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CASE REPORT

CO Poisoning Cured by HFNC

Hemant Kumar Rathi[1], Gaurav Chauhan[2], Kishalay Datta[3], Priya Govil[4]

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ABSTRACT

Carbon monoxide (CO) poisoning is a potentially life-threatening condition that typically requires prompt administration of high-concentration oxygen, most commonly delivered via a non-rebreather mask (NRB). While this method remains the standard of care, high-flow nasal cannula (HFNC) therapy has gained popularity as an effective alternative for oxygen delivery in various respiratory disorders. HFNC provides heated and humidified oxygen at high flow rates, which may offer physiological benefits such as improved oxygenation, reduced work of breathing, and enhanced patient comfort. This case report describes an innovative application of HFNC in the acute management of CO poisoning. The patient presented with elevated carboxy-haemoglobin levels and was successfully treated using HFNC rather than conventional NRB therapy. This case highlights the potential role of HFNC as a feasible and effective option in the treatment of CO poisoning and encourages further investigation into its utility in similar toxicological emergencies.

KEYWORDS

• CO poisoning • Carbon Monoxide • HFNC • High flow nasal canula

INTRODUCTION

Carbon monoxide (CO) poisoning represents a significant health concern, leading to hundreds of deaths and tens of thousands of hospitalizations each year.[1,2] The primary objective in treating CO exposure is to expedite the removal of CO from the body by delivering high concentrations of oxygen, which competes

AUTHOR'S AFFILIATION:

[1] Resident PGY-2, Department of Emergency Medicine, Max Super Speciality Hospital, Shalimar Bagh, New Delhi, India.

[2] PGY-2, Department of Emergency Medicine, Max Super Speciality Hospital, Shalimar Bagh, New Delhi, India.

[3] HOD and Director, Department of Emergency Medicine, Max Super Speciality Hospital, Shalimar Bagh, New Delhi, India.

[4] Principal Consultant, Department of Emergency Medicine, Max Super Speciality Hospital, Shalimar Bagh, New Delhi, India.

CORRESPONDING AUTHOR:

Hemant Kumar Rathi, Resident PGY-2, Department of Emergency Medicine Max Hospital, Shalimar Bagh, New Delhi, India.

E-mail: hemantrathi14@gmail.com

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with CO for binding sites on haemoglobin[3]. In most cases, this is accomplished using a non-rebreather mask (NRB), a device capable of supplying high-flow oxygen. For individuals with severe poisoning indicated by very high carboxyhaemoglobin (COHb) levels or significant neurological or cardiovascular symptoms hyperbaric oxygen therapy may be considered. In recent years, high-flow nasal cannula (HFNC) therapy has emerged as a promising alternative for oxygen delivery in various respiratory conditions[4]. HFNC provides warmed and humidified oxygen at flow rates up to 60 liters per minute, which can improve patient tolerance, generate low levels of positive airway pressure, and help flush out anatomical dead space. These characteristics make HFNC a potentially advantageous option for CO poisoning, particularly in patients who may not tolerate NRB masks well. Although current evidence remains limited, with only a few published cases reporting successful use of HFNC in CO poisoning[4,5], this approach may offer a viable and effective alternative worth further exploration.

CASE

A 24-year-old male patient was brought to the emergency department (ED) of our hospital in ambulance with complaints of headache and giddiness. He was found semiconscious in his hostel room. His initial vitals in the ED (drowsy, pulse rate – 136/min, BP – 100/70 mmHg, RR – 16/min, SpO_2 – 98% on NRB mask, Temperature – 101*F, RBS – 157mg/dL). His friends describe the event – the patient was cooking barbeque in his hostel room in closed space so that no-one else could identify. The patient was in his room with the barbeque preparation for around 2 hours. He informed his friends about the preparation and invited them. Later, when his friends arrived, the door was locked and not opened after. After around 30 minutes of unanswered, his friends break open his hostel door and found him in unconscious state with on-going barbeques. Doctors were informed that patient on the way to hospital, vomited 2-3 times in the ambulance.

Arterial blood gas (ABG) on NRB mask revealed a pH 7.259 (7.35–7.45), partial pressure of carbon dioxide (pCO_2) of 45 mmHg (35–45 mmHg), partial pressure of oxygen (pO_2) of 92.4 mmHg (75–100 mmHg), and COHb level of 31.6% (0–2%). All other vital parameters (electrocardiogram, chest X-ray) were within normal limit.

Based on the ABG results, the patient was started on 100% oxygen via HFNC at 30 LPM concerning his severe nausea which can cause vomiting. His condition started improving within the first hour of HFNC treatment. Patient was advised admission in ICU but they were reluctant in the beginning. After 100 minutes of therapy via HFNC, the second ABG showed: pH 7.38, COHb 15.3%, pCO_2 41.1 mmHg, and pO_2 of 484.4 mmHg. The symptoms resolved significantly and it was felt that the patient was responding to HFNC treatment as evidenced by the second ABG findings. HFNC therapy at the same settings was continued for a total of approximately 240 minutes when a last ABG was obtained revealing a COHb of 3.4%. By this point, the patient was asymptomatic and therapy was discontinued. The patient did not receive antiemetic medication in the ED.

The patient was symptom free and they decided to take the patient back home (leave against medical advice - LAMA). The patient was symptom-free. The next day follow-up in ED, pt was fine and healthy with complete resolution of symptoms. 7th day follow-up was uneventful.

DISCUSSION

Our patient was diagnosed as a case of carbon monoxide poisoning. The factors which supported the diagnosis closed space cooking with coal, raised COHb levels, resolution of symptoms and fall in COHb levels after initiation of oxygen therapy.

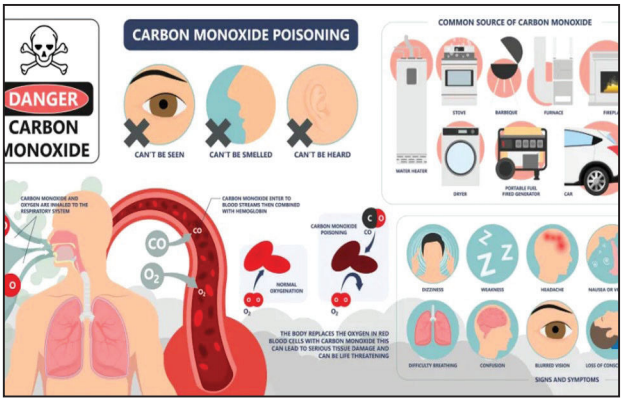


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Carbon monoxide (CO) poisoning is a common yet potentially fatal condition that results from inhaling CO gas, a colourless and odourless compound produced by incomplete combustion of carbon-based fuels[6]. CO binds to haemoglobin with an affinity over 200 times greater than oxygen, forming carboxyhaemoglobin (COHb), which significantly impairs oxygen transport and utilization at the tissue level. As a result, affected individuals may develop a wide range of symptoms from headache and dizziness to loss of consciousness and death depending on the duration and concentration of exposure[7]. Annually, CO poisoning accounts for hundreds of deaths and thousands of hospital admissions globally. The cornerstone of treatment involves rapidly displacing CO from haemoglobin by administering high concentrations of supplemental oxygen[6,7,8]. Conventionally, this is done using a non-rebreather mask (NRB), while severe cases may require hyperbaric oxygen therapy to accelerate CO elimination and minimize neurological damage associated with prolonged hypoxia[8].

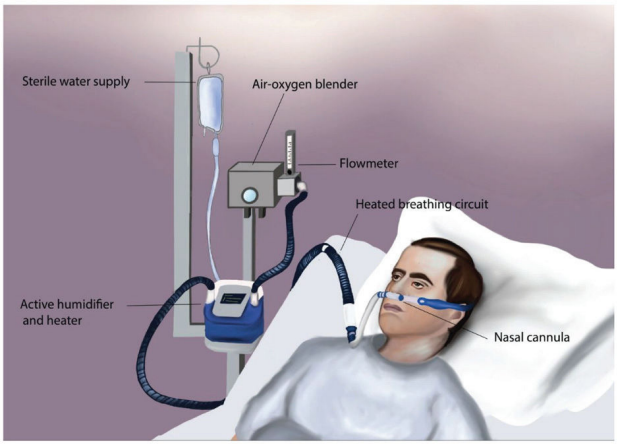


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High-flow nasal cannula (HFNC) therapy has become increasingly popular as a method of non-invasive oxygen delivery in both emergency and critical care settings[4]. Unlike traditional nasal cannulas or face masks, HFNC systems deliver heated and humidified oxygen at flow rates that can reach up to 60 litres per minute. This high-flow capacity meets or exceeds the patient's inspiratory demand, thus reducing the dilution of administered oxygen by room air. Additionally, HFNC generates a mild degree of positive airway pressure typically between 2 and 5 mmHg which helps keep alveoli open, improve ventilation-perfusion matching, and reduce the effort required for breathing[5,9]. The humidification component is particularly important, as it prevents mucosal drying, promotes secretion clearance, and enhances overall comfort and compliance[9]. These physiological benefits make HFNC not only a more tolerable option for patients compared to non-rebreather masks but also a potentially more effective one, especially in cases of moderate to severe hypoxemia[9,10].

While high-flow nasal cannula is well-established for treating hypoxemic respiratory failure, its application in carbon monoxide poisoning remains relatively novel. Theoretically, HFNC offers distinct advantages in this context due to its ability to deliver high concentrations of oxygen comfortably over extended periods[12]. By maintaining high flow rates, HFNC reduces the mixing of room air with delivered oxygen, thus ensuring a more stable and elevated fraction of inspired oxygen (FiO_2). This is crucial in CO poisoning, where the goal is to rapidly displace carbon monoxide from haemoglobin and restore effective oxygen transport[11]. Additionally, the positive airway pressure provided by HFNC may enhance alveolar recruitment and oxygenation efficiency. Although existing literature includes only a few reported cases, initial outcomes suggest that HFNC may be a viable alternative to NRB masks, particularly for patients who do not tolerate tight-fitting masks well[4,5,11]. Further clinical studies are needed to validate its effectiveness and safety in toxicological emergencies like CO poisoning.

CONCLUSION

Carbon monoxide (CO) poisoning is a serious condition caused by inhalation of CO gas, which binds to haemoglobin with high affinity, reducing oxygen delivery to tissues. Symptoms range from mild headache to life-threatening complications. Treatment typically involves high-flow oxygen via non-rebreather masks or hyperbaric oxygen in severe cases. High-flow nasal cannula (HFNC) therapy is an emerging alternative, offering warm, humidified oxygen at high flow rates. HFNC improves patient comfort, reduces work of breathing, and delivers consistent oxygen concentrations. Though its use in CO poisoning is still limited, early reports suggest HFNC may be a

promising and effective treatment option.

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Abbreviations:

Carbon Monoxide: CO

Emergency Department: ED

Intensive care unit: ICU

High Flow Nasal Canula: HFNC

Non-Re-Breather: NRB

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