BRONCHOALVEOLAR LAVAGE (BAL)

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BAL-OTELLI

in the second se





Typical microliths (calcospherites)



Acute Respiratory Failure. Clinical history. Treated for GI cancer



Bollèe G, et al. Clinical picture of P J P in Cancer Patients Chest 2007, 132: 1305-1310

CLINICAL PRESENTATION

- 54 years
- Male
- Carpenter
- Current smoker (19 pky)
- No other exposures
- Family history negative
- No known allergies to drugs



CLINICAL PRESENTATION

- 5 years history of recurrent episodes of atrial fibrillation, treated with
 - Propafenone
 - Flecainide
 - Pulmonary vein encircling ablation (n = 3)
 - Amiodarone (for 9 months, until 1 year ago)

CLINICAL PRESENTATION

- 1 month history of dry cough and shortness of breath
- No CTD symptoms
- No GER-related symptoms
- No fever



- Examination: no clubbing, no velcro sounds, no signs of right heart failure, SpO2 95% on room air at rest
- Current medications: warfarin, flecainide

LABORATORY FINDINGS

- WBC 10.80x10^9/L [4.00 10.00]
- Eosinophils 0.62x10^9/L [0.00 0.50]
- LDH nn 200 U/L [135 225]
- CRP * 15.5 mg/L [< 5.0]

• Kidney, liver, urinalysis unremarkable





LUNG FUNCTION TESTS

- Tiffenau 77%
- FVC 2,92 * L 72% p
- FEV1 2,38 L 73 % p
- DLCO * 44 % p
- DLCO/VA 70 % p



• ABGs: PaO2 73 mmHg, PaCO2 32 mmHg, pH 7,45















BRONCHOALVEOLAR LAVAGE

- Total cells 180x10^6/L
- Neutrophils 2.0 %
- Eosinophils 27.0 % *
- Macrophages 24.0 %
- Lymphocytes 47.0 % *
 - CD4+ T lymphocytes 40 %
 - CD8+ T lymphocytes 45 %
- Microbiology negative
- No foamy macrophages

Taking into account *HRCT SCAN FEATURES (perilobular pattern)

*BAL FEATURES Which histology do you expect?

OP NSIP UIP DAD NSIP-OP IT IS A USELESS QUESTION (we do not need histology)











DIAGNOSIS: FLECAINIDE LUNG INJURY

Patterns I.a Acute pneumonitis/ILD I.b Subacute pneumonitis/ILD I.g Pulmonary fibrosis

XV.c Path: Organizing pneumonia (OP/BOOP-pattern) (see also Id) XV.j Path: Pulmonary fibrosis (UIP-pattern) **Clinical presentation**

- 74 years
- Male
- Former smoker (quit one year ago, 40 pky)
- Carpenter
- Exposure: chicken/turkeys (~30 years ago)
- No allergies to drugs
- Family history: negative

- Benign prostatic hypertrophy
- Previous deep venous thrombosis

Clinical presentation

- 1 year history of productive cough and shortness of breath
- No CTD signs/symptoms
- No GER related symptoms
- Treatment with steroids with no benefit
- No current medications

Examination: intense dyspnoea at rest, SpO2
93-94% on oxygen 3L/min, thoracic rales, no
signs of right heart failure

•	WBC	10.75x10^9/L	[4.00 - 10.00]
•	Neutrophils	9.23x10^9/L	[2.00 - 8.00]
•	Hb	13.0 g/dl	[13.5 - 17.0]
•	MCV	91.0 fl	[80.0 - 95.0]
•	MCH	30.0 pg	[27.0 - 32.0]
•	Sodium	* 134 mMoli/L	[136 – 145]
•	CRP	1.5 mg/L	[< 5.0]

Lung function tests

- Tiffenau Index 78%
- FVC 1,44L * 45% pred
- FEV1 1,12L * 46% pred
- DLCO 14% * pred
- DLCO/VA 34% pred
- ABGs on oxygen 3L/min: PaO2 66 mmHg, PaCO2 39,8 mmHg, pH 7,44 U









BRONCHOALVEOLAR LAVAGE

- Total cells 70x10^6/L
- Neutrophils 7.0 %
- Lymphocytes 23 %
- Macrophages 70.0 %
- Microbiology: negative






IS BAL DIAGNOSTIC?

DIFFUSE ALVEOLAR DAMAGE (DAD)

PULMONARY LYMPHOMA

COP

ADENOCARCINOMA

IT IS A USELESS QUESTION (we need histology)

















Poletti V, et al. Sem Respir Crit Care Med 2007, 28: 534-545





Clinical presentation

- 68 years
- Male
- Former smoker (30 pky, quit 14 years ago)
- Bus driver
- Family history: negative
- No exposures
- No allergies to drugs
- GERD, arterial hypertension, HBV
- Medications: pantoprazole, alendronic acid, losartan, aspirin

3 years history of dry cough and shortness of breath on exertion

No fever

No CTD signs/symptoms

No GER – related symptoms

Examination: velcro sounds, no clubbing, no signs of right heart failure, SpO2 95% on room air at

rest

Laboratory findings

- WBC $* 13.95 \times 10^{9}/L$ [4.00 10.00]Lymphocytes $* 5.35 \times 10^{9}/L$ [1.00 4.00]Hb14.1 g/dl[13.5 17.0]LDH151 U/L[135 225]proBNP152 pg/ml[< 900]
 - CRP <1 mg/L [< 5.0]
 - Kidney, liver and urinalysis: negative
 - Autoimmune profile: negative
 - Precipitins: negative
 - Anti HBsAg and HbcAb positive, anti HCV negative

Lung function tests

- Tiffenau Index 83%
- FVC 2,47 L 67% pred
- FEV1 2,06 L 72% pred
- RV 2,01 L 81% pred
- TLC 4,58 L 70% pred
- DLCO 78% pred
- DLCO/VA 124% pred















Radiologic report from the audience

DEFINITE UIP

POSSIBLE UIP

INCONSISTENT with UIP

POSSIBLE UIP but with a "clue"



Total cells 80 x 10⁶/L

Neutrophyls	10.0 %
Eosinophyls	1.0 %
Lymphocytes	8.0 %
Macrophages	91.0 %

Microbiology: negative

ARE CLINICAL HISTORY+HRCT scan+BAL DIAGNOSTIC?

YES

NO

IT IS A USELESS QUESTION (we need biopsy)

IT IS A USELESS QUESTION (we need "lumpectomy")

Surgical Lung Biopsy (lateral right lower lobe)











Significance of Bronchoalveolar Lavage for the Diagnosis of Idiopathic Pulmonary Fibrosis

Shinichiro Ohshimo¹, Francesco Bonella¹, Ai Cui¹, Martin Beume², Nobuoki Kohno³, Josune Guzman⁴, and Ulrich Costabel¹

Patient No. 2 3 5 1 4 6 **Final diagnosis** NSIP NSIP NSIP EAA EAA EAA Age 60 65 82 84 67 71 Sex Μ Μ Μ Μ Μ Μ Smoking history Ex Ex Ex Ex Ex Ex History of antigen No No No Yes Yes Yes exposure Type of exposure Humidifier NA NA NA Birds and Moldy mold water hay Positive precipitins ND Yes Yes No No No Type of biopsy SLB SLB TBB TBB TBB ND **Biopsy result** NSIP NSIP EAA NSIP Not NA diagnostic **BALF** analysis TCC, $\times 10^6$ cells/ml 0.03 0.15 0.11 0.53 0.43 0.32 Lymphocytes, % 30 67 41 63 68 70 Granulocytes, % 30 21 8 15 12 1 Neutrophils, % 27 10 5 1 1 1

TABLE 2. CLINICAL CHARACTERISTICS OF THE SIX PATIENTS WITH DIAGNOSES OF NON-IPF

Definition of abbreviations: BALF = bronchoalveolar lavage fluid; EAA = extrinsic allergic alveolitis; Ex = ex-smoker; IPF = idiopathic pulmonary fibrosis; M = male; NA = not applicable; ND = not done; NSIP = nonspecific interstitial pneumonia; SLB = surgical lung biopsy; TBB = transbronchial biopsy; TCC = total cell count.

Measurements and Main Results: A cut-off level of 30% for lymphocytes in BAL demonstrated a favorable discriminative power for the diagnosis of IPF. Six of the 74 patients (8%) showed a lymphocytosis of 30% or greater in BAL. Their final diagnoses were idiopathic nonspecific interstitial pneumonia (n = 3) and extrinsic allergic alveolitis (n = 3). The change in perception of the diagnosis was validated by a surgical biopsy in two cases and by subsequent outcome in four cases.



Strongyloides stercoralis hyperinfection in a patient treated with steroids for IBD



Herpes simplex I pneumonitis





BAL findings in DAD (organizing phase)

CKs

Linssen KC, et al. Reactive type II pneumocytes in BAL fluid Acta Cytol 2004, 48: 497-504


Organizing Pneumonia: BAL findings (BAL performed in 67/78 cases)

Cells/ml

 $418 + -229 \times 10^{3}$

- **Lymphocytes** % 45.0+/-22.5
- Neutrophils % 8.6+/-11.7
- [°] Eosinophils % 5.15+/-2.9
- ° Mast cells % 2.3 +/- 2.14
- Ratio CD4/CD8 < 1 in 45%; normal 51% and >1 in 2 cases
- ° Scattered plasma cells (up tp 6%)
- ° Polyclonal CD 20+ cells in 1 case (12%)
- ° Atypical RP II cells in 6 cases

Cazzato S et al. BOOP: an Italian experience Respir Med 2000, 94: 702-708

Hypersensitivity Pneumonitis: BAL FINDINGS

Euge increase of total cell count (>600.000/ml)
Eymphocytosis (>50%)
Small number of eosinophils
Small number of mast-cells (*degranulated*)
A few plasma cells
Acute transient neutrophil alveolitis
Eoamy macrophages



Differential Diagnosis

BOOP/NSIPPulmonary lymphomasMiral infectionsSarcoidosisPneumonia

- BAL is always indicated in primary diagnosis of HP
- BAL is the preferred method for identification of an alveolitis in HP pts , being more sensitive than chest X-ray, LFTs or precipitines and less invasive than lung biopsy
- BAL does not differentiate between individuals with subclinical alveolitis (sensitized healthy) and pts with overt HP
- Normal BAL citology virtually excludes HP
- Persistent BAL abnormalitiy indicates that total allergen avoidance has not been achieved

Bronchoalveolar Lavage













Vol. I. Gennaio 1920

Fasc. L.

HAEMATOLOGICA

ARCHIVIO DI EMATOLOGIA E SIEROLOGIA

Intituto di Patologia Generale dell'Università di Pavia.

Suila struttura dei globuli rossi dell'uomo e di altri animali, (') (con una teroia hitografica a colori) per il prot. Camilio Goigi

Figure 2. The first article published on Haematologica by Nobelpreize Camillo Golgi; the title was "On the structure of red cells humans and other animals".

function of the liver begins. The validity of this insight was confirmed 7 years later by Minot and Murphy's great discovery (1927) of the hepatic treatment of pernicious anemia.

But Ferrata was also an important pioneer in the field of immunology. In fact, in 1907 a very young Ferrata working at the Pathology Institute of the eminent immunologist from

Adolfo Ferrata 1880-1946



Marcel Bessis 1917-1994





George Nicolas Papanicolaou 13 May 1883 in Kymi (Greece), † 19 February 1962 New Jersey (USA)

HRCT features predicting diagnostic utility of BAL

Alveolar opacification

Ground glass attenuation

Perilymphatic nodules

Peribronchiolar findings

BAL: Diagnostic in

Disseminated neoplasms

Alveolar proteinosis

Langerhans cell histiocytosis

Infections (PCP,....)

Diffuse alveolar damage

Alveolar hemorrhage/capillaritis

Lipoid pneumonia

Rarities.....

BAL: A good diagnostic contributer in

OP

NSIP-OP

Eosinophilic pneumonia

HP pneumonitis (subacute)

Sarcoidosis

Pneumoconioses

BAL: Useful in the diagnostic work-up of

NSIP DIP IPF LIP