

SPE: A Time for Lowering Cost

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Abstract

Serum protein electrophoresis (SPE) is usually ordered to diagnose multiple myeloma (MM). Although levels of proteins in the serum change in predictable way in response to different clinical situations that can be detected from SP bands on a gel; people tend to use other multiple laboratory tests. 44 patient's samples negative for MM were analyzed using automatic agarose gel electrophoresis system/compact Microgel Interlab. Readings for bands were compared to each other's and compared to albumin/globulin ratio (G/A). Bands studied showed 14 cases with polyclonal bands, one with sign of hemolysis, other hyperlipidemia, and one with low serum globulin. All bands showed significant positive correlation with A/G except for $\alpha 2$ negative correlation; $p < 0.05$. SPE can predict clinical situation other than MM when used with trained personnel.

Introduction

Electrophoresis is the main technique used nowadays for diagnosing multiple myeloma (MM) [1]. Since it is a powerful informative and reasonably easy and inexpensive technique. However; this test is underestimated due to insufficient diagnostic evidence [1]. Most of the proteins demonstrated by electrophoresis are readily available for specific assay by nephelometry or other immunoassay techniques [2]. Therefore; extensive line of testing done to evaluate the clinical picture of a diseases even in the presence of SPE result. We studied SPE as tool for detecting the clinical situation of patients other than MM [2] in one setting & possibility of excluding sophisticated multiple test usually done for follow up.

Methods & Material

44 patients were involved attending J.A. Armed forces hospital-Kuwait (20 males & 24 females). Samples were withdrawn by venipuncture using BD vacutainer plain tubes. Samples separated using Beckman-coulter Allegra 6 centrifuge with speed set to 6800 rpm for 10 minutes. Using Jencons Sealpette Pro Advanced Single Channel Pipe; 29 μ l of serum pipetted each patient into separate well. In each gel use 29 μ l of normal and abnormal control provided by the manufacturer. Run the gel as instructed by the manual using automatic agarose gel electrophoresis system/compact Microgel Interlab.

Nephelometry testing for immunoglobulin (IgA, IgM & IgG) were also done using Beckman Immage immunoassay system while routine biochemical analysis including total protein (TP), transferrin (TRN), low density lipoprotein (LDL) and Lactate dehydrogenase (LD) were analyzed using Beckman DXc600 I analyzer. MM free samples were chosen and analysed; each fraction was reported & compare to normal & abnormal control. Results were also compared with other laboratory tests (biochemical & immunology).

Result

Descriptive statistics for 44 patients are shown in Table 1.

	$\alpha 1$ g/l	$\alpha 2$ g/l	β g/l	γ g/l	Albumin g/l	A/G
Median	1.1	0.49	0.54	1.1	1.3	0.047
Minimum	0.4	1.7	1.7	5.1	2.7	0.6
Maximum	31.9	13.3	15.3	35.7	47	1.7
25%	1.7	7	7.0	10.2	27.6	0.8
95%	29.4	12.9	13.8	35.7	45.2	1.74

Table 1: Descriptive statistics of patient's bands.

Decrease in $\alpha 2$ (3.5 g/l) in parallel with increase in levels of enzyme LD (194 IU/l). A patient showed increased β (11.7 g/l) band compared to LDL (LDL 4.3 mmol/l; TRN 2.9 g/l). A case diagnosed with a gammaglobuliemia with low albumin (27.4 g/l, DXC600i) in parallel with SPE pattern low albumin (27.2 g/l) & β (2.7 g/l), high $\alpha 1$ (1.6 g/l), $\alpha 2$ (9.1 g/l) and normal γ (8.4 g/l). Nephelometry showed also normal immunoglobulins (IgM 1.81 g/l; IgG 10.2 g/l; IgA 2.0 g/l).

A positive case for Salmonella and Brucella (agglutination tests) presented with polyclonal band (20.51 g/l) with SPE pattern (albumin 39.6 g/l, $\alpha 1$ 2.0, $\alpha 2$ 8.3g/l, β 9.3 g/l) & normal nephelometer pattern (I gm 1.11g/l; IgG 11.9 g/l, IgA 1.66 g/l).

Using statistical analysis $\alpha 1$ ($p=0.29$; $t=107$) & albumin ($p=0.4$; $t=0.9$) were independent variables of γ band while $\alpha 2$ ($p=0.03$; $t=-2.25$) is inversely related to γ compared to β that was directly related ($p=0.024$; $t=2.34$). No significant gender differences affected bands readings ($p > 0.05$).

14 cases with polyclonal bands in the γ region demonstrated a negative correlation between A/G and γ ($p=0.0$, $t=-5.01$), β ($p=0.003$; $t=-3.3$), $\alpha 2$ ($p=0.0$; $t=-5.8$) & $\alpha 1$ ($p=0.03$; $t=-2.3$) but not albumin ($p=0.0$; $t=10.3$). Two cases showed normal nephelometric reading for immunoglobulins. Nephelometric measurements didn't show any correlation with γ band measurement except for IgM correlated with

α_2 ($r=0.85$; $p=0.004$). Interestingly; γ related to α_1 ($r=0.7$; $p=0.005$) while total protein related directly to γ , β , IgG & IgA ($p<0$).

Discussion

Plasma protein levels display reasonably predictable changes in response to acute inflammation, malignancy, trauma, necrosis, infarction, burns, and chemical injury (acute-reaction protein pattern) along with associated conditions or disorders [2].

However, it is debatable whether one needs to evaluate so many early clinical applications of electrophoresis other than MM. Technique still underestimated, however, here we tried to prove that SPE is powerful tool to evaluate many clinical situations in one run from couple aspects of view:

1st albumin: globulin ratio although not specific but can tell a lot since protein synthesis in the liver can be evaluated through measurement of albumin and total protein [2]. Welder V studied albumin/globulin ratio (A/g) as a picture of albumin and globulin in blood since albumin reflects amount of tissue damage either in liver diseases or burns or malnutrition [3]. Kyle RA found it correlating with all bands in the SPE gel.

2nd α_1 could be a predictor of amount of IgM in blood in cases involving changes in the immune system and malignancy [3]. β reflects amount of immunoglobins migrating from nearby region (γ) and it can detect high cholesterol levels [3] as seen in case with high LDL [4]. α_2 inversely proportionate to γ as a result of decreased synthesis of proteins detected in this band a result of increase synthesis of immunoglobulin in γ band.

3rd Hemolysis [5] can be detected from presence unexplained low α_2 with normal Transferrin strongly suggest presence of hemoglobin generated from hemolysis. Similar to routine testing techniques it may

or may not affect readings. Finally, Response to inflammation can also collect group of changes in one test.

A lot of information from SPE still concealed and need to be evaluated such as conditions that affect size and shape of proteins such as drugs since albumin is a famous carrier for therapeutic medicines [4].

SPE could be powerful tool to predict future diseases in presence of polyclonal gammopathy, alteration in albumin charge and drug bioavailability. To detect abnormal proteins, absence or change in concentration of one or group of proteins.

Conclusion

Analysis of SPE may give a rough idea about clinical situation of a patient and guide towards further analysis and thus decrease time and cost of testing in clinical laboratory by excluding unnecessary testing. However; further studies needed.

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