| | Mediscope | | The Journal of GMC | |

ORIGINAL ARTICLE

Sensitivity, Specificity and Predictive Values of Chest Indrawing in the Diagnosis of Severe Pneumonia

SMA Rashid[1], *MK Islam[2], MS Ali[3], MJ Uddin[4], F Yasmin[5], MS Mollah[6]

Abstract

Background: Pneumonia is a recognized leading killer disease in under 5 children not only in Bangladesh but also in all developing countries. The presence of lower chest indrawing means that the child has severe pneumonia. This study aimed to determine the sensitivity, specificity and predictive values of chest indrawing in the diagnosis of severe pneumonia. **Methods:** This analytical study was conducted in the department of pediatrics, Sher-e-Bangla Medical College Hospital, Barisal, from January 2015 to December 2015. A total of 100 cases of severe pneumonia aged from 2 months to 5 years and similar numbers of suitably matched controls who fulfilled inclusion criteria were enrolled in this study. A detailed history was taken, a thorough physical examination was done, data were recorded in a preformed questionnaire and were analyzed using a scientific calculator. **Results:** Out of 100 cases, 80 (80%) and 100 controls, 72 (72%) were in the age group of 2 months to 1 year. Fast breathing was present in 98 (98%) cases and 88 (88%) controls. Chest indrawing was present in 56 (56%) cases and 42 (42%) controls. Roentgenographically, 44 (44%) cases revealed labor/segmental consolidation, and bilateral patchy consolidation was present in 56 (56%) cases. Among the control group, 28 (28%) patients had hyperlucency of peripheral lung fields in their chest X-rays. In this study, it was found that sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) of chest indrawing in the diagnosis of severe pneumonia was 56%, 58%, 57.1% and 56.8% respectively. **Conclusion:** Chest indrawing alone is not a highly sensitive tool to predict severe pneumonia but in rural areas where X-ray facilities are not available, chest indrawing may play an important role in identifying children with possible severe pneumonia.

Keywords: Chest indrawing, Pneumonia, Sensitivity, Specificity, Predictive values.

Introduction

Pneumonia is a recognized leading killer disease in under 5 children not only in Bangladesh but also in developing countries around the world.[1] Every year about 13 million under-5 children die in the world, 95% of them in developing countries, among them about 4 million due to pneumonia.[2] The under-5 mortality rate (U5MR) in Bangladesh is 45/1000 and it is claimed that 25-30 children/thousand/year die from acute respiratory

1. Dr. S.M. Abdur Rashid, Assistant Professor, Department of Pediatrics, Khulna Medical College & Hospital, Khulna.
2. Dr. Mohammed Kabirul Islam, Assistant Professor, Department of Pediatrics, Khulna Medical College & Hospital, Khulna.
   Email: kabir0123@gmail.com
3. Dr. Mohammad Showkat Ali, Assistant Professor, Department of Pediatrics, Khulna Medical College & Hospital, Khulna.
4. Dr. Mohammed Jamal Uddin, Assistant professor, Department of Pediatrics,
   Jahurul Islam Medical College & Hospital, Kishoreganj.
5. Dr. Farhana Yasmin, Junior Consultant, Department of Pediatrics, Khulna Medical College & Hospital, Khulna.
6. Dr. Muhammad Solaiman Mollah, Assistant Professor, Department of Pediatrics,
   Sylhet MAG Osmani Medical College & Hospital, Sylhet.

infection (ARI).[3] Various community and hospital based studies in Bangladesh have shown that the morbidity of pneumonia varies from 4-30%.[4-8] National health services of Bangladesh reported that amongst all outpatients in a rural health center, about 18.2% had an acute respiratory infection of which 16% were children between 0-5 years of age.[9]

Pneumonia is an inflammatory process involving the lung parenchyma.[10] As pneumonia progresses and becomes more severe, lung elasticity is gradually reduced and chest indrawing develops (lower chest wall draws in when the child breathes in). The presence of lower chest indrawing means that the child has severe pneumonia.[11] A child with chest indrawing may not have fast breathing because the respiratory rate can fall when pneumonia becomes severe or the child is exhausted. A child with chest indrawing is at a higher risk of death from pneumonia than a child with fast breathing without chest indrawing.[2] Chest indrawing may also be caused due to asthma, bronchiolitis (the most frequent cause of hospitalization of infants)[12] or other respiratory infections. Chest indrawing may not occur in children with lobar pneumonia since the involvement of one lobe may not decrease total lung compliance.[13]

The discussion on the most reliable clinical signs of pneumonia has however continued[14-16], because previous studies included a large number of cases of pneumonia diagnosed clinically but unconfirmed by X-ray.[17-19] X-ray of the chest is a reliable tool for the diagnosis of pneumonia and has been used as the gold standard in two recent studies.[14,15]

Integrated Management of Childhood Illness (IMCI) was incorporated into the national program to reduce morbidity & mortality of children, where chest indrawing has been identified as a sign of severe pneumonia. Since the WHO guidelines are intended to rationalize case management in a simplified manner for the paramedical personnel in rural areas where investigation facilities like chest X-ray and trained pediatricians are not

available, chest indrawing will be an important tool for the diagnosis of severe pneumonia.[20]

This study aimed to determine the role of chest indrawing in the diagnosis of severe pneumonia and also determine the sensitivity, specificity and predictive values of chest indrawing in the diagnosis of severe pneumonia.

Methodology

This analytical study was conducted in the department of pediatrics, Sher-e-Bangla Medical College Hospital, Barisal, from January 2015 to December 2015. A total of 100 cases of severe pneumonia aged from 2 months to 5 years, having cough or difficult breathing < 2 weeks and lobar, segmental or bilateral patchy consolidation in chest X-rays and similar numbers of suitably matched controls were included. Patients having features of severe malnutrition, recurrent wheezes or asthma, congenital heart disease and laryngomalacia were excluded from this study.

A detailed history was taken and a thorough physical examination was done immediately after admission. To elicit chest indrawing, the child was kept lying flat in the mother's lap exposing the chest and abdomen. Inward movement of the lower chest and outer movement of the upper chest and abdomen was looked for when the child breathed in. Chest X-rays were done immediately after admission.

Data were collected in a preformed questionnaire and were analyzed using a scientific calculator. Frequency distribution tables were prepared and then interpretations were done

Results

Out of 100 cases, 80 (80%) and 100 controls, 72 (72%) were in the age group of 2 months to 1 year. Male was preponderant among the cases, 74 (74%) were boys and 26 (26%) were girls. 68 (68%) were boys and 32 (32%) were girls in the control group. In most of the cases, [88 (88%)] and controls, [84 (84%)] were from lower

socioeconomic groups. In the majority of cases, [96 (96%)] and controls, [88 (88%)] were presented with cough, and difficulty in breathing was present in 94 (94%) cases and 86 (86%) controls. Fever was present in 78 (78%) cases and 65 (65%) controls. The feeding difficulty was present in 78 (78%) cases and 64 (64%) controls. Fast breathing was present in 98 (98%) cases and 88 (88%) controls. Chest indrawing was present in 56 (56%) cases and 42 (42%) in controls. Roentgenographically, 44 (44%) cases revealed labor/segmental consolidation, and bilateral patchy consolidation was present in 56 (56%) cases. Among the control group chest x-ray was normal in 72 (72%) patients whereas, in 28 (28%) patients, there was hyperlucency of peripheral lung fields (Table 01). In this study, it was found that sensitivity, specificity, PPV and NPV of chest indrawing in the diagnosis of severe pneumonia were 56%, 58%, 57.1% and 56.8% respectively (Table 02, 03, 04, 05).

Table 01: Demographic, Clinical and laboratory profile of study subjects (Cases, n=100 & Controls, n=100)

Characteristics	No. of Cases	%	No. of Controls	%
1. Age-				
2m-1yr	80	80	72	72
>1-<2yr	14	14	22	22
2-5yr	6	6	6	6
2. Sex-				
Boys	74	74	68	68
Girls	26	26	32	32
3. Socio-economic status-				
Low	88	88	84	84
Middle	7	7	9	9
High	5	5	7	7
4. Symptoms-				
Cough	96	96	88	88
Difficult Breathing	94	94	86	86
Fever	78	78	65	65
Feeding difficulties	40	40	18	18
Fast breathing	94	94	75	75
Chest indrawing	56	56	42	42
Cyanosis	5	5	2	2
5. Chest X-ray findings-				
Lobar/Segmental consolidation	44	44		
Bilateral patchy consolidation	56	56		
Hyperlucency of peripheral lung field			28	28

Table 02: Sensitivity of chest indrawing in the diagnosis of severe pneumonia

Test Result (Chest indrawing)	Severe Pneumonia(case)	Controls	Sensitivity
Positive	True positive-56	False positive-42	56%
Negative	False negative-44	True negative-58	

Table 03: Specificity of chest indrawing in the diagnosis of severe pneumonia

Test Result (Chest indrawing)	Severe Pneumonia(case)	Controls	Specificity
Positive	True positive-56	False positive-42	58%
Negative	False negative-44	True negative-58	

Table 04: Positive predictive value (PPV) of chest indrawing in the diagnosis of severe pneumonia

Test Result (Chest indrawing)	Severe Pneumonia(case)	Controls	PPV
Positive	True positive-56	False positive-42	57.1%
Negative	False negative-44	True negative-58	

Table 05: Negative predictive value (NPV) of chest indrawing in the diagnosis of severe pneumonia

Test Result (Chest indrawing)	Severe Pneumonia(case)	Controls	NPV
Positive	True positive-56	False positive-42	56.8%
Negative	False negative-44	True negative-58	

Discussion

In the present study, it is found that acute respiratory infection is significantly higher i.e., 80 (80%) in children below 1 year of age. This is consistent with some other studies.[8,21,22] Fast breathing was present in 94 (94%) cases and 75 (75%) control group. A study by Dai Y, et al. found fast breathing in 85.4% of cases of radiological proved pneumonia and in 65.5% of patients where no abnormal radiology was found.[23] In our series, chest indrawing was present in 56 (56%)

cases. Singhi S et al. found chest indrawing in 42% casese.[24]

Chest X-ray P/A view revealed lobar or segmental consolidations in 44 (44%) cases and bilateral patchy consolidation in both lung fields in 56 (56%) cases. Akbar MS described features suggestive of lobar pneumonia in 38% of cases and bronchopneumonia in 33% of cases.[6] Ahmed Z found lobar pneumonia in 20.7% and broncho-pneumonia in 49% of cases.[22] Our study is close to the range of the above-mentioned studies. We found that the sensitivity of chest indrawing was

56% and the specificity of chest indrawing was found to be 58%. Gupta D et al found that the sensitivity of chest indrawing was 62%[25]. A study conducted in Vellore, India showed chest wall indrawing was 89% sensitivity & specificity 89%.[26] These findings differ from our study.

In our study, bronchiolitis, the most common lower respiratory tract infection of which >90% present with chest indrawing was included, which had reduced the specificity of chest indrawing. Large inter-observer variations in eliciting chest indrawing may be a contributing factor.

For the above-mentioned reason, the predictive (positive and negative) values are quite lower than other studies. Positive predictive value in this study was 57.1% and negative predictive value was 56.8%. Gupta D et al. found that the positive and negative predictive values were 92% and 89% respectively.[25]

X-ray of the chest is a reliable tool for the diagnosis of pneumonia and has been used as a gold standard.[14,15] Widely available and relatively inexpensive x-ray facility could precisely exclude pneumonia. But it may lead to additional risk of frequent exposure to radiation as because "children below 5 years of age suffer from several episodes of ARI, per year". Whether little modification of existing WHO protocol of ARI case management encompassing clinico-radiological evidences could be done, is an emerging query of this study.

Conclusion

It can be concluded that chest indrawing alone is not a highly sensitive tool to predict severe pneumonia. Since WHO guidelines are intended to rationalize case management of ARI in a simplified manner by the health care providers at the primary health care level, where X-ray facilities and trained pediatricians are not available, chest indrawing may play an important role for identification and early referral of children with possible severe pneumonia for better management.

References

1. Haque MS, Ruhulamin M, Akbar MS. Independent risk factors of severe and very severe pneumonia in children (2-59 Months). DS (child) HJ 2000; 2: 19.
2. World Health Organization Programme for the control of acute respiratory infections. Technical bases for the WHO recommendations on management of pneumonia in children at first level health factions. Geneva: WHO 1991; 1-16.
3. Kobir ARML, Kawser CA, Shahidullah M, Hasan MQ, Talukder MQK. Situation analysis of child health in Bangladesh. Bangladesh J of Child Health 1995; 19(2): 53-60.
4. Pioa, Leowask J, Tendar HG. The Magnitude of the problem of Acute respiratory infection. In Douglas RM, Kervy E, editors. Acute respiratory infections. In; proceedings of international workshop, Adelaide, South Australia, University of Australia 1984: 3-16.
5. Paiseley JW. pathogens associated with acute lower respiratory tract infection in young infants. Paediat infect Dis 1984; 3: 14-19.
6. Akbar MS, Ehsan A, Ali CMH. Clinical profile and management of acute respiratory infection at Dhaka Shishu (children) Hospital. Bangladesh J Child Health 1992; 16: 5-8.
7. Spika JS, Munshi MH, Wojiyniak B, sack DA, Hossain A, Rahman M, et al. Acute respiratory infection; a major cause of death in children in Bangladesh. Ann Trop paediat 1989; 9: 33-39.
8. Khan MR, Moula M, Rahman ME. Acute respiratory infection (ARI) in children. JIPGM & R 1987; 2: 4-6.
9. Morbidity and Mortality Survey of Diarrhoeal Diseases in Rural Areas of Bangladesh 1983. National Health Services, Govt. of Bangladesh.
10. Balachhandran A, Pneumonia in children. In: Parthasarathy, Menon PSN, Nair MKC, Mathur YC, Mukherjee D, Bhave SY, et al. IAP Text Book of pediatrics 2002; 11. 6:390.
11. Shann F, Hart K, Thomas D, Acute lower respiratory tract infections in children: possible criteria for selection of patients for antibiotic therapy and hospital admission. Bull World

Health Organ 1983; 52: 749-53.

12. Orenstrin DM, Bronchiolitis. In: Behrman RE, Kleigman RM, Jenson HB, Nelson HB, Nelson Text Book of peadiatrics 16th ed. USA. WB. Saunders Company 2000; 391: 1285-1286.

13. World Health Organization. Acute Respiratory infection of children: Case management in small hospital in developing countries. A manual for doctor's and other senior health workers. WHO/ARI/90.5 1990: 1-69.

14. Harari M, Shann F, Spooner V, Clinical signs of pneumonia in children. Lancet 1991; II: 928-30.

15. Usha N, Katariya S, Walia BNS. Simple clinical signs of lower respiratory infection. Trop Doct 1990; 20: 158-60.

16. Gove S, Pio A, Campbell H, Cattaneo A, WHO guidelines on detecting pneumonia in children. Lancet 1991; II: 1453.

17. Shan F, Hart K, Thomas D, Acute lower respiratory infections in children: possible criteria for selection of patients for antibiotic therapy & hospital admission. Bull WHO 1984; 62: 749-53.

18. Cherian T, Jacob JT, Simoes E, Steinhoff MC, John M, Evaluation of Simple clinical signs for the diagnosis of acute lower respiratory tract infection. Lancet 1988; II: 125-8.

19. Campbell H, Byass P, Grenwood BM. Simple clinical signs for diagnosis of acute lower respiratory tract infection in children. Lancet 1988; II: 742-3.

20. Sachdev HPS, Chawal M, Shagunand GA. Improving antibiotic and bronchodilator. prescription in children presenting with difficult breathing. Experience from an urban hospital in India. Indian pediatr 2001;38: 830.

21. Hossain MA, Clinical profile and outcome of acute respiratory infection: study of 100 hospitalized children of 0-5 years. Dissertation (paediatrics), BCPS, Dhaka 1994.

22. Ahmed Z, Clinical diagnosis of acute lower respiratory tract infections in children and its radiological evaluation in children of 0-5 yr. Dissertation (paed). BCPS, Dhaka 1990.

23. Dai Y. Respiratory rate and signs in roentgen graphically confirmed pneumonia among children of China. Paediatr Infect Dis J 1995; 14: 48-50.

24. Singhi S. Clinical sings of pneumonia in infants under 2 months. Arch Dis Child 1994;70: 413-17.

25. Gupta D, Mishra S, Chaturvedi P. Fast Breathing in the diagnosis of pneumonia-A reassessment. J Trop paediatr 1996; 42: 196-99.

26. Bulletin of the World Health Organization 1997; 75: 119-123.