Coronary Artery Revascularization Without Cardiopulmonary Bypass After A Cardiac Stab Wound

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INTRODUCTION
Penetrating cardiac injuries are among the most dynamic and fatal of all injuries, requiring immediate surgical intervention, excellent surgical skills, and perioperative and postoperative critical care. Currently, broad ranges of cardiac stab wounds have been clinically presented ranging from hemodynamic stability to cardiopulmonary arrest. In addition, if a coronary artery injury is associated with injury to the cardiac chamber, the patient's condition becomes very serious with an increase in mortality. Cardiopulmonary bypass (CPB) is generally necessary to repair cardiac stab wounds, especially when the injury is complex or coronary artery related. We would like to present in this case report, the importance of an urgent approach for a penetrating cardiac injury using off-pump technology.

CASE REPORT
A 19-year-old male was admitted with a 3-cm skin incision caused by a stab wound to the chest localized at the junction of the left side of the manubrium sterni and 5th intercostal space. An initial evaluation of the patient revealed no detectable vital signs, such as arterial blood pressure, pulse, and breathing, but electrical activity of the heart was present. The patient was immediately intubated and started for external cardiopulmonary resuscitation. During this time, an anterolateral thoracotomy was performed in the left 5th intercostal space to control the bleeding and to diagnose the severity of the cardiac stab wound.

The thoracotomy revealed that the left hemi-thorax was filled with 2500 mL of blood and fresh thrombi. A pericardial tamponade was diagnosed and the fluids were released from the pericardial cavity through a pericardial incision near the anterior side of the left phrenic nerve. A 2-cm stab wound in the left ventricle was seen and the bleeding was controlled with a finger depressing the wound. The cardiac wound was temporarily sutured with prolene suture.

Internal cardiac massage was provided continuously. The heart was shocked twice, first at 150 Joules and the second at 200 Joules, the latter at which sinus rhythm was recovered. Arterial and venous lines were inserted through the right femoral artery and vein. The arterial pressure was 50 mm Hg and a blood gas analysis revealed that the hemoglobin was 6.8 g/dL and a hematocrit of 22%. As a result, some volume (almost 500 mL - 0.9% saline) was administered and an intravenous drip of dobutamine 5 g/kg/min was started.

It was observed that the stab wound had transected at the middle of the left anterior descending coronary artery (LAD) and penetrated to the left ventricle. The cardiac wound was repaired with pledgeted mattress sutures and the proximal side of the LAD was ligated. Afterwards, the patient showed signs of progressive myocardial ischemia and required internal defibrillation due to ventricular tachycardia and fibrillation. Persistent hypotension and recurrent ventricular fibrillation led to the decision to proceed with revascularization without transporting the patient to the...
operating room. The left internal thoracic artery (LITA) was transected and anastomosed to the distal side of the transected LAD. The anastomosis was performed on the beating heart with the assistance of an atraumatic clamp for stabilization. The patient's ECG signs of ischemia resolved and blood pressure stabilized. The patient was weaned from inotropes within 54 hours experienced no further cardiac problems or complications. The patient couldn't regain full his cognitive function. The patient died as a result of an unrelated respiratory complication 20 days after the surgery.

**DISCUSSION**

Penetrating cardiac injuries are one of the most fatal injuries. Despite the increase in emergency medical services response time about 60% to 80% of cardiac injuries result in death at the scene of the injury or while being transported to a hospital while 37% patients with cardiac injuries died in either the emergency or in the operating rooms (1, 4).

Penetrating cardiac wounds are associated with coronary artery injuries in up to 9% of all cases (2). The LAD is the most frequently injured vessel primarily because of its anatomical position. Cardiac injuries associated with a coronary artery wound have been described as an unfavorable prognostic factor with a mortality rate as high as 89% (1, 2).

The primary method of management of penetrating injuries to the coronary vessels is to ligate peripheral branches. Attempts of cardiac repair or bypass surgery should be performed if the injured vessel is large and is the dominant artery supporting a significant ventricular mass such as the LAD or if signs of progressive ischemia or uncontrollable arrhythmias occur (3). Using CPB during coronary artery repair, revascularization, or any severe cardiac wound repair is advantageous to the patient. Providing not only optimal surgical conditions, but also allows rapid rewarming and resuscitation of the patient. However, CPB requires full heparinization, which is an important concern in trauma patients who may suffer from other injuries that may contraindicate the administration of heparin (4).

Recently, cardiac surgical procedures have been performed more frequently without the use of CPB. For example, aortocoronary bypass surgeries from an anterolateral thoracotomy fashion have been performed off-pump (5). An anterolateral incision, equivalent to an emergency thoracotomy, allows easy access to the cardiac chamber and coronary arteries, especially the LAD. In our case, the anterolateral thoracotomy both cardiac and coronary vessel injury and an aortocoronary bypass was performed using LITA to the distal side of LAD without any complications.

**CONCLUSION**

Off-pump coronary artery bypass surgery can be safely used in cardiac stab wounds with coronary artery related injuries, thus minimizing some adverse effects of CPB. As a result, even if the patient is in the emergency room, cardiac surgeons should consider surgical intervention for penetrating cardiac injuries without the use of CPB.

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