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# Catheterization and Cardiovascular Diagnosis

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# Coronary Angioplasty Through 4 French Diagnostic Catheters

Vivek K. Mehan, MD, Bernhard Meier, MD, Philip Urban, MD, Vitali Verine, MD, Emmanuel Haine, MD, and Pierre-André Dorsaz, PhD

**In 50 consecutive patients subjected to coronary angioplasty immediately following a 4 French (F) diagnostic study, the technical feasibility and economical aspects of angioplasty through 4F catheters of 54 lesions were assessed. The patients were selected, but multiple, eccentric, and long lesions were not a priori excluded. 4F diagnostic catheters (Cordis), and fixed-wire dilatation catheters (Ace, Scimed) were used in all cases. The procedure was successful in 43 lesions (80%) using 4F catheters. For 11 stenoses (20%), a change over to a larger French size was required. Two of these lesions could not be crossed with the balloon despite the larger sized guiding catheter. The final overall success rate was 96%, and there were no major complications. The use of diagnostic 4F catheters for angioplasty in these 50 patients resulted in the saving of 39 guiding catheters and 19 introducer sheaths. For 12 lesions (22%), an additional 4F catheter became necessary since the shape used for the diagnostic study was inadequate for angioplasty. In 7 cases, more than 1 balloon was used, but 5 of these balloon exchanges were independent of the use of 4F catheters. Three exchanges were performed through the 4F catheter (1 for need of a larger balloon to improve on an unsatisfactory angiographic result and 2 for a crimped guide wire tip of the Ace balloon). In the remaining 4, a larger catheter was used; in 2 of them, angioplasty eventually failed (failure to cross lesion) and in the remaining 2, a Monorail system solved the problem, which is incompatible with 4F catheters. In these 4 cases, a balloon could have been saved if the procedure had been started with a larger catheter and a movable wire system. We conclude that angioplasty through diagnostic 4F catheters completing a 4F coronary angiography is technically feasible and represents an economically viable alternative in selected patients.**



**Key words: interventional cardiology, coronary disease, PTCA**

## INTRODUCTION

In an era where cost constraints dictate short hospital stays, the use of outpatient cardiac catheterization for the diagnosis of coronary artery disease is growing. Several reports have described the use of 6 French (F) [1], 5F [2], and 4F [3,4] catheters for coronary angiography. When combining coronary angioplasty with the diagnostic study, (as in ad hoc coronary angioplasty, or ''PTCA at first sight'' [5]) it is intriguing to use the same small catheter for both procedures [6–8]. This has become possible due to thinner-walled catheters with good torque control and ultralow profile fixed-wire dilatation catheters with low friction coating. This report describes our initial experience of coronary angioplasty through 4F diagnostic catheters.

## METHODS

The study population comprises the first 50 consecutive patients to undergo coronary angioplasty through 4F diagnostic catheters. This series started in December 1990.

### Patients

The population was predominantly male (Table I). The majority of patients had single vessel disease and good left ventricular function. Single vessel angioplasty accounted for 92% of the cases. A total of 54 lesions were attempted in the 50 patients. Most patients had mid segment lesions. The patients were selected, but multiple, eccentric, and long lesions were not a priori excluded. There was 1 case of chronic total occlusion. The hard-

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**TABLE I. Baseline Characteristics: 50 Patients/54 Lesions**

| Characteristics | N | % |
|---|---|---|
| Clinical | | |
| Mean age (years) | 57 ± 10 (36–77) | |
| Male sex | 43 | 86 |
| Smoking | 42 | 84 |
| Hypertension | 17 | 34 |
| Diabetes | 4 | 8 |
| Asymptomatic, objective signs of ischemia | 16 | 32 |
| Angina class III or IV* | 10 | 20 |
| Unstable angina | 10 | 20 |
| Previous infarction | 22 | 44 |
| Previous angioplasty | 16 | 32 |
| Previous bypass surgery | 2 | 4 |
| Angiographic | | |
| Ejection fraction (%) | 67 ± 10 (43–86) | |
| Number of sites attempted | | |
| 1 | 46 | 92 |
| 2 | 4 | 8 |
| Coronary artery attempted | | |
| Right | 15 | 28 |
| Left anterior descending | 19 | 35 |
| Left circumflex | 20 | 37 |
| Site of lesion | | |
| Proximal | 14 | 26 |
| Mid | 37 | 68 |
| Distal | 3 | 6 |
| Mean initial stenosis (%) | 91 ± 8 (70–100) | |
| Mean residual stenosis (%) | 21 ± 18 (0–95) | |

*According to the classification of the Canadian Cardiovascular Society.

**TABLE II. Hardware: 50 Patients/54 Lesions**

| Hardware | N | % |
|---|---|---|
| 4F diagnostic catheter for angioplasty | | |
| Judkins shape | 38 | 70 |
| Amplatz shape | 16 | 30 |
| Introducer sheath | | |
| None | 19 | 38 |
| 4F | 20 | 40 |
| Larger, for crossover | 11 | 22 |
| Changeover to larger guiding catheter | 11 | 20 |
| Right coronary artery | 2 | 4 |
| Left anterior descending coronary artery | 3 | 6 |
| Left circumflex coronary artery | 6 | 11 |
| Size of largest balloon | | |
| 2.0 mm | 1 | 2 |
| 2.5 mm | 26 | 48 |
| 3.0 mm | 26 | 48 |
| 3.5 mm | 1 | 2 |
| Use of additional balloons | 7 | 13 |
| With 4F catheter: | 3 | 6 |
| Crimped wire while negotiating lesion | 2 | 4 |
| Inadequate results with first balloon | 1 | 2 |
| With larger guiding catheter: | 4 | 8 |
| Failed angioplasty | 2 | 4 |
| Need for a Monorail system | 2 | 4 |

ware utilized is depicted in Table II. In most cases (87%), a single balloon was used.

### Technique

The diagnostic study was performed by the femoral route, with 4F catheters using previously described techniques [3]. The use of a 4F introducer sheath was up to the discretion of the operator. In the majority of cases, it was not used (Table II). In 4 cases (8%), an Amplatz catheter in addition to the Judkins catheter was required for the diagnostic study. The 4F catheter (Cordis) (Fig. 1) has an external diameter of 1.3 mm (0.054″), and a lumen of 1.0 mm (0.040″). Its novel shaft technology is based on Pellethane, braided with stainless steel wire, and provides excellent torque control [3]. All angioplasty procedures (except for 1 done during a demonstration course) were performed immediately following a diagnostic study with 4F catheters. Patients for whom it was anticipated that several balloons, stents, or perfusion catheters might be required, were not considered for 4F angioplasty. Standard angioplasty techniques were used [8,9]. The patients received intravenous aspirin unless they were on oral aspirin, and 20,000 units of heparin intravenously before the procedure. Ace balloons (Scimed), ranging in sizes from 2.0 mm to 3.5 mm, were utilized in all patients (Fig. 1). In 10 lesions (18%), the residual pressure gradient across the dilated stenosis was assessed by advancing the 4F catheter beyond the lesion over the distally placed balloon and performing a pullback pressure recording (Fig. 2).

Continuous variables are expressed as mean ± SD.

## RESULTS

Primary success through the 4F catheter was obtained for 43 lesions (80%) (Table III). All 4 double vessel angioplasties were successful. For 11 lesions (20%), a change over to a larger catheter became necessary; in 2 due to the need for a movable wire system, with its greater maneuverability (Monorail system in both, which are incompatible with 4F catheters), in 1 since the balloon could not be negotiated into an acute take off of the left anterior descending coronary artery using the 4F system (poor torque control of the balloon straddling the tip of the 4F catheter), and in 8 patients, including 1 with a chronic occlusion of the first marginal branch of the left circumflex coronary artery, due to problems with the 4F catheter (e.g., unstable position in the ostium, inadequate support). In 2 of these 8 patients, it remained impossible to negotiate the lesions using 7F guiding catheters and a variety of guide wires and balloons. In no case was wedging of the 4F catheter in the coronary ostium observed, and deep intubation of the catheter for

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