DIAGNOSIS OF SPUTUM CULTURE POSITIVE ORGANISMS AND THEIR ANTIMICROBIAL SENSITIVITY PROFILE IN A TERTIARY CARE CENTRE- KANYAKUMARI

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ABSTRACT

BACKGROUND
Lower respiratory tract infections are quite common in the general population occurring with increased frequency in older individuals and younger children and those with chronic diseases or compromised immune function. Aetiologic diagnosis of the responsible pathogen is made by culture of respiratory tract secretions or by isolation of a compatible organism from blood (or pleural fluid) cultures. While a positive blood or pleural fluid culture definitely identifies the pathogen, an organism growing from a respiratory specimen is not as readily implicated as the aetiologic agent. Many organisms maybe normal flora or colonisers of the respiratory tract and not responsible for the clinical syndrome. As a result, there is considerable controversy about the diagnostic value of many respiratory specimens. A rationale approach to specimen collection and the interpretation of results must be used if clinically useful information is to be obtained.

Lower respiratory tract infection- An acute illness (present for 21 days or less), usually with cough as the main symptom with at least one other lower respiratory tract symptom (sputum production, dyspnoea, wheeze or chest discomfort/pain) and no alternative explanation (e.g. sinusitis or asthma).

Acute Bronchitis (AB)- An acute illness occurring in a patient without chronic lung disease with symptoms including cough, which may or may not be productive and associated with other symptoms or clinical signs that suggest LRTI and no alternative explanation (e.g. sinusitis or asthma).

Influenza- An acute illness usually with fever together with the presence of one or more of headache, myalgia, cough or sore throat.

Community-Acquired Pneumonia (CAP)- An acute illness with cough and at least one of new focal chest signs, fever >4 days or dyspnoea/tachypnoea and without other obvious cause, but supported by chest radiograph findings of lung shadowing that is likely to be new. In the elderly, the presence of chest radiograph shadowing accompanied by acute clinical illness (unspecified) without other obvious cause.

Acute Exacerbation of COPD (AECOPD)- An event in the natural course of the disease characterised by a worsening of the patient's baseline dyspnoea, cough and/or sputum beyond day-to-day variability sufficient to warrant a change in management. If chest radiograph shadowing consistent with infection is present, the patient is considered to have CAP.

Acute Exacerbation of Bronchiectasis (AEBX)- In a patient with features suggestive of bronchiectasis, an event in the natural course of the disease characterised by a worsening in the patient's baseline dyspnoea and/or cough and/or sputum beyond day-to-day variability sufficient to warrant a change in management. If chest radiograph shadowing, consistent with infection is present, the patient is considered to have CAP.

MATERIALS AND METHODS
Sputum is the thick mucus or phlegm that is expelled from the lower respiratory tract (bronchi and lungs) through coughing; it is not saliva or spit. Care must be taken in the sample collection process to ensure that the sample is from the lower airways and not from the upper respiratory tract. In this study, we collected 851samples from the patients in whom lower respiratory tract infections were suspected in a tertiary care centre- Kanyakumari district during the year January 2016-June 2016.

RESULTS
Sputum cultures were positive for 29% of the patients. Among these cultures, Klebsiella pneumonia (73%), Pseudomonas aeruginosa (19%), Staphylococcus aureus (4%) and others (Acinetobacter and Streptococcus pneumonia) (5%) were the common organisms found. Highest antimicrobial sensitivity amongst these pathogens was found with cefoperazone/sulbactam and amikacin.

CONCLUSION
Cefoperazone/sulbactam and amikacin were the highly sensitive systemic antibiotics while ciprofloxacin and co-trimoxazole were the sensitive oral antibiotics in our locality.

KEYWORDS
Sputum Culture Positive Organisms, Antimicrobial Sensitivity Profile, LRTIs.

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BACKGROUND

Bacterial sputum cultures detect the presence of disease-causing bacteria (pathogens) in people who are suspected of having bacterial pneumonia or other lower respiratory tract infections. Bacteria in the sample are identified and susceptibility testing is performed to guide antibiotic treatment.

Sometimes, a respiratory infection is caused by a pathogen that cannot be grown and identified with a routine bacterial sputum culture. Other tests, such as an AFB smear and culture, fungal culture or viral culture maybe ordered in addition to or instead of a routine culture.

Typically, the first step in the routine analysis of a sputum sample is a Gram stain to identify the general type of bacteria that maybe present. The sample is then placed on or in appropriate nutrient media and incubated. The media encourages the growth of bacteria that are present allowing for further testing and identification.

Sputum is not sterile. That means that when a person has a bacterial respiratory infection, there will typically be harmless bacteria that are normally present in the mouth, throat, etc. (normal flora) as well as disease-causing (pathogenic) bacteria present.

A trained laboratorian differentiates normal flora from pathogenic bacteria and identifies the various types of bacteria present in the culture. Identification is a step-by-step process that may involve several biochemical, immunological and/or molecular tests and observations of the organism's growth characteristics. Facilities of bacterial culture are not available at majority of peripheral health institutions. Knowledge of local bacterial aetiology and antibiotic sensitivity patterns of LRTIs facilitates early introduction of proper empirical antibiotics, which can reduce the morbidity, mortality and improve prognosis particularly at peripheral level where facility for culture studies are not available. There are very limited data available in this aspect from Asia Pacific region.

So, we conducted this study to know the bacteria predominantly causing the LRTIs in our region and the antibiotic sensitivity pattern of these organism, so that we can design a proper antibiotic regimen, which will have a beneficial effect on the morbidity and mortality of the disease.

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In the present study, we wished to determine the circumstances under, which adult patients admitted to our hospital had sputum cultures obtained and to describe the pattern of antimicrobial use in response to sputum culture results.

Antimicrobial susceptibility testing is frequently required to guide the treatment and to determine whether the bacteria present are likely to respond to specific antibiotics.

The sputum culture, Gram stain (s) and susceptibility testing all contribute to a report that informs the health practitioner, which pathogen(s) are present and which antibiotic therapies are likely to inhibit their growth.

MATERIALS AND METHODS

The study was conducted in Kanyakumari Government Medical College Hospital during the period of January 2016-June 2016. This is a hospital-based retrospective study. The study protocol was approved by the institution's ethical committee. 851 samples collected from patients suspected with lower respiratory tract infections. Sputum samples were taken directly under sterile precautions by deep coughing and culture and sensitivity was done.

OBSERVATION AND RESULTS

Among the 851 samples, 243 cultures (29%) were positive.

Sputum Culture

Total number of samples = 851
Number of positive cultures = 243 (29%)
Others;
Acinetobacter
Strep. pneumoniae.

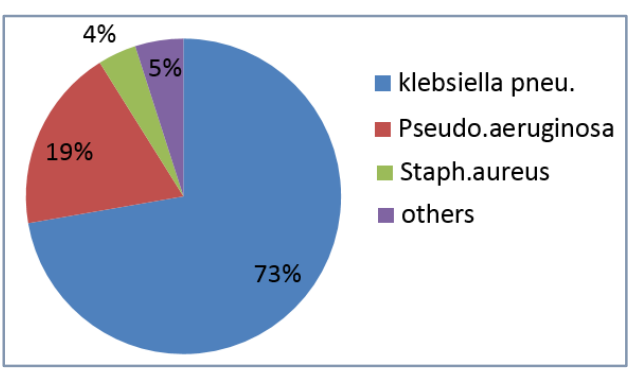

Figure 1. Presentation of Positive Sputum Culture

Pathogens

Among the culture positive organisms, the commonest pathogens found were Klebsiella pneumonia (73%), Pseudomonas aeruginosa (19%) and Staphylococcus aureus (4%).

Their corresponding antimicrobial sensitivity was done. In Klebsiella pneumonia, 94% of them were sensitive to cefoperazone/sulbactam, 75% were sensitive to amikacin, 58% sensitive to ceftazidime, 63% sensitive to ciprofloxacin,

65% sensitive to gentamycin, 48% sensitive to cefuroxime and 44% were sensitive to co-trimoxazole.

In Pseudomonas aeruginosa, 99% of them were sensitive to cefoperazone/sulbactam, 79% were sensitive to amikacin, 55% were sensitive to gentamycin, 49% were sensitive to ciprofloxacin, 58% were sensitive to ceftazidime, 28% sensitive to cefuroxime and 52% were sensitive to co-trimoxazole.

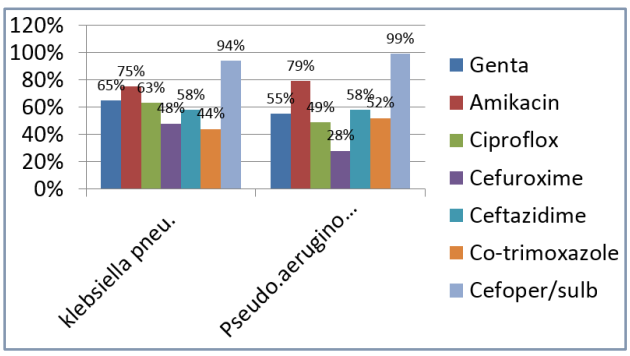

Figure 2. Antimicrobial Sensitivity Profile in Sputum Positive Cultures

DISCUSSION

Lower Respiratory Tract Infection (LRTI), while often used as a synonym for pneumonia can also be applied to other types of infection including lung abscess and acute bronchitis.

Symptoms include shortness of breath, weakness, fever, coughing and fatigue.

There are a number of symptoms that are characteristic of lower respiratory tract infections. The two most common are bronchitis and pneumonia.

Sputum Appearance	Most Likely Cause or Type of Pneumonia
Purulent	Typical pneumonia
Mucoid	Interstitial pneumonia
Rust color	Streptococcus pneumoniae
Green color	Pseudomonas aeruginosa or Haemophilus influenzae
Thick currant jelly-like	Klebsiella pneumoniae
Large amount of blood	Cavitary tuberculosis and lung abscess
Foul smelling	Anaerobic bacterial pneumonia

Table 1. LRTIs- Sputum Appearance and Most Likely Cause or Type of Pneumonia

In 2013, there were about 150 million LRTIs.[1] These resulted in 2.7 million deaths. This was 4.8% of all deaths in 2013.[2]

Bronchitis describes the swelling or inflammation of the bronchial tubes. Additionally, bronchitis is described as either acute or chronic depending on its presentation and is also further described by the causative agent. Acute bronchitis can be defined as acute bacterial or viral infection of the larger airways in healthy patients with no history of recurrent disease.[3] It affects over 40 adults per 1000 each year and consists of transient inflammation of the major bronchi and trachea.[1] Most often, it is caused by viral infection and hence antibiotic therapy is not indicated in immunocompetent individuals. Treatment of acute bronchitis with antibiotics is common, but controversial as their use has only moderate benefit weighted against potential side effects (nausea and vomiting), increased resistance and cost of treatment in a self-limiting condition.[4] Acute Exacerbations of Chronic Bronchitis (AECB) are frequently due to noninfective causes along with viral ones. Antibiotics have only been shown to be effective if all three of the following symptoms are present- increased dyspnoea, increased sputum volume and purulence.[5]

Pneumonia occurs in a variety of situations and treatment must vary according to the situation. It is classified as either community or hospital acquired depending on where the patient contracted the infection. It is life-threatening in the elderly or those who are immunocompromised. The most common treatment is antibiotics and these vary in their adverse effects and their effectiveness. The most common cause of pneumonia is pneumococcal bacteria, Streptococcus pneumoniae accounts for 2/3 of bacteremic pneumonias. This is a dangerous type of lung infection with a mortality rate of around 25%.[6,7,8] For optimal management of a pneumonia patient, the following must be assessed- pneumonia severity (including treatment location, e.g., home, hospital or intensive care), identification of causative organism, analgesia of chest pain, the need for supplemental oxygen, physiotherapy, hydration, bronchodilators and possible complications of emphysema or lung abscess.

The pathogens identified in our study are contrast to those of many other studies conducted in different regions. The differences in the type and distribution of pathogens may result from different environmental conditions and host factors and practices such as healthcare, socioeconomic standards and hygiene practices in each region.

The clinical and epidemiologic factors mentioned above are used to determine the most likely causes of each individual case of pneumonia and have a significant role in the antimicrobial agents used to empirically treat patients with pneumonia.

In our study, we found that Klebsiella pneumoniae is the most prevalent organism (73%) among the sputum culture positive samples obtained in our locality. This is followed by Pseudomonas aeruginosa (19%) and Staphylococcus aureus (4%). This finding is similar to other studies reported from India by Chawla et al who had found Pseudomonas aeruginosa, while Madhavi et al had found Klebsiella pneumonia was the most common organism. But, our results were found contrast with many other reported studies where Streptococcus pneumonia was found to be the common pathogen.[9]

According to our results, the efficacy of cefoperazone/sulbactam and amikacin was comparable to other reports.[10] Main international guidelines recommend empirical therapy in LRTIs.[11] Except for patients with CAP admitted to the ICU, no data exists to show that treatment

directed to a specific pathogen is statistically superior to empirical therapy. Therefore, most CAP patients are treated empirically because most cases of pneumonias are caused by bacteria, treatment usually involves antibiotic therapy.[12,13] In about, one half of pneumonia patients, the aetiologic agent can be determined and if the agent is known, more definitive therapy can be initiated. The efficacy of such empirical therapy depends on periodic assessment of antimicrobial sensitivity profiles specific to a particular region.

Limitations

Although, it is local, we believe that in this observational retrospective study, we reached our goal in terms of obtaining precise scientific data dealing with the sensitivity rates of pathogens in a tertiary care hospital serving to the Kanyakumari district. Spontaneously expectorated sputum was used for microbiological sampling. The accuracy could be increased by taking sample bronchoscopically. Further studies with larger number of isolates from each individual geographical region are needed to confirm our results. However, clinicians should be aware of regional sensitivity rates and it should be taken into consideration before initiating empirical antimicrobial therapy for LRTIs.

Inclusion Criteria

All the inpatients in our hospital admitted with complaints of cough with expectoration for more than 4 days, above 18 years of age.

Exclusion Criteria

Patients having malignancy and other evident disease on chest x-ray.

Patients previously admitted within 21 days and taken antibiotics.

Patients having sputum positive for Acid-Fast Bacilli (AFB).

CONCLUSION

The concentration of organisms in culture is important and clinical correlations are critical. Since, culture facilities are not readily available and time consuming, it is better to know the pattern of bacterial flora and their sensitivity of a particular geographical area. This helps to reduce the mortality and morbidity in patients suffering from LRTIs.

Klebsiella pneumoniae is still the most common pathogen in patients of this area and cefoperazone/sulbactam is the most effective antibiotic against all organisms. Hence, cefoperazone/sulbactam should be the first choice empirical antibiotics for patients in this area.

We also found quinolones (ciprofloxacin) to be less effective against gram-negative organism. This maybe because of very frequent use of quinolones in this area. Even though, quinolones are effective, it should be used cautiously in area where prevalence of tuberculosis is high.

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