**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](image)

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 dilatation
- Anomalous 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.
Figure 3: 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.

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.