltophilia* from lower respiratory specimens of AECOPD patients

R: resistant; S: susceptible; I: intermediate.

2.4.6 金黄色葡萄球菌

122株金黄色葡萄球菌对苯唑西林和利奈唑胺的耐药率分别为41.8%和4.5%,未发现对万古霉素和替加环素耐药的菌株。除青霉素和四环素外,痰分离菌株对其他测试药物的耐药率低于非痰样本分离菌株的耐药率($P < 0.05$),如图6所示。

2.4.7 苛养菌

148株流感嗜血杆菌对氨苄西林和氨苄西林/舒巴坦

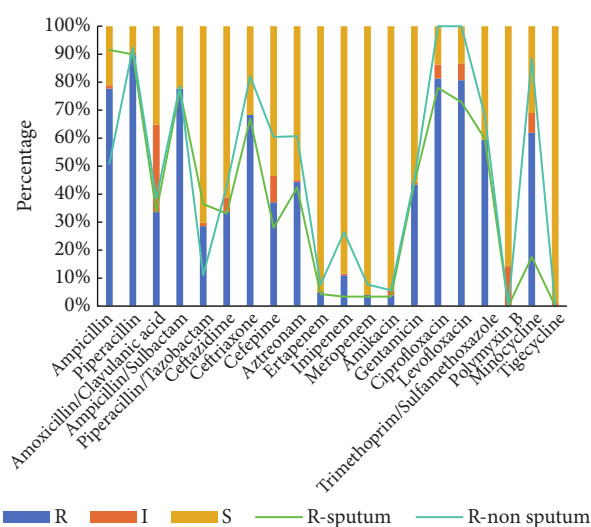


图5 AECOPD患者下呼吸道样本分离的大肠埃希菌体外药物敏感性
Fig 5 *In vitro* susceptibility of *Escherichia coli* from lower respiratory specimens of AECOPD patients

R: resistant; S: susceptible; I: intermediate.

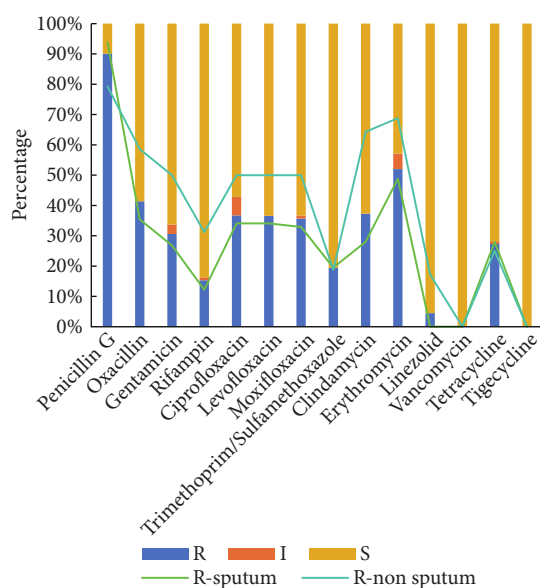


图6 AECOPD患者下呼吸道样本分离的金黄色葡萄球菌体外药物敏感性
Fig 6 *In vitro* susceptibility of *Staphylococcus aureus* from lower respiratory specimens of AECOPD patients

R: resistant; S: susceptible; I: intermediate.

的耐药率分别为67.2%和77.5%,对头孢噻肟、美罗培南和氯霉素的耐药率均低于15.0%;痰分离菌株对氨苄西林、氨苄西林/舒巴坦和美罗培南的耐药率均高于非痰样本分离菌株的耐药率($P < 0.05$)。61株卡他莫拉菌对常用抗生素的耐药率均低于20.0%,35株肺炎链球菌对青霉素的耐药率为10.5%,如图7、图8所示。

2.5 多重耐药菌检出率

耐碳青霉烯鲍曼不动杆菌(carbapenem-resistant *Acinetobacter baumannii*, CRAB)的检出率为69.9%

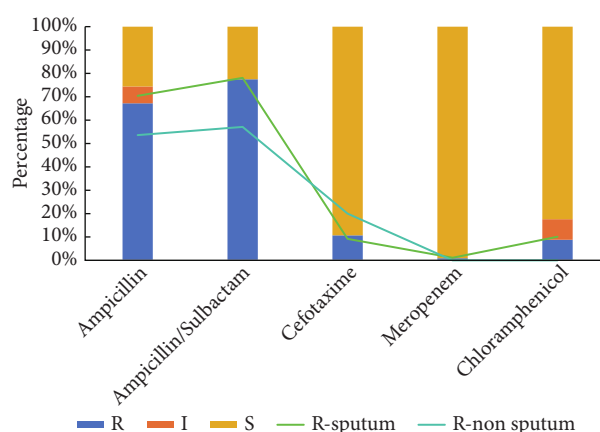


图7 AECOPD患者下呼吸道样本分离的流感嗜血杆菌体外药物敏感性
Fig 7 *In vitro* susceptibility of *Haemophilus influenzae* from lower respiratory specimens of AECOPD patients

R: resistant; S: susceptible; I: intermediate.

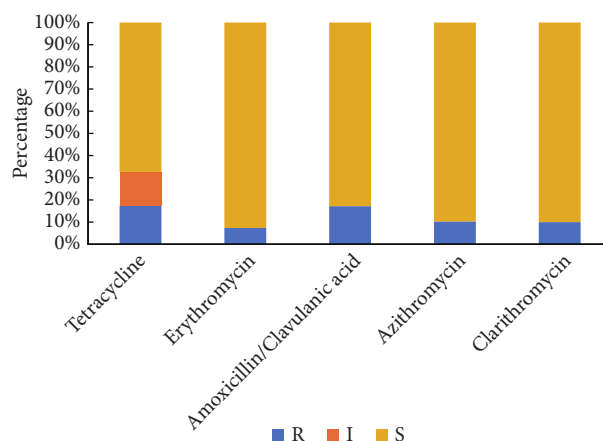


图8 AECOPD患者下呼吸道样本分离的卡他莫拉菌体外药物敏感性
Fig 8 *In vitro* susceptibility of *Moraxella (Branh.) catarrhalis* from lower respiratory specimens of AECOPD patients

R: resistant; S: susceptible; I: intermediate.

(635/908),耐甲氧西林金黄色葡萄球菌(methicillin-resistant *Staphylococcus aureus*, MRSA)的检出率为41.8%(51/122),耐碳青霉烯铜绿假单胞菌(carbapenem-resistant *Pseudomonas aeruginosa*, CRPA)的检出率为29.3%(240/819),耐碳青霉烯肺炎克雷伯菌(carbapenem-resistant *Klebsiella pneumoniae*, CRKP)和耐碳青霉烯大肠埃希菌(carbapenem-resistant *Escherichia coli*, CREC)的检出率分别为18.1%(87/480)和12.0%(21/175)。如表2所示,相对于痰样本,MRSA、CRE和CRPA在非痰样本的多重耐药菌检出率更高($P < 0.01$)。

3 讨论

肺部感染是AECOPD最常见的诱因^[13]。肺部感染能激活炎症细胞产生炎症介质,导致呼吸道黏液增加和肺

表 2 AECOPD患者不同下呼吸道样本多重耐药菌检出率

Table 2 Detection rate of Multidrug-Resistant bacteria in lower respiratory specimens of AECOPD patients

Bacteria	Total	Sputum	Non-sputum	χ^2	P
MRSA	41.2%	35.1%	57.1%	13.552	< 0.001
CREC	11.9%	3.8%	27.5%	28.632	< 0.001
CRKP	17.3%	17.0%	22.4%	7.654	0.018
CRAB	69.7%	59.6%	89.5%	8.657	0.011
CRPA	29.3%	19.5%	49.4%	19.532	< 0.001

MRSA: methicillin-resistant *Staphylococcus aureus*; CREC: carbapenem-resistant *Escherichia coli*; CRKP: carbapenem-resistant *Klebsiella pneumoniae*; CRAB: carbapenem-resistant *Acinetobacter baumannii*; CRPA: carbapenem-resistant *Pseudomonas aeruginosa*; Non-sputum species: aspirates, bronchoalveolar lavage fluids.

泡破裂,如不及时有效治疗,可导致不良预后^[14-15]。因此,针对这类患者的肺部感染应尽早有效管理。本研究回顾性分析近10年我院收治的3 861例AECOPD患者,年龄中位数为73.9岁,以男性为主,常见的基础疾病为心血管系统疾病、支气管扩张和糖尿病。研究报道,AECOPD合并支气管扩张患者肺部感染的发病率和死亡率更高^[16]。因此,对于有合并症的AECOPD患者,应尽早明确感染诊断并实施抗感染治疗。

细菌是引起AECOPD患者肺部感染的重要病原体^[17]。本研究结果显示:AECOPD患者肺泡灌洗液和气管分泌物的细菌检出率高于痰的细菌检出率,提示针对AECOPD疑似发生下呼吸道感染患者,可优先送检非痰样本进行细菌分离培养,但这类样本的采集要求较高,需评估患者情况进行采集。革兰阴性菌为主要分离菌,前五种革兰阴性菌占有所有分离细菌的74.0%(2 828/3 824);革兰阳性菌中金黄色葡萄球菌为主要分离菌,占有所有分离细菌的3.2%(122/3 824)。2021年全国细菌耐药监测网针对呼吸科的细菌耐药监测报告显示,全国呼吸道样本分离细菌中,前5位分别为肺炎克雷伯菌(21.1%)、铜绿假单胞菌(18.1%)、鲍曼不动杆菌复合群(9.3%)、大肠埃希菌(8.5%)和金黄色葡萄球菌(5.5%)^[18],但COPD患者肺部感染的病原体分布具有较强的地区差异^[19],这与患者基础疾病、呼吸道病原菌区域流行病学等因素有关,提示进一步了解本地区AECOPD患者呼吸道病原菌的流行病学特征,有利于AECOPD患者肺部感染的预防和控制。

值得注意的是,本研究中住院患者鲍曼不动杆菌复合群和铜绿假单胞菌的分离率均超过20.0%。有报道指出,鲍曼不动杆菌复合群在COPD患者中的分离率为11.5%,是院内获得性肺炎或呼吸机相关肺炎患者的主要分离细菌^[20];也有研究报道,从AECOPD住院患者中分离

的细菌以铜绿假单胞菌(17.8%)为主,其次是肺炎链球菌(9.0%)和肺炎克雷伯菌(7.8%)^[21]。还有研究发现,铜绿假单胞菌定植是引发AECOPD的独立风险因素,呼吸道样本多次分离出铜绿假单胞菌是AECOPD患者死亡风险增高的因素^[22-23]。因此,对于AECOPD住院患者应密切关注这类细菌引起的感染。

另外,本研究纳入患者呼吸道样本中,苛养菌的总体检出率为6.4%,肺炎链球菌、卡他莫拉菌和流感嗜血杆菌的检出率分别为0.9%、1.6%和3.9%。2021年全国细菌耐药监测网呼吸科细菌监测结果显示,肺炎链球菌、卡他莫拉菌、流感嗜血杆菌分别为5.0%、2.0%和4.9%^[18]。国内一项多中心研究发现,引起AECOPD患者肺部感染的主要细菌为流感嗜血杆菌(10.7%)、肺炎克雷伯菌(10.4%)、肺炎链球菌(7.4%)、金黄色葡萄球菌(4.5%)和卡他莫拉菌(2.6%)^[24]。一项国际多中心研究结果指出,AECOPD患者肺部感染主要细菌包括肺炎链球菌(8.0%)、铜绿假单胞菌(7.0%)和流感嗜血杆菌(3.0%)^[25]。苛养菌的检出率与样本送检之前抗菌药物使用情况、样本是否及时送检和接种、患者人群来源等因素有关。

本研究分离主要细菌的体外药物敏感性分析结果显示:鲍曼不动杆菌复合群对测试药物的耐药率大多超过60.0%;铜绿假单胞菌、肺炎克雷伯菌和嗜麦芽窄谱单胞菌的耐药率大多低于40.0%;大肠埃希菌对青霉素类抗生素的耐药率超过70.0%,但对除氨基苄西林/舒巴坦外的酶抑制剂复合青霉素类抗生素的耐药率均低于40.0%;金黄色葡萄球菌对苯唑西林的耐药率为41.8%,有研究提示金黄色葡萄球菌的生物膜会降低其对抗生素的敏感性^[26]。据报道,AECOPD患者痰分离的鲍曼不动杆菌复合群和铜绿假单胞菌对黏菌素、妥布霉素和庆大霉素的敏感性超过80.0%,肺炎克雷伯菌对测试药物的体外敏感性超过80.0%^[27];AECOPD患者呼吸道分离细菌的总体耐药率呈上升趋势,肺炎克雷伯菌、鲍曼不动杆菌复合群和大肠杆菌对四环素类抗生素的体外敏感性高,铜绿假单胞菌对氨基糖苷类和氟喹诺酮类的敏感性高^[28]。以上提示不同国家和地区从AECOPD患者分离的菌株耐药表型存在差异,应进一步评估分离菌株的耐药机制。

值得注意的是,本研究纳入的AECOPD患者下呼吸道分离的多重耐药菌中,CRAB的检出率最高(69.9%),MRSA的检出率次之(41.8%),CRPA、CREC和CRKP的检出率分别为29.3%、12.0%和18.1%。2021年全国细菌耐药监测网对呼吸道样本的多重耐药菌监测报道指出:CRAB和MRSA检出率分别为47.7%和34.2%,CRPA、CREC、CRKP的检出率依次为16.2%、2.4%和9.5%^[18]。欧

洲一项多中心前瞻性队列研究显示:发生下呼吸道感染的ICU患者,呼吸道各类样本中CRAB和MRSA检出率9.1%和5.2%,CRPA、CREC和CRKP的检出率依次为14.5%、5.9%和9.9%^[29]。由此可见,本研究纳入患者多重耐药菌检出率较高,这可能导致疾病严重程度、恶化频率和死亡率增加^[30],提示针对AECOPD患者下呼吸道感染应尽早分离病原菌并进行体外药物敏感性测试,有利于及时调整治疗方案。

另外,本研究还发现,非痰样本MRSA、CRE和CRPA的检出率较高,提示针对AECOPD疑似发生下呼吸道感染患者,尽量送检非痰样本进行病原菌分离和体外药敏结果,可改善患者治疗有效性^[31]。

综上所述,AECOPD患者下呼吸道分离细菌以革兰阴性菌为主,苛养菌检出率较低;相对于痰分离细菌,非痰样本分离细菌的耐药性较高,多重耐药菌检出率高,对于有明确肺部感染临床表现的患者应尽早实施抗感染治疗。

* * *

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Author Contribution WANG Yuanfang is responsible for formal analysis and writing--original draft. WU Chongyang, JIANG Ziyang, and DENG Jin are responsible for data curation and investigation. HE Chao is responsible for conceptualization, project administration, and writing--review and editing. All authors consented to the submission of the article to the Journal. All authors approved the final version to be published and agreed to take responsibility for all aspects of the work.

利益冲突 所有作者均声明不存在利益冲突

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