# Sputum Bacteriology And In-Vitro Antibiotic Susceptibility In Hospitalized Patients With Community Acquired Pneumonia In A State Tertiary-Referral Hospital – A Retrospective Study

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**Introduction:** To review the sputum bacteriology and its *in-vitro* antibiotic susceptibility in patients hospitalized with community-acquired pneumonia (CAP) in a state tertiary-referral Hospital (Penang hospital, Malaysia) in order to determine the most appropriate empiric antibiotics.

**Methods:** From September 2006 to May 2007, 68 immunocompetent adult patients [mean age: 52 years (range 16-89); 69% male] admitted to respiratory wards for CAP with positive sputum isolates within 48 hours of admission were retrospectively identified and reviewed.

**Results:** 62 isolates were Gram(-) bacilli (91%) & 6 were Gram(+) cocci (9%). The two commonest pathogens isolated were *Pseudomonas aeruginosa* (n=20) and *Klebsiella pneumoniae* (n=19) which together constituted 57% of all positive isolates. Among the *Pseudomonas* isolates, 84.2% were fully sensitive to cefoperazone and cefoperazon/sulbactam; 95% to ceftazidime, cefepime, piperacillin/tazobactam, ciprofloxacin and amikacin, and 100% to gentamycin, netilmycin, imipenem and meropenem. Among the *Klebsiella* isolates, 5.3% were fully sensitive to ampicillin; 84.2% to amoxicillin, ampicllin/sulbactam, cefuroxime and ceftriazone; 89.5% to piperacillin/tazobactam; 93.3% to cefoperazon/sulbactam and 100% sensitive to ceftazidime, cefepime, ciprofloxacin, all aminoglycosides and carbopenems.

**Conclusion:** In view of the high prevalence of respiratory *Pseudomonas aeruginosa*, ampicillin/sulbactam, currently the most prescribed antibiotic to treat CAP in our respiratory wards, may not be the most appropriate empiric choice. Higher generation cephalosporins with or without beta-lactamase inhibitors, ciprofloxacin or carbapenem may be the more appropriate choices. The lack of information on patients' premorbidities such as recent hospitalization and prior antibiotic exposure, limits the interpretation of our findings and may have biased our results towards higher rates of Gram negative organisms.

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*Key Words: Antibiotic sensitivity, Community-acquired pneumonia, Penang hospital, Sputum bacteriology*

## Introduction

Community–acquired pneumonia (CAP) is a common condition that brings about morbidity and mortality. Pneumonia was ranked the 6th main cause of death for patients hospitalized in Penang government hospitals, Malaysia, in the year 2005[1], and it remains the leading cause of death in many developed[2] and developing countries[3-4]. It is now recognized that prognosis is significantly dependant on treating these pneumonias early[5] and with the most appropriate empirical antibiotics based on the local microbial susceptibility data.[6]

Numerous bacteriology reports from western[7-12] and Asian[13-16] countries have consistently identified *Streptoccocal pneuomoniae* as the commonest causative agent for CAP. However, several studies from local hospitals in Malaysia had shown a different spectrum of microorganisms[6, 17-20] where Gram negative bacilli such as *Klebsiella* spp, constantly stood out above the rest. Currently, data is being collected on antibiotic susceptibility of these typical CAP pathogens in various institutions in Malaysia. To this end, we conducted a retrospective study to review the pattern of sputum bacteriology and its *in-vitro* antibiotic susceptibility in patients hospitalized with CAP in our state 1200 bed tertiary-referral hospital (Penang hospital, Malaysia) with the view of help identifying the most appropriate empirical antibiotics for our local practices.

## Methods

From September 2006 to May 2007, 68 adult patients [mean age: 52 years (range 16-89); 69% male] admitted to our respiratory wards for CAP, with positive sputum isolates within 48 hours of admission, were retrospectively identified and reviewed. CAP was defined as an acute illness with radiographic pulmonary shadowing that was at least segmental or present in one lobe, which was not pre-existing or of any other known cause, and which developed less than 48 hours of

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admission or before admission.[21] All age groups were included except for those under the age of 12 years. Patients with immunosuppression such as HIV infection, hematological or nonhematological malignancy with or without chemotherapy induced neutropenia, and those in whom sputum bacteriology were negative were excluded. Data was analyzed using descriptive statistics.

**Results**

Sixty two sputum isolates were Gram (-) bacilli (91%) and 6 were Gram (+) cocci (9%) (Figure 1). The two commonest pathogens isolated were *Pseudomonas aeruginosa* (n=20) and *Klebsiella pneumoniae* (n=19) which together constituted 57% of all positive isolates (Table I). Among the *Pseudomonas* isolates, 84.2% were fully sensitive to cefoperazone and cefoperazon/sulbactam; 95% to ceftazidime, cefepime, piperacillin/tazobactam, ciprofloxacin and amikacin, and 100% to gentamycin, netilmycin, imipenem and meropenem (Figure 2). Among the *Klebsiella* isolates, only 5.3% were sensitive to ampicillin; 84.2% were fully sensitive to amoxicillin, ampicllin/sulbactam, cefuroxime and ceftriazone; 89.5% to piperacillin/tazobactam; 93.3% to cefoperazon/sulbactam and 100% to ceftazidime, cefepime, ciprofloxacin, gentamycin, amikacin, netilmycin, imipenem and meropenem (Figure 3).

Susceptibility to ampicillin/sulbactam in *Pseudomonas species* is not routinely tested in our hospital in view of its intrinsic resistance. However, *Klebsiella pneumoniae* was highly susceptible to this antibiotic (84.2%). Susceptibility to cefotaxime was not tested in both *Pseudomonas* & *Klebsiella* isolates.

**Discussion**

The most frequently isolated pathogen in our study was *Pseudomonas aeruginosa* followed by *Klebsiella pneuomoniae*, in contrast to reports from the west[7-12] as well as from many Asian countries, including our neighboring countries such as Singapore[13] and Thailand[14-16], stating that *Streptococcal pneumonia* was the leading causative agent in patients hospitalized with CAP. This finding is also somewhat different from other local Malaysian studies[6, 17-20] which showed *Klebsiella pneumoniae* as the first or second ranking CAP pathogen, but did not find such a high prevalence of *Pseudomonas aeruginosa*. Very few Gram positive cocci were isolated and no *Hemophilus influenzae* and *Moraxella catarrharis* were identified. There was also no Extended-Spectrum Beta-Lactamase producer among the *Enterobactericae* isolates.

The reason for the high *Pseudomonas aeruginosa* prevalence in our study is unclear. It is postulated that higher percentage of our patients who acquired CAP, could possibly also have been having coexisting chronic lung disease such as bronchiectasis and destructive lung due to previous Pulmonary Tuberculosis. This might have contributed to the high rate of *Pseudomonas aeruginosa* isolation, as it is known that *Pseudomonas aeruginosa* commonly colonizes and sometime causes overt infection in the destructive lungs.[22-25] The second postulate for our finding is that, as a tertiary referral medical center, we receive CAP patients with a wide range of disease severity, many of them carrying multiple co-morbidities. These patients might have been exposed to antibiotics for treatment of respiratory tract related or non respiratory tract related infections prior to admission to our wards, this inevitably would pose a risk to the patients contracting infections which are literally caused by hospital acquired pathogens.

In view of such a high prevalence of *Pseudomonas aeruginosa*, ampicillin/sulbactam, currently the most prescribed antibiotic to treat CAP in our respiratory wards, may not be the most appropriate empiric choice. Higher generation cephalosporins with or without beta-lactamase inhibitors (such as ceftazidime, cefoperazone, cefepime, cefoperazone/sulbactam), ciprofloxacin, piperacillin/tazobactam or carbapenems may be the more appropriate choices. If *pseudomonas* spp is the likely causative agent, then cefotaxime and antibiotics with oral preparations (such as cefuroxime, cotrimoxazole, amoxicillin & ampicillin/sulbactam) should best be avoided.

The interpretation of the findings in our study is hampered by several important methodology weaknesses. Firstly, the lack of information on the patients' premorbidities such as pre-existing chronic lung disease, recent hospitalization or prior antibiotic exposure, limits the interpretation of our findings, and may have biased our results towards higher rates of Gram negative organisms. Better patient characterization and more reliable history profiles that explore patients' co-morbidities and risks for Healthcare-associated pneumonia (HCAP) as defined by American Thoracic Society[26] may help to clarify the authenticity of our findings. Secondly, the exclusion of other patients due to incomplete medical data and the inherent weaknesses of a retrospective study can create bias to our findings and reduces the validity of our results. In our study, we only sought to collect data that were indisputable i.e. key patient demographics, microbial laboratory results and evidence of pneumonia requiring hospital treatment, and avoided data that were based on doctors' case notes as they can be highly variable and dependant on whether specific issues were recorded. Finally, to differentiate between a harmless colonizer or contaminate with an invasive pathogen can be difficult, especially in a poorly collected sputum specimen. Since the quality of the sputum was not always stated in the case notes or in the culture reports of our patients, we therefore adhered strictly to the definition of CAP as the inclusion criteria for this study in order to minimize the likelihood of considering the colonized organisms or contaminants an infection.

It is obvious that antibiotic guidelines for CAP treatment recommended by foreign institutions should not be adopted entirely, because of the differences in microbial etiology, antibiotic susceptibility, and antibiotic prescribing policies in various countries and regions. Collecting local data on CAP pathogens and antibiotic susceptibility will help to establish own local prescribing policies that will improve mortality and morbidity in patients with CAP hospitalized in local hospital.

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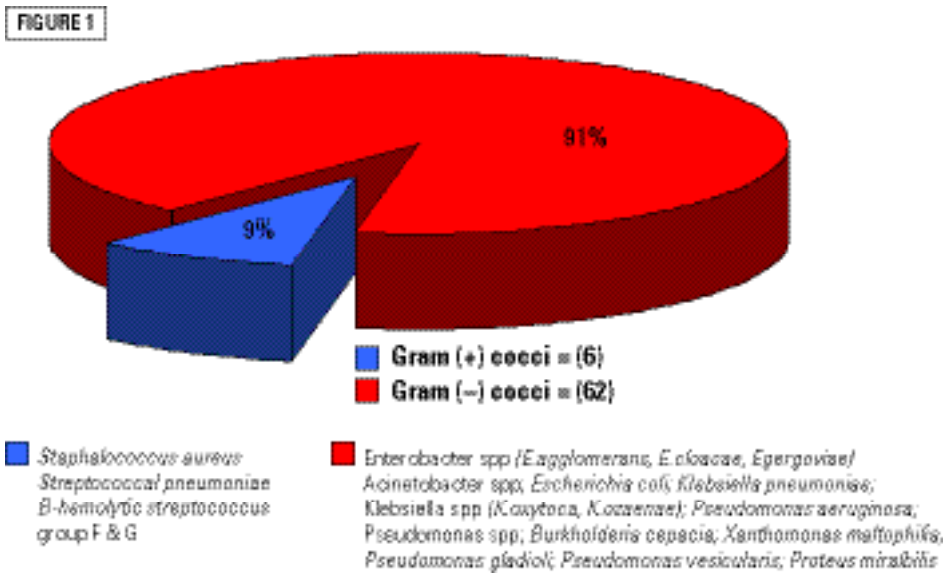
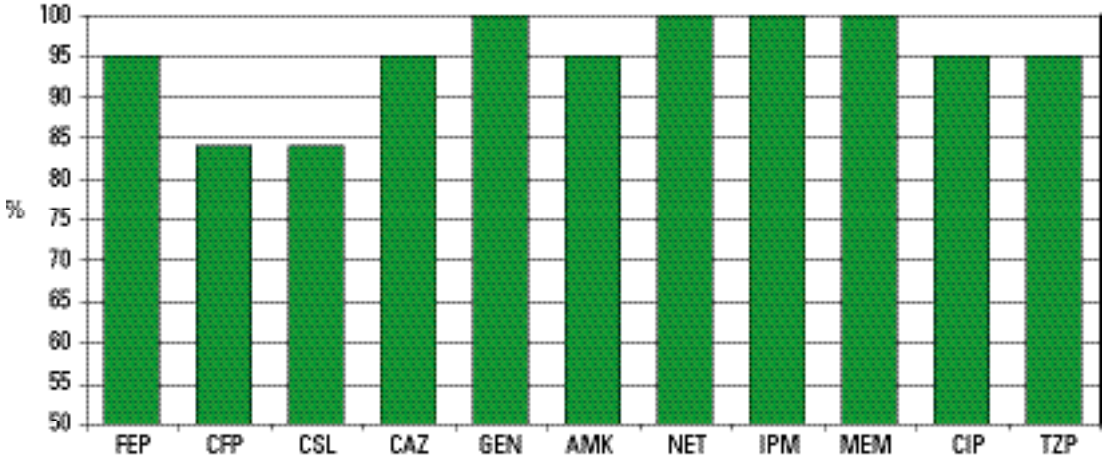



**FIGURE 1 : Percentage of Gram Positive & Gram Negative Bacteria in Sputum Isolates.**

**Table 1 : Microbial etiology in hospitalized patient with Community-acquired pneumonia**

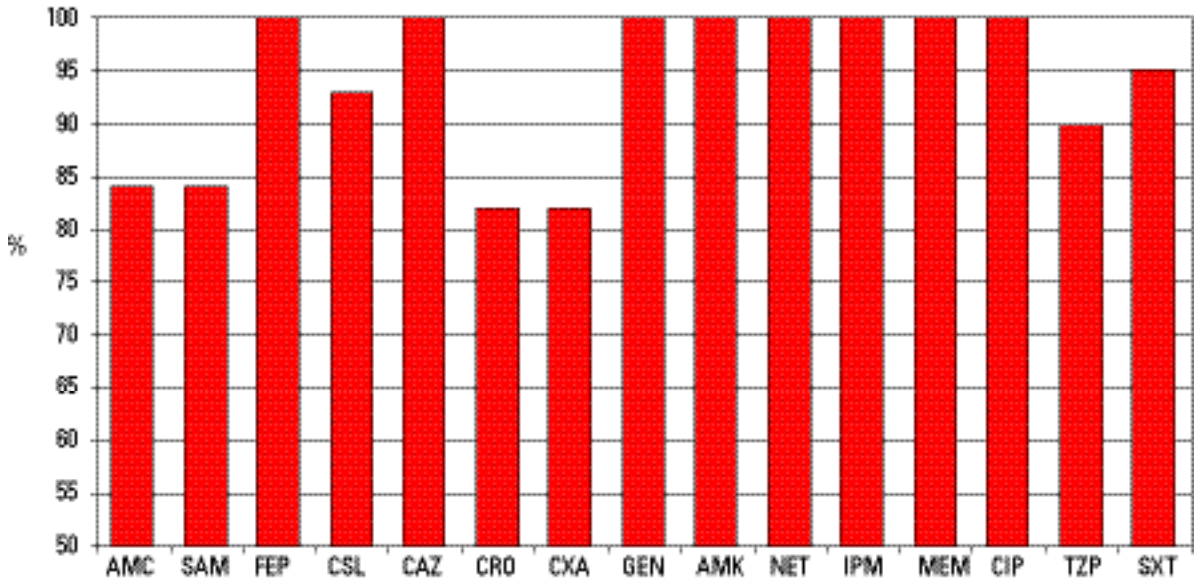
| MICROORGANISMS | PATIENTS |
|---|---|
| Pseudomonas aeruginosa | 20 |
| Klebsiella pneumoniae | 19 |
| Enterobacter spp (E.agglomerans,E.cloacae,E.gergoviae) | 9 |
| Klebsiella spp (K.oxytoca,K.ozaenae) | 4 |
| Escherichia coli | 3 |
| Staphalococcus aureus | 3 |
| Acinetobacter spp | 2 |
| Beta-hemolytic streptococcus group F&G | 2 |
| Pseudomonas spp | 2 |
| Pseudomonas maltophilia | 2 |
| Burkholderia cepacia | 1 |
| Pseudomonas gladioli | 1 |
| Pseudomonas vesicularis | 1 |
| Streptococcal pneumoniae | 1 |
| Proteus miralbilis | 1 |
| **TOTAL** | **68** |




**ANTIBIOTICS**

**FEP** = Cefepime, **CFP** = Cefoperazone, **CSL** = Cefoperazone / Sulbactam, **CAZ** = Ceftazidime, **GEN** = Gentamycin, **AMK** = Amikacin, **NET** = Netilmycin, **IPM** = Imipenem, **MEM** = Meropenem, **CIP** = Ciprofloxaxin, **TZP** = Piperacilin / Tazobactam

**FIGURE 2 : Percentage of** Pseudomonas Aeruginosa**Susceptible to Antibiotics.**




**ANTIBIOTICS**

**AMC** = Amoxicillin, **SAM** = Ampicillin / Sulbactam, **FEP** = Cefepime, **CSL** = Cefoperazone / Sulbactam, **CAZ** = Ceftazidime, **CRO** = Ceftriaxone, **CXA** = Cefuroxime, **GEN** = Gentamycin, **AMK** = Amikacin, **NET** = netilmycin, **IPM** = Imipenem, **MEM** = Meropenem, **CIP** = Ciprofloxaxin, **TZP** = Piperacillin / Tazobactam, **SXT** = Cotrimoxazole

**FIGURE 3 : Percentage of** Klebsiella Pneumoniae**Susceptible to Antibiotics**