Original Article-II

Evaluation of Pulmonary Infiltrates in Patients with Haematological Malignancies Using Fibreoptic Bronchoscopy and Bronchoalveolar Lavage

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ABSTRACT

Background : Chest infection is the major cause of morbidity and mortality among patients with haematological malignancies. Conventional diagnostic methods – chest x-ray , blood and sputum culture have limited yield . We used fibreoptic bronchoscopy and bronchoalveolar lavage to evaluate nature of pulmonary infiltrates on chest x-ray.

Patients and Methods :

25 patients with haematological malignancies with fever and pulmonary infiltrates were studied. Patients median age was 32 years, ranging from 16 to 65 years. There were 21 males and 4 females. Initial evaluation included – detailed physical examination including chest to see for any focus of infection. In all patients , base line blood counts (total and differential), chest x-ray and cultures from blood and other body fluids were taken before starting broad spectrum antibiotics . Those not responding over next 48-72 hours received gram positive coverage followed by amphotericin-B therapy . Patients with persistent fever and pulmonary infiltrates were subjected to fibre-optic bronchoscopy (FOB) and bronchoalveolar lavage (BAL) and samples were collected for bacterial, fungal, AFB and viral studies. The findings were correlated with Chest x-ray and CT scan.

Results

The median time for FOB and BAL was 16 days (range, 3 to 32 days) after the clinical diagnosis of chest infection.. BAL fluid examination/culture grew microbial isolates in 21 of 25 patients (84%). Of these- bacteria alone were present in 10, fungi alone in 1 and polymicrobial isolates were seen in 10 patients (40%). Later included- a combination of bacteria and fungi - in 2 patients, bacteria and AFB - 6 and a combination of bacteria, AFB and fungi were seen in 2 patients. BAL changed the radiological diagnosis in 14 patients (56% diagnostic utility). Therapy was modified according to BAL results in 6 patients (therapeutic utility of 24 %). Concordance between radiological and BAL findings were found only in 5 patients (20%). FOB procedure was tolerated well, with mild and reversible complications (throat pain, transient hypoxia, tachycardia) in some patients.

CONCLUSIONS

Infections are the main cause of pulmonary infiltrates in patients with haematological malignancies. Bacterial , fungal and mycobacterium tubercular organisms are the main isolates. Isolation of ESBL positive organisms and polymicro-bial isolates suggest inclusion of appropriate initial empirical antibiotics in these patients to prevent development of resistant organisms. Higher frequency of AFB isolates (32%) was the surprising finding and need to be confirmed in future studies.

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INTRODUCTION

Infections are the major cause of morbidity and mortality in patients with haematological malignancies. Chest is the common site of infection[1-2]. Pulmonary infiltrates, seen on radiological investigations, in these patients are generally considered to be of infective etiology. Less frequently, non-infectious causes are also found either alone or in combination . In presence of fever with pulmonary infiltrates, such patients are started on empirical antibiotics along with antifungals. In a number of patients these infiltrates persists in spite of treatment, and the etiology remains obscure. This could be due to infections caused by resistant organisms. Super added infections with other organisms, reactivation of latent infections, or non-infectious causes like pulmonary haemorrhage, congestive cardiac failure and the disease itself, can also cause pulmonary shadows in this setting.[3]

Since the range of etiologies is very wide in such a clinical setting, empirical therapy may not always be appropriate. Specific diagnosis and institution of specific treatment promptly would be very critical to reduce the mortality and morbidity in these patients.

In order to obtain appropriate material for diagnosis, fiber optic bronchoscopy (FOB) with broncho-alveolar lavage (BAL) has been found useful in these patients.[4-11]

We have recently conducted a study using FOB and BAL in patients with haematological malignancies with persistent pulmonary infiltrates to determine the spectrum of microbial pathogens involved in the etiology and to correlate clinical, radiological and BAL findings to assess if this would help in optimizing our therapeutic strategy for these patients. This report describes the results.

PATIENTS & METHODS

Between January 2001 and June 2002, patients with haematological malignancies admitted in the medical oncology ward were studied. Patients characteristics are shown in table-1. Eligibility criteria included – (i) patients with clinical and radiological evidence of pneumonitis, not responding to empirical anti microbial treatment for minimum of 48 hours, (ii) ECOG performance status $\leq$ 2, (iii) hemodynamically stable. (i.e. normal blood pressure, pulse rate and oxygen saturation) (iv) no evidence of bleeding diathesis, (v) supported platelet counts $\geq 100 \times 10^9$/L.

Pulmonary infiltrate was defined as evidence of pneumonitic opacities (pulmonary infiltrates) seen on Chest X Ray. Fever was defined as single reading of oral temp $\geq 101^0$ F or 2 values > 100.4^0 F recorded at least 1 hour apart, unrelated to blood product transfusions or chemotherapy drugs administration. For present study patients were defined to have neutropenia if absolute neutrophil count (ANC) was $\leq 2.0 \times 10^9$/ L.

Initial evaluation for a febrile episode included- detailed physical examination for any clinical focus of infection in chest or other sites. Complete haemogram including absolute neutrophil count and aerobic blood cultures from peripheral blood and central line were taken. Chest x-ray was done to look for any pulmonary infiltrate. Wherever possible and indicated , sputum was submitted for direct smear examination by gram stain, Ziehl- Nielson (Z-N) stain for acid-fast bacilli (AFB) and staining for demonstration of fungal hyphae.

Fiber optic bronchoscopy (FOB) and bronchoalveolar lavage (BAL) - Each patient was explained the nature of the procedure in detail and an informed consent was taken. The patient was kept on an overnight fast. A small dose of sedative was given as pre -medication.

The FOB was introduced intranasally after topical anaesthesia using lignocaine jelly. After the bronchial tree was examined, the

bronchoscope was wedged into the airway of the involved lobe segment of the lung. 25-50 ml aliquots of normal saline at room temperature were instilled and gently aspirated using suction machine into sterile trap bottles.[12-13]

BAL specimen was submitted for the (i) bacterial studies using Gram's stain and aerobic bacterial cultures, both qualitative and quantitative. For quantitative cultures the BAL fluid was diluted with normal saline from $1:10^2$ to $1:10^4$ times. It was then inoculated on to culture media viz. blood agar, Mac Conkey's agar and chocolate blood agar. Thioglycollate broth was also introduced if the results of culture plates were negative. The colony count of $> 10^4$ cfu /ml was considered significant. Studies for acid-fast bacilli by Z-N stain and mycobacterial cultures on Lowenstein- Jenson (LJ) medium. (ii) Fungal studies by direct KOH mount and fungal culture (iii) Viral studies for herpes simplex virus (HSV) and cytomegalovirus (CMV) by culture / PCR (iv) cytopathological studies were done to look for malignant cells, inflammatory cells, AFB, Pneumocystis carinii by silver methanamine stain and hemosiderin.

Table-1 Patients Characteristics

Total no of patients	25
Age median (range)	32 years (16-65)
Sex : M:F	21:4
Primary Diagnosis	
AML	10
NHL	5
CLL	3
HD	2
ALL	2
Myeloma	1
CML	1
MDS	1
Presenting Symptoms/Signs	
Fever	23
Cough	11
Haemoptysis	2
Chest Pain	3
Dyspnoea	2
Crepitations	10
Tachypnoea	1
Bronchial breath sounds	1

Table : 2 Radiological Features

Sl No .	CT Scan Findings	X Ray Findings	Radiological Impression
1	Not done	Alveolar opacities	Bacterial pneumonia
2	Alveolar opacities	Alveolar opacities	Bacterial pneumonia
3	Not done	Alveolar opacities	Bacterial pneumonia
4	Calcification, Nodular shadows	Alveolar opacities	Fungal Pneumonia
5	Not done	Alveolar opacities	Bacterial pneumonia
6	Alveolar opacities, Calcification Lymph node enlargement	Alveolar opacities	Tuberculous Pneumonia
7	Alveolar opacities	Alveolar opacities	Bacterial pneumonia
8	Not done	Alveolar opacities	Bacterial pneumonia
9	Not done	Nodular shadows	Fungal Pneumonia
10	Not done	Alveolar opacities Pleural Effusion	Bacterial Pneumonia
11	Not done	Alveolar opacities Bacterial Pneumonia	Pleural Effusion
12	Alveolar opacities, Lymph Node Enlargement.	Alveolar opacities	Bacterial Pneumonia
13	Cavity, Alveolar opacities	Cavity, Alveolar	Tuberculous Pneumonia
14	Alveolar opacities Lymph Node Enlargement	Alveolar opacities	Tuberculous Pneumonia
15	Normal	Interstitial Shadows	Bacterial Pneumonia
16	Cavity/ Alveolar shadows Lymph Node Enlargement	Lymph Node Enlargement	Bacterial Pneumonia
17	Cavity with fungal ball	Cavity	Fungal Pneumonia
18	Not done	Alveolar Opacities	Bacterial Pneumonia
19	Alveolar/ Nodular	Alveolar opacities	Bacterial Pneumonia
20	Alveolar	Alveolar	Bacterial Pneumonia
21	Not done	Alveolar Opacities	Bacterial Pneumonia
22	Alveolar/ Nodular	Alveolar opacities	Bacterial Pneumonia
23	Not done	Alveolar/ Effusion	Tuberculous Pneumonia
24	Interstitial lesions	Interstitial opacities	Tuberculous Pneumonia
25	Pleural Effusion/Alveolar	Pleural Effusion/Alveolar	Bacterial Pneumonia.

TREATMENT PROTOCOL

All patients received broad spectrum antibiotics mainly third generation cephalosporin plus amikacin or a combination of piperacillin plus aminoglycosides. Patients were examined daily or twice a day for any focus of infection. At 48 to 72 hours, patients who became afebrile were continued on same antibiotics. Patients who were still febrile, antibiotics were changed according to culture

report. For patients with evidence of worsening, with culture sterile, amphotericin B was added empirically . For patients with central line, gram positive cover was added followed by amphotericin-B. Patients with persistent pulmonary infiltrates despite above antibiotics, were subjected to FOB and BAL. The treatment was modified based on the results of BAL or on clinical judgement where BAL was negative. All the data was collected according to pretested proforma and entered in SPSS 10 software for statistical analysis.

RESULTS

Between January 2001 and June 2002, 25 patients with hematological malignancies were included in the present study. The median age was 32 years ranging from 16 to 65 years. There were 21 males and 4 females. Underlying haematological diagnosis was acute myeloid leukemia ,n=10, non Hodgkin's lymphoma ,n=5, chronic lymphocytic leukemia (CLL)-3, Hodgkin's disease –2, and acute lymphoblastic leukemia –2 and chronic myeloid leukemia (CML) , multiple myeloma (MM) , and myelodysplastic syndrome in one patient each. Symptoms and signs at the time of febrile episode are given in table-1. Presenting symptoms were – fever –23 (92%), cough (11), chest pain-3, hemoptysis -2, dyspnoea –1, and expectoration -1. The common signs were crepitations on chest auscultation (10 patients). Bronchial breath sounds and tachypnoea were seen in one patient each. In 14 patients (56%), no signs of pneumonitis could be detected.

RADIOLOGICAL FEATURES

Table –2 depicts the radiological features of the patients. CT scan of chest was available in 16 patients. Chest radiographs was done for all the patients. In 15 patients the radiological diagnosis was bacterial pneumonia. Fungal pneumonia and tuberculous pneumonia was suspected in 5 patients each.

HAEMATOLOGICAL INVESTIGATIONS

Eight patients (32%) were non-neutropenic for the entire duration of the episode of pneumonitis while 17 patients (68%) had neutropenia at some point during the episode. On the day of BAL, 14 patients (56%) were neutropenic (ANC< $2.0x10^9$/L), while 11 patients (40%) were non neutropenic . (grade 0, ANC > $2.0X10^9$/L). 4 patients had grade 4 (ANC < $0.5X 10^9$/L) neutropenia. Sputum findings In 4 patients sputum culture grew bacteria, In one patient - fungus candida albicans was isolated, and in 1 patient the culture was sterile. In 15 patients no sputum sample was available while in 4 patients the sample was found to be inappropriate on microbiological examination. Concordance between sputum and BAL was seen only in one patient.

BRONCHO ALVEOLAR LAVAGE (BAL) FLUID FINDINGS

The median time for FOB and BAL was 16 days (range, 3 to 32 days) after the clinical diagnosis of chest infection.. BAL fluid examination/ culture grew microbial isolates in 21 of 25 patients (84%). Overall bacterial isolates were seen in 20 patients (80%), while fungi were isolated in 5 patients (20%). In 8 patients (32%) AFB was demonstrated.

Bacteria alone were found in 10 patients while fungi alone were seen in 1 patient. Polymicrobial isolates were seen in 10 patients (40%). A combination of bacteria and fungi were seen in 2 patients, while bacteria and AFB were seen in 6 patients. A combination of bacteria, AFB and fungi were seen in 2 patients.

Table-3 : Microbial Isolates

Total no of microbial isolates	21	84%
Type	No	%
Bacterial alone	10	40
Fungi alone	1	4
AFB alone	0	0
Bacteria + Fungi	2	8
Bacteria + AFB	6	24
Bacteria + AFB + Fungi	2	8
Total	21	84%

Table-4 : Microbiological Spectrum

Organisms isolated	**Number of patients**
Pseudomonas aeruginosa	
ESBL +	9
ESBL -	2
E. coli (ESBL -)	1
Acinetobacter (ESBL+)	1
Mixed Growth (bacteria)	7
Total no. of positive cases	**20 (80%)**
Fungi:	
Organism	***Number***
Candida tropicalis	1
Aspergillus fumigatus	3
Aspergillus niger + A. flavus	1
Total	5

Table –5 : Isolation of Acid Fast Bacilli (AFB) in BAL Fluid

Patient No	AFB Smear	AFB on Cytology sample	AFB Culture	Comments
4	+	-	-ve	Improved on ATT (14 months follow up)
8	+	+	-ve	Improved on ATT. LFU (4 months)
10	+	++	-ve	Improved on ATT,LFU. (2 months)
13	+	-	-ve	Died of GVHD
18	-	+/-	+ve	Improved on ATT
19	-	+++	-ve	Improved on ATT. Follow up (2months)
20	-	+	-ve	Improved, No ATT (4 months follow up)
21	-	++	-ve	Improved, No ATT Evidence of TB spine, 3 months follow up

ATT- Anti tuberculosis treatment, LFU- Lost to follow up, GVHD- Graft v/s host disease.

BACTERIOLOGY

Bacteria were isolated in a total of 20 patients. Extended spectrum β- lactamase producing (ESBL+) pseudomonas aeruginosa was the commonest species of bacteria isolated (9 patients). Other bacteria isolated included ESBL (-) Pseudomonas aeruginosa in 2 patients, ESBL (-) Esherichia coli in 1 patient and ESBL (+) Acinetobacter in 1 patient. In 7 patients a polymicrobial growth was grown on culture.

Fungi were grown on culture in 5 patients. Aspergillus fumigatus was grown in 3 patients. In 1 patient a combination of A.niger and A.flavus was seen, while Candida tropicalis was seen in 1 patient. None of the patients were positive for the direct KOH stain.

Acid Fast Bacilli: Eight out of 25 patients (32%) had AFB isolated from the BAL specimen . In 4 patients AFB was detected in the routine Z-N stain. Another 4 cases were detected to be AFB positive when the same samples were processed for cytopathology. However only 1 patient had a positive culture for mycobacterium tuberculosis.

Six patients were started in anti tuberculous treatment (ATT) based on the results of BAL. Two patients were kept on follow up without ATT, as their chest infiltrates had cleared up completely with empirical antibiotic and antifungals treatment. On follow up, pulmonary infiltrates in 7 patients improved. One patient expired before response to ATT could be assessed due to other co - morbid conditions.

VIRUSES

Samples could be processed for viruses in 15 patients. Herpes simplex virus (HSV) was identified in 1 patient by PCR. This patient had undergone treatment with allogeneic peripheral stem cell transplant for CML.

RADIOLOGICAL, CLINICAL AND BAL CORRELATION

Table –6 shows the radiological and clinical correlation with BAL findings.. The final respiratory diagnosis after the BAL results were, bacterial pneumonia in 10 patients, fungal pneumonia in 1 patient and mixed group of infection in 10 patients. In 4 patients the BAL cultures were sterile; two of these patients had BAL fluid stain positive for hemosiderin, suggestive of pulmonary hemorrhage. BAL changed the radiological diagnosis in 14 patients (56% diagnostic utility). Therapy was modified according to BAL results in 6 patients (therapeutic utility of 24%). Concordance between radiological and BAL findings were found only in 5 patients (20%).

Complications of BAL : The procedure of Bronchoscopy was well tolerated by the patients and the problems encountered (tachycardia- 12 , hypoxia- 6 , throat pain-9) were mild and reversible. One patient developed mild epistaxis, which responded to conservative management.

DISCUSSION

We carried out present study to evaluate nature of pulmonary infiltrates using BAL and compare with conventional method of diagnosis e.g. clinical, radiology , blood and sputum culture . Even though the no of patients studied was small, the study population was unique as it included patients of various haematological malignancies both neutropenic and non neutropenic.

Presence of fever in most neutropenic patients is generally indicative of an underlying infective cause. However, localizing signs may

Table 6 : Clinical , radiological and BAL Correlation with Final Outcome

Sl. no	Radiologic Impression	**BAL findings**	BAL Changed diagnosis	BAL Modified treatment	Final Respiratory diagnosis	Final outcome
1	BP	A.fumigatus.	Yes	No	FP	improved
2	BP	P.aeruginosa+	No	No	BP	improved
3	BP	Sterile	No	No	Idiopathic	improved
4	FP	P.aeruginosa+ AFB	Yes	Yes	Mixed Infection	improved
5	BP	Sterile	No	No	Idiopathic	improved
6	TB	P.aeruginosa+	Yes	Yes	BP	improved
7	BP	P. aeruginosa (-)	No	No	BP	improved
8	BP	Poly microbial A.flavus,A.niger AFB	Yes	Yes	Mixed Infection	improved
9	FP	Polymicrobial A.fumigatus	Yes	No	Mixed Infection	improved
10	BP	Poly microbial AFB	Yes	No	Mixed Infection	improved
11	BP	P.aeruginosa+ C. tropicalis	Yes	No	Mixed Infection	improved
12	BP	Poly Bacterial Hemosiderin	No	No	BP Pulmon H'ge	improved
13	TB	Poly Bacterial A.fumigatus AFB	Yes	Yes	Mixed Infection	Died
14	TB	Sterile	No	No	Idiopathic	improved
15	BP	P.aeruginosa+ Hemosiderin	No	No	B P ? Pulmon H'ge	Improved
16	BP	Acinetobacter (+)	Yes	Yes	BP Hemosiderin	improved
17	FP	Polymicrobial	Yes	No	BP	improved
18	BP	Polymicrobial AFB	Yes	Yes	Mixed Infection	improved
19	FP	P.aeruginosa+ AFB	Yes	No	Mixed Infection	improved
20	BP	P.aeruginosa+ AFB	Yes	No	Mixed Infection	improved
21	BP	P.aeruginosa (–) AFB	Yes	No	Mixed Infection	improved
22	FP	Poly microbial	No	No	BP	improved
23	TB	P.aeruginosa (+)	No	No	BP	improved
24	TB	Sterile	No	No	Idiopathic	improved
25	BP	Poly microbial	No	No	BP	improved

BP-bacterial pneumonia, FP-fungal pneumonia, TB-tubercular, Pulmon.Hge- pulmonary haemorrhage

be subtle or absent. Respiratory signs were present in less than half of the patients in the present study, indicating that signs of respiratory infection are blunted in many of these patients, as their capacity to mount an inflammatory response is limited. This highlights the importance of other modes of investigations like chest radiographs[14] and CT scans in detecting onset of pulmonary infections in these patients.[15-18] Our study also confirms earlier observations[1-2] that sputum studies are not appropriate for this group of patients. Fifteen patients could not give a sample and in 4 patients the sample was inappropriate. This is most probably due to the fact that these patients do not mount a significant immune response, as they are immunosuppressed.

Gram negative pathogens were the most common isolates. In 10 out of 20 patients ESBL positive bacteria were isolated. This points out to the emergence of these types of organisms as an important cause of infection in these patients. This also highlights the importance of using antibiotics that are capable of neutralizing the β-lactamase, produced by these organisms and incorporating them into upfront empirical antibiotic combinations. Gram-positive bacteria were not isolated separately in our study. This is in contrast to the global trends where in gram-positive bacteria are replacing gram-negative bacteria as the predominant infecting agent in these groups of patients.[19] This may be partly due to the fact that effective antibiotics active against gram-positive bacteria are incorporated early as part of empirical antibiotic therapy. It is important to remember that infection patterns vary considerably depending on local factors. Therefore each institution must have an antibiotic policy based on local prevalence and sensitivity patterns.

It is interesting to note that in a significant proportion of the patients in whom microbes were isolated (10 out of 21), more than one type of organism (mixed infection) were present. Mixed infections cannot be detected by the routine clinical and radiological tests. In this aspect, BAL forms an important diagnostic tool for these patients to optimize antimicrobial treatment.

In 7 out of 20 patients in whom bacteria were isolated, multiple bacteria were grown simultaneously. This may represent actual infection with more than one bacterium or may be due to contaminants. One of the disadvantages of the FOB is the possible contamination during its introduction through the nasal passage. Therefore it is important to be careful during the procedure of collection and transport of the BAL specimen. Surveillance cultures from the upper airways and correlation with the BAL isolates may be helpful in distinguishing between contamination from the upper airway and true infection of the lower respiratory tract.[4] Quantitative estimation of the cultures also would be helpful in this regard.

Fungi could be grown in culture from 5 patients. However none of the patients stained positive for fungi from the direct KOH examination. Two out of the 5 patients has received Amphotericin - B as part of empirical treatment, which might have been a reason for KOH preparation being negative. Sensitivity of the organism to antifungals drugs was not done in our study. One patient , who had evidence of cavity with fungal ball inside, which was highly suggestive of Aspergillosis radiologically, however did not show any fungal growth on BAL culture. This patient also had received empirical antifungals therapy with Amphotericin-B, which might have been the reason. This highlights the fact that BAL findings can be falsely negative as far as fungal infections are concerned . Strong clinical or radiological evidence of fungal infection should be treated with full course of antifungal therapy, as BAL cultures can be sterile for fungi, especially if the patient has already been started on anti fungal therapy empirically.[20]

Eight out of 25 (32%) patients had evidence of AFB. This was higher than

expected. It is of interest to note that in all the patients the AFB was seen either in combination with bacteria (6 patients) or in combination with fungi (2 patients). However, only one sample out of the 8 positive for AFB grew on culture. This may have been due to the fact that most of the patients had received broad-spectrum antibiotics (including amikacin) as part of their empirical antibiotics, to which the AFB may have been sensitive. Species determination of the AFB was not done in our study. It should kept in mind that the pulmonary infiltrates cleared up in all the 7 patients in whom response could be assessed. This was due to the fact that AFB was seen in combination with either bacteria or fungi and all the patients received broad-spectrum antibiotics and anti-fungals therapy for the same. Two patients were not put on anti tubercular treatment (ATT) as their pulmonary lesions completely cleared and were kept under observation. Interestingly one of them, subsequently developed clinical and radiological evidence of spinal tuberculosis with paraparesis after a period of 2 months and was put on ATT.

The high incidence of AFB in our study was unexpected but not surprising. A study by Modi et al[21] from our institute using FOB and BAL in post renal transplant patients, revealed an incidence of 39 % (7 out of 18 cases). The high prevalence of mycobacterium in our population is well known.[1-2] This could either represent a reactivation of latent infection, which is more likely, or a new infection.[22] Infection with mycobacterium is many a time missed out in these patients, as they usually have other acute infections, which are more readily manifested. However the possibility of underlying mycobacterium infection must be always be kept in mind while treating these patients. Another issue that must be addressed in this regard is the possibility of mycobacterial contamination of the bronchoscope. We had detected AFB once, during routine examination of bronchoscope washing. This highlights proper maintenance and decontamination of the instruments to avoid false positive results.

In our study only one instance of HSV (out of 15 cases tested) was found. This was in the patient who underwent transplant. Probably viral infections are not a major cause of morbidity in hematological malignancies and are more important in patients undergoing bone marrow transplant only.[23] However our study sample size was small for any definitive conclusions in this regard. Our study did not reveal any Pneumocytstis carinii. The exact reason for this was not very clear. [24]

The median number of days between onset of symptoms and BAL was 16 days. This was more than that was anticipated. This was due to the fact that most of our patients who developed pneumonitis were having a poor performance status (PS). Therefore we had to delay procedure till the performance status of the patients improved so that they could tolerate the procedure. Also we had to ensure a platelet count of at least $100x10^{9}$ /L. This was difficult to achieve as most of the patients had received intensive cytotoxic therapy and subsequently were severely myelosuppressed. Therefore in achieving an adequate platelet count, the procedure was often delayed. A well-coordinated approach and aggressive platelet support should help in decreasing the time interval between onset of symptoms and BAL. Reduction of the minimum required platelet count to 50×10^{9}/L, in patients who does not have any evidence of bleeding may be tried out in this regard. Overall, the procedure was tolerated well with minor reversible complications. With increasing experience and due precautions, major complications seen in earlier days[25-26] are rarely encountered .

We had a diagnostic yield of 84 %. This compares well with the other studies reported.[4,10] However our therapeutic utility was only 24 %. This could be due to the fact that organisms in the pulmonary parenchyma take more time to clear compared to blood. BAL would pick up these organisms, which were

otherwise responding to the therapy. Also our empirical therapy protocol included agents effective against ESBL + organisms. The identification of organisms ensured that the full courses of antimicrobial therapy could be given to these patients as part of definitive therapy. Therefore, the actual benefit to the patients may have been higher than indicated. Furthermore, if these organisms are not eradicated fully they could form part of resistant colonization. These could be potential source of further morbidity in future chemotherapy courses. These finding would probably help in optimizing empirical antimicrobial therapy during future chemotherapy schedules. Knowledge of prevalence of organisms and their sensitivity patterns would also help in formulating effective empiric antibiotic protocols.[19] This would help in decreasing the morbidity and also in cutting cost of antibiotic treatment. Our finding also emphasizes the importance of appropriate empirical antimicrobial therapy, which forms the mainstay of treatment for these patients.[3]

Our finding suggests that BAL has got several potential advantages in evaluating patients with hematological malignancies. However it must be emphasized that the effectiveness of BAL depends on several local factors. Presence of good microbiological and cytopathological back up is crucial in analyzing the specimen. The availability of a dedicated team to do the bronchoscopy is also very important. A well-coordinated approach by all the teams involved cannot be overemphasized.

In summary, our initial experience with FOB and BAL in patients with hematological malignancies pulmonary infiltrates is encouraging. It has been a learning experience and the results obtained would be of benefit in planning further studies.

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KGMC Travel Fellowship

Indian Society of Medical & Paediatric Oncology invites application for KGMC Travel Fellowship. The total award amount is Rs. 2500-00 (to cover their travel and stay). There are two fellowships each year. Candidates are expected to spend 2 weeks at a major cancer centre in India. On completion, they have to submitt one page visit report. Awarded candidates should correspond with the host institute to finalise their dates of visit and stay arrangements. Interested applicants may send their brief CV to

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