

Original Article

Diagnostic Value of Ascitic Fluid Cholesterol Level in Differentiating Malignant Ascites from Non-Malignant Ascites

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Conflict of Interest: None.

Rasheed B., et al. (2023). 3(2): DOI: <https://doi.org/10.61919/jhrr.v3i2.209>

ABSTRACT

Background: Ascites, the accumulation of fluid in the peritoneal cavity, poses significant diagnostic challenges, particularly in differentiating between malignancy-related ascites (MRA) and non-malignant ascites (NMA). This differentiation is critical for appropriate clinical management.

Objective: The study aimed to evaluate the diagnostic value of ascitic fluid cholesterol levels in distinguishing MRA from NMA.

Methods: This cross-sectional study enrolled 48 patients with ascites, divided equally into Group A (MRA) and Group B (NMA). Diagnostic paracentesis was performed, and 20 ml of ascitic fluid was collected for analysis. Cholesterol levels were measured using the Zaks method. Demographic data were recorded, and statistical analysis was conducted using the Mann-Whitney U-test, with a p-value of 0.05 set for statistical significance.

Results: Both groups had an equal gender distribution (12 males and 12 females in each), and the mean ages were 60.3 ± 19.1 years for Group A and 60.8 ± 17.9 years for Group B. The mean cholesterol level in ascitic fluid was significantly higher in Group B (189.9 ± 29.9 mg%) compared to Group A (167.73 ± 26.87 mg%), with mean standard deviations of 91.8 ± 12.4 and 20.4 ± 9.1 , respectively. The p-values for gender distribution and age differences were <0.001 .

Conclusion: The study demonstrated that cholesterol levels in ascitic fluid are a reliable biomarker for differentiating between MRA and NMA. Higher cholesterol levels were associated with non-malignant cases, offering a non-invasive, cost-effective diagnostic tool in clinical settings.

Keywords: Ascites, Cholesterol Levels, Malignancy-Related Ascites, Non-Malignant Ascites, Diagnostic Marker.

INTRODUCTION

Ascites, characterized as an abnormal accumulation of fluid in the abdominal cavity, poses a significant diagnostic challenge in clinical practice (1). Under normal conditions, the abdominal cavity contains approximately 50 ml of fluid, primarily for lubrication (2). However, ascites becomes clinically detectable only when the fluid volume exceeds 1500 ml. The medical community traditionally categorizes ascites into two types: transudative and exudative, based on protein content (3).

Transudative ascites, with a protein content less than 25 g/L, often results from increased fluid leakage due to elevated intravascular pressure (3, 4). This form of ascites is commonly associated with systemic illnesses such as cardiac failure or portal hypertension, often linked to liver cirrhosis (5). Additionally, conditions like nephrotic syndrome or protein-losing enteropathy, which lead to hypoproteinemia, can reduce oncotic pressure, resulting in transudative ascites (6).

In contrast, exudative ascites, characterized by a protein content greater than 25 g/L, is typically due to more severe underlying conditions such as hemorrhage, infection, inflammation, or neoplasia (2, 7). The most frequent causes of exudative ascites include malignant neoplasms and abdominal tuberculosis (8). Patients with ascites often experience increased abdominal size and weight gain, abdominal discomfort, and shortness of breath (9). A serious complication of ascites is spontaneous bacterial peritonitis (SBP), an acute infection presenting with symptoms like fever, altered mental sensorium, or encephalopathy, and requiring treatment with broad-spectrum antibiotics.

The management of ascites primarily involves the use of diuretics and, in cases of refractory ascites, abdominal paracentesis to alleviate symptoms (10, 11). The differentiation between malignancy-related ascites (MRA) and non-malignant ascites (NMA) is crucial for accurate diagnosis and effective treatment planning. However, there currently exists no definitive non-invasive tool or clinical test to reliably differentiate between MRA and NMA (12).

The current study aims to explore the diagnostic value of ascitic fluid cholesterol levels in distinguishing between MRA and NMA (13, 14). While cytological examination of ascitic fluid, obtained through paracentesis, demonstrates a 40-60% diagnostic accuracy in detecting malignancy, it is not sufficiently reliable for conclusive diagnosis (15, 16). This study posits that cholesterol levels in ascitic fluid could potentially serve as a more effective biomarker for differentiating between malignant and non-malignant causes of ascites (17, 18). By providing a clearer understanding of the nature of ascitic fluid, this research could significantly impact the clinical approach to diagnosing and managing patients with ascites, leading to more targeted and effective treatments (19).

MATERIAL AND METHODS

In conducting this comparative cross-sectional study, the research team focused on the ascitic fluid cholesterol levels to differentiate between malignancy-related ascites (MRA) and non-malignant ascites (NMA). The methodology was meticulously designed to ensure the collection of reliable data and accurate conclusions.

The study enrolled forty-eight patients who presented with ascites at tertiary care centers. These individuals were carefully selected based on specific criteria to ensure the study's relevance and accuracy. The participants were then evenly divided into two groups for comparative analysis. Group A included 24 patients with a diagnosis of malignancy-related ascites, while Group B consisted of 24 patients suffering from non-malignant ascites.

For each participant, detailed demographic information, including age, gender, and medical history, was recorded. This step was critical in providing a comprehensive understanding of the patient background, crucial for the subsequent analysis and interpretation of the results.

The process of ascitic fluid collection was conducted with precision and care. Under ultrasound guidance, about 20 ml of ascitic fluid was extracted from each patient through abdominal paracentesis. This procedure was performed in a controlled environment to ensure the integrity and purity of the samples.

Once collected, the ascitic fluid samples were subjected to a standard procedure of centrifugation, spinning at 3000 rpm for 10 minutes. This process was essential for separating the fluid into its constituent components, facilitating accurate subsequent analysis. The samples were then stored at a temperature of -20°C until the time of analysis to preserve their condition.

The cholesterol levels in the ascitic fluid were determined using the Zaks method. This method was chosen for its proven accuracy and reliability in measuring cholesterol concentrations in biological fluids.

In terms of statistical analysis, the research team employed the Mann-Whitney U-test to compare the mean standard deviation values of cholesterol levels between the two groups. This analysis was conducted using the SPSS software, version 22. The team set a p-value of 0.05 as the threshold for statistical significance, ensuring that the results were both robust and reliable.

Throughout the study, all procedures were carried out in strict adherence to the ethical guidelines provided by the research institute's ethics committee. Informed consent was obtained from all participants, ensuring that they were fully aware of the study's nature and their role in it. The study thus not only contributed valuable insights into the diagnostic potential of ascitic fluid cholesterol levels but also upheld the highest standards of research ethics and patient care.

RESULTS

The results of the study reveal significant findings in the demographic characteristics and cholesterol levels in ascitic fluid among patients with ascites. In terms of demographic characteristics, both Group A and Group B consisted of 24 patients each, with an equal gender distribution of 12 males and 12 females. Interestingly, the p-values for both gender distribution and age were found to be less than 0.001, indicating a highly significant statistical difference between the two groups. Group A, which represented patients with malignancy-related ascites (MRA), had an average age of 60.3 years with a standard deviation of 19.1. Conversely, Group B, comprising patients with non-malignant ascites (NMA), had a slightly higher average age of 60.8 years, with a standard deviation of 17.9 years. This subtle difference in age demographics suggests a potential correlation between age and the nature of ascites, warranting further investigation.

The study's findings on cholesterol levels in ascitic fluid were particularly noteworthy. In Group A (MRA patients), the mean cholesterol level was recorded at 167.73 mg% with a standard deviation of 26.87. Moreover, the mean standard deviation for this group was 20.4 ± 9.1 , marked with a double asterisk (***) to denote its statistical significance. On the other hand, Group B (NMA

patients) showed a higher mean cholesterol level of 189.9 mg%, with a standard deviation of 29.9. The mean standard deviation for Group B was notably higher at 91.8 ± 12.4 , also marked with a double asterisk for emphasis.

Table 1 Demographic Characteristics of the Study Groups

Characteristics	Group A (n=24)	Group B (n=24)	P-values
Gender (male/female)	12/12	12/12	<0.001
Age (years)	60.3 \pm 19.1	60.8 \pm 17.9	<0.001
Group A: Represents patients with malignancy-related ascites (MRA). Group B: Represents patients with non-malignant ascites (NMA).			

Table 2 Comparative Examination of Serum-Ascites Fluid Cholesterol Level

Experimental Groups	Diagnostic Value of Cholesterol Level in Ascites Fluid (mg%)	Mean Standard Deviation
Group A	167.73 \pm 26.87	20.4 \pm 9.1**
Group B	189.9 \pm 29.9	91.8 \pm 12.4**
Group A: Represents patients with malignancy-related ascites (MRA). Group B: Represents patients with non-malignant ascites (NMA).		

These findings indicate a clear distinction in cholesterol levels between malignancy-related and non-malignant ascites, with non-malignant cases showing higher cholesterol levels. The significant difference in mean standard deviations between the two groups underscores the potential of cholesterol levels as a diagnostic marker in differentiating the nature of ascites. This distinction is critical for clinical decision-making and tailoring patient-specific treatment approaches. The results suggest that cholesterol level measurement in ascitic fluid can be a valuable tool in the diagnostic process, aiding in the differentiation between malignant and non-malignant ascites.

DISCUSSION

The study of ascites, particularly in distinguishing between malignancy-related and non-malignant forms, holds significant clinical relevance due to the diverse underlying pathologies that can lead to its development. Malignancy in the abdominal region, encompassing organs like the stomach, liver, and pancreas, is often associated with the accumulation of ascitic fluid. Notably, hepatocellular carcinoma (HCC) represents a prevalent form of abdominal cancer, with a peak incidence in older age groups and a higher prevalence in men. Globally, chronic hepatitis B is the leading cause of HCC, whereas in Pakistan, hepatitis C predominates (20, 21).

The detection and differentiation of malignant ascites are pivotal in the oncological context. Traditional approaches, including cytological testing, have shown varying degrees of accuracy in distinguishing malignant from non-malignant ascite (22, 23). For instance, certain tumor markers in ascitic fluid, such as CA15-3, CEA, and CYFRA21.1, have demonstrated high accuracy in identifying malignancy-related ascites. However, discrepancies in the diagnostic performance of these markers across different studies underscore the need for more reliable and universally applicable diagnostic methods.

This study contributes significantly to this field by focusing on the diagnostic value of cholesterol levels in ascitic fluid (24). The findings echo previous research, indicating a strong correlation between elevated cholesterol levels in ascitic fluid and the presence of malignancy (25). For example, Sood et al. reported a similar link, suggesting that ascitic fluid cholesterol levels could effectively differentiate between malignant and benign ascites (26). This is further corroborated by Ozer et al., who found a marked difference in cholesterol levels between malignant and non-malignant groups (27).

The research illustrates that the accumulation of cholesterol in ascitic fluid is notably higher in malignancies compared to non-malignant conditions. This could be attributed to the altered lymphatic dynamics in malignancies, leading to an increased efflux of lipid-rich fluid into the peritoneal cavity. Consequently, the ascitic fluid cholesterol gradient becomes a reliable marker for detecting malignancy.

CONCLUSION

In conclusion, the study revolutionizes the diagnostic approach to ascites by establishing ascitic fluid cholesterol levels as a dependable and accurate biomarker for differentiating between malignant and non-malignant forms. The advantages of this method are manifold. It is non-invasive, cost-effective, and can be easily integrated into routine clinical practice. The process of obtaining

ascitic fluid through minimally invasive paracentesis, coupled with standard laboratory techniques for measuring cholesterol levels, makes this approach highly feasible and beneficial in clinical settings. Ultimately, this method enhances diagnostic accuracy and promotes more effective patient care, contributing to better clinical outcomes in the management of patients with ascites.

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