

Utility of the yale observation scale in predicting bacteremia in febrile children aged 3–36 months: a hospital-based prospective observational study.

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Abstract

Background:

Early identification of bacteremia in febrile children remains a major clinical challenge, particularly in resource-limited settings. The Yale Observation Scale (YOS) is a simple bedside clinical tool used to assess illness severity in children.

Objective:

To evaluate the diagnostic performance of YOS in predicting bacteremia among febrile children aged 3–36 months.

Methods:

This hospital-based prospective observational study was conducted over 12 months at the Department of Pediatrics, Barpeta Medical College, Assam, India. A total of 150 children presenting with fever $\geq 38^{\circ}\text{C}$ without an identifiable source were enrolled using consecutive sampling. Clinical assessment using YOS was performed at admission, followed by laboratory investigations, including a complete blood count, absolute neutrophil count, and a blood culture. Receiver operating characteristic (ROC) curve analysis was used to determine the optimal YOS cutoff for predicting bacteremia.

Results:

Among the 150 children included, 56.7% were females and 43.3% were males. Blood culture positivity was observed in 21.3% of cases. Higher YOS scores were significantly associated with bacteremia, elevated white blood cell count, prolonged fever, longer hospital stay, and mortality ($p < 0.05$). ROC analysis demonstrated that a YOS cutoff value of 14.5 had a sensitivity of 97% and specificity of 79.6% for predicting bacteremia. All children with YOS scores ≥ 25 had positive blood cultures and poor clinical outcomes.

Conclusion:

YOS is a sensitive and practical bedside screening tool for identifying febrile children at increased risk of bacteremia. However, because of its moderate specificity, it should be used together with laboratory investigations for definitive diagnosis.

Recommendation:

YOS may be incorporated into early pediatric triage protocols in resource-limited settings to facilitate prompt identification and management of high-risk children.

Keywords: Yale Observation Scale, bacteremia, febrile child, pediatric infection, screening tool.

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Introduction

Fever without an apparent source is a common presentation in pediatric practice, particularly among children aged 3–36 months. While most cases are viral and self-limiting, a subset represents serious bacterial infections (SBIs), including bacteremia, which can lead to significant morbidity and mortality if not promptly identified [1]. The diagnostic challenge lies in differentiating bacterial from viral etiologies at initial presentation. Although blood culture remains the gold standard for diagnosing bacteremia, its delayed turnaround time and limited availability in

resource-constrained settings restrict its utility in early decision-making [2].

The Yale Observation Scale (YOS) is a clinical assessment tool developed to evaluate illness severity. It is a rapid, non-invasive method that aids in differentiating serious bacterial infections (SBIs) from less severe illnesses and has been widely studied in pediatric populations. This scale comprises six parameters—quality of cry, reaction to parental stimulation, state variation, hydration status, skin color, and social interaction. Each criterion is scored between 1 and 5, resulting in a total score ranging from 6 to 30. Higher total scores suggest a greater likelihood of

serious illness. Despite its widespread use, evidence regarding its predictive accuracy for bacteremia remains inconsistent [3].

This study aims to evaluate the utility of YOS as a predictor of bacteremia in febrile children aged 3–36 months and to determine an optimal cutoff for clinical use.

Materials and Methods

Study Design and Setting

This hospital-based prospective observational study was conducted in the Department of Pediatrics, Barpeta Medical College A, Assam, India, over a period of 12 months from November 2023 to October 2024. Silchar Medical College and Hospital is a tertiary care teaching institution providing specialized pediatric inpatient, emergency, and critical care services to patients from Assam and neighboring northeastern states of India.

Participants and Sampling Technique

Children aged 3–36 months presenting with fever $\geq 38^{\circ}\text{C}$ without an identifiable focus of infection were screened for eligibility. Participants were recruited using a consecutive sampling method until the required sample size was achieved.

Inclusion Criteria

- Age 3–36 months
- Fever $\geq 38^{\circ}\text{C}$
- No clear source of infection
- Informed consent obtained

Exclusion Criteria

- Immunodeficiency disorders
- Chronic illnesses (e.g., congenital heart disease, malignancy)
- Localized infections
- Antibiotic use within 48 hours

Study Size

The sample size of 150 participants was determined based on feasibility, expected prevalence of bacteremia among febrile children from previous studies, study duration, and patient flow at the study center.

Bias

To minimize potential bias, YOS scoring was performed by trained pediatricians blinded to laboratory findings and

blood culture results. Standardized clinical assessment methods and aseptic techniques for blood culture collection were followed throughout the study.

Data Collection

Each child underwent:

- Clinical assessment using YOS (score range: 6–30)
- Complete blood count (CBC)
- Absolute neutrophil count (ANC)
- Blood culture under aseptic conditions

YOS scoring was performed by trained pediatricians blinded to laboratory results.

Outcome Measures

- Primary: Association of YOS with blood culture positivity
- Secondary: Correlation with clinical severity indicators

Statistical Analysis

Data were analyzed using SPSS version 26.

- Chi-square test for associations
- ROC curve analysis for diagnostic accuracy
- $p < 0.05$ is considered statistically significant
-

Results

A total of 176 febrile children aged 3–36 months were initially screened for eligibility during the study period. Of these, 18 children were excluded due to identifiable localized infections, 5 had received antibiotics within 48 hours before presentation, and 3 declined participation. Finally, 150 eligible children were enrolled and included in the final analysis.

Baseline Characteristics

A total of 150 children were included, with a relatively uniform age distribution. Females constituted 56.7% while males constituted 43.3% of the study population. Blood culture positivity was observed in 21.3% of the total cases.

Clinical and Laboratory Findings

Higher fever ($>104^{\circ}\text{F}$), longer duration of fever (>5 days), elevated WBC ($>15,000$), and elevated ANC ($>10,000$) were significantly associated with higher YOS scores.

TABLE 1. YALE OBSERVATION SCORE CATEGORY AND THE NUMBER OF CASES

Yale observation score (YOS)	Number of cases
6-12	77
13-18	52
19-24	17
25-30	4
Total	150

TABLE 2. CORRELATION BETWEEN CULTURE AND YALE'S OBSERVATION SCORE

CULTURE DISTRIBUTION	YOS (6-12)		YOS (13-18)		YOS (19-24)		YOS (25-30)		Total cases	P-VALUE
	N	%	N	%	N	%	N	%		
CULTURE POSITIVE	0	0	14	26.9	14	82.4	4	100.0	32	0.001
CULTURE NEGATIVE	77	100.0	38	73.1	3	17.6	0	0	118	

Among the participants, 32 (21.3%) had positive culture results, while 118 (78.7%) had negative results. All patients in the YOS (6-12) category had sterile blood culture, while

patients in the YOS (25-30) category had a positive culture result (100%), indicating that those with higher YOS have positive bacteremia.

TABLE 3. CORRELATION BETWEEN OUTCOME AND YALE'S OBSERVATION SCORE

OUTCOME	YOS (6-12)		YOS (13-18)		YOS (19-24)		YOS (25-30)		Total cases	P-VALUE
	N	%	N	%	N	%	N	%		
IMPROVED	76	98.7	51	98.1	13	76.5	0	0	140	0.068
EXPIRED	1	1.3	1	1.9	4	23.5	4	100.0	10	

Among the study population, 140 (93.3%) showed improvement, while 10 (6.7%) had a fatal outcome. Patients with higher YOS scores were more likely to have a fatal outcome. All patients with the YOS (25-30) category succumbed to their illness (100%).

TABLE 4: CORRELATION BETWEEN STAY IN HOSPITAL AND YALE'S OBSERVATION SCORE

STAY DISTRIBUTION	YOS (6-12)		YOS (13-18)		YOS (19-24)		YOS (25-30)		Total	P-VALUE
	N	%	N	%	N	%	N	%		
<7 DAYS	71	92.2	29	55.8	1	5.9	0	0	101	0.0032
8-14 DAYS	6	7.8	18	34.6	10	58.8	1	25.0	35	
>14 DAYS	0	0	5	9.6	6	35.3	3	75.0	14	

101 (67.3%) patients had a hospital stay of <7 days, while 14 (9.3%) stayed for more than 14 days. Patients requiring longer hospital stays had higher YOS scores, with 75.0% of those staying >14 days falling into the YOS (25-30) category.

TABLE 5. DISTRIBUTION OF PATTERN OF INFECTION

Type of infection	Percentage
Pneumonia	40%
Bronchiolitis	30%
Meningitis	20%
Cellulitis	10%

Diagnostic Performance of YOS

ROC curve analysis identified an optimal cutoff of 14.5, with:

- **Sensitivity:** 97%
 - **Specificity:** 79.6%
- Higher cutoffs increased specificity but reduced sensitivity

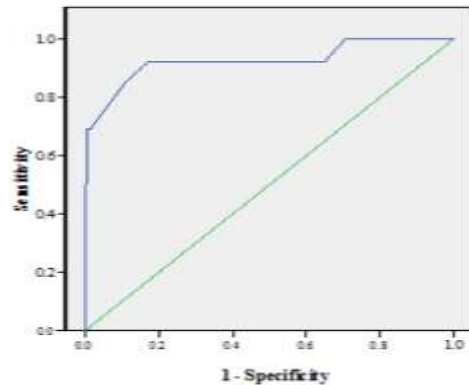


Figure 1. Receiver Operating Characteristic (ROC) Curve Analysis of Yale Observation Scale for Predicting Bacteremia

Clinical Outcomes

Higher YOS scores were associated with:

- Increased hospital stay
- Greater severity of illness
- Higher mortality

All patients with YOS ≥ 25 had poor outcomes.

Discussion

The present study evaluated the utility of the Yale Observation Scale in predicting bacteremia among febrile children aged 3–36 months. The findings demonstrated that higher YOS scores were significantly associated with blood culture positivity, prolonged hospitalization, severe clinical outcomes, and mortality[4].

A YOS cutoff value of 14.5 demonstrated high sensitivity (97%) and moderate specificity (79.6%) for predicting bacteremia. These findings suggest that YOS may serve as an effective early screening tool for identifying febrile children at increased risk of serious bacterial infections.

The findings of the present study are consistent with those reported by McCarthy et al., who originally described YOS as a useful clinical tool for identifying serious illness in febrile children.[1] Similarly, Isaacman et al. reported that elevated clinical severity scores were associated with increased likelihood of bacteremia in children aged 3–36 months.[3]

The present study also demonstrated that children with higher YOS scores experienced longer hospital stays and poorer outcomes. These observations are comparable to findings from Craig et al., who emphasized the importance of clinical assessment tools in identifying children at risk of severe bacterial infections.[5,6]

Despite its high sensitivity, YOS demonstrated only moderate specificity, indicating that some children with elevated scores may not have bacteremia. Furthermore, a small number of children with lower YOS scores also had positive blood cultures. Therefore, YOS should not replace

laboratory investigations but rather complement them in clinical decision-making[7,8].

The findings of this study may be generalizable to similar tertiary care and resource-limited healthcare settings where rapid laboratory diagnostics are unavailable or delayed. The simplicity, low cost, and bedside applicability of YOS make it particularly useful in such environments.

Conclusion

The Yale Observation Scale is a sensitive and practical bedside tool for identifying febrile children at risk of bacteremia. A cutoff score of 14.5 demonstrated optimal diagnostic performance. However, due to moderate specificity, YOS should be used alongside laboratory investigations rather than as a standalone diagnostic tool.

Limitations

This study was conducted at a single tertiary care center with a moderate sample size, which may limit the generalizability of the findings. Interobserver variability in YOS scoring may also have influenced the results. Additionally, reliance on blood culture alone may underestimate bacteremia because of its limited sensitivity.

Recommendations

YOS should be incorporated into pediatric triage and early assessment protocols, especially in resource-limited settings. Further multicenter studies with larger sample sizes are recommended to validate the diagnostic utility of YOS and improve its predictive accuracy.

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List of Abbreviations

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YOS Yale Observation Scale
CBC Complete Blood Count
ANC Absolute Neutrophil Count
ROC Receiver Operating Characteristic
SBI Serious Bacterial Infection

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Conflict of Interest

The authors declare no conflict of interest.

Source of Funding

The study did not receive any external funding.

Data Availability

The datasets used and analyzed during the current study are available from the corresponding author upon reasonable request.

Author Contributions

- Dilip Sai Babu D.: Conceptualization, data collection, manuscript drafting
- Nazrul Islam Barbhuiya: Supervision, methodology, manuscript review
- Rehana Sultana: Statistical analysis, interpretation of results, manuscript editing

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