Percutaneous coronary intervention of a tortuous and complex circumflex lesion using the robotic CorPath GRX system

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Robotic-assisted percutaneous coronary interventions (R-PCI) dramatically reduce physician radiation exposure and potential musculoskeletal injuries [1]. In addition, accumulating evidence has demonstrated R-PCI safety and efficacy in a broad range of lesion types [2, 3]. We report the 1st case of R-PCI performed in Poland using the CorPath GRX (Corindus Vascular Robotics) system (Supplementary material, Figure S1 and S2) to treat a complex tortuous lesion of the left circumflex (Cx) artery.

A 47-year-old male with previous PCI to the left anterior descending artery (LAD) was referred with worsening typical angina (Canadian Cardiovascular Society class III). Echocardiography revealed hypokinesia in the basal and mid-segments of the inferior and posterior wall. Diagnostic angiography revealed a short left main stem (LMS) and a tortuous Cx artery with a critical lesion in the mid-vessel (Figure 1A) associated with a separate critical lesion in the 1st
obtuse marginal (OM) branch (Figure 1B). The right coronary artery was hypoplastic and the LAD stent was patent with no significant other lesions. A provisional strategy was planned to treat the disease in the Cx/OM1.

6Fr right radial access was secured and the operator manually cannulated the LMS with a 6Fr AL1 guiding catheter. Following successful and stable cannulation, the guiding catheter was connected to the robotic arm, and the rest of the procedure was completed from the remote workstation (Supplementary material, Figure S3). A Runthrough NS Floppy wire (Terumo systems) was selected and robotically advanced to the distal vessel, with the tortuosity and diseased segment successfully navigated using a combination of manual joystick controls and pre-set automation techniques (Figure 1C). A 2.5 × 27 mm non-compliant (NC) balloon was used to pre-dilate the lesion. Precise measurement (1 mm precision) of the lesion length was performed using the robotic system and accordingly a 3.0 × 38 mm drug-eluting stent (Promus PREMIER, Boston Scientific) was advanced and successfully implanted at the intended site (Figure 1D). Post-dilatation of the proximal portion of the stent was performed with a 3.5 × 15 mm NC balloon. Following main vessel stenting, the main vessel wire was retracted and robotically advanced into the OM1 branch which was treated with balloon-only angioplasty using a 2.0 × 12 mm NC inflated at 10 atm (Figure 1E).

Final angiography revealed good angiographic result, optimal stent expansion with no complications (Figure 1F). Fluoroscopy time was 22 minutes, radiation dose was 943mGy and total contrast volume was 150 ml.

**DISCUSSION**

This case demonstrates how the R-PCI system can be used to safely and successfully treat complex lesions. Despite the lack of haptic feedback, wiring of this tortuous vessel was achieved using the joystick controls manually aided by the built-in automated robotic movements. The CorPath GRX system can accommodate multiple coronary wires and devices simultaneously. In such instances, one wire and one device is allocated to the active drive and can be controlled from the console, whilst the remaining wires and devices cannot be maneuvered but remained fixed in the passive drive. This can enable operators to treat complex lesions including bifurcations and perform final kissing inflations when required. The presence of a short LMS, required repeated re-positioning and stabilization maneuvers of the guiding catheter, which were all performed using the guide catheter joystick control. During initial wiring, the guide catheter dis-engaged into the aorta with subsequent loss of wire position. With
the robotic controls, the guide catheter was safely manipulated back into a more stable position achieving semi-selective cannulation of the Cx artery.

Worldwide experience with R-PCI systems is growing enabling increasingly complex coronary lesions to be treated safely and effectively, without compromising procedural time and with improved operator safety [4, 5]. In our case, the primary operator completed the entire procedure without wearing any radioprotection sat at the robotic console, which was located within the operating room.

REFERENCES


Figure 1. Robotic assisted PCI of tortuous complex circumflex lesion. Baseline angiography (A–B) demonstrates the critical lesions (yellow dotted lines) in the mid circumflex artery and proximal segment of the 1st marginal branch. The tortuous segment of the vessel (yellow star) arises just before the critical lesion in the mid-vessel. Through a 6Fr AL1 guiding catheter a 0.014” coronary wire was advanced distally (C) using the robotic controls, and following predilatation, the stent was advanced and deployed (D–E) in the intended position (dashed black line). The marginal lesion was wired and treated with balloon angioplasty (E) using the robotic controls. Final result (F) was optimal without any angiographic complications.