



CT Image Overlay on Live X-Ray as Guidance for Intervention on a Right Coronary Artery Arising from the Left Coronary Sinus

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ABSTRACT

For patients with coronary anomalies, interventions can be challenging. This case report describes a coronary intervention on a patient with a right coronary artery arising from the left coronary sinus facilitated by CT-image overlay using Heart Navigator[®].

1. Introduction

In about 0.5% of patients, the Right Coronary Artery (RCA) has an anomalous take-off from the left coronary sinus (1, 2). In these cases, coronary interventions are known to be difficult (3). Selection of the adequate guiding catheter, cannulation of the anomalous ostium, and obtaining a stable catheter position are all parts of the procedure that may result in a challenging coronary intervention. In this case report, we describe a successful Percutaneous Coronary Intervention (PCI) of a high-grade stenosis in the RCA with an anomalous take-off from the left coronary sinus facilitated by CT-image overlay using Heart Navigator[®] (Philips Healthcare, Best, The Netherlands). Heart Navigator[®] is an interventional planning and guidance tool that is normally intended to support the interventionalist performing structural heart disease procedures like Transcatheter Aortic Valve Replacement (TAVR) (4).

2. Case Presentation

A 69-year-old woman with progressive chest pain was referred to our hospital for coronary catheterization. The

left coronary artery was normal. However, the RCA could not be selectively cannulated due to its atypical take-off. By unselective aortography, an atypically take-off of the RCA from the left coronary sinus was assumed. Despite several attempts using different diagnostic catheters (Judkins JR 4.0, Judkins JR 5.0, Multipurpose MBI, Amplatz AL 1, Amplatz AL 2, Extra Backup EBU 3.5, Hockey Stick II, Amplatz AR 2 and Multipurpose MB 2), selective cannulating of the vessel could not be obtained. Thus, the procedure was terminated and a retrospectively ECG-gated coronary CT-angiography was performed on a SOMATOM Sensation 64 (Siemens Healthcare, Forchheim, Germany) at 120 kVp tube voltage, 900 mAs reference tube current using an image slice thickness of 0.6 mm and an image matrix of 512x512 pixels. CT confirmed an atypical take-off at the border between the left and the right coronary sinus (Figure 1). A 3D model of the coronary arteries reconstructed from the fluoroscopic images has been depicted in Figure 2 for better visualization of the anatomy.

Coronary angiography was repeated in a hybrid-catheterization laboratory, which was equipped with the Heart Navigator[®] software. An aortography was performed first and used to create a fusion image of the angiography with the stored CT data (Figure 3). In this way, movement of the C-arm resulted in the respective views of the fused

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Figure 1. CT Confirmed the Atypical Take-off of the Right Coronary Artery

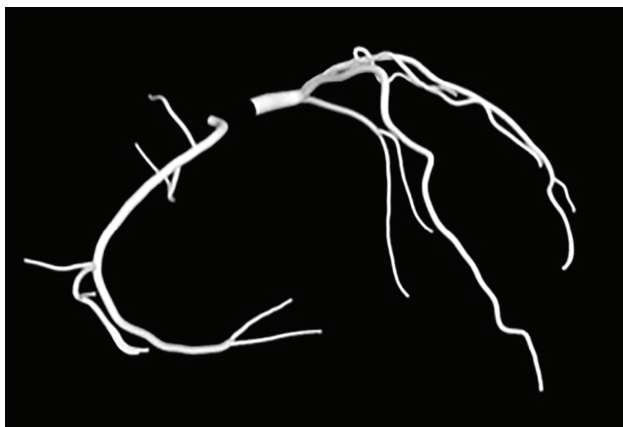


Figure 2. 3D Model of the Coronary Arteries Derived from the Fluoroscopic Images (3D Model Created by James Chen, University of Colorado Denver) (5)

images. The requirements for correct overlay are as follows: The heart needs to be positioned at the isocenter of the C-arm and the table height has to remain unchanged throughout the procedure. For adequate registration of CT and angiography, two non-oblique projections (30° to 150° apart) need to be selected for aortic root angiography. In this study, a view was selected, which located the presumed take-off of the RCA at the left border of the aorta. The anomalous take-off corresponded to a type D site according to Sarkar et al. (2). Selection of the most suitable catheter (Amplatz AL 1) and engagement of the ostium were facilitated by the CT image overlaying the live X-ray. A high-grade stenosis in the middle part of the RCA was detected. PCI was successfully performed using a 14 Balance Middleweight Universal II guidewire and a drug eluting stent (Xience Pro, Abbott), which was directly implanted at the site of the stenosis (Figures 4 and 5).



Figure 3. Overlay of X-Ray and CT with Heart Navigator®

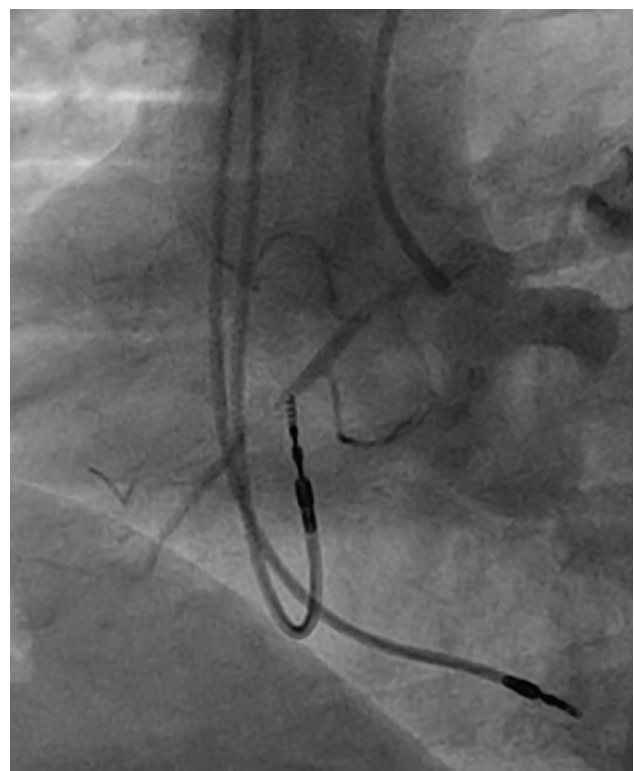


Figure 4. RCA before the Intervention

3. Discussion

In patients with an anomalous originating RCA, PCI is challenging (3). The technical difficulty is often reflected by the long procedural and fluoroscopy time as well as increased use of contrast dye (6). In the present case, the procedure was supported by an overlay of a cardiac CT on the live X-ray image using Heart Navigator®. The overlay supported identifying a perpendicular projection of the take-off of the anomalous RCA facilitating the engagement



Figure 5. RCA after the Intervention

of the ostium.

This approach can also be applied to patients with coronary bypass grafts. Marking the ostia of the grafts in Heart Navigator® on the CT overlay might facilitate finding and engaging them. This might lead to a reduction in the total use of contrast dye as well as in the procedural and total fluoroscopy time even when the needed CT is taken into consideration.

3.1. Conclusion

For the first time, overlay of a cardiac CT on the live X-ray image using Heart Navigator® software was employed to facilitate the coronary intervention on a patient with an anomalous take-off of the RCA. The general impact of this method on complex coronary interventions has to be

evaluated in further studies.

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Authors' Contribution

Nils Petri: Writing the manuscript, planning of the procedure; Tobias Gassenmaier: Evaluation of the CT, preparation of figure 1, review of the manuscript; Peter Nordbeck: Performing the PCI, review of the manuscript; Wolfram Voelker: Performing the PCI, planning of the procedure, review of the manuscript.

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The authors declare that there is no conflict of interests.

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References

1. Fujimoto S, Kondo T, Orihara T, Sugiyama J, Kondo M, Kodama T, et al. Prevalence of anomalous origin of coronary artery detected by multi-detector computed tomography at one center. *Journal of cardiology*. 2011;**57**(1):69-76.
2. Sarkar K, Sharma SK, Kini AS. Catheter selection for coronary angiography and intervention in anomalous right coronary arteries. *Journal of interventional cardiology*. 2009;**22**(3):234-9.
3. Lee BI, Gist HC, Jr., Morris EI. Percutaneous coronary artery stenting of an anomalous right coronary artery with high anterior takeoff using standard size 7 French left Judkins guiding catheters. *The Journal of invasive cardiology*. 2003;**15**(11):682-4.
4. Philips Healthcare. Heart Navigator product overview. [cited]; Available from: [https://HYPERLINK \"http://www.usa.philips.com/healthcare/product/HCOPT20/heartnavigator-planning-and-guidance-software\"www.usa.philips.com/healthcare/product/HCOPT20/heartnavigator-planning-and-guidance-software](https://HYPERLINK \).
5. Chen SJ, Carroll JD. 3-D reconstruction of coronary arterial tree to optimize angiographic visualization. *IEEE transactions on medical imaging*. 2000;**19**(4):318-36.
6. Cohen MG, Tolleson TR, Peter RH, Harrison JK, Sketch MH, Jr. Successful percutaneous coronary intervention with stent implantation in anomalous right coronary arteries arising from the left sinus of valsalva: a report of two cases. *Catheterization and cardiovascular interventions : official journal of the Society for Cardiac Angiography & Interventions*. 2002;**55**(1):105-8.