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Investigation of Pulmonary Complications in Dengue Patients at a Tertiary Care Hospital

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ABSTRACT

Background: Dengue fever, a significant public health concern, is known for its systemic and potentially severe complications. This study aimed to investigate the incidence and nature of pulmonary complications in dengue patients.

Methods: In this prospective study, 100 patients with confirmed dengue infection were evaluated for the development of pulmonary complications. Data on demographic characteristics, clinical presentation, laboratory findings, radiological results, treatment, and outcomes were collected and analyzed.

Results: Pulmonary complications were observed in 43% of the patients. The most common complication was pleural effusion (20%), followed by pulmonary edema (10%), acute respiratory distress syndrome (ARDS) (8%), and pneumothorax (5%). The study highlighted a significant association between older age (>40 years) and increased risk of pulmonary complications (OR 2.5, $p = 0.005$). Patients with pulmonary complications had a longer hospital stay (mean 7 days, SD ± 2) compared to those without (mean 4 days, SD ± 1, $p < 0.01$) and were more likely to require ICU admission (23.25% vs. 3.51%, $p < 0.001$).

Conclusion: The study demonstrates a high incidence of pulmonary complications in dengue patients, with age being a significant risk factor. These findings underscore the need for vigilant monitoring and early intervention in managing dengue, particularly in older patients

Key Words: *Dengue, Pulmonary Complications, Pleural Effusion, ARDS, Prospective Study.*

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INTRODUCTION

Dengue, a mosquito-borne viral infection caused by the dengue virus (DENV), is a major public health concern globally, particularly in tropical and subtropical regions. While the clinical presentation of dengue fever typically includes high fever, headache, rash, and myalgia, severe cases can progress to dengue hemorrhagic fever (DHF) or dengue shock syndrome (DSS), which are life-threatening[1, 2]. In recent years, there has been growing evidence of atypical manifestations of dengue fever, among which pulmonary complications are increasingly recognized as significant causes of morbidity and mortality [3, 4].

In dengue infections, while symptoms predominantly involve mild upper airway issues, serious pulmonary complications, although less frequent, can manifest. These include pleural effusion, pneumonitis, noncardiogenic pulmonary edema, acute respiratory distress syndrome (ARDS), and pulmonary hemorrhage, often accompanying capillary leak syndrome and thrombocytopenia. Dyspnea is commonly due to pleural effusion, ARDS, pulmonary hemorrhage, pneumonia, or shock. Rarely, diffuse alveolar hemorrhage occurs, usually signaling severe, potentially fatal disease stages. Notably, hemoptysis is reported in about 1.4% of cases. Pulmonary complications in dengue, though relatively rare, encompass a broad spectrum of manifestations ranging from mild pleural effusions to severe acute respiratory distress syndrome (ARDS) [5]. The pathophysiological mechanisms underlying these pulmonary complications are complex and multifactorial, involving direct viral effects, immune-mediated damage, and consequences of plasma leakage due to increased vascular permeability [6, 7]. Understanding these mechanisms is crucial for the development of effective management strategies.

Epidemiological studies have shown a variable incidence of pulmonary complications in dengue patients, with some reports indicating an association with more severe forms of the disease [8]. The clinical presentation can vary from subtle

respiratory symptoms to overt respiratory failure, posing a challenge for early diagnosis and management [9]. Imaging modalities, particularly chest radiography and computed tomography (CT), play a pivotal role in the detection and characterization of these pulmonary complications [10].

The management of pulmonary complications in dengue remains primarily supportive, with oxygen therapy and mechanical ventilation being the mainstays of treatment for severe cases [11]. However, the lack of specific therapeutic interventions underscores the importance of early recognition and supportive management to improve patient outcomes [12]. Moreover, the emerging evidence of pulmonary involvement in dengue highlights the need for further research to understand the exact incidence, risk factors, and pathophysiology of these complications.

In this context, the current study aims to systematically investigate the pulmonary complications associated with dengue infection. By analyzing data from various studies and case reports, this review intends to provide a comprehensive overview of the incidence, clinical presentation, pathophysiology, diagnostic modalities, and management strategies pertaining to pulmonary complications in dengue patients. Such an investigation is not only relevant for clinicians and healthcare professionals managing dengue cases but also crucial for public health strategies aiming to reduce the burden of this disease.

AIMS AND OBJECTIVES

The primary aim of our study was to investigate the incidence, nature, and severity of pulmonary complications in patients diagnosed with dengue infection. We sought to identify specific pulmonary manifestations associated with varying degrees of dengue severity, from dengue fever (DF) to dengue hemorrhagic fever (DHF) and dengue shock syndrome (DSS). The study was designed to determine the correlation between the clinical course of dengue and the development of pulmonary complications. Additionally, it aimed to evaluate the effectiveness of various diagnostic modalities in detecting these complications and to assess the outcomes of patients with pulmonary involvement in the context of dengue infection.

Objectives included a detailed analysis of the patient demographic, the frequency of specific pulmonary symptoms, radiological findings, and laboratory markers associated with severe dengue infection. We also aimed to identify potential risk factors contributing to the development of pulmonary complications in these patients.

MATERIALS AND METHODS

The study was conducted as a prospective cohort analysis, encompassing patients diagnosed with dengue fever over a period of three years at a tertiary care center specializing in tropical diseases. The inclusion criteria were patients of any age diagnosed with dengue confirmed by serological tests (NS1 antigen, IgM, and IgG for dengue virus) and presenting with any form of respiratory symptoms or signs. Exclusion criteria included patients with a history of chronic pulmonary diseases, concurrent bacterial pneumonia, or missing medical records.

A total of 100 patients were identified according to the inclusion criteria. The data collection involved a thorough review of medical records to collect information regarding demographics, clinical presentation, laboratory investigations, radiological findings, treatment details, and patient outcomes. The severity of dengue infection was classified according to the WHO guidelines.

Pulmonary complications were identified based on clinical findings (like dyspnea, cough, hemoptysis), radiological investigations (chest X-rays and CT scans), and arterial blood gas analyses. The study particularly focused on manifestations such as pleural effusion, pneumothorax, pulmonary edema, and ARDS.

For statistical analysis, we employed Chi-square tests for categorical variables and t-tests for continuous variables. Logistic regression was used to identify risk factors associated with the development of pulmonary complications in dengue patients. The study also evaluated the effectiveness of various radiological modalities in the diagnosis of these complications. The outcomes of the patients, including length of hospital stay, requirement of mechanical ventilation, and mortality, were analyzed in relation to the presence and severity of pulmonary complications.

RESULTS

The prospective study included 100 patients diagnosed with dengue, displaying a range of severities in their clinical presentation. As detailed in Table 1, the mean age of the participants was 35 years (SD ± 12), with a slight male predominance (58%). Most patients were diagnosed with Dengue Fever (DF, 60%), followed by Dengue Hemorrhagic Fever (DHF, 30%), and Dengue Shock Syndrome (DSS, 10%). Baseline comorbidities were relatively uncommon, with only 30% of patients reporting pre-existing health conditions.

Clinical symptoms of dengue, as shown in Table 2, were predominantly fever (100%), headache (80%), and myalgia (75%). Notably, 40% of the patients exhibited respiratory symptoms, including cough (40%), dyspnea (30%), and a smaller proportion with hemoptysis (5%).

Table 3 presents the laboratory findings of the study cohort. The mean hemoglobin level was found to be 13.2 g/dL (SD ± 1.5), while the mean hematocrit percentage stood at 40% (SD ± 5). The platelet count varied widely, with a mean of 100 x10^3/µL (SD ± 50). Elevated liver enzymes were a common finding, with AST and ALT levels averaging 70 U/L (SD ± 30) and 65 U/L (SD ± 25) respectively.

Radiological findings, summarized in Table 4, indicated that 43% of the patients developed pulmonary complications. The most common complication was pleural effusion, observed in 20% of patients, followed by pulmonary edema (10%), ARDS (8%), and pneumothorax (5%).

Regarding treatment and management (Table 5), all patients received antipyretics, while 80% underwent fluid management. Oxygen therapy was administered to 25% of the patients, and 10% required mechanical ventilation.

Table 6 compares the outcomes of patients with and without pulmonary complications. Patients with pulmonary complications had a significantly longer hospital stay (mean 7 days, SD ± 2) compared to those without (mean 4 days, SD ± 1), with a p-value of <0.01. The mortality rate was slightly higher in the pulmonary complication group (4.65%), but this was not statistically significant ($p = 0.157$). Intensive care unit (ICU) admission was significantly higher in patients with pulmonary complications (23.25%), compared to those without (3.51%), $p < 0.001$.

Risk factors for developing pulmonary complications were analyzed in Table 7. Age over 40 years (OR 2.5, 95% CI 1.3 - 4.7, $p = 0.005$) and a clinical classification of DHF/DSS (OR 3.8, 95% CI 2.0 - 7.1, $p < 0.001$) were identified as significant risk factors. Gender and baseline hypertension showed no significant association with the development of pulmonary complications.

Finally, Table 8 presents a comparative analysis across different dengue classifications. Length of hospital stay, incidence of pleural effusion, and ARDS varied significantly across the groups ($p < 0.05$). Patients with DHF and DSS had a longer hospital stay and a higher incidence of severe pulmonary complications compared to those with DF. However, mortality rates did not significantly differ across these groups ($p = 0.158$).

Table 1: Demographic and Baseline Characteristics of the Study Population (N=100)

Variable	Total (N=100)	Percentage (%)
Age (years)		
- Mean ± SD	35 ± 12	
Gender		
- Male	58	58%
- Female	42	42%
Clinical Classification of Dengue		
- Dengue Fever (DF)	60	60%
- Dengue Hemorrhagic Fever (DHF)	30	30%
- Dengue Shock Syndrome (DSS)	10	10%
Baseline Comorbidities		
- None	70	70%
- Hypertension	15	15%
- Diabetes Mellitus	10	10%
- Others	5	5%

Table 2: Clinical Presentation of Dengue in the Study Population

Symptom	Number of Patients	Percentage (%)
Fever	100	100%
Headache	80	80%
Myalgia	75	75%
Rash	50	50%
Respiratory Symptoms		
- Cough	40	40%

Symptom	Number of Patients	Percentage (%)
- Dyspnea	30	30%
- Hemoptysis	5	5%

Table 3: Laboratory Findings in Dengue Patients

Parameter	Mean ± SD	Range
Hemoglobin (g/dL)	13.2 ± 1.5	10.0 - 16.5
Hematocrit (%)	40 ± 5	30 - 50
Platelet Count (x10^3/µL)	100 ± 50	20 - 150
AST (U/L)	70 ± 30	15 - 150
ALT (U/L)	65 ± 25	10 - 120

Table 4: Radiological Findings in Patients with Pulmonary Complications

Complication	Number of Patients	Percentage (%)
Pleural Effusion	20	20%
Pneumothorax	5	5%
Pulmonary Edema	10	10%
ARDS	8	8%

Table 5: Treatment and Management of Dengue Patients

Treatment Type	Number of Patients	Percentage (%)
Fluid Management	80	80%
Antipyretics	100	100%
Oxygen Therapy	25	25%
Mechanical Ventilation	10	10%

Table 6: Outcomes of Dengue Patients with and without Pulmonary Complications

Outcome	With Pulmonary Complications (N=43)	Without (N=57)	p-value
Recovery	38	57	<0.05
Length of Hospital Stay (days)	7 ± 2	4 ± 1	<0.01
Mortality	2	0	0.157
ICU Admission	10	2	<0.001

Table 7: Risk Factor Analysis for Pulmonary Complications in Dengue

Risk Factor	Odds Ratio (OR)	95% CI	p-value
Age > 40 years	2.5	1.3 - 4.7	0.005
Male Gender	1.2	0.6 - 2.4	0.6
DHF/DSS Classification	3.8	2.0 - 7.1	<0.001
Baseline Hypertension	1.9	0.9 - 4.0	0.08

Table 8: Comparative Analysis of Patients with Different Dengue Classifications

Variable	DF (N=60)	DHF (N=30)	DSS (N=10)	p-value
Length of Hospital Stay (days)	3 ± 1	5 ± 2	8 ± 3	<0.001
Pleural Effusion	5	10	5	0.042
ARDS	0	5	3	0.013
Mortality	0	1	1	0.158

DISCUSSION

The current study offers significant insights into the pulmonary complications associated with dengue infection, emphasizing their prevalence and the associated clinical challenges. The incidence of pulmonary complications in our cohort was 43%, a figure that aligns with some previous studies but is higher than others, suggesting variability based on geographic and demographic factors [13].

The most common pulmonary complication observed was pleural effusion (20%), which is consistent with the findings of Gupta et al., who reported pleural effusion in 22% of their dengue patients [14]. However, our incidence of ARDS (8%) was higher compared to the 5.6% reported by Tantracheewathorn et al. [15]. This discrepancy could be attributed to differences in the severity of dengue cases, patient demographics, or healthcare practices.

Our study found a significant association between the severity of dengue infection and the development of pulmonary complications. Patients with DHF and DSS were more likely to develop complications like ARDS and pleural effusion. This finding echoes the work of Malavige et al., who observed an increased risk of severe complications in DHF and DSS patients [16].

Interestingly, the risk of developing pulmonary complications was higher in patients over 40 years of age (OR 2.5, p = 0.005). This observation is in line with studies like that of Lee et al., which also reported age as a risk factor for severe dengue [17]. However, unlike the study by Narayanan et al., we did not find a significant association between gender and the risk of pulmonary complications [18].

The length of hospital stay was significantly longer in patients with pulmonary complications (mean 7 days), paralleling findings from Shah et al., where dengue patients with pulmonary involvement had prolonged hospitalizations [19]. Mortality rates, while higher in the pulmonary complication group, were not statistically significant in our study, a result that contrasts with the findings of Agarwal et al., where mortality was significantly associated with pulmonary complications [20].

Our study's limitations include its single-center design and the relatively small sample size, which might limit the generalizability of the findings. Additionally, the retrospective nature of the data collection could have introduced selection bias.

In conclusion, the study highlights the importance of monitoring for pulmonary complications in patients with severe dengue, especially in older age groups. It underscores the need for heightened awareness and early intervention strategies in the management of dengue, particularly in regions where the disease is endemic.

CONCLUSION

This prospective study elucidated the significant burden of pulmonary complications in patients with dengue fever. The findings revealed that 43% of dengue patients developed pulmonary complications, with pleural effusion (20%) being the most prevalent, followed by pulmonary edema (10%), ARDS (8%), and pneumothorax (5%). These results underscore the critical nature of monitoring for respiratory complications in dengue, especially considering the extended hospital stay and higher ICU admission rates observed in this group.

A noteworthy aspect of the study was the correlation between age and the severity of dengue infection. Patients over 40 years demonstrated a higher risk (OR 2.5, p = 0.005) of developing pulmonary complications. This age-related vulnerability highlights the need for diligent care and monitoring in older dengue patients.

The study's limitations, including its single-center nature and the modest sample size, suggest a need for larger, multicenter studies to validate these findings. However, the results provide valuable insights for clinicians managing dengue patients, particularly in endemic regions, emphasizing the importance of early detection and management of pulmonary complications to improve patient outcomes.

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