International Society for
Adult Congenital Heart Disease

Supplementary ACHD Echo Acquisition Protocol for

Atrial Septal Defects

The following protocol for echo in adult patients with atrial septal defects (ASDs) is a guide for performing a comprehensive assessment of this group of patients. It is intended as a supplementary guide to the ISACHD echo protocol and sequential analysis and all regular measurements should be included. It highlights areas of interest in each view specific to unrepaired & repaired ASDs.

Background

- ASD represents one of the most common congenital heart disease lesions in adult patients.
- It is not uncommon that it remains undiagnosed until adulthood since patients may remain asymptomatic or only mildly symptomatic for a long time.

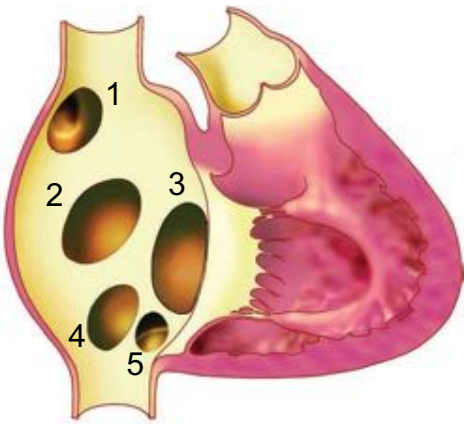


Diagram showing different types of ASDs
1. Sinus venosus (SVC type)
2. Secundum ASD
3. Primum ASD
4. Sinus venous (IVC type)
5. Unroofed coronary sinus ASD.

Diagram adapted from Popelova et al

- The secundum ASD - located within the region of the oval fossa - is by far the most common type (approximately 80% of ASDs).
- The “primum ASD” - located near the crux of the heart - accounts for approximately 15% of ASDs. It belongs to the group of atrioventricular septal defects (partial AVSD or partial AV canal) and is typically associated with AV-valve abnormalities and will be addressed in the atrial ventricular septal defect protocol.
- The sinus venosus defects are located at the regions connecting atrium and the caval veins.
    - The superior sinus venosus defect is much more common (~5% of ASDs) than the inferior one (<1%) and is typically associated with partial (sometimes complete) drainage of the right pulmonary veins to the SVC and right atrium.
    - Sinus venosus defects can be difficult to visualise on transthoracic echo, so often transoesophageal echo is necessary.

- The unroofed coronary sinus is a rare form of ASD, characterised by a communication between the coronary sinus and the left atrium. It is almost always associated with a persistent left caval vein draining to the roof of the left atrium.

Common associations

- Right ventricular volume overload
- Elevated pulmonary artery pressure
- Secondary tricuspid regurgitation
- Right atrial dilatationAnomalous pulmonary venous connection (sinus venosus and secundum defects)
  Persistent left SVC (unroofed coronary sinus)

Treatment

Defect can be closed either via:

- Surgical patch
- Direct suture (if small)
- Percutaneous occluder

Residual haemodynamic lesions and complications in repaired ASDs

- Residual shunt
- Residual RV dilatation and/or dysfunction
- Residual elevated pulmonary artery pressure
- Pulmonary venous obstruction
- Septal occluder erode to aortic root or atrial wall
- Thrombus (in region of device)
- Tricuspid regurgitation

Imaging protocol for atrial septal defect

Subcostal views	• Establish abdominal and atrial situs, cardiac position & direction of apex • Assess IVC size & collapse to estimate RA pressure • Hepatic venous Doppler to assess for venous flow pattern or flow reversal • In 4 chamber view, sweep through from posterior to anterior aspect of the interatrial septum checking for defects. Add reduced colour Doppler scale and repeat. • In short axis view, sweep from patient's right to left (IAS to apex). Add reduced colour Doppler scale and repeat. • Bicaval view: modified short axis view demonstrating IVC & SVC inflow. Add reduce colour scale and repeat. • Rim dimensions. Maximum diameter ASD in multiple planes • RV size(compared to LV size) and function • Check pulmonary venous anatomy, especially for anomalous connection into SVC near RA junction.
Parasternal views	• Overall RV function including the anterior wall & outflow tract • Ventricular septal motion for RV volume & pressure overload • Pulmonary valve anatomy & function, degree of PR • Doppler of pulmonary valve & estimation of PA mean & end-diastolic pressure • Anatomy of main pulmonary artery and proximal branches • Aortic rim dimension • Pulmonary venous return • Tricuspid regurgitation. CW for RV systolic pressure • Dilatation of coronary sinus
Apical views	• Detailed LV function assessment. • Assess aortic valve function • Detailed RV size and function assessment (qualitative compared to LV size & quantitative). • RA size • Anterior angulation to assess anatomy and function of right ventricular outflow • Assess tricuspid valve function • Pulmonary venous return • Posterior angulation to coronary sinus
Suprasternal views	• Assessment of pulmonary venous return where possible (crab view) • Assessment of branch pulmonary arteries • Assessment of right +/- left-sided SVC in the setting of dilated coronary sinus

ASD Reporting:

Key points to include in transthoracic echo report:

- ASD
    - Location
    - Measurement
    - Direction of shunting
- RV size/degree of dilatation and systolic function
- RVSP or mean PA pressure
- Presence of functional TR
- Associated lesions specific to type of ASD
- LV diastolic function

- For secundum ASD and suitability of percutaneous closure:
    - Atrial septal rims are important. Comment on presence of absence of posterior rim if possible.
    - Normal pulmonary venous drainage is also important
- Post repair:
    - RV size & function as a function of remodelling
    - Patch/occluder integrity and any residual leak
    - Mitral & tricuspid regurgitation
    - RVSP
    - LV diastolic function.

Key views specific to ASD patients:

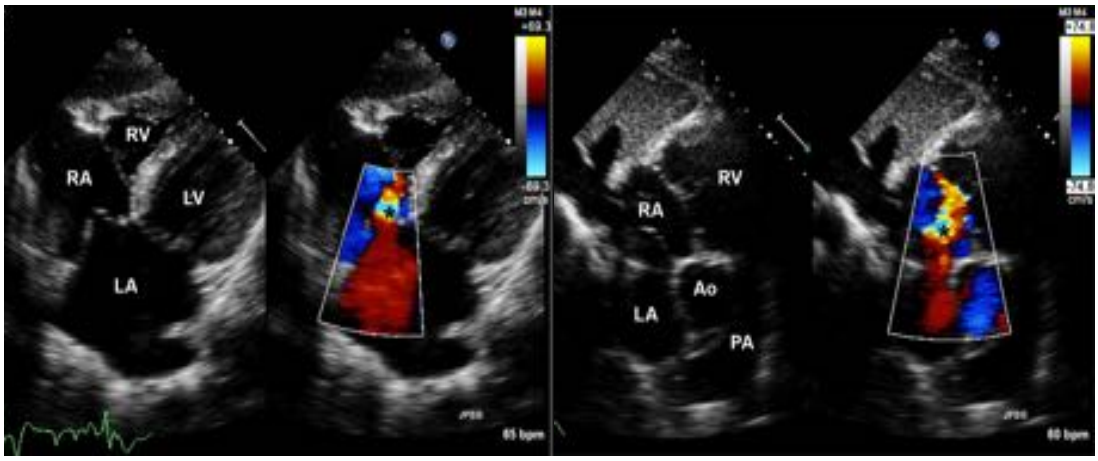


Figure 1 Subcostal long (A) and short (B) axis view of a secundum ASD (shown as *)

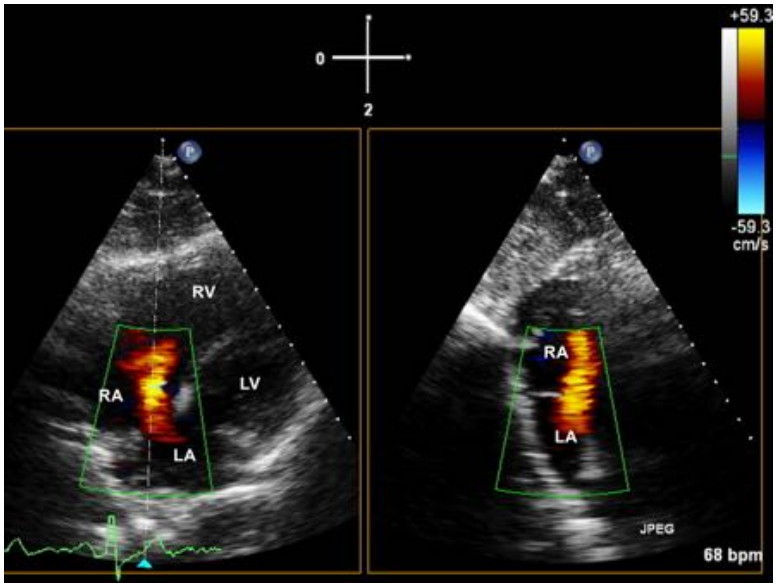


Figure 2 Subcostal long and short axis view of a secundum ASD taken with bi-plane imaging.

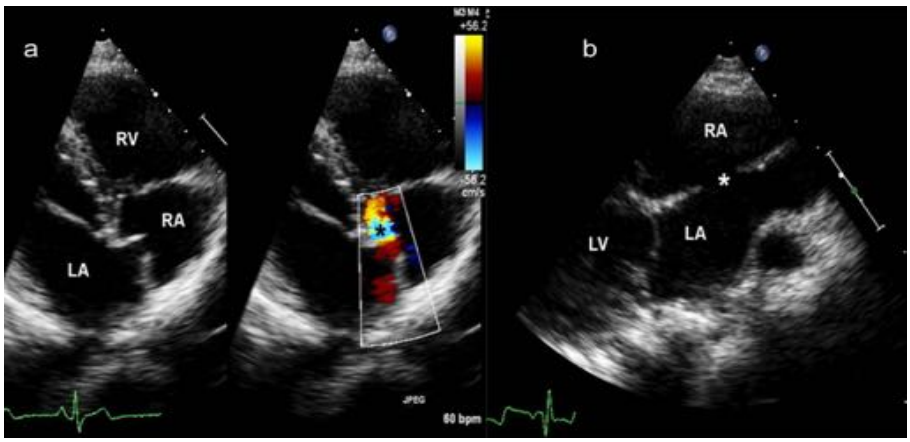


Figure3 If subcostal imaging is of poor quality, a parasternal fore-shortened view (A) or a low or high right parasternal view (B) are two good options for ASD (*) visualization

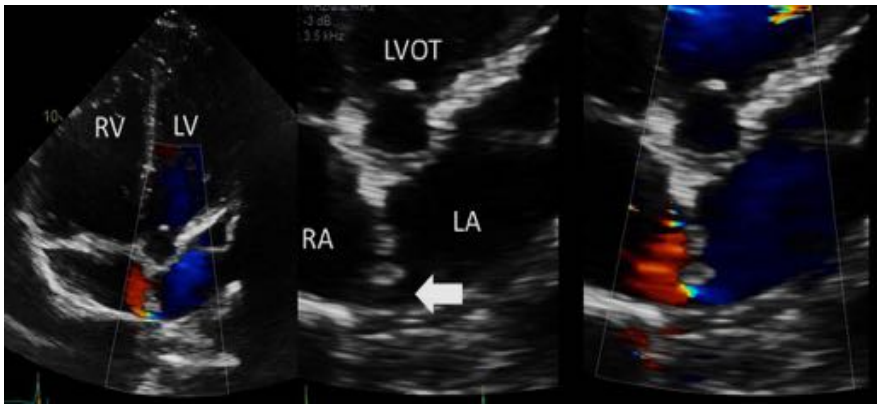


Figure 4: SVC type sinus venosus ASD seen in apical 5 chamber view (left) & zoomed views (right) (arrow)

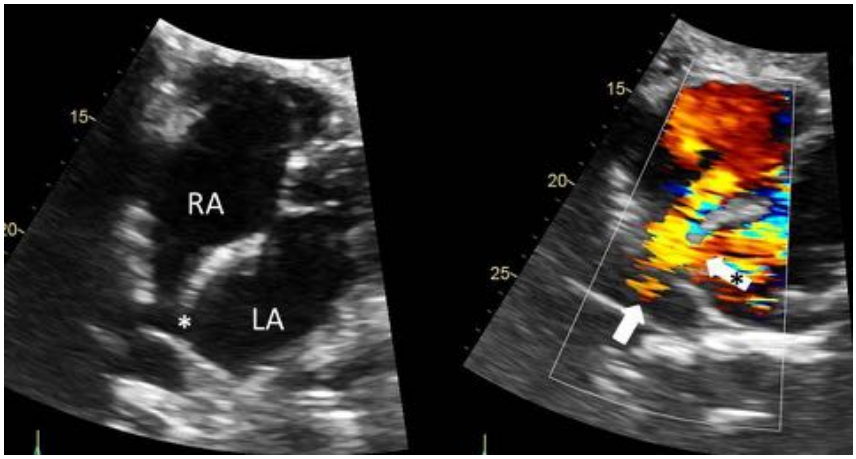
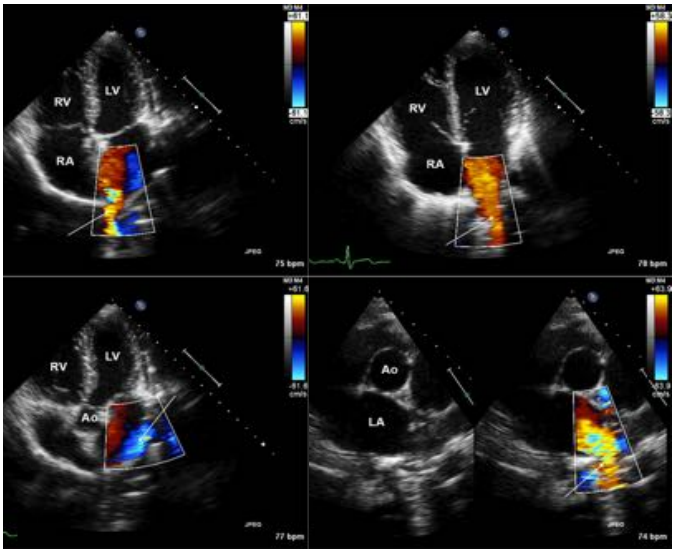


Figure 5: SVC type sinus venosus ASD seen in zoomed subcostal view with slight clockwise rotation (left) SVASD denoted by asterisk & (right) asterisked arrow demonstrates left to right flow. Plain arrow shows normal SVC flow.

A B



C D

Figure 6 Visualization of the 4 pulmonary veins:
From the apical 4 chamber:
A; right upper pulmonary vein
B; right lower pulmonary vein
C; left upper pulmonary vein
D;The left lower pulmonary vein is best visualized from the parasternal short axis view

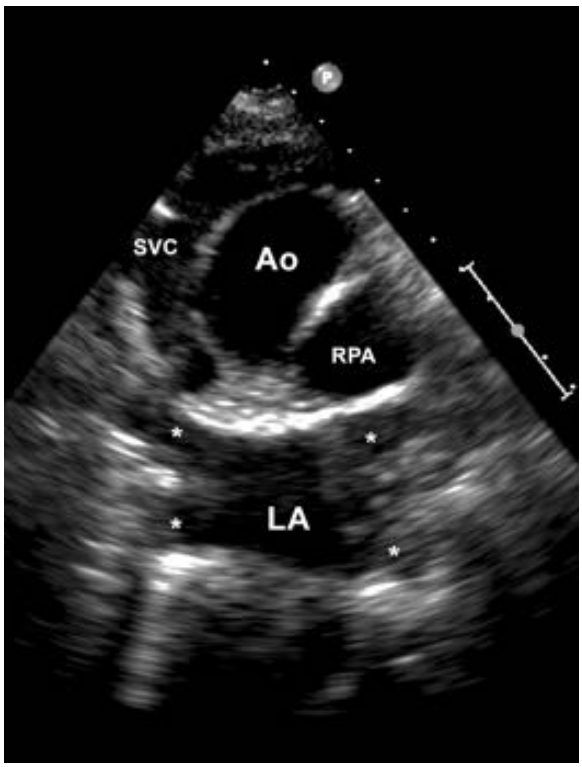


Figure 7

Suprasternal scan showing all four pulmonary veins entering the left atrium.