ORIGINAL RESEARCH

Yale observational scale score and final outcome among 3-60 months old febrile children

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Received: 02Sept, 2023 Accepted: 25Sept, 2023

Abstract
Sepsis is one of the leading causes of mortality in children under 5 years of age. In young febrile children, differentiation between bacterial and non-bacterial causes of fever is necessary owing to a high incidence of viral infections. Early diagnosis of bacteremia in a febrile child is important in reducing childhood mortality. This is a prospective observational study done on 180 children meeting the inclusion and exclusion criteria, who were admitted to the pediatric ward and PICU. History, examination, and provisional diagnosis were made and then the Yale observation scale was applied to children under the study. ROC curves showed that the sensitivity and specificity of YOS at the cut-off value of 12 was found to be 60% and 72% respectively. A YOS score of ≤12 predicts non-serious illness, however a YOS score of >12 does not necessarily indicate serious bacterial infection, and thus should undergo evaluation to confirm bacterial infection.

Key words: Bacteremia, YOS, blood culture

Introduction

"Fever is defined as a rectal temperature ≥38 °C(100.4 F)". Physiologically the maximum temperature is recorded during the evening hours and the minimum temperature during the morning hours.

The thermoregulatory center is situated in the hypothalamus. It regulates the core body temperature by modifying heat production and heat losses. It does so by integrating the input from cold and warm thermal receptors located throughout the body and generates output responses that conserve body heat or increase its dissipation =thermostatic set point [1].

The heat-dissipating behaviors start when the core body temperature increases above the normal range, whereas there is an increase in heat production when the body temperature falls below the normal range.

Fever, or pyrexia, describes an elevation in body temperature which is due to a cytokine-induced upward displacement of the set point of the hypothalamic thermoregulatory center. Fevers that are regulated by the hypothalamus usually do not rise above 41 °C, as a safety mechanism [2].

Fever is one of the commonest complaints in children for which parents seek help(1).Body temperature fluctuates in a defined normal range(36.6°C-37.9°C rectally), so that the highest point is reached in early evening and the lowest point is reached in the morning. Any abnormal rise in body temperature should be considered a symptom of an underlying condition [3].

Based on Wunderlich's original observations made 120 years ago the overall mean temperature for normal individuals aged 18 to 40 years is actually 36.8+0.40(98.2+0.70 F) with a nadir at 6 am and a zenith at 4 to 6 pm(2).

The normal 24-hour circadian temperature rhythm is associated with temperature varying typically by 0.50 C(0.90F)(2). This morning low and evening high pattern is usually preserved in febrile diseases.

Fever without a focus refers to a rectal temperature of 38 °C or higher as the sole presenting feature. The terms "fever without localizing signs" and "fever of unknown origin"(FUO) are subcategories of fever without a focus [4].

Fever of acute onset, with duration of < 1 week and without localizing signs, is a common diagnostic dilemma in children < 60 months of age. The etiology and evaluation of fever without localizing signs depends on the age of the child. Traditionally, 3 age groups are considered: neonates or infants to 1 month of age, infants > 1 month to 3 months of age, and children > 3 months to 5 years of age Sepsis is one of the leading causes of mortality in children under 5 years of age In young febrile children, differentiation between bacterial and non-bacterial causes of fever is necessary owing to a high incidence of viral infections. Early diagnosis of bacteremia in a febrile child is important in reducing childhood mortality. Laboratory investigations can only be used as supporting evidences with blood culture and sensitivity being the gold standard to confirm bacteremia(results take 48-72 hrs.) leaving clinical assessment as the major tool for early diagnosis. A scale is necessary for the initial assessment and immediate treatment of young children with fever [5, 6].

Methodology

Children aged 3 months to 60 months, admitted to the pediatric ward with documented fever >38 degree centigrade or 100.4 Fahrenheit. The study was done in the department of pediatrics for a period of one and half years starting from October 2020

Study design: Prospective observational study.

Study period: 18 months.

Sample size: 180.

All febrile infants and children of age 3-60 months were consecutively enrolled in the study after taking prior informed consent from the parents. Axillary temperature of the cases were documented. Detailed evaluation(history and physical examination) of the child was done**.** Yale observation scoring was done. YOS takes into consideration 6 parameters including quality of cry, state of hydration, color, state of wakefulness, response to parental stimulation, and to social overtures such as playing, talking, and smiling**.** Based on the presenting history blood, urine and stool samples was sent for culture and sensitivity and other relevant investigations. The data was entered into a well-structured proforma.

Inclusion criteria

All children of age 3-60 months who were admitted in department of pediatrics with documented fever in the hospital which is defined as axillary temperature >39 degree celsius.

Exclusion criteria

- A known case of immunodeficiency states, arthritis, autoimmune disease, connective tissue disorders, tumors.
- Nosocomial infection(children developing fever more than 8 hours after hospital admission).
- History of having received parenteral antibiotics, sedatives within 24 hours of presentation, antipyretics within 8 hours of presentation.
- History of having received immunization within 48 hours Patient with no laboratory evidence of any bacterial infections.

Results

180 children were enrolled in the study group who had a axillary temperature of more than or equal to 100.40Fahrenheit. Data from these 180 children were used for various analysis and interpretations.

The percentage of children included were studied in terms of distribution of age, sex, temperature recorded, duration of fever, duration of hospital stays and final outcome of the patients.

The final YOS scores, divided into various ranges were compared with the biochemical parameters of WBC count, ANC and the culture reports of the body fluids showing evidence of a bacterial infection.

Table 1: Yale observation scale distribution in the study

Yale observation scale score	No. of Patients	%
6-12	119	66.1
13-18	43	23.9
19-24	11	6.1
25-30	7	3.9
Total	180	100.0

Among the children who presented with fever and met the inclusion criteria, majority had a Yale Observation Scale score between 6-12,119(66.1%). 43(23.9%) of children had a score between 13-18, 11(6.1%) had a score between 19-24, the rest of the 7 patients had a score between 25-30(3.9%).

Table 2: Final outcome

Outcome	No. of Patients	%
Discharged	167	92.8
Death	13	7.2
Total	180	100.0

From the above table it is clearly evident that 167 patients(92.8%) out of the 180 children studied improved with effective management and were discharged. The rest of the 13 patients(7.2%) expired,

probably due to various complications in due course of illness.

Table 3: Outcome in correlation with the yale observation score

Variables	Yale observation scale score				Total	P Value
Outcome	6-12	13-18	19-24	25-30		
Discharged	118 (99.2%)	41 (95.3%)	8 (72.7%)	0 (0%)	167 (92.8%)	<0.001**
Death	1 (0.8%)	2 (4.7%)	3 (27.3%)	7 (100%)	13 (7.2%)	
Total	119 (100%)	43 (100%)	11 (100%)	7 (100%)	180 (100%)	

Among the 167 children who improved and were sent home, 118 had a YOS score of 6-12, 41 had a score of 13-18, 8 had a score between 19-24. From the above table it is evident that, lower YOS score is associated with a higher rate of improvement. As the score goes higher up the mortality increases, as is clearly evident from the table that among the 13 patients out of the 180 study population, a significant number of children 7 belonged to group who had a score 25-30 followed by the next high score between 19-24.

Table 4: ROC curve

Variables	ROC results to predict Combined Culture positivity				Cut-off	AUROC	SE	P value
	Sensitivity	Specificity	LR+	LR-				
YOS	59.26	72.00	2.12	0.57	>12	0.660	0.0629	0.0112

The cut off of 12 has sensitivity of 60% and a specificity of 72% hence making the Yale Observation Score a specific tool in ruling out bacteremia when the score is less than 12 and therefore this score cannot be used as an initial screening scale to predict the risk of bacteremia in a febrile child.

Discussion

Bacteremia was found in 15% of the children in the present study whereas in the study done by Baker RC *et al.* bacteremia was of 12.5% and they included both opd and emergency room patients in their study. Kuppermann*et al.* [7] also reported that bacteremia was found in 12% of their patients, the main reason stated for this is that they included toxic appearing children as well. In a study done by Kansakar*et al.* [8] bacteremia was only 3.5%, this was because only 28% of the patients had blood culture sent as per the hospital protocol. Studies conducted by Jamuna*et al.* [9] and Yilmaz*et al.* [10] reported a lower prevalence of bacteremia of 4%,2.9% and 4.4%.This was mainly because they considered only occult bacteremia and excluded patients with obvious signs and symptoms of serious bacterial infection.

In our study YOS also correlates well with the outcome of the child, i.e., as the score goes higher the mortality seems to increase and vice versa. This was in accordance with the findings of Walia*et al.* [11]

In our study sensitivity and specificity value of YOS>12 to detect serious bacterial illness was 60% and 72% respectively. Whereas in the study done by Kansakar*et al.* [8] showed that the sensitivity and specificity value of YOS >10 to detect serious bacterial illness in febrile children aged 1-36 months was 45.45% and 88.05% respectively. Sensitivity was higher in our study when compared to Kansakar*et al.*, [8] may be because we studied only patients who were admitted to the ward. The specificity was similar to our present study which shows that YOS >10 was very good in ruling out serious bacterial infection. Study done by Bang *et al.*[12] had shown mean YOS scores were significantly higher in bacteremic children with 14.9 in bacteremic children vs.8.78 in non bacteremic. Sensitivity and specificity of YOS score >10 to predict bacteremia were 87.93% and 83.78% respectively.

In our study we used YOS score>12 for prediction of bacteremia and serious bacterial infection similar whereas study conducted by yilmaz*et al.* [10], where the YOS score >10 provided diagnostic information regarding bacteremia.

Conclusion

- Prevalence of bacteremia was found to be present in 15% of the patients.
- Area under ROC curve was 0.66. The sensitivity of YOS>12 was 60% and the specificity was 72%.
- A YOS score of ≤12 predicts non-serious illness while a YOS>12 does not necessarily indicate serious bacterial infection.
- YOS also correlates well with the outcome of the child, i.e., as the score goes higher the mortality seems to increase and vice versa.

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