Journal of Cardiovascular Magnetic Resonance

BioMed Central

Meeting abstract

Open Access

109 Antegrade percutaneous closure of membranous ventricular septal defect using X-Ray fused with MRI (XFM)

Kanishka Ratnayaka*, Venkatesh K Raman, June H Kim, Merdim Sonmez, Anthony Faranesh, Michael C Slack, Cenzighan Ozturk and Robert Lederman

Address: National Heart, Lung, and Blood Institute, Bethesda, USA

* Corresponding author

from 11th Annual SCMR Scientific Sessions
Los Angeles, CA, USA. 1–3 February 2008

Published: 22 October 2008

Journal of Cardiovascular Magnetic Resonance 2008, **10**(Suppl 1):A10 doi:10.1186/1532-429X-10-S1-A10

This abstract is available from: http://jcmr-online.com/content/10/S1/A10

Introduction

Catheter-based closure of ventricular septal defects (VSD) is technically demanding. It involves crossing the VSD retrograde (from the left to right ventricle), retrieving a guidewire from the right ventricle side, positioning a delivery sheath for the closure device into the left ventricular apex, and device deployment.

Purpose

We used X-ray Fused with MRI (XFM) to localize the VSD and guide antegrade (right to left) catheter crossing. We hypothesized that XFM-guided antegrade VSD crossing would simplify the procedure and reduce fluoroscopy time and radiation exposure.

Methods

12 Yucatan miniswine (29–55 kg) with inherited perimembranous VSD underwent baseline MRI scanning to delineate VSD, ventricular cavities and outflow tracts, aortic valve and root (see Figure 1). These features of interest from end-diastolic MRI frames were "fused" with live X-ray using external fiducial markers for rigid-body registration.

We compared antegrade VSD crossing attempts, in random order, under conventional X-ray or XFM guidance. We also compared, in random order, antegrade XFM guided sheath delivery and conventional retrograde X-ray guided crossing, wire exchange, and sheath exchange. Finally we closed the VSD using appropriately sized Amplatzer Memranous VSD Occluder (courtesy of AGA Medical Corp).

Results

In all twelve animals, XFM-guided antegrade crossing of the VSD (2–9 mm) was successful. Antegrade guidewire crossing was faster under XFM (38 ± 18 s) than under conventional X-ray (391 ± 325 s, mean difference 314 ± 328 s, $p = 0.02$)

XFM-guided antegrade VSD closure was greatly simplified compared with conventional X-ray guided retrograde closure (Table 1). XFM was qualitatively useful to indicate device orientation and spatial relationships to crucial structures such as the aortic valve (Figure 2).

Conclusion

XFM-guided antegrade catheter crossing and closure of perimembranous VSD was considerably easier, faster, and associated with reduced radiation compared with conventional techniques.

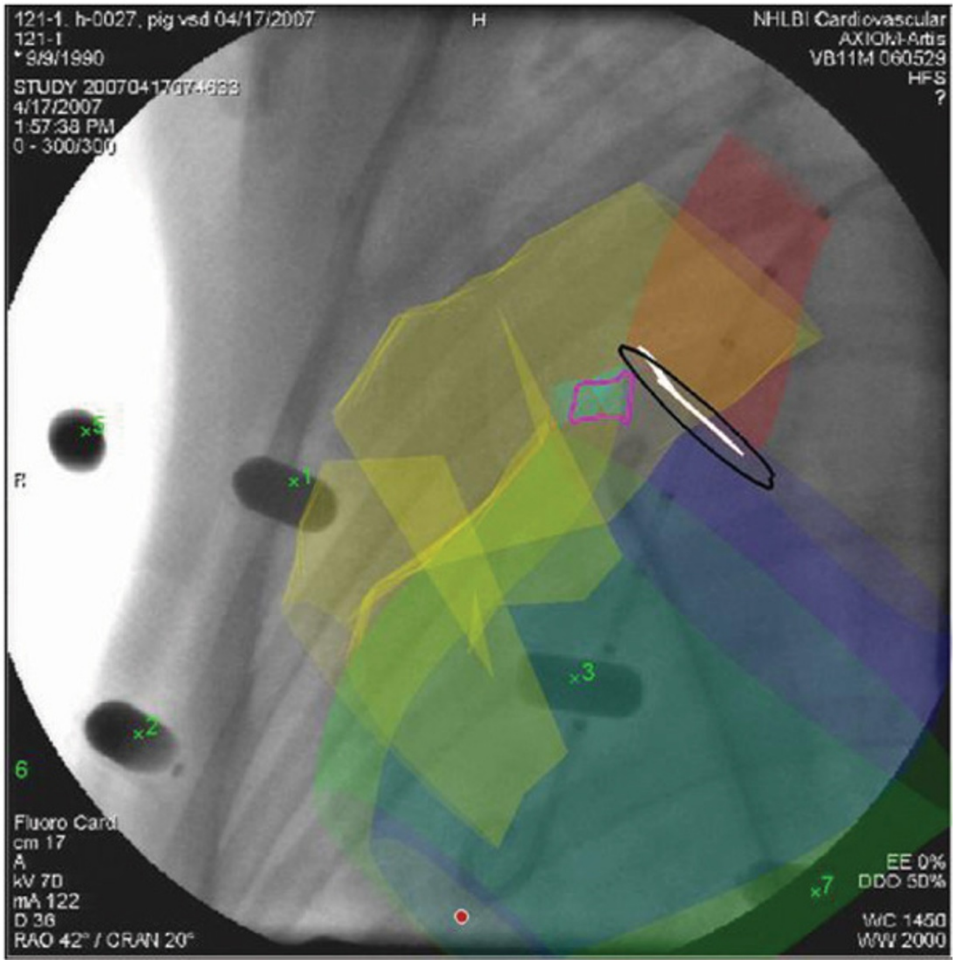

Figure 1
XFM fused images provide "target" for crossing VSD. Right ventricle and Right Ventricle Outflow Tract (yellow), Left ventricle epicardial and endocardial contour (green and purple, respectively), Left Ventricle apex (red dot), VSD (pink and turquoise – segmented from two imaging planes to corroborate location), aortic valve annulus and commisures (black circle and white lines), aortic root (red).

Table 1: Conventional XRAY/Retrograde Technique versus Novel XFM/Antegrade Technique

	Conventional XRay Guided Retrograde Technique	Novel XFM Guided Antegrade Technique	Difference Between XFM vs XRAY	*p* value 2-tailed *t* test)
VSD crossing time	275 ± 161 s	132 ± 90 s	143 ± 199 s	p = 0.04
Sheath platform time	469 ± 170 s	97 ± 102 s	372 ± 221 s	p < 0.001
Fluoroscopy time	493 ± 184 s	180 ± 127 s	288 ± 229 s	p = 0.001
Radiation dose-area-product (DAP)	5318 ± 2261 mGm^2	2433 ± 2381 mGm^2	2885 ± 1862 mGm^2	p < 0.001

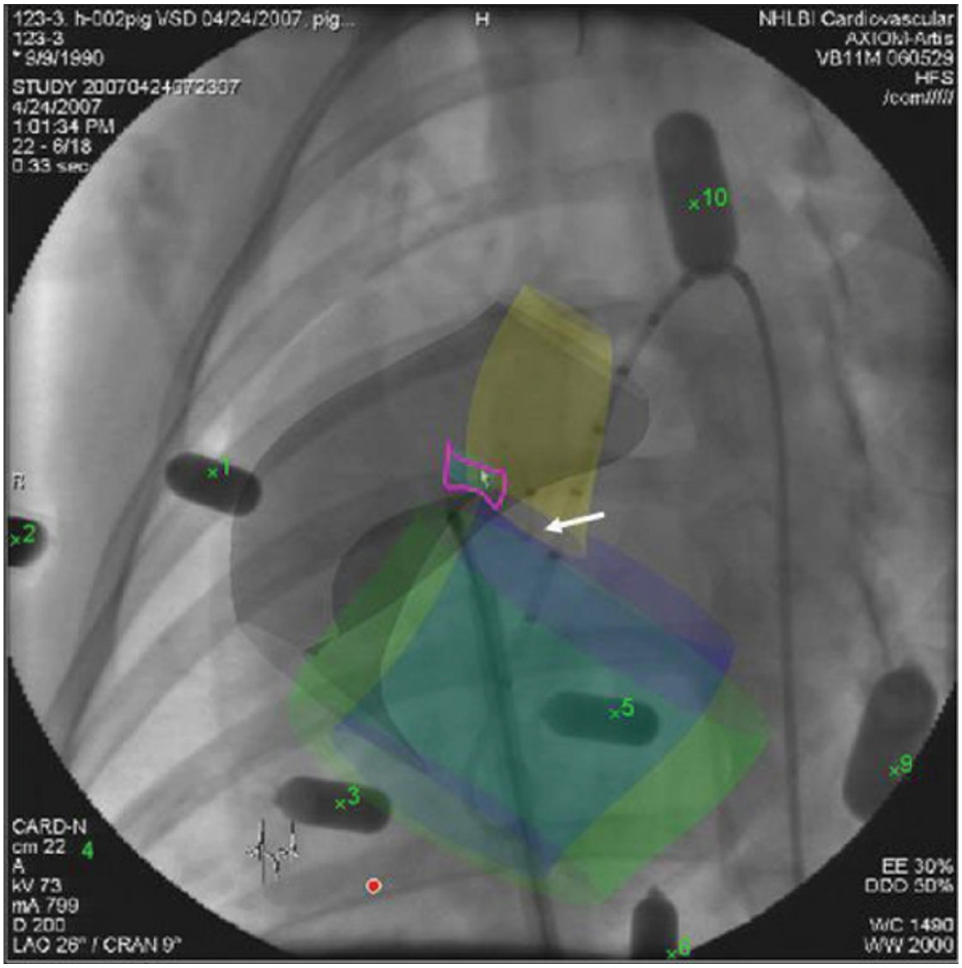

Figure 2

Assessment of device orientation. Despite anatomic distortion by device and delivery system, XFM suggests appropriate position with Left Ventricle disk orientation marker (white arrow) pointing toward the Left Ventricle apex (red dot). Right Ventricle and Right Ventricular Outflow Tract (gray), Left Ventricle endocardial (green) and epicardial (purple) surfaces, VSD (pink outline and blue volume – segmetned from different slice orientations), aortic root (yellow).