How-to-do-it

Intraoperative angiography for quality control in MIDCAB and OPCAB

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Abstract

We present our initial experience with intraoperative angiographic evaluation of coronary artery bypass grafts placed on the beating heart. Thirty-three grafts were investigated in 23 patients. Transfemoral angiography was performed using an OEC 9800 mobile C-arm. Spasm of the graft and/or target vessel was present in 11 grafts, two grafts were severely stenosed requiring surgical revision. In a third case an additional bypass graft was placed due to angiography findings. There was no hospital mortality and no significant perioperative myocardial ischemic event. All patients were free of angina 6 months postoperatively. Intraoperative angiography seems to reveal valuable information in beating heart coronary surgery.

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1. Introduction

The quality of coronary artery bypass grafts placed on the beating heart is still a matter of debate. The primary goal of any surgical coronary grafting procedure must be that the patient leaves the operating room with adequately sutured and well functioning conduits. Intraoperative angiographic visualization of coronary artery bypass grafting (CABG) grafts has been an intention already during early development of surgical coronary revascularization but has never become a routine procedure, most probably because of logistic and technical reasons. Mobile C-arms with adequate resolution have led to renewed interest in intraoperative graft angiography especially in off pump procedures.

2. Patients and methods

Thirty-three grafts were investigated in 23 patients (median age 60 (40–74) years, 20 male, three female). These patients underwent off-pump coronary artery bypass grafting (OPCAB, n = 14) or minimally invasive direct coronary artery bypass grafting (MIDCAB, n = 9).

2.1. Angiographic examination

A 7-F femoral access was gained in the left or right groin to perform graft angiography following the Judkins technique. For reasons of time all preparations for the examination were carried out in parallel to operative steps in the OPCAB or MIDCAB procedures. Eight examinations were performed immediately after suturing the bypass grafts, 15 examinations were performed after thoracotomy closure. Fluoroscopy was carried out with GE OEC 9800 mobile C-arm at 25 frames/s. The C-arm was covered with sterile plastic sheets and the thorax was additionally covered with sterile drapes. Two to four projections (anterior posterior, LAO 20°, RAO 20°, or LAO 90°) were used to visualize the grafts. Depending on individual anatomical features, standard Judkins right and left or bypass catheters (Boston Scientific) were used. The operating table was a Maquet 1150.10D0 (Maquet, Rastatt, Germany). All sequences were transferred electronically to a computer work station, viewed on OEC CRS-PC Software, and stored on CD.

3. Results

A list of grafts examined is shown in Table 1. In four cases it was impossible or unadvisable to intubate aortocoronary bypass grafts at the proximal anastomosis.
All other conduits could be adequately visualized. Median examination time was 25 (8–80) min, fluoroscopy time was 469 (211–1337) s, and the radiation dose reached 39 291 (11 967–174 398) mGy. Spasm of the bypass and/or target vessel was present in 11/29 (37.9%) grafts and responded well to intraluminal injection of nitroglycerine in nine of these 11 (81.8%). Two grafts showed stenoses at the anastomosis which were unresponsive to the intraluminal vasodilator and these grafts were surgically revised. Fig. 1 shows one of the grafts which required surgical revision. In another case of radial artery bypass to the RCA angiography revealed a significant stenosis of the posterolateral artery (PLA) close to the anastomosis while the posterior descending artery (PDA) was patent. An additional vein graft was placed on the PLA. The overall surgical revision rate in our series was 3/29 (10.4%).

Postoperatively, no death or major cardiac event occurred. All patients of the series were angina free at 6 months postoperatively and no patient required repeat target vessel revascularization.

4. Discussion

Our preliminary experience underlines previous findings [1–3], which demonstrated that coronary artery bypass grafts placed on the beating heart exhibit a relatively high rate of occlusions or stenoses when examined by intraoperative angiography. Spasm seems to be a highly prevalent confounding problem for interpretation of angiographic results after coronary artery bypass grafting. This has been stressed in papers on intraoperative and immediate postoperative graft angiography [1,4]. In contrast to previous authors who encountered significant problems distinguishing spasm from stenosis [4] we noted a considerable responsiveness of spastic vessels to intraluminal nitroglycerine which allowed us to clearly differentiate between morphologically stenosed vessels and contracted ones.

In a recently published prospective randomized trial comparing MIDCAB and stenting for proximal left anterior descending artery stenoses [5], a 4.5% rate of early reoperations for anastomotic stenoses and erroneously placed grafts was noted. We speculate that this technical error rate may have been detected by intraoperative angiography and that immediate repair during the same surgical session would have been possible. In the above prospective randomized trial comparing MIDCAB and stenting, 21% of patients experienced return of angina 6 months after surgery and 18% of patients showed stenoses greater that 50% at the anastomosis or in the graft. Five percent of the patients underwent catheter intervention of these lesions. By comparison, none of the patients in our series developed angina at 6 months postoperatively and none of the grafts restudied by angiography showed lesions greater than 50%. This underlines our opinion that intraoperative angiography may have a place for improvement of results in beating-heart coronary surgery.

Table 1

Coronary artery bypass grafts investigated by intraoperative angiography

<table>
<thead>
<tr>
<th>Graft Type</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>LIMA to LAD</td>
<td>20</td>
</tr>
<tr>
<td>LIMA to Dg</td>
<td>1</td>
</tr>
<tr>
<td>SVG to Dg</td>
<td>1</td>
</tr>
<tr>
<td>RA to Dg</td>
<td>1</td>
</tr>
<tr>
<td>RA to RCA</td>
<td>3</td>
</tr>
<tr>
<td>SVG to RCA</td>
<td>3</td>
</tr>
<tr>
<td>SVG to PLA</td>
<td>1</td>
</tr>
<tr>
<td>SVG to Cx (Y-graft)</td>
<td>2</td>
</tr>
<tr>
<td>SVG to OM (Y-graft)</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>33</td>
</tr>
</tbody>
</table>

LIMA, left internal mammary artery; LAD, left anterior descending artery; Dg, diagonal branch; SVG, saphenous vein graft; RA, radial artery; RCA, right coronary artery; PLA, posterolateral artery; Cx, circumflex artery; OM, obtuse marginal branch.

References


