

# Virological analysis of bronchoalveolar lavage fluid (BALF): Diagnostic yield and indications

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## Introduction

Bronchoalveolar lavage is a major diagnostic tool for infectious lung diseases. Viral respiratory infections are a frequent cause of asthma and COPD exacerbations as well as severe pneumonia. Development of molecular detection techniques by PCR and discovery of new emerging viruses (coronavirus, metapneumovirus, ...) explain the renewed interest in viral diseases, particularly those affecting the respiratory tract. However, in clinical practice, viral analysis of BALF has not always the expected yield.

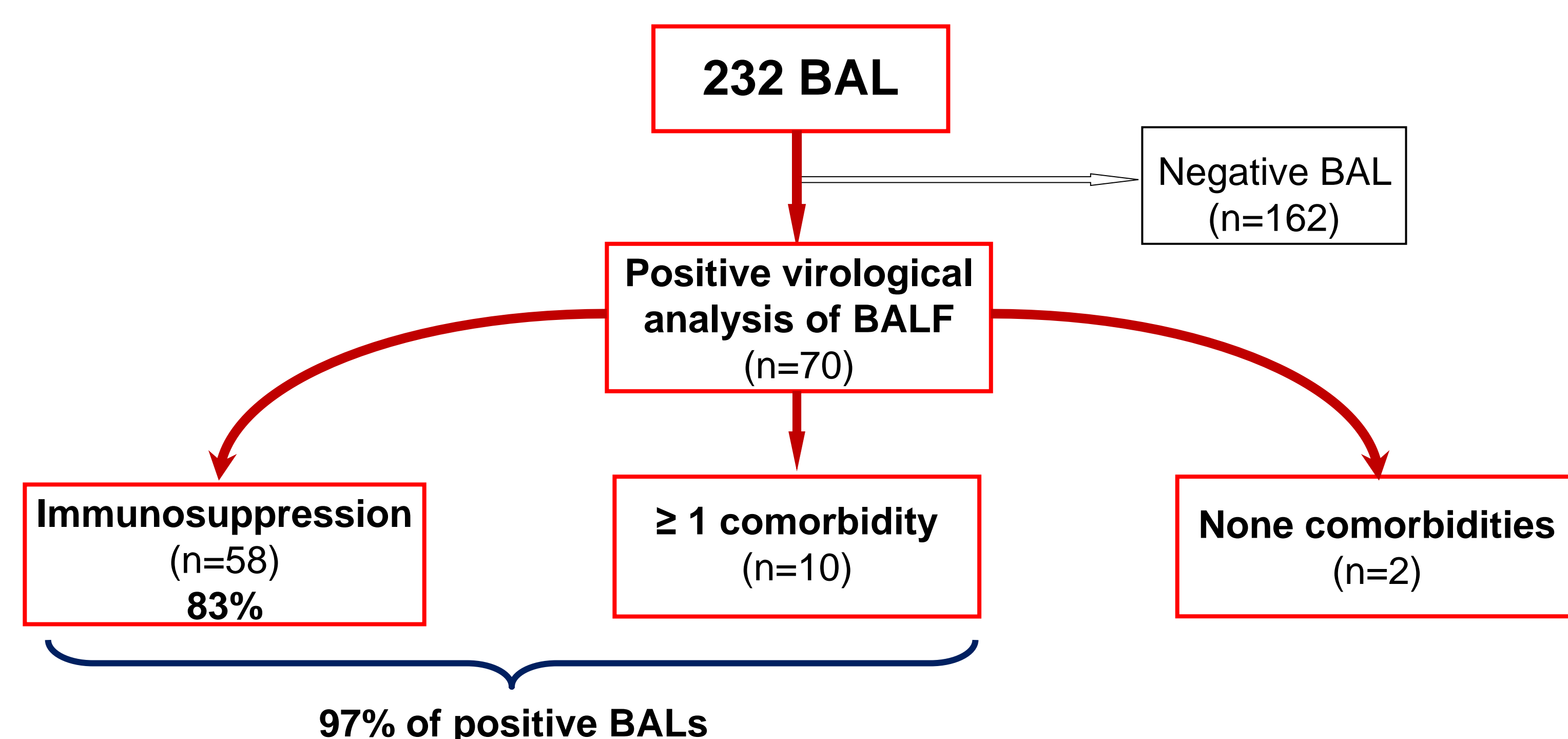
## Aims

1. To assess the diagnostic yield of virological analysis of BALF ;
2. To analyze the characteristics of subjects with positive virological analysis of BALF ;
3. To identify predictive factors of positive virological analysis of BALF.

## Methods

- Retrospective study of all virological analyses in an adult population (immunofluorescence, viral culture and PCR) performed on BALF in 2008 at Rennes University Hospital, France.
- Comparison of characteristics of patients with positive *versus* negative virological analysis of BALF.
- Uni and multivariate analysis (logistic regression) to identify predictive factors of positive virological analysis of BALF

## Results



In 2008, 232 BAL were performed in 212 patients. Seventy BAL were positive (diagnostic yield of 30%).

84 viruses were identified: HSV1 (n=27), CMV (23), EBV (17), HHV6 (12), RSV (3), rhinovirus (1) and adenovirus (1).

PCR was performed in approximately two thirds of BAL (n=149) and was the only positive virological analysis in 21 cases. Without this molecular technique, diagnostic yield would drop to 20%.

Immunocompromised patients (HIV patients, corticosteroids >10 mg/day for ≥ 3 weeks or immunosuppressive therapy) represent 83% of all positive BAL.

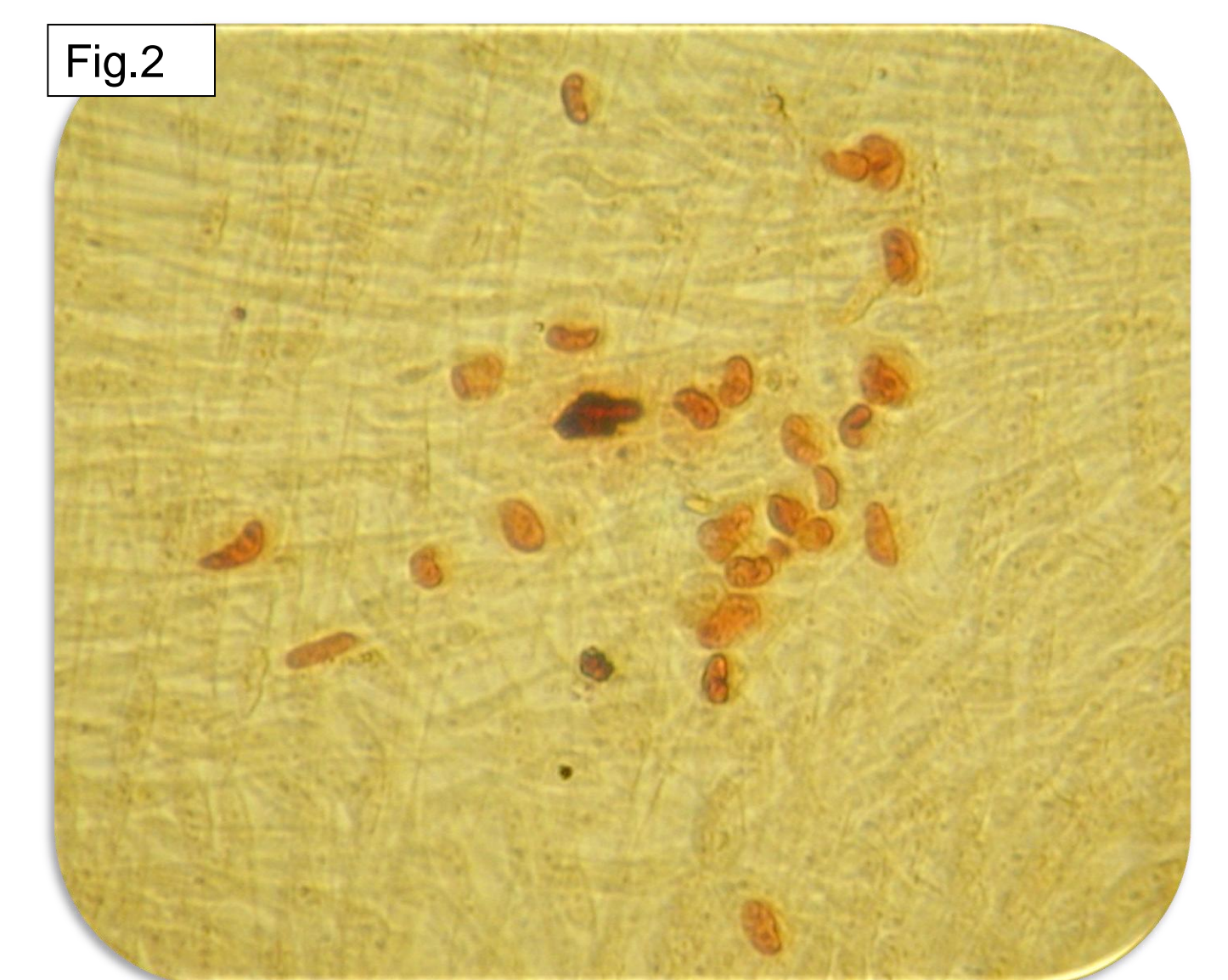
Diagnostic yield was higher in subgroup of immunosuppressed patients in comparison with immunocompetent population (43% *versus* 12%).

## Results

|                                       | Positive BAL<br>n=70 | Negative BAL<br>N=162 | p                  |
|---------------------------------------|----------------------|-----------------------|--------------------|
| <b>Demographic characteristics</b>    |                      |                       |                    |
| - Male gender                         | 42 (60)              | 103 (63,6)            | 0,66               |
| - Age (years)                         | 54,7 +/- 14,4        | 54,5 +/- 15,9         | 0,93               |
| <b>Clinical characteristics</b>       |                      |                       |                    |
| - Fever                               | 67 (95,7)            | 148 (91,3)            | 0,29               |
| - Dyspnea                             | 43 (61,4)            | 82 (50,6)             | 0,15               |
| - Cough                               | 32 (76,2)            | 73 (69,5)             | 0,54               |
| - Sputum                              | 24 (57,1)            | 62 (59)               | 0,85               |
| - Sputum                              | 7 (16,7)             | 20 (19)               | 0,81               |
| - Hemoptysis                          | 2 (2,8)              | 8 (4,9)               | 0,73               |
| <b>Radiological characteristics</b>   |                      |                       |                    |
| - Chest CT-scan                       | 68 (97,1)            | 153 (94,4)            | 0,51               |
| - Large Nodule(s)                     | 50 (71,4)            | 107 (66)              | 0,45               |
| - Small centrilobular nodules         | 12 (17,1)            | 23 (14,2)             | 0,55               |
| - Excavation(s)                       | 15 (30)              | 31 (29)               | 1,00               |
| - <b>Ground glass opacities</b>       | <b>37 (74)</b>       | <b>54 (50,5)</b>      | <b>0,0057</b>      |
| - Bronchial dilatation                | 2 (4)                | 15 (14)               | 0,09               |
| - Air-space consolidation(s)          | 48 (68,5)            | 94 (58)               | 0,14               |
| - Excavation(s)                       | 1 (1,4)              | 8 (4,9)               | 0,28               |
| <b>Immunosuppression</b>              |                      |                       |                    |
| - HIV                                 | <b>58 (82,8)</b>     | <b>76 (46,9)</b>      | <b>&lt; 0,0001</b> |
| - Steroids                            | 11 (15,7)            | 9 (5,6)               | 0,019              |
| - Steroids                            | 25 (35,7)            | 32 (19,8)             | 0,012              |
| - Immunosuppressive therapy           | 28 (40)              | 41 (25,3)             | 0,028              |
| - Others acquired immune deficiencies | 16 (22,8)            | 25 (15,4)             | 0,19               |
| <b>Comorbidities</b>                  |                      |                       |                    |
| - ≥ 1 comorbidity                     | 51 (72,8)            | 103 (63,6)            | 0,17               |
| - Hemopathy/Cancer                    | 24 (34,3)            | 51 (31,5)             | 0,76               |
| - COPD                                | 8 (11,4)             | 16 (9,9)              | 0,81               |
| - Smoking                             | 27 (38,5)            | 66 (40,7)             | 0,77               |
| - Alcoholism                          | 12 (17,1)            | 29 (17,9)             | 1,00               |
| - Drug addiction                      | 4 (5,7)              | 6 (3,7)               | 0,49               |
| - Diabetes                            | 9 (12,9)             | 9 (5,6)               | 0,059              |

Values are number (percentage of column total) and mean ± SD for continuous variables

In multivariate analysis, fever or respiratory symptoms in immunocompromised subjects (OR=6,4;CI95:2,8-14,3;p<0,0001) as well as existence of ground glass opacities on chest CT-scan before BAL (OR=3,7;CI95:1,8-7,7;p=0,0004) were independent predictors of viral identification on BAL.



42 year-old man with cytomegalovirus pneumonia after immunosuppressive therapy (tacrolimus and mycophenolate mofetil) for liver transplantation.

Fig.1: bilateral ground glass attenuations on CT scan. Fig.2: CMV in immunocytochemistry technique.

Pneumonia in immunocompromised subjects was the most frequent indication of BALF viral analysis (55%) with a diagnostic yield of 44%. None of the 17 virological analysis of BALF performed for assessment of diffuse infiltrative lung disease was positive.

## Conclusions

This retrospective study shows that our **diagnostic yield** of virological analysis of BALF is **30%**, is comparable to the literature and is optimal in the immunocompromised population.

The best indication of virological analysis of BALF seems to be pneumonia in **immunocompromised** hosts, especially when chest CT-scan demonstrates **ground-glass attenuations**.

**PCR** improves diagnostic yield of virological analysis of 50%.