A Case Report: Successful Treatment of a Teenager Patient Presented with Acute Respiratory Distress Syndrome Complicating *Plasmodium Vivax* Malaria

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Abstract- *Plasmodium vivax* malarial species are associated with ARDS is life-threatening condition rarely occurs in teenagers. ARDS may occur either at the initiation of treatment or after the decline of parasitemia when the patient is improving. We have reported a 17-year-old teenager patient presented to ER with high-grade fever, chills and generalized body ache for 3 days diagnosed with malaria due to *P. vivax* and developed ARDS during hospitalization. Chest X-ray reported dense heterogeneous opacities in bilateral lungs fields with sparing of apices and ABGs exhibited type 1 respiratory failure. The patient was shifted to ICU and put on BiPAP for non-invasive ventilation. An ICT was positive for *P. vivax* malaria thus empiric treatment was started with IV Artesunate, followed by a combination of IV Piperacillin Tazobactam along with supportive treatment for ARDS. Patient was discharged on day 8 in better clinical condition and was prescribed Primaquine to prevent any recurrence. *P. vivax*-associated ARDS has a high mortality rate. Early diagnosis and timely therapeutic treatment along with ventilation support can be life-saving.

Index Terms- ARDS, Artesunate, Non-invasive ventilation, Plasmodium vivax, Primaquine, Teenager

I. INTRODUCTION

Malaria is very devastating and the most commonly occurring parasitic disease worldwide, transmitted through an infected vector i.e., a female Anopheles mosquito. Malaria becomes problematic and life threatening when it gets severe due to associated complications such as shock, ARDS, AKI, pneumonia and anemia. ARDS associated with *P. vivax* is very rare in young children (Chairunnisa, Putri, & Arwati). The current evaluation of malaria epidemiology by WHO shows how malaria infection has evolved around the globe. According to the current report of 2022 (González-Sanz, Berzosa, & Norman, 2023), malaria cases rose again in 2021. Despite an increased ratio from the previous year, case prevalence remained stable. Similarly, mortality rate related to malaria peaked in the year 2020 as compared to the year 2019 (Choy, Bristowe, Khozoee, & Lampejo, 2022). The epidemiology of an endemic malaria is also varying because of the travel limitations during pandemic, fewer people migrated globally and this also leads to decreases in the prevalence of malaria (Steffen, Lautenschlager, & Fehr, 2020). Despite this, multiple reports revealed that the pandemic year also leads to rise in complicated malaria among travelers coming back from endemic regions (Norman et al., 2022). An effective and prompt diagnosis along with availability of suitable and highly effective therapeutic treatment are the key factors to control malaria and related complications. The WHO recommends that before starting any therapeutic treatment for malarial symptoms, it is important to ensure the presence of the specific parasite with an appropriate diagnostic technique to reduce any irrational practice. The emergence of drug resistance has played a significant role in increasing mortality rate in children due to malaria in Eastern and Southern Africa (Kavishe et al., 2014). Artemisinin combination therapy used to be the drug of choice for uncomplicated malaria (Organization, 2015), but the failure rates associated with Artemisinin and other drugs like Chloroquine led to a change in first-line treatment to Artesunate (Budiarso, 2023). Moreover, relapse prevention with a hypnozoitcidal medication i.e., Primaquine is recommended (Rahi, Sirohi, & Sharma, 2023).

II. CASE PRESENTATION

A 17-year-old male presented to the Emergency Room because of high-grade fever with chills for the past 3 days, associated with generalized weakness and body ache. Patient had no history of travelling from a malaria-endemic area. Past history was not significant. Presenting Complaints were associated with nausea along with 3 episodes of vomiting for past 24 hours. Initially on examination, temperature was 103°F, pulse rate (PR) - 113 bpm, blood pressure (BP) - 100/66 mmHg, respiratory rate (RR) – 16 breaths/min, peripheral saturation was 98% on room air, moreover dehydration and mild upper abdominal tenderness were noticed with no respiratory findings. An Immunochromatographic blood test (ICT) for malarial antigen showed positivity for *P. vivax* antigen. Later, patient was transferred from ER Department to the Medicine Ward where anti-malarial drugs were commenced.

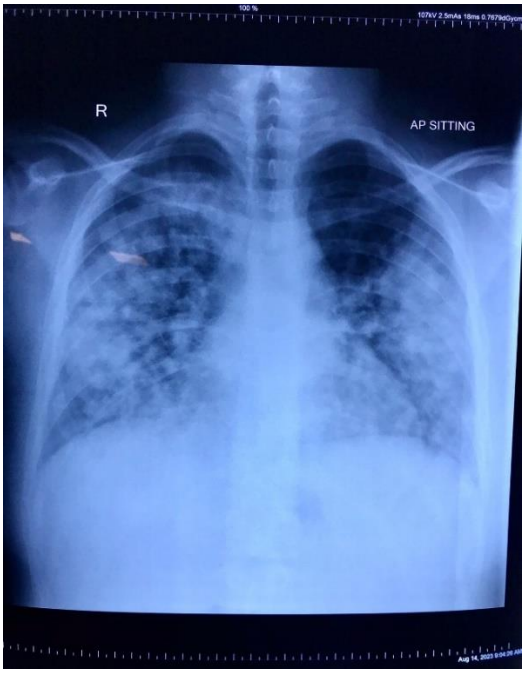
Table 1 shows the results of blood laboratory investigations ordered at the time of admission.

Table 1: *Laboratory Findings of the Patient on Admission.*

Laboratory Test	Result	Reference range
Hemoglobin (Hb)	10.6	13-16.5g/dl
Hematocrit (HCT/PCV)	31.7	39-49.5%
White blood cells	5.6	4-10 X 1000/ul
Platelets	48	150-410 x 1000ul
Total Bilirubin	2.71	0.0-1.0mg/dl
Direct Bilirubin	1.83	0.0-0.25mg/dl
Alkaline Phosphatase (ALP)	132	40-129U/l
Alanine Aminotransferase	41	0-41U/l
Aspartate Aminotransferase	52	0-35U/l
Gamma Glutamyl Transferase	76	11-61U/l
Sodium	138	136-145meq/l
Potassium	3.6	3.8-5.2meq/l
Chloride	111	96-107meq/l
Bicarbonate	19	22-29meq/l
C-Reactive Protein	68.28	<5.0mg/L

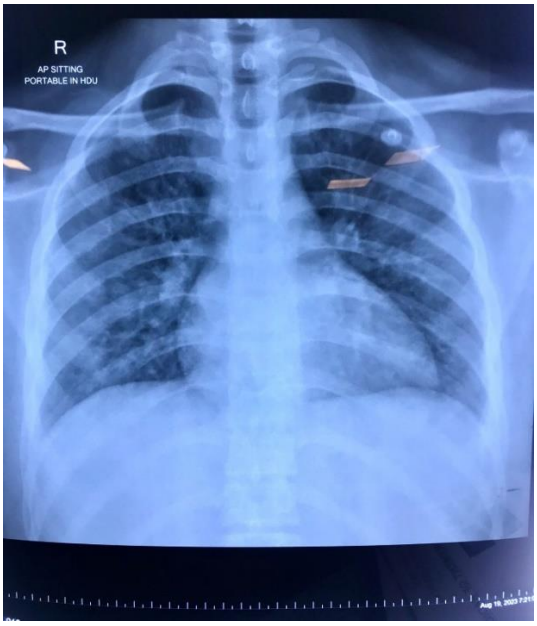
During the hospital stay there was a significant clinical deterioration characterized by persistent high-grade fever 103ºF, cough, shortness of breath, respiratory rate 40breaths/min and O_2 saturation of 70% on room air. ABGs on 10litres O2 via face mask showed pH 7.48, pCO_2 25.2mmHg, PaO_2 59.7mmHg, HCO_3 19.1mmol/L and PaO_2/FiO_2 ratio was 99.5. Chest X-ray reported dense heterogenous opacities in bilateral lungs fields with sparing of apices (Figure 1). An echocardiography revealed normal cardiac function, however respiratory examination showed bilateral basal crackles. Both the blood and tracheal aspirate culture showed no growth of any organism which ruled out the hospital acquired pneumonia. Therefore, diagnosis of severe acute respiratory distress syndrome (ARDS) has made.

Figure 1: *Chest X-Ray Reported Dense Heterogeneous Opacities in Bilateral Lung Fields with Sparing of Apices*



Patient shifted to critical care unit immediately and started on non-invasive positive pressure ventilation at IPAP of 14 and EPAP of 8. Therapeutic treatment was initiated with IV Tazobactam/Piperacillin, IV Ciprofloxacin, IV Artesunate, IV Dexamethasone and IV Furosemide. Patient showed improvement on chest X-ray (Figure 2) and ABGs findings without oxygen were pH 7.47, pCO_2 32 mmHg, PaO_2 93 mmHg, HCO_3 23 mmol/L on 4th day of hospitalization. On the 8th day, the patient was discharged and prescribed with oral Primaquine to prevent any relapse and advised to follow up after a week.

Figure 2: *Chest X-Ray Reported Significant Improvement in Heterogeneous Opacities in Bilateral Lung Fields*



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III. DISCUSSION

Clinically, malarial patients usually present with high grade fever, chills and generalized body ache (Islam, Dhar, & Rahman, 2023). Complicated *P. vivax* infection often presents with Acute lung injury (ALI), acute respiratory distress syndrome (ARDS), Acute renal failure (ARF), severe anemia, severe thrombocytopenia, severe hepatic injury and other multiple organ failure are also associated (Karim et al., 2023).

ARDS often exacerbates critical illness. Diagnosis is made when three conditions are met; acute onset (initially in 1 week), bilateral heterogeneous opacities showed on chest x-ray and ratio of PaO_2/FiO_2 (Serazin et al., 2021).

The Berlin categorized severity of ARDS associated hypoxemia in three categories; mild: PaO_2/FiO_2: >200 to $\leq$300 mmHg, moderate: PaO_2/FiO_2: >100 to $\leq$200 mmHg and severe: PaO_2/FiO_2: $\leq$100 mmHg (Ranieri et al., 2012). Our study reveals severe type of ARDS i.e., PaO_2/FiO_2: 99.5 mmHg.

A current study verified that clinically uncomplicated malarial cases comprising both *P. falciparum* and *P. vivax* presented with clinically compromised functioning of lungs due to an obstruction in the airway leads to impaired gas exchange and an increase in phagocytic activity of the lungs (Trivedi & Chakravarty, 2022). This mechanism is responsible for the inflammatory response occurs in pulmonary intravascular system. In some cases, severe pulmonary distress appears from six hours to 8 days after initiation of therapeutic treatment where as in some cases it appears after the reduction of malaria, proving the immune mediated inflammatory response occurs in lungs (Phyo, Dahal, Mayxay, & Ashley, 2022).

In previous study morbidity and mortality due to *P. falciparum* malaria species were more common (Bur et al., 2023). In our case, *P. vivax* malaria was the causative agent. Lungs involvement is rarely noticed in *P. vivax* (Praveen, Saradhi, & Suraj). Acute Respiratory Distress Syndrome complications is more commonly observed with *P. falciparum* and rarely noticed in *P. vivax* (Irinantenaina et al., 2023).

In previous reported case Sulfadoxine-pyrimethamine was shown to be effective against *P. vivax* (Fitri et al., 2023) but our patient showed effectiveness for Artesunate and Primaquine and showed rapid clinical outcomes.

Acute respiratory distress syndrome therapeutic treatment usually required intubation and mechanical ventilation with low tidal volume (Motes, Singh, Vinan Vega, & Nugent, 2023) as per the previous researches where as our patient showed the good clinical outcomes associated with non-invasive ventilation.

IV. CONCLUSION

Our teenager patient presented with severe signs and symptoms of malaria caused by *P. vivax* and later developed ARDS, which is very rare condition in young children and even show good clinical response to non-invasive positive pressure ventilation.

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