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E: ISSN NO.: 2349-980X **Shrinkhla Ek Shodhparak Vaicharik Patrika**

Role of Total Protein in the Diagnosis and Prognosis of Protein Energy Malnutrition (PEM)

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Abstract

The assessment of the degree of malnutrition or its prognosis on clinical grounds alone is universally accecpted as being difficult. It is strongly emphasized that for making reliable and specific diagnosis of malnutrition as per severity of disease the physical examination should be supplemented with biochemical parameters. Hence, biochemical markers like serum total protein and albumin measurements may be used for the assessment of nutritional status. Readily available and reliable biochemical tests can often detect nutritional deficiencies before they have an adverse effect on biological functions and certainly before deficiencies can be detected by physical examination. An early diagnosis with the help of biochemical parameters would prevent the children from serious illness and hence give a better life to lead.

Keywords: Protein Energy Malnutrition, Total Protein, Albumin, Diagnosis, Prognosis.

Introduction

Malnutrition is a major contributor to mortality and is increasingly recognized as a cause of potentially lifelong functional disability. Malnutrition is a complex syndrome where several nutrient deficiencies exist simultaneously. Malnutrition is an important cause of immune-competence impairment and consequently malnutrition can result in illness and death due to infectious diseases. Critically ill children are at risk for fat or protein depletion and development of malnutrition, which is associated with increased morbidity and mortality. Assessment of PEM has traditionally been clinical which is time consuming and skill dependent, with considerable inter-observer variability. So present study is undertaken to explore the significance of biochemical parameters total protein and albumin in the diagnosis and prognosis of malnutrition.

Aim of the Study

Present study has been planned to study biochemical parameters total protein and albumin which would help in the early diagnosis and prognosis of PEM and associated disorders. The possible importance of these biochemical parameters will also be utilized to assess the severity of protein energy malnutrition.

Material and Method

350 PEM cases and 70 healthy subjects (controls) belonging to 6 months to 12 years of age group were taken in the study. On the basis of Wellcome trust classification 60 cases were diagnosed as Undernutrition, 23 as Kwashiorkor, 43 as Marasmic kwashiorkor and 224 as Marasmus. Approximately 5-6 ml blood was taken by venipunture. The blood was allowed to clot at 37 degree Celsius for half an hour and then centrifuged to get the serum. The separated serum was used for analysing serum Total Protein and albumin in control and PEM cases. Serum Total Protein was estimated by using Biuret method and serum albumin was estimated by Bromo Cresol Green dye Binding method. Patients were followed upto 45 days to determine the final outcome of the disease. Blood samples from PEM cases were collected on the day of admission (day 0), 7th day , 15th day , 30th day ,and 45th day . Mean levels of serum total protein on the day of admission and follow-up were compared with respective levels of controls. The patients were graded into uncomplicated recovered, complicated recovered and expired cases according to the final outcome of the disease. Serum total protein was estimated in these cases to assess

their role in pathogenesis and their diagnostic and prognostic importance. Students t- test was used to analyse the data for statistical significance.

Results

Table 1 Serum Proteins In Control And Pem Cases

Groups (no. of cases)	Total protein(gm/dl) Mean±S.D. Range	Albumin(gm/dl) Mean±S.D. Range	Globulin (gm/dl) Mean±S.D. Range	A:G Ratio
Control group (70)	6.58± 1.21 5.60-8.2	4.13± 1.18 3.00-5.27	2.46± 0.79 1.62-3.56	1.68
Study group Undernutrition (60)	5.91± 1.17 ** 4.63-7.17	3.42± 0.94 *** 2.56-4.62	2.38± 1.09 2.07-3.6	1.44
Kwashiorkor (23)	4.08± 0.93 *** 3.10-5.99	1.84± 0.80 *** 2.00-4.13	2.37 ±1.09 1.60-3.90	1.24
Marasmic kwashiorkor (43)	5.24 ±1.06 *** 3.97-6.58	2.94± 1.08 *** 2.00-4.13	2.37± 1.09 1.60-3.90	1.24
Marasmus (224)	6.10± 2.08 4.00-8.13	3.74± 1.68 1.99-5.20	2.61± 1.58 1.63-3.96	1.43
Total (350)	5.83± 1.48 *** 3.10-8.13	3.46± 1.18 *** 1.14-5.20	2.52± 1.68 1.51-4.00	1.37

*p < 0.05 **p < 0.01 *** p < 0.001

Table 1 shows mean values of serum total protein, albumin and globulin in control and PEM cases. The table reveals that both serum total protein and albumin were significantly (p<0.001) reduced in total PEM cases as compared to controls. Serum globulin did not show any significant change in PEM. Maximum reduction in total protein and albumin level was observed in kwashiorkor group followed by marasmic kwashiorkor and undernutrition groups. No significant change in total protein was observed in marasmus group. The globulin level showed only slight differences in all study groups. The A:G ratio was also low in all the PEM study groups as compared to controls and went below unity in kwashiorkor group.

Table 2 Serial Levels of Total Protein (gm/dl) in PEM Cases During Follow Up

Groups (no. of cases)	Day 0 Mean±S.D. Range (No.of cases)	Day 7th Mean±S.D. Range (No.of cases)	Day 15th Mean±S.D. Range (No.of cases)	Day 30th Mean±S.D. Range (No.of cases)	Day 45th Mean±S.D. Range (No.of cases)
Control group (70)	6.58± 1.21 5.60-8.20 (70)				
Study group Undernutrition (60)	5.91± 1.17 ** 4.63-7.17 (60)	6.21± 1.38 5.12-7.22 (48)	6.50± 1.89 5.40-7.59 (32)	6.54± 1.77 5.60-7.72 (25)	6.56± 2.63 5.59-7.92 (16)
Kwashiorkor (23)	4.08± 0.93 *** 3.10-5.99 (23)	5.21± 0.88 *** 3.90-6.22 (23)	6.13± 0.99 4.79-6.72 (22)	6.49± 1.38 5.05-7.30 (18)	6.53± 1.83 5.40-7.76 (16)
Marasmic kwashiorkor (43)	5.24± 1.06 *** 3.97-6.58 (43)	5.63± 1.12 *** 4.00-6.72 (43)	6.38± 1.89 4.69-7.05 (39)	6.49± 1.78 5.00-7.72 (35)	6.55± 1.93 5.50-7.99 (26)
Marasmus (224)	6.10 ±2.08 4.00-8.13 (224)	6.23± 1.68 4.11-7.84 (222)	6.54± 0.97 4.56-7.92 (194)	6.56± 0.98 4.69-7.98 (168)	6.60± 1.01 4.78-7.99 (143)

*p < 0.05 **p < 0.01 *** p < 0.001

Table 3 Serial Levels of Serum Albumin (gm/dl) in PEM Cases during Follow Up

Groups (no. of cases)	Day 0 Mean±S.D. Range (No.of cases)	Day 7th Mean±S.D. Range (No.of cases)	Day 15th Mean±S.D. Range (No.of cases)	Day 30th Mean±S.D. Range (No.of cases)	Day 45th Mean±S.D. Range (No.of cases)
Control group (70)	4.13± 1.18 3.00-5.27 (70)				
Study group Undernutrition (60)	3.42± 0.94 *** 2.56-4.62 (60)	3.76± 0.79 * 2.67-4.49 (48)	4.05± 0.93 2.76-4.89 (32)	4.08± 0.98 3.00-5.19 (25)	4.12± 1.04 3.00-5.23 (16)

Kwashiorkor (23)	1.84± 0.80 *** 1.10-3.01 (23)	2.83± 0.76 *** 1.51-3.91 (23)	3.62± 0.84* 1.93-4.19 (22)	3.98± 0.97 2.16-5.01 (18)	4.11± 1.03 2.98-5.16 (16)
Marasmic kwashiorkor (43)	2,94± 1.08*** 2.00-4.13 (43)	3.27± 0.94*** 2.16-4.00 (43)	3.83± 1.74 2.39-4.59 (39)	4.03± 1.87 2.56-5.13 (35)	4.10± 1.90 2.91-5.39 (26)
Marasmus (224)	3.74 ±1.68 1.99-5.20 (224)	3.86± 1.41 1.98-4.20 (222)	4.06± 1.33 2.14-4.80 (194)	4.09± 1.59 2.50-4.82 (168)	4.14.± 1.68 2.59-4.86 (143)

*p < 0.05 **p < 0.01 *** p < 0.001

Table 2 and 3 show serial levels of serum total protein and serum albumin in PEM cases during follow up. Table 2 reveals that total protein reached the normal level by 7th day in undernutrition group and by 15th day in kwashiorkor and marasmic kwashiorkor group. Table 3 reveals that serum albumin reached the normal level by 15th day in undernutrition group and marasmic kwashiorkor group and by 30th day in Kwashiorkor group. No significant change in serum total protein and serum albumin was observed in marasmus group during follow up.

Table 4

Prognostic Importance of Total Protein (gm/dl) on The Day of Admission In PEM Cases

Study groups (No. of cases)	Uncomplicated Recovered Cases Mean±S.D. Range (No.of cases)	Complicated Recovered Cases Mean±S.D. Range (No.of cases)	Expired cases Mean±S.D. Range (No.of cases)
Undernutrition (60)	5.84± 1.17 4.82-7.17 (50)	5.55± 0.90 4.70-6.93 (9)	4.65 (1)
Kwashiorkor (23)	4.85± 0.98 3.69-5.99 (9)	3.76± 0.83* 3.40-4.98 (6)	3.28 ±1.17** 3.1-4.00 (8)
Marasmic kwashiorkor (43)	5.91± 0.98 4.08-6.58 (20)	4.83± 0.89* 3.99-5.42 (13)	4.48± 1.19** 3.97-5.23 (10)
Marasmus (224)	6.08± 1.98 4.93-8,13 (167)	5.79± 1.68 4.52-7.44 (39)	5.65± 2.08 4.00-7.10 (18)
Total (350)	5.95± 1.28 3.69-8.13 (246)	5.39± 1.21** 3.40-7.44 (67)	4.93± 1.68*** 3.10-7.10 (37)

*p < 0.05 **p < 0.01 *** p < 0.001

Table 5

Prognostic Importance of Serum Albumin (Gm/Dl) on The Day of Admission in PEM Cases

Study groups (No. of cases)	Uncomplicated Recovered Cases Mean±S.D. Range (No.of cases)	Complicated Recovered Cases Mean±S.D. Range (No.of cases)	Expired Cases Mean±S.D. Range (No.of cases)
Undernutrition (60)	3.47± 0.94 2.60-4.62 (50)	3.25± 1.09 2.59-4.38 (9)	2.57 (1)
Kwashiorkor (23)	2.43± 0.92 1.86-3.01 (9)	1.51± 0.70* 1.20-2.53 (6)	1.47 ±0.74* 1.11-2.40 (8)
Marasmic kwashiorkor (43)	3.36± 0.96 2.81-4.13 (20)	2.67± 0.87* 2.30-3.96 (13)	2.31± 0.81** 2.00-3.46 (10)
Marasmus (224)	3.52± 1.72 2.43-5.20 (167)	3.34± 1.17 2.00-4.59 (39)	3.38± 0.97 1.99-4.40 (18)
Total (350)	3.46± 1.12 1.86-5.20 (246)	3.03± 1.01** 1.20-4.59 (67)	2.66± 0.87*** 1.11-4.40 (37)

*p < 0.05 **p < 0.01 *** p < 0.001

Table 4 and 5 reveal the prognostic importance of serum total protein and albumin in PEM cases. Serum total protein and albumin were significantly reduced in total complicated recovered ($p < 0.01$) and expired cases ($p < 0.001$) as compared to total uncomplicated recovered cases. Maximum reduction in serum total protein and albumin was observed in complicated recovered and expired cases of kwashiorkor and marasmic kwashiorkor groups.

Discussion

In total PEM cases there was a significant ($P<0.001$) lowering of serum total proteins and albumin as compared to controls. Except marasmus all the three study groups of PEM (Undernutrition, Kwashiorkor and marasmic kwashiorkor) showed significant) ($p<0.001$) lowering of serum total proteins and albumin. The reduction in whole body protein turnover and net protein loss induced by (PEM) has been well documented. Similar to our results Ibrahim et al (1994) also reported significantly ($p<0.001$) reduced levels of total protein and albumin in malnourished children as compared to controls. In our study kwashiorkor patients were characterized by marked hypoproteinaemia and marked hypoalbuminaemia. This finding is similar to studies done in India (Mehta 1985), Jamaica (Taiwo et al 1992) and Khartoum (Ibrahim et al 1994).

Kwashiorkar is a syndrome of acute onset and shortage of dietary proteins means inadequate supply of amino acids available for the synthetic process. Fechner et al.(2001) also reported marked decrease in albumin level in kwashiorkor patients. So in this study it has been observed that total protein and albumin are significantly lower in malnourished children as compared to normal healthy children.

Serial Levels of Serum Total Protein in PEM cases during follow-up

In present study during follow up a significant rise in the levels of serum total protein and albumin was seen within a week of treatment but normal level could be gained after 15 days of treatment. Other workers have also reported similar results. Dutta et al (1981) reported significant rise in serum total protein and albumin level after 15 days of treatment.

Prognostic Importance of Serum Proteins in PEM

Serum total protein levels were significantly reduced in total complicated recovered (5.39± 1.21 gm/dl, $p<0.01$) and total expired cases (4.93 ±1.68gm/dl,$p<0.001$) as compared to tatal incomplicated recovered cases (5.95±1.28gm/dl) of PEM. Although reduction in total protein level of complicated recovered and expired cases was not significant in undernutriotion and marasmus group but it was significant in kwashiorkor and marasmic kwashiorkor group. Expired cases of kwashiorkor has serum proteins (3.28 ± 1.17 gm/dl) in a very low range. Low levels of total protein and albumin in malnutrition are well known and are of great prognostic value for kwashiorkor and marasmic kwashiorkor groups being diagnostic for these two groups of PEM. Morlese et al.(1998) also reported that increased morbidity and mortality is associated with lower plasma protein concentrations in children with severe PEM cases. Fatality rates for children with kwashiorkor (including marasmic kwashiorkor) have remained high at 20-49% (Shimeles et al. 1994). Low levels of albumin are responsible for the presence of oedema and are of great prognostic use as very low levels show complications and further low are fatal. Francois et al. (1992) and Ibrahim et al. (1994) also reported a strong association between albumin level and mortality.

Conclusion

So it can be concluded that a change in total protein and albumin level can be used as a nutritional marker that is easy to assay and can provide a functional index of mild to moderate nutritional deficiency before overall depletion has occurred. Serum total protein and albumin may be applicable as parameters having diagnostic and prognostic significance for PEM. Serial estimation of these parameters during follow up is helpful in evaluation of effectiveness of the treatment of malnutrition.

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