

## ORIGINAL RESEARCH

### **A Hospital Based Prospective Study to Compare the Serum Ascitic Fluid Albumin Gradient (SAAG) with Ascitic Fluid Total Protein (AFTP) in Hepatic and Non-Hepatic Causes of Ascites at Tertiary Care Center**

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#### **ABSTRACT**

**Background:** The traditional way of classification of ascites by AFTP offers little insight to the pathophysiology of ascites formation and it has further drawbacks. In order to overcome it the classification of ascites based on SAAG has emerged. Even SAAG also has some draw backs like non correlation with ascites due to nonalcoholic cirrhosis and difficulty in identifying the ascites due to mixed etiology. So, the study is conducted to compare the serum ascetic fluid albumin gradient (SAAG) with ascetic fluid total protein (AFTP) in hepatic and non-hepatic causes of ascites at tertiary care center.

**Materials& Methods:** A hospital based prospective study done on 80 patients who were admitted in the medical ward under Department of General Medicine, General surgery and radiation oncology in SMS Medical College, Jaipur, Rajasthan. They are classified on the basis of SAAG into High SAAG and low SAAG and on the basis of AFTP into Transudate and Exudate. After the etiology of ascites evaluated by various diagnostic procedures the sensitivity, specificity and diagnostic accuracy of SAAG and AFTP in identifying the pathophysiology of ascites calculated separately. The diagnostic accuracies of SAAG and AFTP compared statistically.

**Results:** Our study showed that the mean age was 50.23 years. Male to female ratio was 2.33:1. The cirrhosis occupies the maximum with 60%, liver metastasis, Antenatal with Hypertension occupies the least with 1.25% each. The diagnostic accuracy of SAAG and AFTP for individual aetiologies of ascites were found and compared. SAAG was found to be superior to AFTP with a P value of <0.01 which was statistically significant.

**Conclusion:** We concluded that the diagnostic accuracy of SAAG and AFTP was compared and SAAG was found to be superior to AFTP and it was proved statistically significant.

**Keywords:** Hepatic, Non-heaptic, SAAG, AFTP, Ascites.

#### **INTRODUCTION**

Ascites is one of the most common problem which a physician confronts in his daily practice, which can be effectively diagnosed by ascitic fluid analysis.<sup>1</sup>The pathological

accumulation of fluid within the peritoneal cavity is called as ascites.<sup>2</sup> The most common cause of ascites is hepatic cell failure and is considered as the cardinal sign of portal hypertension.<sup>2</sup> Though the liver cell failure is envisioned to be the major cause of ascites, others include tuberculosis, malignancy, renal failure, heart failure, pancreatic causes and others. The ascites is classified traditionally based on estimating the AFTP (ascitic fluid total protein) as 'exudative' and 'transudative' ascites.<sup>1</sup> The ascitic fluid total protein is, more than or equal to 2.5 g/dl in exudative ascites and less than 2.5 g/dl intransudative ascites. This when used in routine clinical practice, has many pitfalls especially in cases of cardiac ascites<sup>3</sup>, cirrhotic patients on prolonged diuretic therapy<sup>4</sup> and in about 1/3<sup>rd</sup> patients of malignant ascites<sup>5</sup>, sometimes even in usual cirrhotic patients' ascitic fluid<sup>6</sup> and in SBP (spontaneous bacterial peritonitis)<sup>7</sup> where it cannot identify the pathophysiology of ascitic fluid formation accurately. To overcome this issue, a newer way of classification of ascites based on SAAG was introduced. The difference between the serum and ascitic albumin concentration was used to classify the ascitic fluid under two categories: A gradient  $\geq 1.1$  g/dl in cases with portal hypertension and  $< 1.1$  g/dl in ascites due to other causes.<sup>1</sup> Even the SAAG has drawbacks like difficulty in identifying ascites due to non-alcoholic cirrhosis<sup>8</sup>, due to mixed etiological conditions<sup>9</sup>, and it could not differentiate between ascites due to malignancy and tuberculosis.<sup>10</sup>

The Starling hypothesis is the underlying physiology behind the estimation of SAAG.<sup>11</sup> The SAAG is based on the principle of oncotic – hydrostatic pressure balance. The abnormally elevated hydrostatic pressure gradient between the portal bed and the ascitic fluid results in the development of portal hypertension.<sup>11</sup> Similarly, a huge difference must be present between the intravascular and ascitic fluid the oncotic forces.<sup>11</sup> It is Albumin which exerts a greater oncotic pressure than that exerted by other proteins. Thus, the pressure within the porta system correlates directly with the difference between the serum and the ascitic fluid albumin concentration. The aim of this study to compare the serum ascetic fluid albumin gradient (SAAG) with ascetic fluid total protein (AFTP) in hepatic and non-hepatic causes of ascites at tertiary care center.

## **MATERIALS & METHODS**

A hospital based prospective study done on 80 patients who were admitted in the medical ward under Department of General Medicine, General surgery and radiation oncology in SMS Medical College, Jaipur, Rajasthan.

### **INCLUSION CRITERIA**

- All patients with ascites due to any cause previously not established.
- Patients with a normal coagulation profile.

### **EXCLUSION CRITERIA**

- Patients with severe coagulopathy or with disseminated intravascular coagulation (DIC)
- Ascitic patients with blunt injury to abdomen.
- Ascitic patients with Hepatic encephalopathy or acute gastrointestinal bleeding.
- Ascitic patients on diuretic therapy before ascitic fluid analysis.

## **METHODS**

A complete history and a thorough clinical examination were done for all the patients. Eighty patients who matched the set criteria were included in this study. Ascitic fluid and blood sample were collected simultaneously and examined for ascitic fluid albumin, ascitic fluid total protein and serum albumin.

The Bromo cresol green method<sup>12</sup> was used to calculate ascitic fluid albumin and serum albumin and Biuret method<sup>13</sup> was used to measure ascitic fluid total protein on automated chemistry analyser, Selectra-2.

SAAG was calculated by using the following formula<sup>10</sup>:

**SAAG = Serum Albumin - Ascitic Fluid Albumin**

All the 80 patients underwent various other diagnostic investigations like ultrasound imaging and CT scan as of required and aetiology of the ascites were established. Then, the diagnostic accuracies of AFTP and SAAG were calculated and compared based on the already established diagnosis.

The most rapid and cost-effective method of diagnosing the cause of ascites is abdominal paracentesis followed by effective clinical examination. Even though cirrhotic patients have abnormal coagulation parameters they don't bleed by abdominal paracentesis unless the needle is entered into a vessel site, the commonest complication of abdominal paracentesis is abdominal wall haematoma formation which is about 20-25 percent.

### TECHNIQUE OF PARACENTESIS<sup>14</sup>

Sterile gloves should be utilised while doing abdominal paracentesis procedure. The site of needle entry and surrounding area all over in the quadrant should be draped with povidone iodine solution. Local anaesthetic should be infiltrated in the site of entry from skin to subcutaneous tissue. The Z tract technique is used to avoid the leak of fluid from the site of needle entry after the withdrawal of needle. According to this technique, the skin has to be stretched 2 cm down and then the needle with syringe has to be advanced, with the plunger of the syringe being retracted simultaneously. The stretched skin should be released only when the ascitic fluid flows into the syringe and the needle has entered the peritoneum. The needle should be advanced slowly through the anterior abdominal wall at an increment of 5mm. Slow insertion of the needle prevents injury to the bowel loops as it allows the bowel to move away from the needle. Intermittent suctioning of the syringe should be done rather than continuous suctioning as the latter can cause obstruction to the flow by causing adherence of the bowel loop to the tip of the needle once it enters the peritoneum due to negative pressure. About 30 ml of ascitic fluid is aspirated and sent for various diagnostic investigations mentioned above.

### STATISTICAL ANALYSIS

Analysis of variance (ANOVA) has been used to find the significance of study parameters between three or more groups of patients, Chi-square/ Fisher Exact test has been used to find the significance of study parameters on categorical scale between two or more groups.

### RESULTS

Our study showed that mean age was 50.23 years. Male to female ratio was 2.33:1. The cirrhosis occupies the maximum with 60%, liver metastasis, Antenatal with Hypertension occupies the least with 1.25% each (table 1).

**Table 1: Demographic profile of patients**

Demographic profile	No. of patients (N=80)	Percentage
Age (yrs) Mean±SD	50.23±12.78	
<b>Gender</b>		
Male	56	70%
Female	24	30%
<b>Etiology</b>		
Cirrhosis	48	60%
CCF	10	12.5%
TB ascites	10	12.5%

<b>Peritoneal carcinomatosis</b>	5	6.25%
<b>Nephrotic syndrome</b>	3	3.75%
<b>Hypothyroidism</b>	2	2.5%
<b>Liver metastasis</b>	1	1.25%
<b>Antenatal with Hypertension</b>	1	1.25%

The most common etiology was cirrhosis was statistically significant in between SAAG <1.1 &>1.1 (table 2).

**Table 2: SAAG Level With etiology**

<b>ETIOLOGY</b>	<b>SAAG&lt;1.1 (N=24)</b>	<b>SAAG≥1.1 (N=56)</b>	<b>P value</b>
<b>Cirrhosis</b>	7	41	<0.001***
<b>CCF</b>	1	9	<0.001***
<b>TB ascites</b>	9	1	0.34
<b>Nephrotic syndrome</b>	2	1	-
<b>Peritoneal carcinomatosis</b>	4	1	0.38
<b>Hypothyroidism</b>	0	2	-
<b>Liver metastasis</b>	0	1	-
<b>AN &amp; HTN</b>	1	0	-

The cirrhosis, CCF, TB Ascites and peritoneal carcinomatosis was statistically significant in between AFTP<2.5 and AFTP≥2.5 (table 3).

**Table 3: AFTP levels along with a etiology**

<b>ETIOLOGY</b>	<b>AFTP&lt;2.5 (N=44)</b>	<b>AFTP≥2.5 (N=36)</b>	<b>P value</b>
<b>Cirrhosis</b>	31	17	<0.001***
<b>CCF</b>	3	7	0.001***
<b>TB ascites</b>	3	7	<0.001***
<b>Nephrotic syndrome</b>	2	1	0.243
<b>Peritoneal carcinomatosis</b>	1	4	0.004**
<b>Hypothyroidism</b>	2	0	-
<b>Liver metastasis</b>	1	0	-
<b>AN &amp; HTN</b>	1	0	-

The diagnostic accuracy of SAAG and AFTP among the patients with ascites for evaluating the etiological causes of ascites is determined and was found to be 87% and 61% respectively which showed that SAAG-Serum Ascitic Fluid Albumin Gradient is superior to AFTP in diagnosing the etiological cause of ascites (table 4).

**Table4: Comparison of diagnostic accuracy of AFTP and SAAG for individual a etiology of ascites**

<b>ETIOLOGY</b>	<b>SAAG</b>	<b>AFTP</b>
<b>Cirrhosis</b>	87	65
<b>CCF</b>	92	38
<b>TB ascites</b>	92	69
<b>Nephrotic syndrome</b>	75	50
<b>Peritoneal Carcinomatosis</b>	83	83
<b>Miscellaneous</b>	100	100

## DISCUSSION

Our study showed that mean age was 50.23 years. This is consistent with the findings of the various other studies done by Valdivia et al<sup>15</sup>, Younas et al<sup>16</sup>, Al-knawye et al<sup>17</sup>,

KhanFyetal<sup>18</sup> andJiangetal<sup>19</sup>. The distribution of ascites among males and females show more preponderance to males when compared to females. In this study 70% were males and this is similar to the observation of Al-knaweyetal<sup>17</sup>, younasetal<sup>16</sup>, jiangetal<sup>19</sup> andkhanetal<sup>18</sup>.

According to the studies conducted by Valdivia et al<sup>15</sup>, Beg M et al<sup>1</sup>, Shaikh etal<sup>20</sup>, Younas et al<sup>16</sup> cirrhosis is found to be the most common cause of ascites as in this study. The second most common cause of ascites in this study was found to be tuberculosis and cardiac failure while that of Shaikh etal<sup>20</sup>, Younas et al<sup>16</sup> showed that carcinomatosis was the second most common cause. The tuberculous ascites was found to be the second most common cause of ascites in the study conducted by Valdivia et al<sup>15</sup> and Beg M et al.<sup>1</sup> However the etiological classification is based on the hospital-based studies, and it represents only the tip of the iceberg seen in the general population.

The classification of ascites based on SAAG into high SAAG and low SAAG showed that 70 % of the patients studied had high SAAG. This finding is consistent with the findings of study by Shaikh et al<sup>20</sup> which had 85 % of the studied patient had high SAAG suggesting that predominant cases of ascites have high SAAG and consequently portal hypertension. The SAAG value is high in most of the patients this can be attributed to the low mean serum albumin value.

Among the patients with ascites having high SAAG the commonest etiology was found to be cirrhosis with 73.2% and cardiac failure with 16.07%. This is similar to that of finding obtained by Khan et al<sup>18</sup> with cirrhosis as the major cause of ascites among high SAAG ascites. The second most common cause of high SAAG ascites was found to be cardiac failure while in the study conducted by Khan et al<sup>18</sup> showed it was massive hepatic metastasis.

Among the patients with ascites having low SAAG the commonest aetiology was found to be tuberculous ascites with 37.5%. This is contradictory to the findings of Khan et al<sup>18</sup> which had peritoneal carcinomatosis as the predominant cause of low SAAG ascites followed by tubercular ascites. This can be because India has more burden of tuberculosis according to the observation of John<sup>21</sup>, when compared to other countries and hence the tubercular ascites is more predominant among the low SAAG ascites compared to the other study which was done in the state of Qatar.

The classification of ascites by ascitic fluid total protein into two groups based on their values in our study showed that 55% of the patients had AFTP < 2.5, this is similar to the findings obtained by Beg M et al<sup>1</sup> where it was 68.42 % suggesting that predominant ascites had ascitic fluid total protein less than 2.5. This is contradictory to the findings of Younas et al<sup>16</sup> which had only 48.38 % of patients having AFTP less than 2.5.

The most common cause among cirrhosis causing ascites in our study was found to be secondary to alcohol aetiology. This is similar to the findings obtained by Khan et al<sup>11</sup> who had about 51.7 % of ascites was due to cirrhosis of alcoholic aetiology while in the present study it was about 45%. Further the most common cause of cirrhosis is due to alcoholic aetiology and in our study alcoholic cirrhosis accounts for 75% of total cirrhosis. This is similar to the results study obtained by Maskey et al<sup>22</sup> which showed alcoholic cirrhosis as the most common cause of cirrhosis accounting for about 85.71%. This is contradictory to findings of Perzetal<sup>23</sup> which suggested cirrhosis due to Hepatitis viruses as the commonest cause of cirrhosis.

## CONCLUSION

We concluded that the diagnostic accuracy of SAAG and AFTP was compared and SAAG was found to be superior to AFTP and it was proved statistically significant.

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