

## BLOOD PLASMA PROTEIN FRACTIONS AND IMMUNOFIXATION IN MYELOMA DISEASE – IMMUNO-LABORATORY ANALYSIS

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### **Abstract**

This article analyzes the changes in the fractional composition of blood plasma proteins in multiple myeloma and the diagnostic value of the immunofixation method. The detection of the formation of monoclonal immunoglobulin (M-protein) specific for myeloma using protein electrophoresis and immunofixation was highlighted. These laboratory methods play an important role in the early detection, confirmation and monitoring of the disease.

### **Keywords**

multiple myeloma, blood plasma proteins, electrophoresis, immunofixation, monoclonal immunoglobulin, M-protein.

**Myeloma** is a malignant tumor (cancer) of the blood and bone marrow. It develops as a result of uncontrolled proliferation of immune cells called plasma cells.[1,2,3,4,5]

Briefly and clearly:

Plasma cells in the bone marrow overproliferate. These cells crowd out normal blood cells. As a result, the bones, kidneys, and immune system are damaged.

Cause of myeloma

The exact cause is not fully known, but there are risk factors:

- Being older than 40–50 years
- Hereditary predisposition
- Exposure to radiation or chemicals
- Long-term immune disorders[6,7,8,9]

Key symptoms (CRAB signs):

Doctors use the CRAB abbreviation to remember myeloma:

- C (Calcium) – increased calcium in the blood
- R (Renal) – impaired kidney function
- A (Anemia) – anemia

- B (Bone) – bone pain and fractures[10,11,12,13]

Other symptoms:

Back and spine pain, Frequent infections, Weakness, weight loss, Decreased urination or swelling.[14,15,16,17]

### **Introduction**

Multiple myeloma is a hematological tumor disease characterized by clonal proliferation of plasma cells in the bone marrow and the production of pathological monoclonal immunoglobulins. These immunoglobulins significantly change the fractional composition of blood plasma proteins. Therefore, electrophoresis and immunofixation of blood plasma proteins are of important laboratory diagnostic importance in the diagnosis of myeloma.[18,19,20,21,22]

Fractions of blood plasma proteins

Blood plasma proteins are separated into the following main fractions by electrophoresis:

- albumin
- alpha-1 globulins
- alpha-2 globulins
- beta globulins
- gamma globulins[23,24,25,26]

In normal conditions, these fractions are in a specific ratio, and immunoglobulins are mainly located in the gamma-globulin fraction.

Changes in protein fractions in myeloma

Gamma-globulin fraction

The most characteristic laboratory sign of myeloma is the appearance of a sharp peak (M-spike) in the gamma fraction. This peak is associated with pathological immunoglobulin produced by monoclonal plasma cells.[27,28,29]

Beta-globulin fraction

In some types of myeloma, especially IgA myeloma, the M-protein may be localized in the beta-globulin zone, which requires attention in diagnosis.

Albumin and other fractions

- Albumin levels are often reduced
- The synthesis of polyclonal immunoglobulins is impaired
- As a result, secondary immunodeficiency develops[30,31,32]

Immunofixation method

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Immunofixation method

The essence of immunofixation

Immunofixation is a highly sensitive laboratory method performed after protein electrophoresis, which allows you to determine the presence and type of monoclonal immunoglobulin.

Immunofixation determines:

- Immunoglobulin class: IgG, IgA, IgM (rarely IgD, IgE)
- Light chain type: kappa ( $\kappa$ ) or lambda ( $\lambda$ )

For example: IgG- $\kappa$  myeloma, IgA- $\lambda$  myeloma.

Diagnostic significance of immunofixation

Immunofixation:

- accurately confirms the diagnosis of myeloma;
- helps to differentiate between monoclonal and polyclonal gammopathies;
- allows you to determine the type of disease;
- is important in assessing the effectiveness of treatment and relapses.

Free light chains and Bence-Jones protein

In some cases of myeloma, only light chains ( $\kappa$  or  $\lambda$ ) are produced. This condition is called Bence-Jones myeloma. In this situation:

- the amount of free light chains in the blood increases;
- The  $\kappa/\lambda$  ratio is of diagnostic importance;
- The risk of kidney damage increases.[1,2,3,4]

### **Conclusion**

In multiple myeloma, the fractional composition of blood plasma proteins changes significantly. The M-peak detected by protein electrophoresis and monoclonal immunoglobulin confirmed by immunofixation are the main laboratory criteria for the diagnosis of myeloma. The immunofixation method has a high diagnostic value in the detection, classification and clinical monitoring of the disease.

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