10.5005/jp-journals-10057-0038

RESEARCH ARTICLE

Role of Capillary Electrophoresis in the Evaluation of Serum Protein Abnormalities: An Experience of a Tertiary Care Teaching Hospital

[1]Ram M Jaiswal, [2]Anjana Mittal, [3]Shweta Sharma, [4]Shubhi Saxena, [5]Haresh Saxena

ABSTRACT

Introduction: Serum protein electrophoresis (SPE) has been an integral part of the diagnostic process for more than a decade. It is used mainly to assess the patients for the presence of a monoclonal gammopathy, but it is also useful for detecting humoral immunodeficiency, liver disease, alpha-antitrypsin deficiencies, acute phase reaction, chronic inflammation, and various other conditions.

Materials and methods: The present study was conducted on 90 serum samples to detect presence and quantify monoclonal gammopathy in clinically indicated cases.

Conclusion: Capillary electrophoresis (CE) provides high-resolution and detailed information about the major protein fractions. Capillary electrophoresis is an exciting new method that may improve the detection of monoclonal gammopathies and other abnormalities.

Keywords: Capillary electrophoresis, Monoclonal gammopathy, Protein electrophoresis.

How to cite this article: Jaiswal RM, Mittal A, Sharma S, Saxena S, Saxena H. Role of Capillary Electrophoresis in the Evaluation of Serum Protein Abnormalities: An Experience of a Tertiary Care Teaching Hospital. J Mahatma Gandhi Univ Med Sci Tech 2017;2(2):69-70.

Source of support: Nil

Conflict of interest: None

INTRODUCTION

Electrophoresis is a method of separating proteins based on their electrokinetic charge. Serum is placed on a specific medium, and a charge is applied. The net charge (positive or negative) and the size and shape of the protein are commonly used in differentiating various serum proteins.[1] Several subsets of SPE are available. The names of these subsets are based on the method that is used to separate and differentiate the various serum components. During the past decade, a new technique, CE, has been developed for use in clinical laboratories.[2,3] The indications for SPE are listed in Table 1.

[1]Associate Professor, [2,3]Assistant Professor, [4]Postgraduate Resident, [5]Professor

[1,5]Department of Transfusion Medicine, Mahatma Gandhi Medical College and Hospital, Jaipur, Rajasthan, India

[2-4]Department of Pathology, Mahatma Gandhi Medical College and Hospital, Jaipur, Rajasthan, India

Corresponding Author: Ram M Jaiswal, Associate Professor Department of Transfusion Medicine, Mahatma Gandhi Medical College and Hospital, Jaipur, Rajasthan, India, e-mail: drraj_j@rediffmail.com

MATERIALS AND METHODS

The present study was conducted in Pathology Department of Mahatma Gandhi Medical College & Hospital, Jaipur, Rajasthan, India, on 90 serum samples from January 2016 to April 2017 in clinically indicated cases. Fresh serum samples were recommended for analysis, and hemolyzed samples were avoided. The test was done on CE—Minicap Sebia, and the results were interpreted. Proteins are detected automatically, by their absorption, as they pass the detection window in the cathodic end of the capillary. No staining was required. Results were represented as an electrophoretic curve. The values of each protein fractions are given in percent (%). But the result was interpreted in g/L for interpretation and diagnosis. Total protein concentration was quantified using other methods and entered with patient information.

RESULTS

In the present study, out of 90 cases, 58 were males and 32 were females. Most of the cases were in the age group of 51 to 60 years (Table 2), i.e., 28 cases. Out of 90 cases, 25

Table 1: Indications for SPE

Suspected multiple myeloma, Waldenström's macroglobulinemia, primary amyloidosis, or related disorder
Unexplained peripheral neuropathy (not attributed to long-standing diabetes mellitus, toxin exposure, chemotherapy, etc.)
New-onset anemia associated with renal failure or insufficiency and bone pain
Hypercalcemia attributed to possible malignancy (e.g., associated weight loss, fatigue, bone pain, abnormal bleeding)
Back pain in which multiple myeloma is suspected
Rouleaux formations noted on peripheral blood smear
Renal insufficiency with associated serum protein elevation
Unexplained pathologic fracture or lytic lesion identified on radiograph
Bence Jones proteinuria

Table 2: Age and sex distribution of the cases

Age (in years)	*Male*	*Female*	*Total*
21–30	3	2	5
31–40	3	3	6
41–50	10	4	14
51–60	22	6	28
61–70	13	12	25
71–80	5	4	9
81–90	2	1	3
Total	58	32	90

Table 3: Distribution of different cases

Normal	9
Acute inflammatory	9
Chronic inflammatory	28
Hypergammaglobulinemia	10
Hypogammaglobulinemia	1
Bisalbuminemia	2
M Band	25
Suspicious	1
Others	05

cases were reported as multiple myeloma (MM), 28 were chronic inflammatory, 10 were hypergammaglobulinemia, 9 were acute inflammatory, 9 were normal, 1 case was hypogammaglobulinemia, 2 cases were bisalbuminemia, 1 case was suspicious, and 5 cases were others (Table 3).

DISCUSSION

Capillary electrophoresis is based on the electrokinetic separation of proteins in a capillary filled with electrolyte buffer. The pattern of SPE results depends on the fractions of two major types of protein: Albumin and globulins.

Albumin, the major protein component of serum, is produced by the liver under normal physiologic conditions. Globulins comprise a much smaller fraction of the total serum protein content. The subsets of these proteins and their relative quantity are the primary focus of the interpretation of SPE.[1,4]

Multiple myeloma is a neoplasm of B-cell lineage, which is characterized by excessive proliferation of abnormal plasma cells. These abnormal plasma cells secrete abnormal immunoglobulin that produces a condition called monoclonal gammopathy, which can be detected by the presence of M protein in serum and urine electrophoresis.[5] It accounts for 10% of the hematological malignancies.[6] It is a debilitating malignancy that is a part of a spectrum of diseases which range from monoclonal gammopathy of unknown significance (MGUS) to plasma cell leukemia. The clinical symptoms that are suspected for a plasma cell disorder include back pain, weakness or fatigue, osteopenia, osteolytic lesions, spontaneous fractures, and recurrent infections.[7]

It is very important to distinguish between MM from MGUS due to the general nature of manifestation of MM and the vast difference between the occurrence of MM and MGUS. The occurrence of MM is 4:100,000 worldwide[8] and that of MGUS is approximately 1% among the population who are over 50 years of age. It is 3% among those who are over 70 years, and it is up to 10% among those who are over 80 years of age.[9,10] Moreover, the need for therapy is also very much different in these two conditions. Therefore SPEP should be done to evaluate the general manifestations like malaise, weakness, chronic bone pain, and anemia, to detect monoclonal gammopathy and to know the quantity of the M protein in these patients so that we can differentiate between MM and the other causes of monoclonal gammopathy.

CONCLUSION

Serum protein electrophoresis is an easy-to-perform laboratory test, which can be used for detection and quantification of monoclonal gammopathy and should be recommended as preliminary test for suspected cases of monoclonal gammopathy.

REFERENCES

1. Jacoby RF, Cole CE. Molecular diagnostic methods in cancer genetics. In: Abeloff MD, et al., eds. Clinical oncology. 2nd ed. New York: Churchill Livingstone; 2000. pp. 119-121.
2. Landers JP. Clinical capillary electrophoresis. Clin Chem 1995 Apr;41(4):495-509.
3. Karger BL, Chu YH, Foret F. Capillary electrophoresis of proteins and nucleic acids. Annu Rev Biophys Biomol Struct 1995;24:579-610.
4. Ravel R. Clinical laboratory medicine: clinical application of laboratory data. 6th ed. St. Louis: Mosby; 1995. pp. 343-346, 350.
5. Abdalla IA, Tabbara IA. Nonsecretory multiple myeloma. South Med J 2002 Jul;95(7):761-764.
6. Breitkreutz I, Lokhorst HM, Rabb MS, Holt BV, Cremer FW, Herman D, Glasmacher A, Schmidt wolf IG, Blan IW, Martin H, et al. Thalidomide in newly diagnosed multiple myeloma: the influence of the thalidomide treatment on the peripheral blood stem cell collection yield. Leukemia 2007 Jun;21(6): 1294-1299.
7. The International Myeloma Working Group. The criteria for the classification of the monoclonal gammopathies, multiple myeloma and the related disorders. Br J Hematol 2003 Jun;121(5):749-757.
8. Kyle RA. Multiple myeloma: an overview in 1996. Oncologist 1996;1(5):315-323.
9. Kyle RA, Rajkumar SV. Monoclonal gammopathies of undetermined-significance. Hematol Oncol Clin North Am 1999 Dec;13(6):1181-1202.
10. Kyle RA, Therneau TM, Rajkumar SV, Offord JR, Larson DR, Plevak MF, Melton LJ 3rd. A long-term study on the prognosis of monoclonal gammopathy, of an undetermined significance. N Engl J Med 2002 Feb;346(8):564-569.