Discharge Outcome and Associated Factors of Severe Pneumonia among Pediatric Patients Admitted to Jimma Medical Center: One-Year Retrospective Study

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Abstract

Pneumonia kills children more than any other illness such as AIDS, Malaria and measles combined. More than 2 million children die from pneumonia each year accounting for almost 1 in 5 under-five deaths worldwide. This study was aimed to analyze death as discharge outcome and factors associated with the death as discharge outcome of severe pneumonia among pediatric patients admitted to JMC. A one-year retrospective study was conducted on the admitted pediatric patients with severe pneumonia from June 2017 to June 2018. The data was collected from medical records of patients and discharge log book using structured questionnaire having the same structure with medical records of patients and discharge log book. The nit data was entered to epi-data version 3.1 and imported to SPSS version 22. Descriptive statistics was conducted, Chi-square test was done to trace the significant association at the P-value < 0.05 and variables were presented using, frequencies and proportion and the result was presented using number, ratio, and tables.

From a total of 219 pediatric patients admitted in the past 1 year, 204 patients had both charts and log books included in the study. The male to female admission ratio was 1:8. A total 12 (5.88%) deaths had occurred at the hospital, with a significant associations with associated factors (p-value < 0.05); 189 (92.65%) were discharged with improvement and 3 (1.5%) self-discharge.

As a conclusion, death as discharge outcome was significantly associated with nutritional status, previous history of pneumonia, duration of hospital stay, duration of illness prior to admission and the presence of complication and other co-morbidities.

Keywords: *Severe Pneumonia; Pediatric Patients; Discharge Outcomes; Retrospective Study; Jimma Medical Centre*

Introduction

Pneumonia is an inflammation of the lung parenchyma mostly caused by microorganisms. However, there are also non-infectious causes for pneumonia such as aspiration of food or gastric acid, foreign bodies, hydrocarbons, and lipoid substances, hypersensitivity re-

Discharge Outcome and Associated Factors of Severe Pneumonia among Pediatric Patients Admitted to Jimma Medical Center: One-Year Retrospective Study

54

actions and drug or radiation. Pneumonia could be community acquired (CAP) as a previously healthy child acquired an infection outside a hospital, and hospital acquired (HAP) as an infection acquired in the Hospital by previously healthy child. The etiology of pneumonia is not well understood because direct culture of lung tissue is invasive and rarely performed unless in children with complicated CAP. Age appears to be a good predictor of etiology [1,2,5,7].

Identifying the etiology of pneumonia among children is important and can help in prioritization of the interventions, such as in the development of specific vaccines and to treat the disease empirically [6]. Low yield of blood cultures, the difficulty to acquire adequate sputum specimens and the reluctance to perform lung aspiration and broncho-alveolar lavage in children make the identification exact etiology of pneumonia difficult among children. Furthermore, differences between studies regarding in the season, setting, age of the children, prior hospital admission history of the children, and local criteria for diagnosis makes it difficult to apply results in published studies to other populations [3,4,8,9].

Pneumonia becomes a major cause of morbidity, mortality in children (particularly among children < 5 year of age) and an increased health care costs both in the developed as well as developing nations [1,3,19]. Globally, pneumonia is among the four major killers, (pneumonia, diarrheal diseases, preterm birth complications, and birth asphyxia), of under-five children and it remains the leading cause of mortality in children on these age groups as it causes the estimated 6.9 million under-five child deaths per year globally, pneumonia accounts for 1.3 to 1.6 million (roughly 18%) deaths [9,15]. In developing nations, there was an estimated 146 - 159 million new episodes of pneumonia per year and causes approximately 4 million deaths among children worldwide [1,3,5,7].

Bacteria, virus, fungi and parasite can cause pneumonia and the extent of pulmonary involvement, the onset, pattern and duration of symptoms as well as the mortality rate depends on both the causative agent and precipitating factors [8,9,11,16-18].

Streptococcus pneumonia, Homophiles influenza, and staphylococcus aurous could be taken as common causative agents for hospitalization and death from pneumonia among children in developing countries [2,24], and the clinical features and patterns, etiology and outcome of treatment of severe pneumonia with respect to age and associated co-morbidity like malnutrition, and HIV co-infection are considered among the commonly identified precipitating factors. Management of children with pneumonia is based on their anticipated risk of poor outcome [9,12-15].

In Ethiopia, as one of developing countries, severe pneumonia remains to be a public health concern and considerable socio-economic burden. Studies conducted Tikur Anbessa Specialized Hospital (TASH) Addis Ababa and Jimma Medical Centre (JMC) revealed the severe pneumonia as the leading cause of admission and death of children in Ethiopia [3,4,10].

Acute lower respiratory infection (ALRI), such as pneumonia, bronchitis and bronchiolitis accounts for 20% of all deaths in under-five children and 90% of these deaths are due to severe pneumonia. In one-third of cases, the signs and symptoms of pneumonia such as rapid breathing and lower chest wall in drawing, wheezing and fever overlaps with that of bronchiolitis (which is caused by respiratory syncytial viruses RSV's and occurs predominantly in the first year of life with decreasing frequency in the second and third years) makes the early diagnosis of pneumonia in children [8,9,20-23], though, an early recognition and prompt treatment of pneumonia is life saving [6].

In many low-income and middle-income countries hospital admission is recommended when a child crosses the threshold from a non-severe to a severe pneumonia classification according to revised WHO 2013 definitions. Hospital care should allow for prompt identification of signs of clinical deterioration and timely intervention with appropriate investigations, treatment, and supportive care including oxygen, fluids, and feeds. Children admitted to hospital could also benefit from expert review that can detect other causes of illness such as heart disease, which might be misdiagnosed as pneumonia by junior clinicians [8,9,17-19].

Aim of the Study

This study was aimed to analyze the pattern and outcomes of treatment of severe pneumonia, to identify the common factors that affect the treatment outcome, to examine the epidemiological evidence on the burden and distribution of pneumonia, and to assess the current levels of treatment and prevention.

Discharge Outcome and Associated Factors of Severe Pneumonia among Pediatric Patients Admitted to Jimma Medical Center: One-Year Retrospective Study

55

Materials and Methods

A one-year retrospective study was conducted at JMC from August 13 - 27, 2018. All patients who were admitted with a diagnosis of severe pneumonia one year prior to study period were considered as the study participants and all the data found on charts of was used to study the past one year prevalence of severe pneumonia. The total number of admission with the diagnosis of severe pneumonia was 219. Children with diagnosis of severe pneumonia according to Revised WHO criteria and who were in the age group of 3 months to 13 years were included in the study and those with diagnosis of pneumonia other than severe pneumonia, in age group below 3 months and above 13 years and those cards with incomplete information's were excluded from this study. The discharge outcome of severe pneumonia were considered as the study outcome variable and the age, sex, housing condition, sero-status, prior history of pneumonia, smoker in the house, pattern of pneumonia (complication), immunization status of the children were the independent variables.

A data abstraction tool, having the same structure with medical records of patients and discharge log book, was used to collect data. The tool was comprised of components such as patient background information, sero-status, and immunization status of children, age, and sex, prior history of pneumonia, family background history and diagnosis made. Three nurses recruited for data collection. Overall data collection processes were supervised by 1 service provision trained clinician using structured questionnaire. The collected data was cleaned for inconsistency and incompleteness. The nit data was entered to epi-data version 3.1 and imported to SPSS version 22. Descriptive statistics was conducted and variables were presented using, frequencies and proportion and the result was presented using number, ratio, and tables.

Ethical consideration

Research protocol was submitted to IRB and got ethical approval. Research permission was obtained from JMC. Confidentiality of patient information was maintained though use of codes, where name and personal identifiers of patients were not recorded. Paper based data were kept in a locked cabinet and computer based data were secured with passwords. Except the research team member, anyone couldn't access patient data.

Results

A total of 219 patients with severe pneumonia diagnosis were retrieved from the patient log book during the specified study period. Two hundred-and-four (93.2% response rate) out of 209 patients had both charts and log books and included in this study. Regarding the age grouping, 114 (55.9%) out of 204 patients were between age group 3 months to 1year and 78 (38.2%) were between the age group 1 year to 5 years. With regards sex distributions of study participants, 132 (64.7%) out of 204 patients were males and 72 (35.3%) were females with male to female ratio of 1:8 (Table 1).

In the past year (June 2017 - 2018, severe pneumonia was found to be the leading cause of admission at pediatric ward of JMC with the 219 (43.2%) out of a total admission was severe pneumonia. With regards to discharge outcomes, 12 (5.9%) out of 204 patients, were died at the hospital, 189 (92.6%) were discharged with improvement and 3 (1.5%) were self-discharge. Out of 12 patients died at hospital, 3 (25%) were females and 9 (75%) were males, but there was no significant association between sex and death as discharge outcome (P = 0.314). Nine (75%) out of 12 deaths occurred in the hospital, were in age group between 3 months and 1 year and 3 (25%) were in 1 year and 5 years, but again there was no significant association between age and death as discharge outcome (P = 0.324) (Table 2).

Discharge Outcome and Associated Factors of Severe Pneumonia among Pediatric Patients Admitted to Jimma Medical Center: One-Year Retrospective Study

56

Characteristics		Frequency	Percentage (%)
Age	3 months - 1 year	114	55.9
	1 - 5 years	78	38.2
	5 - 10 years	9	4.4
	10 - 13 years	3	1.5
Sex	Male	132	64.7
	Female	72	35.3

Table 1: *Age and sex distribution of patients with severe pneumonia at JMC from June 2017 to June 2018.*

Characteristics		Discharge outcome			Association	
		Died	**Improved**	**Self discharge**	**Chi square**	**P value**
Age	3 - 12 months	9 (7.9%)	106 (92.1%)	0	6.8	0.324
	1 - 5 years	3 (3.8%)	71 (92.3%)	3 (3.8%)		
	5 - 10 years	0	8 (100%)	0		
	10 - 14 years	0	4 (100%)	0		
Sex	Male	3 (4.2%)	69 (95.8%)	0	2.3	0.314
	Female	9 (6.8%)	120 (90.9)	3 (2.3%)		
Total		12 (5.9%)	189 (92.5%)	3 (1.5%)		

Table 2: *Age and sex distributions of discharge outcome of pediatric patients admitted with severe pneumonia at JMC from June 2017 to June 2018.*

Associated factors			Discharge Outcomes			Total	Association	
			Died	**Improved**	**Self discharge**		**Chi square**	**P value**
Duration of illness prior to hospital admission	<48hours		0 (0.00%)	82 (40.2%)	0 (0.00%)	82 (40.2%)	29.6	0.000
	>48 hours	48-72 hours	1 (0.49%)	73 (35.78%)	3 (1.47%)	122 (59.80%)		
		>72 hrs	11 (5.39%)	34 (16.67%)	0 (0.00%)			
Total			12 (5.88%)	189 (92.65%)	3 (1.47%)	204 (100%)		
Nutritional status Non malnourished	Malnourished		11 (5.39%)	13 (6.37%)	0 (0.00%)	24 (11.76%)	95.7	0.000
	1 (0.49%)		176 (86.27%)	3 (1.47%)	180 (88.23%)			
Total			12 (5.88%)	189 (92.65%)	3 (1.47%)	204 (100%)		
Duration of Hospital stay	<48hours		6 (2.94%)	90 (44.11%)	0 (0.00%)	96 (47.06%)	14.9	0.005
	>48hours	48-72hours	0 (0.00%)	54 (26.47%)	0 (0.00%)	108 (52.94%)		
		>72hours	6 (2.94%)	45 (22.06%)	3 (1.47%)			
Total			12 (5.88%)	189 (92.65%)	3 (1.47%)	204 (100%)		
Sero-status Non reactive	Reactive		3 (1.47%)	1 (0.49%)	1 (0.49%)	5 (2.45%)	0.003	0.803
	9 (4.41%)		188 (92.16%)	2 (0.98%)	199 (97.55%)			
Total			12 (5.88%)	189 (92.65%)	3 (1.47%)	204 (100%)		

Discharge Outcome and Associated Factors of Severe Pneumonia among Pediatric Patients Admitted to Jimma Medical Center: One-Year Retrospective Study

57

Immunization	Fully vaccinated	1 (0.49%)	65 (31.86%)	0 (0.00%)	66 (32.35%)	18.85	0.003
Partially vaccinated		8 (3.92%)	40 (19.61%)	3 (1.47%)	51 (25.00%)		
Vaccinated for age		0 (0.00%)	75 (36.76%)	0 (0.00%)	75 (36.76%)		
Not vaccinated		3 (1.47%)	9 (4.41%)	0 (0.00%)	12 (5.88%)		
Total		12 (5.88%)	189 (92.65%)	3 (1.47%)	204 (100%)		
Previous hx of pneumonia	Yes	5 (2.45%)	36 (17.65%)	1 (0.49%)	42 (20.59%)	0.025	7.401
No		7 (3.43%)	153 (75.00%)	2 (0.98%)	162 (79.41%)		
Total		12 (5.88%)	189 (92.65%)	3 (1.47%)	204 (100%)		
Pattern of severe pneumonia	Non-complicated	4 (1.96%)	184 (90.19%)	1 (0.49%)	189 (92.65%)	91.7	0.002
Complicated		8 (3.92%)	5 (2.45%)	2 (0.98%)	15 (7.35%)		
Total		12 (5.88%)	189 (92.65%)	3 (1.47%)	204 (100%)		

Table 3: *Discharge outcome and associated factors of severe pneumonia among pediatric patients admitted with severe pneumonia at JMC from June 2017 to June 2018.*

Regarding the hospital admission, 82 (40.2%) out of 204 patients presented in less than 48 hours after the onset of the illness and the rest of 122 (59.8%) presented after 48 hours of the onset of illness. Eleven (91.7%) out of 12 deaths occurred in the hospital were in those children admitted 48 hours after the onset of the illness and thus, the duration of illness prior to hospital admission has significant association with the death as discharge outcome (P = 0.043) (Table 3).

Concerning the nutritional status, 24 (11.76%) out of 204 children were malnourished and from a total of 12 deaths 11 (91.7%) occurred among malnourished, and a significant association was observed between the death as discharge outcome and severe acute malnutrition (p value = 0.000).

With regard to hospital stay, the maximum duration for hospital stay was 34 days and the minimum was 16 hours. The mean duration of hospital stay was 4 days for those patients discharged with improvement. Out of 12 patients died at hospital, half died before 48 hours after admission and the rest half died after 72 hours after admission, and a significant association was observed between the death as discharge outcome and length of hospital stay (p value = 0.005) (Table 3).

Concerning the sero-status, 199 (97.55%) out of 204 patients, were with non reactive sero-status and the rest 5 (2.45%) were with reactive sero-status, and no significant association was existed between death as discharge outcome and sero-status of the patient (p-value = 0.803). Regarding immunization status, 75(36.80%) out of 204 patients were vaccinated for age, 66 (32.40%) were fully vaccinated, 51 (25.00%) were partially vaccinated and 12 (5.88%) were not vaccinated at all. Out of 12 patients died at hospital, 8 (66.7%) of death occurred in those who are partially vaccinated, 3 (25%) of death occur in those who were not vaccinated at all and the rest 1 (8.3%) occur from those who were fully vaccinated, and strong association was derived between immunization and death as discharge outcome (p = 0.03) (Table 3).

Discharge Outcome and Associated Factors of Severe Pneumonia among Pediatric Patients Admitted to Jimma Medical Center: One-Year Retrospective Study

58

With regard to prior admission history, 42 (20.6%) out of 204 admission, had previous admission and 5 (41.7%) of death occur in those children who had previous history of pneumonia, and a significant association was existed between death as discharge outcome and previous history of pneumonia (p = 0.025) (Table 3).

Concerning the pattern of pneumonia, 15 (7.4%) out of 204 patients with severe pneumonia, were with complicated pneumonia and 8 (66.7%) out of 15 patients with complicated pneumonia were died at hospital. There was a significant association between complicated pneumonia and outcome (p = 0.00) (Table 3).

Regarding housing condition, 48 (23.53%) children were with smoker in the house, 90 (44.12%) were with kitchen in the main house and 44 (23.06%) were in the house with non-functional windows, and a significant association was existed between death as discharge outcome and housing condition of the study participants (p-value < 0.05) (Table 4).

		Discharge outcome					
		Died	**Improved**	**Self-discharge**	**Total**	**p-value**	**Chi-square**
Smoker in the house	Yes	5 (2.45%)	43 (21.08%)	0 (0.00%)	48 (23.53%)	0.016	12.234
	No	4 (1.96%)	131 (64.22%)	3 (1.47%)	138 (67.65%)		
	Unknown	3 (1.47%)	15 (7.35%)	0 (0.00%)	18 (8.82%)		
Total		12 (5.88%)	189 (92.65%)	3 (1.47%)	204 (100%)		
Presence of Kitchen	Separate	0 (0.00%)	98 (48.03%)	1 (0.47%)	99 (48.53%)	0.001	18.484
	In the main house	9 (4.41%)	79 (38.73%)	2 (0.98%)	90 (44.12%)		
	Unknown	3 (1.47%)	12 (5.88%)	0 (0.00%)	15 (7.35%)		
Total		12 (5.88%)	189 (92.65%)	3 (1.47%)	204 (100%)		
Number of functional windows 1-2 windows >2 Windows	None	8 (3.92%)	37 (18.14%)	3 (1.47%)	48 (23.53%)	0.000	85.7
	2 (0.98%)	151 (74.02%)	0 (0.00%)	153 (75.00%)			
	2 (0.98%)	1 (0.47%)	0 (0.00%)	3 (1.47%)			
Total		12 (5.88%)	189 (92.65%)	3 (1.47%)	204 (100%)		

Table 4: Discharge out-come of severe pneumonia and housing conditions among pediatric patients admitted with severe pneumonia at JMC from JUN 2017 to JUN 2018.

Regarding co-morbidity, 63 (30.9%) of study participants were with related co-morbidities. Out of which rickets, 27 (42.9%), took the leading position followed by SAM 24 (38.1%) of the admitted cases. SAM, rickets, measles and HIV/AIDS were the causes for death of 5 (41.7%) out of 12 patients died at hospital; and SAM, cardiac illness, Down syndrome and rickets were considered as the causes for death of 3 (25%) out of 12 patients died at hospital. There is a significant association between related co-morbidities and death as discharge outcomes (p = 0.000) (Table 5).

One-hundred-and-twenty (58.80%) out of total study participants were fed orally and the rest 84(41.20%) fed by NGT.

With regards to drugs administered to hospital admitted study participants, 140 (68.60%) were treated with Ceftriaxone and the rest 64(31.40%) patients were treated with Crystalline penicillin.

Discharge Outcome and Associated Factors of Severe Pneumonia among Pediatric Patients Admitted to Jimma Medical Center: One-Year Retrospective Study

59

Related co morbidities	Discharge outcome				Association	
	Died	**Improved**	**Self-discharge**	**Total**	**Chi-square**	**p-value**
Cardiac illness	0 (0.00%)	9 (4.41%)	0 (0.00%)	9 (4.41%)	263.7	0.000
SAM	1 (0.47%)	11 (5.39%)	0 (0.00%)	12 (5.88%)		
Rickets	0 (0.00%)	18 (8.82%)	0 (0.00%)	18 (8.82%)		
SAM, Rickets, measles and HIV/AIDS	5 (2.45%)	1 (0.47%)	0 (0.00%)	6 (2.94%)		
Cardiac illness, SAM, down syndrome and rickets	3 (1.47%)	0 (0.00%)	0 (0.00%)	3 (1.47%)		
SAM and TB	1 (0.47%)	1 (0.47%)	1 (0.47%)	3 (1.47%)		
Other	1 (0.47%)	9 (4.41%)	2 (0.98%)	12 (5.88%)		
No-co-morbidity	1 (0.47%)	140 (68.63%)	0 (0.00%)	141 (69.11%)		
Total	12 (5.88%)	189 (92.65%)	3 (1.47%)	204 (100%)		

Table 5: *Discharge outcome of severe pneumonia and associated co-morbidities among pediatric patients with severe pneumonia admitted at JMC from June 2017 to June 2018.*

Discussion

The minimum age at admission was 3 month for both sexes in the current study and it was comparable to the findings of similar studies done in Jimma University specialized and Tikur Anbessa Specialized hospitals, Ethiopia in the year 2008. Male to female ratio was found to be 1:8 with a male predominance over a female in the present study and it was again comparable with other study findings in Chiro Hospital, Ethiopia and Tikur Anbessa Specialized hospitals, Ethiopia [3,4].

Severe pneumonia was the leading cause of admission at pediatric ward of JMC in past 1 year and it was almost similar for other study findings in Chiro Hospital and Tikur Anbessa Specialized hospitals, Ethiopia and in similar study done previously at Jimma University specialized hospital, Ethiopia [3,4].

The death rate of severe pneumonia was 5.9 which were smaller than results from Chiro hospital, Ethiopia (8.7%), and Tikur Anbessa Specialized hospitals, Ethiopia (14.3%). The discrepancies in the death rate might be due to the improved service over the years (2008 versus 2018) or the small size of the study population or poor record keeping practice which might distort the information [3].

In the current study, the duration of illness prior to hospital admission has significant association with death as the discharge outcome, with 11 out of a total of 12 deaths occurred in cases brought to hospitals later than 48 hours. Only 1 out of 12 deaths occurred in children brought to the hospital less than 48 hours after the onset of illness since duration of illness was not included in the similar studies done so far and it was not possible to make comparison.

Duration of hospital stay among the children admitted with severe pneumonia was found to be significantly associated with the death as discharge outcome where half of the deaths occurred in cases stayed at the hospital for less than 48 hrs and the remaining half occurred

Discharge Outcome and Associated Factors of Severe Pneumonia among Pediatric Patients Admitted to Jimma Medical Center: One-Year Retrospective Study

60

in cases stayed above 48 hours in the hospital. This finding was different from the findings from similar study done in Tikur Anbessa Specialized hospital, Ethiopia where less death rate (28 (34.1%)) deaths occurred within 48 hours of hospital stay and 54 (69.4%) died within the next 48 to 96 hours of hospital stay [3,4]. The discrepancies may be due to large sample size in the study done at Tikur Anbessa Specialized hospitals, Ethiopia were majority of admitted cases developed the hospital acquired pneumonia.

From a total of 12 deaths, 11 (91.7%) deaths were occurred among malnourished children in the current study and again it was comparable to the finding in the previous study in the setup where from a total of 17 deaths, 11 deaths were occurred among malnourished [3,4].

Among those patients with severe pneumonia, 42 (20.6%) had previous admission and 15 (7.4%) had complicated pneumonia and since previous history of admission and pattern were not included in the similar studies done so far and it was not possible to make comparison.

The present study revealed that 32.4% cases were fully vaccinated, 25% were partially vaccinated and 5.88% were not vaccinated at all. This finding was far different from not similar study done at JMC in 2008 (52.34%, 39.25% and 8.41% respectively). This might be due to the lack of awareness towards immunization in the community.

Twenty-three point five percentage (23.5%) of the children had a person in the family who was a smoker and this was higher when compared to research done at JMC in 2008 (7.5%). The difference may be due to poor assessment of presence of smoker in the house [4]. In EDHS 2011, children's of smokers were greater than non-smokers to have symptoms of ALRI. Exposure to cigarette smoke increased risk of pneumonia in children less than 1 year according to the Este town study [7].

In this study, lack of separate kitchen was significantly associated with occurrence of pneumonia 90 (44.1%). Similar result was reported at study conducted in Este town Northwest Ethiopia where risk of acquiring pneumonia is higher among children from household in which cooking takes place at main-house and study conducted in Nigeria where indoor cooking smoke associated with childhood pneumonia and bronchiolitis. Furthermore, the finding agree with study conducted in Ndola, Zambia where significant association was observed between not having a separate room for cooking and occurrence of ALRI in under-five children Ndola, Zambia and study in Kenya in which cooking near the bed was significantly associated with occurrence of ALRI in under-five children [1,7,10,14]. In both cases risk of indoor air pollution is high which increase vulnerability of children to acquire ALRI including pneumonia.

Conclusion

Based on the results of the present study, the following conclusions were derived:

- Pneumonia was the leading cause of admission and death as discharge outcomes of severe pneumonia in the present study was much lower than continental data but comparable to national studies.

- Death as discharge outcome was significantly associated with nutritional status, previous history of pneumonia, duration of hospital stay, duration of illness prior to admission and the presence of complication and other co-morbidities.

Discharge Outcome and Associated Factors of Severe Pneumonia among Pediatric Patients Admitted to Jimma Medical Center: One-Year Retrospective Study

61

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Discharge Outcome and Associated Factors of Severe Pneumonia among Pediatric Patients Admitted to Jimma Medical Center: One-Year Retrospective Study

62

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