Original Article

Role of fiberoptic bronchoscopy and BAL in assessment of the patients with non-responding pneumonia

Mohamed El-Shabrawy\textsuperscript{a,}\textsuperscript{*}, Rehab H. EL-Sokkary\textsuperscript{b}

\textsuperscript{a} Chest Department, Zagazig University, Egypt
\textsuperscript{b} Medical Microbiology & Immunology Department, Zagazig University, Egypt

Received 21 October 2015; accepted 14 December 2015
Available online 2 March 2016

Abstract Background: Non-responding pneumonia is usually a topic of interest for pulmonologists. Fiberoptic bronchoscopy (FOB) and bronchoalveolar lavage (BAL) may be an important tool in assessment of non-responding pneumonia. There is paucity of recent studies in this area.

Aim: This study aimed to assess the impact of early bronchoscopy and BAL in etiological diagnosis of the patients with non-responding pneumonia with special emphasis on efficacy of FOB and BAL in diagnosis.

Settings and design: A prospective, observational study was conducted in chest and medical microbiology and immunology departments, Zagazig University Hospitals.

Patients and methods: There were total 135 patients included in our study after fulfilling the criteria of non-responding pneumonia by clinical and laboratory parameters, patients were subjected to FOB and BAL microbiological, cytological, histopathological investigations.

Results: The patients were 90 males and 45 females with a mean age of 47.6 ± 12.2 years. Unilateral lung involvement was seen in 108 (80%) patients, whereas bilateral involvement in 27 (20%) patients. Right upper lobe was the most commonly involved site (25.9%). In this study, bacterial pneumonia 83.71% was found to be the commonest etiology of non-resolving pneumonia, followed by bronchogenic carcinoma 13.3% and tuberculosis 2.96%. FOB was done for all patients. BAL fluid results were 88 positive, gram stain samples (65.1%), 4 BAL ZN stain and mycobacterial culture positive cases (2.96%), pyogenic organisms were isolated in 113 patients 83.71% by BAL fluid culture. Bronchoscopic biopsies were also performed in 18 cases. BAL fluid cytology was positive in 6 cases (33.3%), transbronchial forceps biopsy positive results were found in 10 cases (55.55%) and bronchial brushing showed positive results in 3 cases (16.66%).

Conclusions: NRP is common and represents a difficult clinical problem as the cause may vary from a benign delay in recovery to life-threatening progressive pneumonia. A systematic approach...
to investigation and management is recommended with consideration of both infectious and non-infectious causes. © 2015 Production and hosting by Elsevier B.V. on behalf of The Egyptian Society of Chest Diseases and Tuberculosis. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

Introduction

One of the most common acute medical conditions requiring hospitalization is community-acquired pneumonia (CAP). Most of hospitalized patients with CAP respond rapidly to antibiotic therapy and follow an uncomplicated course, but a proportion of patients fail to respond to initial therapy and require additional investigations and treatment [1,2]. Despite great advance in clinical care, the mortality rate remains 5–15%. Patients with non-responding or progressive pneumonia represent a group of patients where appropriate early intervention can improve outcome while preventing overtreatment [3,4].

Radiological evaluation of response to treatment has traditionally been difficult to define because changes, can take up to 6 weeks to resolve and often lag behind the clinical recovery of patients. However microbiological results becomes negative very quickly after initiation of empirical antibiotic treatment as, inflammatory process then begins to resolve, by a reduction in inflammatory cytokines and biomarkers such as C-reactive protein (CRP) [5]. Also, patient symptoms start to improve as, inflammatory process then begins to resolve, by a reduction in inflammatory cytokines and biomarkers such as C-reactive protein (CRP) [5].

The definition of non-responding pneumonia ‘NRP’ is not clearly established. Treatment failure pneumonia is defined as delayed radiographic improvement or deterioration according to worsening of radiology, which have proven to be relatively insensitive markers of treatment response so, non-responding pneumonia is therefore better accepted as a lack of an adequate clinical response to treatment, and therefore, a failure to reach clinical stability in the expected period of time [11,12]. The duration to achieve the clinical stability in most studies is 3 days; for this reason, routine re-evaluation of all hospitalized patients still at day 3 to identify patients with NRP is done [13].

Exclusion criteria

Patients were excluded if any of the following was met:

Nosocomial pneumonia or healthcare-associated pneumonia (HCAP), severe immunosuppression (HIV, use of immunosuppressant such as cytotoxic drugs, cyclosporins or monoclonal antibodies) and admission in an intensive care unit.

All the patients received antibiotic therapy on admission according to Infectious Diseases Society of America/American Thoracic Society (IDSA/ATS) 2007 guidelines [14]. The following antibiotic regimens were given: empirical antibiotic regimen (according to drug availability at time of admission).

Levofloxacin 500 mg/24 h I.V., cefotaxime 1 g/12 h I.V. and azithromycin 500 mg/24 h I.V., ampicillin-sulbactam 1.5 g/8 h I.V. combined with azithromycin 500 mg/24 h I.V. and ceftriaxone 1 g/24 h I.V. and azithromycin 500 mg/24 h I.V.

Methods

Included patients were subjected to the followings:

1. Thorough medical history: history taking from the patients. Smoking history and history of other comorbid diseases etc.

2. Full clinical examination: including both general and local chest examinations. Evaluations of improvement were done by comparison between vital signs on day 1 and day 4.
(3) **Pneumonia Severity Index (PSI):** PSI was designed to measure the severity of CAP for patients. Twenty-four hours after hospital admission, the scoring has been completed and resulted in an integrated point score between 0 and >130. According to PSI scoring patients were classified into:

a. Class I: Points 0: Mortality 0.1% (low risk) → Mild.
   b. Class II: Points <70: Mortality 0.6% (low risk) → Mild.
   c. Class III: Points 71–90: Mortality 2.8% (low risk) → Mild.
   d. Class IV: Points 91–130: Mortality 8.2% (moderate risk) → Moderate.
   e. Class V: Points >130: Mortality 29.2% (high risk) → Severe [9].

(4) **Laboratory investigations:** were done at day 1 and day 4.

a. Complete blood count.
   b. Kidney function tests (serum urea level and creatinine).
   c. Liver function tests.
   d. Serum electrolytes (Na and K).
   e. Arterial blood gas analysis.
   f. Serum level of C-reactive protein (CRP).

Fresh blood sample was drawn from peripheral vein when CAP was diagnosed. CRP was measured by ELISA assay using a commercially available kit (Tina-quant CRP; Roche Diagnostics, Mannheim, Germany). For this assay, the lower limit of detection was 1.38 mg/L, and the standard curve ranges between 5 mg/L and 170 mg/L. and the normal value limit of detection was 1.38 mg/L, and the standard curve was for 7 patients and biopsy for 10 patients were obtained.

(5) **Radiological investigation:**

a. **Plain chest X-ray:** posteroanterior view was done to all patients at day (1) and (4) by X-ray machine (ROTALiX SRT 32, Philips, Italy).
   b. **Computed tomography (C.T.):** conventional chest C.T. was done for all cases to confirm diagnosis of pneumonia detects any complication. It was done by chest C.T. (Hi-speed spiral C.T., GE Medical System, Xi’an 710075, China).

(6) **Microbiological investigation:** blood culture and sputum examination by gram stain and culture were done for all patients [16].

(7) **Bronchoscopy:** All patients were subjected to FOB (Pentax FB15TV, Philips, Tokyo, Japan), as they were not responding to empirical antibiotic therapy. Flexible bronchoscopy was performed with fiberoptic scope through transnasal route under topical anesthesia (2% lignocaine). Oxygenation was monitored throughout the procedure with pulse oximetry [17].

Appropriate samples such as BAL for all patients, brushing for 7 patients and biopsy for 10 patients were obtained depending on the lesion after thorough evaluation of endobronchial tree during the procedure. Samples were subjected to cytology, histopathology, AFB staining and culture/sensitivity, depending upon the clinical diagnosis and bronchoscopic findings.

**Procedure of BAL**

**Specimen collection**

Under complete aseptic conditions the following was done with continuous monitoring of the pulse, blood pressure, and oxygen saturation throughout the whole procedure. The scope was wedged into the orifice of the bronchus draining the segment likely to be involved, as judged radiologically, or, in cases of diffuse radiologic presentation, in the posterior bronchus of the lower lobe. As little topical lidocaine as possible was used so as not to interfere with bacterial growth (never > 20 mg per bronchus). Aspiration of secretions by the bronchoscope was avoided. The sample was collected after instilling three aliquots of 50 mL sterile saline (0.9% NaCl solution) through the bronroscope. At least 40% of injected saline was suctioned. The bronchoscope was then removed from the patient’s airway.

The sample was sent immediately for culture. The presence of >1% squamous epithelial cells suggested a highly contaminated specimen [18].

**Microbiological processing**

BAL samples were mechanically liquefied and homogenized by vortexing for 1 min with glass beads, followed by centrifuging at 3000 rotations per minute for 10 min [19]. After obtaining our microbiological samples, an empirical change in antibiotic therapy with combinations that cover broad microbial etiologies is mandatory for those non responding patients.

**Antibiotic susceptibility test**

The susceptibilities of the collected isolates were determined by the Kirby–Bauer disk diffusion method using Mueller Hinton agar plates as recommended by the Clinical and Laboratory Standards Institute (CLSI) [20].

Freshly isolated colonies were suspended in isotonic saline to match the turbidity of 0.5 McFarland standard suspensions. They were streaked using sterile swabs over the surface of Mueller Hinton agar plates. Disks loaded with different tested antimicrobial agents were transferred to the surface of the inoculated plates and gently pressed. The antimicrobial disks were obtained from Oxoid®, UK and Bioanalyse®, Turkey. The tested antimicrobials were: amikacin (30 μg), ampicillin sulbactam (SAM) (20 μg), co-amoxiclav (amoxicillin/ clavulanic acid 20/10 μg), piperacillin–tazobactam 100/10 μg, etrapenem (10 μg), meropenem (10 μg), cefotaxime (30 μg), cefepime (30 μg), cefoperazone (75 μg), cefuroxime (30 μg), ceftriaxone (30 μg), ceftazidime (30 μg), azithromycin (15 μg), clindamycin (2 μg), ciprofloxacin (5 μg), levofloxacin (5 μg), co-trimoxazole (trimethoprim/ sulfamethoxazole 1.25/23.75 μg), moxifloxacin (5 μg) and vancomycin (30 μg). The plates were incubated at 37°C for 16–18 h. The inhibition zone diameters were measured to the nearest millimeter and recorded. Isolates that were resistant to three or more classes of antimicrobials were considered as multi drug resistant isolates [21].

(8): hospital outcome was then evaluated and tabulated patients were classified according to hospital outcome.

(9) **Statistical analysis:** all data were collected, tabulated and reformatted for statistical analysis using Statistical Package
for Social Science (SPSS version 19; SPSS, Inc., Chicago, IL). The results of this work were analyzed and presented as numbers and percentage or mean ± standard deviation (SD). Student’s “r” test, analysis of variance (ANOVA) and Chi-square (χ² test or Fisher’s exact test) were used for comparisons between group’s data. A P-value < 0.05 was considered significant and P-value < 0.001 was considered highly significant [22].

Results

During the period from September 2013 to February 2015, 135 patients of both sexes, diagnosed as non-responding pneumonia according to our study criteria, were included in this study. Overall, mean age of the patients was 47.6 ± 12.2 years, 45 patients (33.3%) were females and 90 (66.7%) males. Fifty-four patients (40%) had at least one comorbidity, diabetes mellitus was by far the most common (29.62%) followed by hypertension (25.92%), ischemic heart diseases (18.55%), liver diseases (9.25%), and chronic obstructive pulmonary diseases (16.66%). Eighty-seven patients (64.4%) were smokers and 48 (35.6%) were non-smokers (Table 1).

After four days of hospitalization, non-responding patients remained febrile, continued to experience raised WBCs and CRP levels. Respiratory rate, heart rate and blood pressure had no change. These abnormalities coexisted in some patients (Table 2).

As regards radiological findings in the studied patients, unilateral lung involvement was seen in 108 (80%) patients, whereas bilateral involvement in 27 (20%) patients. Right upper lobe (25.9%) was the most common involved site, followed by right lower lobe (21.5%), left lower lobe (17.78%), and left upper lobe (14.8%). Bilateral involvement was seen in 27 (20%). On chest X-ray, consolidation was present in 113 patients (83.7%), consolidation along with cavity was present in 13 patients (9.6%) and consolidation along with effusion was present in 9 (6.7%) patients. On the other hand, by CT scan of the thorax other findings were recorded, such as, mediastinal lymphadenopathy in 11 (8.14%) patients, collapse in 8 (5.9%) patients and increased cases of effusion to be 17 (Table 3).

Our findings in this study for causes of non-responding patients were pyogenic infection in 113 (83.71%) followed by malignancy in 18 (13.33%) and 4 tuberculous in patients (2.96%) (Table 4).

The yield of different diagnostic techniques either bronchoscopic or non bronchoscopic specimens ranging from 0% to 83.7% with sputum Zn having the lowest yield and BAL fluid culture and sensitivity having the highest one. Fiberoptic bronchoscopy was done for all patients. BAL fluid results were; 88 positive for Gram stain samples (65.1%), 4 BAL Zn stain and mycobacterial culture positive cases (2.96%), pyogenic organisms were isolated in 113 patients (83.7%) by BAL fluid culture. Bronchoscopic biopsies were also performed in 18 cases according to bronchoscopic findings. BAL fluid cytology was positive in 6 cases (33.3%), transbronchial forceps biopsy positive results were 10 cases (55.5%), and bronchial brushing showed positive results in 3 cases (16.66%) (Table 5).

The spectrum of bacterial isolates obtained from the BAL fluid analysis was 113 pyogenic and 4 mycobacterial isolates. Klebsiella pneumoniae was the most common isolate obtained, 29 isolates (24.78%), followed by both Pseudomonas aeruginosa and Streptococcus pneumonia 23 isolates (Table 6).

Discussion

Non-responding pneumonia is not an infrequent clinical problem that faces pulmonologists. The terms NRP and treatment failure are often used interchangeably, but in fact, both are quite different entities. It is very important to define treatment response and non-response for proper clinical decision-making, such as, switching medication from intravenous to oral with stepping down, hospital discharge and also, taking into account non-infective causes for that pulmonary infiltrate which called ‘pneumonia mimics’ [23].

Chalmers et al. [24] reported that, non-responding pneumonic patients, who don’t reach clinical improvement at day 3, should be re-evaluated. Reevaluation of physical examination alongside some important investigations such as CRP
can be useful. In state of failure of non-invasive microbiological and blood sampling investigations to be informative, bronchoscopy is most likely to be a good diagnostic tool where multidrug resistant microbes or endobronchial lung cancer may be present. Use of bronchoscopy and bronchoalveolar lavage is recommended in such patients [23].

Table 3 Radiological findings in all studied patients.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>CXR Bilaterality</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unilateral</td>
<td>108</td>
<td>80</td>
</tr>
<tr>
<td>Bilateral</td>
<td>27</td>
<td>20</td>
</tr>
<tr>
<td>Distribution</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rt. upper lobe</td>
<td>35</td>
<td>25.9</td>
</tr>
<tr>
<td>Right lower lobe</td>
<td>29</td>
<td>21.5</td>
</tr>
<tr>
<td>Left lower lobe</td>
<td>24</td>
<td>17.78</td>
</tr>
<tr>
<td>Left upper lobe</td>
<td>20</td>
<td>14.8</td>
</tr>
<tr>
<td>Bilateral</td>
<td>27</td>
<td>20</td>
</tr>
<tr>
<td>Findings</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Consolidation and effusion</td>
<td>113</td>
<td>83.7</td>
</tr>
<tr>
<td>Consolidation and cavitation</td>
<td>9</td>
<td>6.7</td>
</tr>
<tr>
<td>CT Cavity</td>
<td>14</td>
<td>10.4</td>
</tr>
<tr>
<td>Consolidation</td>
<td>135</td>
<td>100</td>
</tr>
<tr>
<td>Effusion</td>
<td>17</td>
<td>12.6</td>
</tr>
<tr>
<td>Mediastinal</td>
<td>11</td>
<td>8.14</td>
</tr>
<tr>
<td>lymphadenopathy</td>
<td>8</td>
<td>5.9</td>
</tr>
</tbody>
</table>

Table 4 Etiology of non-responding pneumonia diagnosed by bronchoscopy.

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>No. of cases</th>
<th>N = 135 (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bacterial pneumonia</td>
<td>113 (83.71)</td>
<td></td>
</tr>
<tr>
<td>Malignancy</td>
<td>18 (13.33)</td>
<td></td>
</tr>
<tr>
<td>Tuberculosis</td>
<td>4 (2.96)</td>
<td></td>
</tr>
</tbody>
</table>

Table 5 Yield of different laboratory measurements and bronchoscopic procedures.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Positive/n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sputum analysis</td>
<td>n = 135</td>
</tr>
<tr>
<td>Sputum gram stain positivity</td>
<td>85/135 (62.9)</td>
</tr>
<tr>
<td>Sputum Zn stain positivity</td>
<td>0/135 (0)</td>
</tr>
<tr>
<td>Sputum C/S positivity</td>
<td>5/135 (3.7)</td>
</tr>
<tr>
<td>Blood analysis</td>
<td>n = 135</td>
</tr>
<tr>
<td>Blood culture positivity</td>
<td>9/135</td>
</tr>
<tr>
<td>Pleural fluid analysis</td>
<td>n = 17</td>
</tr>
<tr>
<td>Pleural fluid gram stain positive cases</td>
<td>4/17 (23.52)</td>
</tr>
<tr>
<td>Pleural fluid C/S positivity</td>
<td>2/17 (11.76)</td>
</tr>
<tr>
<td>BAL analysis</td>
<td>n = 135</td>
</tr>
<tr>
<td>BAL gram stain</td>
<td>88/135 (65.1)</td>
</tr>
<tr>
<td>BAL ZN</td>
<td>4/135 (3)</td>
</tr>
<tr>
<td>BAL mycobacterial culture</td>
<td>4/135 (3)</td>
</tr>
<tr>
<td>BAL C/S</td>
<td>113/135 (83.7)</td>
</tr>
<tr>
<td>Cytology and histopathology</td>
<td>n = 18</td>
</tr>
<tr>
<td>BAL cytology</td>
<td>6/18 (33.3)</td>
</tr>
<tr>
<td>Transbronchial forceps biopsy</td>
<td>10/18 (55.55)</td>
</tr>
<tr>
<td>Brush biopsy</td>
<td>3/18 (16.66)</td>
</tr>
</tbody>
</table>

Table 6 Bacterial spectrum of BAL fluid analysis.

<table>
<thead>
<tr>
<th>Organism</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monomicrobial</td>
<td>109</td>
<td>93.2</td>
</tr>
<tr>
<td>Klebsiella pneumoniae</td>
<td>29</td>
<td>24.79</td>
</tr>
<tr>
<td>Streptococcus pneumonia</td>
<td>23</td>
<td>19.66</td>
</tr>
<tr>
<td>Pseudomonas aeruginosa</td>
<td>23</td>
<td>19.66</td>
</tr>
<tr>
<td>Staphylococcus aureus</td>
<td>18</td>
<td>15.53</td>
</tr>
<tr>
<td>Escherichia Coli</td>
<td>16</td>
<td>13.56</td>
</tr>
<tr>
<td>Polymicrobial.</td>
<td>4</td>
<td>3.4</td>
</tr>
<tr>
<td>Mycobacterial tuberculosis</td>
<td>4</td>
<td>3.4</td>
</tr>
</tbody>
</table>

Total 117 100

BAL provides a very useful tool for diagnosing lower respiratory tract infection and can be performed safely and rapidly. Although conventional BAL performed without the use of protected catheters may be contaminated, there is no evidence that protected BAL provides more reliable results than conventional BAL [25].

So, the aim of this study was to evaluate the important role of early bronchoscopy and BALF in etiological diagnosis of the patients of non-responding pneumonia with special emphasis on efficacy of FOB and BAL in diagnosis.

This study was conducted on 135 patients diagnosed as non-responding pneumonia (90 males and 45 females), with a mean age of 47.6 ± 12.2 years. All patients had pneumonia severity index less than class v (Table 1) This was in agreement with Schroder et al. [26] and Angele et al. [27] who observed the differences between men and women in their studies and suggested that females are less likely to develop complications and this sex differences may be due to both the biological response to infection and patterns of health care delivery.

Regarding smoking, 87 patients (64.4%) were smokers and 48 (35.6%) were non-smokers. Smoking is a well-known risk factor for CAP through alterations of the host defense mechanisms. There is consistent evidence in many studies that shows association between smoking habits and CAP development as reported by Pedro-Botet et al. [28] and Straus et al. [29].

Fifty-four patients (40%) had at least one comorbidity, diabetes mellitus was by far the most common (29.62%) followed by hypertension (25.92%), ischemic heart diseases (18.55%), liver diseases (9.25%), and chronic obstructive pulmonary diseases (16.66%) (Table 1). Similar comorbidities were recorded by Confalonieri et al. [30], who found those comorbidities but did not report an impact of each one on their studied groups, while Meijvis et al. [31] reported other comorbidities with different frequencies: congestive heart failure (16%), diabetes mellitus (15%), renal disease (13%), chronic obstructive pulmonary diseases (13%), neoplastic disease (6%) and liver disease (1%).

As regards clinical and laboratory parameters at days 1 and 4 the studied patients had no changes (Table 2). Near similar results were reported by Finch and Chalmers [32] who classified their patients by day 4, as responding and non-responding. Non-responding patients were identified if they met at least one of the following conditions: temperature ≥ 37.2 °C, heart rate ≥ 100 beats/min, respiratory rate ≥ 24 breaths/min, systolic blood pressure ≤ 90 mmHg, and oxygen saturation ≤ 90% or arterial oxygen partial pressure ≤ 60 mmHg. They also found that, after 72 h of treatment (day 4), CRP levels between days 1 and 4 showed no changes.
Every effort should be made to obtain standard poster-anterior (PA) and lateral chest radiographs which are valuable in patients with the possibility of pneumonia, the radiograph can be useful in differentiating pneumonia from other conditions that may mimic it and also, identify coexisting conditions. Radiography is also useful for evaluating severity of illness by identifying multilobar involvement and bilaterality [33].

Fiberoptic bronchoscopy (FOB) was done to 135 patients where etiological diagnosis is established by different ways. The yield of different bronchoscopic procedures in our study was as follows; BAL culture and sensitivity results “which were done to all patients” was 83.7%, BAL cytology was 33.3%, transbronchial forceps biopsy was 55.5% and brush biopsy was 16.6% (Table 5).

This is in accordance with Silver et al. [34] who investigated non-resolving pneumonic patients by FOB and infections were the most common etiology obtained in 86% cases.

Although Jimnez et al. [35] performed bronchoscopy to community acquired pneumonia patients who were receiving antibiotics; they were able to establish an infective etiological diagnosis in 81 percent of cases by BAL culture.

Kottmann et al. [36] reported overall yield of 63.4% of BAL, which was performed within 3 days of starting antimicrobials to pneumonia patients.

Hohenadel et al. [37] reported that, the diagnostic yield of BAL in the diagnosis of pneumonia had been reported to be 81% (9) in patients with or without immunosuppression.

In a study by Chaudhuri et al. [38] bronchogenic carcinoma was found to be 26.6%, of which squamous cell carcinoma was the commonest variety followed by adenocarcinoma. They reported malignancy as a specific cause for non-resolving pneumonia in 11.4% cases in their series and their results were near our results.

In this study, pyogenic infection was diagnosed as etiological agents in 113 (83.71%) cases among them Klebsiella representing 24.78%, S. pneumonia 19.65% and Pseudomonas 19.65% were the common pathogens (Table 6). These results were consistent with considerations of Finch and Chalmers [32] who reported that non-responding pneumonia was mostly due to organisms not covered by initial empirical antibiotic therapy, such as multidrug resistant pathogens, atypical pathogens or tuberculosis, or severe infections with a recognized longer response time to treatment, e.g. Staphylococcus aureus pneumonia.

In our study, bronchogenic carcinoma was found in 18 patients (13.3%) (Table 4), this was in agreement with Finch and Chalmers [32] who reported that non-infectious causes are less frequent than infectious one affecting about 20% of NRP patients.

Also, Arancibia et al. [10] who studied 444 hospitalized CAP patients with; 30 patients had NRP. Infection being the most frequent cause was identified in 65% of patients, and non-infectious disorders were present in 35% of patients (malignancy, cardiac complications and foreign body).

In our study, K. pneumonia was the most common isolate obtained, 29 isolates (24.78%), followed by both P. aeruginosa and S. pneumonia 23 isolates (19.65%), 18 (15.53%) S. aureus isolates, E. coli was 16 (13.56%), 4 polymicrobial infection isolates (3.4%) and Mycobacterial tuberculosis isolates (3.4%) (Table 6).

Near similar results were reported by, Lin et al. [39] who concluded that K. pneumonia has been implicated in 15%, 32%, and 34% of community-acquired pneumonias in Singapore, Africa and Taiwan, respectively. Also, in study by Motayo et al. [40], who found that in respiratory tract infections, K. pneumonia was the most prevalent organism with 40.5%, followed by S. pneumonia (21.6%), and the least prevalent was poly infection 2.7%.

Other Spain study illustrated that, among the most common bacterium cultured from the CAP patients who don’t respond to treatment, P. aeruginosa and S. pneumonia were the most common isolates, and both had the same frequency of occurrence [10].

On the other hand with review of various studies, which studied hospitalized CAP patients, they reported that 82% of the patients had bacterial infection and that S. pneumonia was the most common pathogen isolated, followed by Haemophilus influenzae [41]. In another study involving 70 patients of CAP, it was concluded that, the most common isolate was S. pneumoniae (35.8%), followed by K. pneumoniae (22%) and S. aureus (17%) [42]. Investigators from a tertiary care center in New Delhi studied 124 cases of CAP at the Internal Medicine and Pediatric Department and found that the bacterial pathogens in CAP were S. pneumoniae (35.3%), S. aureus (23.5%), K. pneumoniae (20.5%) and H. influenzae (8.8%) [43]. Our results are not consistent with the above studies, and this may be explained by the fact that in those studies, routine cases of CAP were included and not the special subtype of CAP patients who are non-responding ones. Hence, the spectrum and distribution of bacterial pathogens may not be similar to CAP patients who show favorable response.

Silver et al. [34] found that 5.7% of BAL fluid culture of non-resolving pneumonia was tuberculous and this is near our results (2.96%) (Table 5).

Conclusion

A systematic approach to investigation and management of NRP is recommended with consideration of both infectious and non-infectious causes. Early bronchoscopy and BALF analysis can play an important role in the evaluation NRP patients and may provide or strongly support specific diagnoses.

Funding

This research did not receive any specific grant from any funding agency in the public, commercial or not-for-profit sector.

Conflict of interest

The authors declare that they have no conflict of interest.

References


