Real-time 3D echocardiographic visualization of a large interventricular septal defect complicating acute antero-apical myocardial infarction

Clinical Case Portal

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Introduction

In patients with post-acute myocardial infarction interventricular septal defect (IVSD) who refuse cardiac surgery, percutaneous closure of the IVSD may be a treatment option. However, exact localization and sizing of the IVSD and detailed anatomy of the defect and surrounding structures are prerequisites before considering this therapeutic option.

Case Report

A 65-year-old caucasian man was admitted for acute myocardial infarction occurred during hemodialysis. Patient history prior to this event was remarkable for long-standing hypertension and diabetes mellitus with both microvascular (retinopathy and nephropathy in chronic hemodialysis for the last two months) and macrovascular complications (peripheral artery disease with prior percutaneous revascularization and subsequent right lower limb amputation).

On admission, he was hemodynamically stable, with no more pain. A diagnosis of acute antero-apical myocardial infarction was made based on ECG signs of anterior ischemic lesion and necrosis and elevated myocardial biomarkers. Clinical examination revealed an intense precordial systolic murmur, whereas a large apical IVSD was detected at standard echocardiography (Figure 1) with a significant bidirectional shunt (Qp/Qs 4.59) (Figure 2). Echocardiography also showed a large thin-walled apical left ventricular (LV) aneurysm, severe pulmonary hypertension with right-heart chamber enlargement and severe right ventricular (RV) systolic dysfunction. He underwent IACP hemodynamic support and Swan-Ganz catheter invasive monitoring. Coronary angiogram was performed, showing a suboccluded proximal left anterior descendent artery.

The patient constantly refused both dialysis session and surgical intervention. In order to attempt a percutaneous closure of IVSD, a real-time three-dimensional echo (RT3DE) study of the defect was performed. RT3DE study allowed a more detailed assessment of the morphology of the defect (Figure 3), allowing multiplane visualization (Figure 4) and “en face” views of the defect both from the left (Figure 5) and the right (Figure 6) side for its exact sizing (Figure 7). Unfortunately, patient’s condition rapidly deteriorated and he died 10 days after admission.

Discussion

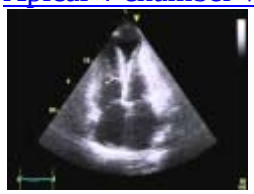
IVSDs are mechanical complications of myocardial infarction, preceeded by acute transmural infarcted tissue expansion. IVSDs can be visualized by 2D echocardiography, often using nonconventional approaches. Using the RT3DE and 4D full-volume data-set, it is possible to provide an accurate assessment the LV anatomy, global and regional biventricular function, as well as the exact localization and morphological details of IVSD. Using electronic cropping tools, the IVSD may be clearly delineated both in longitudinal section and also as ”en face’ views for optimal characterization of anatomical details (size and dynamic shape) and precise localization of the defect. 3D echocardiography is a potentially valuable clinical tool to provide accurate imaging with significant impact on treatment options (surgical/catheter-based closure) of complex IVSDs. In addition, overall LV function, the presence of pulmonary hypertension and RV function may serve as prognostic markers in these patients.

References

1. Mercer-Rosa L et al. Illustration of the additional value of real-time 3-dimensional echocardiography to conventional transthoracic and transesophageal 2-dimensional echocardiography in imaging muscular ventricular septal defects: does this have any impact on individual patient treatment? J Am Soc Echocardiogr 2006;19:1511-1519
2. Chen FL et al. Real time three-dimensional echocardiography in assessing ventricular septal defects: an echocardiographic-surgical correlative study. Echocardiography 2006; 23(7):562-568

Video 1 :

Apical 4-chamber view



Video 2 :
Magnified apical 4-chamber view with color Doppler

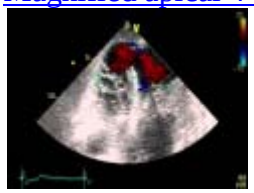
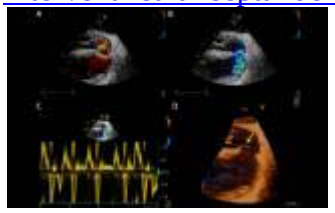


Fig. 1 :
Interventricular septal defect imaged from a modified subcostal 4-chamber view



Video 3 :
Multiplane visualization of IVSD from a subcostal approach

Video 4 :
“En face” view of the IVSD from the left ventricle

Video 5 :
“En face” view of IVSD from the right ventricle

Fig. 2 :

Measurement of IVSD dimensions