Case report - Coronary

Surgical treatment for late postoperative radial artery graft spasm

Denyan Mansuroglu*, Suat Nail Omeroglu, Bahadir Daglar, Gokhan Ipek

Department of Cardiovascular Surgery, Kosuyolu Heart and Research Hospital, Kadikoy, 81020 Istanbul, Turkey

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Abstract

Hemodynamic instability due to late postoperative radial artery spasm is a rare phenomenon. This entity developed in our patient who was operated on for severe left main coronary artery stenosis with a dominant circumflex artery. The spasm could not be relieved with intraluminal vasodilator therapy, and the patient underwent reoperation using a saphenous vein graft-anastomosed distal to radial artery.

Keywords: Radial artery; Late spasm; Reoperation

1. Introduction

Superior long-term results of left internal mammary artery (LIMA) grafting led to the search of other arterial conduits. First, in 1971, Carpentier proposed the use of radial artery for coronary artery bypass grafting (CABG) [1]. This new concept was rapidly abandoned due to frequent complications such as spasm and graft occlusion. Radial artery grafting became popular again in 1990s mainly because of the advent of new antispasmodic pharmacological agents and new, less traumatic harvesting methods that yielded good short- and mid-term results [2]. Although currently radial artery spasm is a rare phenomenon, when it does occur it can be fatal [3]. We report a patient who developed late postoperative radial artery spasm that resulted in severe ischemia and low cardiac output.

2. Case report

A 57-year-old male patient was admitted to hospital with unstable angina pectoris. Coronary arteriography showed triple-vessel disease with 90% stenosis of the left main coronary artery (LMCA). Ventriculography and echocardiography showed normal left ventricular function.

Electrocardiogram (ECG) failed to reveal signs of myocardial infarction; however, T-wave negativities were detected at DI and aVL (Fig. 1a). The patient was operated electively. LIMA and left radial artery were harvested simultaneously. At the beginning of operation the patient was put on diltiazem (1 µg/kg per min) and nitroglycerine (0.3–0.5 µg/kg per min), which were continued for 2 days. After extubation he was also started on oral diltiazem. The radial artery was checked by injecting a solution that included 60 mg papaverine and 5 mg verapamil in 250 cc isotonic solution. The artery was preserved in the same solution. CABG was performed in the usual manner. LIMA was anastomosed to the left anterior descending artery (LAD), whereas radial artery and saphenous vein grafts were anastomosed to the second obtuse marginal branch of the circumflex artery and right coronary artery (RCA), respectively. Continuous retrograde isothermic blood cardioplegia was used for myocardial preservation. The operation was completed uneventfully. No ischemic findings were present on ECG done at the end of the operation (Fig. 1b). There were no ischemic changes on ECG at the 6th postoperative hour. Subsequently the patient was extubated. On postoperative day 7, he woke up with angina. ECG showed marked ST segment depression at V4–V6 (Fig. 1c). His angina did not respond to medical therapy. Coronary angiography revealed severe spasm of the proximal part of the radial artery (Fig. 2a). LIMA to LAD and saphenous vein graft (SVG) to right coronary artery (RCA) anastomoses were patent, whereas the LMCA was totally occluded. Verapamil (0.2 mg) and nitroglycerine

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(0.2 mg) in 2 ml isotonic solution was administered intraluminally into the radial artery graft. Although we repeated this intervention several times, it did not release the spasm (Fig. 2b). The angina did not respond to vasodilator therapy and the ischemic changes persisted on ECG. Echocardiography showed marked decrease in ejection fraction together with hypokinesia of the anterolateral and apical segments. The patient started to show signs of heart failure due to low cardiac output. A second operation with SVG anastomosis distal to radial artery anastomosis was planned. Hemodynamic failure occurred at induction so perfusion was started as soon as possible. LIMA was clamped and myocardial preservation was maintained by antegrade–retrograde blood cardioplegia. Spasm of the proximal half of the radial artery was seen and also palpated. A major branch of the radial artery was opened, the distal segment of the radial artery was clamped with a bulldog clamp and flow was present while antegrade cardioplegia was delivered. A dilator was not passed through this branch but was passed through the arteriotomy made for the distal anastomosis of the SVG, and the distal anastomosis of the radial artery was found to be patent. SVG to second obtuse marginal branch of the circumflex artery anastomosis was performed distal to radial artery anastomosis. Proximal anastomosis was performed on cross-clamped aorta. The heart began to beat spontaneously. Aortic cross-clamp time was 28 min. In order to diminish the left ventricular depression, extracorporeal membrane oxygenator support

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**Fig. 1.** (a) Preoperative ECG. There are no signs of myocardial infarction; however, T-wave negativities at DI and aVL are observed. (b) No ischemic findings were present on ECG done at the end of the first operation. (c) ECG on postoperative day 7: There is marked ST segment depression at V4–V6. (d) ECG after the second operation: ST depressions have returned to baseline.
was maintained for 3 h. The total perfusion time was 220 min. Weaning from cardiopulmonary bypass was done with intra-aortic balloon pump together with inotropic support. After this second operation, ST depressions on ECG returned to baseline (Fig. 1d). The postoperative process was uneventful. The patient was extubated at the end of the first postoperative day and intra-aortic balloon pump support was stopped on the 10th postoperative day. The patient was discharged on the 28th postoperative day with an ejection fraction of 45%. Echocardiography performed 2 months after the operation showed clear improvement in the lateral wall movements and the ejection fraction had increased to 55%. A coronary angiogram was also performed and the patency of SVG to the second obtuse marginal branch of the circumflex artery was observed (Fig. 2c). LIMA to LAD and SVG to RCA anastomoses were patent, whereas the radial artery was totally occluded.

3. Discussion

Radial artery is a type III arterial graft and is more spastic than type I arterial grafts (internal mammary artery and inferior epigastric artery). The anatomic features of radial artery, harvesting and filling techniques, vasodilator therapy, inotropic support, bioactive peptides released during and after CABG, local and generalized hypothermia, and blood pH values are all thought to be important factors in the early period spasm [1,4]. Intraluminal injection of vasodilators such as calcium antagonists, nitroglycerine, papaverine or milrinone can provide an effective antispastic therapy [5,6].

Radial artery spasm can be fatal in patients like ours who have LMCA stenosis, thin LAD and dominant circumflex arterial system. The frequency of radial artery spasm was reported to be between 0 and 9.7% [2,5,7]. The incidence of radial artery spasm in our experience is 2% [3]. We harvest the radial artery using a no-touch technique and as a vasodilator protocol we prefer nitroglycerine, a calcium channel blocker, and papaverine [8]. Coronary angiography was deemed initially unnecessary in this case due to both negative ECG findings and successful treatment of pain with medications on the first postoperative day. However, control angiography was necessary on the 7th day postoperatively because of chest pain, serious ECG changes and hemodynamic instability. Coronary angiography revealed long-segment spasm in the proximal half of the radial artery. The patient underwent reoperation on the 7th day due to

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Fig. 2. (a) Control coronary angiography revealed severe spasm of the proximal part of the radial artery. (b) After intraluminal vasodilator administration, radial artery spasm persisted. (c) The patency of SVG, anastomosed to the second obtuse marginal branch in the second operation, is shown.
severe spasm that was not relieved with intravenous and intraluminal vasodilator therapy.

It should be kept in mind that radial artery spasm might reoccur in the late postoperative period. Radial artery spasm must be ruled out in patients who develop hemodynamic instability without intractable ventricular arrhythmias or ischemic ECG changes. Radial artery spasms that do not respond to intraluminal vasodilators must be treated surgically.

References


Appendix A. ICVTS on-line discussion

Author: Dr. Hitoshi Hirose, MD, Juntendo University, Cardiovascular Surgery, Hongo, Bunkyo-ku, Tokyo 44106, Japan

Date: 13-Sep-2003

Message: It was an interesting paper to remind us about radial artery vasospasm. Pharmacological precaution of vasospasm include systemic administration of calcium channel blocker and intraluminal injection of papaverin, calcium channel blocker or milrinone has been considered to be important. A literature review showed radial artery vasospasm may occur at the incidence of 7.3% despite modern pharmacological precautions [1]. I agree with the author that the radial artery vasospasm may cause acute hemodynamic changes and it may occur any time during the early postoperative period. At our institution, skeletonized radial artery harvesting has been performed to reduce the incidence of vasospasm [2,3]. We use an ultrasonic scalpel for skeletonization and intraluminal injection of milrinone to reverse vasospasm. The skeletonized radial artery responds well to the intraluminal injection of vasodilators because of a lack of the adventitia (Fig. 1). We have not encountered hypoperfusion syndrome related to radial artery vasospasm. The skeletonized radial artery harvest could be an option to further reduce the incidence of postoperative vasospasm.

Fig. 1. Harvested radial artery by skeletonized technique.

References