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ORIGINAL ARTICLE

To determine the prognostic value of some serum protein fractions as Early Index of Clinical Recovery in Pulmonary Tuberculosis patients

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ABSTRACT:

Aim: To determine the prognostic value of some serum protein fractions as Early Index of Clinical Recovery in Pulmonary Tuberculosis patients. **Methods:** The Department of Pulmonary Medicine conducted this cross-sectional investigation. For this study, 80 people between the ages of 20 and 50 were readily recruited. There were 40 clinically diagnosed PTB patients who did not have HIV or malaria co-infections. They were further subdivided into drug-naive TB subjects 20 and TB subjects on ATT 20. The remaining 40 were age-matched apparently healthy controls (40 girls and 20 men). **Results:** The results indicated that BMI (kg/m2) was considerably reduced in drug naive TB participants (20.25± 2.75), and in TB subjects on ATT (21.30± 2.80) as compared to control subjects (25.58± 3.05) (p ¼0.000). The difference in mean weight (kg) between TB participants on ATT (59.17± 4.62) and treatment naïve TB subjects (52.47± 10.50) was not statistically significant (p ¼ 0.10). The mean blood total protein levels (g/dl) in TB participants on ATT (8.82 ±1.64) and treatment naïve TB subjects (9.02± 1.77) were substantially greater as compared to the control subjects (7.78 0.89) (p > 0.002). The mean (SD) serum albumin (g/dl) in TB participants on ATT was substantially greater (5.41± 1.47) as compared to control subjects (3.73± 1.05) (p ¼ 0.000). When compared to the control (3.73± 1.05), the medication naïve TB participants had substantially reduced mean serum al- bumin (2.78± 0.77) (p ¼ 0.000). The mean serum globulin (g/dl) level in TB participants on ATT (3.41± 1.52) was considerably lower than in their non-ATT counterparts (6.23± 1.86) (p ¼0.000). However, as compared to control participants, both groups of TB subjects had substantially higher mean blood globulin levels (3.85 ±1.40) (p ¼ 0.000). Similarly, the mean level of albumin- globulin ratio was significantly higher in TB subjects on ATT (2.33 ± 1.77) but decreased significantly in drug naive TB subjects (0.52±0.31) when compared with control subjects (1.09 ± 0.57) (p ¼ 0.000 respectively). **Conclusion:** We determined that as compared to control participants, BMI was considerably lower in both drug-naive PTB subjects and PTB subjects on ATT.

Keywords: prognostic value, serum protein fractions, Pulmonary Tuberculosis

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INTRODUCTION

Tuberculosis is a contagious illness that affects people all over the world. It is caused by Mycobacterium tuberculosis, which generally affects the lungs but can also cause lesions in other organs or tissues. TB of the lungs is the most common kind of tuberculosis because the lungs are more usually afflicted than any other organ, partly because inhalation is the most common source of infection and partly because lung tissue offers a good environment for the organism's development. Specialists and general practitioners often assess disease progression primarily based on the amount of ESR, which is determined solely by the fibrinogen level in the blood. In many situations, this number is initially normal, resulting in a mistaken diagnosis.[1] It is widely known that variations in serum protein levels occur in response to both acute and chronic infections. Changes in plasma protein levels are to be expected in patients with air infections such as mycobacterium TB. The change in protein level at any given moment, however, should represent the net impacts of both the rate of synthesis and the rate of catabolism as a result of host microbe interactions. [2]

Despite recent advances in anti-TB medication availability, tuberculosis remains a major cause of illness and mortality globally. A worldwide resurgence of tuberculosis has been reported, with the bulk of cases occurring in impoverished nations such as Nigeria. The HIV-[1] pandemic and malnutrition are substantial risk factors. [3] Others risk factors include smoking, diets and chronic liver disease.[4]

Previous research has found a link between TB and starvation. [2] Tuberculosis, in particular, can cause malnutrition due to increased metabolic demands and decreased food intake, whereas nutritional deficiencies might aggravate the disease or postpone recovery by suppressing essential immune activities. [2] Weight loss is a typical indication of tuberculosis,[5] implying that being underweight (BMI 18.5) raises the risk of TB while being overweight lessens the risk. [6] According to the findings, serum protein fraction levels alter in response to both acute and chronic illnesses, including TB. [7-9] According to Shingdang and colleagues, the change reflects the total creation and breakdown of proteins as a result of microbial interactions. In chronic infectious TB illness, albumin levels fall while globulin levels rise,

resulting in a low albumin to globulin (A/G) ratio. [7] This demonstrates that protein fractions change significantly in TB infections.

The current study is thus intended to evaluate the predictive usefulness of albumin and albumin/globulin ratio as indicators of therapy recovery in TB patients, particularly in resource-limited settings.

MATERIAL AND METHODS

This cross-sectional study was done the Department of pulmonary medicine, after taking the approval of the protocol review committee and institutional ethics committee.

This study enlisted the participation of 80 people ranging in age from 19 to 48 years. There were 40 clinically diagnosed PTB subjects (20 men and 20 females) with no HIV or malaria co-infections. According to WHO criteria, they were diagnosed with sputum smear microscopy and radiography (class 3 TB). [10] They were further separated into TB subjects on ATT 20 (eight females and twelve males) and drug-naive TB subjects 20. (12 females and 8 males). For eight (8) weeks, the TB participants on ATT were on the DOTS (regimen of Rifampicin (R), Isoniazid (H), Pyrazinamide (Z), and Ethambutol (E) or Streptomycin (S). The remaining 40 were age-matched apparently healthy controls (40 girls and 20 men).

SAMPLING TECHNIQUE

Weight was measured with light clothing and without shoes and approximated to the nearest 0.1kg using a mobile lever scale, while height was measured to the nearest 0.1cm using a stadiometer. BMI was calculated by dividing weight (in kilogrammes) by height squared (in meters). The waist circumference was measured by wrapping a flexible, non-stretch measuring tape around the body in a horizontal position halfway between the lower rib edge and the iliac crest. The hip circumference was measured with the tape parallel to the floor around the broadest part of the buttocks. The measurements were taken to the closest millimetre.

Each individual had 5ml of whole blood drawn from the cubital fossa via aseptic venipuncture into simple test tubes. After allowing the samples to clot, they were centrifuged at 3500 rpm for 5 minutes. The sera was then transferred in aliquots into suitably labelled simple tubes and kept at —20 C until total protein and albumin levels were determined.

METHODOLOGY

Dale's[11] Biuret technique was used to determine serum total protein. The Biuret test (Piotrowski's test) is a chemical test for detecting peptide bonds. In an alkaline solution, a copper (II) ion generates violet-colored coordination complexes in the presence of peptides. Savoury et al[12] described the BromoCresol Green (BCG) technique for determining serum albumin. Serum albumin is quantified by its quantitative binding to the indicator BCG. At pH 4.2, albumin is sufficiently cationic to bind the anionic dye bromocresol green (BCG) to create a blue-green complex. When the absorbance at 620-630nm is measured, the intensity of the blue green colour is directly proportional to the albumin quantity in the samples. Serum globulin concentration was calculated by subtracting serum albumin concentration from total serum protein content. The albumin-globulin ratio was calculated by dividing the albumin value by the globulin value.

Statistical investigation

The Statistical Package for Social Science, SPSS version 23.0 for Windows, was used to generate group mean SD for each parameter, and significant differences between means were examined using analysis of variance (ANOVA). The T-test was performed to compare group differences, and p 0.05 was considered statistically significant.

RESULTS

The results indicated that BMI (kg/m2) was considerably reduced in drug naive TB participants (20.25± 2.75), and in TB subjects on ATT (21.30± 2.80) as compared to control subjects (25.58± 3.05) (p 14 0.000). Similarly, waist and hip circumferences (cm) of medication naive TB participants (51.12± 1.34, 71.58 2.00) and TB subjects on ATT (52.04 ±2.88, 71.46 ±2.65) were substantially smaller than control subjects (53.24 ±4.46, 73.23 ±3.44) (p ¼ 0.02, 0.01). However, as compared to control participants (0.73± 0.06), the mean value of WHR in drug naive TB subjects (0.72± 0.04) and TB subjects on ATT (0.74± 0.04) was not statistically significant (p ¼ 0.25).

Furthermore, the mean weight (kg) of TB participants on ATT (59.17 ±4.62) compared to medication naive TB subjects (52.47± 10.50) was not statistically significant (p ¼ 0.10). (Table 2).

The mean blood total protein levels (g/dl) in TB participants on ATT (8.82 ±1.64) and treatment naïve TB subjects (9.02± 1.77) were substantially greater as compared to the control subjects (7.78 ±0.89) (p ¼ 0.002). The mean (SD) serum albumin (g/dl) in TB participants on ATT was substantially greater (5.41± 1.47) as compared to control subjects (3.73 ±1.05) (p ¼ 0.000). When compared to the control (3.73± 1.05), the medication naïve TB participants had substantially reduced mean serum al- bumin (2.78± 0.77) (p ¼ 0.000).

The mean serum globulin (g/dl) level in TB participants on ATT (3.41± 1.52) was considerably lower than in their non-ATT counterparts (6.23± 1.86) (p 14 0.000). However, as compared to control participants, both groups of TB subjects had substantially higher mean blood globulin levels (3.85± 1.40) (p ¼0.000). Similarly, as compared to control participants (1.09± 0.57), the mean level of albumin-globulin ratio was considerably greater in

TB subjects on ATT (2.33± 1.77), but significantly lower in drug naive TB subjects (0.52±0.31). (Table3).

Table 1: Age and Gender distributions

Gender	PTB	Control
Male	20	20
Female	20	20
Age in years	41.25±4.36	40.85±5.45

Table 2: Anthropometric parameters in TB subjects on ATT, drug naive TB subjects and control subjects.

Groups	Height (m)	Weight (kg)	BMI (kg/m2)	WHR
TB subjects on ATT (A) n ¼	1.78 ± 0.24	59.17 ± 4.62	21.30 ± 2.80	0.74 ± 0.05
20 Drug naive TB subjects (B)	1.73 ± 0.23	52.47 ± 10.50	20.25 ± 2.75	0.72 ± 0.04
n ¼ 40 Control (C) n ¼ 20	1.81 ± 0.23	74.33 ± 12.86	25.58 ± 3.05	0.73 ± 0.06
F- value	2.64	24.07	30.56	1.31
P- value	0.06	0.00	0.00	0.26
A vs B	0.33	0.10	0.32	0.39
A vs C	0.64	0.00	0.00	0.98
B vs C	0.05	0.00	0.00	0.28
P < 0.05 ¼ Significant. Data was expressed as mean ± SD.				

Table 3: Levels of Total protein, Albumin, Globulin and Albumin-Globulin ratio in TB subjects on ATT, drug naive TB subjects and control subjects.

Groups	TP (g/dl)	Albumin (g/dl)	Globulin (g/dl)	AGR
TB subjects on ATT (A) n ¼	8.82 ± 1.64	5.41 ± 1.47	3.41 ± 1.52	2.33 ± 1.77
20 Drug naive TB subjects (B)	9.02 ± 1.77	2.78 ± 0.77	6.23 ± 1.86	0.52 ± 0.31
n ¼ 40 Control (C) n ¼ 20	7.88 ± 0.89	3.73 ± 1.05	3.85 ± 1.40	1.09 ± 0.57
F- value	6.02	40.48	24.67	14.42
P- value	0.005	0.00	0.00	0.00
A vs B	0.85	0.00	0.00	0.00
A vs C	0.02	0.00	0.46	0.002
B vs C	0.005	0.001	0.00	0.15

P < 0.05 ¼ Significant. Data was expressed as mean ± SD.

DISCUSSION

When compared to the control, BMI and WHR were considerably lower in both TB participants on ATT and their drug-naive counterparts in the current research. This might be due to the extreme wasting and starvation that is typically associated with TB. TB wasting affects both muscle and fat mass, and it may take a long time to restore the body's protein supplies to pre-disease levels.

The current study's findings also revealed that there was no significant difference in weight between TB participants on ATT and their drug-free peers. This conclusion is consistent with previous studies by PrayGod et al. [13] Previous research has linked it to variances in weight gain contribution in various body compartments despite a high anabolic response. [14] Significant weight loss has been seen in individuals with active TB, which has been related to a likely mix of accompanying tissue inflammations and immunological responses. Weight increase during anti-tuberculosis medication, according to the scientists, is an inaccurate predictor of total treatment success. [12,13]

Bekker et al.[15] previously shown that clinical and functional recovery frequently delays following microbiological cure. Despite the fact that weight increase is widely used to assess treatment response in tuberculosis,[16] the findings of this investigation revealed considerably lower albumin and albumin globulin ratios in drug-naive TB sufferers when compared to control participants. Serum albumin deficiency in drug-naive TB patients suggests a persistent infectious disease and may be due to oedema or malnutrition.

Acute and chronic inflammatory reactions, nephrotic syndrome, malnutrition, and reduced immunity may all be contributing causes. This is consistent with previous findings. [7,8] Poor nutritional status has also been documented in individuals with active pulmonary TB as compared to healthy controls. [17] Other investigations have found lower levels of plasma albumin and total protein in people with chronic tuberculosis. [8,9]

The current study also found that TB participants on ATT had considerably higher albumin and albumin-globulin ratios than their drug-free peers.

This might be attributable to some amount of improvement brought about by the ATT programme. This agrees with the findings of Egah et al.[18] The elevated albumin-globulin ratio may be attributable to albumin's role as an antioxidant in preventing cellular damage and tissue loss in TB patients, according to the author. The increases in serum albumin reported in TB patients on ATT may also be due to increased albumin synthesis by the liver, which may be directly or indirectly related to the action of anti-tuberculosis medication (ATT).

The rise in blood total proteins and albumin found in this study's pulmonary TB individuals may be attributable to the anti-tuberculosis medications isoniazid and rifampicin, indicating considerable improvement with the treatment regimen. This was consistent with the earlier report18 and contradicted the findings of Damburam et al.[19] In TB, the author found lower serum levels of total protein and albumin. This discordance might be attributed to sample size and heterogeneity in patient distribution across geographical areas. Variations in the amount and pattern of serum proteins in tuberculosis patients have been linked to parasite infestations, culture, and socioeconomic position. [20]

Serum globulin levels in TB patients were also higher than in seemingly healthy controls. This might be due to the fact that in infectious illnesses such as TB, serum globulin creation increases considerably as a result of an enhanced immunological response, which results in the production of antibodies. Elevated serum globulin levels in drug-free TB patients may be due to the host immunological response to the TB infection. This was consistent with Edozien's findings. [21]

The higher albumin-globulin ratio seen in the previous study is a direct result of low serum albumin (hypoalbuminaemia) and high globulin. This is consistent with previous findings. Damburam et al[19] ascribed the higher serum globulin levels to the host immune response to tubercle bacilli, which causes gamma globulin synthesis.

CONCLUSION

We determined that as compared to control participants, BMI was considerably lower in both drug-naive PTB subjects and PTB subjects on ATT. The depletion of serum albumin and considerable drop in the albumin-globulin ratio found in drug-naive TB cases is suggestive of a chronic infectious disease, which might be related to oedema or malnutrition, or it could be owing to delayed diagnosis.

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