Risk Factors which affect the change of Antibiotics in Neonatal Pneumonia observed in A Tertiary Care Hospital

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Abstract

Background : Neonatal pneumonia accounts for significant morbidity and mortality specially in developing countries like Bangladesh. Perhaps because of its etiologic complexity, pneumomia in neonates has been relatively refractory to reduce its severity and improve the prognosis. Re- evaluation of the antibiotic therapy is necessary in patients to have at 48 hours after diagnosis. Physician should suspect inappropriate antibiotic therapy in cases with persistence of symptoms.

Objective: This study was carried out to find the risk factors (clinical and laboratory parameters) which affect the change of antibiotic in neonatal pneumonia and its effect on morbidity and mortality .

Methodology: This prospective observational study was conducted in Dhaka Shishu (children) Hospital from July 2009 to June 2010. A total of 115 neonates who met the inclusion criteria were enrolled in the study. The neonates were managed using a standard protocol. They were closely followed up to see the outcome with the change in antibiotics.

Results : Total 115 neonates were admitted with mean age 16.2±5.9 days, mean weight 2857.6±580.6gm,58% were male & 42% female,26% were preterm & 74% were term and majority of them (73%) were from rural areas. Among the neonates, 36 (31,3%) needed a change in antibiotics. Fever, positive CRP, low O_2 saturation, low PaO_2, high alveolar-arterial O_2 gradient, low arterial-alveloar O_2 tension and low pH were significantly associated with change in antibiotics.

Conclusion : Addressing the clinical and laboratory parameters appropriately the change in antibiotic in selected cases can reduce both morbidity and mortality of neonates with pneumonia.

Key Words: Neonatal pneumonia, risk factors, clinical & laboratory parameters.

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Introduction

Pneumonia is an important cause of neonatal infection and accounts for significant morbidity and mortality especially in developing countries where the World Health Organization estimates that 800,000 neonatal deaths occur each year from acute respiratory infections mostly pneumona[1]. The greatest risk of death from pneumonia in childhood is in the neonatal period[2].

Although pneumonia is an important cause of morbidity among neonates, it remains a difficult disease to identify and treat[3]. Clinical manifestations are often non-specific, sharing respiratory and hemodyanamic signs with a host of non-inflammatory process[4].

In general, neonates with the diagnosis of pneumonia in the newborn nursery receive broad spectrum antibiotics, usually ampicillin and gentamicin[5].

Determining the duration of antibiotic therapy for neonatal pneumonia poses a dilemma for the clinician; the infection must be adequately treated, for avoiding needless prolong hospitalization and exposure to antibiotics. The antibiotics were changed if the patients did not improve after 48 hours of initiation of treatment or deteriorated in the form of increasing chest in drawing or worsening hypoxaemia[6].

Therefore, there is a need to evaluate the clinical and laboratory parameters which affect the need for change of antibiotics during the management of neonatal pneumonia and may aid in reducing morbidity and mortality in neonates.

Materials and Methods

This was a prospective observational study carried out in Dhaka Shishu (Children) Hospital from July 2009 to June 2010. 115 neonates were selected following inclusion criteria. Pneumonia was diagnosed when neonates were presented with any of the respiratory symptoms like rapid, noisy or difficult breathing, respiratory rate³ 60/min, severe chest in drawing, grunting or cyanosis, cough, if age of neonates<72 hours with maternal fever, foul smelling liqueur, prolonged rupture of membrane (PROM) and any of radiographical finding of chest like nodular or any patchy opacity or sub-lobar consolidation.

Neonates having congenital heart disease, congenital malformation of respiratory or GI tract, meconium aspiration syndrome, TTN, RDS were excluded from the study.

A structured questionnaire was used for recording all the information's. After taking written consent, all neonates who full filled the inclusion criteria were evaluated in a calm and quiet state. Respiratory rate (RR) for 1 minute was recorded. Poor-feeding/sucking, lethargy, poor reflexes, hypo or hyperthermia, abdominal distension, prolonged capillary refill time (CRT>3 sec), heart rate (HR), grunting, cyanosis were recorded by examining the neonates.

Following investigations were done at the time of enrollment: CBC, CRP, Blood C/S, measurement of FiO_2, O_2-saturation by pulse oximetry, Alveolar-

arterial oxygen gradient (PAO_2-PaO_2) and arterial- alveolar Oxygen tension ratio (PaO_2/PAO_2) were calculated and CXR Daily follow up like RR, HR, temp., SPO_2, cyanosis were observed and change in antibiotic was done when the clinical condition deteriorated or did not improve after 48 hours of treatment. All neonates were followed up to outcome.

Informed written consent was taken from guardian of every single patient.

Data analysis was done by software SPSS 16 version.

Results

In this study 115 neonates hospitalized with pneumonia were selected according to inclusion criteria during the study period from July 2009 to June 2010. The findings from the data analysis are documented below.

Table -I : Demographic characteristics of study patients

		No. of Neonate	Percent (%)
	1-7 days	11	9.6
Age group	8-12 days	24	20.9
	13-18 days	31	27.0
	19-28 days	49	42.6
Mean ±SD	16.2 ±5.9	Range 03-27 days	
Sex	Male	67	58
	Female	48	42.0
	1700-2500 gm	30	26.1
Weight in gm	2501-3000 gm	43	37.4
	3001-3500 gm	29	25.2
	>3500 gm	13	11.3
Mean ±SD	2857.6±580.6	Range 1785-4500 gm	
Gestational age	Preterm	31	26
	Term	84	74

The mean age of the neonates was 16.2± 5.9 days with majority of them were older than 7 days, male neonates were 58% and female were 42% with male & female ratio of 1.38:1. Mean weight was 2857.6 ± 587.6 gm and 26.1% of them were with low birth weight. Twenty six percent of the neonates were preterm (Table 1).

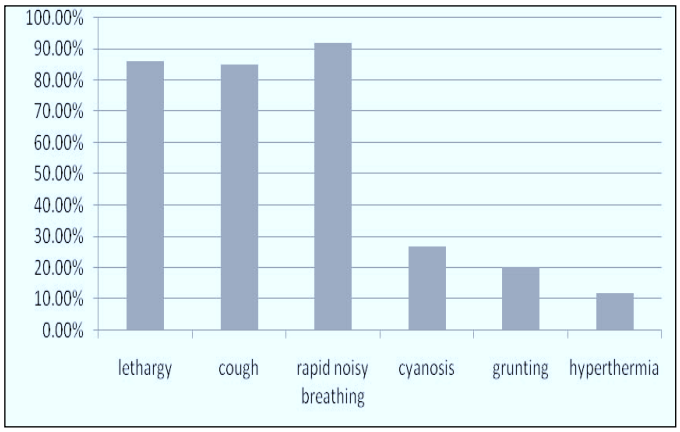

Fig. 1: Presenting complaints of pneumonia cases (multiple response)

The presenting features of the patients (multiple response) were mostly rapid noisy breathing (92.17%, 106 pts), lethargy (86.08%, 99 pts), cough (85.22%, 98 pts), cyanosis (26.95%, 31 pts), grunting (20%,23 pts), hyperthermia (12.17%, 14 pts).

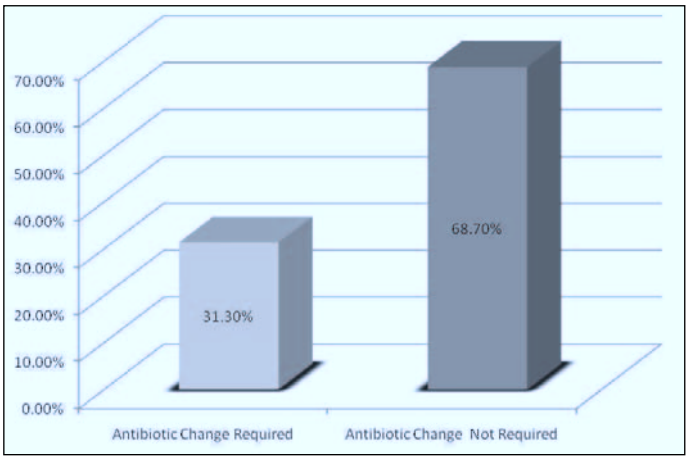

Fig.-2: Proportion of patients with outcome variable

Antibiotic change was required in 36 (31.3%) patients.

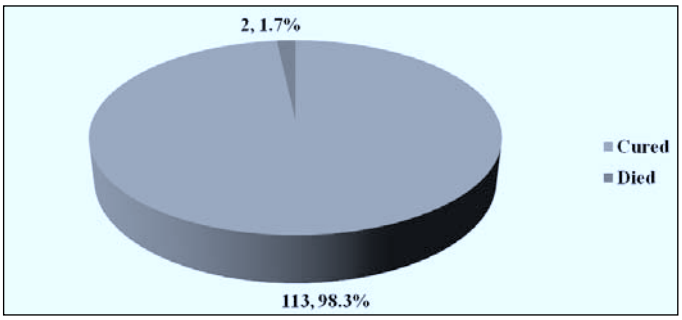

Figure 3 : Outcome of neonates with pneumonia.

Of the 115 neonates admitted with pneumonia, 113 patients (98.3%) were cured and 2 patients (1.7%) died.

Table. II Laboratory parameters of the patients

Investigations		Number	%
Blood film	Normocytic Normochromic	75	65.2
	Macrocytic Normochromic	17	14.8
	Others	23	20.0
Chest X-ray	Normal	03	2.6
	Nodular Coarse patchy opacity	55	47.8
	Diffuse haziness Granularity	54	47.0
	Sub lobar consolidation	02	1.7
	Non specific pul infection	01	0.9
Blood culture	No growth	115	100
	Growth	00	00
Arterial Blood gas	Normal	103	89.5
analysis	Respiratory acidosis	12	10.5
CRP	Positive	56	48.7
	Negative	59	51.3

Blood film showed normocytic normochromic picture in 65.2%, macrocytic normochromic 14.8%, others 20%, chest X-ray showed

normal in 2.6%, nodular coarse patchy opacity in 47.8%, diffuse haziness or granularity in 47%, sub lobar consolidation in 1.7%. Blood culture showed no growth in any samples. Arterial blood gas analysis was normal in 89.5% and respiratory acidosis in 10.5%, CRP was positive in 48.7% and negative in 51.3% .

Table. III: Association between of change of antibiotics and clinical parameters.

Clinical parameter		Change in antibiotic: Antibiotic changed	Antibiotic not change	Total	Relative Risk	p value
Cough	Yes	80	18	98	1.36	0.73
	No	13	04	17	(0.39-4.68)	
Rapid noisy or	Yes	85	21	106	0.56	1.0
difficult breathing	No	08	01	09	(0.06-4.27)	
Grunting	Yes	19	04	23	1.16	1.0
	No	74	18	92	(0.32-4.59)	
Cyanosis	Yes	25	06	31	1.06	0.87
	No	67	17	84	(0.83-1.24)	
Lethargy	Yes	71	28	99	1.97	0.26
	No	09	07	16	(0.67-5.80)	
Fever	Yes	05	09	14	0.08	0.01
	No	87	14	101	(0.02-0.30)	

Fever was significantly associated with change in antibiotics.

Table: IV: Association between change in antibiotic and CRP

CRP	Change in antibiotic: Yes	No	Total	Relative Risk	p value
Positive	15	41	56	3.32 (1.15-9.05)	0.02
Negative	06	53	59		
Total	21	94	115		

Positive CRP was significantly associated with change in antibiotic.

Table V: Association between changes in antibiotic and blood count

	Change of antibiotic: Yes Mean	(±SD)	No Mean	(±SD)	p value
Hb%	13.7	(±01.6)	14.2	(±0.9)	0.11
TLC	11288.1	(±3426.4)	11801.6	(±3173.8)	0.51
Platelet	289190.5	(±57117.9)	284956.5	(±66002.2)	0.78

In this study, no association was found between blood count and change in antibiotic.

Table VI : Association between change in antibiotics and arterial blood gas analysis, alveolar-arterial oxygen gradient, arterial-alveolar oxygen tension.

	Change of antibiotic: Yes Mean	(±SD)	No Mean	(±SD)	p value
pH	7.35	(± 0.05)	7.3.8	(±0.03)	0.002
O_2 Saturation	90.1	(±7.2)	92.7	(±2.3)	0.04
PaO_2	103.4	(±1.1)	98.6	(±19.2)	0.03
Alveolar arterial oxygen gradient	13.5	(±3.4)	14.9	(±2.4)	0.02
Arterial alveolar oxygen tension	0.8	(±0.2)	0.9	(±0.02)	0.01
Arterial Blood gas analysis					
PO_2	84.8	(±15.6)	87.3	(±7.5)	0.27

The factors which significantly associated with change in antibiotics were low O_2-saturation, low PaO_2, high alveolar-arterial O_2 gradient, low arterial-alveolar oxygen tension and low pH.

Discussion

Pneumonia is an important cause of neonatal morbidity and mortality. Besides taking preventing measures to decrease the incidence of neonatal pneumonia it is utmost important to predict the factors which are associated with outcome of the pneumonia in hospitalized neonates so that appropriate management can be administered in order to reduce the morbidity and mortality in neonates.

In this study, the mean age at presentation was 16.23 ±5.91 days which is comparable to a study[5] in the United States in which the median age was 18.9 days (SD ± 4.6). In another study[7] it was shown that the mean age at presentation was also within 2 weeks. Male patients (58%) and female (42%) which is comparable to a study in Bangladesh.[8] The mean weight in this study was 2870.58 ± 580.59 gm which is comparable to a study in Bangladesh.[8]

In our study chest X-ray findings were nodular coarse patchy opacity in 47.6%, diffuse haziness in 46.5%, sublobar consolidation in 2%, other non specific finding in 1% and in 3% cases were normal. Benjamin G described chest X-ray finding as diffuse reticular nodular appearance with focal or coarse densities[9] which is comparable with our study.

In another study by Mathur NB[10] et al, chest X-ray finding were alveolar infiltrates in 44.6% cases, sub-lobar consolidation in 17.4%, lobar consolidation in 9.7%, diffuse haziness in 11.6%, opacity with reticulogranular pattern in 1.9% and clear in 14.5%.

Blood culture was negative in all cases of our study which is comparable with T. Duke described that bacterial isolation in the WHO study in Kenya showed that majority cases were not associated with bacteremia.[5] In another large study it became evident that routine surveillance culture contribute little to the prediction and management of pneumonia and may be even misleading.[5]

In this study, 36 patients (31.3%) required change in antibiotic due to deterioration of clinical condition and certain clinical and laboratory parameter which included fever, positive CRP, decreased oxygen saturation, increase alveolar-arterial oxygen gradient, low arterial-alveolar oxygen tension, abnormal pH. Duke et al[1] described antibiotic change in neonatal pneumonia in different countries as 20% in Kenya, 24% in India, 43% in Pakistan due to first line antibiotic treatment failure which is comparable to this study. In another study, it was evident that pneumonia should be treated according to the unit's antibiotic policy and reevaluation is necessary in children who continue to have unresolved symptoms or fever at 48 hours after diagnosis. In these patients, physicians should suspect inappropriate antibiotic therapy and thus need a change in antibiotic[11].

Conclusions

This study concluded that neonates hospitalized with pneumonia presented with fever, positive CRP, decreased O_2 saturation, decreased PO_2, increased alveolar-arterial O_2 gradient and decreased arterial-alveolar O_2 tension required change in antibiotic during the course of treatment.

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