

# COMPARISON BETWEEN MINI-BAL AND BAL RESULTS AMONG ICU PATIENTS WITH PREDOMINANT RIGHT LOWER LOBE PNEUMONIA

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## ABSTRACT

**Background:** Bacterial pneumonia is one of the public health concerns with high ICU admissions, morbidity and mortality in individuals of all ages worldwide. The diagnosis in intensive care unit (ICU) settings poses challenges, primarily obtaining rapid and reliable microbiological confirmation. Objective of the present study is to compare the results of mini-BAL and BAL among ICU patients with predominant right lower lobe pneumonia.

**Material and Methods:** This Prospective randomized comparative cross-sectional study as done Medical ICU, Services Hospital, Lahore – 1 year. The study was carried out after approval from the institute's ethics committee. Our study had 66 participants, 33 in each group. Each group of patients was assigned at random. The first group had the BAL procedure, whereas the second group received the mini-BAL procedure. Both groups' demographic, clinical, laboratory, bacteriological, and mycological data were obtained. SPSS version 23 was used to analyse the data collected. Mean, standard deviation, frequency, and percentages were utilised in descriptive statistics. The Chi square test was also used to compare groups. Cut off set to  $p < 0.05$ .

**Results:** The BAL technique isolated bacteriological pathogens in 13(39.4%) patients and mini-BAL technique isolated bacteriological pathogens in 15(45.5%) patients. The BAL technique isolated mycological pathogens in 12(36.4%) patients and mini-BAL technique isolated mycological pathogens in 14(42.4%) patients. There was no statistically significant difference among the two procedures. ( $p > 0.05$ )

**Conclusion:** In the mini-BAL group, the frequency of isolation of bacteria and mycological pathogens is slightly higher. Although there was no statistically significant difference, we propose that mini-BAL be used instead BAL because it is less invasive.

**Key Words:** Comparison, Mini-BAL, BAL ICU patients, Right lower lobe, Pneumonia

## BACKGROUND

Bacterial pneumonia is one of the most important public health challenges due to its high medical and economic expenses, which result in increased morbidity and mortality in individuals of all ages worldwide.<sup>1-3</sup> Pneumonia is an acute inflammation and consolidation of lung tissue caused by infectious organisms such as bacteria, viruses, fungi, and parasites.<sup>1</sup> Bacterial pneumonia is an inflammation of one or two lobes of the lung caused by bacterial infection.<sup>4</sup>

The most prevalent ICU-acquired infection is ventilator-associated pneumonia (VAP). Five to forty percent of incidents are reported. It is strongly recommended that infections be confirmed microbiologically. Which sampling technique to employ is still a matter of debate. Emerging microbiological tools will likely alter our standard diagnostic and treatment procedures for VAP in the near future.<sup>5</sup>

The diagnosis in intensive care unit (ICU) settings poses challenges, primarily obtaining rapid and reliable microbiological confirmation. BAL is a diagnostic tool for bacteriological and fungal infections.<sup>6</sup> The BAL bronchoscopic technique is costly and requires experienced personnel. Complications associated with invasive procedures, such as BAL, are more likely to occur in critically ill patients. Therefore, the hazards and advantages of BAL should be carefully weighed in the case of a critically ill patient.<sup>7</sup> Mini bronchoalveolar lavage (Mini-BAL) is an alternate approach for acquiring respiratory samples from mechanically ventilated patients that is straightforward,

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less invasive, and inexpensive.<sup>8,9</sup> A study could not find any difference in the diagnostic frequency of the two procedures.<sup>10</sup>

Less invasive and new diagnostic techniques, like mini-BAL, has been investigated in the recent years based on above observation, notably in diagnosis of VAP "ventilator associated pneumonia".<sup>7</sup> However, there is inadequate evidence to evaluate the diagnostic usefulness of mini-BAL to BAL in ICU patients with predominant right lower lobe pneumonia. Feasibility and diagnostic usefulness of this less invasive technique, the mini-BAL, is gaining popularity. The aim of our study was to compare the results of mini-BAL and BAL among ICU patients with predominant right lower lobe pneumonia.

## MATERIAL AND METHODS

After approval from ethical committee of institute the study was conducted at Medical ICU, Services hospital Lahore from 01-01-2020 to 31-12-2020. The study design was comparative cross sectional. The sample size of our study was 66, 33 in each group (ICU patients with predominant right lower lobe pneumonia). The patients were randomly assigned to each group. One group underwent BAL procedure and second group mini-BAL procedure.

Regarding BAL, under aseptic measures and local anesthesia with lignocaine, fibro optic bronchoscope was introduced through Endotracheal tube and then into the lavaged section. Two aliquots of 20ml saline were utilized to capture the return fluid in the mucous trap bottle. A minimum of 20ml of sample was sent to the lab for diagnosis.

In mini-BAL procedure; A sterile long suction catheter of size 12 French (Fr) was inserted through the ET and

blindly progressed into the distal airways until resistance was encountered, at which point the tube was jammed. Suction was used to collect aspirate in a sterile mucous extractor container after 20 ml of Sodium Chloride 0.9 percent was given through the catheter. Following these procedures, the probe was carefully withdrawn utilizing turning movements.

The demographic, clinical, laboratory, bacteriological and mycological information for both groups were collected. The collected information was analyzed by using SPSS version 23. In descriptive statistics, mean, standard deviation, frequency with percentages were used. Chi square test was also used to compare outcome. P value less than 0.05 was set as significance level.

## RESULTS

We enrolled 66 patients in our study 33 in each group. One group was BAL group and second group was Mini BAL group. Frequency and percentages of qualitative variables; gender, use of the antibiotic, diabetes mellitus, hypertension, atherosclerotic cardiac disease, chronic renal failure, sepsis, chronic liver failure are presented in Table-I. Descriptive statistics (mean±SD) of Age, APACHE II, Temperature °C, Leukocytes/mm<sup>3</sup>, CRP mg/dl, Procalcitonin ng/dl, Albumin, g/dl, Creatinine mg/dl are presented in Table-II. The outcome (bacteriological or mycological) was compared among BAL and mini-BAL group. Difference was not statistically significant Table-III.

**Table-I: Qualitative Demographic, clinical and laboratory data of patients**

		Groups	
		BAL Group	Mini BAL Group
Gender	Male	21 63.6%	24 72.7%
	Female	12 36.4%	9 27.3%
Use of the Antibiotic	Yes	30 90.9%	26 78.8%
	No	3 9.1%	7 21.2%
Diabetes Mellitus	Yes	12 36.4%	13 39.4%
	No	21 63.6%	20 60.6%

Hypertension	Yes	10 30.3%	8 24.2%
	No	23 69.7%	25 75.8%
Atherosclerotic cardiac disease	Yes	12 36.4%	9 27.3%
	No	21 63.6%	24 72.7%
Chronic Renal Failure	Yes	9 27.3%	8 24.2%
	No	24 72.7%	25 75.8%
Sepsis	Yes	7 21.2%	8 24.2%
	No	26 78.8%	25 75.8%
Chronic Liver Failure	Yes	1 3.0%	2 6.1%
	No	32 97.0%	31 93.9%

**Table-II: Quantitative demographic, clinical and laboratory data of patients**

	BAL Group	Mini BAL Group
Age	56.18±5.68	57.33±5.54
APACHE II	22.45±2.40	22.88±2.25
Temperature °C	36.97±0.92	36.70±0.85
Leukocytes, / mm <sup>3</sup>	11535.27±280.69	11551.79±321.46
CRP, mg/dl	22.73±4.68	21.79±4.57
Procalcitonin, ng/dl	4.18±1.69	4.61±1.89
Albumin, g/dl	2.52±0.51	2.61±0.50
Creatinine, mg/dl	1.55±0.51	1.48±0.51

(APACHE II "Acute Physiology and Chronic Health Evaluation", CRP "C-reactive protein")

**Table-III: Bacteriological and mycological results of BAL and mini-BAL samples**

		Groups		p value
		BAL Group	Mini BAL Group	
Bacteriological Results	Acinetobacter baumannii	3 9.1%	4 12.1%	0.977
	Streptococcus pneumoniae	3 9.1%	2 6.1%	
	Staphylococcus aureus	3 9.1%	2 6.1%	
	Enterococcus faecium	1 3.0%	2 6.1%	
	Pseudomonas aeruginosa	1 3.0%	1 3.0%	
	Stenotrophomonas species	1 3.0%	2 6.1%	
	Klebsiella species	1 3.0%	2 6.1%	
	No agent	20 60.6%	18 54.5%	
	Candida spp.	11 33.3%	12 36.4%	
	Aspergillus spp.	1 3.0%	2 6.1%	
Mycological results		21 63.6%	19 57.6%	0.788

## DISCUSSION

The study was carried out at Medical ICU Services Hospital to compare the outcomes of mini-BAL and BAL in ICU patients with predominate right lower lobe pneumonia.

Whether obtained in the community or through medical care, pneumonia is a serious condition. It has been established that mortality is reduced when antibiotic treatment is initiated promptly.<sup>11</sup> Due to the difficulty in identifying the causative organisms, selecting the appropriate antibiotic may be problematic. Because of this, broad-spectrum antibiotics are frequently prescribed, at least until microbiological testing is complete. Due to contamination from infected upper airways, endotracheal samples collected from intensive care patients may produce inaccurate results.<sup>12</sup> As a result, physicians must collect reliable lower respiratory tract samples that are free of contamination. Microbiological analysis of bronchoscopy material is regarded as a particular diagnostic technique for determining the causal bacteria in pneumonia.<sup>13</sup>

Bronchoscopy is an invasive, needs expertise, longer time for perform, expensive, disturb the respiratory mechanics, oxygenation and hemodynamics in intensive care unit during procedure. So, an easy method is needed to perform this.<sup>14</sup>

BAL has been linked to a number of problems in patients, particularly acute respiratory distress syndrome. Bleeding, cardiac arrhythmias, pneumothorax and Hypoxemia are some of the other problems. As a result, in the critical patient scenario, the benefits/risks of BAL should be carefully assessed before to application, with the procedure being used when less invasive techniques have limits or are not useful for diagnosis.<sup>15</sup>

Protected mini-BAL is less invasive, needs less expertise, requires less time to perform, inexpensive, has less impact on respiratory mechanics, oxygenation and hemodynamics in intensive care unit during procedure.<sup>16</sup>

In several investigations, the sensitivity and specificity of mini-BAL were reported to be 63-100 % and 66-96 %, respectively. These findings are comparable to those obtained with the fiberoptic BAL. Bronchoscopy is not recommended as a standard diagnostic procedure for some pneumonias, such as CAP, and should be reserved for people with severe types of pneumonia

who have not responded to early medication and require further pneumonia investigations.<sup>17</sup>

In our study we find mini-BAL technique isolated bacteriological pathogens more than BAL technique similar in mycological pathogens results. The difference was present but the difference was not significant statistically. These results matched with the results of study.<sup>1,11</sup>

Another study could not find any difference in the diagnostic frequency of the two procedures.<sup>10</sup> Rouby et al. utilized mini-BAL in patients with hospital-acquired pneumonia. In terms of microbiological correctness, mini-BAL was 74 percent comparable to pathologic examination of postmortem lung tissue. They proposed that instead of bronchoscopy, mini-BAL might be utilized.<sup>11</sup>

Limitations of the present study were small sample size; sample size was not calculated and use of single centre for data collection. We recommend large multi centre trials for confirmatory evidence so that guidelines can be developed and on the basis of evidence less invasive procedure may replace invasive procedure.

## CONCLUSION

The frequency of isolation of bacteria and mycological pathogens is slightly higher in the mini-BAL group. Although there was no statistically significant difference, we propose that mini-BAL be used instead of BAL because it is less invasive, less expensive, requires less expertise, takes less time to perform, and causes less disruption to respiratory mechanics, oxygenation, and hemodynamics.

## CONFLICT OF INTEREST

Authors declare no conflict of interest

## AUTHOR CONTRIBUTIONS

**Anam Ahmad:** Data collection and interpretation, literature review

**Syed Mazhar Ali Naqvi:** Study design, concept and data analysis

**Humaira Nazir:** Data collection and interpretation

**Noma Sarwar:** Drafting and design of questionnaire

**Waqas Aslam:** Data collection and analysis

**Rabia Tariq:** Data interpretation and literature review

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