

Persistent Diaphragmatic Paralysis in a Patient after a Coronary Artery Bypass Graft: A Case Report

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Abstract:

Coronary artery disease is a common disease within the United States. For those who have severe disease, a coronary artery bypass graft may be pursued. There are a number of complications that could arise from the surgery, however, a nerve injury such as that of the phrenic nerve is not a commonly recognized one. For a patient with persistent diaphragmatic paralysis following the coronary artery bypass graft surgery, a phrenic injury might be suspected. In the event that such an injury occurs, there are no clear guidelines on how the patient should be managed. We present the case of a patient who had a coronary artery bypass graft and was having a persistent hemidiaphragmatic restriction. It was later discovered that he had a left-sided phrenic nerve injury and responded well to anticonvulsant medication.

Key words: coronary artery bypass graft; rib pain; coronary artery disease; gabapentin; diaphragmatic paralysis; phrenic nerve injury; thoracic surgery

Introduction

Coronary artery disease (CAD) is a prevalent heart condition characterized by the buildup of atherosclerotic plaque within the arterial lumen [1]. CAD is the most common cause of major morbidity and mortality in the US and worldwide [1]. Coronary artery bypass grafting (CABG) is a major surgical operation where atheromatous blockages in a patient's coronary arteries are bypassed with harvested venous or arterial conduits [2]. The bypass restores blood flow to the ischemic myocardium which, in turn, restores function, viability, and relieves anginal symptoms [2]. Almost 400,000 CABG surgeries are performed each year making it the most commonly performed major surgical procedure, but surgical trends have decreased as the use of alternative options such as medical treatment and percutaneous coronary intervention (PCI) have increased [2]. The currently recognized complications of the CABG surgery are infection, stroke, and deep sternal wound infections [3]. The phrenic nerve originates from the anterior rami of C3 through C5 and traverses the neck, heart, and lungs to reach the diaphragm [4]. From its origin, the phrenic nerve descends vertically and adjacent to the internal jugular vein [4]. In the neck and upper thorax, the left phrenic nerve tracts proximal to

the subclavian artery [4]. The right phrenic nerve runs superficial to the anterior scalene muscle and the second part of the right subclavian artery [4].

This article will present the interesting case of a patient who suffered from persistent diaphragmatic paralysis after having a coronary artery bypass graft which was believed to be due to a left-sided phrenic nerve injury.

Case Presentation:

The patient was a 61 year old male with a past medical history significant for a coronary artery bypass graft, coronary artery disease, hyperlipidemia, hypertension, and chronic obstructive pulmonary disease presented to the clinic with complaints of persistent left-sided rib pain. The patient had an extensive cardiopulmonary medical history.

The patient received a cardiac stent placement at age 54 in the year 2020. However, he was having persistent chest pain that didn't seem to subside despite revascularization. He was seen at a cardiologist office after his stent placement and an in-office EKG was within normal limits (Figure 1).

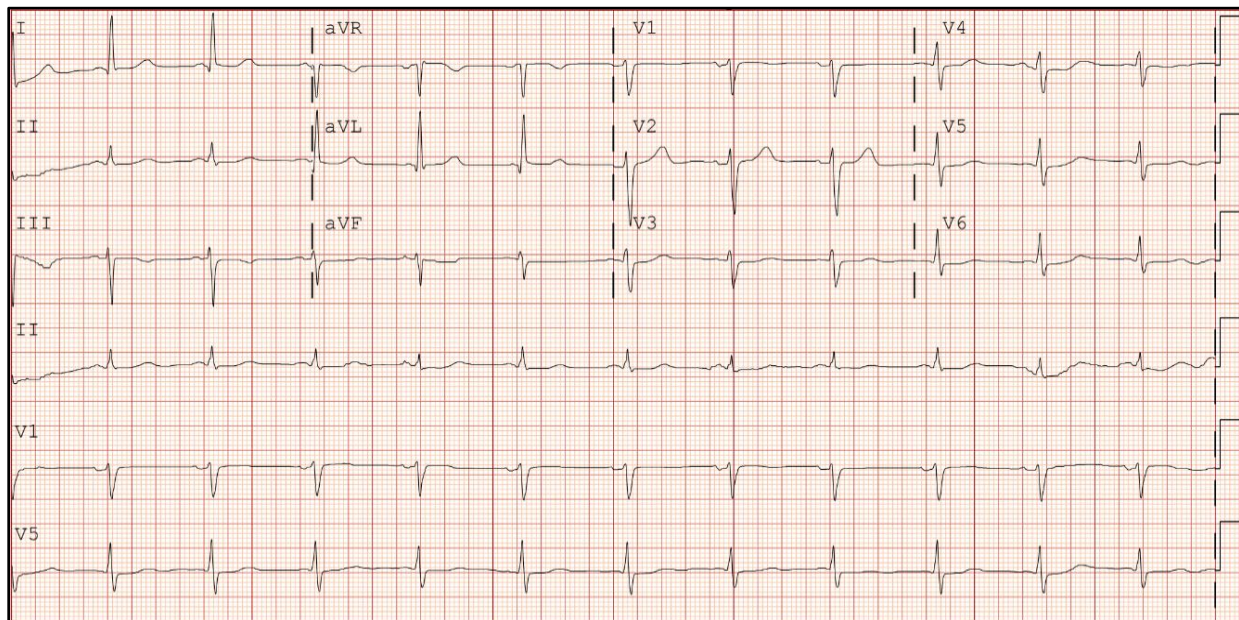


Figure 1: Patient's EKG at Cardiologist

Figure 1: Figure 1 depicts the normal EKG that the patient had in 2020.

The patient was then lost to follow-up for five years due to personal life struggles. He presented to the emergency room in the year 2025 with complaints of high blood sugar readings. Approximately a month prior he had been noticing fasting blood sugar readings in the 200s to 300s. He then spoke to his endocrinologist who advised him to increase his long-acting insulin from 50 units to 60 units a day. He continued to have elevated blood sugar readings despite the increase in medication. He was having increased thirst despite drinking increased amounts of water.

Also, he reported some occasional right-sided chest pain which had been occurring for a few weeks.

There were no significant abnormalities that a laboratory workup revealed except for a mildly elevated glucose level. There was no evidence of diabetic ketoacidosis, troponins were negative, and an EKG was within normal limits. Additionally, a chest x-ray showed no significant acute pathology (Figure 2). The recommendation at the time was for the patient to follow-up with his primary care physician, cardiologist, and endocrinologist.

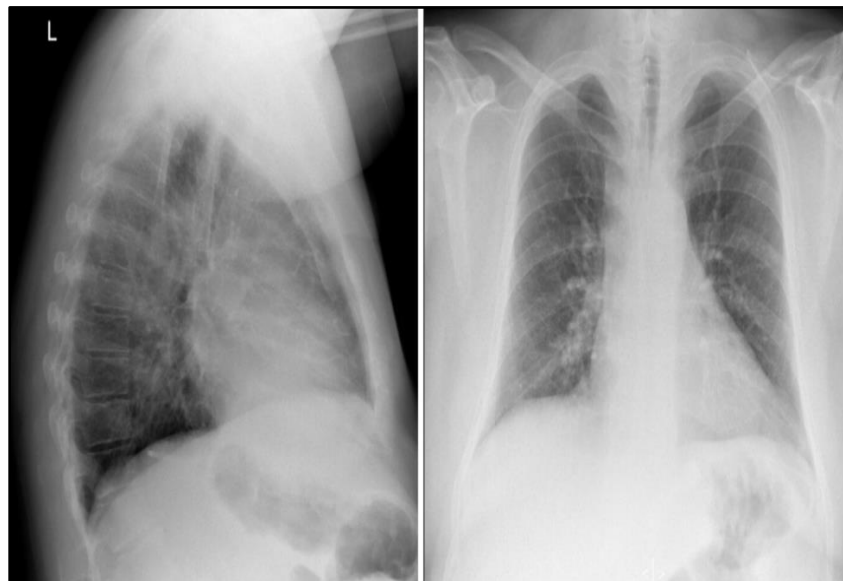


Figure 2: Chest X-Ray Ordered by ED Physician

Figure 2 depicts the chest x-ray that the patient had at the Emergency Department.

When the patient presented to his cardiologist, he was reporting complaints of heaviness in his midsternal area with radiation to his jaw. He then had a coronary artery bypass graft in another state. When he

followed up with his cardiologist, he appeared to have a paralyzed left hemidiaphragm postoperatively but overall seemed to be doing well. He did not report any chest pain, orthopnea, paroxysmal nocturnal dyspnea, or palpitations. The cardiologist then had a non-contrast CT of the chest ordered (Figure 3). The non-contrast CT of the chest showed an elevated left diaphragm with left basilar atelectasis (Figure 3). There was also esophageal wall thickening suggestive of esophagitis (Figure 3).



Figure 3: CT of the Chest

Figure 3: Figure 3 depicts the CT of the Chest that the patient had.

The patient then had a follow-up appointment with a thoracic surgery clinic who concluded that the patient likely had a left-sided phrenic nerve

injury during his CABG which resulted in a left hemidiaphragm paralysis. This was also supported by a chest fluoroscopy that the patient had which showed left diaphragmatic paralysis (Figure 4).

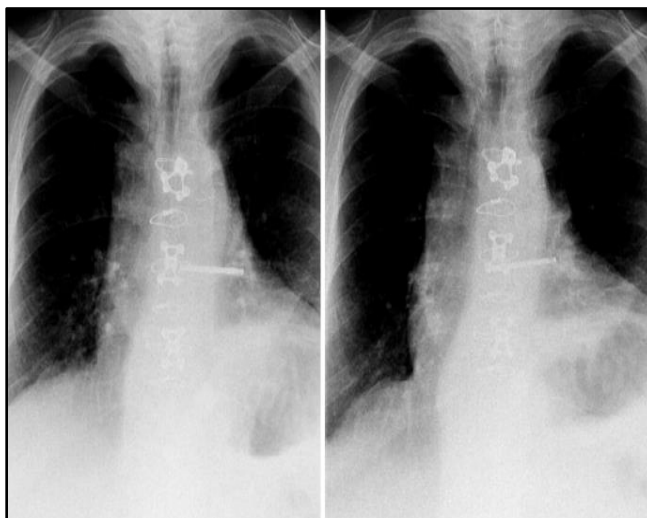


Figure 4: Chest Fluoroscopy

Figure 4: Figure 4 shows the chest fluoroscopy that the patient had.

With there being no cure for this condition, the plan of care was then centered around symptomatic management. With the likely culprit of the patient's persistent pain being primarily neuropathic in nature, the patient was started on 500mg of gabapentin taken 3 times daily. The patient noted a considerable improvement of symptoms, but was having some breakthrough pain episodes. The gabapentin dosage was then tapered to 750mg taken 3 times daily which the patient was satisfied with.

Discussion:

Firstly, this patient was suffering from severe coronary artery disease. He had been relatively noncompliant with the lifestyle modifications and medication adherence necessary for an uncomplicated outcome to his disease. There seems to be some gaps in current education and support for those suffering from coronary artery disease. This could likely prevent the downstream consequences of inevitably needing a coronary artery bypass graft when the disease progresses beyond the point of simply placing a stent. Additionally, the patient after the surgery had complications of the phrenic nerve injury. It took the evaluation of at least three doctors for him to receive this diagnosis. This shows immense gaps in knowledge with the potential outcomes of a coronary artery bypass graft. This also leaves us with the question if a patient should be assessed in the hospital for this potential outcome, so it could be diagnosed and treated faster. This

could likely be added to the post-surgical surveillance guidelines for a patient who has undergone a coronary artery bypass graft. We are also left unknowing if the left phrenic nerve was struck by the surgeon himself/herself during the surgery or if rapid changes in intrathoracic pressure resulted in long-term dysfunction of the vagus nerve.

Conclusion:

A coronary artery bypass surgery is a life-changing event for a patient suffering from severe coronary artery disease. However, the surgery can provide an incredible benefit when it is successful. In this case, the patient benefitted from the surgery but was left with a life-long complication that could be adequately managed with pharmacotherapy. All in all, there is quite a ways to go in terms of learning of the potential side-effects of a coronary artery bypass graft and the respective treatment thereafter. Additional studies are needed to see if there is a potential phrenic nerve repair surgery, in addition to other complications of the coronary artery bypass graft.

Statement of Informed Consent:

Informed consent was obtained from the patient that was presented in the case report.

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