**Patterns of serum protein electrophoresis, our experience at King Hussein Medical Center, Jordan**

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**Background:** The aim of this study is to analyze the results of serum protein electrophoresis, to determine the electrophoretic patterns of separated proteins. Materials and Methods: This study was conducted at the Immunology Department at Princess Iman Center for research and Laboratory Sciences, Royal Medical Services- Amman/Jordan during November and December, 2013. Data was collected after analysis of 54 specimens of patients who attended outpatient clinics at King Hussein Medical Center. All specimens were analyzed by gel electrophoresis. Results: 54 specimens were included in this study with an average age between 30 & 85 years. 28 (51.8%) were males and 26 (48.2%) were females. Analysis of densitometry diagram and agarose gel electrophoresis revealed normal electrophoretic pattern in 7 patients (13%), acute inflammation in 8 patients (15%), chronic inflammation in 32 patients (59%) and monoclonal gammopathy in 7 patients (13%). For monoclonal gammopathy cases, immunofixation was done to identify heavy and light chains. 4 samples identified as IgG κ, 2 samples IgA κ and 1 sample IgA λ. Conclusion: Different patterns of serum protein electrophoresis were encountered and the spectrum extends from acute and chronic inflammation to monoclonal gammopathy. Therefore serum protein electrophoresis is the first step in differentiating benign from malignant conditions.

Serum protein electrophoresis (SPE) is a laboratory test that is used to examine specific proteins in the blood. Serum protein electrophoresis is used to identify patients with plasma cell myeloma and other serum protein disorders. (1) Electrophoresis separates proteins based on their physical properties, where the blood is collected and the serum is placed into a gel and exposed to an electric current which separates the serum protein components into five major fractions according to size and electrical charge; serum albumin, alpha-1 globulins, alpha-2 globulins, beta globulins, and gammaglobulins (2). Figure 1.

Plasma protein levels show almost predictable changes in response to acute inflammation, malignancy, burns trauma, infarction, necrosis and chemical injury. A homogeneous peak in the gamma-globulin region indicates a monoclonal gammopathy, Figure 2.

Monoclonal gammopathies are associated with a clonal process that is either malignant or potentially malignant, including plasma cell myeloma, Waldenström’s macroglobulinemia, solitary plasmacytoma, smoldering myeloma, monoclonal gammopathy of undetermined significance, heavy chain disease, plasma cell leukemia and amyloidosis. (3,4) The quantity of the monodonal protein, the results of the bone marrow biopsy, and other criteria can help differentiate multiple myeloma from the other causes of monoclonal gammopathy. (4)

In contrast, polyclonal gammopathies may be caused by any reactive or inflammatory process.
This study was conducted at the Immunology Department at Princess Iman Center for Research and Laboratory Sciences, Royal Medical Services- Amman/Jordan during November and December, 2013. 54 specimens were included in the study, analyzed by gel electrophoresis.

Sera were collected from patients and stored at 4˚c. The electrophoresis was performed within 6 days after sample collection.

Semi automated agarose gel electrophoresis and immunofixation were performed with the Hydrasys instrument from Sebia manufacture using hydragel 15 for serum protein electrophoresis and hydragel4 for immunofixation.

For serum protein electrophoresis in the first step 10 µl of sample was applied to the template and allowed to diffuse. After diffusion the gel was transferred to the staining part of the instrument and allowed to staining, destaining and drying. In the second step the gels were scanned with the HYRYS 2 densitometer.

Regarding immunofixation assay in the first step 10 µl of sample was applied to the template on an agarose gel and allowed to diffusion and separation, then monospecific anti sera (IgG, IgA, IgM, κ, λ) were applied. The final step consist of staining, destaining and drying.

The detection of monoclonal bands was by scanned densitometry, visual inspection for serum protein electrophoresis and by visual inspection for immunofixation.

Materials and Methods

Results

54 specimens were included in this study with an average age between 30 & 85 years. 28 (51.8%) were males and 26 (48.2%) females.

Analysis of densitometry diagram and agarose gel electrophoresis revealed normal electrophoretic pattern in 7 patients (13%), acute inflammation in 8 patients (15%), chronic inflammation in 32 patients (59%) and monoclonal gammopathy in 7 patients (13%).

For monoclonal gammopathy cases, immunofixation was done to identify heavy and light chains.

4 samples identified as IgG κ, 2 samples IgA κ and 1 sample IgA λ.

Discussion

Serum protein electrophoresis commonly is performed when multiple myeloma is suspected; other indications include unexplained anemia, hypercalcemia, and unexplained renal insufficiency. Electrophoresis is a method of separating proteins depending on their physical characteristics.

Serum is placed on a medium, and a charge is applied. The net charge (positive or negative) and the size and the shape of the protein commonly are used in differentiating the various serum proteins. The pattern of serum protein electrophoresis depends on the fractions of two major types of protein, which are albumin and globulins. Albumin, the major protein component of serum, is produced by the liver under normal physiologic conditions.

Globulins on the other hand, comprise a much smaller fraction of the total serum protein. The subsets of these proteins and their relative quantity are the primary focus of the interpretation of serum protein electrophoresis. The main reason of serum protein electrophoresis is to detect monoclonal band. Also other findings include acute inflammation, chronic inflammation, iron
and alpha-1 antitrypsin deficiency can be detected. In a low percentage plasma cell disorders missed when serum protein electrophoresis was performed alone in comparison with combination the SPE and immunofixation. Immunofixation can be tested in order of the pathologist if the serum protein electrophoresis suggest presence of abnormality to reduce the number of immunofixation performed and thus lead to improve the laboratory work.

The aim of the study was to analyze the results of protein electrophoresis as a single test to differentiate benign from malignant conditions.

**Conclusion**

Different patterns of serum protein electrophoresis were encountered and the spectrum extends from acute and chronic inflammation to monoclonal gammopathy. Therefore serum protein electrophoresis is the first step in differentiating benign from malignant conditions.

**REFERENCES**