

Original Research Article

Simplified bronchiolitis severity score for health care providers

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ABSTRACT

Background: Bronchiolitis is a viral lower respiratory infection of young infants. It requires monitoring by outpatient health care providers and rarely needs hospitalization. Scoring of severity in community helps in early referral. A simplified bronchiolitis scoring for rural health care providers with no facility for measurement of oxygen saturation (SpO₂) and chest X-ray (CXR) is a long-felt need. This study proposes a simplified score.

Methods: The proposed bronchiolitis severity score (PSS) has to be validated against the standard bronchiolitis severity score (SSS). The PSS was administered by a physician, nurse and researcher. The reliability was measured by the compartment of internal consistency and inter-observer agreement.

Results: The physicians rating of severity by SSS and PSS was similar in 97% of cases. The internal consistency of 0.72 and the kappa index of 0.86 were obtained. The inter-rater agreements between physician, nurse, researcher was 0.94, 0.94 and 0.93 respectively.

Conclusions: The PSS is reliable, valid and can be administered by nurses in peripheral health care settings.

Keywords: Bronchiolitis, Health care providers, Respiratory infection, Severity score

INTRODUCTION

Bronchiolitis is an acute wheezing in children less than 24 months of age with viral infection. The invading microbes spread the disease, resulting in the erosion of the respiratory epithelium, increase the mucus production and inflammation leading to breathing difficulty. Acute prodromal symptoms consist of rhinorrhea, cough and on occasion, a low grade fever progresses to rapid respiration, chest retractions, and wheezing.¹ Most of the bronchiolitis cases occur in winter season and mostly from remote areas where nurses are the key health care providers.² But assessing the severity in children with bronchiolitis is a great challenge to the nurses and health care workers in rural areas where 70% of Indian population survives.³ Severity assessment is essential because moderate and severe cases need monitoring, intervention and timely referral. Many scoring scales

have been published to assess the severity and are used in clinical researches.^{2,4-8} Assessment of severity in a setting without the facility for measuring oxygen saturation (SpO₂) and chest X-ray (CXR) is essential. Hence, author tried to develop a simplified clinical bronchiolitis score for health care providers in the community.

METHODS

Construction of scoring scale

A simple standard bronchiolitis severity score (SSS) was built using the aforementioned published scoring scales for validating the proposed bronchiolitis severity score (PSS) (Table 1) (Table 2). The simple items selected for SSS are respiratory rate according to their age (1-2 months, >2 months to 1 year and > 1 year), cyanosis, sensorium, nasal flare/retraction (intercostal, subcostal,

suprasternal and supraclavicular), feeding and air entry/wheeze, which can be easily assessed by health care workers. Chest X-ray was left out to avoid unnecessary exposure of radiations and its non-availability in rural settings. The PSS excludes the measurement of SpO₂ because the facility for measuring the oxygen saturation

may not available in remote areas. The common medical terms are used in PSS instead of complex medical terms which can be easily understood and used by health care workers in community. The scores for each item ranged from 1-3. Higher the score means, more severe bronchiolitis.

Table 1: Standard bronchiolitis severity score.^{4,8}

Items	Score 1	Score 2	Score 3
Respiratory rate	1-2 months ≤60	61-69	≥70
	>2 month-1 yr ≤50	51-59	≥60
	>1 year ≤40	41-44	≥45
Cyanosis	Normal	Peripheral	Central
SPO ₂	94-100%	90-93%	≤89%
Sensorium	Mild irritable but easy to console	Difficult to console	Lethargy/drowsy
Nasal flare/retraction (SC, IC, SCS) Max:4	1	2	3 or 4
Feeding	Normal	≥50%	<50%
Air entry/Wheeze	Normal, scattered rhonchi /crepitation end expiratory	Fair, rhonchi/rales in both inspiration and expiration	Poor, grunt, rhonchi and crepitation

≤ 7=Mild, 8-14=Moderate, 15-21=Severe.

Table 2: Proposed bronchiolitis severity score.

Items	Score 1	Score 2	Score 3
Respiratory rate	1-2 months <60	61-69	>70
	>2 month-1 year <50	51-59	>60
	> 1 year <40	41-44	>45
Nasal flare/retraction (Max:4) (SC, IC, SCS)	1	2	3 or 4
Feeding	Normal	≥50%	<50%
Sensorium	Normal	Irritable	Lethargy/drowsy
Cyanosis	Normal	Peripheral	Central
Wheeze and prolonged expiration	Prolonged expiration	Palpable wheeze	Audible wheeze

6=Mild, 7-12=Moderate, 13-18=Severe.

Table 3: Interpretation of items in proposed scoring scales.

Items	Interpretation
Respiratory rate (RR)	Number of times the chest rises in a minute
Cyanosis (Bluish/purplish discoloration)	Peripheral- only fingers and extremities Central- around lips and tongue
Nasal flare	Widen nostrils while breathing
Chest retractions (sucking in of skin)	Intercostal- between ribs, sub sternal- below breast bone, subcostal- below rib cage, suprasternal- above breast bone and supraclavicular- above collar bone.
Feeding	Amount of feeding taken before and after occurrence of disease
Sensorium	Where the child is irritable/crying or lethargy/Not responding to mother
Wheeze (whistling sound)	Expiration time prolonged, Palpation of chest wall for wheeze or heard with/ without stethoscope

Procedure

Children <2 years of age with clinically diagnosed bronchiolitis were included in this study through convenience sampling.⁸ Cases with lobar pneumonia and

recognizable upper respiratory and cardiac malformations were excluded. Staff nurses working in the emergency department were explained regarding the SSS and PSS and how to assess it (Table 3). At admission the treating physician assessed the case and scored as per SSS and

PSS in the emergency room. Then the PSS was administered by other care givers (nurse, researcher) independently for the same case before starting any treatment within minutes of arrival.

Basic information like age/sex, breast feeding duration, fever, frequency of nebulization, supplemental oxygen etc. was collected. Admitted children were treated as per the treatment protocol of the department.

The general characteristics of the children were documented as frequency, median and interquartile range. The total clinical score is sum of all sub scores (SSS-mild- < 7, moderate- 8-14, severe- 15-21. PSS- ≤ 6=mild, 7-12=moderate, 13-18=severe). Reliability of PSS was measured against SSS assessed by physician using correlation analysis. Cronbach’s alpha was used to check internal consistency of the PSS. A score over >0.6 indicated good internal consistency.^{2,6,9} Kappa statistics was used to check reliability in terms of inter-rater agreement between physician, researcher and nurse. The kappa score range of >0.75 was considered as excellent, 0.40-0.75- good and <0.40 as marginal.^{4,10} Kappa score was also calculated for individual items in the PSS. The statistical analysis was done using SPSS version 16.0.

RESULTS

As per the simplified proposed bronchiolitis severity score out of 100 cases, 21 are severe, 71 are moderate and 8 are mild cases with 84% of them were from rural areas. All severe cases required admission (PICU-14 and paediatric ward-7) with a mean duration of hospital stay was 8 (6-10) days, 3 of them required invasive ventilator and 9 required non-invasive ventilator, 3 of them developed ventilator associated pneumonia.

Seventy one (71) moderate cases had an average hospital stay of 4 (2-6) days and all of them received 3% normal

saline nebulization. Sixty-three (63) of them required observation and O₂ administration. All the mild cases were discharged directly from emergency department after 12-24 hours of observation. There was no mortality and re-admission after discharge from the hospital.

The physicians rating of severity by SSS and PSS was similar in 97% of cases. The correlation between the SSS and PSS measured by the physician was 93.2% with a kappa value of 91.1% indicating that the PSS is a highly reliable tool for assessing bronchiolitis severity.

Physician (P), Researcher (R) and Nurse (N) who were taking care of the children assessed the PSS for 100 children. Among them 41% were female and 59% were male with a median age of 5 months (IQR- 3-7) and 84% of them were from rural and only 16% were from urban community.

Cronbach’s alpha value for PSS was 0.72 indicating a good internal consistency. The observed agreement for P-N, N-R and R-P was 94%, 94% and 93% with a kappa value of 0.87, 0.85 and 0.87 respectively. For all the pairs the kappa value indicates an excellent inter-observer agreement. The Cronbach’s alpha and the Kappa agreement index for individual items in the PSS are shown in (Table 4 and 5).

Table 4: Cronbach’s alpha of the various items in the PSS.

Items	Value
Respiratory rate	0.955
Nasal flare/chest retraction	0.904
Feeding	0.904
Sensorium	0.945
Wheeze and prolonged expiration	0.937

Cronbach’s alpha couldn’t be calculated for cyanosis since there is zero variance.

Table 5: Inter-observer Kappa agreement index of the various items in the sample.

Items	Doctor and nurse 1		Doctor and nurse 2		Nurse 1 and nurse 2	
	Kappa	p value	Kappa	p value	Kappa	p value
Respiratory rate	0.847	<0.01	0.795	<0.01	0.880	<0.01
Nasal flare/chest retraction	0.670	<0.01	0.662	<0.01	0.747	<0.01
Feeding	0.619	<0.01	0.635	<0.01	0.573	<0.01
Sensorium	0.699	<0.01	0.750	<0.01	0.680	<0.01
Wheeze and prolonged expiration	0.686	<0.01	0.668	<0.01	0.736	<0.01

Kappa value couldn’t be computed for cyanosis since it is constant.

DISCUSSION

Bronchiolitis occurs in one third of lower respiratory infections in children under 2 years of age and its diagnosis is mostly based on clinical examinations. Most

of the children with mild condition get better with supportive care at home and a minor percentage of children need hospitalization. Non-availability of physician and inadequate medical equipment in remote areas delays the treatment and referral to higher institute.³

This study aimed to assess a valid and reliable simple clinical score for classifying the severity of bronchiolitis which a nurse can measure with stethoscope alone. This study was conducted among the south Indian population from Tamil Nadu and Puducherry, India. Median age group of the participants in this study was 5 months and the internal consistency of PSS was good similar to the study of McCallum GB et al.² This study also demonstrates an excellent inter-observer agreement among the physician, researcher and the nurse (i.e., 94%, 94% and 93%) with kappa range 0.85-0.87 better than the outcome (90.3% and 92.9%) with kappa range 0.69-0.74 of Gajdos V et al.¹¹ The inter-observer agreement between the individual items by different observer pairs varies from 0.573-0.880 as the subjective measures (feeding and sensorium) changed according to the assessment time even in the same case. In researcher proposed scale, SpO₂ is left out due to non-availability of facility in some rural areas. Instead cyanosis will help to identify the need for oxygen supplementation. In maximum referred scales, most of the items are described in medical terms and in researcher developed PSS the common terms are used which help the nurses and health care worker to assess quickly. Compared to other scales, the PSS shows good internal consistency and excellent inter-observer agreement. The results of the current study was significant because this scoring scale has a very good inter observer agreement and can be applied in a rural setting to identify severity of bronchiolitis to make a clinical decision and management.

Nevertheless, present study has some constraint. The convenience sample restricted the number of children participation. The study was conducted in emergency room and pediatric ward at JIPMER not in community settings. Assessment also varied according to the professional and clinical experiences of the care provider. A similar study should be conducted in community settings with higher sample size can find out the usefulness of this PSS in rural areas.

CONCLUSION

This study showed that the PSS exhibits a high level of consistency and reliability within and between the care providers. Hence, the PSS is valid and reliable for classifying the severity. It can also be administered by nurses and other health care workers even in peripheral health care settings without the facility for the measurement of SpO₂ and CXR.

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