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Case Series

Paediatrics Section

# Paediatric Scrub Typhus Complicated by Myocarditis and Acute Respiratory Distress Syndrome: A Series of Four Cases

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## ABSTRACT

Scrub typhus is an emerging zoonotic infection in Southeast Asia that can cause severe complications in children, including myocarditis and Acute Respiratory Distress Syndrome (ARDS). A case series of paediatric patients presenting with fever, respiratory distress, and cardiovascular compromise requiring intensive care is described here. In all the cases, laboratory evaluation revealed thrombocytopenia, elevated inflammatory markers, and positive *Orientia tsutsugamushi* IgM ELISA. Echocardiography confirmed myocarditis with reduced Left Ventricular Ejection Fraction (LVEF), while ARDS was diagnosed on clinical and radiographic grounds. Cases were managed with doxycycline, Intravenous Immunoglobulin (IVIG), ionotropic support, and ventilatory measures. While three patients improved with timely intervention, one child succumbed to illness, which reflects the potential severity of scrub typhus in paediatric age groups. This series emphasises the importance of early recognition and prompt management in endemic regions to prevent life-threatening complications and reduce morbidity and mortality. Clinicians in endemic regions should maintain a high index of suspicion for scrub typhus in children presenting with acute febrile illness and cardiorespiratory compromise, as early diagnosis and targeted therapy can be lifesaving.

**Keywords:** Cardiac dysfunction, Children, Febrile illness, Intensive care, Respiratory failure, Zoonoses

## INTRODUCTION

Scrub typhus is an important zoonotic infection presenting as an acute febrile illness in Southeast Asia and the Pacific regions and is emerging in the Middle East and South America [1]. It is caused by *Orientia tsutsugamushi*, an antigenically diverse organism distinct from other rickettsiae due to the absence of lipopolysaccharide and peptidoglycan in its cell wall. Transmission occurs through the bite of larval trombiculid mites (chiggers), which act as both vector and reservoir [1].

*O. tsutsugamushi* primarily infects endothelial cells, leading to vasculitis, the hallmark pathological feature of the disease, and may also involve macrophages and cardiomyocytes [2]. Community seroprevalence in India is reported to be 34.2%, with mortality rates ranging from 24% to 38.9% [3-5]. Approximately, one million cases are reported annually in Southeast Asia, with mortality as high as 42% [6].

Scrub typhus can result in multisystem involvement, including hepatitis (40.5%), ARDS (20.5%), acute kidney injury (19.2%), meningitis (16.4%), shock (16.2%), and myocarditis (15.5%) [3,7]. Severe complications typically develop after the first week and may progress to multiple organ dysfunction syndrome [7,8]. While cardiac and respiratory complications are well described in adults, paediatric data remain limited [9-13]. This case series highlights scrub typhus as an important cause of myocarditis and ARDS in children, emphasising the need for early recognition and prompt management.

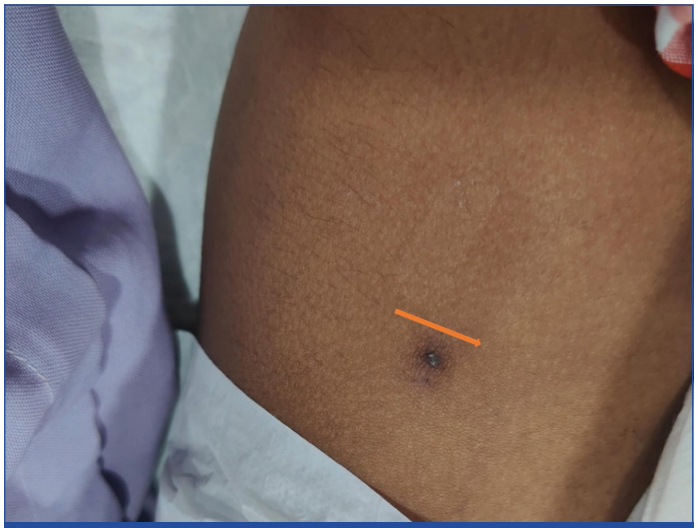
### Case 1

An 11-year-old girl presented to the paediatrics emergency department with intermittent fever accompanied by chills, rigours and headache for six days, pain in the abdomen for three days, and fast breathing for one day. There was no similar past history or family history.

Physical examination revealed pallor, a pulse rate of 136 beats per minute, a respiratory rate of 54 breaths per minute using accessory muscles, and a SpO2 of 82% on 10 litres of oxygen. The blood pressure measured 88/40 mmHg, and the peripheral pulses were feeble. Though pallor was present, there were no signs of icterus, purpura, or lymphadenopathy. Cutaneous examination revealed a 0.5-cm eschar on the anterior aspect of the right thigh, first noted two days before admission [Table/Fig-1].

During the respiratory examination, conducted sounds and decreased air entry in both lung fields upon auscultation were noted. The rest of the systemic examination was normal. Cardiorespiratory status was maintained with intubation, fluid, and ionotropic support, and a third-generation cephalosporin at 100 mg/kg/day in two divided doses was started empirically and continued for seven days.

Initial laboratory investigations showed a Haemoglobin (Hb) of 9.6 g/dL; Total Leukocyte Count (TLC) of 3,400 cells/ mm$^3$ with 80% polymorphs, platelet count of one lac, C-reactive protein 28 mg/dL, urea 31 mg/dL, and serum creatinine 0.6 mg/dL. Malaria and dengue were negative, including peripheral smear for malarial parasite [Table/Fig-2] and dengue serology (NS1 antigen and IgM



**[Table/Fig-1]:** An eschar on the right thigh (case 1).

| Parameters | Case 1 | Case 2 | Case 3 | Case 4 |
|---|---|---|---|---|
| Haemoglobin (g/dL) | 9.6 | 8.2 | 7.7 | 6.5 |
| White Blood Cell Count (/mm$^3$) | 3400 | 1800 | 6800 | 16400 |
| Differential Count | 80/15/1/4 | 54/42/01/03 | 68/30/01/01 | 56/33/01/10 |
| Platelet count (cells/L) | 1,00,000 | 40,000 | 75,000 | 1,20,000 |
| Blood urea nitrogen (mg/dL) | 31 | 44 | 64 | 26 |
| Serum creatinine (mg/dL) | 0.6 | 0.7 | 0.7 | 0.2 |
| Sodium (mEq/L) | 138 | 135 | 136 | 136 |
| Potassium (mEq/L) | 4.9 | 4.5 | 3.9 | 3.4 |
| Total bilirubin (mg/dL) | 0.6 | 0.4 | - | 1.0 |
| Aspartate aminotransferase (U/L) | 65 | - | - | 78 |
| Alanine aminotransferase (U/L) | 36 | - | - | 56 |
| C-reactive protein (mg/dL) | 28 | >90 | 20 | >90 |
| Erythrocyte Sedimentation Rate (ESR) (mm) | 18 | 38 | 52 | - |
| ELISA IgM scrub | Positive | Positive | Positive | Positive |
| Blood culture | No growth | No growth | No growth | No growth |
| Peripheral smear for malaria | Negative | Positive for P. vivax | Negative | Negative |
| Troponin I (ng/mL) | 0.08 | 0.04 | 0.05 | 0.09 |
| 2D Echocardiography | LVEF 50% | LVEF 40% | LVEF 55% | LVEF 40% |
| Electrocardiography (ECG) | Sinus tachycardia with ST elevation | Sinus bradycardia with ST elevation with atrial ectopics | Sinus tachycardia | Sinus tachycardia |
| PaO2/FiO2 ratio | 180 | 200 | 200 | 100 |
| Pharyngeal swab for respiratory viruses | - | - | Not detected | Not detected |

**[Table/Fig-2]:** Diagnostic workup of the patients.
LVEF: Left ventricular ejection fraction

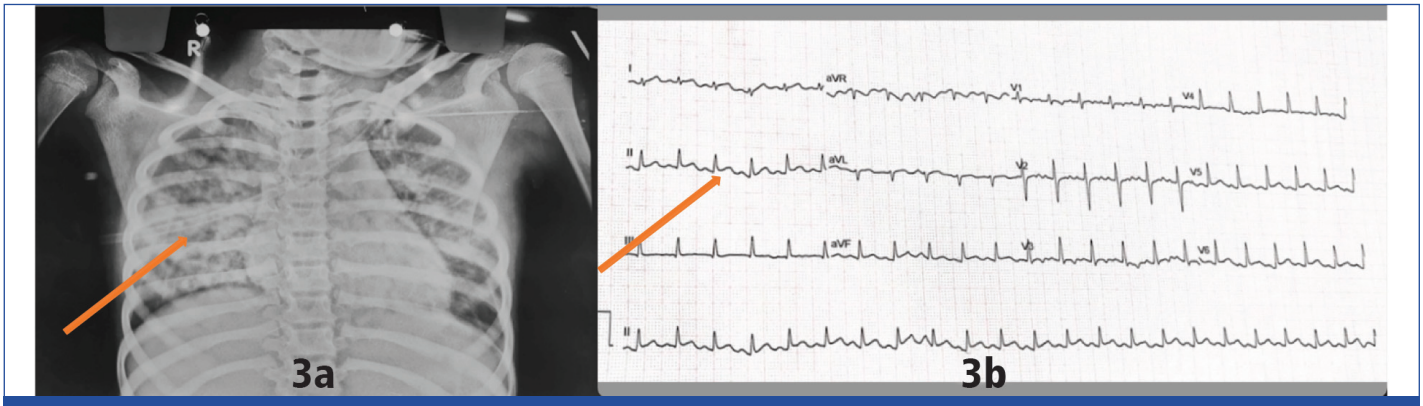
antibody). Arterial Blood Gas (ABG) analysis revealed a PaO2/FiO2 ratio of 180. Troponin I was 0.08 ng/mL, and 2D echocardiography revealed a reduced LVEF of 50%. The patient was managed as ARDS and myocarditis with supportive intensive care, including oxygen therapy, lung-protective ventilation strategies, and conservative fluid management.

The chest radiograph showed the presence of diffuse infiltrates involving both lung fields, and an Electrocardiogram (ECG) showed sinus tachycardia with ST-segment elevation. [Table/Fig-3a,b]. The patient was treated on the lines of ARDS and myocarditis. High-grade fever and thrombocytopenia persisted on the third day despite the above management, and the ELISA IgM scrub test yielded positive results [Table/Fig-2]. The patient was started on injection doxycycline at 2.2 mg/kg/dose in two divided doses and IVIG at 1 gm/kg/day over two days, because of scrub typhus positivity and declining LVEF. By the fifth day of admission, the child became afebrile, ARDS, and myocarditis had resolved, and the child was successfully extubated. The child was discharged after a 10-day hospital stay and showed good recovery on follow-up.

## Case 2

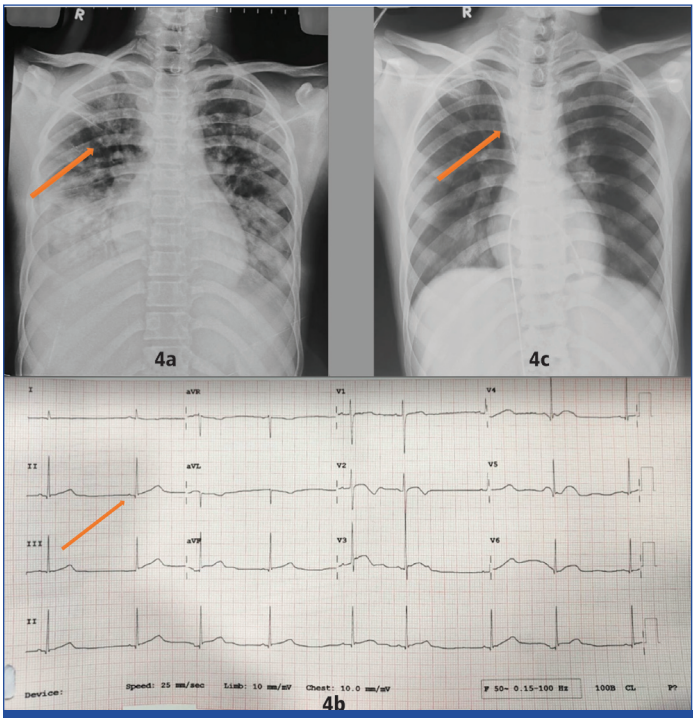
A 16-year-old male patient presented to the hospital emergency department with complaints of high-grade continuous fever for four days, increased work of breathing for one day, and one episode of malaena. The patient received treatment from a local hospital with no relief.

Upon arrival at the hospital, the patient was febrile with feeble peripheral pulses. The pulse rate was 142 beats/minute, the respiratory rate was 36 breaths/minute with chest retractions, Spo2 was 87% on a 5-litre face mask, and blood pressure was 97/66 mmHg. There was the presence of pallor on general examination, but no icterus, eschars, purpura, or lymphadenopathy. Respiratory system examination revealed reduced bilateral air with coarse crepitations. The liver was 6 cm below the right costal margin with a span of 14 cm, and the spleen was 5.5 cm below the left costal margin. The rest of the systemic examination was within normal limits. Initial lab investigations revealed an Hb of 8.2 g/dL, a TLC of 1800 cells/mm$^3$ (polymorphs 54%, lymphocytes 44%), platelet count of 40,000, CRP >90 mg/dL, and a peripheral smear for malaria came positive for Plasmodium vivax. Troponin I was 0.04 ng/mL, and 2D ECHO revealed a reduced LVEF of 40%. Chest radiograph revealed diffuse infiltrates in both lung fields, and the PaO2/FiO2 ratio came out to be 200 [Table/Fig-4a]. The child was initially managed as a case of malaria complicated with ARDS and myocarditis. Injectable antimalarial therapy was administered in the form of intravenous artesunate at a dose of 2.4 mg/kg at




**[Table/Fig-3a-b]:** (a) X-ray chest showing diffuse infiltrates involving both lung fields (case 1); (b) ECG showing sinus tachycardia with ST elevation (case 1).

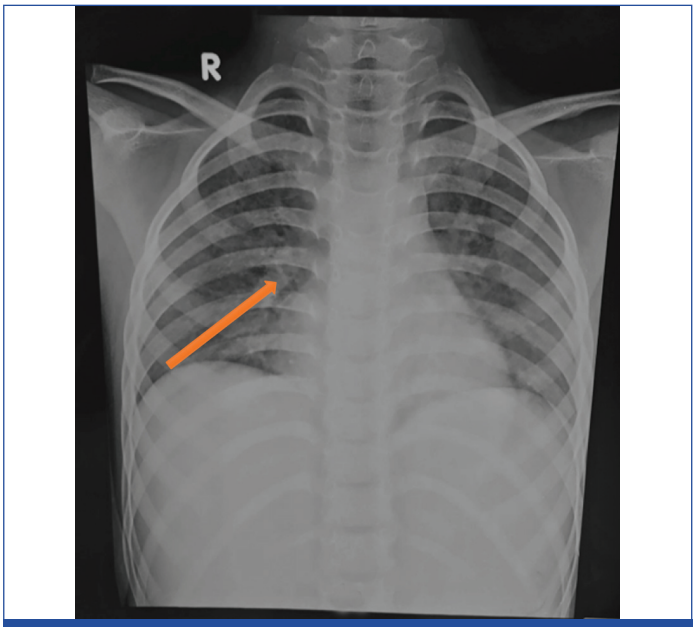
0, 12, and 24 hours followed by once daily. ARDS was managed with a high-flow nasal cannula, fluid restriction, and furosemide infusion at 0.1 mg/kg/hour. Cardiovascular support was provided with dobutamine infusion at 5-10 µg/kg/min and noradrenaline infusion at 0.05-0.1 µg/kg/min for 36 hours, adjusted according to haemodynamic response. To address anaemia, the child received a PRBC, and a platelet transfusion was administered for anaemia and symptomatic thrombocytopenia. On the second day, the child developed Supraventricular Tachycardia (SVT), which was managed with adenosine 0.1 mg/kg i.v. rapid bolus with immediate saline flush and metoprolol 0.1 mg/kg i.v. over two minutes. By the third day, ARDS improved significantly; however, the child developed Sinus Node Dysfunction (SND), reflecting variable heart rate and hypotension clinically and sinus bradycardia (HR- 46/min) with ST elevation and atrial ectopics on ECG [Table/Fig-4b]. SND was managed with the insertion of a temporary pacemaker [Table/Fig-4c]. IVIG at a dosage of 1gm/kg/day over two days was also given for myocarditis. Meanwhile, the child also tested positive for ELISA IgM Scrub typhus, for which Inj. Doxycycline at 2.2 mg/kg/dose in two divided doses was started. LVEF and trop I normalised by day 7, and the pacemaker was removed. The child was discharged successfully after ten days of hospital stay.




**[Table/Fig-4a-c]:** (a) X-ray chest showing diffuse infiltrates involving both lung fields (case 2); (b) ECG showing sinus bradycardia with ST elevation and atrial ectopics (case 2); (c) Temporary cardiac pacemaker inserted via the femoral vein (case 2).

## Case 3

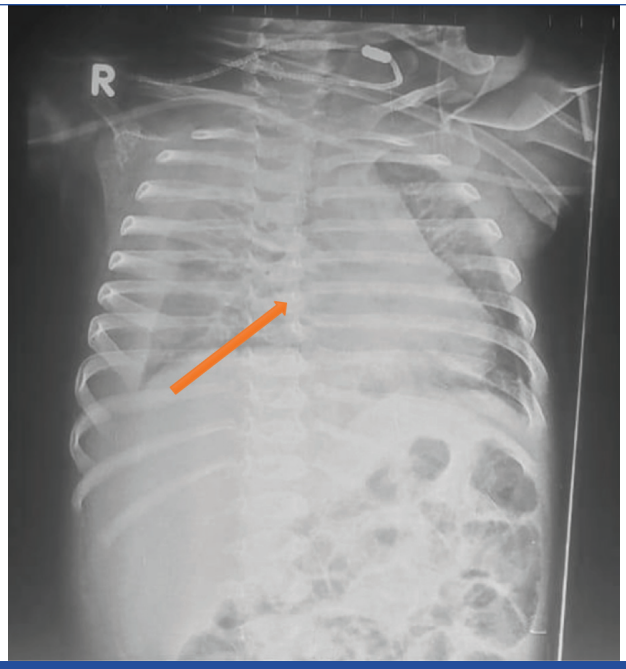
A nine-year-old male patient presented to the hospital emergency department with complaints of fever for six days and rapid breathing for three days. On presentation, the child was afebrile (axillary temperature 98.6°F) but there was tachycardia of 124 beats/minute, tachypnoea of 32 breaths per minute, with the use of accessory muscles, Spo2 of 88% on 2 litre nasal prongs, and a blood pressure of 108/66 mmHg. General examination revealed the presence of pallor, with no signs of icterus, eschars, purpura, or lymphadenopathy. On respiratory system examination, bilateral air entry was reduced with bilateral coarse crepitations and wheezing. Per abdomen, examination revealed only a soft spleen of 2 cm below the left costal margin. The rest systemic examination was within normal limits. Initial laboratory investigations revealed an Hb of 7.7 g/dL; TLC of 6800 cells/mm$^3$, platelet count of 75,000, CRP of 20 mg/dL, dengue, and malaria, and pharyngeal swab for respiratory viruses were negative [Table/Fig-2]. The chest radiograph showed the presence of diffuse infiltrates involving both lung fields [Table/Fig-5] and a PaO2/FiO2 ratio of 200 in ABG was suggestive of ARDS. The child was initially managed on the lines of acute febrile illness with ARDS with empirical antibiotics, high-flow nasal cannula, restricted fluid, and furosemide infusion at 0.1 mg/kg/hour. He received a PRBC Transfusion to address anaemia. Persistent tachycardia prompted evaluation of Troponin I (Trop I) and LVEF by 2D ECHO, which were found to be 0.05 ng/mL and 55%, respectively. On day 2 of admission, the child tested positive for ELISA IgM scrub, for which Inj. Doxycycline was commenced. By the third day of admission, there was a significant improvement in ARDS, oxygen support was gradually tapered and removed, the fever subsided, and the child was discharged successfully after 12 days of hospital stay.




**[Table/Fig-5]:** X-ray chest showing diffuse infiltrates involving both lung fields (case 3).

## Case 4

A one-year-old female patient presented to the hospital emergency with complaints of high-grade fever for seven days, and fast breathing for two days, Initial vital signs revealed a feeble peripheral pulse of 162 beats per minute, a respiratory rate of 72 breaths per minute with chest retractions, $SpO_2$ of 84% on a 10 L non-rebreathing mask, an axillary temperature of 101.3°F, and a blood pressure of 66/34 mmHg. Only pallor was a significant finding on general examination. Respiratory system examination revealed reduced bilateral air entry and conducted sounds. On the abdominal examination, there was hepatomegaly, with the liver palpable 5 cm below the right costal margin, and splenomegaly, with the spleen palpable 4 cm below the left costal margin; both organs were soft and non-tender. The rest systemic examinations were within normal limits. Initial laboratory investigations were suggestive of anaemia (Hb 6.5 g/dL), leucocytosis (TLC 16400 cells/mm$^3$), and thrombocytopenia (platelet count 1.2 lacs). Malaria, dengue, and pharyngeal swabs for respiratory viruses did not detect anything [Table/Fig-2]. The PaO2/FiO2 ratio in ABG came to 100, and the chest radiograph showed the presence of diffuse infiltrates involving both lung fields [Table/Fig-6]. The child was taken on ventilatory and ionotropic support due to the worsening cardiorespiratory status. The child was also started on empirical broad-spectrum intravenous antibiotics in the form of ceftriaxone (100 mg/kg/day in two divided doses) and vancomycin (15 mg/kg/dose every 6 hours), planned for a duration of seven days, and received a PRBC transfusion for correction of anaemia. Because of resting tachycardia and variable heart rate, Trop I and 2D ECHO were done. Trop I was 0.09 ng/mL, and 2D ECHO revealed a diminished LVEF of 40%. The child tested positive for scrub typhus (IgM ELISA), and intravenous azithromycin




**[Table/Fig-6]:** X-ray chest showing diffuse infiltrates involving both lung fields (case 4).

was initiated at a dose of 10 mg/kg/day. On day 2 of admission, ionotropic support was increased, and IVIG infusion at 1 g/kg/day was given to address myocarditis-induced cardiogenic shock. Fresh frozen plasma was also transfused to address deranged PT/INR and nasogastric bleeding. On the third day of admission, the child deteriorated and went into cardiac arrest and could not be revived.

## DISCUSSION

We have described four serologically confirmed cases of scrub typhus with complications of myocarditis and ARDS. All cases were reported between September and December 2024 from the catchment area and presented to our tertiary care centre and medical college.

Out of the four cases, three were febrile at presentation, and all four had respiratory distress with low oxygen saturation at room air. On examination, eschar was found in only one case, considered pathognomonic of the disease and associated with severity of illness and higher mortality [14,15]. Hepatosplenomegaly was present in three cases, with splenomegaly in one case. Anaemia with thrombocytopenia was invariably present in all four cases, which is supposed to be associated with a more critical form of the disease [16,17].

These cases presented with hypoxia, low-volume peripheral pulse, hypotension, and one had severe shock, which led us to evaluate cardiac status, revealing low LVEF in 2D ECHO (40-55%), high TROP-I (0.04-0.09 ng/mL), and ECG changes suggesting myocarditis. Treatment was upgraded accordingly with ionotropes, IVIg, antiarrhythmics, and a temporary pacemaker. The presence of tachycardia, hypotension, dyspnoea, cardiogenic shock, or conduction disturbances should prompt the clinician to assess myocardial function and investigate biomarkers of cardiac injury, troponins, and echocardiographic findings for the possibility of myocarditis [18]. Cardiac biomarkers creatine kinase-MB and Troponin T are specific for myocarditis. NT-pro-BNP level is nonspecific but useful to assess left ventricular dysfunction [19,20]. Pericarditis has also been reported in cases of scrub typhus in the adult population with pericardial effusion, cardiomegaly, and congestive heart failure. Recently, cardiac Magnetic Resonance Imaging (MRI) has been used for the diagnosis and prognosis of myocarditis [21].

Second-degree heart blocks, relative bradycardia, prolonged QT interval, and atrial fibrillation have been noted in the adult population with ST [22]. Also, what is noteworthy is that ischaemic changes are not detected in coronary angiography, so cardiac biomarkers, ECG, and Echocardiography are invaluable. Early detection and aggressive monitoring can help institute timely intervention, which can mitigate untoward complications like arrhythmias.

In our case series, all the patients presented with tachypnoea, low SpO2, hypoxaemia in ABG with a P/F ratio of < 200, and diffuse pulmonary infiltrates in chest X-ray suggestive of ARDS. High-flow nasal cannula and mechanical ventilation were initiated. Three out of the four cases were able to get extubated and finally discharged. Literature has revealed that in cases of scrub typhus with ARDS and severe hypoxaemia can be refractory to conventional mechanical ventilation needing modalities like Airway Pressure Release Ventilation (APRV), High Frequency Oscillatory Ventilation (HFOV), and Extra-Corporeal Membrane Oxygenation (ECMO), as few options are left [7]. Kwon HJ et al., have reported a case of life threatening ST complicated by ARDS and haemophagocytosis, the patient improved with intensive care support and clarithromycin therapy [23]. Similarly, Bhanushali JD et al., have also reported scrub typhus in an 18-year-old girl, which developed acute-onset hypoxemia, bilateral lung infiltrates on radiology, and increased pulmonary capillary permeability, pointing towards the diagnosis of ARDS [24]. ARDS remains a dreaded complication of scrub typhus, and studies have shown a higher proportion of children with eschar, anaemia with thrombocytopenia, and hepatosplenomegaly likely to develop ARDS [24].

Besides these complications, other rare complications reported in ST are pancreatitis, acute disseminated encephalitis, basal ganglia encephalitis, cerebral infarction, cerebral haemorrhage, Guillain-Barré Syndrome, rhabdomyolysis, and acute hearing loss. Microinfarcts leading to gangrene have also been reported in untreated children and adults [25,26]. Therefore, it is crucial to identify infectious and non-infectious autoimmune causes of vasculitis as they have different and distinct approaches to case management. Along with supportive measures and specific management as needed, treatment was effective with i.v. doxycycline in the cases above, with patients becoming afebrile and haemodynamically stable.

Doxycycline in a dose of 2.2 mg/kg/dose twice a day is the drug of choice for ST in children. Azithromycin is used along with Doxycycline or as an alternative to treat ST. Additionally, tetracycline and rifampicin are also established as effective treatments for scrub typhus. Varghese GM et al., study concluded that an intravenous course of doxycycline and azithromycin is superior to either treatment alone in terms of persistent fever, complications, and mortality observed on the 5$^{th}$, 7$^{th}$, and 28$^{th}$ day, respectively, and also led to earlier PCR clearance of the organism [27].

## CONCLUSION(S)

This paediatric case series demonstrates that scrub typhus can cause severe myocarditis and ARDS, often without classic signs like eschar. Early suspicion in endemic area prompted by fever with tachycardia, hypotension, or hypoxia is critical. Timely cardiac evaluation (echocardiography, troponins) and appropriate antibiotic therapy (doxycycline/azithromycin) with aggressive supportive care can improve outcomes, as shown by the recovery of three of four patients.

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