Type of the Paper (Article)

Specificity and Sensitivity of Ascitic Fluid Total Protein (AFTP) and Serum Ascitic Albumin Gradient (SAAG) in Diagnosis Etiology of Ascites

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Abstract

Introduction: Ascites is a pathological buildup of fluid in the peritoneal cavity. It worsens the patient's condition and develops as a result of a variety of underlying diseases. Understanding the etiologies is necessary for effective management.

Aim of the study: The goal of the work was to evaluate SAAG and AFTP's sensitivity and specificity in identifying the ascites-causing factor. Understanding the various causes of ascites was another goal of the study.

Subjects and procedures: The study comprised 100 participants who had ascites. They underwent a thorough clinical evaluation and diagnostic paracentesis. They underwent AFTP and SAAG tests. The specificity, sensitivity, and diagnostic accuracy of AFTP and SAAG were calculated individually after several diagnostic techniques were used to determine the etiology of ascites.

Results: The studied patients had an average age of 57.44 ±10.5 years, and 57% were men. 91% had ascites associated with portal hypertension (PHT). The most common etiologies were liver cirrhosis (LC) associated with hepatitis C virus (HCV) (78%) and malignant and cardiac ascites (4%). The SAAG has a 96.7% sensitivity, 100% specificity, and 98.4% diagnostic accuracy compared to the AFTP's 94.6%, 100%, and 97.3%, respectively.

Conclusions: LC linked to HCV was the most frequent etiology of ascites. SAAG and AFTP had high diagnostic accuracy in determining ascites' etiology. When the SAAG is high, PHT is present; when it is low, PHT is absent.

Keywords: Ascites; SAAG; AFTP; LC; PHT.

1. Introduction

Liquid accumulating abnormally in the peritoneal cavity is known as ascites [1]. Ascitic patients present diagnostic and therapeutic challenges. Abdominal paracentesis and ascitic fluid analysis should be the first steps in assessing patients with ascites, as they are the quickest and most effective methods. Ascites is typically divided into exudate and transudate using the ascitic fluid total protein (AFTP) estimate, which is high in exudative (> 2.5 gm/dl) and transudate ascites (<2.5 mg/dl)

[2]. This categorization, however, cannot properly define the etiological causes underlying its occurrence [3, 4]. The Serum Ascites Albumin Gradient (SAAG), which is the concentration of serum albumin minus ascitic fluid albumin content, has been proposed as an alternative, physiologically based criteria for categorizing ascites. SAAG differentiates ascites into portal hypertensive (PHT) and non-portal hypertensive ascites with gradients >1.1gm/dl and 1.1 gm/dl, respectively [5]. According to multiple studies, SAAG is preferable to the transudate-exudate paradigm for classifying ascites [6–8]. Studying the specificity and sensitivity of AFTP and SAAG in determining the causes of ascites was the objective of the present study.

2. Subjects and methods

2.1. Subjects

One hundred randomly selected patients with undiagnosed ascites participated in an across-sectional study. Ascites was identified through a physical examination combined with abdominal imaging. (Usually ultrasonography). Patients from the hepato-gastroenterology divisions of the General Fayoum Hospital and the Fayoum University Hospital were enrolled between July 2019 and February 2021.

Inclusion criteria

Any ascitic patient who agreed to participate in the research study and provided a sample of ascitic fluid.

Exclusion criteria

Patients who refused to share in the study or who were medically unable to provide an ascitic sample due to abdominal wall cellulitis or disseminated intravascular coagulation (DIC).

2.2. Methods

Each patient underwent a thorough review of their medical history and clinical examination, as well as an ascitic sample for chemical analysis. Serum and ascitic samples were collected concurrently in less than 24 hours to estimate SAAG and AFTP. The difference between serum and ascites albumin concentrations was used to calculate SAAG. Low SAAG (1.1 g/dl) corresponds to ascites associated with non-PHT (peritoneal tuberculosis, ovarian tumor, and nephropathy), whereas high SAAG (1.1 g/dl) corresponds to ascites associated with PHT (post-hepatic cirrhosis, alcoholic cirrhosis, hepato-splenic schistomiasis, and heart disease). The clinical, biochemical, and morphological components all played a role in the identification of various etiological lesions. Transudate and exudate ascites were categorized based on AFTP. Protein levels of 2.5 g/dl cause transudate ascites, whereas levels of 2.5 g/dl cause exudate ascites [10]. All patients underwent an abdominal-pelvic ultrasound (US) examination to confirm the presence of ascites, obtain a diagnostic ascitic sample, and examine the internal organs.

2.3. Statistical Analysis

Data was collected, double-entered into Microsoft Access, and coded to facilitate data manipulation. SPSS program 22 running on Windows 7 was used to conduct the analysis. (SPSS Inc., Chicago, IL, USA). For qualitative data, simple descriptive analysis using percentages and numbers is appropriate. For parametric quantitative data, arithmetic means are used to determine the central tendency, while standard deviations are used to determine dispersion. test of specificity and sensitivity for a novel test using the "Receiver Operating Characteristic" (ROC) curve. Statistical significance was determined by a P-value of 0.05.

3. Results

There were 100 ascites patients in total (mean age was 57.44 ±10.5 years; 57% were male). Six patients had diabetes, six had hypertension, and five had both conditions. Furthermore, 4% had previously been exposed to canal water (Table 1).

Table 1: Baseline socio-demographic characteristics of the patients under study.

Variables		Frequency (N=100)
Age[a] (years) Mean ± SD (range)		57.44±10.5 (18-70)
Sex [b]	Male	57 (57%)
	Female	43 (43%)
Comorbidities	DM[b]	6 (6%)
	HTN[b]	6 (6%)
	Both (DM and HTN) [b]	5 (5%)
History of contact with canal water [b]	No	96 (96%)
	Yes	4 (4%)

[a] Data are given in mean (M) and standard of deviation (SD); [b] Data are given in number of cases (%); N: number, DM: Diabetes mellitus, HTN: Hypertension

Hepatic causes (87%) [post-viral cirrhosis (80%), hepatic schistomiasis (4%) and Budd Chiari syndrome (3%)], cardiac ascites (4%), malignant ascites (4%) and peritoneal tuberculosis (2%) were the most frequent etiologies of ascites, respectively. HCV was the primary cause of LC in 97.5% (78/80) of the patients, but only 23.1% (18/78) of the patients had received HCV treatment (Figure 1).

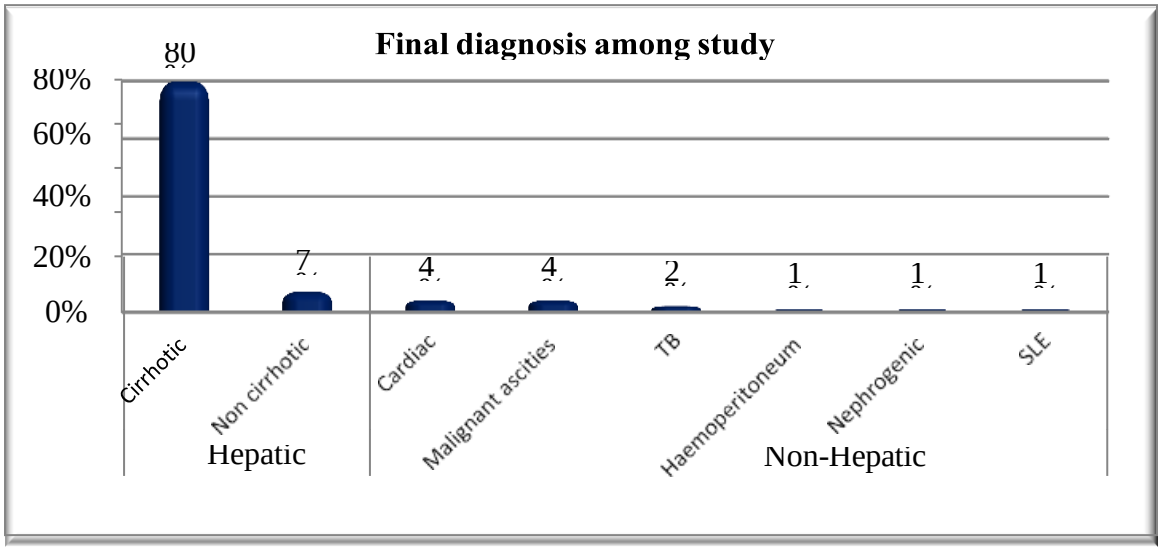

Figure 1: Patients distribution based on the cause of the ascites. TB: Tuberculosis, SLE: Systemic lupus Erythematosus.

SAAG was low in 13% of cases and high in 87% of patients. 89% of instances had transudate ascites, while 11% of cases had exudate ascites (Table 2). With an AUC of 98.4% (*P <0.001*), the specificity and sensitivity tests of SAAG in PHTN diagnosis were 100% and 96.7%, respectively. AFTP's sensitivity and specificity in transudate ascites diagnosis were 94.6% and 100%, respectively, with an AUC of 97.3% (*P <0.001*), based on Table 3 and Figures 2, 3.

Table 2: Patient distribution based on SAAG and AFTP.

Variables		Frequency (N=100)
Serum Ascitic Albumin Gradient (SAAG)	SAAG ≥1.1	87 (87%)
	SAAG <1.1	11 (13%)
Ascitic Fluid Total Protein (AFTP)	AFTP ≥ 2.5	11 (11%)
	AFTP < 2.5	89 (89%)

Table 3: SAAG and AFTP's specificity and sensitivity in ascites diagnosis.

Variables	Sensitivity	Specificity	PPV	NPV	AUC
SAAG in diagnosis of PHTN	96.7%	100%	100%	70%	98.4%
SAAG in diagnosis of transudate ascites	94.6%	100%	100%	58.3%	97.3%

SAAG: serum ascitic albumin gradient, AFTP: Ascitic fluid total protein, AUC: Area under curve, PPV: Positive predictive value, NPV: Negative predictive value, PHT: Portal hypertension.

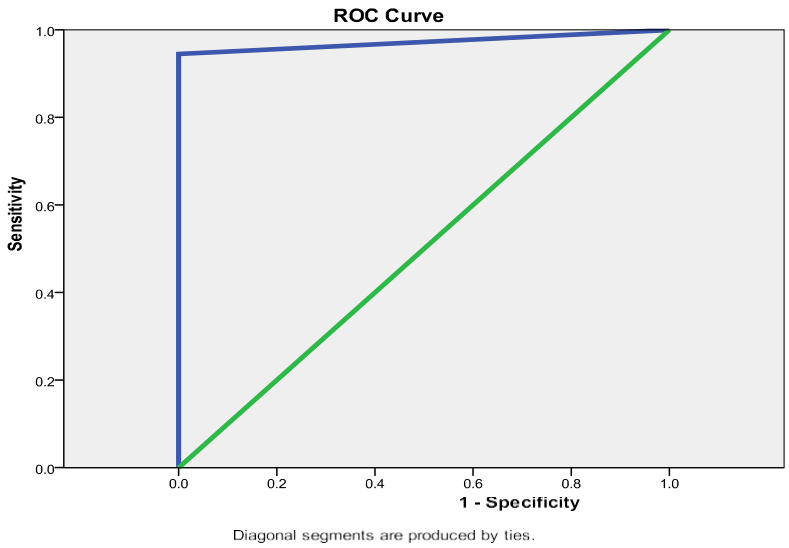

Figure 2: ROC curve for SAAG's specificity and sensitivity in PHT ascites diagnosis**.**

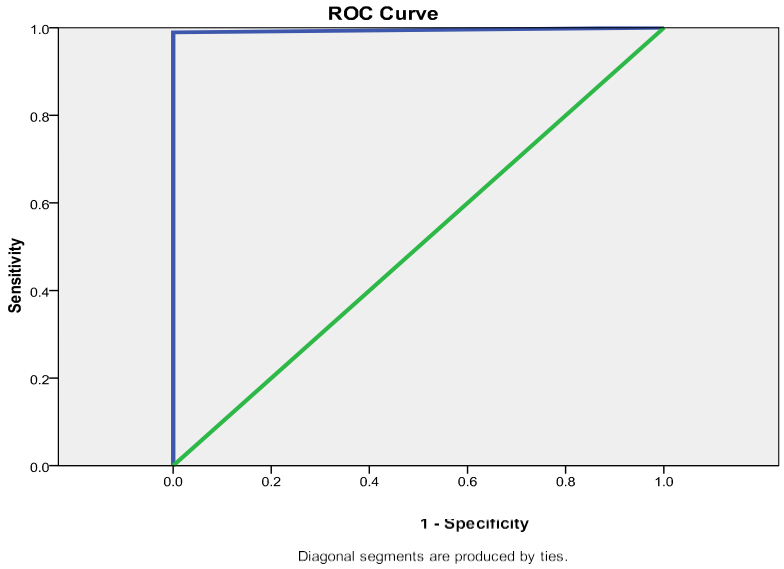

Figure 3: ROC curve for AFTP's specificity and sensitivity in transudate ascites diagnosis.

4. Discussion

Ascites is a symptom of numerous diseases. One of the key elements in identifying the prognosis and treatment of ascites is finding the underlying cause. An accurate diagnosis requires the integration of ascitic fluid analysis, clinical data, and pathological data. The study's objective was

to evaluate and compare AFTP and SAAG in ascites diagnosis [11].

The study's participants ranged in age from 18 to 70, with an average age of 57.44 years and a male predominance of 57%. This is consistent with a study by Bindu and Nayak, which found that the incidence of ascites was highest in people between the ages of 40 and 50 and that male patients made up the majority of those affected (85%) [12]. The peak incidence of ascites was observed in people between the ages of 41 and 60, and numerous studies have shown that men dominated [13–16].

In our investigation, the most frequent causes of ascites were post-viral cirrhosis (80%), hepatic schistomiasis (4%), cardiac ascites (4%), malignant ascites (4%), BCS (3%), and peritoneal tuberculosis (2%). HCV accounted for 97.5% (78/80) of LC cases, while 2.5% (N = 2/80) had hepatitis B virus (HBV).

This is in line with a number of studies that mentioned LC (78%), followed by tuberculous peritonitis (8%), as the most frequent etiologies of ascites. Although drinking alcohol was the most frequent culprit in LC (85%), HBV infection came in second [12, 14]. According to Baptiste's research, post-viral cirrhosis (74%), followed by HCC (16.60%) and peritoneal TB (13.7%), accounted for the majority of etiologies [9]. Alcoholic cirrhosis and HCC predominated in Europe's etiologies [17].

One percent of the world's population is afflicted by CHC infection, which results in cirrhosis and HCC by slowly damaging the liver [18]. Egypt topped the list of nations with a significant burden of HCV due to the high prevalence of schistomiasis and the widespread use of risky intravenous injections to treat it in the 1950s and 1980s [20]. This explains why our study subjects had a high incidence of LC caused by HCV.

According to the results of our study, 87% and 89% of patients had high SAAG levels and transudate ascites, while 13% and 11% of patients had low SAAG levels and exudate ascites, respectively. This was consistent with research from Europe and Asia, where high SAAG levels predominate [17, 21]. All of the patients with high SAAG ascites (87/100; N = 87) were connected to PHT (post-viral cirrhosis, hepatic schistomiasis, BCS, HCC, and heart disease). This was in line with Bindu and Nayak's findings that liver cirrhosis patients had high levels of SAAG, and 96% of them also had PHT [12].

In the current study, SAAG's sensitivity, specificity, and diagnostic accuracy were 96.7%, 100%, and 98.45%, respectively. The PPV and NPV for SAAG were 100 percent and 70 percent, respectively. Although our negative predictive value was lower, these results were comparable to many other outcomes [13, 16, 22].

Gopi and Hanifah (2019) mentioned that SAAG had diagnostic accuracy, specificity, and sensitivity of 86%, 83.33%, and 86.84, respectively, compared to AFTP's 60% [14]. Many studies have found that the SAAG's specificity and sensitivity outperform the AFTP's in identifying ascites etiology, in contrast to our findings, which showed that they were nearly similar to each other and had higher sensitivity and diagnostic accuracy (96.7%, 100%, and 98.45% for the SAAG versus 94.4%, 100%,

and 97.3%, respectively, for the AFTP) [14, 24–27]. As a result, the British and American recommendations include SAAG as an initial testing approach.

Contrarily, SAAG was reported by Baptiste et al. (2018) and Cervantes Pérez et al. (2020) to have poor diagnostic performance (44% and 57%) with low sensitivity (35% and 66%) but high specificity (84% and 86%), respectively [9, 15]. They also came to the conclusion that AFTP's diagnostic accuracy (73%), when it comes to distinguishing between PHT and non-PHT ascites, is better than SAAG's (57%).

In the current trial, the SAAG and AFTP PPVs were both 100%. The results of other studies, however, showed that SAAG (94.28%) regarding the PPV was superior to AFTP (27.27%) [14, 16, 27, 29].

In the current study, it was discovered that SAAG and AFTP had NPVs of 70 and 58.3 percent, respectively. This result agreed with those of Younas et al. and Rana et al., who concluded that SAAG's NPV was 90% and AFTP's was 27% [27, 29], but it differed from those of Das et al. (1998) and Gopi and Hanifah, (2019) who concluded that SAAG's NPV was 85% and 64.6% when compared to AFTP's NPV (92% and 85.7%, respectively) [14, 25]. The higher number of false negatives for AFTP in this study accounted for the lower negative predictive value of AFTP for SAAG.

The study's largest flaw was its small sample size, which only includes 100 ascitic patients, the majority of whom had PHT. As a result, we advised considering a larger sample size in order to include more individuals with ascites caused by causes other than PHT.

Conclusion

When determining the etiology of ascites for prompt treatment, SAAG and AFTP are dependable, affordable, and time-efficient tests with a high degree of diagnostic accuracy.

Ethical Approval Statement: Faculty of Medicine's Institutional Ethics Committee in Fayoum, Egypt, gave its approval to the study (M395).

Funding: This research is not funded.

Conflicts of Interest: All authors declare no conflict of interest.

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