

Cerebrospinal Fluid Analysis

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Cerebrospinal fluid analysis

- **lumbar puncture**
- **inflammation of CNS (meningoencephalitis)**
- **bleeding (intracerebral hemorrhage, subarachnoid hemorrhage)**
- **tumours of CNS (primary tumours, metastases)**

Contraindication of lumbar puncture

- **intracranial hypertension: occipital and temporal brain herniation**
- **skin inflammation in area of lumbar puncture**
- **coagulation abnormalities and anticoagulant therapy**
- **severe spondylosis of lumbar area**

Analysis of cerebrospinal fluid

- **macroscopic appearance - clear,cloudy, xanthochromatic, hemorrhagic**
- **protein content**
- **cytology quantitatively and differential cell count including the presence of bacteria**
- **lactate**
- **glucose**

Standard CSF analysis

Macroscopic appearance:

- protein content
- cytology, differential cell count
- lactate and glucose in CSF
- albumin, IgG, IgA, IgM in CSF and serum
- oligoclonal IgG bands in CSF and serum
- specific antibody indices (AI - IgG class)
- MRZ reaction (M-measles, R-rubeolla, Z-varicella zoster)
- erythrocytes and haemoglobin

Enlarged CSF analysis

- **PCR - polymerase chain reaction-HSV encefalitidu**
- **tumour markers-carcinoembryonal antigen**
- **specific CNS proteins - neuron specific enolase in CSF and serum**
- **tau protein, fosforylated tau protein**
- **beta-amyloid 1-42 in cerebrospinal fluid**
- **beta trace protein-liquorrhea (CSF leakage, nose, ear)**

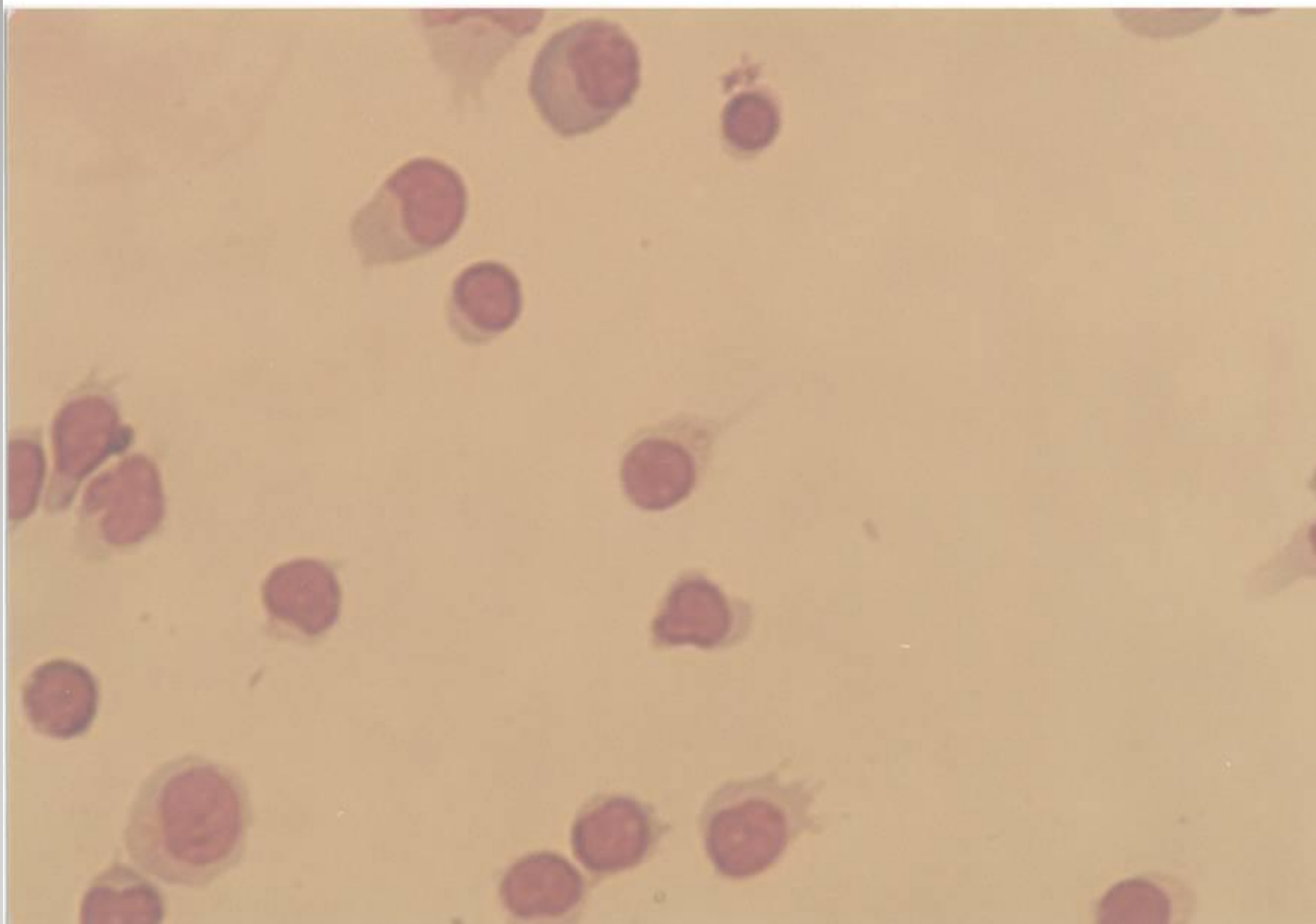
Cytological analysis of CSF

**cell number and differential cell count
70% lymphocytes, 30% monocytes**

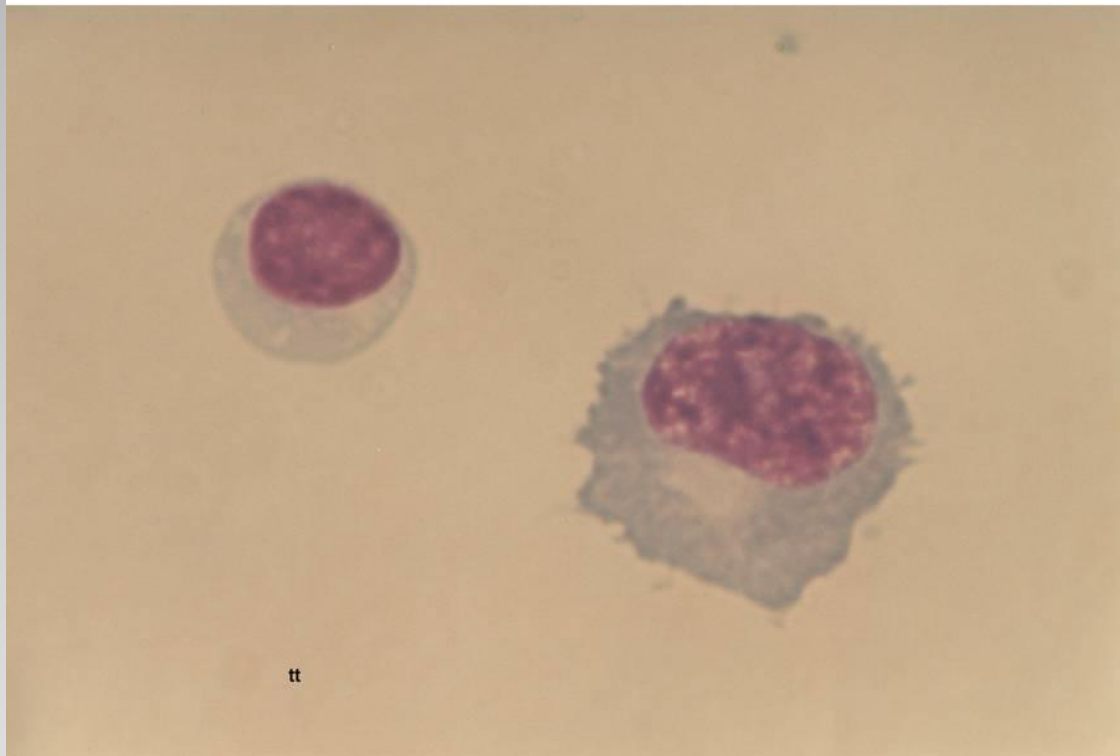
**Fuchs Rosenthal chamber
pleocytosis: >5 cells/1 μ l**

- inflammatory syndrome**
- pathological bleeding(phagocytes)**
- non-specific irritative syndrome**
- malignant cells-infiltration of meninges**

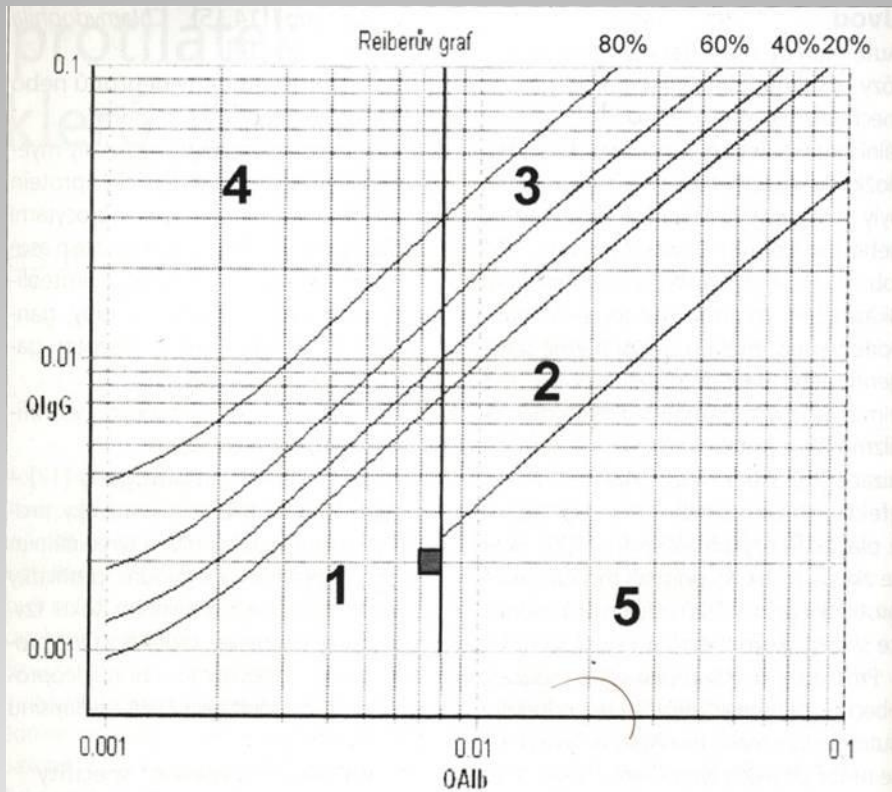
Lymfocytární pleocytósa v likvoru u pacienta s roztroušenou sklerózou.



Lymfocyt a plasmocyt v likvóru u pacienta s roztroušenou sklerózou.



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Interpretace grafu (pro věk 40–60 let):

1. Oblast normálních hodnot
2. Porucha hemato-likvorové bariéry bez lokální syntézy IgG
3. Porucha hemato-likvorové bariéry spojená intratekální (autochtonní) syntézou IgG
4. Intratekální syntéza IgG při normální funkci hemato-likvorové bariéry
5. V této oblasti se nemohou vyskytovat žádné hodnoty (odběrová nebo analytická chyba)

Diagnostical markers

- **oligoclonal IgG bands**
- **MRZ**

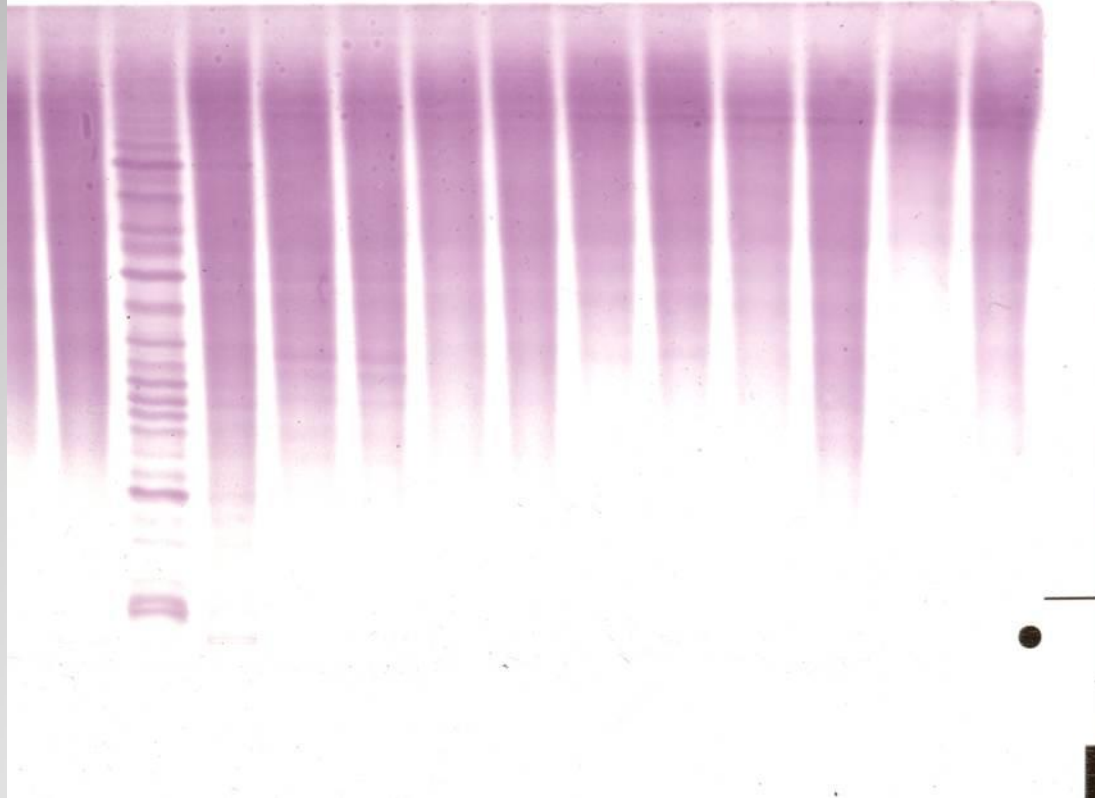
- **neurofilaments of neuronal and glial cytoskeleton-longitudinal follow-up**
- **repeated lumbar punctures**
- **tau protein, fosforylated tau protein, beta-amyloid-triplet (dementia diagnosis)**

Oligoclonal IgG

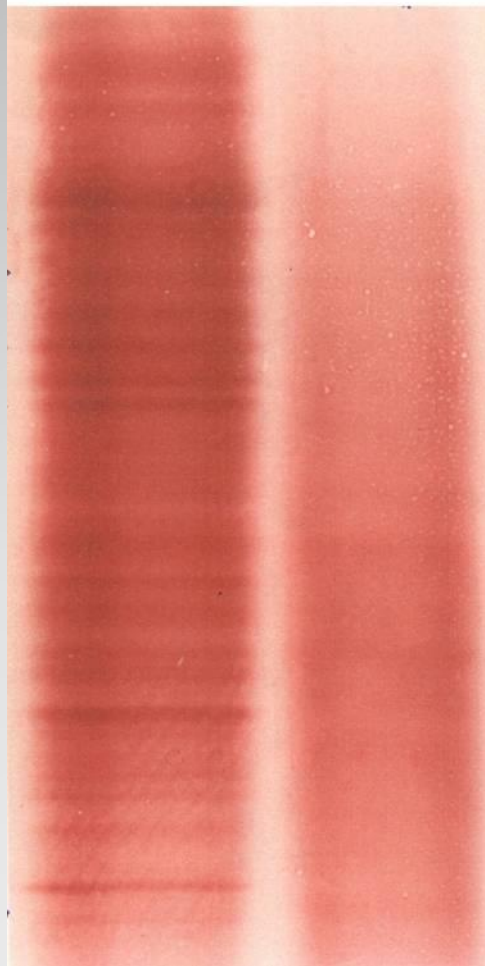
- **Methods: isoelectric focusing, immunoblotting, immunoenzymatic staining**
- **5 patterns of oligoclonal IgG in parallel investigation of CSF and serum**
- **normal polyclonal IgG in CSF and serum**
- **oligoclonal IgG only in CSF (sclerosis multiplex)**
- **oligoclonal IgG in CSF and serum (more IgG bands in CSF comparing IgG bands in serum)**
- **monoclonal IgG bands in CSF and serum (myeloma, monoclonal gammopathy)**

Oligoklonální IgG pásy v likvoru pacienta s roztroušenou sklerózou (firma Sebia).

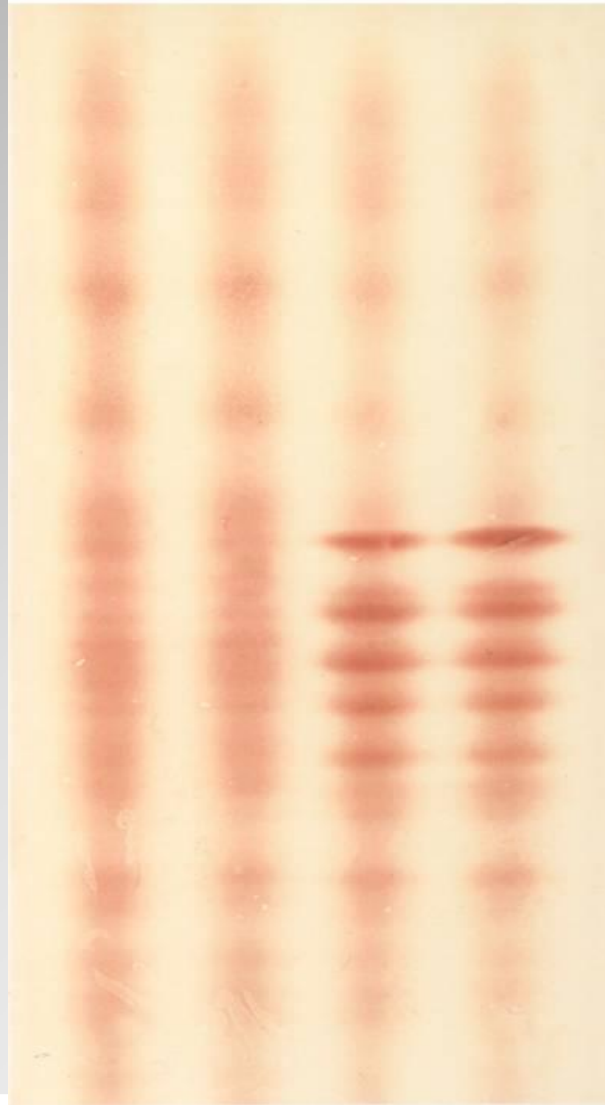
3' 4 4' 5 5' 6 6' 7 7' 8 8' 9 9'



Oligoklonální IgG pásy v likvoru metodou
isoelektrické fokusace.



Obraz monoklonálního IgG v likvoru a séru.



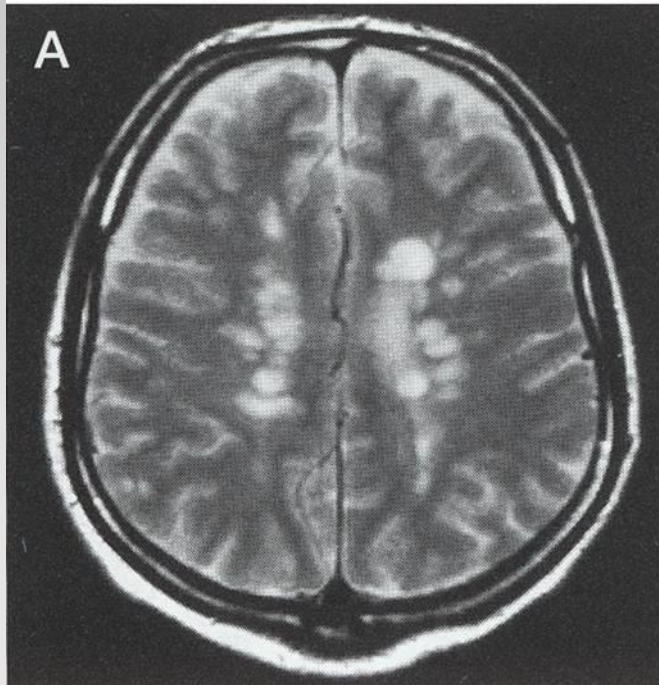
MRZ reaction

- **intrathecal antiviral antibody synthesis**
- **M-measles, R-rubella, Z-varicella zoster viruses**
- **MRZ-biomarker of chronic autoimmune inflammatory process**
- **MRZ sensitivity in multiple sclerosis:84-92 %**
- **frequency and value of antibody indices increase in parallel with general intrathecal IgG synthesis**

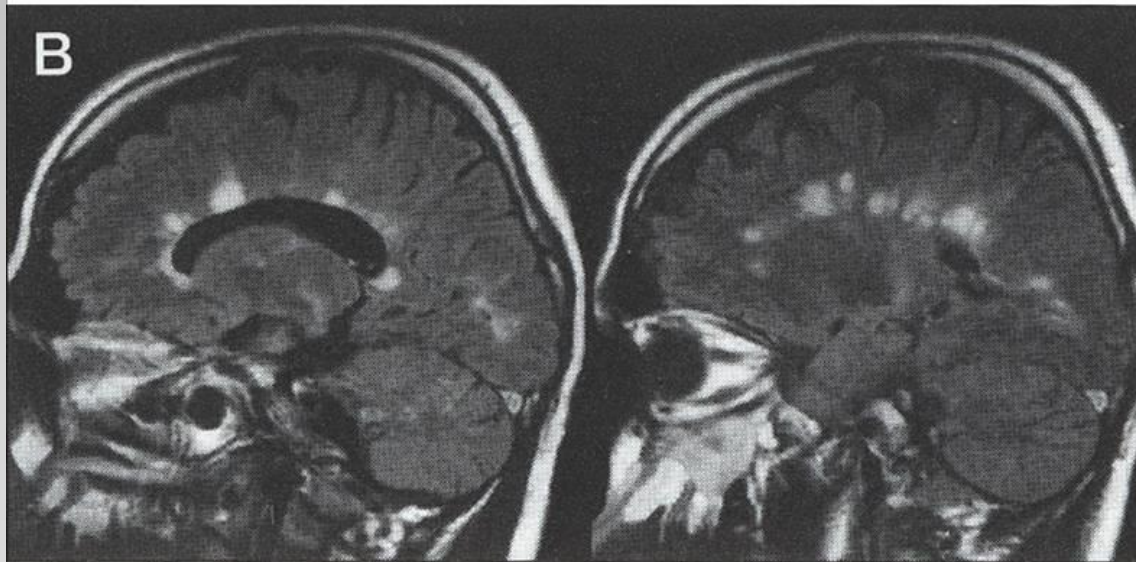
Polyspecific immune reaction in CNS and antibody indices

- Antibody index
- **antibody index -AI reflects pathological, intrathecally produced fraction of specific antibodies in CSF**
- **reference range AI = 0.7-1.3**
- **pathological values AI >1.4**

**Hyperintenzní ložiska v bílé hmotě
u pacienta s roztroušenou
sklerózou.**



**Hyperintenzní ložiska v bílé hmotě u pacienta
s roztroušenou sklerózou v oblasti corpus callosum.**



Neurological diseases with autoimmune pathogenesis

- Paraneoplastic autoimmune neurological syndromes

anti-Hu, anti-Yo, anti-Ri, anti-Ta/Ma2, anti-CV2, anti-amphiphysin, NMDAR

- NMO - neuromyelitis optica Devic

**demyelinating disease with specific IgG antibodies (NMO)-IgG (anti-AQP-4)
immunoblotting, immunohistochemistry**

Neurological diseases with autoimmune pathogenesis

- Systemic autoimmune diseases with CNS involvement
- **lupus erythematoses, Sjögren´s syndrome, Wegener´s granulomatosis - MRZ reaction**
- AIDP - Guillain-Barré syndrome
- **Qalb > 6.5 x 10⁻³**
- **normal CSF cytology**
- **intrathecal Ig synthesis negative**

Neuroborreliosis

- Dominant IgM intrathecal synthesis
- **disease related pattern: IgM>IgA>IgG**
- **B-activated lymphocytes (intracytoplasmatic IgM)**
- **disturbance of blood-CSF barrier, i.e. Qalb > 6.5**
- **IgG OB-70% positive-monophasic course**
- **positive specific antibody synthesis (AI Bb >1.4)**
- **cytological finding - mixed cell pleocytose**