

“BROAD Effect: Bradycardia in Obstructive Airway Disease” An Unusual Phenomenon: A Case Report

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Abstract

Non Invasive Ventilation (NIV) is frequently used in Obstructive Airway Disease (OAD) especially COPD (Chronic Obstructive Pulmonary Disease). Patients often get hypoxic or retain carbon dioxide during attempts to feed the patient orally or trial of intermittent support. However, patient developing sudden bradycardia by mere taking off the mask and reverting to sinus rhythm as soon as mask is put back is extremely rare. We present one such case that was also a treatment challenge for us. Recurrent bradycardia in COPD, with repeatability on discontinuation of Non Invasive Ventilation (NIV) is an extremely rare condition with not much reports/studies in the medical literature. The mechanisms leading to such an event are poorly understood. To the best of our knowledge, it's the first case to be reported from India.

Keywords: Bradycardia, noninvasive ventilation, recurrent

INTRODUCTION

Recurrent bradycardia with repeatability on discontinuation of Non Invasive Ventilation (NIV) is an extremely rare condition with not much reports/studies in the medical literature. The mechanisms leading to such an event are poorly understood. We could find only one case report in the literature. We report one such case of a female with long history of obstructive airway disease that developed this condition.

CASE REPORT

A case of 55-year-old female patient k/c/o bronchial asthma (on inhalers and intermittent oral steroid) was admitted with complaints of increasing breathlessness for 7–8 days. The patient consulted local doctor and was relieved partially of her symptoms. Note was made of recent bilateral total knee replacement (TKR) done a month before admission following which patient was mobilizing gradually at home though surgery was uneventful. However, the patient developed breathlessness for which she was rushed to local hospital where she was found hypoxic and put on high-flow oxygen. She gradually became drowsy, was intubated and put on ventilator support. Chest X-ray showed left pneumonitis and

patient was put on broad-spectrum antibiotics. In view of difficult weaning, the patient was shifted to our hospital. On examination, the patient was conscious, hemodynamically stable, obese, intubated, and on ventilator support. All routine investigations were sent which were reported normal except raised total leukocyte count of 12,900 and low potassium (K⁺) of 2.91. Her thyroid functions were also normal. Antibiotics were continued and potassium was replaced. Repeat electrolytes were reported to be normal. Arterial blood gases showed Type II respiratory failure. Next day, the patient was extubated on noninvasive ventilation (NIV), in the process patient had brief episode of bradycardia. Subsequently, it was observed that each time even if the NIV mask was partially removed/displaced patient rapidly developed bradycardia [Figure 1a] and replacing the mask reversed the event into sinus rhythm with same rapidity. The event was repeatable each time with mask removal. Two-dimensional echocardiography done showed concentric left ventricular

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Figure 1: (a) Electrocardiogram showing transition from sinus rhythm toward bradycardia on noninvasive ventilation removal. (b) Electrocardiogram showing transient bradycardia during closed suctioning

hypertrophy, diastolic dysfunction, moderate pulmonary arterial hypertension, pulmonary artery systolic pressure = 50 mmHg, and left ventricular ejection fraction = 56%. The patient gradually became drowsy and had to be intubated. During each episode of suctioning using closed system, the patient went into bradycardia for the time the suction catheter was in endotracheal tube [Figure 1b]. To study this unusual event, we searched medical literature which did not help much. Neurology examination also did not reveal any abnormality. Hence, trial of atropine infusion was started to see if these episodic bradycardia events could be resolved and the patient responded to this measure. Subsequently, in discussion with cardiologist temporary, pacemaker was put and atropine could be gradually tapered off. The patient improved and was extubated on NIV support. The patient was then weaned off pacing as well, over the period of the next 6 days. Her episodic bradycardia events had resolved and she was discharged on home bi-level pressure support in view of type two respiratory failures.

DISCUSSION

Recurrent bradycardia on the removal of NIV in patients with obstructive airway diseases has not been reported, to the best of our knowledge. Similar episodes of bradycardia have been described in one patient of amyotrophic lateral sclerosis by Echevarria *et al.*,^[1] while Robert *et al.*^[2] documented such events in four intubated patients of adult respiratory distress syndrome on attempt to wean them off the ventilator. In both the reports, the bradycardia events gradually resolved over 2–9 days of medical management.

The mechanisms of bradycardia are poorly understood due to the rarity of this condition. Robert *et al.*^[2] proposed two potential mechanisms. First, vagal stimulation of arterial baroreflex leading to bradycardia and secondly, due to an imbalance between sympathetic and parasympathetic tone in susceptible subjects causing bradycardia. On reduction in

intrathoracic pressure, it leads to increase in venous return and consequently stroke volume. This leads to increase in transmural pressure across the aorta, stimulating the high-pressure baroreflex and subsequently bradycardia events. Second, they suggest an imbalance between sympathetic and parasympathetic tone. As all events occurred in the recovery phase, this is plausible; the arterial high-pressure baroreflex would be offset by high sympathetic tone when the patient was acutely ill but not during the recovery phase as sympathetic tone fell back toward normal levels. However, this does not explain why the events subsequently resolved. In addition, we postulate that an unknown/unidentified trigger must be there which precipitated the event this time, as our patient had undergone TKR few months back without any weaning difficulty. We propose a term “Bradycardia in Obstructive Airway Disease” effect for these self-limiting recurrent bradycardic episodes in patients with obstructive airway disease.

Echevarria *et al.*^[1] proposed additional mechanism suggesting down-regulation of adrenergic receptors during the period of heightened sympathetic response which subsequently gets restored once the sympathetic tone returns to normal. Catecholamine levels have also been studied in patients with obstructive sleep apnea; it has been documented that the initial high levels in these patients show falling trend even after one overnight treatment with continuous positive airway pressure therapy.^[3-5]

In both the reports,^[1,2] three patients were male and two females, all but 1 patient was between 40–55 age group.

The overall prognosis in these patients appears to be a favorable one. However, patients may require long-term NIV treatment at discharge to support their breathing in case of respiratory compromise. Our patient and one reported by Echevarria *et al.* (with ALS) were discharged on NIV. In the study by Robert *et al.*, three out of the four patients deteriorated and required advance care while the fourth required cardiac pacing. Eventually, all got discharged under stable condition.

CONCLUSION

Recurrent and sudden bradycardia associated with NIV removal, without documented hypoxia, acid-base disorder, or metabolic derangement is a rare event. It appears to be a self-limiting event as most of the patients recovered spontaneously over a variable period of time. Heart needs to be supported with medical management during this duration. No triggers have yet been identified. Mechanisms leading to such event are poorly understood and require further studies. Weaning of such patients should be done very slowly and preferably in a well-equipped intensive care unit.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published

and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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