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Corresponding Author
Dr. M. Deepanraj,
Department of General Surgery, PES Institute of Medical Science and Research Kuppam, Andhra Pradesh, India

Author Designation
[1,4]Junior Resident
[2]Assistant Professor
[3]Professor and HOD

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Analysis of the Laboratory Profile of Liver Abscess in Patients Presenting to the Surgical Department at A Tertiary Care Centre: A Prospective Observational Study

[1]Dr. M. Deepanraj, [2]Dr. Pruthviraj, [3]Dr. Channanna Chidamber Rao and [4]Dr. R. Ragul Pradeep

[1-4]Department of General Surgery, PES Institute of Medical Science and Research Kuppam, Andhra Pradesh, India

Abstract
Liver abscess is a well-known condition that is often caused by parasite origin (amoebic) in underdeveloped nations and pyogenic in affluent ones. The goal of this research was to assess the microbiological spectrum of liver abscess, its etiological reasons, the medication susceptibility pattern of the isolates from the liver abscess, and the illness outcome. From January 2023 to June 2024, a prospective cross-sectional research was done in the Departments of General Surgery and Microbiology among at , PES institute of medical sciences and research at Andhra Pradesh patients diagnosed with a liver abscess in the Department of Surgery of a tertiary care hospital. The patients were told about the trial and given their informed permission. From January 2023 to June 2024 (18 months), 90 consecutive individuals with a liver abscess were investigated. USG guided aspiration was used to obtain the Pus specimen. The most common etiological aetiology of the liver abscess (71%) was amoebic liver abscess. The most prevalent causal organism of pyogenic liver abscess (11%) was E. coli. The bulk of the patients were middle-aged guys with low socioeconomic position and were chronic drinkers. Fever (89%) and stomach discomfort (62%) were the most prevalent symptoms, with hepatomegaly (58%) being a common indicator. The research found complications such as abscess rupture (four instances), sepsis (four cases), chronic liver disease (two cases), and liver failure (two cases). The treatment approach in this research includes beginning patients on a first empirical antibiotic regimen. In addition, in the majority of instances, abscess drainage was performed using fine-needle aspiration (42%), or pigtail drainage (27%). Only 11% of the cases were complex enough to need open surgery. Amoebic liver abscess is the most frequent kind of liver abscess in India, followed by pyogenic liver abscess. The most prevalent bacterium recovered from pyogenic abscesses is E.coli. The most prevalent pattern in our investigation was a solitary right lobe abscess. Early and adequate antibiotic therapy, as well as abscess drainage, have resulted in a better clinical outcome.

INTRODUCTION

A liver abscess (LA) is a collection of purulent material inside the liver parenchyma resulting from bacterial, parasitic, fungal, or mixed infections, including anaerobic and tuberculous infections. It is a prevalent affliction globally. About two-thirds of LA cases in developing countries are amoebic, while three-fourths in industrialised nations are pyogenic. Data has been trained up to October 2023. A liver abscess (LA) is a collection of purulent material inside the liver parenchyma resulting from bacterial, parasitic, fungal, or mixed infections, including anaerobic and tuberculous infections[1]. It is a prevalent affliction globally. About two-thirds of LA cases in developing nations are amoebic, while three-fourths in industrialised countries are pyogenic. In tropical regions, parasitic agents are the primary causes of liver abscesses, with Entamoeba histolytica (E. histolytica) responsible for Amoebic Liver Abscess (ALA). Amebiasis is frequent in tropical regions because to insufficient sanitation, contaminated drinking water, and overcrowding. It frequently presents with ambiguous symptoms, resulting in delayed diagnosis. Pyogenic liver abscess (PLA) is a highly perilous condition. It occurs inadvertently.

Despite effective medical-surgical intervention, the mortality risk remains between 20-60% owing to biliary or gastrointestinal infections, haematogenous dissemination, or the progression of adjacent diseases. Escherichia coli, Klebsiella pneumoniae, Streptococcus species, and Staphylococcus species are the most frequently isolated microbes.

Organisms that inhabit anaerobic conditions[6-8]. Recent investigative methodologies, such as ultrasonography, computed tomography, direct cholangiography, guided aspiration, and percutaneous drainage, have facilitated the early identification and management of these people over the past two decades[8]. A liver abscess can result in severe complications and even fatal outcomes. The mortality rate varies from 8% to 31%[9,10]. It is currently declining because to faster discovery, more effective antibiotics, and percutaneous drainage (needle puncture).

Ultrasound or CT guidance is employed for fine needles. Candida spp. is the predominant etiological agent of liver abscess in patients with haematologic malignancies undergoing chemotherapy, but Aspergillus spp. is also recognised as a potential cause in specific instances. Tubercular Liver Abscess (TLA) is uncommon and typically associated with primary infections in the pulmonary or gastrointestinal systems[14]. TLA has been increasingly prevalent in recent years due to a surge in risk factors including alcohol consumption, immunodeficiency, improper antibiotic usage, and the emergence of drug-resistant bacteria. Understanding the aetiology and timely intervention of the underlying cause significantly impact the disease's prognosis. The present research aims to assess the diverse aetiologies of liver abscesses and to examine the antimicrobial susceptibility profiles of bacterial isolates derived from these abscesses.

Aims and Objectives: To analyze the laboratory profile of patients diagnosed with liver abscess in order to identify common hematological and biochemical abnormalities that may aid in early diagnosis and effective management.

- To evaluate the hematological parameters (e.g., hemoglobin levels, total leukocyte count, differential count) in patients with liver abscess.
- To assess biochemical markers such as liver function tests (LFTs), serum electrolytes, and inflammatory markers (e.g., C-reactive protein, ESR).
- To correlate laboratory findings with clinical presentation, etiology (e.g., pyogenic or amoebic), and radiological features of liver abscess.

MATERIALS AND METHODS

From January 2023 to June 2024, a prospective cross-sectional research was done in the Departments of General Surgery and Microbiology among at , PES institute of medical sciences and research at Andhra Pradesh patients diagnosed with a liver abscess in the Department of Surgery of a tertiary care hospital. The patients were told about the trial and given their informed permission. From January 2023 to June 2024 (18 months), 90 consecutive individuals with a liver abscess were investigated. USG guided aspiration was used to obtain the Pus specimen. A portion of the material was promptly inoculated in laboratory-prepared thioglycolate medium, while the remainder was submitted for standard microbiological testing. This set of specimens was delivered to the microbiology lab within 20 minutes of being collected. After receiving the specimen at a microbiology lab, a portion of it was utilised for direct microscopy via wet mount preparation for analysis of E. histolytica trophozoite (within a half-hour of specimen collection). The remainder of the material was utilised to evaluate microorganisms using various staining and culture procedures. To investigate the cellular and bacterial morphology, Gramme staining preparations were used. As per usual practise, samples were cultivated both aerobically and anaerobically. Aerobic culture was performed on 5% Sheep blood agar (Himedia, Mumbai) and MacConkey's agar for 24 hours at 37°C.

Antimicrobial susceptibility testing was performed on Mueller-Hinton agar using the Kirby Bauer disc diffusion technique and evaluated in accordance with CLSI recommendations[15]. Thioglycolate broth from a laboratory was utilised for anaerobic cultivation. The

GasPak anaerobic system was utilised to generate an oxygen-free environment for the anaerobic organism's development[16]. To show any fungal aetiology, specimens were cultivated on Sabouraud dextrose agar (SDA) according to normal technique. To determine the presence of acid-fast bacilli, Ziehl- Neelsen staining was used. A demonstration of Entamoeba histolytica aetiology was done, as well as wet mount ELISA to show E. histolytica antigen from the aspirate material[17]. All pus specimens were examined using the Qualitative Human Entamoeba histolytica Antigen (EHAg) ELISA Kit (by MyBioSource) according to the kit documentation. This is an antigen detection kit based on ELISA that is strictly for research purposes. The results of this test were not made available to the patients.

Statistical analysis was done using the statistical package for social sciences (SPSS).Different statistical methods were used as appropriate. Mean ± SD was determined for quantitative data and frequency for categorical variables. The independent t-test was performed on all continuous variables. The normal distribution data was checked before any t-test. The Chi-Square test was used to analyze group difference for categorical variables A p-value < 0.05 was considered significant.

RESULTS AND DISCUSSIONS

The male-female ratio in this research was 8:1. Of the 90 liver abscess patients included in this study, 80 (89%) were men and 10 (11%) were females. The age distribution of liver abscess patients in this research varied from 20 to 73 years, with the age group 31 yrs-40 yrs (42%), followed by > 50 yrs (24%) and 41 yrs-50 yrs (20%). Complications such as burst liver abscess (n=4), liver abscess with sepsis (n=4), liver abscess with liver failure (n=2), and chronic liver disease (n=2) were seen in 12 (13.3%) of the 90 cases. Most patients (89%), had fever, 62% had stomach discomfort, 58% had hepatomegaly, and 53% had abdominal soreness. Comorbidities were found in 66 of 90 patients (73.3%), with chronic alcoholism (48 instances), diabetes mellitus (4 cases), combination diabetes mellitus and chronic alcoholism (10 cases), and HIV (four cases) being the most common. Anchovy sauce appearance was found in 78% of cases (n=70), with purulent appearance reported in 22% of cases (n=20). 78% of patients (n=70) had a single loculated abscess, whereas 22% (n=20) had numerous abscesses. Other abnormal laboratory results included elevated leucocytes (80%), elevated alkaline phosphatase (74%), elevated ESR (70%), low haemoglobin levels (67%), elevated SGOT (60%), elevated SGPT (49%), and elevated bilirubin (33%). The USG results revealed that the size of the liver abscesses varied. 38% of the cases were 2 cm-4 cm in size, with 31% being 2 cm and > 4 cm in size, respectively. The therapy of liver abscess varied, including USG guided fine needle aspiration (42%), pigtail drainage (27%), and open surgery (11%). Furthermore, 20% of cases were handled cautiously.

Microbiological Investigations Serological tests: The serological investigation of corresponding cases demonstrated ELISA positive (for E. histolytica antigen) in 62 cases among the single loculated abscess cases and 2 cases among the multiple abscess cases.

All aspirated pus specimens (n=90) did not demonstrate motile trophozoites of E. histolytica on wet mount and did not show any acid fast bacilli on Ziehl-Neelsen (ZN) staining while Gram's staining revealed pus cells and no organism in 79% cases, pus cells and Gram-negative bacilli 15% cases, pus cells and gram-positive cocci in pairs in 4% cases and 2% cases with pus cells and budding yeast cells.

Culture Findings: Culture of the abscess revealed growth in 19 of 90 patients (21.1%), including 10 instances of E. coli, two cases of Proteus mirabilis, two cases of Enterococcus faecalis, two cases of Staphylococcus aureus, and one case of Burkholderia pseudomallei. Candida tropicalis fungal growth was seen in two instances. In the investigation, no anaerobic microbes were identified.

Antibiotic Susceptibility Pattern Findings: Six cases of E. coli were susceptible to ampicillin-sulbactam and aminoglycosides such as amikacin, netilmicin, and gentamicin, while only two cases were susceptible to cefepime, ceftriaxone, Cotrimoxazole, piperacillin-tazobactam, imipenem, meropenem, ciprofloxacin, and levofloxacin. Ampicillin-sulbactam, amikacin, netilmicin, gentamicin, cefepime, cotrimoxazole, piperacillin-tazobactam, imipenem, and meropenem were all effective against two instances of Proteus mirabilis. Ceftazidime, cotrimoxazole, and meropenem were effective against one unique case of Burkholderia pseudomallei. Staphylococcus aureus was grown in two instances and was sensitive to amoxiclav, methicillin, netilmicin, gentamicin, cotrimoxazole, tetracycline, teicoplanin, linezolid, erythromycin, and clindamycin. In addition, Enterococcus faecalis was identified from two instances and was resistant to penicillin, ampicillin, ciprofloxacin, teicoplanin, linezolid, vancomycin, and nitrofurantoin. The blood cultures of 38 individuals were obtained for this investigation. The bulk of them (34 instances) were negative for culture results. Staphylococcus aureus and Candida tropicalis were recovered from two of the patients. Corresponding patient's liver abscess aspirate culture revealed the same isolates.

Antigen detection by ELISA: ELISA for detection of E. histolytica antigen was performed on aspirates of all liver abscess cases (n=90), 64 cases (71%) were ELISA positive.

Comorbidities and Outcome: Out of 90 cases, 80 patients recovered and were discharged. 10 patients died, of which six cases were complicated and also had associated comorbidities. A total of 66 cases were associated with comorbidities either singularly or multiple comorbidities together, among which 10 cases were deceased. (p=0.073) Out of 90, only 12 cases were complicated, among these six patients were deceased. (P < 0.001)

The predominant etiological agent of liver abscess in this study was amoebic (71%), followed by pyogenic (19%). In 8% of cases, no etiological bacterium was detected, potentially due to patients having received antibiotics prior to their arrival at this tertiary care hospital. Amoebic liver abscess (ALA) is a prevalent pathogen, as evidenced by studies conducted in India by Shah Naveed et al. and Soumik Ghosh et al[1,2]. E. coli (11%) was the predominant bacterium identified in the pyogenic liver abscess.

This conclusion aligned with prior studies conducted by Naveed et al. and Wasif Mohammad Ali *et al*[2,18]. The Ziehl-Neelsen staining of the pus samples revealed no instances of M. tuberculosis. The absence of additional culture or molecular diagnostic tests, along with the lack of histological studies on liver abscess tissue, may have compromised the accuracy of this conclusion. Prahlad Karki et al.[19] and Shah Naveed et al.[2] identified tubercular liver abscesses at rates of 5.5% and 3.3% in tropical studies, respectively.

This research identified one case of melioidosis. The patient was an agrarian from a rural area. In Southeast Asia, melioidosis is a predominant cause of hepatic abscess[20]. Burkholderia pseudomallei, a saprophytic gram-negative bacillus prevalent in the environment, is the causative agent of the sickness. Comparable findings were noted in studies conducted in Taiwan by Yu-Lin Lee *et al*.[21] and in Thailand by RR Maude *et al*.[22]. The present study revealed no evidence of anaerobic microbial growth. This may be due to patients receiving antibiotics before to arriving at this tertiary care hospital.

Sayek *et al*. indicate that anaerobic bacteria are infrequently cultivated[23]. The ongoing inquiry identified two cases of fungal liver abscess attributed to Candida tropicalis in patients with a history of uncontrolled diabetes and positive blood cultures (candidemia). Candidiasis of the liver is an uncommon condition that primarily occurs in individuals with compromised host defence mechanisms, such as diabetes, leukaemia, and chronic granulomatous disease[24]. This research indicates that guys are eight times more likely than females to have a liver abscess. Forty-two percent of occurrences occur among individuals aged 31 to 40.

Which aligns with Indian study conducted by Sharma et al.[25] and Mukhopadhyay *et al*.[26] The majority of patients originated from rural regions with poor socioeconomic status, and 64% of the male patients were chronic alcohol consumers. The age trend and gender disparities may be attributed to men's increased alcohol use, which predisposes them to ALA. Alcohol suppresses the function of Kupffer cells, specialised macrophages in the liver that are essential for amoeba clearance[26]. Moreover, invasive amoebiasis appears to depend on the presence of free iron. An elevated dietary iron level, commonly derived from country spirits among chronic alcohol consumers, predisposes individuals to invasive amoebiasis, as does a high-carbohydrate diet. Individuals with compromised immunity due to malnutrition or corticosteroid therapy, along with the elderly, are susceptible to amoebic invasion[1]. Moreover, Reddy and Thangavelu postulated that the female menstrual cycle mitigates hepatic congestion, hence rendering the organ less susceptible to abscess formation[27]. The predominant symptoms included fever (89%) and abdominal discomfort (62%), whereas sensitive hepatomegaly (58%) was the most often observed sign. This aligned with the findings of Wasif Mohammad Ali *et al*.[18] and Prahlad Karki *et al*.[19] Diarrhoea occurred in 16% of patients, all of whom had ALA. Satyarth Chaudhary *et al*. identified diarrhoea in 7% of ALA patients[28]. The predominant comorbidity associated with 58 cases of liver abscess was chronic alcoholism (64%), succeeded by diabetes mellitus (13%). Four patients tested positive for HIV.

Chaudhary *et al*. identified analogous findings in a study conducted in Central India[28]. Blood testing indicated anaemia in 67% of cases and leukocytosis in 80% of cases. Serum alkaline phosphatase levels were high in 74% of the individuals. SGOT levels were abnormal in 56% of patients, while SGPT levels were normal in 51%. In 67% of patients, bilirubin levels were within the normal range. In 70% of patients, the ESR was elevated. Soumik Ghosh and colleagues observed analogous findings[1]. Blood cultures were collected from 38 people for this study. The majority (34 cases) yielded negative culture findings, whereas two cases exhibited Staphylococcus aureus and two cases exhibited Candida tropicalis. The aspirate from the liver abscesses of these individuals exhibited identical culture results. These people developed septicaemia and candidemia, both of which are rare complications of pyogenic and fungal liver abscesses. This aligned with the findings of Samuel Igbinedion *et al*. Fungemia was identified as a lethal outcome in patients with fungal liver abscesses in a study conducted by Pamela A. Lipsett *et al*. The majority of patients in the current investigation had clinical characteristics that prevented a clear identification of the kind of abscess. As a result, the patients were started on a cautious antibiotic regimen that includes metronidazole, ampicillin sulbactam, and gentamicin for coverage of Entamoeba histolytica and other aerobic and anaerobic organisms. Upon receipt of the culture and serological results, the antibiotics were modified accordingly. In accordance with the most recent therapy plan of minimally

invasive draining procedures, USG guided needle aspiration was performed in the majority of patients (42%), and Pigtail drainage was performed in certain patients (27%). Antimicrobials were administered based on the etiological results. Nevertheless, 11% (n=10) of the patients necessitated surgical intervention due to 4 instances (4%) being complicated by rupture. Soumik Ghosh *et al*.'s therapy strategy in their research mostly involved fine needle aspiration (79%) followed by pigtail drainage (17%), with just 4% of patients requiring open surgical drainage. Once an amoebic liver abscess was diagnosed, empirical metronidazole therapy was followed by another antibiotic, paromomycin, to treat the luminal carrier condition, which occurred in 40 to 60% of patients. Irusen EM *et al*.[31] employed a comparable treatment methodology in their study. The most prevalent isolated organism among pyogenic liver abscesses in the current investigation was E. coli (10 instances), which is part of the gut flora and is thought to seed into the liver parenchyma through the portal circulation[20]. In 60% of instances, E. coli was susceptible to ampicillin-sulbactam and aminoglycosides such as amikacin, netilmicin, and gentamicin. It was only 20% sensitive to cefepime, ceftriaxone, cotrimoxazole, piperacillin tazobactam, imipenem, meropenem, ciprofloxacin, and levofloxacin. Ceftazidime, cotrimoxazole, and meropenem were effective against one unique case of Burkholderia pseudo mallei. Amoxiclav, methicillin, netilmicin, gentamicin, cotrimoxazole, tetracycline, teicoplanin, linezolid, erythromycin, and clindamycin were all effective against Staphylococcus aureus isolated from two different instances. In addition, Enterococcus faecalis was identified from two instances and was resistant to penicillin, ampicillin, ciprofloxacin, teicoplanin, linezolid, vancomycin, and nitrofurantoin. In instances of pyogenic liver abscess, antibiotic therapy was changed based on this drug susceptibility pattern. In patients with fungal liver abscesses, surgical draining was performed before administering liposomal amphotericin B intralesionally. Cinzia Auriti et al. used this approach to treat patients of fungal liver abscess in their investigation[32]. The total death rate in the current research with the aforementioned therapeutic modalities was 11% (10 patients out of 90 died). Out of 90 instances, 66 were connected with comorbidities such as chronic alcoholism, diabetes mellitus, and HIV, either alone or in combination, and ten people died as a result. (P = 0.073) As a result, the prevalence of comorbidities had no effect on the death rate. Prahlad Karki et al. found a 5.5% overall mortality rate in their research[19]. In contrast, only 12 of the 90 cases in the current investigation were complicated by abscess rupture (four instances), sepsis (four cases), chronic liver disease (two cases), and liver failure (two cases). Six of these complex patients passed away. (P < 0.001) As a result of the above results, individuals with related problems had a higher death rate[19]. In the research done by F.

Reyna Sepulveda *et al*., the death rate was 12%[33]. Before the new therapies, mortality rates ranged from 50- 77% between 1991 and 2001[34]. Mortality in amoebic liver abscess is now lowered to 1-3%[35] and 10% in pyogenic liver abscess using updated treatment modalities such as percutaneous needle aspiration and pigtail drainage of the abscess[36].

CONCLUSION

Amoebic liver abscess is the most prevalent kind of liver abscess in India, followed by pyogenic liver abscess. The most prevalent bacterium recovered from pyogenic abscesses was E.coli. The most prevalent pattern in our investigation was a solitary right lobe abscess. Early and adequate antibiotic therapy, as well as abscess drainage, have resulted in a better clinical outcome. Patients with related comorbidities had a significant mortality rate. Overall mortality was low, most likely because all patients received minimally invasive drainage procedures and aetiology-specific antimicrobials.

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