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Double Guide Catheter Technique for Sealing an Iatrogenic Coronary Perforation

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Abstract

Introduction: Coronary vessel perforation is one of the most feared complications of coronary angioplasty. The treatment of this complication relies mostly on the implantation of covered stents. However, due to their design, covered stents are difficult to advance in a tortuous or calcified vessel.

Case Presentation: We present a case of a grade III coronary perforation in which the double guiding catheter technique helped us to deliver the graft stent.

Conclusions: The double-guiding technique is useful in emergency situations to increase the safety and efficacy of sealing a coronary perforation.

Keywords: Angioplasty, Adverse Effects, Management

1. Introduction

Vessel perforation is one of the most challenging and feared complications of percutaneous coronary intervention (PCI). It occurs rarely today, with an incidence between 0.2 and 0.6%, but morbidity and mortality are known to be high with this complication.

Ellis has classified coronary perforation into three types (1). Grade III is defined as an active extravasation through a large breach (at least 1 mm) in the integrity of the adventitia of an epicardial artery in the pericardial space or in a cardiac chamber. It is the most serious form and is associated with the highest mortality rates, ranging from 7% to 44%. It is also associated with very high rates of cardiac tamponade (2) (up to 40%) and with the need for emergent coronary artery by-pass grafting (CABG) in 20 – 40% of cases (3). Treatment modalities include prolonged balloon inflation, covered stent implantation, pericardiocentesis for cardiac tamponade, CABG, and microcoil embolization (4).

The emergence of polytetrafluoroethylene (PTFE)-covered stents has dramatically reduced the incidence of cardiac tamponade and the need for CABG (5). However, one major limitation of covered stents is their limited flexibility due to their "metallic sandwich" design. This significantly increases the difficulty of delivering them to the target site, especially in perforations located distally to a very tortuous or heavily calcified lesion.

We present a case of a grade III coronary perforation in which the double guiding catheter technique helped us to deliver the graft stent.

2. Case Presentation

An 80-year-old woman with a history of diabetes mellitus, dyslipidemia, and hypertension was admitted to our center due to effort angina and a positive stress test with anterior wall ischemia. A coronary angiogram revealed diffuse severe calcification of the coronary tree. Severe stenoses were identified in the mid and distal portions of the left anterior descending artery (LAD) and in the distal left circumflex artery (LCX) (Figure 1A). The decision then was to proceed with PCI in the LAD. Using an XB 3.5 guiding catheter (Cordis, Miami, FL, USA) via right radial access, a Whisper ES (Abbott Vascular, Santa Clara, CA, USA) was advanced into the distal LAD. After predilatation with an Emerge 2.25 – 15 mm balloon (Boston Scientific, Natick, MA, USA) and a Scoreflex balloon 2.5 – 10 mm (Orbus Neich, Fort Lauderdale, FL, US), a stent SYNERGY 2.25x38 mm (Boston Scientific, Natick, MA, USA) was successfully implanted in the mid-LAD lesion (Figure 1B). Thereafter, an attempt to perform a plain balloon angioplasty in the distal LAD stenosis was carried out (Figure 1C). However, after inflation with the Emerge 2.25 – 15 mm, a type III perforation was noted (Figure 1D). Immediately, the

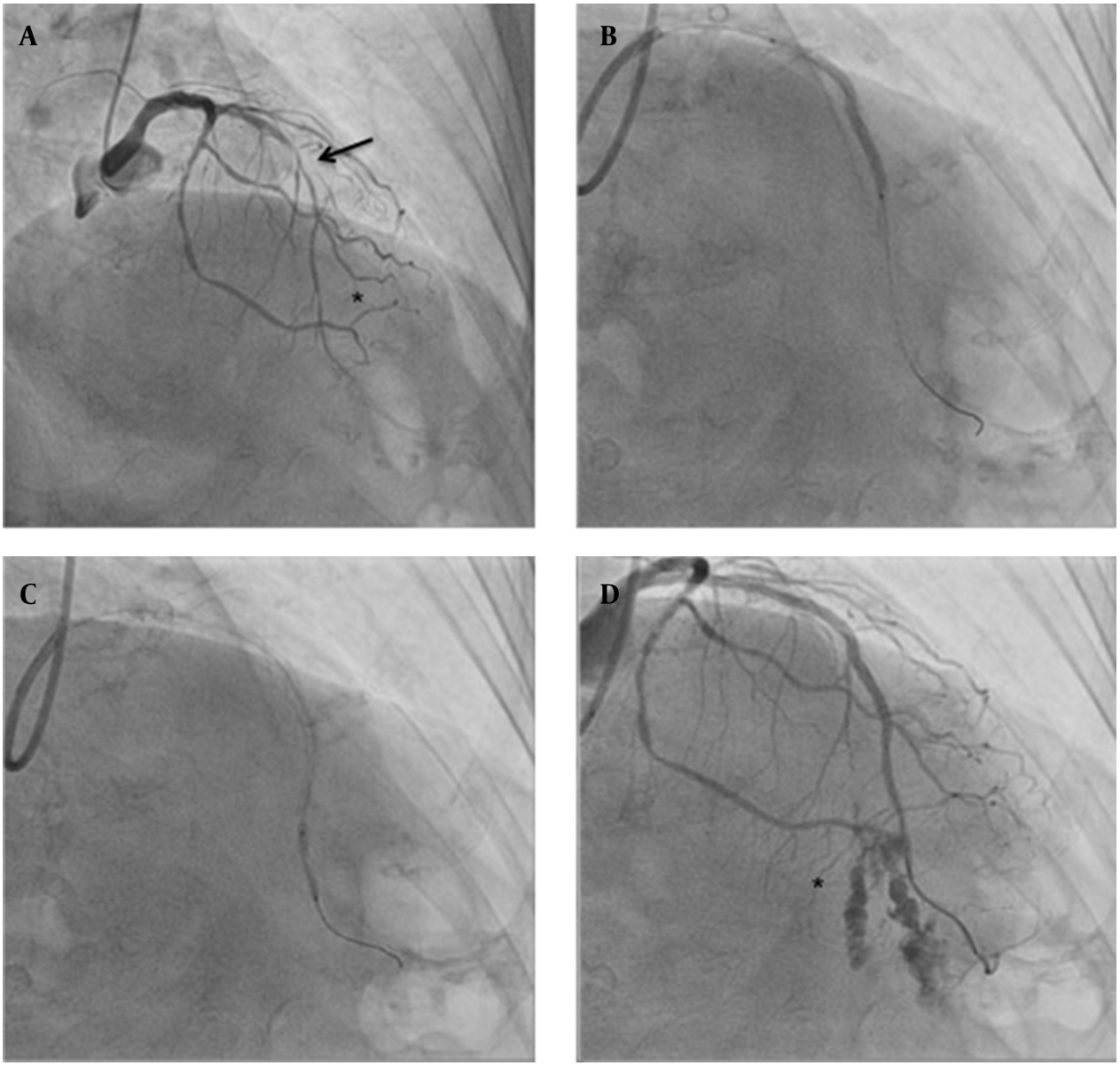

Figure 1. Panel A, left coronary angiogram showing the severe mid-LAD lesion (arrow) and the distal LAD lesion (asterisk); Panel B, expansion of stent in the mid-LAD with good results; Panel C, image of balloon dilation of distal LAD stenosis. Note the dog-boning effect of the balloon; Panel D, grade III coronary perforation was demonstrated after balloon deflation.

balloon was inflated again to prevent bleeding. Thereafter, we tried to deploy a 2.8 – 16 mm GraftMaster stent (Abbott Vascular, Santa Clara, CA, USA), but the stent was unable to cross the previously implanted stent.

At this point, we inserted a 7Fr EBU guiding catheter (Medtronic, Minneapolis, MN, USA) via the right femoral artery. While the previous balloon was inflated to prevent the development of pericardial effusion, the prior guiding catheter was retracted and dislodged from the left main artery, and the latter guiding catheter was engaged. The patient did not experience any hemodynamic disturbances, and no significant pericardial fluid was noted during this maneuver. A new Whisper ES wire was advanced distally to the perforation (Figure 2A). We performed high-pressure balloon inflations to over expand the mid-LAD stent (Figure 2B) and, using the wire trapping technique, we gained enough support to advance the covered stent to the target lesion (Figure 2C). Eventually, the stent was deployed, and the perforation was sealed (Figure 2D).

The patient experienced an uneventful evolution with a minimal amount of pericardial fluid and was discharged home three days after the procedure.

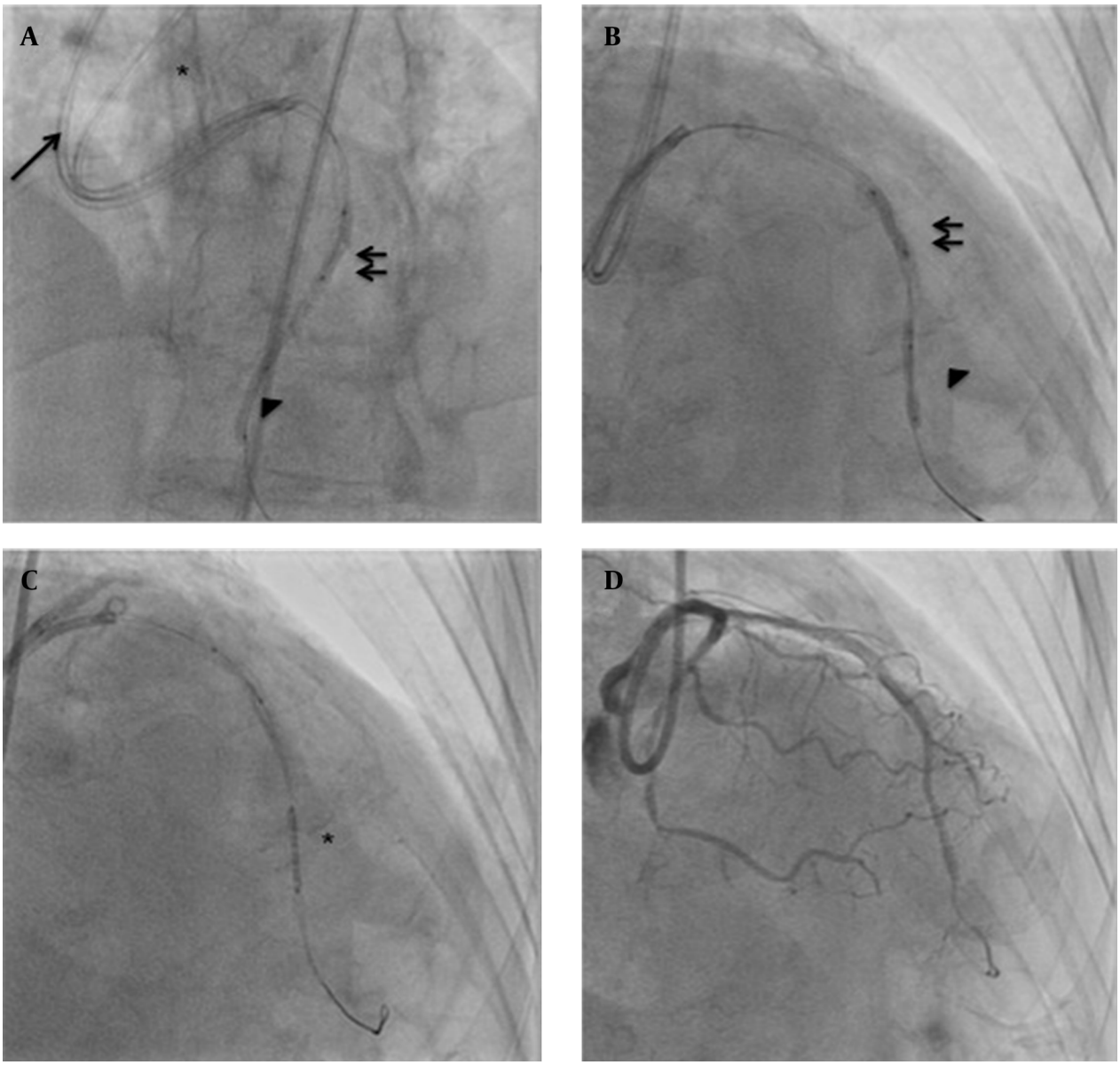

Figure 2. Panel A, double guide catheter inserted in the left main trunk (arrow and asterisk); One balloon was inflated to seal the coronary peroration (arrow-head), while a second balloon was used in an attempt to over expand the mid-LAD stent (double-arrow); Panel B, attempt to over expand the mid-LAD stent (double arrow) while the second balloon avoided the pericardial effusion (arrow-head); Panel C, after post-dilation of the stent and using an anchor-like technique, the graft stent could be placed in the perforation site (asterisk); Panel D, final result with absence of contrast extravasation.

3. Discussion

Grade III coronary perforation is currently a very uncommon complication in PCI. However, when it occurs, it is associated with high morbidity. Predictors of this complication have been reported, such as PCI in complex coronary lesions or coronary total occlusions and the use of rotablation or to intravascular ultrasound (IVUS) (6).

Multiple methods of treatment are available, but prolonged balloon inflation and covered stent implantation is usually the default strategy, and it solves the complication in a significant proportion of cases. However, a relevant limitation of this strategy is the necessity of deflating the balloon that is protecting the perforation to advance the grafted stent. Because the crossing profile of this device is poor, when the stent encounters difficulties in reaching the target site, a cardiac tamponade may develop, and the hemodynamic stability of the patient may be compromised. To overcome this drawback, we report the use of the double guiding catheter technique, the pur-

pose of which is two-fold: First, by keeping the balloon of the first guide inflated in the rupture site, we avoid the development of pericardial effusion. Second, the entrapment of the coronary wire advanced through the second guide allows us to increase the support to advance the graft stent through a tortuous or calcified segment by performing an anchoring-like maneuver. Interestingly, in recent years, new covered stents have been developed in order to improve the profile and trackability of these devices (e.g., Papyrus BK Biotronik or Bentley Innomed). These are formed by only one layer of membrane cover (polyurethane or micro-porous PTFE) in a backbone of cobalt-chromium stent. These features allow easier navigability through complex lesions and lower French catheter guide compatibility. However, even without this improved material, the technique is still of high utility in preventing bleeding while the covered stent is prepared and advanced to the target site.

3.1. Conclusion

The double-guiding technique is useful in emergency situations to increase the safety and efficacy of sealing a coronary perforation.

Footnote

Authors' Contribution: Rodrigo Estevez-Loureiro and Miguel Rodriguez-Santamarta wrote the manuscript; Tomas Benito-Gonzalez, Maria Lopez-Benito and Carlos Cuellas reviewed critically the literature; Armando Perez de Prado and Felipe Fernandez-Vazquez reviewed the text and gave final approval.

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