CASE REPORT

Sleep Disordered Breathing Postcoronary Artery Bypass Graft Surgery: A Case Report

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Abstract

Unilateral diaphragmatic paralysis (UDP) is usually found incidentally in those who underwent chest radiography for some other reason. Often patients are asymptomatic at rest but may have breathlessness upon exertion and have a decrease in exercise capacity. Dyspnea at rest may occur if the patient has an underlying lung disease. Few develop orthopnea, which is less intense than patients with bilateral diaphragmatic paralysis (DP). Others present with positional snoring and progressive orthopnea misinterpreted it as sleep-disordered breathing. Here we present a 54-year-old male who presented late with sleep-disordered breathing and was diagnosed to have diaphragmatic palsy postcoronary artery bypass graft.

Keywords: Desaturation, Diaphragmatic palsy, Orthopnea, Sleep-disordered breathing, Sniff test.

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Introduction

The Diaphragm is the primary element of the respiratory system as it is the chief muscle of respiration which leads to respiratory failure if its weakened or injured.[1] DP is a common condition. Usually, patients are asymptomatic or have mild symptoms; hence it's underdiagnosed or undetected. Nevertheless, a condition with bilateral involvement of the diaphragm causes grave symptoms, such as severe orthopnea and dyspnea, that should direct to the necessary workup.[2] It is also an iatrogenic complication postcardiothoracic surgeries (e.g., CABG). The etiology of diaphragmatic palsy postcardiac surgery is also uncertain. Direct damage at some stage in the harvesting of the internal mammary artery,[3] cold injuries because of pericardial ice slush, and inadvertent stretch injuries at some stage in intrapericardial manipulation of the heart are a few documented causes; however, the damage can also additionally arise without an obvious reason.[4] Postcardiac surgical treatment diaphragmatic palsy typically has a tendency to be unilateral; however, not often can it be bilateral with consequent ventilatory failure. With paralysis of the diaphragm, the affected person has to place extra attempts into breathing, which ends up in a fatigue of the respiratory muscles and might cause ventilatory failure.

Case Description

A 54-year-old man, nonaddict, presented to us with complaints of snoring, excessive irritability, dyspnea on exertion, and orthopnea for 8 months. No excessive daytime sleepiness or apneic episodes were reported. He was a diagnosed case of diabetes mellitus, hypertension, and ischemic heart disease (IHD) poststatus CABG since 1 year. The patient had a history of left-sided pleural effusion post-CABG, hence was evaluated with high-resolution computer tomography of the thorax, which revealed a left-sided moderate pleural effusion with fibrotic bands and tubular bronchiectasis with bronchial wall thickening in the right lower lobe. The patient was managed with empirical antibiotic therapy. However, in view of the increase of orthopnea, the patient followed up with us for further evaluation. At presentation, his pulse rate and respiratory rate was 90 beats/minute and 18 cycles/minute, respectively. His transcutaneous oxygen saturation was 97% in sitting and 88% in the supine position. Palpation under the coastal margin during inspiration of the descending hemidiaphragm was felt. On percussion, dullness was present in the right lower chest. On auscultation, breath sounds were decreased in the right infrascapular areas. Sleep scores were taken. Sleep apnea clinical score was 42 and the Epworth Sleepiness Scale was 8. Both scores revealed a low pretest probability for sleep apnea. Chest radiograph showed right elevated hemidiaphragm with left pleural thickening (Fig. 1). Arterial blood gas estimation on sitting showed pH 7.39, pCO_2 39 mm Hg, PO_2 83 mm Hg, HCO_3 23 mmol/L, and arterial oxygen saturation 96%. On supine, pH 7.39, pCO_2 41 mm Hg, PO_2 68 mm Hg, HCO_3 24 mmol/L, and oxygen saturation of 90%. Ultrasonography (USG)—guided sniff test was done, which showed upward movements of the diaphragm on the right side during inspiration. Clinico-radiologically spirometry on sitting was suggestive of restrictive abnormality with forced expiratory volume in 1 second/forced vital capacity (FEV1/FVC) of 41%, actual FVC of 1.12 L, FVC% predicted of 40%, actual FEV1 0.45 L, and FEV1% predicted 40%. Spirometry on supine FEV1/FVC of 26%, actual FVC

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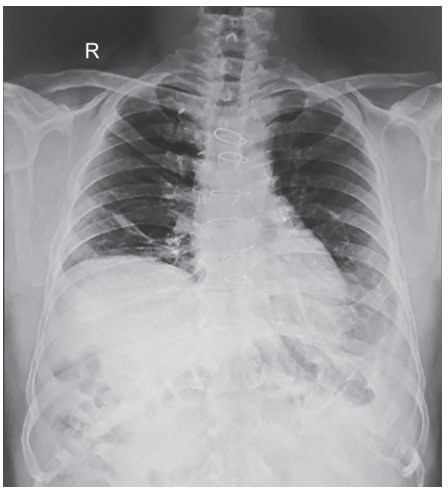

Fig. 1: Chest X-ray—right elevated diaphragm with fibrotic strands in the right lower zone areas post-CABG

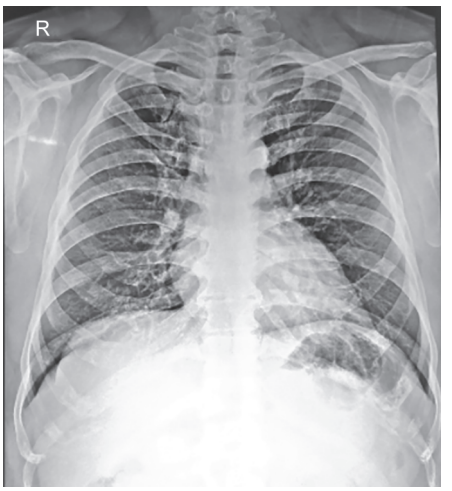

Fig. 2: Chest X-ray—within the normal limit is pre-CABG

of 0.6 L, FVC% predicted of 27%, actual FEV1 of 0.15L, and FEV1% predicted of 26%. A sleep study was done, which showed an Apnea–Hypopnea Index of 9.6 with average saturation of 93% and lowest desaturation of 86%. Chest radiograph presurgery was inquired, which was found normal (Fig. 2). Diagnosis of right diaphragmatic palsy post-CABG was made.

Discussion

The respiratory system acts as an important pump that moves air in and out of the lungs to facilitate gas exchange. The diaphragm is the vital component of this respiratory muscle pump. It contributes to 60–70% of total ventilation at rest in sitting and lying positions. The diaphragm is surrounded by cervical motor neurons (C3–5) through phrenic nerves. Prevalence and incidence of DP postcardiac surgeries are not well-defined in the literature because partial or unilateral involvement may go unnoticed. However, the incidence of DP post-CABG ranges from 10 to 60% in the English literature.[5] The diagnosis of phrenic nerve injury and DP is an ongoing challenge because symptoms are often misinterpreted with other cardiovascular causes of breathlessness, such as congestive heart failure, recurrent pulmonary embolism, other cardiovascular etiologies, or unrelated to the heart or in general, such as anemia, psychological disorder, or respiratory illness.[2] In our patient, orthopnea can be due to IHD or pleural effusion, but the pleural effusion resolved and the orthopnea persisted even after CABG. Diagnosis of the UDP is confirmed historically by dynamic fluoroscopy with upright tidal breathing, vital capacity maneuvers, and "sniff" maneuver, which is done by rapid inspiration with a closed mouth. Ultrasound to assess diaphragmatic excursion has been observed to be useful. USG is easy and precise for diagnosing DP and it can be carried out at the bedside. The paralyzed side suggests no active caudal motion of the diaphragm on inspiration and atypical paradoxical motion, mainly with the sniff test. Lung volume is crucial to determine upper airway patency. An increase in lung volume increases upper airway caliber and decreases its resistance and tendency to collapse. Contrarily, the reduction in end-expiratory lung volume with sleep contributes to a greater susceptibility to upper airway collapsibility. Possible mechanisms by which increased lung volume may lead to the greater opening of the upper airways include increased transmural distending pressure from increased pressure gradients associated with chest expansion at the thoracic inlet and/or mediastinal tension caused by stabilization of the airway wall by caudal traction as the diaphragm descends.[6] To date, researchers have not determined the relative contributions of these effects. DP reduces the measured compliance of the lung and may develop a restrictive pattern. Normally, lung capacity decreases by 10% in the supine position. In contrast, patients with bilateral DP had a 50-fold increase in lung capacity in the recumbent position. This decrease is due to the displacement of contents of the abdomen towards the cephalad.[2] In our patient, the difference of desaturation in sitting and supine position was about 9%, and the decline in FVC in spirometry in sitting and supine of about 520 mL was observed. Chest X-ray pre- and post-CABG showed significantly elevated hemidiaphragm. The elevated hemidiaphragm caused a significant decrease in lung volume which reduced the caliber of the upper airway and enhanced its resistance and collapsing tendency causing snoring and orthopnea, so the patient presented with chief complaints of sleep-disordered breathing. A sleep study showed mild obstructive sleep apnea syndrome. USG sniff test revealed a paradoxical motion, elevation of the right dome of the diaphragm on inspiration, and confirmed the diagnosis of right hemidiaphragm paralysis.

Conclusion

Patient with diaphragmatic palsy may present with complaints of sleep-disordered breathing, but a simple imaging tool like chest radiograph and USG helps in aiding prompt diagnosis. USG is a simple and valuable tool for quick diagnosis of DP.

Declaration of Patient's Consent

Informed consent has been taken to publish this case report. In the form, the patient has given his consent for his images and other clinical information to be reported in the journal. The patient understands that his name will not be published and due efforts will be made to conceal his identity.

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