Rev Esp Cardiol. 2015;68(12):1111–1117

Original article

Structural Damage to Jailed Guidewire During the Treatment of Coronary Bifurcations: Microscopic Evaluation

Elena Villanueva,[a,*] Manuel Pan,[b] Soledad Ojeda,[b] Javier Suárez de Lezo,[b] Miguel Romero,[b] Pedro Martín,[c] Francisco Mazuelos,[b] José Segura,[b] Alfonso Medina,[c] and José Suárez de Lezo[b]

[a] *Área de Cardiología, Hospital Santa Bárbara, Puertollano, Ciudad Real, Spain*
[b] *Servicio de Cardiología, Hospital Reina Sofía, Universidad de Córdoba (IMIBIC), Córdoba, Spain*
[c] *Servicio de Cardiología, Hospital Dr. Negrín, Universidad de Las Palmas, Las Palmas de Gran Canaria, Spain*

Article history:
Received 28 October 2014
Accepted 9 February 2015
Available online 27 May 2015

Keywords:
Bifurcation lesions
Coronary angioplasty
Jailed guidewire technique

ABSTRACT

Introduction and objectives: The use of the jailed guidewire technique is highly useful when treating bifurcation lesions by provisional stenting. However, at the time of withdrawal, the guidewire can suffer damage and even fracture. The aim of this study was to evaluate structural damage in both polymer-coated and nonpolymer-coated jailed guidewires.

Methods: Between January 2011 and December 2012, an observational study was conducted using stereoscopic microscopy to evaluate 135 jailed guidewires (45 nonpolymer-coated and 90 polymer-coated) previously used in the percutaneous treatment of bifurcation lesions. Damage after withdrawal was classified as mild, moderate, or severe.

Results: Age and sex distributions were similar in both groups of patients treated with polymer-coated and nonpolymer-coated guidewires. However, operators selected polymer-coated guidewires more frequently when treating more complex bifurcations and in diabetic patients. Some type of microscopic damage was observed in 25 of the guidewires analyzed (18%). Paradoxically, damage was more common in nonpolymer-coated guidewires (53.0% vs 1.1%; $P < .001$). None of the guidewires suffered complete fracture.

Conclusions: Coronary guidewires that are jailed during the treatment of bifurcations using provisional stenting often suffer nonsevere microscopic damage. Although polymer-coated guidewires were used in more complex bifurcation lesions, paradoxically, they were damaged less frequently.

Daño estructural de la guía encarcelada en el tratamiento de bifurcaciones coronarias. Evaluación microscópica

Palabras clave:
Lesiones de bifurcación
Técnica de la guía encarcelada
Angioplastia coronaria

RESUMEN

Introducción y objetivos: La técnica de la guía encarcelada resulta de gran utilidad en el tratamiento de lesiones bifurcadas mediante la técnica de *stent* provisional. Sin embargo, esta guía puede sufrir daño e incluso fracturarse en el momento de la retirada. El objetivo de este estudio es evaluar la aparición de daño estructural en las guías encarceladas, tanto poliméricas como no poliméricas.

Métodos: Entre enero de 2011 y diciembre de 2012 se realizó un estudio observacional en el que se evaluaron mediante microscopia estereoscópica 135 guías (45 no poliméricas y 90 poliméricas) utilizadas previamente en el tratamiento percutáneo de bifurcaciones y que resultaron encarceladas. El daño tras la extracción se valoró como leve, moderado o grave.

Resultados: Las distribuciones de edad y sexo fueron similares en los dos grupos de pacientes tratados con guías poliméricas y no poliméricas. Sin embargo, los operadores seleccionaron las guías poliméricas con más frecuencia en bifurcaciones más complejas y en pacientes diabéticos. Se observó algún tipo de daño microscópico en 25 de las guías analizadas (18%). Paradójicamente, estas alteraciones fueron más frecuentes en el grupo de guías no poliméricas (el 53,0 frente al 1,1%; $p < 0,001$). Solo se produjo daño grave en 2 casos (1,5%). No se produjo ninguna rotura completa de la guía.

* Corresponding author: Área de Cardiología, Hospital Santa Bárbara, Malagón s/n, 13500 Puertollano, Ciudad Real, Spain.
E-mail address: Lnavf@hotmail.com (E. Villanueva).

http://dx.doi.org/10.1016/j.rec.2015.02.023
1885-5857/

Conclusiones: Las guías coronarias que se encarcelan durante el tratamiento de las bifurcaciones con *stent* provisional presentan a menudo daño microscópico no grave. Aunque las guías poliméricas se utilizaron en bifurcaciones más complejas, paradójicamente se dañaron con menos frecuencia.

Abbreviations

MV: main vessel
SB: side branch

INTRODUCTION

The treatment of coronary bifurcation lesions accounts for 15% to 20% of all percutaneous interventions.[1] These lesions form part of the group of complex lesions and their treatment poses a major technical challenge. They have been associated with high rates of restenosis and complications, although these rates have been reduced by the use of new strategies. Simple or "provisional stenting" is the most widely accepted technique,[2–5] which consists in stenting the main vessel (MV) and covering the origin of the side branch (SB). The SB can be predilated before stent implantation and the procedure concluded if good results are obtained (Figure 1A). If the outcome of the procedure is suboptimal, the SB can be postdilated through the metal structure of the stent and, again, the procedure can be concluded if successful (Figure 1B). Postdilation can be performed by dilation of the SB alone, sequential dilation of the SB and MV, or simultaneous dilation of both vessels (kissing-balloon technique). Stenting of the SB is reserved for patients with a suboptimal outcome after the above-mentioned maneuvers have been attempted (T-stenting) (Figure 1C). However, this strategy is not without risk because the SB can become occluded when a stent is implanted in the MV. Recrossing the SB can sometimes be difficult or impossible. This maneuver is facilitated by the "jailed guidewire technique", which involves leaving a coronary guidewire in the SB jailed between the vessel wall and the stent struts. If the branch becomes occluded, this guidewire marks the position to facilitate access.[6] However, there are several reports of severe complications caused by the guidewire fracturing during withdrawal.[7–15]

A pilot study was conducted using stereoscopic microscopy to evaluate damage to polymer-coated and nonpolymer-coated guidewires after they were jailed during percutaneous procedures using the jailed guidewire technique.

METHODS

Patients

During 2011 and 2012, the study included 135 patients with bifurcation lesions treated with the provisional stenting technique. The patients met the following inclusion criteria: *a)* irrespective of its length, morphology or angulation, MV lesion > 50% located at a bifurcation point; *b)* MV diameter ≥ 2.5 mm; *c)* SB diameter ≥ 2.25 mm; and *d)* length of the stenosis in the SB < 10 mm. Exclusion criteria: *a)* contraindications to dual antiplatelet therapy; *b)* acute phase of myocardial infarction (direct or rescue angioplasty), and *c)* cardiogenic shock. All patients gave written informed consent.

Procedure

All interventions were performed using the femoral approach. All patients were treated using a stepwise provisional stenting strategy.[16] A first stent was implanted in the MV and a guidewire was jailed between the stent mesh and the SB vessel wall. At this point, the SB ostium was evaluated. If the SB was compromised, another guidewire was advanced into the SB, the jailed guidewire was extracted, and the SB was simultaneously or sequentially dilated. After this maneuver, the SB ostium was again evaluated and a second stent was implanted in the SB at the discretion of the operator. The operator also chose the type of guidewire to be jailed. Two types were available: "nonpolymer-coated" BMW [Balance MiddleWeight] and Floppy II models; Abbot Vascular, Illinois, United States) and "polymer-coated" (Pilot 50 or Whisper MS models; Abbott Vascular). Procedural success was defined as TIMI (Thrombolysis In Myocardial Infarction) grade 3 flow in both the MV and SB and residual stenosis visually estimated as ≤ 20% in the MV. At the time of percutaneous coronary intervention, all patients were receiving dual antiplatelet therapy with acetylsalicylic acid and clopidogrel. Procedural anticoagulation was achieved with unfractionated heparin (100 U/kg intravenous bolus). Glycoprotein IIb/IIIa inhibitors were administered at the discretion of the operator. After the intervention, all patients received combined anticoagulant and dual antiplatelet therapy for 12 months and were instructed to continue aspirin indefinitely. After percutaneous coronary intervention, all patients underwent an electrocardiogram and troponin and creatine levels were measured at 6 hours and 24 hours. If clinically indicated, further electrocardiograms and enzyme tests were ordered. Non-Q-wave myocardial infarction was defined as an increase in the creatine kinase level up to 3 times the upper limit of the normal range.

Angiographic Study

The Medina classification was used to assess the anatomy of the bifurcation at baseline.[17] All patients underwent angiograms before and after percutaneous coronary intervention, and the MV and SB reference diameters, minimal lumen diameters, and percentages of stenosis were measured. Data were obtained on a group of variables that could influence subsequent damage to the guidewire, such as the type of bifurcation, tortuosity, and calcification.

Microscopic Study

During the study period, coronary guidewires were consecutively collected that had been used to treat the bifurcation lesions using the jailed guidewire technique. After the guidewires were withdrawn, they were cleaned with an aqueous solution and allowed to dry before analysis. The microscopic study was performed using an SMZ-800 stereomicroscope (Nikon Instruments, Inc.; Melville, New York, United States). This microscope is mounted with a parallel double lens and interchangeable objectives with a magnification range of 1.0× to 6.3× and a