

A PROSPECTIVE OBSERVATIONAL STUDY FROM NORTHWEST RAJASTHAN: ON CLINICO-EPIDEMIOLOGICAL PROFILE AND OUTCOMES OF LIVER ABSCESS IN CHILDREN

Paediatric Medicine

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ABSTRACT

Background: Liver abscess is an important cause of morbidity and mortality in children in developing countries. Data on clinico-epidemiological characteristics, microbiological profile, and prognostic indicators in Indian children remain limited, particularly from the north-western region of Rajasthan. **Objectives:** To study the clinical presentation, laboratory profile, microbiological etiology, radiological characteristics, management strategies, and outcomes of pediatric liver abscess, and to identify prognostic factors influencing recovery. **Methods:** This prospective observational study was conducted in the Department of Paediatrics, SMS Medical College and Hospital, Jaipur, from March 2023 to April 2024. Ninety children aged ≤ 18 years with ultrasonographically confirmed liver abscess were enrolled. Detailed demographic, clinical, nutritional, laboratory, microbiological, and imaging data were recorded. Management included intravenous antibiotics with or without ultrasound-guided percutaneous drainage. Outcomes and prognostic indicators were analyzed using SPSS version 19. **Results:** The highest incidence was observed in children aged 2–4 years (34%), with male predominance (71%). Most children belonged to lower socioeconomic strata (83.4%) and 79% resided in urban areas. Fever (83.3%), abdominal pain (72.2%), and right upper quadrant pain (67.8%) were the most common symptoms. Malnutrition (41.1%), anemia (64.4%), hypoalbuminemia (70%), and poor socioeconomic status (70%) were major associated risk factors. Single abscesses were seen in 80% of cases, predominantly in segment VI of the right hepatic lobe (53.3%). *Escherichia coli* and *Staphylococcus aureus* were the most common isolates. Amoebic serology was positive in 8.8%. Elevated alkaline phosphatase (>350 IU/L), positive culture, impending rupture, and clinical icterus were associated with prolonged defervescence. All children recovered with no mortality. **Conclusions:** Pediatric liver abscess in northwest Rajasthan is strongly associated with malnutrition, anemia, and poor socioeconomic status. Early diagnosis, appropriate antibiotic therapy, and timely percutaneous drainage result in excellent outcomes. Identification of prognostic markers such as elevated ALP and abscess rupture risk can help guide intensive monitoring and management.

KEYWORDS

Pediatric Liver Abscess, Pyogenic Liver Abscess, Malnutrition, Anemia, Prognosis, Rajasthan

INTRODUCTION

Liver abscess is the most common intra-abdominal visceral abscess and represents a significant cause of morbidity and mortality in children in developing countries¹. It is classically classified into amoebic liver abscess (ALA), pyogenic liver abscess (PLA), and rarely fungal liver abscess². In developing countries, amoebic abscess predominates, whereas in developed nations, pyogenic abscess accounts for the majority of cases. In children, however, pyogenic liver abscess is the more frequent entity and is commonly caused by *Staphylococcus aureus*, followed by gram-negative enteric organisms³.

The liver is predisposed to infection due to its dual blood supply from the portal vein and hepatic artery, its role in filtration of intestinal blood, and the rich reticuloendothelial system. In children, liver abscess often results from hematogenous spread, portal venous seeding from intra-abdominal infections, biliary tract infections, or cryptogenic causes. Predisposing factors described in the literature include malnutrition, anemia, worm infestation, poor hygiene, chronic infections, immunodeficiency states, and systemic bacteremia⁴.

The clinical presentation of pediatric liver abscess is often nonspecific, characterized by fever, abdominal pain, anorexia, vomiting, and hepatomegaly⁵. This frequently leads to delayed diagnosis, increasing the risk of complications such as rupture into the pleural or peritoneal cavity, sepsis, and prolonged hospital stay. With advances in ultrasonography, computed tomography, interventional radiology, and antimicrobial therapy, outcomes have improved substantially over the last two decades⁶.

Despite these advances, data from many parts of India, especially the north-western region of Rajasthan, remain sparse. Moreover, few studies have systematically evaluated prognostic indicators that influence clinical recovery and outcomes in children with liver abscess. This prospective observational study was therefore undertaken to characterize the clinico-epidemiological profile, microbiological spectrum, radiological features, management strategies, and outcomes of pediatric liver abscess at a tertiary care center in northwest Rajasthan.

Primary Objective

- To assess the clinical presentation, laboratory profile, microbiological etiology, duration of hospitalization, and outcomes of pediatric liver abscess.

Secondary Objectives

- To identify etiological and predisposing risk factors.
- To assess complications associated with liver abscess.
- To correlate laboratory and ultrasonographic findings with management strategies and severity of disease.
- To identify prognostic factors influencing duration of defervescence and recovery.

MATERIALS AND METHODS

Study Design and Setting

This hospital-based prospective observational study was conducted in the Department of Paediatrics, SMS Medical College and Hospital, Jaipur, Rajasthan, from March 2023 to April 2024.

Study Population

Children aged ≤ 18 years admitted with clinically suspected and ultrasonographically confirmed liver abscess were enrolled consecutively.

Inclusion Criteria

- Age ≤ 18 years.
- Ultrasonographic evidence of liver abscess.
- Informed consent obtained from parents/guardians.

Exclusion Criteria

- Age > 18 years.
- Liver abscess secondary to oncologic disease.

Sample Size

Based on an estimated outcome prevalence with 95% confidence interval, 5% alpha error, and 10% allowable error, the minimum sample size required was 79. Accounting for attrition, a final sample size of 90 children was included.

Data Collection: A structured proforma was used to record:

- Demographic details (age, sex, residence, socioeconomic status).
- Dietary history and nutritional assessment.
- Clinical features and physical examination findings.

- Anthropometric measurements using IAP growth charts.
- Laboratory investigations: complete blood count, CRP, liver function tests, serum proteins, INR.
- Blood culture and pus culture (for drained abscesses).
- Amoebic serology.
- Ultrasonographic characteristics (number, size, volume, and segmental location of abscess).

Management Protocol

All children received empirical broad-spectrum intravenous antibiotics, most commonly ceftriaxone, vancomycin, and metronidazole. Antibiotics were modified according to culture sensitivity when available. Ultrasound-guided percutaneous drainage was performed for large abscesses, poor clinical response, or features suggestive of impending rupture.

Outcome Measures

Primary outcomes included duration of fever (defervescence), length of hospital stay, and survival. Prognostic indicators evaluated included number of abscesses, liver function parameters, culture positivity, presence of rupture, anemia, hypoalbuminemia, and clinical icterus.

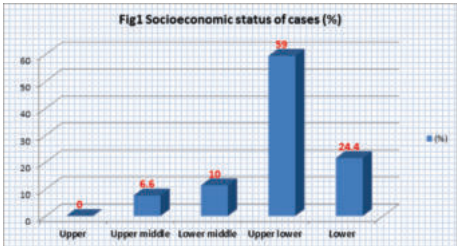
Statistical Analysis

Data were analyzed using IBM SPSS version 25. Continuous variables were expressed as mean ± SD or median (IQR). Categorical variables were expressed as percentages. Associations between prognostic factors and duration of defervescence were assessed using t-test, Mann-Whitney U test, Chi-square test, or Fisher's exact test as appropriate. A p value <0.05 was considered statistically significant.

RESULTS

Demographic Profile

Among the 90 children, the highest proportion belonged to the 2–4-year age group (34%), followed by children older than 8 years (29%). Males constituted 71% of cases, yielding a male-to-female ratio of approximately 2.4:1. Most children resided in urban areas (79%). The majority belonged to the upper-lower (59%) and lower (24.4%) socioeconomic classes.



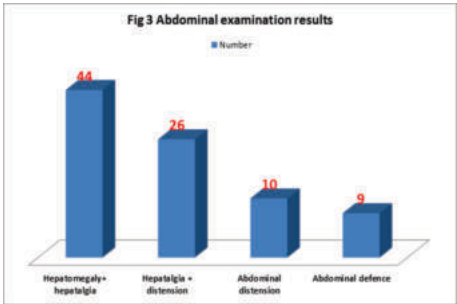
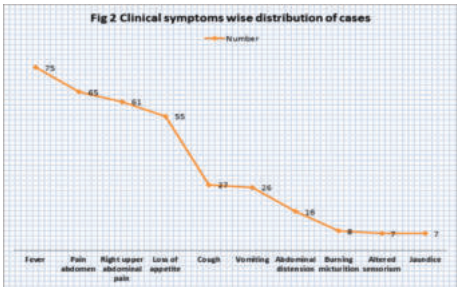
Nutritional and Dietary Status

Among children under 5 years of age, moderate malnutrition was present in 21% and severe malnutrition in 3.3%. In children older than 5 years, 27.8% were underweight. Dietary inadequacies were common: 53.1% had inadequate milk and milk product intake, 33.3% had calorie deficiency, and 29% had protein deficiency.

Clinical Presentation

Fever was the most common presenting symptom (83.3%), followed by abdominal pain (72.2%), right upper quadrant pain (67.8%), and loss of appetite (61.1%). Vomiting (28.8%), cough (30%), and abdominal distension (17.8%) were less frequent. Jaundice and altered sensorium were observed in 7.8% each.

Hepatomegaly (84%) and liver tenderness (60%) were the most common clinical signs. Ascites and decreased air entry due to pleural effusion were present in 20% each.



Laboratory Findings

Mean hemoglobin was 8.6 ± 1.8 g/dL, and all children were anemic. Leukocytosis ($>10,000/\mu\text{L}$) was present in 84%. CRP was elevated in all cases (mean 17.4 ± 8.1 mg/dL). Hypoalbuminemia was observed in 70%. Elevated ALT and AST were seen in 40% and 38.9% respectively. INR was prolonged (>1.1) in 75.5% of children.

Table 1 Lab investigations of children with liver abscess (n=90)	
Lab parameters	n (%)
Hb	
Mean±SD	8.6±1.8
Anemia for age	79 (100)
TLC (counts/ μL)	
Mean±SD	17615.7±6694.9
>10,000	75 (84)
<4000	0 (0)
CRP (mg/dl)	
Mean±SD	17.4±8.1
Elevation for age	90(100)
ALT	
Median (IQR)	32 (20-39)
Elevation for age	4 (5.2)
AST	
Median (IQR)	34 (26.75-45.50)
Elevation for age	4 (5.2)
S. bilirubin	
Median (IQR)	0.45 (0.40-0.83)
Elevation for age	5 (5.2)
Viral markers (Hepatitis A, B, C, and E)	
Negative	90 (100)
Hb=haemoglobin, CRP=C reactive protein, ALT=alanine amino transferase, AST=aspartate amino transferase, IQR=interquartile range, TLC=total leukocyte count	

Microbiological Profile

Blood or pus cultures yielded organisms in a significant proportion. The most common isolates were Escherichia coli and Staphylococcus aureus. Amoebic serology was positive in 8.8% of cases.

Radiological Characteristics

Single abscesses were present in 80% of children. Most abscesses were larger than 50 cc (70%). Segment VI of the right hepatic lobe was the most commonly involved site (53.3%).

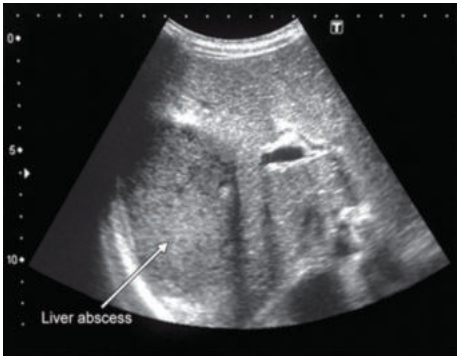


Fig. 4: Ultrasonography Showing Abscess in Liver

Table 2 Prognostic Factors Affecting Outcome

Parameter to compare	Duration for defervescence (days)		P
Number of abscesses	Single (8.92)	Multiple (9.3)	0.45
ALP	<350 IU/L (8.54)	>350 IU/L (11.1)	0.05

TLC: Total leucocytes count, ALP: Alkaline phosphatase

Prolonged defervescence was significantly associated with:

- Elevated alkaline phosphatase (>350 IU/L) ($p=0.05$).
- Presence of rupture or impending rupture ($p=0.01$).
- Positive culture ($p=0.04$).
- Clinical icterus ($p=0.04$).

Treatment and Outcomes

The most frequently used antibiotic regimen was ceftriaxone, vancomycin, and metronidazole (81.2%). Ultrasound guided drainage was performed when indicated. All children recovered, and no mortality was recorded.

DISCUSSION

This prospective observational study provides important insights into the clinico-epidemiological profile and outcomes of pediatric liver abscess in northwest Rajasthan. The findings highlight the strong association of liver abscess with malnutrition, anemia, and poor socioeconomic conditions.

The peak incidence in the 2–4-year age group and the marked male predominance are consistent with previous Indian studies. The high prevalence of malnutrition and anemia underscores the vulnerability of undernourished children to invasive infections. Urban predominance may reflect referral bias or population density effects.

The clinical presentation was largely nonspecific, emphasizing the need for a high index of suspicion in febrile children with abdominal pain. Laboratory findings of anemia, leukocytosis, elevated CRP, and hypoalbuminemia were consistent with severe systemic inflammation.

Microbiologically, gram-negative enteric organisms and *Staphylococcus aureus* predominated, in line with other pediatric series. The low proportion of amoebic seropositivity suggests that pyogenic etiology remains dominant in this region.

Single right-lobe abscesses were most common, likely due to portal venous flow dynamics. The excellent outcome and zero mortality in this cohort reflect the benefits of early diagnosis, modern imaging, prompt antibiotic therapy, and timely percutaneous drainage.

Importantly, elevated ALP, abscess rupture risk, positive cultures, and clinical icterus were identified as adverse prognostic indicators. These parameters can be used to stratify patients requiring closer monitoring and aggressive management.

Limitations

The single-center observational design limits generalizability. Causative associations cannot be firmly established. Immunological profiling was performed only when clinically indicated.

CONCLUSIONS

Pediatric liver abscess in northwest Rajasthan predominantly affects young male children from poor socioeconomic backgrounds and is strongly associated with malnutrition and anemia. Early diagnosis, appropriate antibiotic therapy, and timely drainage result in excellent outcomes. Identification of prognostic indicators such as elevated ALP and abscess rupture risk can help optimize management strategies.

Recommendations

- Routine ultrasonography in febrile children with abdominal pain.
- Nutritional interventions in high-risk populations.
- Empirical antibiotic protocols tailored to regional microbiology.
- Early drainage for large or complicated abscesses.
- Multicentric prospective studies to refine prognostic models.

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