Clinico-etiological and laboratory profile of infants with febrile illness: A retrospective analysis

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Abstract

Background: Febrile illness in infants is a common and challenging presentation due to the broad differential diagnosis, including serious bacterial infections (SBIs) and viral causes. SBIs, especially UTIs, occur in 7-20% of febrile infants under three months, while viral infections like human herpesvirus-6 are also significant contributors. Despite existing research, gaps remain in understanding the full clinical and laboratory profiles of febrile infants. Our study aims to provide a comprehensive analysis of the clinico-etiological and laboratory profiles of infants presenting with febrile illness.

Methods: Our retrospective study at Shridevi Institute of Medical Sciences, Tumkur, included 100 infants aged 1-12 months with a fever over 100.4°F lasting more than three days. Exclusions were patients leaving against medical advice and those with immunodeficiency, HIV, or malignancy. Data from Pediatrics records were collected using a validated proforma, covering clinical examinations and laboratory findings. Data analysis was performed with SPSS, presenting categorical data as frequencies/proportions and continuous data as mean/standard deviation. A p-value of less than 0.05 was considered statistically significant.

Results: Our study analyzed 100 febrile infants aged 1-12 months, with 62% under six months, 53% female and 67% from rural areas. Respiratory tract infections (56%) and gastrointestinal infections (25%) were the most common causes. Fever, cough, and cold (64%) were the primary symptoms, with vomiting and diarrhea in 47%. Laboratory findings showed a median hemoglobin of 10.9 g/dL, with elevated CRP in 23% of cases, indicating infection or inflammation. Culture sensitivity was positive in 55.2% of tested cases, aiding targeted therapy.

Conclusion: Our study effectively identified respiratory and gastrointestinal infections as the primary causes of febrile illness in infants, with significant clinical and laboratory findings, including elevated CRP levels and culture positivity, underscoring the need for targeted diagnosis and treatment in this vulnerable population.

Keywords: Clinico-Etiological Profile, Laboratory Investigations, Febrile Illness, Retrospective Analysis

Introduction:

Febrile illness in infants is a common clinical presentation that poses diagnostic challenges due to the broad differential diagnosis, including serious bacterial infections (SBIs) and viral illnesses. Infants are particularly vulnerable, and febrile episodes can indicate underlying severe conditions, necessitating careful evaluation and management[1,2]

The incidence of febrile illness in infants varies by age and underlying etiology. Studies indicate that SBIs occur in approximately 7-20% of febrile infants under three months old, with urinary tract infections (UTIs) being the most prevalent[1,2]. Viral infections, such as those caused by human herpesvirus-6, also contribute significantly to febrile presentations in this age group[3]. The morbidity associated with these infections underscores the need for prompt identification and treatment.

Despite extensive research, gaps remain in understanding the full spectrum of clinical and laboratory profiles associated with febrile illness in infants. Many studies focus primarily on SBIs, often neglecting viral etiologies or the impact of co-infections[2,4]. Additionally, variations in diagnostic criteria across different studies complicate the establishment of standardized management protocols for febrile infants.

Novelty of our study lies in understanding

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symptomatology and disease burden among febrile infant visiting out tertiary care centre and which will help us in investigation and management of cases and rational use of antibiotics. Results of study can be used to compare with national /international standard. By addressing existing gaps in literature, it seeks to enhance diagnostic accuracy and improve management strategies for this vulnerable population, ultimately reducing morbidity and mortality associated with febrile illnesses[5,6].

Methodology:

Our study with a hospital-based retrospective design was conducted at Shridevi Institute of Medical Sciences and Research Hospital, Tumkur, until a sample size of 100 was achieved. Data was sourced from the medical records of the Pediatrics outpatient and inpatient departments. Inclusion criteria were infants aged 1-12 months with a temperature over 100.4°F and febrile for more than three days. Exclusion criteria included patients who left against medical advice and those with immunodeficiency, HIV, or malignancy.

Convenient/universal sampling was used to select participants. After obtaining permission and ensuring confidentiality, data was collected using a validated semi-structured proforma. This included head-to-toe clinical examinations, systemic examinations, and laboratory findings such as complete blood count, hemoglobin, peripheral smear, C-reactive protein, dengue and malaria serology, Widal test, urine routine, chest X-ray, and abdominal ultrasound.

Data was entered and analyzed using SPSS software. Categorical data was presented as frequencies and proportions, while continuous data was expressed as mean and standard deviation. A p-value of less than 0.05 was considered statistically significant, ensuring robust analysis.

Results:

The majority were aged 1-6 months (62.0%) and females (53.0%). Most subjects were from rural areas (67.0%) and belonged to lower socio-economic status (48.0%). The duration of fever varied, with 41.0% experiencing 4-7 days of fever. (Table 1)

Table 1: Demographic characteristics

Subjects (N=100)		Frequency (N)	Percentage (%)
Age group	1-6 months	62	62.0%
	6-12 months	38	38.0%
Gender	Male	47	47.0%
	Female	53	53.0%
Locality	Rural	67	67.0%
	Urban	33	33.0%
Socio-economic Status	Upper Middle	13	13.0%
	Lower Middle	39	39.0%
	Lower Class	48	48.0%
Duration of fever	4-7 days	41	41.0%
	8-14 days	36	36.0%
	15-21 days	18	18.0%
	>21 days	5	5.0%

The majority were term births (62.0%) and had a birth weight of 1.5 to 2.5 kg (43.0%). Most subjects were breastfed within one hour after birth (64.0%) and exclusively breastfed till 6 months (71.0%). Vaccination status was age-appropriate in 84.0% of subjects. (Table 2)

Table 2: Risk factors

Subjects (N=100)		Frequency (N)	Percentage (%)
Gestation at birth	**Preterm**	38	38.0%
	Term	62	62.0%
Birth Weight	**<1.5 kg**	21	21.0%
	1.5 to 2.5 kg	43	43.0%
	>2.5 kg	36	36.0%
Breastfeeding within 1 hour after birth	**Yes**	64	64.0%
	No	36	36.0%
Exclusive breastfeeding till 6 months	**Yes**	71	71.0%
	No	29	29.0%
Vaccination status	**Age appropriate**	84	84.0%
	Incomplete	13	13.0%
	Unvaccinated	3	3.0%

The majority presented with symptoms of fever, cough, and cold, accounting for 64.0% cases, followed by vomiting and diarrhea at 47.0% cases. Breathing difficulty was observed in 43.0% of cases, while excessive crying occurred in 29.0% cases. Abdominal pain was reported by 28.0% cases, with seizures affecting 12.0% and rashes being the least common at 6.0% cases. (Table 3) The duration of fever was between 4 and 7 days in majority cases (56.0%), followed by the duration more than 7 days (31.0%). (Figure 1)

Table 3: Clinical profile

Subjects (N=100)		Frequency (N)	Percentage (%)
Clinical symptoms	Fever, Cough, Cold	64	64.0%
	Breathing Difficulty	43	43.0%
	Excessive Crying	29	29.0%
	Vomiting, Diarrhea	47	47.0%
	Abdominal pain	28	28.0%
	Rashes	6	6.0%
	Seizures	12	12.0%

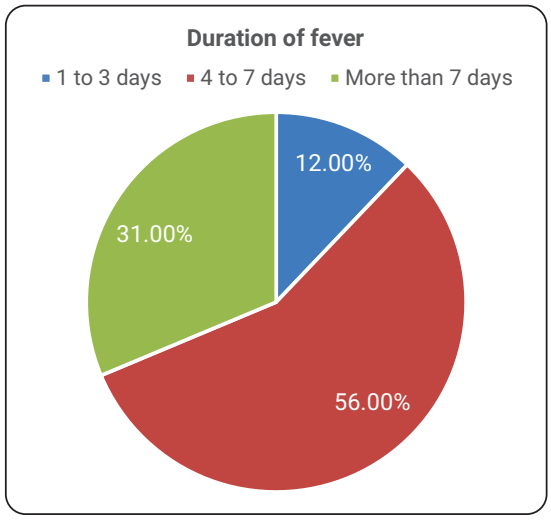

Figure 1: Duration of fever

Respiratory tract infections were the most prevalent (56.0%), followed by gastrointestinal infections (25.0%). Other infections included urinary tract infections (10.0%), meningitis (3.0%), and sepsis (1.0%). Additionally, 5.0% of cases were idiopathic, indicating an unknown origin. (Table 4)

Table 4: Etiological profile

Subjects (N=100)		Frequency (N)	Percentage (%)
Type of infection	Respiratory tract infections	56	56.0%
	Gastrointestinal infections	25	25.0%
	Urinary tract infections	10	10.0%
	Meningitis	3	3.0%
	Sepsis	1	1.0%
	Idiopathic	5	5.0%

The laboratory findings indicate that the median hemoglobin level is 10.9 g/dl, with total white blood cell count at 9200 cells/mm³, suggesting a relatively stable hematological profile in most infants. CRP levels are elevated with a median of 12 mg/L, indicating inflammatory or infectious condition. Electrolyte levels, including sodium (137 mmol/L) and potassium (4.2 mmol/L), remain within normal ranges, providing a baseline for assessing dehydration or metabolic imbalances. (Table 5)

Table 5: Laboratory parameters

Subjects (N=100)		Median	Interquartile range
Laboratory parameters	Hemoglobin (g/dl)	10.9	(9.8, 12.1)
	Total WBC (cells/mm³)	9200	(6,000, 14,300)
	Platelets (cells/mm³)	215000	(1,50,000, 3,10,000)
	CRP (mg/L)	12	(5, 25)
	Sodium (mmol/L)	137	(134, 143)
	Potassium (mmol/L)	4.2	(3.6, 4.8)
	Chlorine (mmol/L)	102	(98, 107)
	Bicarbonate (mmol/L)	23	(21, 25)
	Blood urea (mg/dl)	30	(22, 38)
	Serum creatinine (mg/dl)	0.6	(0.4, 0.8)
	Serum uric acid (mg/dl)	3.5	(2.8, 4.3)
	Total bilirubin (mg/dl)	0.55	(0.30, 1.10)
	Conjugated bilirubin (mg/dl)	0.2	(0.12, 0.60)
	Unconjugated bilirubin (mg/dl)	0.25	(0.14, 0.45)
	AST (u/L)	50	(35, 110)
	ALT (u/L)	30	(18, 80)
	ALP (IU/L)	170	(130, 240)
	Serum albumin (g/dl)	3.9	(3.4, 5.0)

Among the 100 subjects, the majority had normal C-reactive protein levels (77%) and total leucocyte counts (73%). Only 23% showed deranged CRP, and 27% had abnormal TLC. These results suggest that while inflammatory markers are generally within normal ranges, a significant minority still exhibit abnormalities, warranting further investigation and monitoring for underlying infections or inflammatory conditions. (Table 6)

Table 6: Distribution of subjects with respect to CRP and TLC

Subjects (N=100)		Frequency (N)	Percentage (%)
C-Reactive Protein	Normal	77	77.0%
	Deranged	23	23.0%
Total Leucocyte Count	Normal	73	73.0%
	Deranged	27	27.0%

Those who showed deranged CRP levels or TLC, were considered for culture sensitivity. Accordingly, the culture sensitivity was required for 29 cases, out of which, 55.2% returned positive results, emphasizing

the importance of microbiological testing in identifying the causative agents of infections. The relatively high rate of culture positivity underscores the necessity of targeted therapy to address specific pathogens effectively. Negative results (44.8%) highlight cases where viral infections or non-infectious causes may be responsible. (Table 7)

Table 7: Culture (blood / urine / sputum) sensitivity findings

Subjects (N=29)		Frequency (N)	Percentage (%)
Culture sensitivity	Positive	16	55.2%
	Negative	13	44.8%

Discussion:

Our retrospective hospital-based study at Shridevi Institute of Medical Sciences, Tumkur, included 100 infants aged 1-12 months with fever over 100.4°F lasting more than three days. Data was sourced from Pediatrics outpatient and inpatient records.

Demographic Characteristics

Our study included infants aged 1-6 months, with 53% female participants and most from rural areas and lower socioeconomic backgrounds. AbhilashKPP et al,[7] focused on adults, with a mean age of 37.4 years and a predominantly male demographic (54%). BeheraJR et al,[8] examined children aged 1-14 years, with a male-to-female ratio of 1.66:1, emphasizing a rural, lower socioeconomic population. Bhaskaran D et al.[9] included mostly children younger than 5 years (54.5% male), aligning closely with our study. ChhengK et al.[10] also studied children with a median age of 2 years, of whom 54.5% were male, making it comparable to our study's infant cohort. KavirayaniV et al[11] reported that 57.9% of their 214 pediatric patients were male, with most younger than 5 years. This closely resembles the demographics in our study. Overall, pediatric-focused studies show similarities in demographics, while adult studies like Abhilash KPP et al.[7] differ significantly.

Risk Factors

Our study identified breastfeeding within the first hour of birth and vaccination status as key risk factors. Abhilash KPP et al[7] focused on adult risk factors, such as comorbidities like diabetes and hypertension, which are not applicable to the infant population in our study. Behera JR et al.[8] highlighted typhoid vaccination and exposure to contaminated food and water, differing from the neonatal risk factors seen in our study. Bhaskaran D et al.[9] emphasized undernutrition (43%) as a significant risk factor, which mirrors our study's focus on nutritional factors, though breastfeeding was not addressed. Chheng K et al.[10] noted HIV infection and congenital heart disease as significant risk factors, reflecting different underlying conditions compared to our study. Kavirayani V et al.[11] identified undernutrition (50%) and immunosuppression (19%) as key risk factors, similar to the nutritional and immunization risks highlighted in our study. Across studies, risk factors vary significantly based on age and disease focus.

Clinical Profile

Our study reported fever, cough, and cold (64%) as the most common symptoms, followed by vomiting and diarrhea (47%). Abhilash KPP et al.[7] found myalgia and respiratory symptoms, with a focus on fever, which overlaps with our study despite the adult population. Behera JR et al.[8] reported fever and respiratory complaints similar to our study, though abdominal pain was more common, likely due to the older pediatric population. Bhaskaran D et al.[9] found fever alone in 36% of cases, with respiratory and gastrointestinal symptoms similar to our study. Chheng K et al.[10] identified respiratory tract infections and diarrhea as common clinical presentations, aligning closely with the present study. Kavirayani V et al.[11] noted fever, vomiting (38.3%), and respiratory symptoms (38.3%), similar to the clinical profile in the present study. Across the studies, fever and respiratory issues dominate the clinical profile, especially in pediatric cases.

Etiological Profile

In our study, respiratory tract infections (56%) were the most common cause, followed by gastrointestinal infections (25%). Abhilash KPP et al.[7] found scrub typhus (35.9%), dengue (30.6%), and malaria (10.4%) as the leading etiologies, reflecting adult tropical diseases. Behera JR et al.[8] reported Salmonella Typhi as the main pathogen, differing from the respiratory and gastrointestinal infections seen in our study. Bhaskaran D et al.[9] highlighted dengue and typhoid, differing from the more bacterial and respiratory-based etiologies in our study. Chheng K et al.[10] identified dengue and scrub typhus as the most common causes, showing some alignment with our study, but focusing more on vector-borne diseases. Kavirayani V et al.[11] found dengue (10.6%) and hepatitis A to be common, broadening the etiological focus compared to our study. Overall, tropical diseases like dengue and typhoid are more common in older populations, whereas respiratory infections dominate in infants, as seen in our study.

Laboratory Parameters

Our study reported a median hemoglobin level of 10.9 g/dL and elevated CRP levels in 48% of cases. Abhilash

KPP et al.[7] reported a mean hemoglobin of 12.4 g/dL, with lower platelet counts, especially in dengue cases, reflecting different disease profiles. Behera JR et al.[8] noted anemia in 42.86% of cases, with eosinopenia and elevated liver enzymes, similar to the blood and liver function abnormalities noted in our study. Bhaskaran D et al.[9] also highlighted elevated liver enzymes and lower platelet counts, particularly in dengue cases, reflecting more systemic infections than the respiratory-based findings in our study. Chheng K et al.[10] noted elevated CRP and inflammatory markers, aligning with our study. Kavirayani V et al.[11] found leukocytosis (36.4%) and elevated liver enzymes (AST 48.7%, ALT 39.5%), similar to our study. Overall, lab findings across the studies show consistent blood abnormalities, but liver enzyme elevation is more prominent in studies focusing on older populations.

Culture Sensitivity Findings

Our study reported a 55.2% culture positivity rate, emphasizing the importance of culture sensitivity. Abhilash KPP et al.[7] showed a high positivity rate (82.5%) for pathogens like scrub typhus, while Behera JR et al.[8] reported a 26.7% positivity for Salmonella Typhi. Bhaskaran D et al.[9] noted lower rates but emphasized the role of cultures in guiding treatment. Chheng K et al.[10] reported a lower positivity rate (6.3%), while Kavirayani V et al.[11] found MRSA in culture-positive cases. Overall, culture sensitivity plays a critical role in guiding treatment, though positivity rates vary across studies based on pathogen prevalence and population.

Conclusion:

Our study on febrile infants aged 1-12 months highlights respiratory and gastrointestinal infections as the most common causes, with significant clinical symptoms including fever, cough, and vomiting. Laboratory findings revealed elevated CRP in 23%, suggesting inflammation, while 55.2% of culture tests indicated bacterial infections. These insights justify the study's objective of comprehensively analyzing the clinico-etiological and laboratory profiles of febrile infants, contributing to improved diagnostic accuracy and targeted treatment strategies for reducing morbidity in this vulnerable population.

Recommendations:

We suggest multicentric study to be conducted in regional areas for understanding of disease presentation and to prevent irrational use of antibiotics.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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