Severe sepsis and severe pneumonia may be clinically indistinguishable

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Citation

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Abstract

Background: WHO guidelines suggest a diagnosis of severe pneumonia in a child with chest indrawing when X ray facility is not available (1). We have an increasing number of cases presenting with chest indrawing to have normal chest X-rays. In these children, peripheral blood counts, taken as proxy for positive blood culture, suggest bacteremia; blood gas study reveals metabolic acidosis and their blood lactate levels are raised. These findings suggest severe sepsis in them.

Objective: To compare cases with normal chest X-ray and those with lobar consolidation among the subjects presenting with chest indrawing.

Methods: Consecutively admitted thirty-eight children with chest indrawing and with history of fever or documented fever were studied. Age, gender, nutritional status, history of diarrhoea, signs of impaired perfusion, splenomegaly, pallor and conscious level were prospectively recorded. Blood counts, chest X ray, venous blood gas analysis and estimation of blood lactate levels were performed. ELISA test for HIV infection was carried out when social history indicated a risk.

Results: Among 38 children presenting with chest indrawing, 12 (31.6%) with pneumonia and 26 (68.4%) without pneumonia on chest X ray, differed significantly only in respect to nutritional status, history of diarrhoea and hospital stay.

Comments: Some cases of chest indrawing have severe sepsis rather than pneumonia.

INTRODUCTION

The chest X ray is still considered to be the gold standard for diagnosing pneumonia in the developed world. In developing countries pneumonia is diagnosed by a rapid breathing rate in absence of chest X-ray facility ([1]). Chest indrawing suggests severe form of pneumonia and carries high mortality especially among malnourished children ([2]). Rapid breathing and accompanying fever were the most accurate clinical signs of severe lower respiratory tract infections ([3]). Rapid breathing / chest indrawing may also be a presenting feature of respiratory system involvement as a part or organ dysfunction caused by sepsis or of accompanying lactic acidosis resulting from tissue hypoperfusion in severe sepsis. Our study describes how clinical presentation of severe sepsis mimics pneumonia.

SUBJECTS AND METHODS

This study was conducted between January 2003 and May 2003 at the Pediatric ward of the Cama and Albless Hospital, Mumbai. Thirty eight consecutively admitted children with axillary temperature more than 38ºC or history of fever and chest indrawing formed the study sample. Following clinical features were recorded prospectively in a predetermined format: age, gender, nutritional status ([4]), history of diarrhoea, signs of impaired perfusion, chest indrawing, splenomegaly, pallor and level of consciousness. Laboratory investigations performed were: full blood counts, blood gas analysis on peripheral venous blood ([5]), chest X-ray and blood lactate levels. Bacteremia was diagnosed when the leucocyte count was more than 15000 / dl or was less than 5000 / dl or when absolute band count was more than 500 / dl ([6]). Malaria was diagnosed in these cases of fever when parasitemia was documented on peripheral blood smear or in presence of severe anemia (Hb less than 8 g%) or in presence of splenomegaly ([7]). Pneumonia was diagnosed in presence of lobar consolidation on chest X-ray. Blood lactate

level of 2mmol/l or more was considered to be raised.

The two sub-groups, i.e. chest indrawing with or without lobar consolidation, were compared for association of various parameters. Test of significance, Chi-squared or Fischer's test, was applied.

RESULTS

Of the 38 children admitted with fever or history of fever and chest indrawing, 26 (68.4%) had normal chest X ray and 12 (31.6%) had lobar consolidation, 20 (53%) were infants, 24(63%) were male, 10(26%) were normally nourished, 17(45%) had mild - moderate malnutrition and 11 (29%) had severe malnutrition. Severe anemia was noted in three (8%) and splenomegaly in six (16%) children. Seven (18%) children had history of diarrhoea and in three (8%), perfusion were impaired. Conscious level was altered in 13 (34%) children. Venous pH was less than 7.3 in 14(37%) and base deficit was ten and more in 12 (32%). Blood lactate levels were raised in 34 (89%), of which 16 (42%) were highly raised (more than 5mmol/l). Evidence of bacteremia on leucocyte counts was noted in 31 (80%). Of the ten subjects suspected to be at a high risk of HIV infection and where ELISA test was performed, four tested positive. However, in two infants PCR test could not be performed for confirmation. Hospital stay was 7 days or more in 25 (66%) children. Twelve children with pneumonia and 26 children without pneumonia on chest x-ray, when compared, differed significantly only in respect of nutritional status, history of diarrhoea and hospital stay (Table).

Figure 1

Table 1: Comparison of different parameters among children with chest indrawing, with and without X ray evidence of pneumonia

	Parameter	Pneumonia Absent(26)	Pneumonia Present(12)	significance
1)	Age			
	Upto 1 year	13	7	0.45
	More than 1 year	13	5	
2)	Sex			
	Male	17	7	0.78
	Female	9	5	
3)	Nutrition (grade)			
	Normal	9	1	
	*PEMGr I	7	3	
	PEM Gr II	5	2	0.02**
	PEM Gr III	3	2	
	PEM Gr IV	2	4	
4)	Fever or h/o fever			
	No	3	0	
	Yes	23	12	0.3
5)	Anemia (Hb< 8g)			
	No	25	10	0.22
	Yes	1	2	
6)	Splenomegaly			
	No	22	10	0.72
	Yes	4	2	
7)	Impaired perfusion			
	No	23	12	0.3
	Yes	3	0	
8)	History of diarrhea			
	No	19	12	0.05
	Yes	7	0	
9)	Conscious level			
	Altered	8	5	0.84
	Normal	18	7	
10)	Evidence of bacteremia			
	Present	21	8	0.91
	Absent	5	4	
11)	pH			
	Less than 7.3	10	4	0.52
	7.3 and more	16	8	
12)	Base deficit			
	Upto 10	13	9	
	11-15	7	1	0.347**
	More than 15	5	2	
13)	Blood lactate level			
	Normal	3	1	0.62
	Raised	23	11	
14)	HIV- Elisa			
	Positive	1	3	
	Negative	4	2	0.13
	Not done	21	7	
15)	Hospital stay			
	Upto 6 days	12	1	0.02
	7 days and more	14	11	

* Protein Energy Malnutrition
** Linear – by – linear association

DISCUSSION

Community-acquired bacteremia has been found to be a major cause of death among children in a sub-saharan district hospital ([8]). Sepsis and septic shock are the severe forms of bacteremia. Identifying patients at risk of sepsis and septic shock for early aggressive management led to definition of the systemic inflammatory response syndrome (SIRS) and severe sepsis criteria ([9]). Respiratory failure and septic shock are the most common manifestations of organ dysfunction with sepsis presenting as respiratory distress and impaired perfusion . Sepsis is also associated with myocardial dysfunction, which can be severe enough to impair organ blood flow. Cardiac function may be already

compromised in children with malnutrition and those with HIV infection. Therefore, among children in developing countries, cardiac component of cardiovascular compromise may play a more important role in determining morbidity and mortality due to sepsis. This fact may have bearing on management, i.e. fluid resuscitation and inotrope administration.

We have found occult bacteremia as a common cause of fever ([10]). Bacteremia is a laboratory-diagnosed condition without distinctive clinical manifestation suggesting localization of infection. A positive blood culture is a gold standard for diagnosis of bacteremia. Abnormal WBC counts are markers of bacteremia and we used abnormal WBC counts as a proxy to blood culture and therefore our study has some limitations. The subjects however, qualify to be labeled as cases of SIRS with hypoperfusion. Mortality among culture – positive sepsis was found to be 16 % compared to 10 % among those with SIRS and suspected but un-documented infection ([11]). Bacteremia is more likely to progress to severe sepsis, i.e. impaired tissue perfusion leading to altered conscious level and lactic acidosis, in infants and children with malnourished or immunocompromised status. In a study on 792 severely malnourished children, the relative risk of bacteremia on admission was 1.6 and 2.0 respectively when compared to well-nourished children. The relative risk of death in malnourished children with bacteremia was 2.5 times that of malnourished children without bacteremia ([12]). In a community - based study, Campbell and colleagues observed 222 episodes of acute lower respiratory tract infections (LRTI) with radiological evidence of consolidation and found that fever was associated with severe LRTI, both in infants and in children aged one to four years ([3]). High fever together with systemic upset or irritability and signs of consolidation in older children has been used to indicate bacterial pneumonia ([13],[14]). Thus, children with chest indrawing are sicker when accompanied by bacteremia. It appears that the category ‘very severe disease' described while classifying severity of acute respiratory infection represents cases of pneumonia with severe sepsis ([15]).

Lactic acidosis, besides altered mental status and oliguria, is taken as a marker of hypoperfusion in sepsis. It occurs as a result of anaerobic respiration resulting from cellular hypoxia. Lactic acidosis is a metabolic monitor of shock and occurs in association with clinical evidence of poor tissue perfusion or oxygenation, i.e. hypotension, cyanosis, cool and clammy extremities ([16]). Malaria, like bacterial infection, is also associated with excessive production of tissue necrotic factor (TNF), which is responsible for fever and impaired perfusion([17]). Moreover, malaria and bacteremia are found to co-exist in 27 % cases ([18]). Severely malnourished children who carry high mortality may not have chest indrawing even with severe pneumonia and may not have highly increased blood lactate levels even with severe tissue hypoxia due to substrate deficiency. We conclude, chest indrawing may be associated with severe pneumonia and / or severe sepsis. It is important to devise an effective strategy to reduce “ tissue distress” commonly caused by impaired oxygenation and / or perfusion leading to lactic acidosis.

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