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Original Research Article

Clinical Profile and Outcome of Children Under Five Years of Age Hospitalized With Severe Pneumonia

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Abstract: ***Background*:** Severe pneumonia remains a common and serious condition worldwide. The mortality from severe pneumonia remains high and is one of the leading causes of morbidity and mortality in under-fives. ***Objective*:** To Identify clinical profile and outcome Of Children with Severe Pneumonia. ***Materials and Methods*:** This study was a prospective observational cohort study was carried out at 250 Beded General Hospital, Noakhali, Bangladesh from December 2020 to May 2021. Children under 5 years of age admitted with severe pneumonia. One Hundred Fifty included, Due to time limitation collection of this huge amount of sample was not possible within 6 months period. So the total number patients admitted in hospital in this period were included in this study. ***Results*:** The mean age was found 9.49±6.83 months with range from 2 months to 36 months and Male to female ratio was 2:1. The duration of hospital stay was >5 days in almost two third (62.7%) of the patients. More than a half (54.7%) of the patients lived in an overcrowded environment at home. The mean age of the mothers was 24.67±4.19 years. Most of the mother had no institutional background, where 22.7% mother cannot read and write at all and 33.3% mother can only read and write. More than two third (66.7%) of the family member of the patients were smoker, 50.7% of the patients got exclusive breast feeding, 9.3% had low birth weight, 6.7% were not completely immunized up to age. Head nodding was more common clinical presentation, which was 92(62.7%) of the study patients, positive blood culture was found in 20(13.3%) and abnormal CXR in 108(72.0%) of the patients. Among 150 study patients, 98(65.3%) needed a change in antibiotics, 94(62.7%) patients needed more than 5 days hospital stay, 30(20.0%) needed mechanical ventilation and 18(12.0%) died. ***Conclusion*:** In conclusion to identify the Clinical profile and outcome of children hospitalized with severe pneumonia. Lack of exclusive breast feeding, overcrowding, head nodding on presentation, leukocytosis, positive blood culture, abnormal CXR and exclusive breast feeding were significantly that may reduce their hospital stay. Additional Clinical profile and mortality were anaemia, leukocytosis and positive CRP. So, patients presenting with these factors should preferably be admitted in a paediatric intensive care unit for close monitoring and management that could reduce their mortality.

Keywords: Severe Pneumonia, Cyanosis, Hypoxemia, Anaemia, Leukocytosis, Positive CRP.

I INTRODUCTION

Pneumonia is an inflammation of the parenchyma of the lungs [1]. It is usually caused by viruses or bacteria. Most serious episodes are caused by bacteria. Pneumonia is classified as very severe, severe and non-severe based on the clinical

features with specific treatment for each of them.[2] Children with severe and very severe pneumonia require hospital admission for their treatment. According to WHO severe or very severe pneumonia is diagnosed when a child develops cough or difficult breathing plus at least one of the following signs- lower chest wall indrawing, nasal flaring, grunting, central cyanosis, inability to breast feed or drink or vomit everything, convulsion, lethargy or unconsciousness [2]. Pneumonia is a substantial cause of morbidity and mortality in childhood (particularly among children <5 yrs of age) throughout the world, with an estimated 146-159 million new episodes per year in developing countries. Pneumonia is estimated to cause approximately 4million deaths among children worldwide.[1] Pneumonia kills more children than any other illness- more than AIDS, malaria and measles combined. Each year more than 2 million children under five die of pneumonia in the developing world [3]. Recent estimates from the WHO suggest that pneumonia is responsible for 20% of deaths in the above age group, leading to 3million deaths per year. Of these deaths, two thirds occur during infancy and more than 90% occur in the developing countries [4]. In Bangladesh, recent estimates in under-fives suggest that 21% death is due to pneumonia which is also a major cause of death in total population [5]. Various interventions have been done to reduce pneumonia related morbidity and mortality. In 1983, the World Health Organization (WHO) initiated the Acute Respiratory Infection Control programme which led to a decline in the infant mortality rate by 10.7 (4.8-16.7) deaths per 1000 live births and decline in the mortality of under-fives by 36 deaths per 1000 live births [6]. The ARI control programme includes identification of children with pneumonia by clinical features and administration of antimicrobials with a presumption that majority of pneumonia in developing countries are because of bacterial pathogens. For further impact on morbidity and mortality, a thorough knowledge of the determining factors affecting the outcome of the disease is important. Reducing pneumonia deaths requires implementing effective prevention measures so that children are healthier and less likely to develop pneumonia in the first place. So, for both the prevention and also for effective treatment we need to evaluate the relevant factors that determine the outcomes including the need for change of antibiotics, prolonged hospital stay, need for mechanical ventilation and mortality. Various studies have evaluated the determinants for mortality in children due to pneumonia. Factors associated with increased mortality include young age of the mother and lack of proper education, lack of breast feeding, late hospitalization with cyanosis, altered sensorium, grunting, associated chest indrawing and inability to drink [6-8]. Inadequate nutrition and acute lower respiratory infection (ALRI) are overlapping and interrelated health problems affecting children in developing countries.

II MATERIALS AND METHODS

This study was a prospective observational cohort study was carried out at 250 Beded General Hospital, Noakhali, Bangladesh from December 2020 to May 2021. Children under 5 years of age admitted with severe pneumonia. One Hundred Fifty included, Due to time limitation collection of this huge amount of sample was not possible within 6 months period. So the total number patients admitted in hospital in this period were included in this study.

Inclusion Criteria

1. Children under 5 years of age who was admitted with the diagnosis of severe pneumonia according to WHO criteria.

Exclusion Criteria

1. Co-morbidities like chronic respiratory disease or meningitis.
2. Those with the history of admission in another hospital prior to presentation.
3. Those who will develop various complications during treatment like pneumothorax or pleural effusion.

Procedures of collecting data

Data was collected from the legal guardians by interview and by physical examination of the child and from investigation reports. The number of people staying together and the number of available rooms in the house was recorded. Overcrowding was determined by calculating number of family members per room. A child who was not found to be in the following norm: 1 room 2 persons, 2 rooms 3 persons, 3 rooms 5 persons, 4 rooms 7 persons, 5 or more rooms 10 persons (additional 2 for each further room) was labeled as staying in overcrowded house [13]. Immunization status was assessed by verifying the immunization records or asking parents. An infant who received only breast feeding till age of 6 months was considered to be exclusively breast fed. The treatment given and progress notes were recorded daily including any change of antibiotics. Day of discharge or death was recorded. Hospital stay was considered prolong if it is more than 5 days as according to WHO guideline severe pneumonia usually needs three to five days hospital treatment. The antibiotics were changed if the patient did not improve after 48 hours of initiation of treatment or deteriorated in form of increasing chest in drawing or worsening

hypoxemia. Mechanical ventilation was indicated if the child had respiratory failure or had impending respiratory failure.

Procedure of data analysis

Statistical analyses were carried out by using the Statistical Package for Social Sciences version 16.0 for Windows (SPSS Inc., Chicago, Illinois, USA). The mean values were calculated for continuous variables. The quantitative observations were indicated by frequencies and percentages. Chi-Square test was used to analyze the categorical variables, shown with cross tabulation. Unpaired t-test was used for continuous variables. P values <0.05 was considered as statistically significant.

III RESULTS

Table-1: Distribution of the study patients by age (n=150)

Age (months)	Number of patients	Percentage
≤12	102	68.0
13-24	46	30.7
>24	2	1.3
Mean±SD	9.49	±6.83
Range (min, max)	(2	,36)

Table 1 shows age distribution of the study patients. It was observed that majority 102(68.0%) patients belonged to age ≤12 months. The mean age was found 9.49±6.83 months with range from 2 months to 36 months. Pie chart shows sex distribution of the study patients. It was observed that more than two third (66.7%) patients were male and 50(33.3%) were female. Male to female ratio was 2:1. It was observed that almost two third (62.7%) patients duration of hospital stay >5 days (Fig-1). The mean duration of hospital stay was 7.09±3.00 days. It was observed that 68(45.3%) patients live in an overcrowded environment at home. Regarding smoking by family member it was observed that more than two third (66.7%) of the patients family member was smoker and 50(33.0%) was nonsmoker. Exclusive breast feeding of the study patients. It was observed that at least half (50.7%) of the patients got exclusive breast feeding.

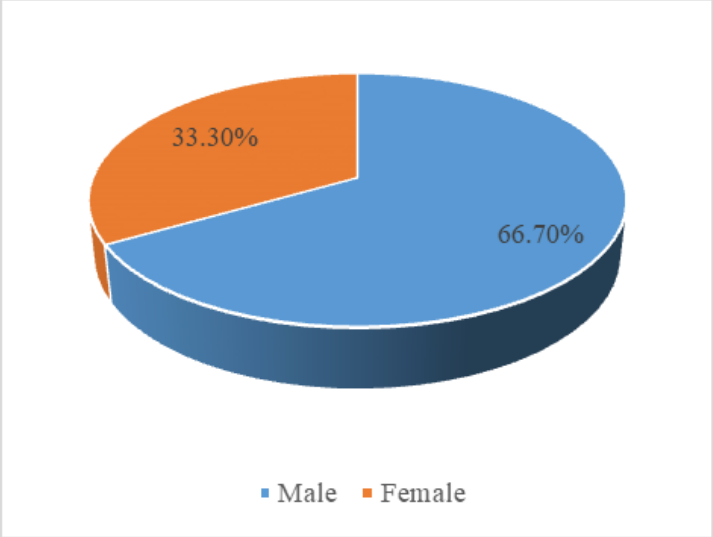

Fig-1: Distribution of the study patients by sex (n=150)

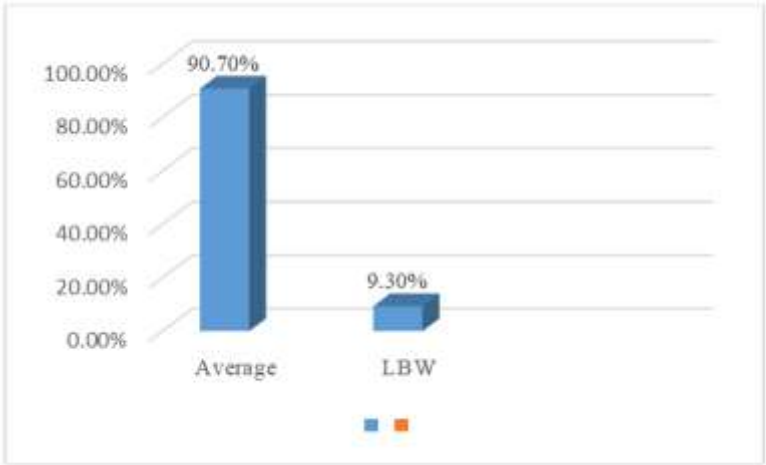

Fig-2: Distribution of the study patients by birth weight (n=150)

Shows birth weight of the study patients. It was observed that majority 136(90.7%) patients had average birth weight and 14(9.3%) had low birth weight (Fig-2).

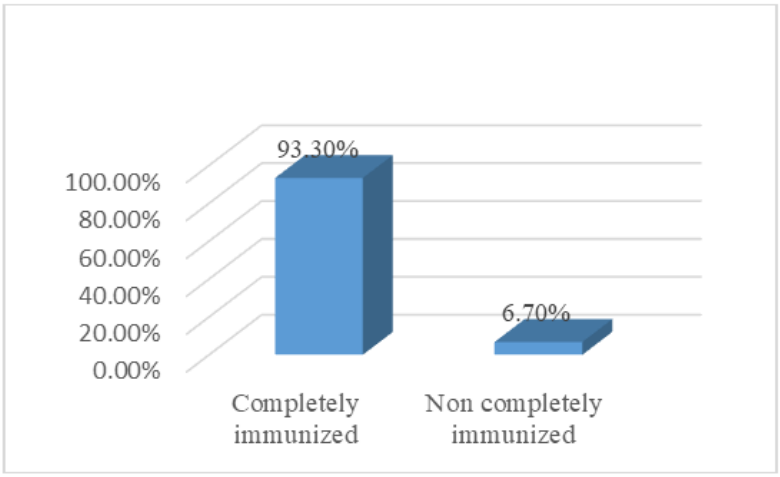

Fig-3: Distribution of the study patients by immunization (n=150)

Shows immunization status of the study patients. It was observed that 140(93.3%) patients were completely immunized upto age and 10(6.7%) were not completely immunized (Fig-3).

Table 2: Distribution of the study patients by clinical evaluation (n=150)

Clinical evaluation	Number of patients	centage
Altered sensorium	16	10.7
Head nodding	94	62.7
Cyanosis	24	16.0
Hypoxemia (SPO_2 <90%)	22	14.7

Table 2 shows clinical evaluation of the study patients. It was observed that 16(10.7%) patients had altered sensorium, 94(62.7%) had head nodding, 24(16.0%) had cysnosis, 22(14.7%) patients presented with SPO_2 <90%.

Table 3: Distribution of the study patients by association of different factors with prolong hospital stay (n=150)

Factors	Prolong Hospital stay (>5days)				
	Yes (n=94)		No (n=56)		P-value
	n	%	n	%	
Over Crowding	50	53.2	18	32.1	[a]0.012[s]
Mothers age (years)					
≤20	16	17.0	10	17.9	
21-25	42	44.7	28	50.0	
26-30	34	36.2	14	25.0	
>30	2	2.1	4	7.1	
Mean±SD	24.51	±3.76	24.93	±4.82	[b]0.562[ns]
Range (min,max)	18	,35	19	,40	
Mothers education					
Cannot read & write	22	23.4	12	21.4	
Can only read & write	36	38.3	14	25	
upto class five	18	19.1	14	25	[a]0.283[ns]
Upto class eight	8	8.5	10	17.9	
SSC & more	10	10.6	6	10.7	
Smoking by family member	68	72.3	32	57.1	[a]0.056[ns]
Exclusive breast feeding	31	33.0	45	80.4	[a]0.001[s]
Low birth weight	12	12.8	2	3.6	[a]0.061[ns]
Incomplete Immunization	8	8.5	2	3.6	[a]0.205[ns]
Altered sensorium	13	13.8	3	5.4	[a]0.103[ns]
Head nodding	78	83.0	16	28.6	[a]0.001[s]
Cyanosis	14	14.9	10	17.9	[a]0.632[ns]
Hypoxemia (SPO_2 <90%)	12	12.8	10	17.9	[a]0.393[ns]
Anaemia	14	14.9	10	17.9	[a]0.632[ns]
Leukocytosis	54	57.4	12	21.4	[a]0.001[s]
Positive CRP	62	66.0	40	71.4	[a]0.487[ns]
Positive blood C/S	18	19.1	2	3.6	[a]0006[s]
Abnormal CXR	78	83.0	30	53.6	[a]0.001[s]

s=significant; ns=not significant

[a]P value reached from chi square test

[b]P value reached from unpaired t-test

Regarding study of association of different factors with prolong hospital stay it was observed that patients who needed prolong hospital stay 53.2% of them live in a overcrowded environment and 32.1% patients live in a overcrowded environment who didn`t need prolong hospital stay. 33.0% patients were exclusively breast feeded of those needed prolong hospital stay and 80.4% among those who didn`t need prolong hospital stay. 83% presented with head nodding among those who needed prolong hospital stay, on the other hand, 28.6% with presented with head nodding those who didn`t need prolong hospital stay. Leukocytosis was found 57.4% and 21.4% among patients those who needed prolong hospital stay and not needed prolong hospital stay respectively. In patients who needed prolong hospital stay, positive blood culture was found in 19.1% cases and it was only 3.6% among patients who didn`t need prolong hospital stay. Radiological abnormality was found in 83% of patients who needed prolong hospital stay and 53.6% in patients who didn`t need prolong hospital stay. Statistically significant ($p<0.05$) factors associated with two groups of patients those who needed prolong hospital stay and those who didn`t need are overcrowding, exclusive breast feeding, head nodding on presentation, leukocytosis, positive blood culture and abnormal CXR (Table-3).

Table 4: Distribution of the study patients by Investigation (n=150)

Investigation	Number of patients	centage
Haemoglobin (gm/dl)		
Low (<9.5)	24	16.0
Normal (9.5-14)	126	84.0
Total leukocyte count		
Normal (4500-11000/cmm)	84	56.0
High (>11000/cmm)	66	44.0
CRP		
Normal (≤6 mg/L)	48	32.0
High (>6 mg/L)	102	68.0
Blood C/S		
Positive	20	13.3
Negative	130	86.7
Radiological Findings		
Normal CXR	42	28.0
Abnormal CXR	108	72.0
Change Of Antibiotics		
Yes	98	65.3
No	52	34.7
Mechanical Ventilation		
Needed Mechanical Ventilation	30	20.0
Not Mechanical Ventilation	120	80.0
Treatment Outcome		
Improved	132	88.0
Died	18	12.0

Table 4 shows investigation results of the study patients. It was observed that 126(84.0%) patients had normal haemoglobin level, normal total leukocyte count was found in 84(56.0%) patients, normal CRP level was found in 48(32.0%) patients. Blood culture status of the study patients. It was observed that organism was found in 20(13.3%) patients. There was no growth in blood culture in 130(86.7%) patients. Radiological findings of the study patients. It was observed that normal CXR was found in 42(28.0%) patients and abnormal CXR was found in 108(72.0%). Antibiotic change was needed in 98(65.3%) and not needed in 52(34.7%) patients. 30(20.0%) patients needed mechanical ventilation (MV) during course of treatment and 132(88.0%) patients were improved and 18(12.0%) patients died.

IV DISCUSSION

This prospective observational cohort study was carried out with an aim to find out the factors upon which the need of change of antibiotics or prolong hospital stay depends, in children hospitalized with severe pneumonia and to identify the factors that can be the predictors of mortality or probable need of mechanical ventilation. A total of 150 children under 5 years of age admitted with severe pneumonia according to WHO criteria were included in this study. Pneumonia is responsible for about 19% of all deaths in children aged less than 5 years, of which more than 70% take place in sub-Saharan Africa and south-east Asia. Although based on limited available evidence, recent studies have identified *Streptococcus pneumoniae*, *Haemophilus influenzae* and respiratory syncytial virus as the main pathogens associated with childhood pneumonia [9]. Community-acquired pneumonia (CAP) remains a common and serious condition worldwide. The mortality from severe CAP remains high, and this has reached 50% in some series. Lee *et al*., [10] conducted a study to determine the mortality and predictors that contribute to in-hospital mortality for patients who exhibit CAP and acute respiratory failure that requires mechanical ventilation. The present study findings were discussed and compared with previously published relevant studies. In this present study it was observed that more than two third (68.0%) of the patients belonged to age ≤12 months and the mean age was found 9.49±6.83 months with range from 2 months to 36 months. Similarly, Tiewsoh *et al*., [4] showed that mean age of the children with severe pneumonia was 11.74±2.44 months and among them 71.5% infants were less than 12 months of age, Uddin *et al*., [11] found in their study that 2-6 months old infants were 62.5% and rest 37.5% age belonged to >6 -12 months. Ramachandran *et al*., [12] mentioned in their study that majority (48.0%)

of the children were in the age group 1-6 months and Andersson and Olomi [13] found the mean age was 11 months, which are comparable with the current study. In this current study it was observed that more than two third (66.7%) of the patients were male and 33.3% were female. Male to female ratio was 2:1, which indicates that severe pneumonia is predominant in male subjects. Uddin *et al*., [11] found out of 192 children, 70.8% and 29.2% were male and female respectively. Similar observations regarding the male predominant in severe pneumonia were also made by Ramachandran *et al*., [12], Andersson & Olomi[13] and Tiewsoh *et al*., [4], which are closely resembled agrees with the present study. In this series it was observed that duration of hospital stay was >5 days in almost two third (62.7%) of the patients and the mean duration of hospital stay was 7.09±3.00 days varied from 1 – 13 days, which is consistent with Tiewsoh *et al*., [4] study, where the investigators found that 51.0% stayed for more than 5 days in the hospital. In this current study it was observed that 46.7% infants' mother belong to 21-25 years age group and the mean age of the mothers was 24.67±4.19 years varied from 18 – 40 years. Uddin et al.[11] found the maternal age under 18 years 5.7% and more than 18 years 94.3%.In this series it was observed that most of the mother had no institutional background, where 22.7% mother cannot read and write at all and 33.3% mother can only read and write and rest of other had poor level of formal education. Academic status of mother below secondary school certificate level was 84.4% & above Secondary School Certificate level was 15.5 % observed by Uddin et al.[11] in their study. In this present study it was observed that more than two third (66.7%) of the family member of the patients were smoker and 33.0% nonsmoker. Uddin *et al*., [11] showed that smoking in bedroom was 66.7% of cases, which is closely resembled, with the present study. In this current study it was observed that at least half (50.7%) of the patients got exclusive breast feeding. Uddin *et al.*, [11] and Tiewsoh *et al*., [4] showed 40.1% and 59.5% infants were on exclusive breast feeding respectively. In this current study it was observed that majority (90.7%) patients had average birth weight and 9.3% had low birth weight. Similarly, Uddin *et al*., [11] found 93.0% average birth weight and 7.0% had low birth weight. In this series it was it was observed that most (93.3%) of the patients were completely immunized upto age and 6.7% were not completely immunized. Uddin *et al*., [11] found in their study that 63.0% were completely immunized and 37.0% were non immunized /incompletely immunized, which is comparable with the current study. Regarding the clinical evaluation it was observed in this present study that 10.7% patients had altered sensorium, 62.7% head nodding, 16.0% cysnosis, 14.7% presented with SPO_2 <90%. In another study, Andersson and Olomi[13] found cyanosis 3.0% in their study, which is a little lesser with the current study. In this current study it was observed that most (84.0%) of the patients had normal haemoglobin level, normal total leukocyte count was found in 56.0%, normal CRP level was found in 32.0% of the patients. Positive blood culture was found in 13.3% and there was no growth in blood culture in 86.7% of the patients. Almost similar findings obtained by Andersson & Olomi *et al*., [13] and Tiewsoh *et al*., [4]. In this present study it was observed that normal CXR was found in 28.0% and abnormal CXR was found in 72.0% of the patients. Almost similar mortality was also found by Andersson and Olomi *et al*., [13], where it was 7.1% of their study. In another study, Radiological abnormality was found in 83% of patients who needed prolong hospital stay and 53.6% in patients who didn`t need prolong hospital stay. Overcrowding, head nodding on presentation, leukocytosis, positive blood culture and abnormal CXR were significantly ($p<0.05$) higher in patients with prolong hospital stay and exclusive breast feeding significantly ($p<0.05$) higher who didn't need prolong hospital stay, which indicates that the above factors are significantly associated with prolong hospital stay, but other factors like Mothers age, Mothers education, Smoking by family member, Low birth weight, Incomplete Immunization, Altered sensorium, Cyanosis, Hypoxemia (SPO_2 <90%), anaemia and Positive CRP were almost similar. Tiewsoh et al[4] mentioned in their study that factors associated with prolonged hospital stay included overcrowding at home [RR (95%CI) - 2.59 (1.78–3.23)], lack of exclusive breastfeeding [RR (95%CI) - 2.56 (2.0– 2.93)] and an abnormal chest radiograph [RR (95%CI) - 2.99 (1.65–4.38)] on multivariate analysis, which is consistent with the present study. In this current study it was observed that antibiotic change was needed in 65.3% and not needed in 34.7% of the patients. Similarly, Tiewsoh *et al*., [4] showed that 56.5% needed a change in antibiotics, which is consistent with the present study. In another study, Andersson and Olomi [13] reported in their study that a second-line treatment with antibiotics was given in 27.8% cases; single treatment with parenteral ceftriaxone was most common, followed by parenteral cloxacilline, 2.0% patients were given a third-line of parenteral antibiotics, 4.3% patients were treated with oral antibiotics only, all received amoxycilline. In this series it was observed that 20.0% patients needed mechanical ventilation during course of treatment, which is similar with Tiewsoh *et al*., [4] where they found 20.5% needed mechanical ventilation. In this

present study it was observed that most (88.0%) of the patients were improved and 12.0% expired. Simialrly, Uddin *et al*., [11] and Tiewsoh *et al*., [4] found died 10.5% and 10.5% in their respective studies.

V CONCLUSION

In conclusion to identify the Clinical profile and outcome of children hospitalized with severe pneumonia. Lack of exclusive breast feeding, overcrowding, head nodding on presentation, leukocytosis, positive blood culture, abnormal CXR and exclusive breast feeding were significantly that may reduce their hospital stay. Additional Clinical profile and mortality were anaemia, leukocytosis and positive CRP. So, patients presenting with these factors should preferably be admitted in a paediatric intensive care unit for close monitoring and management that could reduce their mortality.

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