

## 'Mother and Child' Technique with a New Catheter: Initial Experience

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### ABSTRACT

The our initial experience in this hospital with the GuideLiner™, a 'child' type rapid exchange guide catheter extension, designed to facilitate stent and balloon delivery in complex percutaneous coronary interventions, is reported. This guide catheter extension was used in one case of a complex coronary lesion, in another case of complex anatomy and in a third case with dissection of the left internal thoracic artery graft. All of the procedures were performed successfully. The GuideLiner™ can be used to treat complex artery lesions and to treat complications during the procedure.

**DESCRIPTORS:** Coronary artery disease. Angioplasty. Stents. Myocardial revascularisation.

### RESUMO

#### Técnica "Mother and Child" com um Novo Cateter: Experiência Inicial

Relatamos nossa experiência inicial com o GuideLiner™, uma extensão de cateter-guia de rápida troca tipo "child", desenvolvido para facilitar a entrega de stents e balões em intervenções arteriais percutâneas complexas. Descrevemos sua utilização em um caso com lesão coronária complexa, em outro com anatomia complexa, e em um terceiro caso com dissecação do enxerto de artéria torácica interna esquerda. Todos os procedimentos foram realizados com sucesso. O GuideLiner™ pode auxiliar no tratamento de lesões arteriais complexas e de complicações durante o procedimento.

**DESCRIÇÕES:** Doença da artéria coronariana. Angioplastia. Stents. Revascularização miocárdica.

The GuideLiner™ (Vascular Solutions – Minneapolis, KS, USA) is a modified 'child' type rapid exchange guide catheter extension that provides excellent support, selective intubation, and coaxial alignment. It has a highly flexible 20-cm distal extremity, a polytetrafluoroethylene (PTFE) internal coating, a metal coil structure in the centre, and an outer coating of Pebax® (Arkema – Colombes, France) with silicone lubrication. The catheter is 145 cm long, with a stainless steel strut connected to the distal tube by a metal collar. The distal tube has a radiopaque marker at a distance of 2.7 mm from the

distal tip and two external markings: a single mark that is 95 cm from the proximal extremity and a pair of marks 105 cm from the proximal extremity. The GuideLiner™ decreases the diameter of the 'mother' guide catheter by 1 F (the inner diameter of the GuideLiner™ 6 F is equal to 5 F = 0.056 inch/1.42 mm) and is available in 6 F, 7 F, and 8 F diameters. The catheter can be introduced through the 'Y' haemostatic valve and must be advanced over the 0.014 inch guidewire, thus working as a rapid-exchange balloon catheter. The use of the GuideLiner™ in three procedures is described.

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## CASE REPORT

### Case 1

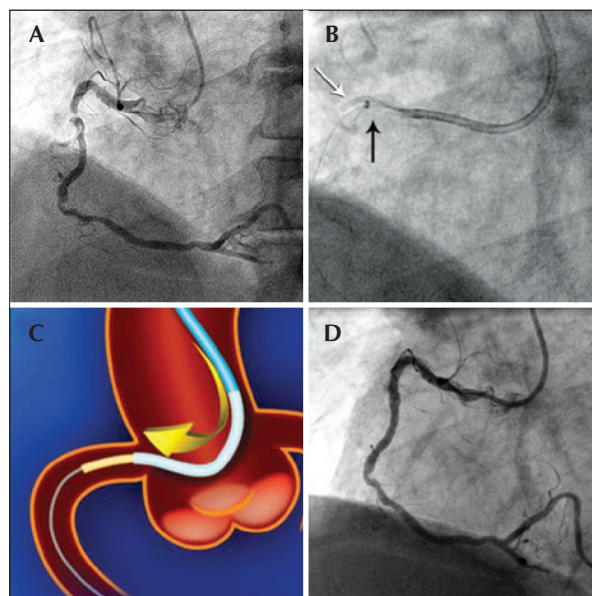
A 72-year-old male patient was admitted with post-myocardial infarction of the inferior wall angina. Coronary angiography via the right radial artery revealed a calcified and tortuous right coronary artery with 90% stenosis and a negative image suggestive of a thrombus in the proximal third of the artery. The circumflex artery was occluded and the anterior descending artery had 40% stenosis. The right coronary artery was cannulated with an AL1 6 F guide catheter (Medtronic – Minneapolis, MI, USA), through which an intracoronary infusion of abciximab was administered. The stenosis was corrected with a 0.014 inch BHW guidewire (Abbott Vascular – Santa Clara, CA, USA). It was not possible to advance the Export™ 6 F thrombus aspiration catheter (Medtronic – Minneapolis, MI, USA), even with the aid of a second 0.014 inch BHW guidewire (buddy wire). The extensive manipulation caused kinking in the Export™ catheter proximal to the target stenosis. Stenosis pre-dilation was then performed with a 2.5/12 mm Trek™ balloon (Abbott Vascular – Santa Clara, CA, USA). During the attempt to cross the first curve with the 3.5/20 mm Pro-Kinetic™ Energy stent (Biotronik – Bulach, Switzerland), the stent broke free in the proximal third of the right coronary artery. It was decided to crush this stent against the vessel wall in the proximal third of the right coronary artery with a 3.5 x 9 mm Maverick™ balloon (Boston Scientific Co. – Natick, MA, USA).

It was not possible to position a new 3.0/20 mm Pro-Kinetic™ Energy stent at the stenosis. It was therefore decided to use the GuideLiner™ 6 F catheter for selective intubation of the right coronary artery, which was positioned beside the crushed stent in the proximal third, allowing the release of the 3.0/20 mm Pro-Kinetic™ stent in the proximal third stenosis after the curve with a good final angiographic result (Figure 1).

### Case 2

A 75-year-old male patient who had a definitive pacemaker implanted for a complete atrioventricular block was hospitalised with class 3 stable angina according to the Canadian Cardiovascular Society (CCS) criteria. Coronary angiography showed a long left main coronary artery with 40% focal stenosis (a minimal luminal area of 5.7 mm<sup>2</sup> on intracoronary ultrasound), an anterior descending artery showing dissection and 70% stenosis at the ostium, as well as an eccentric segmental stenosis of 70% in the middle third (a minimum luminal area of 3.5 mm<sup>2</sup> on intracoronary ultrasound), a tortuous circumflex artery with 90% stenosis in the middle third of the marginal branch, and a right coronary artery without significant lesions. The

patient refused to undergo surgery despite a SYNTAX score of 32 points. Percutaneous coronary intervention was performed via the femoral artery (Figure 2). The left main coronary artery was cannulated with an XB4 7 F guide catheter (Cordis Co. – New Jersey, USA). Due to the marked proximal tortuosity of the circumflex artery, it was impossible to cross its ostium with a Mini Trek™ 2.0/15 mm balloon (Abbott Vascular – Santa Clara, CA, USA) over a 0.014 inch Whisper guide wire (Abbott Vascular – Santa Clara, CA, USA). At that moment, a GuideLiner™ 6 F catheter was positioned in the ostium of the circumflex artery, and the Mini Trek™ 2.0/15 mm balloon was navigated without difficulty to the stenosis of the marginal branch of the circumflex artery, which was treated conventionally with the balloon, with a good final angiographic result. A Whisper guidewire was then placed distally in the left anterior descending artery. Two Xience™ Prime stents (Abbott Vascular – Santa Clara, CA, USA) were successfully implanted with an overlay of 2 mm in the stenosis in the middle third of the left anterior descending artery (3.0/15 and 3.0/33 mm). Two other Xience™ Prime stents were successfully implanted, also with a 2-mm overlap in the anterior descending artery-left main coronary artery segment and in the left main coronary artery (4.0/33 mm and 4.0/12 mm, respectively), without using the GuideLiner™.



**Figure 1** – In A, transradial coronary angiography showing critical stenosis and thrombus in the proximal right coronary artery. In B, 3.5/20 mm Pro-Kinetic™ stent (white arrow) crushed in the proximal third of the right coronary artery and 'mother' (AL1 6 F) and 'child' (the radiopaque spot of the GuideLiner™ 6 F is identified by the black arrow) catheters. In C, schematic illustration representing image B. In D, the final angiographic control after 3.0/20 mm Pro-Kinetic™ stent implanting. Source: Figure 1C – A section of the catheter GuideLiner™ brochure. Available at <http://www.vascularsolutions.com>

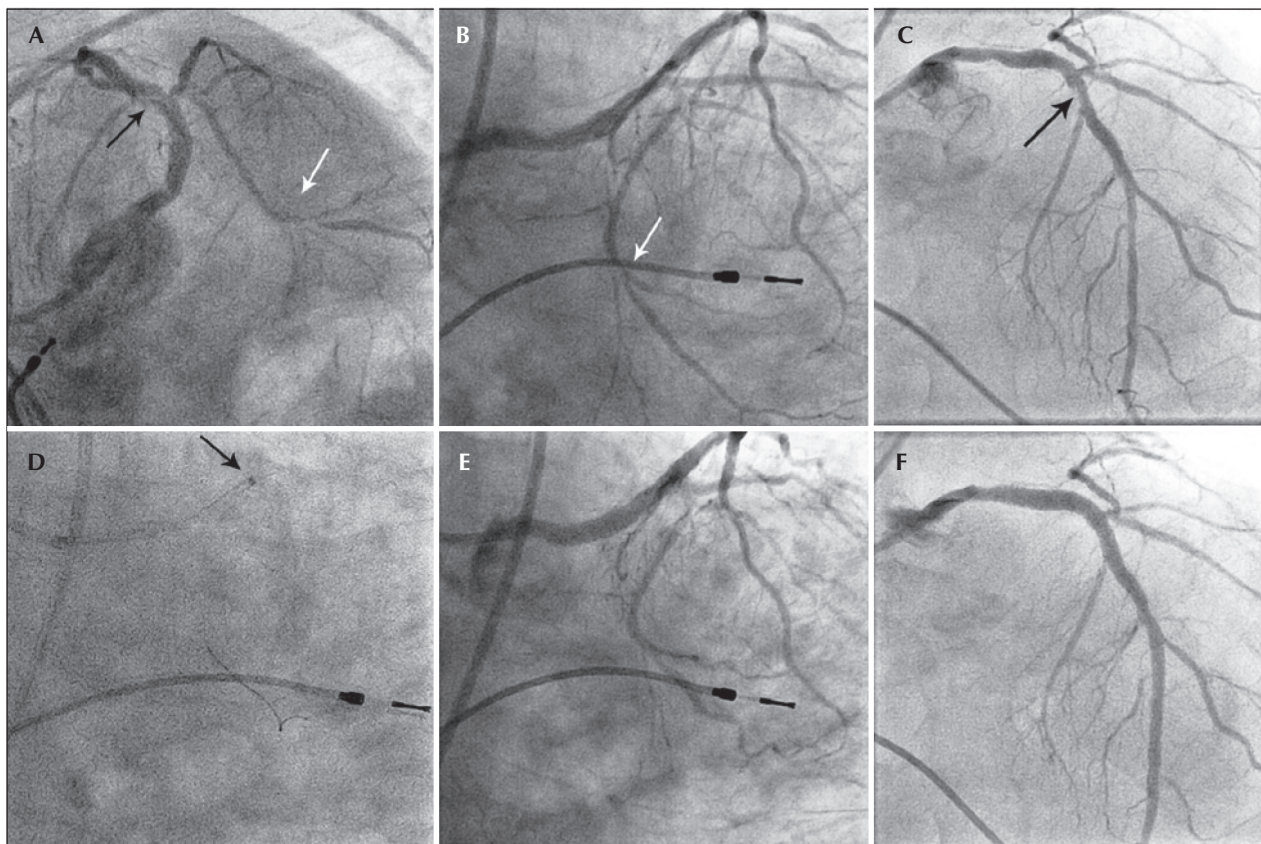
### Case 3

A 75-year-old male patient with a history of coronary artery bypass grafting (left internal thoracic artery-left anterior descending artery, a saphenous vein graft to the right coronary artery, and a sequential saphenous graft to the diagonal and marginal branches) was hospitalised due to acute coronary syndrome without ST-segment elevation. The coronary angiography via the femoral vein showed 95% stenosis in the left subclavian artery, with a slow distal flow to the LITA-LAD graft. It was decided to catheterise the left subclavian artery and the left internal thoracic artery-anterior descending artery graft via the left radial artery. A 90% stenosis was observed in the left anterior descending artery distal to the anastomosis, and the team decided to treat the left subclavian artery via the femoral artery with a Dynamic™ 7.0/25 mm stent implant (Biotronik – Bulach, Switzerland). The control angiography showed dissection at the ostium of the left internal thoracic artery, with a slow distal flow (thrombolysis in myocardial infarction [TIMI] 1). A Pro Kinetic™ Energy 3.0/22 mm

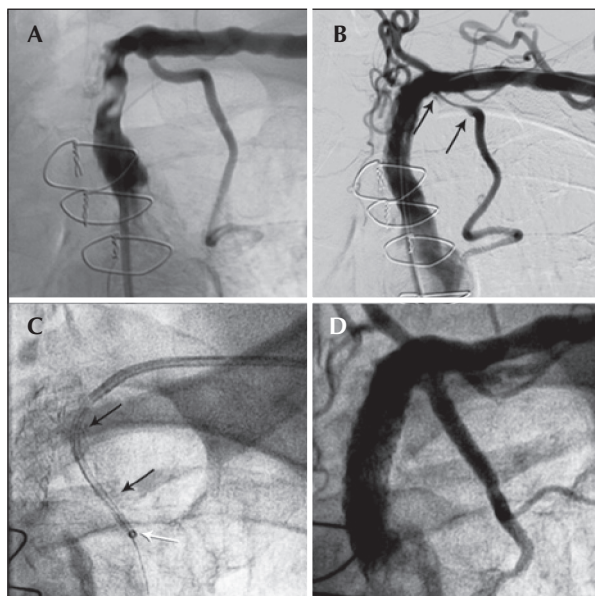
stent was successfully implanted at the ostium of the left internal thoracic artery via the left radial artery. During an attempt to go past the stent at the ostium of the left internal thoracic artery with a Mini Vision™ 2.0/23 mm stent (Abbott Vascular – Santa Clara, CA, USA) stent for the treatment of the anterior descending artery, the stent was displaced. At moment, the ostium of the left internal thoracic artery was passed with a Guideliner™ 6 F catheter, which allowed for the passage of the Mini Vision™ stent to the native bed of the left anterior descending artery without difficulty. The procedure was completed with the placement of a second Pro-Kinetic™ 3.0/13 mm stent in the ostium of the left internal thoracic artery after withdrawal of the Guideliner™ (Figure 3).

### DISCUSSION

The treatment of severe stenoses in tortuous, calcified coronary arteries, sometimes with chronic occlusions and a complex anatomy, is a technical challenge for the release of stents in approximately 5% of procedures.<sup>1</sup>



**Figure 2** – In A, B, and C, coronary angiography via the femoral approach shows a left coronary artery with a long trunk and 40% stenosis in the body. The anterior descending artery dissection (black arrow) and ostial stenosis of 70% and tortuous circumflex artery with marginal branch shows the 90% proximal stenosis (white arrow). A permanent pacemaker electrode in the right ventricle. In D, at the fluoroscopy, the 'mother and child' technique with the distal extremity of the Guideliner™ (the black arrow identifies the radiopaque markers) at the origin of the circumflex artery and the angioplasty guidewire in the marginal branch. In E and F, the final angiographic result after balloon angioplasty in the marginal branch and implantation of four drug-eluting stents.



**Figure 3** – In A, severe stenosis of the left subclavian artery before the origin of the left internal thoracic artery. In B, dissection of the ostium of the left internal thoracic artery (the limits of the dissection are between the black arrows) after a Dynamic™ 7.0/25 mm stent implant in the left subclavian artery. In C, the GuideLiner™ in the proximal third of the left internal thoracic artery, with a distal radiopaque marker (white arrow) after the Pro-Kinetic™ 3.0/22 mm first stent, which was displaced in the ostium (the stent limits are between the black arrows). In D, the final result after implantation of a second Pro Kinetic™ 3.0/13 mm stent in the ostium of the left internal thoracic artery.

Different strategies, such as parallel guide wires (buddy wires), guidewires with more support and weight on the tip, balloons as anchors, atherectomy, and deep intubation with a guide catheter have been designed to overcome this challenge. However, deep intubation is limited by the possibility of dissection, flow obstruction or the incapacity to perform the procedure with the guide catheter. Although useful, these strategies are not universally effective. To improve support for coronary interventions, longer, flexible, and lower-profile ('child') guide catheters were developed, which are capable of being introduced into the conventional guide catheters ('mother') and entering the vascular beds – the so-called 'mother and child' technique.

The GuideLiner™ is a modified 'child' type rapid exchange guide catheter extension that allows both greater support and selective intubation with coaxial alignment. This study reports the initial experience with this catheter in three patients: in two patients, to help manage complications, and in one patient with anatomic variations of the left main coronary artery. In the first case, using the GuideLiner™, it was possible to go past the stent that had detached from the balloon and was crushed against the arterial wall in the proximal third of the vessel, in order to implant another stent for the

treatment of a critical and calcified lesion in the right coronary artery. In the second case, the positioning of the GuideLiner™ in the bifurcation of a very long left main coronary artery allowed for the crossing of a critical lesion in the circumflex artery and the positioning of the angioplasty balloon. In the last case, the catheterisation of the left internal thoracic artery with the GuideLiner™ through the stent allowed it to be advanced into the native bed without difficulty. This technique has been described by other surgeons<sup>1,2</sup> and defies conventional medical practice by treating first the distal lesions and then the proximal lesions. The 'child' catheter was used to overcome difficulties and to assist in the management of complications.

The introduction of the GuideLiner™ into arteries with functional calibres < 2.5 mm, cerebral arteries, and the venous system is not recommended by the manufacturer. There are, however, descriptions of its successful use in venous grafts.<sup>2,3</sup> Furthermore, it is recommended, as a precaution, not to introduce the catheter more than 10 cm beyond the tip, as the GuideLiner™ can get stuck in the guide catheter (generally in the second curvature of the catheter). An intubation beyond 20 cm completely externalises the tube with the metal collar to the vessel, causing severe damage.

Recently, in new uses for the GuideLiner™, Cunningham and Egred<sup>4</sup> reported success in removing a trapped Rotablator™ olive-shaped burr (Boston Scientific Co. – Natick, MA, USA) with the aid of the GuideLiner™, using counter-traction. Tunuguntla et al.<sup>5</sup> described the reduced volume of contrast required for intervention in the obtuse marginal branch with the subselective intubation of the circumflex artery. Similarly, Pershad et al.<sup>1</sup> reported a significant reduction in the volume of contrast required for the visualisation of a right coronary artery occlusion distal to a large aneurysm of the proximal third.

Luna et al.<sup>6</sup> reported dissection in the proximal anterior left descending artery during intubation with a GuideLiner™ 7 F. Murphy and Spence<sup>7</sup> described their first complication with the use of the GuideLiner™ during primary coronary angioplasty of the ostium of the right coronary artery while withdrawing of the GuideLiner™ over the stent for its release: a perforation of the balloon catheter system occurred, caused by the metal collar and the incapacity to appropriately inflate the stent balloon.

Some recommendations for the use of the GuideLiner™ are a) to introduce it only over a 0.014 inch guidewire, preferably over a balloon (considering the anchor balloon technique), and to proceed carefully, while watching the pressure curve; b) to advance the stent only over the first guidewire because if there is a second guidewire, it may have passed externally to the catheter; c) to be careful with the passage of

higher-profile stents through the metal collar, especially drug-eluting stents with diameters  $\geq 4$  mm, as they may be damaged; d) to use a 'child' catheter that has the same profile as the 'mother' catheter because it slips less and decreases the chance that other materials will pass between the catheters; and e) to not make rotations when moving the GuideLiner™, lessening the chances of the wire twisting around the metal rod.

The authors believe this new catheter may help to treat complex coronary lesions and to manage complications and possibly reduce the contrast volume. A probable and unexplored site for its use is the treatment of lesions in visceral vessels by a radial approach, as it can provide more support and range to perform these procedures.

#### CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

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