**Off-pump Coronary Artery Bypass Grafting in a Patient with Severe Ischemic Cardiomyopathy: A Case Report**

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**Abstract**

Ischemic cardiomyopathy is a condition characterized by left ventricular dysfunction due to coronary artery disease. This case study presents a 68-year-old male with ischemic cardiomyopathy, an ejection fraction of 15%, and triple vessel coronary artery disease. The patient, with a history of COVID-19 and type 1 cardiorenal syndrome, underwent off- pump coronary artery bypass grafting to avoid any risks associated with cardiopulmonary bypass. The surgery was successful, and despite persistent left ventricular dysfunction postoperatively, the patient recovered without major complications and was discharged five days later.

**Introduction**

Ischemic cardiomyopathy (ICM) is a condition characterized by an ischemic damage to the myocardium, leading to heart’s inability to pump blood effectively1. ICM is typically present with left ventricular dysfunction in the context of coronary artery disease (CAD), which is known to be the main cause of Heart failure (HF)2. Left ventricular dysfunction in ICM can be a consequence of large infarct size, myocardial stunning, changes in hemodynamics and neurohormonal activation or even inflammation3. Here, we present a case of a 68-year-old male patient with ejection fraction of 15%, diagnosed with ICM and referred to undergo off-pump coronary artery bypass grafting (OPCAB).

**Case description**

A 68-year-old male with a body mass index (BMI) of 35.9 kg/m² was admitted to our hospital with ischemic heart disease (IHD) and CAD, having an ejection fraction (EF) of 15%. The patient had a prior history of COVID-19 infection but was non-diabetic and had no history of alcohol use. Preoperative echocardiography revealed severe left ventricular dysfunction, global hypokinesia, dilation of all cardiac chambers, mild mitral and tricuspid regurgitation, and diastolic dysfunction with high filling pressures.

During his first day of admission, regarding his vital signs, SPO2 rates were stable, with a systolic, diastolic pressure and heartbeat of, 90 ±10.47 mm Hg, 60 ±9.84 mm Hg and 84±3.73 bpm, respectively. the patients’ vital signs improved in the 6th of October, one day prior to the surgery. With a heart rate of 89±4.38 bpm, diastolic pressure of 78±3.73mm Hg and systolic pressure of 115±5.64 mm Hg. During this time, he received heparin, Isosorbide, ceftriaxone, and Aldactone as treatment and support on daily basis. the patient was diagnosed with type 1 cardiorenal syndrome (CRS), 40% risk of poor operation and 30 % chance of renal replacement therapy.

Preoperative Echocardiography demonstrated a severely reduced ejection fraction of 15%, with the dilation of all cardiac chambers accompanied with Mild mitral and tricuspid regurgitation. Diastolic dysfunction, high filling pressure, Mural thrombus, global hypokinesia of the left ventricle, and dysfunction of right ventricle were noticed, along with mild pulmonary congestion and reduced inferior Vana Cava (IVC) collapsibility.

A chest CT scan revealed Diffused ground glass opacity in the lung parenchyma, with consolidation in the right lower lobe, suggesting pneumonia. Enlarged Mediastinal lymph nodes were noticed, with the largest one measuring 17x19mm in the lower pre-tracheal area, bony degenerative changes were seen the spine.

Abdominal ultrasound showed a contracted gallbladder with multiple small gallstones, and also an enlarged prostate measuring 39ml, suggesting benign prostatic hyperplasia (BPH). No space occupying lesions (SOL) was observed. The results of the carotid and vertebral duplex ultrasound were normal on the right side, regarding the left side there were partially calcified plaque seen measuring about 3x7 mm at right common carotid artery, with smooth surface and no evidence of stenosis.

Preoperative laboratory investigations a day before the surgery revealed, a white blood cell count of 6.9 x 103/µL, hemoglobin of 13.8 g/dL, and platelet count of 394 x 103/µL. C-reactive protein of 45.36 mg/dL, renal function tests showed high levels for blood urea (78mg/dL), serum creatinine (1.7 mg/dL) and serum uric acid (10.8 mg/dL). Serum electrolytes were within normal ranges except for sodium which was lower, sodium at 134.5 mmol/L, potassium at 4.74 mmol/L, and calcium at 9.19 mg/dL. Deficiency in vitamin D3 levels was also noted (7.10 ng/dL). Erythrocyte sedimentation rate was abnormal by being 75 mms. Cardiac troponin T levels were elevated at 46.56 pg/mL. D-dimer levels were significantly high by being 3336.17 ng/mL.

**PLAN OF TREATMENT**

**Preoperative Evaluation and Optimization**

Given the patient’s extremely low EF, the strategy was to admit him preoperatively for optimization. A continuous infusion of furosemide and pulmonary vasodilators were initiated after ensuring that the patients’ hemodynamic state was tolerable. This intervention aimed for alleviating circulatory congestion and reducing central venous pressure (CVP) to less than 16 mmHg prior to the surgery. This approach successfully relieved the patient's symptoms of volume overload. Optimizing its condition before conducting the surgery.

**Intraoperative Course**

The patient underwent OPCAB for triple vessel coronary artery disease, which lasted for 3 hours and 45 minutes, in 7th of October 2024. This approach was effective to avoid the high surgical risk posed by cardiopulmonary bypass (CPB). regional anesthesia was administered via an epidural block for minimizing inhalational and intravenous agents. muscle relaxants were prioritized to facilitate the procedure. Following endotracheal intubation, an intra-aortic balloon pump (IABP) was inserted to provide mechanical circulatory support. A central venous line was placed through the right internal jugular vein (IJV), and a radial arterial line was used for continuous arterial pressure monitoring.

the intra operative support which he received was, noradrenaline, dobutamine, adrenaline, vasopressin, and Milrinone. Throughout the surgery the patient had low blood pressure but it was relatively stable, started at 92/62 mmHg and peaked at 110/62 mm Hg, with normal and stable SPO2.

During the surgery, the heart was observed to be severely dilated, with a significant displacement of the apex toward the left. This anatomical alteration made the left internal thoracic artery (LITA) unreachable, prompting the decision to use the radial artery for grafting to the left anterior descending artery (LAD). In addition, Saphenous vein grafts (SVG) were used for the obtuse marginal artery (OMA) and the right coronary artery (RCA) crux. Proximal anastomoses were performed using a side clamp on the aorta.

Distal anastomoses were performed utilizing a combination of deep pericardial stay sutures, apical suction stabilization, and an octopus suction device for maintain clear surgical field during the grafting process. Coronary snaring was utilized to further improve visualization and control during occlusion of the target coronary artery. This approach enabled a bloodless environment, facilitating graft placement. Revascularization was successfully completed with no significant intraoperative complications.

**Postoperative Course**

The patient then was transferred to intensive care unit (ICU) and stayed there for 64 hours, where he continued to receive inotropic support to maintain cardiac output including dobutamine, adrenaline, noradrenaline and insulin. He was extubated without complications and had no major postoperative events. Postoperative echocardiography revealed no significant changes in left ventricular function, with the EF remaining at 15%, which was expected given the preoperative condition. In addition, the patient remained hemodynamically stable. The patient was then transformed to ward, he stayed there for 5 days, with no significant complications mentioned.

two days before his discharge, the echocardiography results were similar with the preoperative results, with the exception of the dilation of left heart chambers rather than all chambers. Right ventricle was normal in size but with reduced longitudinal function, with a tricuspid annular plane systolic excursion (TAPSE) measurement of 12mm. The ejection fraction of 15% was persistent with continued poor left ventricular systolic dysfunction. Post operative laboratory investigations revealed normal ranges of complete blood count (CBC) values, except for the decreased hemoglobin level of 11.2 g/dL, high C-reactive protein level was noted at 146 mg/dL, additionally elevated Blood urea (93 mg/dL) and serum creatinine (1.9 mg/dL) levels were observed, which both levels decreased the following day to 61 and 1.7 mg/dL, respectively. Liver function tests were within the normal limits, with the exception of aspartate aminotransferase (SFOT) which was slightly increased to 41 U/L, which dropped to 28 U/L the next day.

**DISCUSSION**

In patients with very low ejection fraction (EF), coronary artery bypass grafting (CABG) presents with significant challenges, but advancements in surgical techniques and perioperative management have improved outcomes in such high-risk cases. In our case, we successfully managed a patient with ischemic cardiomyopathy and an extremely low ejection fraction (EF) of 15%, undergoing off-pump CABG. The patient’s perioperative management was crucial in preventing complications and ensuring a good recovery.

Patients with severely reduced EF face increased perioperative risks, including hemodynamic instability and organ dysfunction4. For this patient, a meticulous preoperative assessment allowed for risk stratification and optimization before surgery. Inotropic support, careful fluid management, and comprehensive monitoring ensured hemodynamic stability, helping the surgical team anticipate challenges associated with such a low EF.

We performed an OPCAB procedure, which avoided the complications of cardiopulmonary bypass (CPB), such as systemic inflammatory response and fluid overload. Throughout the procedure, the patients blood pressure was stabilized by the use of vasopressors (e.g., noradrenaline and dobutamine) which maintained adequate cardiac output. Consistent with previous case report involving a patient with severely impaired left ventricular function and ejection fraction of 15%, the patient also had increased risk of perioperative complications, however yet stable intraoperative hemodynamics were achieved using inotropic support, contributing to a favorable outcome5. Post operative care for this patient included, continuous monitoring and inotropic support to maintain sufficient cardiac output, the patient experienced no major complication postoperatively, due to effective pain management and intensive care monitoring, the echocardiogram post-surgery showed no significant changes in left ventricular function, which was anticipated due to the severity of the preoperative condition. The literature supports that CABG in patients with very EF, though high risk, can result in improved outcomes if myocardial viability is present. Studies such as the STICH trail and its extension have demonstrated a long-term survival benefit in patients with ischemic left ventricular dysfunction who undergo surgical revascularization. The decision to proceed with CABG is often influenced by the presence of viable myocardium, as revascularization can significantly improve ventricular function in such patients 6,7.

**CONCLUSION**

The management of OPCAB in patients with very low EF requires a multidisciplinary approach involving careful patient selection, and advanced intraoperative monitoring. The successful outcome in this case supports the growing body of evidence that tailored surgical and anesthetics strategies can improve outcomes in this high-risk patient population.

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