Catheterization and Cardiovascular Diagnosis 25:290–292 (1992)

Feature Topic: Clinical Experience With Stents

Preprocedure Warfarinization and Brachial Approach for Elective Coronary Stent Placement—A Possible Strategy to Decrease Cost and Duration of Hospitalization

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Intracoronary stenting, while potentially beneficial to treat abrupt closure and to prevent restenosis after angioplasty, requires intermediate-term warfarinization to prevent stent thrombosis. Hospitalization is often prolonged because of the need to establish anticoagulation. Hospital charges have been reported to be considerably higher with stenting than with balloon angioplasty alone, although the long-term cost ramifications remain uncertain due to the fact that stenting may limit restenosis. We describe a technique wherein stent placement is performed while the patient is already partially anticoagulated, which may decrease costs associated with stenting.

Key words: warfarin, stent, angioplasty

INRODUCTION

Dotter introduced the concept of maintaining vascular patency by endovascular stenting in 1969 [1]. Inadequate design of early prototypes was responsible for the delay in the clinical application of intracoronary stents. Recent improvements in design concurrent with increased need for devices that could maintain vessel patency in the event of abrupt closure and could offer possible solution to restenosis after balloon angioplasty have led to extensive clinical evaluation of coronary stents. The thrombogenic nature of currently available stents led to complex and aggressive anticoagulation protocols [2,3]. The need for aggressive anticoagulation has been, in large part, responsible for reported rates of bleeding requiring transfusion or vascular repair of 9–18% [3–5] and prolonged hospitalization and increased cost compared to patients treated with angioplasty alone [6].

In this case report we describe a novel approach to stent placement using the brachial approach in a patient who had elective ambulatory anticoagulation with warfarin for 4 days prior to admission for the procedure. The aim of this approach was to attempt to decrease the complication rate and duration of hospital stay in patients requiring elective stent implantation.

CASE REPORT

A 60-year-old male with history of coronary artery disease for the last 10 years presented with class IV angina. In 1981 the patient underwent angioplasty of a right coronary (RCA) stenosis. After the angioplasty the patient was asymptomatic until December 1990, when he began to notice angina on effort.

Cardiac catheterization revealed 80% stenosis of the RCA. The patient underwent successful angioplasty of the RCA and was asymptomatic for 4 months when he developed angina on effort. Cardiac catheterization revealed total occulusion of the RCA at the site of the previous angioplasty. The patient had temporary relief of his symptoms for 2 weeks with increased medical therapy and then started to suffer from angina on effort. His anginal syndrome accelerated in the following 4 weeks to having chest pain on minimal effort and occasionally at night. His sublingual nitroglycerin consumption has accelerated to about 6 per day. The patient was then referred to the University of Michigan Medical Center for stent placement.

Risk factors for coronary artery disease include hypercholesterolemia and a history of cigarette smoking. Medications included aspirin (325 mg daily), dipyridamole (75 mg every 8 hours), nitroglycerin (6.5 mg every 8

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Received August 27, 1991;revision accepted November 20, 1991.

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hours), nifedipine (60 mg once daily), and sublingual nitroglycerin (0.4 mg average of about 6 times a day). The patient was treated with warfarin (5 mg daily) 4 days prior to his admission. Two hours prior to the procedure, an intravenous dextran drip (100 ml/hr) was started. Physical examination was unremarkable. His laboratory studies were notable for a prothrombin time of 13.2 sec (PT ratio of 1.1) and a hemoglobin of 14.9 g/dl.

A right brachial artery cutdown was performed with the help of electrocauterization to prevent excessive bleeding. A 9F vascular sheath was introduced to the right brachial artery and flushed with heparin (5000 U). Cardiac catheterization revealed 85% stenosis of the mid RCA (Fig. 1). A heparin bolus (12,000 U) was given and an intravenous drip (1000 U/hr) was started. Using a 9 F "Hockey Stock" guiding catheter (Sherpa™, Medtronic, Minneapolis, MN), a 2.5 mm balloon catheter (P-14™, Scimed, Maple Grove, MN), and a 0.014 in. exchange-length guidewire (HighTorque Floppy™, Advanced Cardiovascular Systems, Temecula, CA), successful predilation of the RCA stenosis was performed with a maximal pressure of 8 atm for 90 sec. Then, a 3.0 mm intracoronary stent system (Palmaz-Schatz Stent™, Johnson and Johnson Interventional Systems, Warren, NJ) was exchanged with the balloon angioplasty system and successfully placed in the predilated region. Contrast material injections through the guiding catheter and the stent's delivery sheath helped to identify the predilated zone (Fig. 2). After the stent placement there was 19% residual stenosis (measured by electronic calipers), no angiographic signs of thrombus, and a TIMI 3 flow. Due to the residual stenosis the stent system was exchanged with a 3.25 mm balloon system system (Piccollino™, Schneider, Minneapolis, MN). The balloon was inflated inside the stent for a maximal pressure of 10 atm for 90 sec. The final result documented 8% residual stenosis with no angiographic signs of thrombus and a TIMI 3 flow (Fig. 3). Arterial repair and cutdown closure were performed in a standard fashion. Bleeding at the incision site was easily controllable, but somewhat more than usual.

After the procedure the patient was admitted to the hospital. His hospital course was uneventful. The patient was ambulatory 9 hr after the procedure. His cut-down area exhibited mild swelling and ecchymosis without motor or sensory deficits, and there was no need for blood transfusion. The day after the procedure the prothrombin time was 14.7 sec (PT ratio of 1.3) and heparin

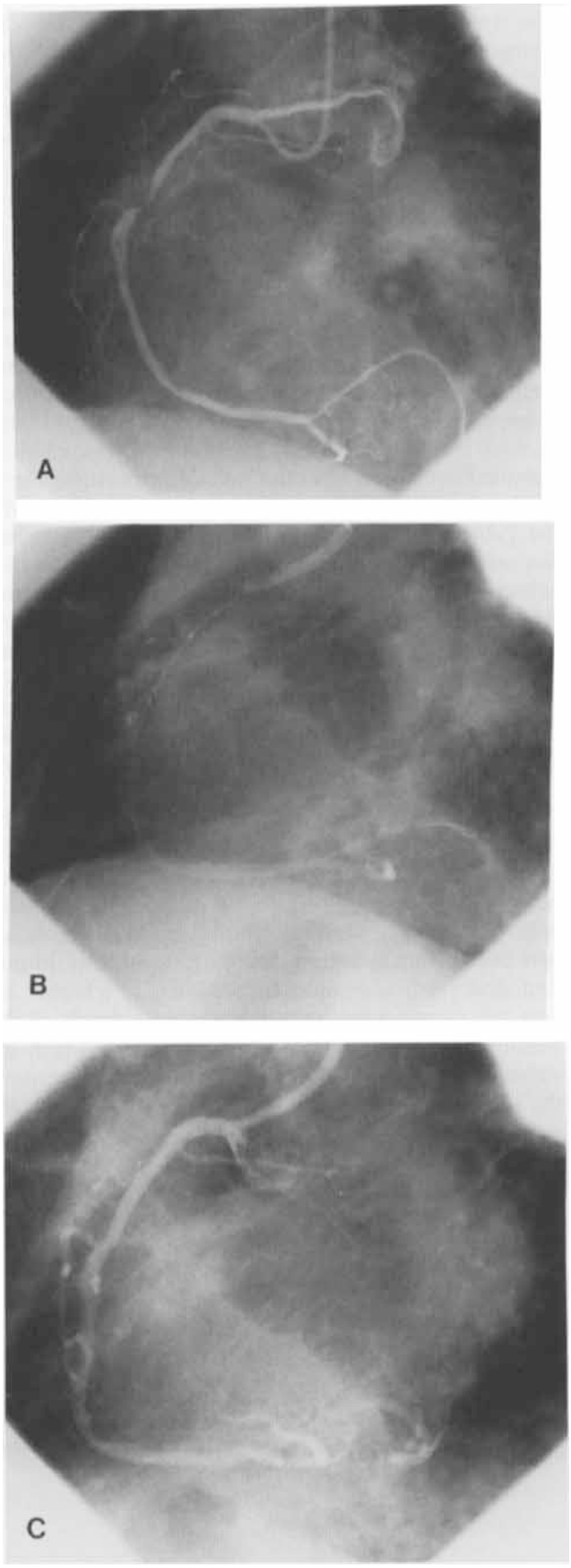

Fig. 1. Sequential angiograms of the right coronary artery stenting in the left anterior oblique projection. A: Baseline angiogram showing 85% stenosis of the mid RCA. B: Stent positioned at the stenosis site. There is mild opacification of the distal RCA after contrast injection through the stent's sheath. C: Final result shows 8% residual stenosis, with no thrombosis and with TIMI 3 flow.

was tapered gradually over 12 hrs. The patient was discharged 2 days after the stent placement with PT of 16.8 sec and hemoglobin of 13.0 g/dl. At follow-up 3 months after the procedure, the patient was asymptomatic without limitations in his physical activity and with no need for sublingual nitroglycerin.

DISCUSSION

Since the original description of Dotter's tubular coil spring, many variants of the original concept have been introduced. While different in geometry, composition, and mechanical behavior, all the currently investigated stents share thrombogenic properties. The stents' thrombogenicity stems in part from the positive electric charge in these metallic devices. Local injury and disruption of laminar flow due to irregular intimal tears contribute to the local thrombogenicity [7,8]. Initial experience with the Palmaz Schatz Stent™, which was no more thrombogenic than other stents in animal studies, found a 16% subacute thrombotic closure incidence when patients were treated with aspirin, dipyridamole, dextran, and heparin, but without warfarin [3]. The addition of warfarin for 1–3 months has decreased this rate to 3% [3].

A recent case-control study found that the patient charges for stent placement were considerably higher ($13,274 ± 7,366 vs. $5,450 ± 1,240) and the duration of hospitalization was longer (5.3 ± 2.7 days vs. 1.3 ± 0.6 days) than routine balloon angioplasty [6]. The longer in-hospital stay was primarily attributed to the time required for conversion of patients from intravenous heparin to adequate and stable oral anticoagulation status with warfarin. The higher morbidity in the stent patients was due to femoral artery bleeding, hematoma formation, and vascular repair. This tendency to a higher access-site complication rate is probably a result of the femoral approach used for stent placement, which involves blind puncture of the artery and a need to remove the large-size (usually 8 F, but 9 F for larger coronary stents of some types) vascular sheaths at a time when vigorous anticoagulation is required.

This case illustrates a novel approach to overcome the limitations of the current methods of stent placement. The patient was treated electively with warfarin prior to the stent placement. Thus, the need for long hospitalization during the conversion from intravenous heparin to oral anticoagulation with warfarin was circumvented. Further, the brachial approach offers access and arterial repair under direct visualization and thus may reduce the risk of hematoma and bleeding, and the vascular complication rate, especially when an interventional procedure is performed on an anticoagulated patient [8]. Thus, elective stent placement in patients who were treated with oral anticoagulation using the brachial approach may reduce the required hospitalization time and complication rate. It must be recognized that vascular complications with the brachial approach occur in about 1% of procedures in nonanticoagulated patients [9], however, and that if bypass surgery were required an increased need for blood-product transfusion could be anticipated.

A limitation of the method is the declining familiarity with brachial approach among interventional cardiologists. Optimal performance with this technique in anticoagulated patients will require experience in the brachial approach with sufficient numbers in order to be able to perform this delicate procedure efficiently and safely. Further, this report is of a single case and the safety of this approach will require validation in large numbers of patients.

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