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Case Report

Monitoring Dilemma for a Combined Coronary Artery Bypass Graft Surgery and Thyroidectomy

Running title: Combined CABG and Thyroidectomy

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Article Info

Received: January 25,2024
Accepted: January 30,2024
Published: February 05,2024

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Citation: Ajmer Singh, Banerjee S, Mukati R, Joshi S, (2024). "Monitoring Dilemma for a Combined Coronary Artery Bypass Graft Surgery and Thyroidectomy". Clinical Research and Clinical Case Reports, 5(1); DOI: http;//doi.org/08.2024/1.1074

Abstract:

An accurate estimation of cardiac output is vital to improve the perioperative outcome in high-risk cardiac surgical patients. Herein, we describe a case of a combined coronary artery bypass graft surgery and thyroidectomy. The potential advantages of the use of continuous cardiac output monitoring vis-a-vis other invasive and non-invasive methods are discussed.

Keywords: Continuous cardiac output; coronary artery bypass graft surgery; thyroidectomy

Introduction:

The number of cardiac patients presenting with thyroid diseases is increasing. The reported prevalence rate of thyroid dysfunction in patients with cardiac disease is as high as 11.2%.[1] Routine assessment of thyroid function in cardiac patients is therefore likely to reveal thyroid masses that may be amenable to excision during cardiothoracic procedure. The rationale of combined cardiac surgery and thyroidectomy is to avoid exposing the patients to two separate interventions, thus decreasing the risk of surgery, hospital stay, and cost. Combined surgeries, nevertheless, must be performed under appropriate monitoring.

Case Report:

A 73-year-old man with acute coronary syndrome and cardiogenic shock was admitted to our institution for coronary artery bypass graft (CABG) surgery. He had severe triple vessel coronary artery disease with 90% stenosis of the left main coronary artery, left ventricular ejection fraction of 35%, congestive heart failure, diabetic nephropathy (serum creatinine 2.1 mg/dl), and multinodular goiter. He was stabilized with non-invasive ventilation and intra-aortic balloon pump support. Thyroid function tests revealed free tri-iodothyronine (T_3) 1.35 pg/ml (reference range 2.77-5.27), free thyroxine 2.11 ng/ml (range 0.78-2.19), and thyroid-stimulating hormone 0.015 µIU/ml (range 0.465-4.68). Computed tomography of the neck showed enlarged lobes of the thyroid with multiple hypodense nodules in both lobes. In addition, a large (4.4 x 3.9 x 2.1 cm) exophytic thyroid nodule was present, which had retrosternal extension into the right tracheo-esophageal groove without producing any luminal compression. After medical stabilization, the patient was taken up for a combined CABG surgery and thyroidectomy. The standard cardiac monitoring included transesophageal echocardiography (TEE) and continuous cardiac output (CCO) monitoring by a pulmonary artery (PA) catheter. The CCO PA catheter (Edwards Lifesciences, Irvine,

CA, USA) was inserted through the right femoral vein, instead of conventional internal jugular vein, using pressure waveform analysis (Figure 1).

Figure 1: Photograph of the patient showing goiter (black arrow), an intra-aortic balloon catheter (red arrow), and a pulmonary artery catheter and central venous catheter inserted via femoral vein (white arrow)

Right ventricular and pulmonary arterial waveforms were obtained at 52 cm and 63 cm respectively. CO and derived hemodynamic parameters were displayed and updated continuously every 15-30 seconds. Bilateral total thyroidectomy with the removal of the retrosternal nodule was done via a horizontal incision in the neck. The recurrent laryngeal nerves and parathyroid glands were preserved. After the closure of the neck incision, an off-pump CABG surgery was performed using the left internal mammary artery and saphenous veins as conduits. The immediate postoperative period and subsequent stay of the patient in the hospital were uneventful. The patient was asymptomatic at three-month follow-up visit.

Discussion:

The case described here emphasizes the utility of continuous, reliable hemodynamic monitoring during a combined high-risk cardiac surgery and a non-cardiac surgery. A Medline and EMBASE research by De Silva et al identified 150 papers and reported good outcomes after combined cardiac surgery and thyroidectomy.[2] The reported prevalence rate of thyroid dysfunction in patients with cardiac disease is as high as 11.2%.[1] Routine preoperative screening of thyroid function in patients with cardiac disease is, therefore, likely to reveal asymptomatic thyroid masses. Dysfunction of the thyroid gland, be it hyper- or hypofunction, can directly affect cardiovascular physiology including heart rate, myocardial contractility, CO, and vascular resistance. Hyperthyroidism can lead to tachyarrhythmia, atrial fibrillation, vasomotor instability, increased oxygen consumption, and myocardial ischemia. The risk of thyroid storm, a life-threatening condition, during surgery is low if the patient is kept euthyroid or hypothyroid. Hypothyroidism, on the other hand, can cause bradycardia, hypertension, impaired cardiac contractility, and abnormal lipoprotein concentration predisposing the patient to coronary artery disease. A decrease in serum T_3 levels after cardiopulmonary bypass, and a postoperative 'euthyroid-sick' state can cause a decrease in CO and an increase in systemic vascular resistance.[3, 4] Persistent upper airway obstruction due to substernal goiter may increase the stress to the cardiovascular system and also increase the risk of the coronary artery disease. Substernal extension of the thyroid can also cause shifting of mediastinal structures, jugular venous dilatation, airway compression, and difficulty in approaching the ascending aorta for cannulation. High-risk cardiac patients, especially those with preoperative left ventricular dysfunction, require continuous monitoring of the perfusion pressure and CO during the perioperative period.[5] The selection of a hemodynamic monitoring site was the primary concern in this patient. Whether to use a standard PA catheter or a CCO PA catheter was another dilemma! PA catheter was used because of left ventricular dysfunction, cardiogenic shock, and IABP support. The internal jugular venous access site was not used because of contemplated surgery on the neck. The subclavian approach is associated with the risk of kinking of the PA catheter and its introducer sheath when the sternal retractor is in place. Measurement of intermittent CO by using a standard PA catheter inserted via the femoral vein would have been technically difficult, because of the inaccessible groin area and difficulty in injecting saline boluses during surgery. Non-invasive or less invasive modalities of measurement of CO have their limitations. Ultrasonic cardiac output monitoring (USCOM) device requires placement of the probe in the suprasternal notch, which was not feasible in this case. Pulse power methods such as Lithium dilution (LiDCO) and pulse contour analysis (PiCCO and FloTrac) require re-calibration during major hemodynamic changes and are not reliable when used in patients with IABP. [6, 7] TEE-derived CO measurement is operator-dependent and cannot provide continuous hemodynamic monitoring.CCO monitoring provided a continuous display of hemodynamic parameters without causing interference to either surgery. Other potential advantages of CCO monitoring during cardiac surgery, such as no risk of fluid overload, minimal risk of infection, hypothermia, less distraction of the anaesthesiologist, etc. are well documented.[8] In conclusion, we found combined off-pump CABG and thyroidectomy, a safe and effective procedure. The superiority of either a combined or two-stage procedure cannot be established due to the paucity of literature on a two-stage procedure. In addition, CCO monitoring via a PA catheter inserted from the femoral vein served as a good substitute for internal jugular and subclavian approaches.

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