

CASE REPORT

A novel approach: how an intracoronary shunt proved to be lifesaving

Karen Booth, Gareth J. Hooks*, Peter C.E. Mhandu, and Haralabos Parissis

Department of Cardiothoracic Surgery, Royal Victoria Hospital, Belfast, Northern Ireland

*Correspondence address. Department of Cardiothoracic Surgery, Royal Victoria Hospital, Grosvenor Road, Belfast BT12 6BA, Northern Ireland.
Tel: +0044-783428103; Fax: +0044-2890326614; E-mail: ghooks01@qub.ac.uk

Abstract

Outcomes and complications following internal massage in cardiac surgery are unknown due to the lack of cumulative effort to capture those events and subsequently developing a registry. Therefore, under the circumstances there are no algorithms defined in the literature. This case report outlines the importance of sound decision-making under pressure in order to achieve a favourable outcome. A potential solution is outlined to a very complex and rare problem: anastomotic disruption during internal cardiac massage in an intensive care unit setting, demonstrating the use of an intracoronary shunt for initial stabilization prior to a definitive procedure.

INTRODUCTION

Open-chest cardiopulmonary resuscitation (CPR) versus closed-chest CPR results in greater perfusion pressures, systemic blood flow and possibly survival. It is indicated in cases of circulatory arrest in the early post-operative phase after cardiothoracic surgery and is felt to be superior to closed-chest CPR [1]. Other management strategies for large pericardial effusion or tamponade include percutaneous pericardiocentesis under echocardiographic guidance, which has been shown to effectively treat post-operative tamponade, but in the case of an arrested heart, emergency re-sternotomy is the primary treatment strategy with the added benefit of internal massage [2].

Internal cardiac massage strategies consist of both single- and double-handed techniques. Single-handed technique may disrupt the right ventricle especially, if it is thin or distended. The European Association of Cardio-Thoracic Surgery recommends a double-handed technique after careful removal of clots [3]. Passage of the right hand over the apex of the heart minimizes the risk of graft avulsion and with a flat left hand on the anterior surface the two hands can be squeezed together. Where there is a mitral valve repair or replacement, the apex should not be lifted

due to the risk of rupture of the posterior ventricle. Emergency re-sternotomy in an intensive care unit (ICU) setting is an integral part of the cardiac arrest protocol up until the 10th post-operative day and is recommended by the European guidelines. Beyond this, the chance of cardiac arrest occurring due to a cause that can be corrected by emergency re-sternotomy is greatly reduced.

CASE REPORT

A 70-year-old man with a Logistic Euroscore 3.44 (Additive Euroscore 5) presented for elective coronary artery bypass grafting. He had an increased BMI and was a current smoker with his medical history including: Type 2 diabetes, chronic kidney disease (creatinine 117 $\mu\text{mol/l}$), intermittent claudication, hiatus hernia and normochromic normocytic anaemia. Preoperative echocardiogram (ECHO) demonstrated mild stenosis of his aortic valve (mean gradient 13 mmHg) with normal left ventricular function.

He underwent on pump coronary artery bypass surgery with antegrade and retrograde cold-blood cardioplegia. The left internal mammary artery (LIMA) was grafted to the left anterior descending artery (LAD), and long saphenous vein grafts were

Received: October 6, 2015. Accepted: December 2, 2015

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anastomosed to the first obtuse marginal (OM1) and posterior descending artery (PDA). This was a straightforward procedure, and the patient came off bypass on the first attempt with minimal inotropic support.

On the first post-operative day, a re-sternotomy was performed for 1200 ml drainage overnight with a normal clotting profile. A bleeding point was identified from the IMA pedicle and was controlled with a liga clip. Subsequent ventilatory wean was slow with extubation and drain removal occurring on Day 6. Continuous renal replacement therapy (CRRT) was instituted for post-operative renal impairment and antibiotic therapy for a chest infection.

Slow and steady clinical improvement was noted with CRRT until Day 10 when the patient developed signs of tamponade with tachycardia, hypotension, and a large pericardial effusion on ECHO. Subsequently, cardiac arrest occurred whilst still in the ICU. An emergency re-sternotomy was performed with internal cardiac massage for 20 min. In an ICU environment and under suboptimal surgical conditions, he was successfully resuscitated. The aetiology of the tamponade to our surprise was a small leak from the heel of the LIMA to LAD anastomosis.

The heart appeared oedematous, and unfortunately during CPR, it became apparent that almost half of the perimeter of the LIMA to LAD anastomosis (involving the heel) had become dehisced. Severe bleeding and ECG changes ensued. Under these circumstances in the ICU environment, it was deemed impossible to institute cardiopulmonary bypass as it was out of hours with a perfusionist on call from home.

With an off-pump coronary artery bypass (OPCAB) surgeon present, a salvaging procedure was performed at the bedside. Using a 1.5 mm intracoronary shunt, management of the bleeding and haemodynamic stability was achieved with some flow restored down the LAD.

Subsequently, in a now controlled environment, the LIMA-LAD anastomosis was deconstructed, the edge of the LIMA refreshed and the anastomosis then re-performed with great difficulty as the tissues (now 10th post-operative day) were swollen and difficult to handle. Off-pump techniques were utilized with the help of a medtronic stabilizer. The patient's chest was splinted open for 5 days to allow for myocardial oedema to resolve prior to closure. A tracheostomy was required to facilitate this second ventilator wean, and following a prolonged ICU stay and rehabilitation on the ward, the patient was discharged on the 42nd post-operative day. At 5 years follow-up, the patient was alive and well with no angina chest pain.

DISCUSSION

The complications following internal massage are largely poorly understood due to the lack of a registry containing such data. As a result, the overall mortality and morbidity are not known but can be assumed to be significant. Patients who survive severe

hemodynamic collapse, open cardiac massage and emergency cardiac reoperation following coronary artery bypass grafting have, however, been reported to achieve a similar long-term survival and cardiac re-intervention rates as pair-matched control patients [4].

There are no papers in the literature analysing the incidence or documenting the outcome following disruption of an anastomosis during internal massage.

Despite adhering to guidelines for internal cardiac massage, disruption of anastomotic sites can still occur as this case demonstrates. Furthermore, with the salvaging nature of this situation and the fact that junior staff may be the only personnel in the immediate vicinity, it is presumed that the outcome is dismal. The management strategy once a graft is disrupted should aim to ensure a safe platform in order to facilitate repair. The benefit of OPCAB knowledge with the use of intracoronary shunting can be essential and in this circumstance proved to be lifesaving. The shunt allows for a bloodless field and preserves at least 50% of forward flow preventing ischaemia [5, 6].

This case outlines the need for a registry for all cases undergoing open resuscitation following heart surgery. Moreover, it provides a potential solution to a very complex and rare problem: anastomotic disruption during internal cardiac massage in an ICU setting, demonstrating the use of an intracoronary shunt for initial stabilization prior to a definitive procedure.

CONFLICT OF INTEREST STATEMENT

None declared.

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