

Bacterial and Fungal Isolates from Lower Respiratory Tract Infections (LRTIs) in Adult IRAQI Leukaemic Patients

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Summary:

Background: Advances in medical technology have spawned an increasing number of transplant patients, patients with treated malignancies, and patients on immunosuppressive therapies. Recurrent episodes of bacterial lower respiratory tract infection suggest the presence of specific predisposing factors. In young adults recurrent LRTIs are associated with defects in host defenses, including leukocytes function and immunoglobulin production.

Objective: To isolate and identify the causative agents of acute and chronic LRTIs in adult leukaemic and non-leukaemic patients groups.

Methods: In the current study 100 Iraqi patients were chosen, 50 adult leukaemic patients (acute myeloid, acute lymphoblastic, chronic myeloid, chronic lymphocytic) and another 50 adult non-leukaemic patients as a control group. Their ages ranged between 15 to 74 years old. The sputum specimens were cultured and the causative microorganisms were identified microbiologically.

Results: The common microorganisms isolated from most leukaemic patients sputum were *Moraxella catarrhalis* (*M.catarrhalis*) 25.4%, followed by *Streptococcus pneumoniae* (*S.pneumoniae*) 23.9%, *Enterobacteriaceae* such as (*Escherichia coli*, *Klebsiella pneumoniae*, *Klebsiella oxytoca*) plus *Pseudomonas aeruginosa* (*P.aeruginosa*) 11.3%, *Mycobacterium tuberculosis* (*M.tuberculosis*) 12.7%, *Staphylococcus aureus* (*S.aureus*) 8.5%, and *Candida albicans* (*C.albicans*) 18.3%. Regarding the non-leukaemic patients, the microorganisms were *S.pneumoniae* 33.8%, followed by *M.catarrhalis* 27.7%, *Enterobacteriaceae* and *P.aeruginosa* 21.5%, *M.tuberculosis* 9.2%, *S.aureus* 6.2%, and *C.albicans* 1.5%.

Conclusion: Common microorganisms isolated from leukaemic patients were predominantly *M.catarrhalis*, followed by *S.pneumoniae*, *Enterobacteriaceae* and *P.aeruginosa*, *M.tuberculosis*, *S.aureus*, and a significant number of *C.albicans*. In non-leukaemic patients the microorganisms were predominantly *S.pneumoniae*, followed by *M.catarrhalis*, *Enterobacteriaceae* and *P.aeruginosa*, *M.tuberculosis*, *S.aureus*, and insignificant number *C.albicans*.

Keywords: Leukemia, infections, lower respiratory tract.

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Introduction

Infection is always the result of a negative balance between the capacity of the host defense system and the virulence of invading microorganisms. Depending on multiple factors, an intact defense system offers protection against most microbial aggressors through a complex interrelationship of protecting surfaces, cells, and soluble factors (1,2).

Leukaemia is by definition affects the immune system itself and exerts a dual deleterious effect. The malignant population interferes with and supplants the immunocompetent elements at their original location. The residue of normal cells is exposed to aggressive chemotherapy, and as a result, profound and prolonged granulocytopenia emerges rapidly (3,4).

Prolonged survival during periods of profound immunosuppression has made infections a common complication and expanded the number of potential pathogens (5,6).

The predisposition of patients with leukaemia to LRTIs is related to multiple factors as decreased granulocyte (phagocyte) number or function; decreased lymphocyte number or function; defects in mechanical barriers to colonization and infection; and contact or exposure to pathogenic organisms (7,8).

Patients and methods :

The patients who were included in this study were admitted to Baghdad Teaching Hospital through the period from December 2003 to May 2004 and met the following criteria; proved to be leukaemic by bone marrow aspirate, clinical features of leukaemia, and the diagnostic imaging suggestive of LRTIs.

The sputum was collected into sterile disposable petri dishes, and the collection of good sputum

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specimens was required, because examination of badly collected sputum can lead to misleading results because of contamination with the normal bacterial oral or throat flora.

Patient's sputum specimens were cultivated within few minutes on blood, chocolate, MacConkey and two fresh Sabouraud's agar plates. Chocolate agar plate was incubated under CO₂ using candle jar, other plates were incubated aerobically at 37°C for 18-24 hours and one Sabouraud's agar plate was incubated at room temperature for two weeks. Microorganisms from all specimens were identified according different microbiological and biochemical tests (9,10,11).

Results :

Table (1) demonstrate the causative agents of LRTIs associated with the four major types of leukaemia compared to causative agents of LRTIs in non-leukaemic patients.

In chronic myeloid leukaemia (CML) patients, the predominant causative agents of both acute and chronic LRTIs was *S.pneumoniae*, 4.2% isolates were acute and 7.1% were chronic cases. *Moraxella catarrhalis* was the causative agent of 9.9% of acute and chronic respiratory infections, while 8.5% were *C.albicans*. Only 2.8% isolates were *S.aureus* and *K.oxytoca*, and a single isolate (1.4%) of *P.aeruginosa*.

The highest frequency of LRTIs associated with acute myeloid leukaemia (AML) cases were *S.pneumoniae* 8.5%, followed by *M.catarrhalis* and *C.albicans* 5.6%, and one isolate (1.4%) of *S.aureus*, *K.oxytoca* and *P.aeruginosa* from acute LRTIs. In chronic LRTIs 5.6% were *M.tuberculosis* and a single isolate (1.4%) of both *S.aureus*, and *E.coli* were isolated.

Acute LRTIs associated with acute lymphoblastic leukaemia (ALL) were caused by *M.catarrhalis* 7% isolates. Regarding chronic LRTIs, the present study demonstrated 2 isolates (2.8%) of *C.albicans*, and *M.tuberculosis*. In addition to a single isolate (1.4%) of *S.aureus* and *K.pneumoniae*.

In the present study, the common causative agent of LRTIs associated with chronic lymphocytic leukaemia (CLL) was *S.pneumoniae*, 4.2% in both acute and chronic LRTIs, followed by *M.catarrhalis* 2.8%, and a single isolate (1.4%) of *S.aureus*, *E.coli*, and *C.albicans*. In addition, a single chronic isolate (1.4%) of *M.tuberculosis* was incriminated.

Interestingly regarding the fifty non-leukaemic patients included in the present study, the most predominant microorganisms detected were *S.pneumoniae* (33.8%), followed by *M.catarrhalis* (27.7%), and *S.aureus* 4 isolates were identified (6.2%). The incidence of family Enterobacteriaceae

and *P.aeruginosa* was (21.5%), while the candidal isolates were low (1.5%).

Discussion:

It has been proved from the current study that both *S.pneumoniae* and *M.catarrhalis* were the commonest respiratory pathogens in LRTIs in both leukaemic and non-leukaemic patient groups. The most predominant microorganisms which have been isolated from 50 adult leukaemic patients with respiratory infections were *M.catarrhalis*, followed by *S.pneumoniae*. The predominance of the above two microorganisms could be due to loading from pathogenic oropharyngeal bacteria to the lower respiratory airway, and this is consistent with other studies (12,13,14). On the other hand, the aetiology of predominance *S.pneumoniae* might be due to impaired antibodies level to pneumococcal polysaccharides associated with leukaemia.

In the present study, it is important to notice that *S.pneumoniae* were common among acute leukaemic patients, and less frequent among chronic leukaemic patients. The cause for the association between *S.pneumoniae* respiratory infections and chronic leukaemias is the granulocytopenia during or after cytotoxic chemotherapy especially fludarabine and prednisone, which is associated with high mortality rate. This result is consistent with other studies carried out abroad (15,16). Also in the present work it has been noticed that among leukaemic patients with LRTIs *S.aureus* was the second gram-positive cocci isolated after *S.pneumoniae*, and both of them were responsible for 32.4% of cases. This result is in agreement with a bacteriological research carried out in Singapore (17).

Concerning the respiratory infections in leukaemic patients, it was of interest to find out that the mucosal pathogenic gram-negative isolates from the family Enterobacteriaceae and *P.aeruginosa* were associated with LRTIs in the immunocompromised leukaemic patients included in the current study (11.3%). This could be explained by the capability of these bacteria to form flagellae, which provide motility and chemotaxis toward preferred substrates and also provide a ligand for clearance by phagocytic cells. As these cells are already decreased in leukaemic patients due to disease process or cytotoxic chemotherapy, the host will be more vulnerable to be infected by these microorganisms. Fungal infection of LRTIs especially *C.albicans* was responsible for 18.3% of the cases among the leukaemic group.

Mycobacterium tuberculosis infections can occur in leukaemic patients, but the frequency is lower than that of other respiratory infections (18). As shown from Table (1) tuberculosis (TB) were observed in AML and CML cases (8.5%), which were more than in ALL and

CLL cases (4.2%), and the usual site of infection was the lung. For this reason, a high index of suspicion should always be maintained particularly in endemic areas as our country. This study results are in consistent with other studies (19,20), which obviously revealed that TB was commonly associated with AML and CML and less commonly with ALL and CLL cases.

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