ORIGINAL ARTICLE

ROLE OF SERUM-ASCITES ALBUMIN GRADIENT IN DIFFERENTIAL DIAGNOSIS OF ASCITES

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Background: The classification of ascites as 'exudative' and 'transudative' based on ascitic fluid total protein (AFTP) has been challenged in many clinical conditions like cardiac ascites, patients on prolonged diuretic therapy and malignant ascites because it had poor diagnostic efficacy. These drawbacks have led to the development of another approach to classify ascites, which is based on Serum-Ascites Albumin Gradient (SAAG) to differentiate ascitic fluid into two categories: SAAG ≥11 g/L in ascites due to portal hypertension and SAAG <11 g/L in ascites unrelated to portal hypertension. Objective of this study was to compare the diagnostic efficacy of serum/ascites fluid albumin gradient and ascitic fluid total protein in patients having ascites. **Methods**: This Cross-sectional comparative study was conducted in the Department of Chemical Pathology and Endocrinology, Armed Forces Institute of Pathology, Rawalpindi from 1st Jun 2007 to 30th May 2008. Ninety-three patients were included in the study by non probability convenience sampling. The patient grouped as: (Group I) 73 cases of liver cirrhosis, (Group II) 14 cases of hepatoma and 6 cases of tuberculous ascites. Ascitic fluid specimen and 3 ml blood were obtained for ascitic fluid estimation of ascitic fluid albumin, total proteins and serum albumin. Diagnostic efficacy of SAAG and AFTP was calculated by comparing the results with clinical, ultrasonographic, histo-pathological findings, ascitic fluid cell count/acid fast bacilli culture and other relevant investigations. **Results:** Seventy-three cases had liver cirrhosis (group I), 14 cases had hepatoma and 6 cases had tubercular ascites (group II). Age ranged 25–80 years with mean age 56 years. Diagnostic accuracy, Sensitivity, Specificity, Positive predictive value (PPV) and Negative predictive value (NPV) of SAAG were 96%, 97%, 95%, 98.6%, and 90% respectively, whereas those of AFTP were 56%, 53%,70%, 86%, and 29% respectively. **Conclusion:** Differential diagnosis of ascites should be based on SAAG because diagnostic efficacy of SAAG was significantly higher than AFTP in work-up of ascites.

Keywords: Ascites, Serum/ascites albumin gradient, Ascitic fluid total protein

INTRODUCTION

The term 'ascites' denotes the pathologic accumulation of fluid in the peritoneal cavity. The causes of ascites may be classified into two broad patho-physiologic categories, one which is associated with a normal peritoneum and second who occurs in a diseased peritoneum. The most common cause of ascites is portal hypertension secondary to chronic liver disease, which accounts for more than 80% cases. The most common causes of non-portal hypertensive ascites include infections and intra-abdominal malignancy.[1]

The traditional classification of ascites into 'exudative' and 'transudative' involves estimation of ascitic fluid total protein (AFTP), which is high (≥25 g/L) in exudate and <25 g/L in transudate.[2] This classification has been challenged in different clinical conditions.[3–7] These drawbacks led to another approach to classify ascites, based on serum/ascites albumin gradient (SAAG), which is being used to differentiate ascitic fluid into two categories: first with gradient ≥11 g/L in ascites due to portal hypertension and second with gradient <11 g/L in ascites unrelated to portal hypertension. However approximately 4% patients have 'mixed ascites', i.e., underlying portal hypertension complicated by a second cause for ascites formation (such as malignancy or tuberculosis).[1]

Presently SAAG is not being used in clinical practice, so keeping in view the current clinical practice. This study was designed to compare the diagnostic efficacy of SAAG and AFTP in work-up of ascites.

MATERIAL AND METHODS

This was comparative cross-sectional study carried out at the Department of Chemical Pathology and Endocrinology, Armed Forces Institute of Pathology, Rawalpindi (AFIP) from 1st Jun 2007 to 30th May 2008. Ninety-three cases of clinically detectable ascites irrespective of sex and age, reporting to AFIP for ascitic fluid analysis were included in the study by non-probability convenience sampling. Out of 93 patients, 73 (77%) had liver cirrhosis and placed in group I of study, 20 (27%) were unrelated to portal hypertension and placed in group II of the study (14

cases of hepatoma and 6 cases of tubercular ascites). Cases of mixed ascites and pregnant ladies were excluded.

After obtaining informed consent, history, clinical details, ultrasound/histo-pathological findings, ascitic fluid cell count/acid fast bacilli-culture and other relevant investigations were recorded. Three ml of blood was collected aseptically from ante-cubital vein in plain test tubes in lying posture simultaneously. Application of tourniquet was minimised to 60 seconds. Blood was allowed to clot and serum was separated. Albumin (g/L) was estimated on both serum and ascitic fluid by the Bromocresol green method[8] and AFTP (g/L) was estimated by Biuret method[9] on automated chemistry analyser, Selectra-2. SAAG was calculated by following formula:

SAAG (g/L)=Serum Albumin - Ascitic fluid albumin

Data analysis was done using SPSS-11. Descriptive statistics were used to calculate frequency distribution of age, gender, SAAG and AFTP. Diagnostic Accuracy, Sensitivity, Specificity, PPV and NPV of SAAG and AFTP were calculated by comparing with clinical, ultrasonographic, histo-pathological findings, ascitic fluid cell count/acid fast bacilli culture and other relevant investigations as under. The statistical analysis was done using student's '*t*' test.

- Accuracy= TP+TN/N×100
- Sensitivity%= TP/TP+FN×100
- Specificity%= TN/TN+FP×100
- PPV%= TP/TP+FP×100
- NPV%= TN/TN+FN×100

RESULTS

Among 93 patients, 67 were males and 26 were females. Mean ages was 57 years. Age range was 25–80 years.

Out of 73 patients of group I, 71 (97%) were correctly identified by SAAG at ≥11 g/L while only 39 patients (53%) were identified as transudate at AFTP <25 g/L. Out of 20 patients of group II, 18 (90%) were correctly identified as by SAAG at <11 g/L and only 14 patients (70%) were identified as exudates at AFTP ≥25 g/L.

The Accuracy, Sensitivity, Specificity, PPV and NPV of SAAG at ≥11 g/L and AFTP at <25 g/L to predict portal hypertension was calculated by using 2×2 tables. Calculated Accuracy, Sensitivity, Specificity, PPV and NPV of SAAG were 96%, 97%, 95%, 98.6%, 90%, and those for AFTP were 56%, 53%, 70%, 86%, and 29% respectively (Table-1).

Table-1: Diagnostic value of SAAG and AFTP (n=93) in differentiating ascites

Variables	Group I Mean ±SD	Group II Mean±SD	*p*-value	Accuracy %	Sensitivity %	Specificity %	PPV %	NPV %
SAAG (g/L)	19.0±4.3	8.9±2.3	<0.001	96	97	95	98.6	90
AFTP (g/L)	22.4±7.4	35.7±14.3	<0.001	56	53	70	86	29

DISCUSSION

Diagnostic paracentesis with ascitic fluid analysis is critical to the accurate diagnosis and management of ascites. Older classification of exudates-transudate has been challenged. Recent advances have improved the evaluation of ascetic fluid; among them is the SAAG for discrimination of ascites. As albumin is the main contributor of oncotic pressure, so SAAG was measured as a reflection of portal hypertension in the genesis of ascites from different causes.

In our study mean value of SAAG (Group I) was 19 g/L which can be explained by finding that majority of patients belonged to older age (Mean age= 57 years) and because serum albumin is already low in decompensated liver disease and in old age; this leads to low ascitic fluid albumin concentrations and a higher degree of SAAG.[10,11]

SAAG ≥11g/L 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. Similarly, mean SAAG in Group II was 8.9 g/L which is in agreement with reported values (Table-2). SAAG <11 g/L would suggest absence of portal hypertension that was compatible with studies worldwide.[12–15]

Results of present study have shown that AFTP has poor diagnostic efficacy in both groups as it could identify only 53% cases in group I at cut-off level of <25 g/L, while 47% of patients showed high AFTP values (exudate) which could not be identified also. On the other hand AFTP at cut-off level of ≥25 g/L has correctly classified 70% cases in group II and 30% cases could not be identified as their AFTP levels were <25 g/L which is in agreement with studies conducted worldwide.[16–18]

Sensitivity (Se), Specificity (Sp), Ac (Accuracy), Positive Predictive Value (PPV), Negative Predictive Value (NPV).

The results of the present study reinforce the superiority of SAAG to the transudate-exudate concept in classifying ascites with efficacy ranging from 80–100%.

Table-2: Different studies about SAAG

Study	n	Country	SAAG (%)					AFTP (%)				
			Ac	Se	Sp	PPV	NPV	Ac	Se	Sp	PPV	NPV
Runyoun *et al* [17]	901	America	96.7	-	-	-	-	55.6	-	-	-	-
Lundao *et al* [19]	98	Spain	95.7	-	-	-	-	65.6	-	-	-	-
Akriviadis *et al* [20]	51	Greece	98	-	-	-	-	52	-	-	-	-
Nadeem *et al* [21]	30	Pakistan	100	-	-	-	-	68	-	-	-	-
Goyal AK *et al* [22]	93	India	97	-	-	-	-	72	-	-	-	-
Beg M *et al* [23]	100	India	96	94.7	-	-	-	68	65.6	-	-	-
Rana SV *et al* [24]	50	India	86	88	84	84	87	72	56	88	82	66
Das BB *et al* [14]	40	India	80	71	92	83	85	63	95	46	48	92
Al-Knawy *et al* [20]	132	Saudia	91	-	-	80	98	84	-	-	68	96
Khan FY *et al* [25]	104	Qatar	-	-	-	88	96	-	-	-	63	95
Sartori M *et al* [26]	153	Italy	92	-	-	77	95	-	-	-	-	-
Present study	93	Pakistan	96	97	95	98.6	90	56	53	70	86	29

CONCLUSION

Differential diagnosis of ascites should be based on SAAG because diagnostic efficacy of SAAG was significantly higher than AFTP in work-up of patients having ascites.

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