Usefulness of Intraoperative Coronary Angioplasty in Aorto-coronary Bypass Surgery

TOSHIHIKO BAN, M.D., RYUZO SAKATA, M.D., JUNICHI SONEDA, M.D.
MITSUHIKO MATSUDA, M.D., KAZUNOBU NISHIMURA, M.D.
KAZUO HIRATA, M.D. AND TAKAAKI MOCHIZUKI, M.D.

Seven patients underwent aorto-coronary bypass grafting combined with intraoperative transluminal coronary angioplasty (OTCA), because of multiple obliteration of the coronary arteries with poor distal run-off. The patients were all males with a mean age of 52.6 years. For OTCA, a SIMPSON-ROBERT vascular dilator system was used. Eight stenoses in seven patients, four in the left anterior descending artery (LAD) and three in the right coronary artery (RCA) were dilated by means of OTCA. In five patients the results were satisfactory but in two patients the procedures resulted in failure. Dilatation failed because of severe calcification of LAD in one case and, in the other, distal RCA was completely obstructed by a compressed atherosclerotic plaque at the bifurcation after the procedure. From these limited experiences we believe that OTCA might be a method of selection to treat the patients with coronary sclerosis with poor distal run-off.

AT present, it is possible for aortocoronary bypass surgery to be performed with an acceptable low mortality rate and improved long term results. This has attained by the improvement of intraoperative myocardial protection on the one hand, and by improved operative technique for accomplishing complete revascularization on the other. Multiple stenosis of the main coronary arterial tree, however, might make complete revascularization difficult. Some portions of diseased coronary arteries remained unrevascularized even after conventional separate vein graft technique. In such a situation, coronary revascularization could usually be performed

by the sequential graft technique in which a single vein graft is anastomosed to proximal and distal sites to the second stenosis of the coronary artery.

In 1974, Grünzig¹ reported using percutaneous transluminal coronary angioplasty (PTCA) with a balloon catheter to treat atherosclerotic coronary stenosis in selected patients. Indeed this method is comparatively simple and has the advantage of providing instantaneous revascularization without surgery, but it is still controversial because there is a possibility for dangerous complications to occur.

We have performed this procedure during aortocoronary bypass surgery in patients with multiple stenosis of the main coronary arterial tree. The present report summarizes our initial experiences in seven patients and discusses the problems.

Key Words:

A-C bypass
Poor distal run-off
Sequential graft technique
Intraoperative transluminal coronary angioplasty

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Department of Cardiovascular Surgery, Kokura Memorial Hospital, Japan

Mailing address: Toshihiko Ban, M.D., Department of Cardiovascular Surgery, Kokura Memorial Hospital, 1-1 Kifune-machi, Kokura-kita-ku, Kitakyushu, 802 Japan

TABLE 1 INTRAOPERATIVE TRANSLUMINAL CORONARY ANGIOPLASTY

No.	Case	Age	Sex	Diagnosis	Operation	Angioplasty	Results
1	H.M.	45y.	m	3 VD LV-Aneurysm	LV-Aneurysmectomy RCA > Bypass CX > Bypass	RCA (Seg. 3)	good
2	T.K.	55y.	m	3 VD	LAD > Bypass CX > Bypass	LAD (Seg. 7, 8)	good
3	M.T.	54y.	m	3 VD	LAD > Bypass CX > Bypass	LAD (Seg. 7)	unsuccessful
4	S.T.	54y.	m	LMT-disease	LAD > Bypass CX > Bypass	LAD (Seg. 7)	good
5	K.T.	52y.	m	3 VD	Diag.-LAD > Bypass 4 PD-CX > Bypass	LAD (Seg. 7)	good
6	J.I.	54y.	m	2 VD	RCA > Bypass LAD > Bypass	RCA (Seg. 3)	occluded
7	Y.O.	54y.	m	2 VD	LAD > Bypass RCA > Bypass	RCA (4 PD)	good

Abbreviations: LV = left ventricle; RCA = right coronary artery; Diag. = diagonal branch; LAD = left anterior descending artery; CX = left circumflex artery; LMT-disease = left main trunk disease; 4 PD = posterior descending branch of RCA; 3VD = three vessel disease; 2 VD = two vessel disease

Fig.1. Patient 4. A: (left) Preoperative left coronary angiogram. Besides the left main trunk lesion, note stenosis in Seg. 6 and 7 of the left anterior descending artery. B: (right) Postoperative angiogram. Grade of stenosis in Seg. 7 was reduced by intra-operative dilatation procedure.

MATERIALS AND METHODS

Seven patients underwent aorto-coronary bypass surgery combined with intraoperative transluminal coronary angioplasty (OTCA) because of multiple obliteration of the coronary arteries (Table I). These patients were all men with a mean age of 52.6 years. For the intra-

operative application of coronary angioplasty, the Simpson-Robert vascular dilator system² was used. The balloon catheter was introduced into the coronary artery with multiple stenosis, from the site of arteriotomy. After the second or third stenosis was dilated, saphenous vein grafting was completed in the usual manner.

RESULTS

As shown in Table I, eight stenoses in seven coronary arteries, four in the left anterior descending artery (LAD) and three in the right coronary artery (RCA) were dilated by the OTCA. All patients survived after the intervention. In five patients the procedures resulted in success.

The results of the procedures are presented briefly by the following two representative cases.

1) Right coronary artery

A 45-year-old man with postinfarction angina (patient 1) underwent left ventricular aneurysmectomy and aorto-coronary bypass grafting to LAD and obtuse marginal branch of the circumflex artery. In this patient, an angiogram revealed 90% stenosis in segment (seg.) 3 of RCA near the bifurcation in addition to 90% stenosis in seg. 2. The RCA was incised immediately proximal to the second stenosis which was dilated by OTCA, and vein grafting was successfully performed. A postoperative angiogram revealed only 50% stenosis in seg. 3 of RCA with patent graft. However, in patient 6, who had similar anatomical changes of RCA as in patient 1, the result of OTCA was disappointing. In this case the stenosis in seg. 3 of RCA extended into the posterior descending and AV-nodal branches. Patient 7, on the other hand, in whom the second stenosis was found in more distal portion in the proximal third of the posterior descending branch, had successful OTCA through the arteriotomy in seg. 3.

2) Left anterior descending artery

A 54-year-old man with left main trunk disease (patient 4) underwent aorto-coronary bypass surgery because of angina pectoris. In this patient severe stenosis was found in segs. 6 and 7 of LAD between which the major septal perforator was sandwiched (Fig. 1). The LAD was incised immediately distal the second stenosis which was successfully dilated by OTCA, and saphenous vein grafting was performed in the usual manner (Fig. 2). In another two patients (patients 2 and 5) the second stenosis were also successfully dilated. In patient 3, the procedure failed because of severe calcification of the stenosis.

As a whole, in five patients the stenosis could be reduced below 50% luminal narrowing with patent graft. One case remained unchanged (case 3) and in another patient (case 6), total obstruc-

tion of the RCA occurred at the dilated site.

COMMENT

At present, aorto-coronary bypass surgery can be performed with an acceptable low mortality rate. Revascularization surgery has come to gain wider indication even in patients with diffuse coronary disease which was formerly considered to be contraindicated, providing ventricular function is satisfactory. To completely revascularize the coronary arteries of multiple stenosis with poor distal run off, sequential graft technique has been usually used. The vein graft was anastomosed in two or even more sites sequentially by means of an end- to side vein-coronary anastomosis distally and side-to-side veno-arterial anastomosis proximally.

Recently PTCA was introduced to treat athelosclerotic coronary stenosis in selected patients. Indeed this procedure is comparatively simple and has the advantage of providing instantaneous revascularization without surgery. Many problems still remain under discussion, especially the problem of serious complications. In our hospital, six patients with proximal stenosis of LAD underwent PTCA with success in two. In two other patients the procedures resulted in failure. The last two patients underwent emergency aorto-coronary bypass surgery because of acute coronary dissection. Fortunately these patients survived and further evolution of myocardial infarction could be prevented. Incidence of serious complication could be decreased with the accumulation of experiences, however, the disadvantage of this procedure is that it is a "blind" technique. However, when this procedure is used during bypass surgery,³ The main disadvantage of "blindness" can be overcome and complete revascularization in patients with diffuse coronary disease can be accomplished more simply. The balloon catheter could be easily and more safely passed through the stenosis ante- or retrogradely through the site of arteriotomy by advancing the catheter only a few centimeters under palpatory guiding. We performed the OTCA in seven patients together with aorto-coronary bypass surgery. In five patients the results were satisfactory but in two the procedures resulted in failure, one because of severe calcification and the other because of complete obstruction of branching by the movement of the compressed plaque. From these limited experiences OTCA could be said to be

applicable during bypass surgery in some selected cases with diffuse coronary sclerosis. It should be contraindicated in the following situations: 1) calcified stenosis which could be confirmed by direct palpation, 2) stenosis located at branching or bifurcation which might be completely obstructed by the movement of compressed plaque after the procedure. To establish the advantage of this procedure over sequential graft technique in patients having coronary sclerosis with poor distal run-off, long term studies are needed.

REFERENCES

1. GRÜNTZIG A: Perkutane Dilatation von Coronarstenosen. Beschreibung eines neuen Kathetersystems. *Klin Wochenschr* **54**: 543, 1976
2. SIMPSON J, BAIN D, ROTHMAN T, HARRISON D: Update of clinical experience with a new catheter system for percutaneous transluminal coronary angioplasty. *Circulation* **64**: IV-252, 1981 (Abstr.)
3. MILLS NL, DOYLE D: Does operative transluminal angioplasty (OTA) extend the limits of coronary artery bypass procedure? *Circulation* **64**: IV-292, 1981 (Abstr.)