Original Research Article

Yale observation scale for bacterial infection in febrile children

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ABSTRACT

Background: Sepsis is one of the leading causes of mortality in children under 5 years by UNICEF statistics which is difficult to diagnose because of nonspecific initial clinical presentation and potential for rapid deterioration. In this regard use of Yale Observation Scale assists in early recognition of serious bacterial infection than other laboratory investigation as it is simple, quick, easy to apply and cost-effective bed side scale.
Methods: All eligible young febrile infants and children were consecutively enrolled in the study. Axillary temperatures of the cases were documented. Yale observation scoring was done. Blood sample were sent for culture and sensitivity. Colonies were identified morphologically by Gram stain and biochemically. The collected data was analyzed using ROC curve for finding cut off scores of Yale Observation Scale for prediction of severe bacterial illness and final outcome. Statistical analysis was performed using the Statistical Packages for Social Sciences (SPSS) version 14 for MS Window.
Results: Bacteremia was found in 23(15.3%) out of total 150 young febrile children enrolled in the present study. It shows that in lower YOS score blood culture was sterile and in higher YOS score blood culture was positive for bacteremia, which is statistically significant with p value (<0.05). As per ROC curve analyses the best cut off value of YOS for prediction of bacteremia was 17.5 with sensitivity 91.3%, specificity 81.9%, PPV 47.7% and NPV of 98.1%.
Conclusions: YOS of >17.5 has a good predictive ability for prediction of bacteraemia in young febrile children.

Keywords: Bacteremia, Febrile children, Serious bacterial infection, Yale observation scale

INTRODUCTION

Fever is the most common presenting complaint in pediatric patients, accounting for approximately 20% of Emergency Department (ED) visits by children.[1,2] Fever is also considered the second most common reason for a child being admitted to hospital. Despite advances in healthcare, infections remain the leading cause of death in children less than 5 year of age.

Fever in young children usually indicates an underlying infection and is the most common cause of concern for parents and caretaker. Most of patients with fever had self-limiting viral illness having nonspecific symptoms and focus of infection, on the other hand some have serious bacterial infections such as meningitis or pneumonia, so it is difficult for a pediatrician to differentiate mild febrile illness from severe bacterial infection.[3] So there is a high need to improve the recognition, assessment and immediate treatment of such illnesses in children.

In young febrile children, it is very necessary to differentiate between bacterial and non-bacterial causes of fever owing to a high incidence of viral infections and the fact that fever may also be due to bacteremia even in absence of localizing signs. Untreated bacteremia can cause serious complications including death, and hence an early diagnosis of bacteremia in a febrile child is important in reducing childhood mortality. Consequently,

a pediatrician relies on clues gained prior to physical examination that might be indicators of the presence of a serious illness. Laboratory investigations can only be used as supporting evidences with blood culture and sensitivity is the gold standard to confirm bacteremia, but it also takes 48-72 for the final result to come, leaving clinical assessment as the major tool for early diagnosis. Obtaining a blood culture in resource-restrained settings, particularly in rural hospitals, is very difficult. Also detailed physical examination needs more time, expertise and may not yield classical signs especially in young children.

Delayed antimicrobial therapy is associated with mortality in critically ill young infants. The surviving sepsis campaign recommended to administer empiric antimicrobials within 1 hour of recognition of severe sepsis in pediatric patients.[4] So most of the pediatrician reaches their judgment of severity of illness of febrile child based on observation prior to history and physical examination. Yale Observation Scale (YOS) is therefore designed to assist healthcare professionals in the initial assessment and immediate treatment of young children with fever presenting to primary or secondary care.

In this regard use of Yale Observation Scale assists in early recognition of serious bacterial infection than other laboratory investigation. Also, it is very simple, quick, easy to apply and cost-effective bed side scale clubbed in 1982 by McCarthy et al.[5,6] It is purely observational scale for gradation of severity of clinical state of the child. Reliability of Yale Observation Scale (YOS) was assessed by Interobserver agreement through kappa statistic.[5] There was no significant Interobserver variability in Yale Observation Scale (YOS) assessment.[7] It is an illness severity scale using 6 parameters (quality of cry, reaction to parent stimulation, state variation, color, hydration and response to social overtures) each assigned a score of 1, 3, or 5. Therefore, the total YOS score ranges from 6 for the most well-appearing infant to 30 for the most ill-appearing infant. This score is easily applicable to each child as it does not include investigations.[8-10]

METHODS

This was a cross sectional, observational, analytic study which include 150 young febrile children. The study was carried out at the tertiary care center in Rajasthan, India. Study was concluded during one-year period after obtaining permission from ethical committee of institute.

Inclusion criteria

- All children of age 3-36 months who were admitted in department of pediatrics with documented fever in the hospital which is defined as a rectal temperature ≥38°C (100.4 °F).

Exclusion criteria

- Children with noninfectious cause of fever

- Nosocomial infection (children developing fever more than 8 hours after hospital admission)
- Children who had been given sedatives within 24 hours of presentation
- Children whose parents did not give consent

Method of collection of data (Including sampling procedure)

All eligible young febrile infants and children were consecutively enrolled in the study after taking prior informed consent from the parents. Axillary temperatures of the cases were documented. Yale observation scoring was done. Blood sample were sent for culture and sensitivity. Colonies were identified morphologically by Gram stain and biochemically. Data was entered into a well-structured proforma.

Statistical analysis

Statistical analysis was performed using the Statistical Packages for Social Sciences (SPSS) version 14 for MS Window. The obtained data was entered into MS Excel. The data was analyzed using descriptive statistics, chi square. Sensitivity, specificity and positive and negative predictive values of different cut off points of Yale observation scale was obtained and Receiver Operating Characteristics (ROC) was carried out to evaluate usefulness of Yale Observation Scale as a screening test to identify young infants with severe bacterial illness.

RESULTS

Authors have enrolled 150 eligible young febrile infants and children in this study. The best cut off value of YOS for prediction of bacteremia was 17.5 (Figure 1). At this value sensitivity of YOS score was 91.3%, specificity was 81.9%, PPV of 47.7% and NPV of 98.1% (Table 1). Based on the YOS cut off of 17.5 study subjects were subdivided in two groups. 106 children were included in YOS group ≤17.5 and 44 children were included in YOS group >17.5.
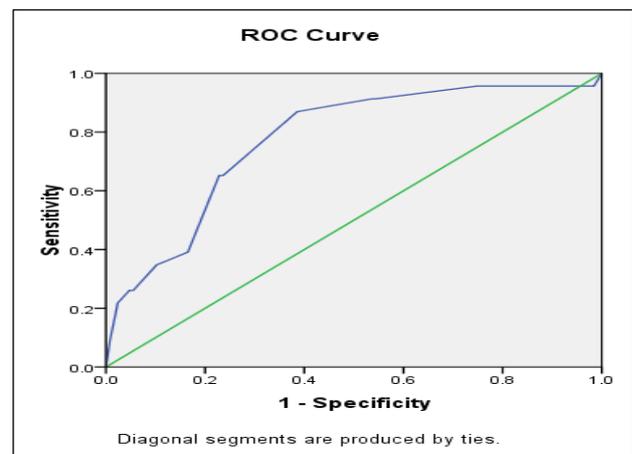

Figure 1: ROC curve for prediction of bacteremia by yale observation scale.

Table 1: Diagnostic values of YOS Scores for Prediction of Bacteremia.

Variables	Cut-off =17.5
Sensitivity	91.3%
Specificity	81.9%
PPV	47.7%
NPV	98.1%

In ≤17.5 YOS blood culture sensitivity report shows 2 (1.8%) children had bacteremia and in >17.5 YOS score 21(47.7%) children had bacteremia. This result is statistically significant with p value (<0.05) (Table 2).

Table 2: Distribution of variables in two Yale Observation score category.

YOS	<17.5 N=106	>17.5 N=44	p value
Male	67(63.2%)	30(68.2%)	<0.05
Female	39(36.8%)	14(31.8%)	
Mean temp.	101.2±1.07	101.7±1.08	1.000
Blood culture positive	2(1.8%)	21(47.7%)	<0.05
Requiring Oxygen support	21(19.8%)	30(68.2%)	<0.05
Requiring antibiotic hike up	7(6.6%)	24(54.5%)	<0.05
Requiring intensive care	26(24.5%)	34(77.3%)	<0.05
Death	0(0%)	7(15.9%)	<0.05

Among the 106(100%) children in <17.5 YOS, 67(63.2%) were male and in >17.5 YOS 30(68.2%) were male. This shows that in authors hospital males were more admitted than females due to social background and this result is statistically significant p value (<0.05). Results of mean temperature are not statistically significant p value (1.000). As in ≤17.5 YOS score, mean temperature was 101.2 with SD of 1.07 and in >17.5 YOS score mean temperature was 101.7 with SD of 1.08.

Requirement of oxygen support was more in YOS group >17.5 (68.2% vs 19.8%) (p value <0.05). Similarly, antibiotic hike up was required in 54.5% children in group with YOS >17.5 in contrast to 6.6% children in another group. (p value <0.05). Requirement of intensive care support was more in YOS group >17.5 (77.3% vs 24.5%), (p value <0.05).

Authors does not observe any mortality in ≤17.5 YOS group, in contrast another group shows 15.9% mortality. This result is statistically significant with p value (<0.05).

DISCUSSION

Bacteremia was found in 23(15.3%) out of total 150 young febrile children enrolled in the present study. Previous studies have reported a bacteremia prevalence ranging from 1.6% to 12.9%.[11-14] The higher prevalence of bacteremia in the present study was probably because authors have enrolled only IPD patient and the subjects being inpatients were expected to have more prevalence than the febrile outpatients enrolled in many studies.

In the present study total no. of male were 97(64.6%) and female were 53(35.3%). If authors compare children according to gender and Yale Observation Scale. It shows that male was significantly more in both category of YOS, 67(63.2%) and 30(68.2%). This result is statistically significant p value (<0.05). Similar results were found in kansakar P et al, and Bang et al, with 59% and 59.36% respectively of male children.[5,15,16] Since male is the preferred gender in India and more number of male children are brought to health care services, so this may be the reason of higher preponderance of male over female in the present study.

In the present study in ≤17.5 YOS score, mean temperature was 101.2 and in >17.5 YOS score mean temperature was 101.7. This result is not statistically significant p value (1.000). It is similar to the result of study conducted by Thapar k et al, which states that rise of temperature showed non-significant correlation to critical illness parameters.[17] But these results are in contrast to the results shown by Sudhakar P et al, and Bhavneet Bharti et al.[18,19]

In the present study in ≤17.5 YOS score requirement of oxygen support and intensive care management was in only 21(19.8%) and 26(24.5%) children respectively and in >17.5 YOS score, 30(68.2%) and 34(77.3%) children require oxygen support and intensive care management respectively. It shows that in lower YOS score requirement of oxygen support and intensive care management were low and in higher YOS score requirement of oxygen support and intensive care management were high, which is statistically significant with p value (<0.05). Similar results were depicted in the study conducted by Walia et al.[7] It shows that as the YOS score increases, the clustering of cases changes from no requirement of oxygen support and intensive care to poor clinical outcomes at higher scores, hence shows the applicability of YOS to monitor admitted patients for diagnosing refractoriness to ongoing treatment in advance.

In the present study in ≤17.5 YOS score requirement of antibiotic hike up was in 7(6.6%) children and in >17.5 YOS score 24(54.5%) children require antibiotic hike up. It shows that in lower YOS score requirement of antibiotic hike up were low and in higher YOS score requirement of antibiotic hike up were high, which is statistically significant with p value (<0.05). Similar results were concluded in the study conducted by Walia et al.[7] It shows that children with YOS >21 found to require higher antibiotics which shows that possibly such patients are infected with drug resistant or atypical microbial strains. As the specificity of the test is high, so patients presenting to the hospital setting with a YOS >17.5, can be managed with the broad-spectrum

antibiotics initially and later can be "downscale" to lower spectrum based on blood culture and sensitivity. This result has great clinical relevance as it has been shown that delayed appropriate antibiotics increase mortality and risk of organ dysfunction in bacteremia.[20]

In the present study in ≤17.5 YOS score no deaths had occurred and in >17.5 YOS score, 7(15.9%) death occurred. It shows that in lower YOS score outcome of patient was better compared to higher YOS score. This result is statistically significant with p value (<0.05). Similar results were concluded in the study conducted by Walia et al, and P. Sudhakar et al, this shows that YOS >17.5 has prognostic implications irrespective of etiology.[7,18] So authors can say that YOS >17.5 in young febrile child signifies toxic state requiring aggressive management based on the clinical presentation.

CONCLUSION

Yale Observation Scale (YOS) is simple and effective screening test for prediction of bacteremia. Hence should be used at the time of admission in young febrile children of age 3-36 months. It can also be used for triage classification and to prognosticate patient outcome.

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