

Comparative Utility of Sero Ascites Albumin Gradient and Ascitic Fluid Total Protein for Differential Diagnosis of Ascites

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Ascites can be defined as the abnormal accumulation of fluid inside the peritoneal cavity. Earlier ascites was classified as transudative and exudative based on the total protein concentration of the ascitic fluid. The traditional concept of high protein ascites (> 2.5 g/dl) as exudate was questioned because: (a) the normal peritoneal fluid protein concentration is some times > 4 g/dl(1); (b) the ascitic fluid protein concentration increases in cirrhotic patients with diuresis and albumin infusion^(^); (c) some transudative ascites like cardiac ascites have high protein concentration while some traditionally exudative ascites like malignant ascites have low concentration of protein(3); and (d) moreover cirrhosis may be the most frequent cause of high protein ascites(4).

To overcome the shortcomings ascites is now being classified as "high gradient" and "low gradient"(5). When the difference between serum albumin and ascitic fluid albumin is > 1.1g/dl it is called high gradient ascites, whereas if the difference is < 1.1 g/dl it is termed as low gradient ascites(6).

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It should be emphasized that Sero Ascites Albumin Gradient (SAAG) is not a ratio but a subtraction. The SAAG is based on oncotic hydrostatic balance. Portal hypertension results in an abnormally high hydrostatic pressure gradient between the portal bed and the ascitic fluid. There must be a similarly large difference between ascitic fluid and intravascular oncotic pressure than other proteins. The difference between serum and ascitic fluid albumin concentration correlates directly with portal pressure(7).

The present study was designed to compare the utility of SAAG and Ascitic Fluid Total Protein (AFTP) for the differential diagnosis of ascites.

Subjects and Methods

This study comprised of 40 -children with ascites between 0 to 12 years age group (70% male and 30% female) whose diagnoses were established by physical and ultrasound examination. They were admitted to SPMCHI, SMS Medical College, Jaipur between July 1994 and December 1995. Before any therapeutic intervention, diagnostic paracentesis of abdomen was done. The samples of ascitic fluid and venous blood samples were obtained in the same sitting. These were analyzed for cell count, pH, specific gravity, cytology, total protein, albumin, cholesterol, LDH and cultures. Specific investigations like liver biopsy, upper gastrointestinal endoscopy, lipid profile and adenosine deaminase level were done wherever indicated, to diagnose the specific etiology of ascites. The diagnosis of chronic liver disease (CLD) was done by clinical, ultrasonography (USG) abdomen, liver function tests, liver biopsy and upper gastrointestinal endoscopy(8,9). The established criteria were followed for diagnosis of nephrotic syndrome (NS) related, ascites. All 26 cases of CLD were biopsy

proved cirrhotic patients. We did not include any case of extra hepatic obstruction leading to portal hypertension. Out of 26 cases, endoscopy diagnosed Grade II varices in 22 cases (85%) and USG abdomen in 18 cases (69%). The mean values were estimated for all biochemical parameters and statistical significance of difference between means were estimated by Student's "t" test. The usefulness of each biochemical parameter was evaluated in terms of sensitivity, specificity, positive predictive value and negative predictive value.

Results

Out of 40 ascitic patients, 26 cases had CLD and 14 NS related ascites. The mean (SD) of AFTP and SAAG for the 2 groups were 2.62 (0.74) and 1.78 (0.55) ($p < 0.01$) and 1.42 (0.34) and 0.96 (0.26), ($p < 0.001$) respectively.

AFTP diagnosed 53.8% cases of CLD and 92% of NS cases correctly as transudative type as per traditional classification (Table I). The misclassification rate in CLD group was high in comparison to NS

group ($p < 0.01$). The SAAG value correctly classified CLD group as high gradient as per the recent concept of classification" in 85% cases and NS group as low gradient in 85% cases. The misclassification rate for SAAG for both groups was 15% and less than that of AFTP.

AFTP is directly influenced by serum total protein and albumin whereas SAAG is less influenced by them. This is evident from analysis of correlation between various parameters. AFTP had r (correlation coefficient) of 0.58 with serum total protein and 0.69 with serum albumin whereas SAAG has r of 0.25 with serum total protein and 0.3 with serum albumin (r value < 0.3 = no correlation, > 0.7 = significant correlation).

The sensitivity, specificity, positive predictive value, negative predictive value and efficacy of AFTP, ratio between AFTP and serum total protein (STP), SAAG and ratio between ascitic fluid LDH (AFLDH) and serum LDH (SLDH) are summarized in Table II.

TABLE I—Comparison of SAAG and AFTP in Classifying CLD and NS Groups

Group	SAAG <1.1g/dl	SAAG ≥1.1g/dl	AFTP ≥ 25g/dl	AFTP ≥ 25g/dl
CLD(%)	15	85	46.2	53.8
NS(%)	85	15	8.0	92

TABLE II- Comparative Efficacy of Individual Tests to Differentiate CLD and NS Groups

Tests	Cut-off values	Sensitivity (%)	Specificity (%)	Positive predictive value (%)	Negative predictive value (%)	Diagnostic efficacy (%)
AFTP	2.5g/dl	95	46	48	92	63
AFTP/STP	0.5	71	35	37	69	48
SAAG	1.1g/dl	71	92	83	85	80
AFLDH/SLDH	0.6	79	23	35	67	43

Discussion

According to the Starling hypothesis, the fluid movement across a capillary membrane is controlled by the balance of hydrostatic and colloid osmotic pressure(10). Forces tend to achieve a dynamic equilibrium such that increased portal pressure is counter balanced by increased oncotic pressure gradients, the effective gradient between serum and interstitial or ascitic fluid absolute oncotic pressure. When portal pressure is not increased, ascites formation occurs in the presence of an oncotic gradient that is not increased. Since albumin is the main determinant of oncotic pressure, we measured the serum-ascites gradient of albumin concentration as a reflection of portal hypertension in the genesis of ascites from various causes.

Our results demonstrated that the SAAG is > 1.1 in 85% cases of CLD patients with presumed portal hypertension and < 1.1 in 85% cases of NS related ascites. The results are similar to earlier studies with efficacy ranging from 84 to 100%(2,5,6).

A serum-ascites albumin gradient > 1.1 suggests presence of portal hypertension not only in patients of portal hypertension with a transudate type of ascites but also in cases with a high protein concentration. Ascites with high protein level in patients with liver disease is probably explained by a high total serum protein concentration or a rather low degree of portal hypertension or both. On the other hand, a serum-ascites albumin gradient < 1.1 would suggest absence of significant portal hypertension in patients of ascites that was compatible with nephrotic syndrome in our study.

The results of this investigation confirm the earlier findings(5). The serum-ascites albumin gradient provided better discrimination between the CLD and NS group than did the ascitic fluid total protein. The

SAAG correlated well with portal pressure in patients with cirrhotic ascites, confirming earlier finding(7) and showing that Starling force strongly influence the albumin content of this variety of transudative ascites.

It is important to emphasize that SAAG did not provide the exact cause of ascites despite its superior discriminatory power. The presence of a high albumin gradient does not diagnose cirrhosis, it simply indicates the presence of portal hypertension. Similarly, a low albumin gradient does not diagnose any specific condition and is not synonymous with exudates as NS related ascites is included in this category. Nevertheless, despite its limitations, the SAAG has more discriminatory power than the ascites total protein concentration and should replace that test in the routine diagnostic examination of ascites. Further, it is a cheap and simple test. From this study it is concluded that SAAG can be used as a screening test in ascitic patients and specific tests should be done when necessary for individual patients.

REFERENCES

1. Buckaert PX, Evers JLH, Doesber WH, Shellekens LA, Brombacher PH, Rolland R. Patterns of change in protein in the peritoneal fluid of women during preovulatory phase of menstrual cycle. *J Reproductive Fertil* 1986; 77: 329-336.
2. Hoef JC. Increase in ascitic WBC and protein concentration during diuresis in patients with chronic liver disease. *Hepatology* 1981; 1: 249-254.
3. Hegarty RE, Smith JR. Mechanism of ascites: A physiological appraisal. *Am J Med* 1954; 16: 434-448.
4. Sampliner RF, Iber FL. High protein ascites in patients with uncomplicated hepatic cirrhosis. *Am J Med Sci* 1974; 267: 275-279.

5. Runyon BA, Montano AA, Akrivadis EA, Antivon MR, Irving MA, McHutchison JG The SAAG is superior to the exudate/transudate concept in differential diagnosis of ascites *Ann Intern Med* 1992, 117: 215-220.
6. Maure K, Manzione N. Usefulness of serum ascites albumin gradient in separating transudative from exudative ascites - Another Look *Dig Dis Sci* 1988, 33 1208-1213.
7. Hoef JC. Serum protein concentration and protal pressure determine the ascitic fluid protein concentration in patients with chronic liver disease *J Lab Clin Med* 1983,102 260 273
8. Mowat AP. Chronic hepatitis *In: Liver Disorders in Childhood*, 3rd edn London, Butterworths and Company, 1994, pp 189-196.
9. Bolondy L, Mazziotti AV. Ultrasonographic study of portal veins in portal hypertension and after portosystemic shunt operations. *Surgery* 1984, 95: 261-269.
10. Starling EH On the absorption of fluids from the connective tissue spaces *J Physiol* 1895,19: 213-242.