Case Study

HIGH FLOW NASAL CANNULA FOR MANAGEMENT OF TUBERCULOUS ARDS IN IMMUNOCOMPROMISED – A VISION OR AN ILLUSION?

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ABSTRACT

Tuberculosis (TB), although commonly thought to be a chronic pulmonary disease, indeed has protean manifestations. One of its varied acute presentations is Tuberculous ARDS, which is a rare but fatal form of TB with mortality reported as high as 69-80%[1]. Here we report a case of sputum smear-positive MDR miliary tuberculosis with tuberculous ARDS in a patient with AIDS managed with HFNC oxygen therapy. Diagnosis of tuberculosis was based on clinical radiological, microbiological and molecular evidence[2,3]. The diagnosis of ARDS was established as per Berlin definition[4]. The patient was successfully managed with HFNC oxygen therapy along with second line anti tubercular treatment (ATT) and supportive measures.

Key Words: HFNS oxygen therapy, ARDS, Tuberculosis, Immunocompromised

INTRODUCTION

A 34-year-old male, a known case of human immunodeficiency virus (HIV) infection on highly active antiretroviral therapy (HAART) - Tenofovir-300mg / Lamivudine-300mg / Efavirenz-600mg for past 17 months with history of poor compliance to HAART medication, initially presented to a tertiary care hospital with complaints of fever with exertional breathlessness of 1-week duration. Clinically, the patient was tachypnoeic with unremarkable systemic examination findings. On further evaluation, he was found to have polymorphonuclear predominant (79%) leucocytosis (TLC – 11,230/cumm), with raised erythrocyte sedimentation rate (48mm fall in 1st hour). His initial arterial blood gas revealed respiratory alkalosis with widened alveolar-arterial oxygen gradient (A-a DO2) (41.1 mmHg). He had mediastinal widening with a bilateral micronodular lesion on chest radiograph. (Fig. 1A).

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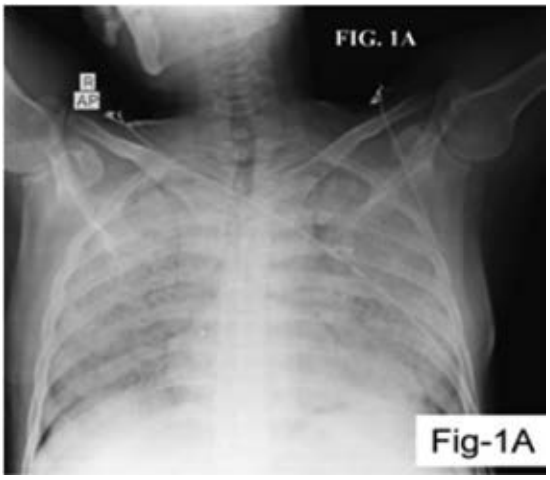
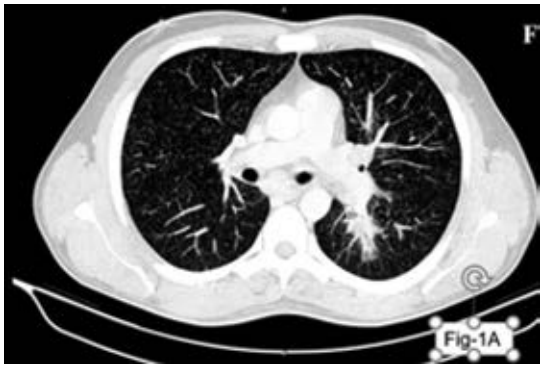


(Fig. 1A) Micronodular lesion on chest radiograph.

He underwent a High-resolution contrast enhanced computed tomography of chest which showed randomly distributed miliary nodular lesions in all segments of both lungs with patchy area of

consolidation in the superior segment of left lower lobe and nodular lesion arranged in tree – in – bud pattern surrounding the consolidation. (Fig. 2).



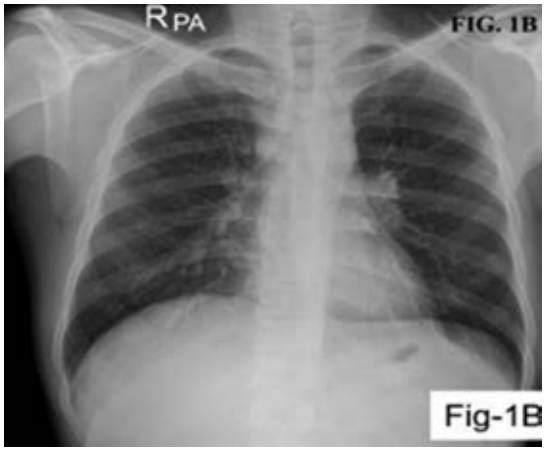
(Fig. 2) Bud pattern surrounding the consolidation.

The patient was provisionally diagnosed as a case of pneumocystis pneumonia and started on a therapeutic dosage of sulphamethoxazole / pyrimethamine and oral steroids. However, the patient continued to worsen clinically and was then transferred to our tertiary care respiratory center in western Maharashtra. At presentation to this hospital, the patient was found to be tachypnoeic and severely hypoxic (Arterial Blood Gas at FiO2-45%, pH – 7.495, pCO2 – 25.7 mmHg, pO2 – 48.4 mmHg, HCO3- 20 mmol/l, A-a DO2 – 69. In accordance to Berlin's criteria, the patient was diagnosed as a case of moderate ARDS (PaO2/FiO2 -107.5 mmHg). on further evaluation he was found to be sputum smear positive for acid-fast bacilli (3+) and sputum cartridge based nucleic acid amplification test (CBNAAT) showed Mycobacterium tuberculosis (MTB) along with Rifampicin (Rif) resistance following this he was started on second line ATT as per weight band (Inj Amikacin, Tab Levofloxacin, Tab Ethionamide, Tab Cycloserine, Tab Pyrazinamide, Tab Ethambutol). He was commenced on high flow nasal cannula oxygen therapy, AIRVO-2 (Fisher & Paykel, Auckland, New Zealand) at a flow rate of 60L/min and FiO2 – 80%.

Table-1 -ROX index at 2-hour, 6-hour and 12-hour showing patient's response to HFNC oxygen therapy.

PARAMETERS → / TIME ↓	SpO_2	FiO_2	Respiratory Rate	ROX Index
2-Hour	99%	60%	34/min	4.85
6-Hour	98%	55%	30/min	5.94
12-Hour	98%	50%	30/min	6.53

Patient was monitored closely as per ROX Index at 2-hour, 6-hour and 12-hour interval (Table 1) to assess the response to HFNC oxygen therapy and foresee the need of invasive mechanical ventilation in event of HFNC oxygen therapy failure. Patient responded well to the treatment with improving Respiratory rate oxygenation (ROX) index at 2-hour, 6-hour and 12-hour. On 3rd day of HFNC his oxygen requirement reduced (flow rate of 30L/min, FiO2 – 40%) and he was eventually weaned off oxygen on 8th day of hospitalisation. Patient was continued on above mentioned ATT regimen for 6 months after which Inj amikacin was stopped as he attained culture conversion (4th month sputum culture for MTB – No growth) and rest of the ATT drugs were continued for 18 months. Patient had an uneventful recovery and was declared cured of TB after negative MTB Culture post treatment completion. His repeat chest radiograph showed significant resolution of opacities after 10 weeks of therapy. (Fig-1B)



(Fig-1B) Opacities after 10 weeks of therapy.

DISCUSSION

Though TB is a very common disease in the Indian subcontinent, it is a rare cause of ARDS which is often associated with high mortality. The pathophysiology behind this fulminant presentation is a component of mycobacterial cell wall *Lipoarabinomannan*, that acts as an antigen and leads to activation of the inflammatory cascade, which further evolves to ARDS[5]. A high index of suspicion is warranted, especially in the backdrop of identifiable risk factors such as alcoholics,

diabetics, patients on immunosuppression, HIV infection, pregnant women and patients of chronic liver disease.

Over the years, the mainstay of management has been invasive ventilation, however, invasive ventilation in immunocompromised patient is often associated with higher mortality[6,7]. A case series of three cases from northern India reported successful management of tuberculous ARDS with non-invasive ventilation (NIV)[8], nevertheless, the cases reported by them were not immunocompromised in contrast to ours. However, another prospective, observational, international multicentre cohort study concluded that NIV seems to be associated with higher ICU mortality in patients with a PaO2 / FIO2 lower than 150 mm Hg[9]. Another observational cohort study of 115 immunocompromised patients of non-tuberculous ARDS, revealed that rates of intubation and mortality in ICU to be significantly lower in the HFNC group (35% & 20% respectively) than in the NIV group (55% & 40% respectively)[10]. Similarly, in one more multicentric randomised study involving 310 patients of acute hypoxemic respiratory failure, the HFNC group was found to have lower intubation rate (38%), higher no. of ventilator-free days and lower 90-day mortality compared to NIV group (50% intubation rate)[11]. The outcome of our case was in concurrence with later two studies, having a favourable outcome using HFNC in an immunocompromised patient of tuberculous ARDS. However, a close monitoring is quintessential to predict the outcome of HFNC oxygen therapy.

ROX index provides an objective and standardised tool to foresee the outcome of HFNC oxygen therapy. ROX Index ≥4.88 measured at 2, 6, or 12 hours after high-flow nasal cannula (HFNC) initiation is associated with a lower risk for intubation[12]. For a ROX Index <3.85, risk of HFNC failure is high, and intubating the patient should be discussed. If ROX Index 3.85 to <4.88, the scoring could be repeated one or two hours later for further evaluation. ROX index not only prevents unnecessary intubation but also prevents urgent and chaotic intubation. HFNC delivers heated and humidified oxygen at high flow rates generating a low positive end-expiratory pressure, by flushing expired carbon dioxide from anatomical dead space in upper airways, this helps in reducing the work of breathing and dyspnoea whereas heating and humidification help in preventing thick secretions and atelectasis[10]. HFNC is also very convenient and tolerable for patients and it is easy to provide care to these individuals in form of feeding and oral care.

CONCLUSION

HFNC is a promising modality in treating ARDS, and its use as first-line management of tuberculous ARDS may be considered. Review of literature suggests that it has favourable outcome in terms of mortality and ventilator free days vis a vis invasive mechanical ventilation and non-invasive ventilation. When complimented with ROX index, adverse outcome of HFNC in form of delayed intubation can be avoided. Moreover, HFNC is better tolerated by the patients and there are no chances of ventilator-induced lung injury and ventilator-associated pneumonia, especially in immunocompromised patients.

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CONFLICT OF INTEREST

None

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