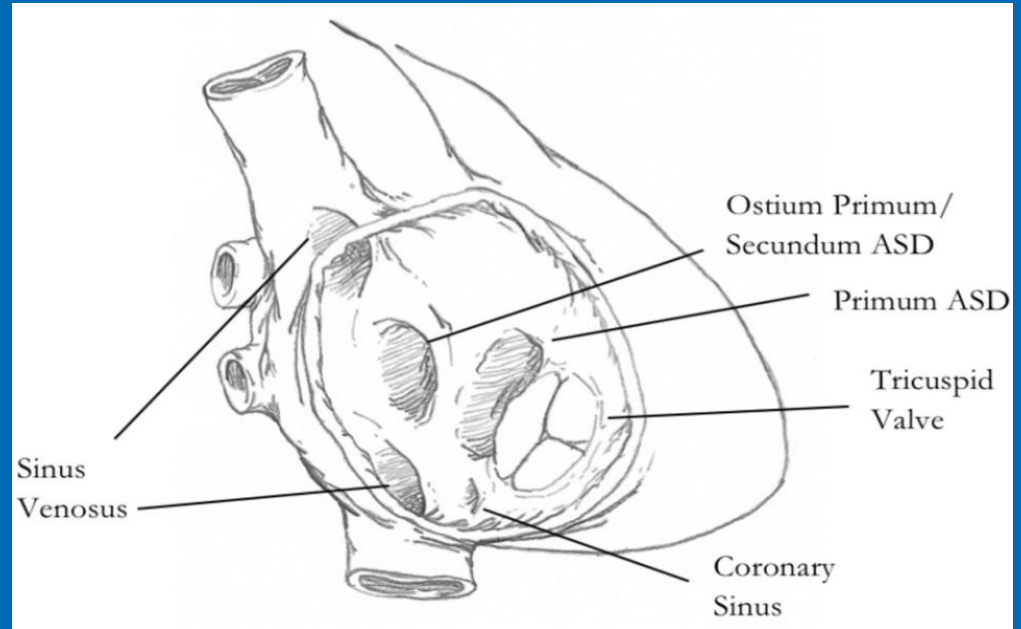


Atrial Septal Defect

Anatomy, Physiology and Abnormalities

Samantha Holmes (Kops), MD
Children's Hospital of Colorado
September 7th, 2024



<https://aneskey.com/chapter-61-atrial-septal-defects/>



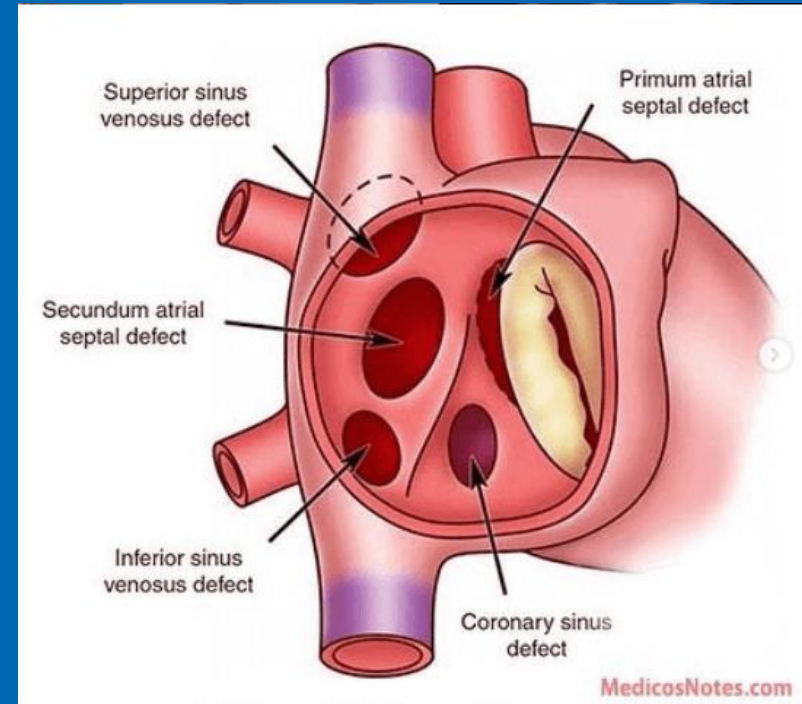
Objectives:

- Epidemiology
- Atrial septal formation
- Physiology of ASD's
- Common types of ASD's



Epidemiology

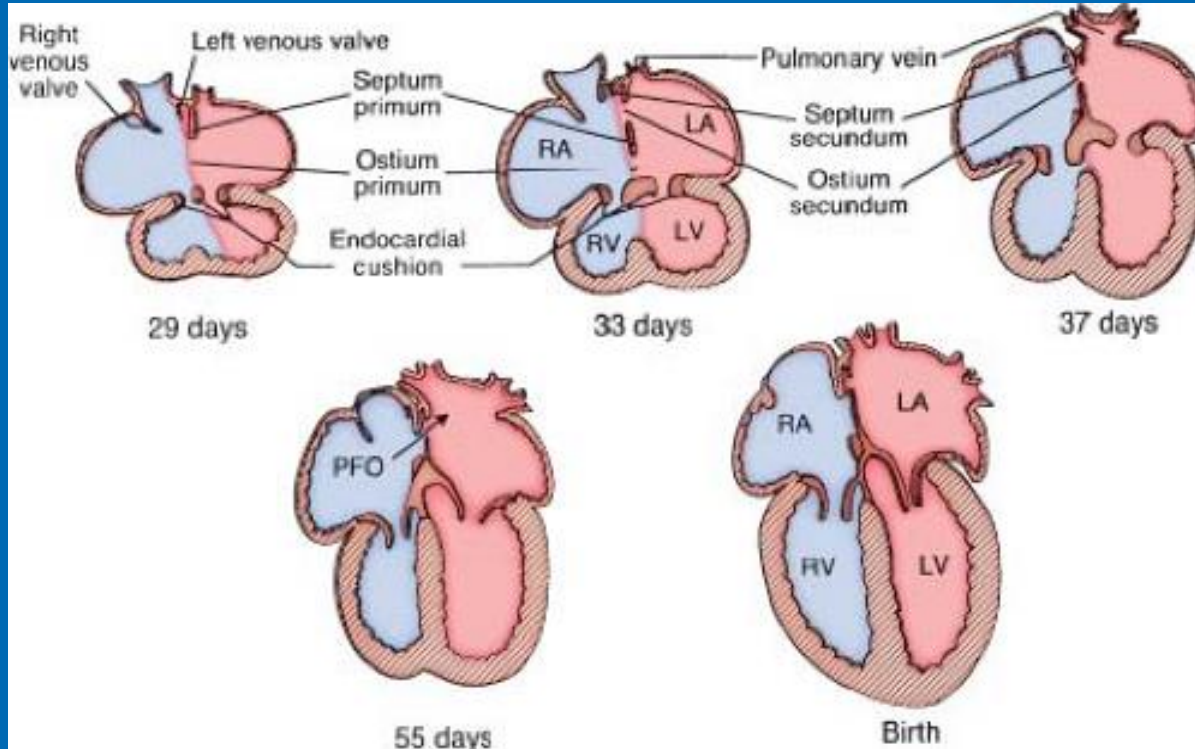
- Results from abnormal atrial formation which allows for communication of the left atrium and right atrium
- Atrial septal defects account for approximately 8-10% of congenital heart defects
- Incidence is 1 in 1,000 live births



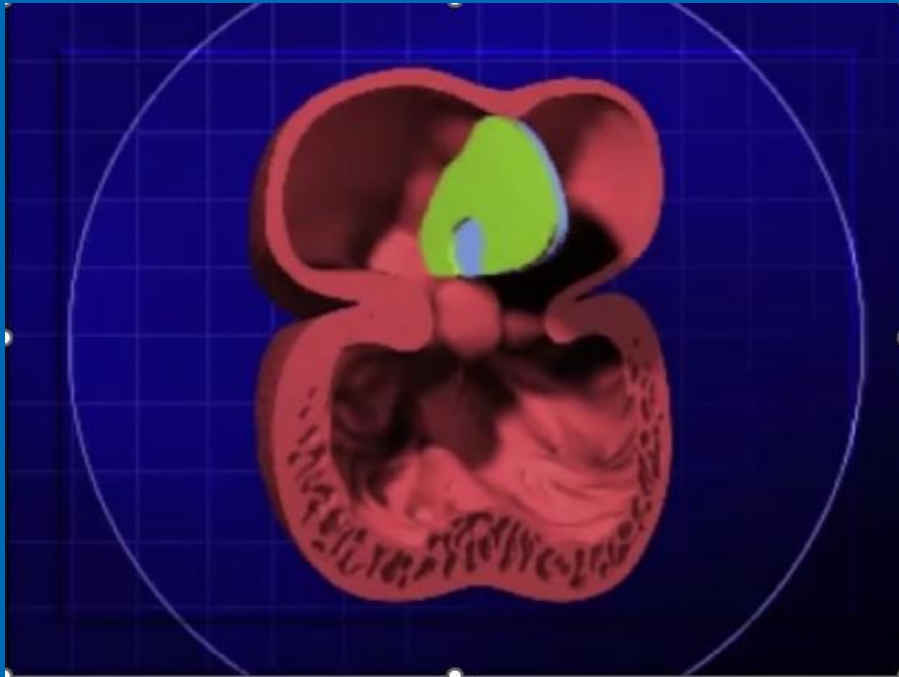
Sridharan, S., Price, G., Tann, O., Hughes, M., Muthurangu, V., Taylor, A.M. (2010). Atrial Septal Defect. In: Cardiovascular MRI in Congenital Heart Disease. Springer, Berlin, Heidelberg. https://doi.org/10.1007/978-3-540-69837-1_13



Formation of the atrial septum



Formation of the atrial septum



Septum primum - blue
Septum secundum - green



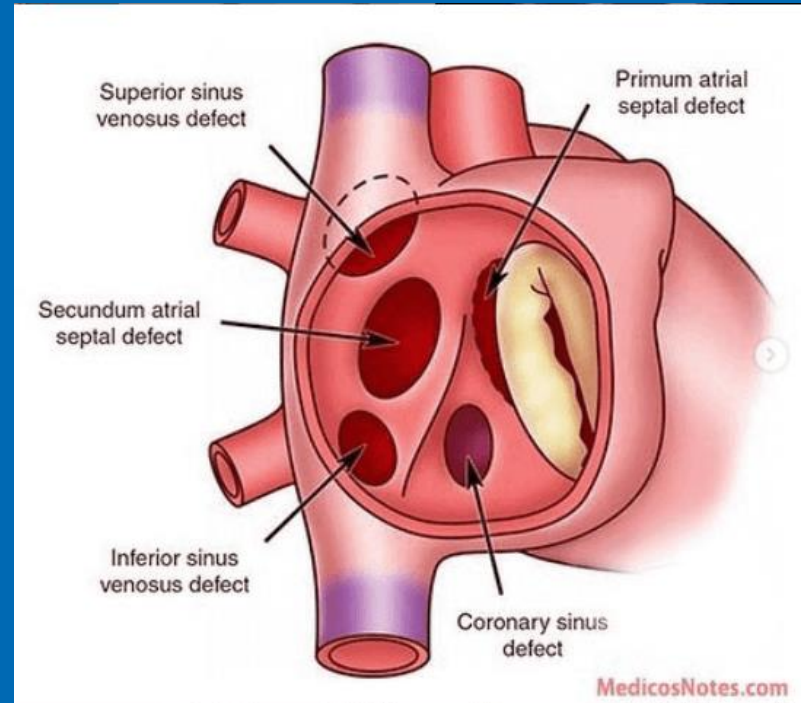
So what happens when these steps do not
occur appropriately?

ASD!



Types of atrial septal defects

- Secundum ASD (75%)
- Primum ASD (20%)
- Sinus venosus ASD (5%)
- Coronary sinus ASD (1%)



Sridharan, S., Price, G., Tann, O., Hughes, M., Muthurangu, V., Taylor, A.M. (2010). Atrial Septal Defect. In: Cardiovascular MRI in Congenital Heart Disease. Springer, Berlin, Heidelberg. https://doi.org/10.1007/978-3-540-69837-1_13



Patent Foramen Ovale

After birth there is increased pulmonary blood flow



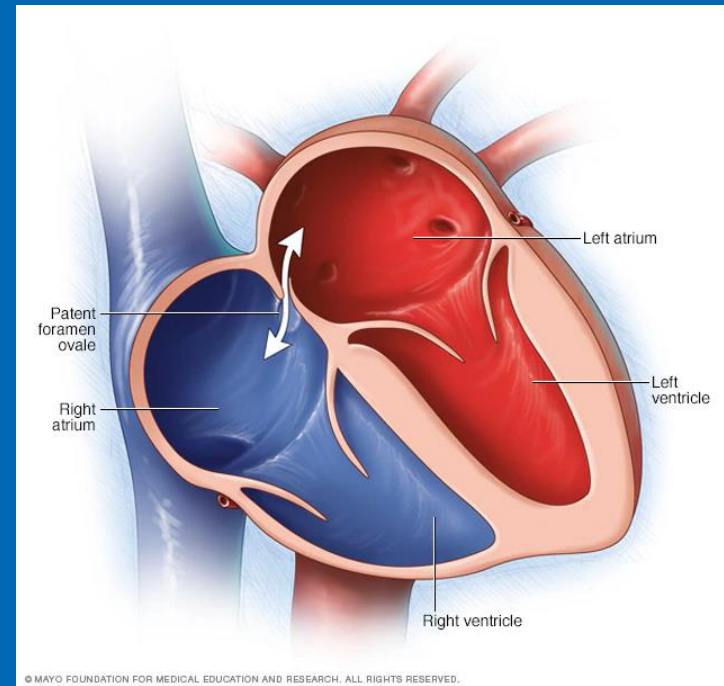
Increased flow to the left atrium



Left atrial pressure > right atrial pressure



Flap closure of the PFO



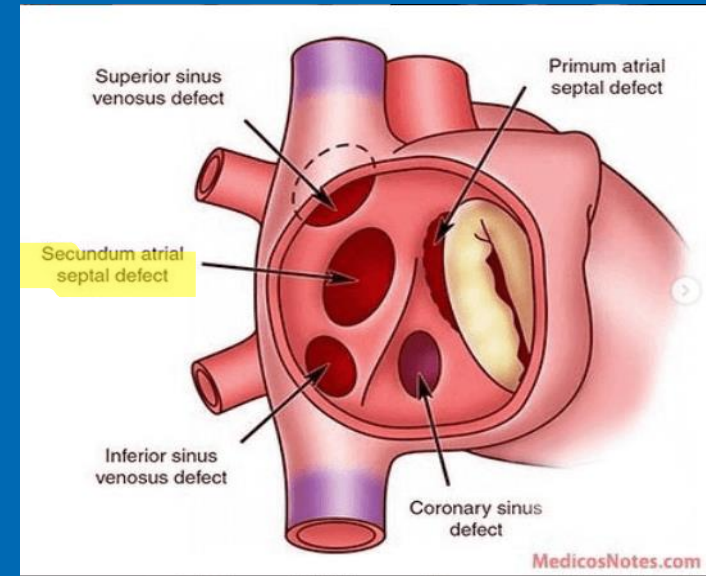
<https://www.mayoclinic.org/diseases-conditions/patent-foramen-ovale/symptoms-causes/syc-20353487>



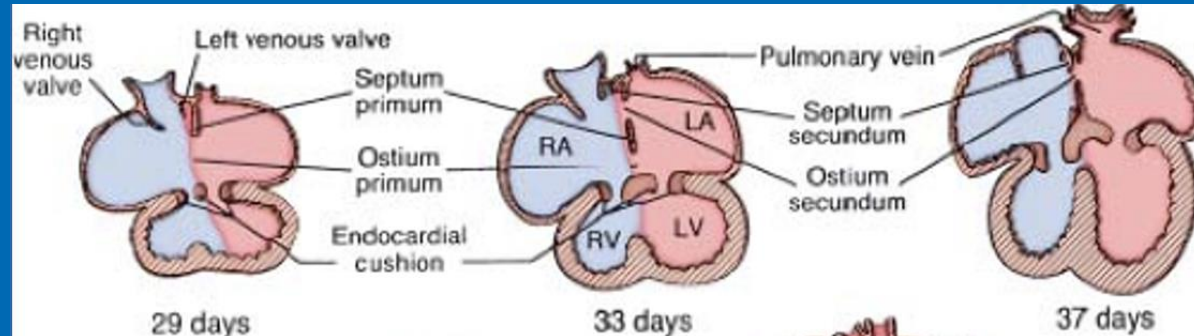
Secundum ASD

Occur in the central portion of the atrial septum and can be due to:

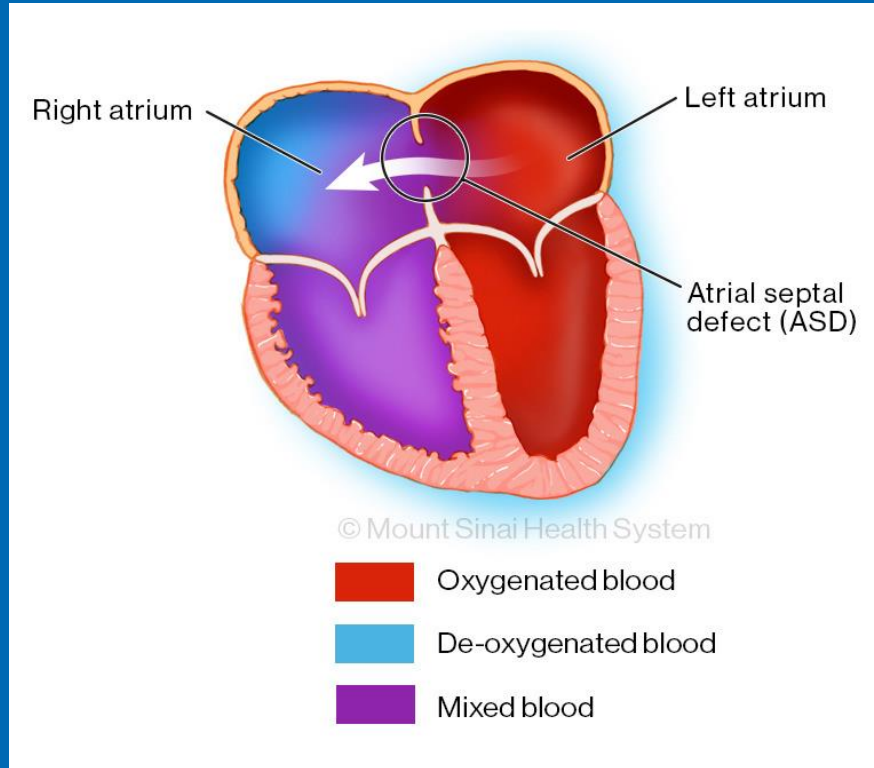
- excessive resorption of septum primum
- deficient growth of septum secundum



Sridharan, S., Price, G., Tann, O., Hughes, M., Muthurangu, V., Taylor, A.M. (2010). Atrial Septal Defect. In: Cardiovascular MRI in Congenital Heart Disease. Springer, Berlin, Heidelberg. https://doi.org/10.1007/978-3-540-69837-1_13



Physiology of atrial septal defects



What happens over time?

Moderate to large ASD



Volume overload and dilation of the right atrium and ventricle



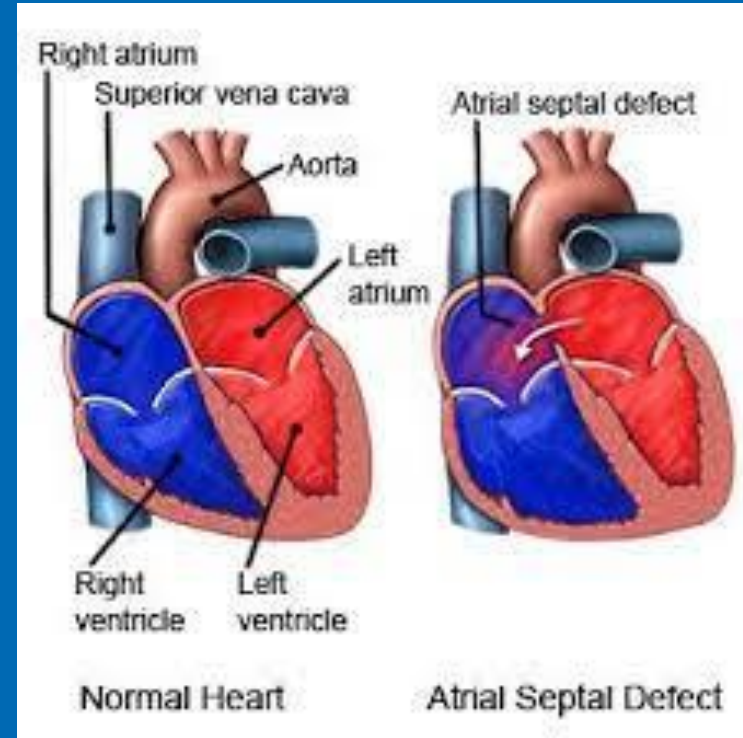
Tricuspid and pulmonary annuli dilation +/- regurgitation



Flow-related pulmonary hypertension



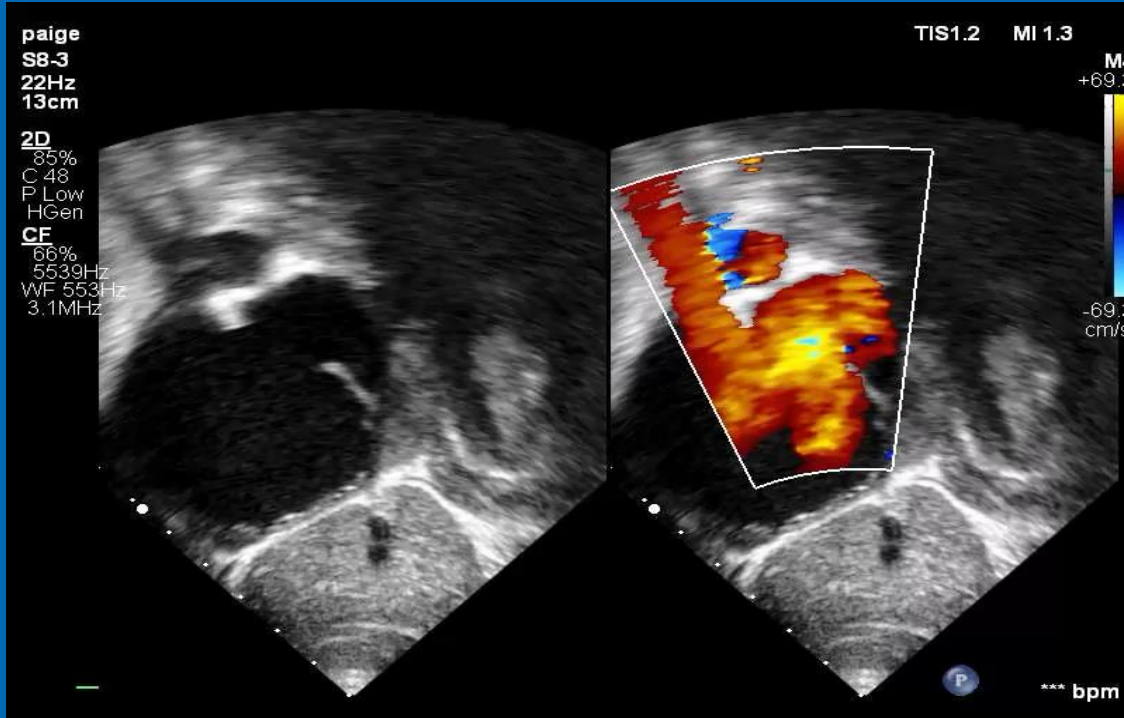
Eisenmenger's Syndrome



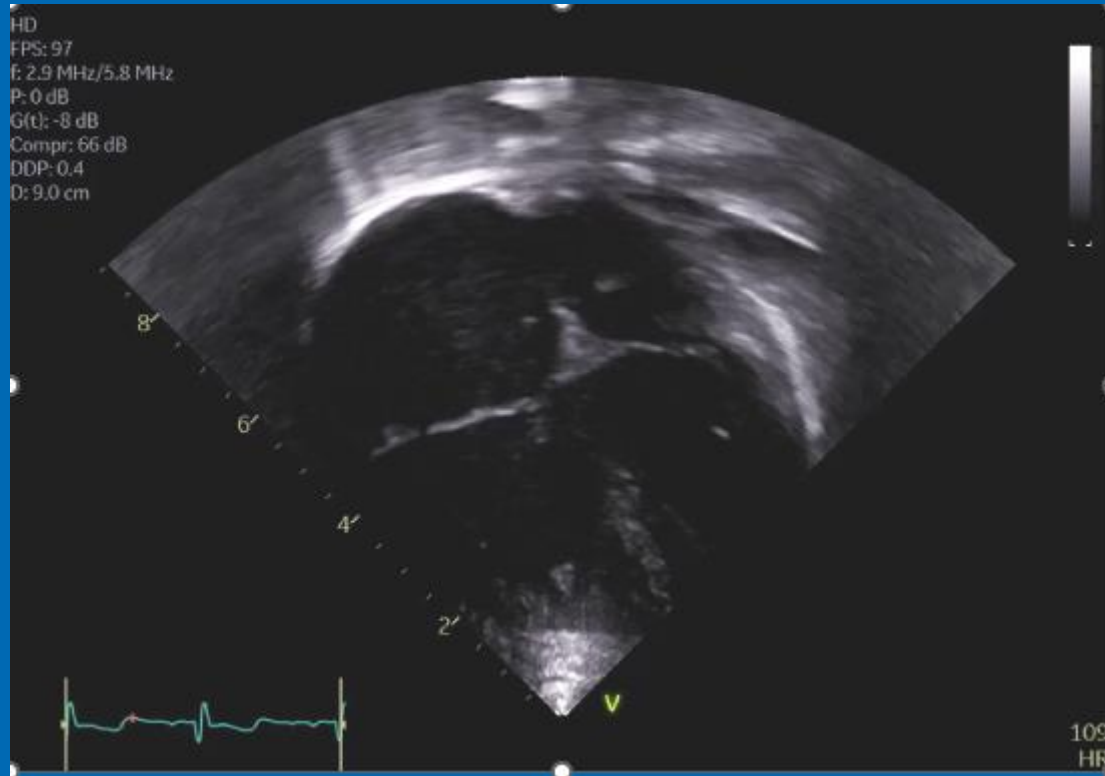
Secundum ASD echocardiography



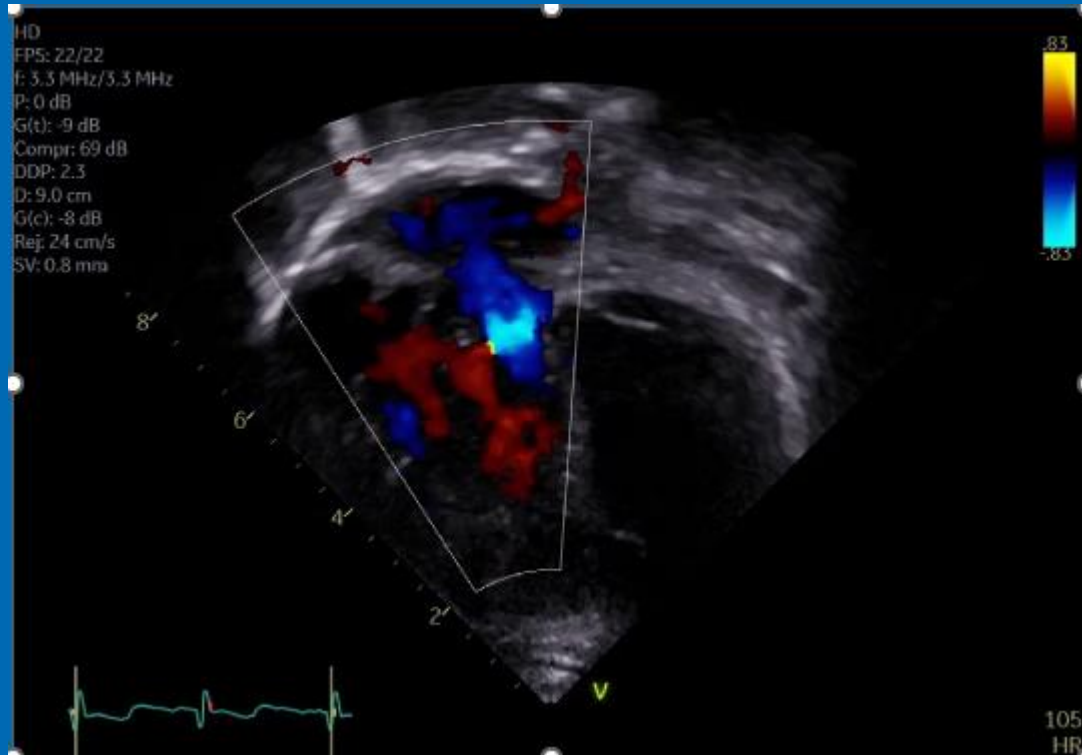
Secundum ASD echocardiography



Right heart dilation

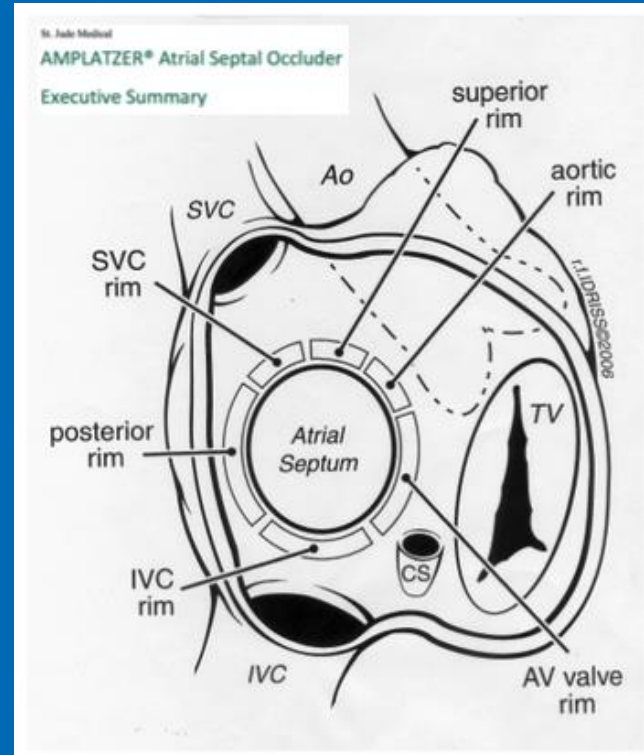


Tricuspid valve annulus enlargement and regurgitation



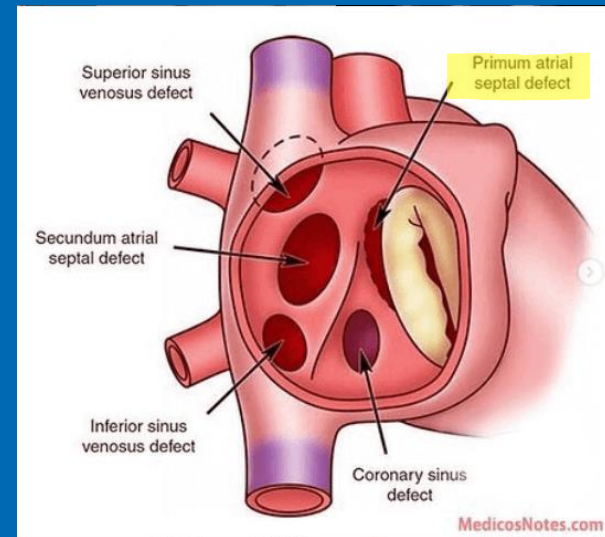
Atrial septal rims for cath closure

- Aortic rim is from defect to aortic annulus
- AV valve rim from defect to AV valve
- SVC rim from defect to SVC os
- IVC rim from defect to IVC os
- Posterior rim from defect to atrial wall
- RUPV rim from defect to RUPV os

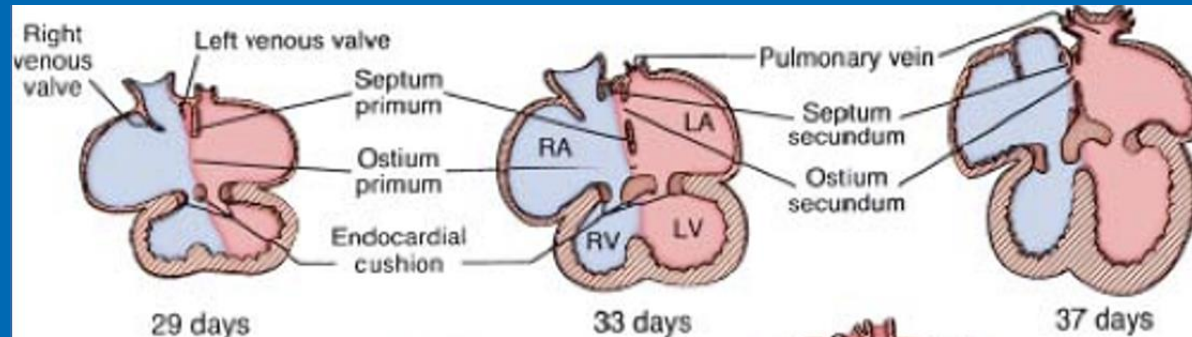


Primum ASD

Occurs on the inferior aspect of the septum primum if it does not fuse with endocardial cushions

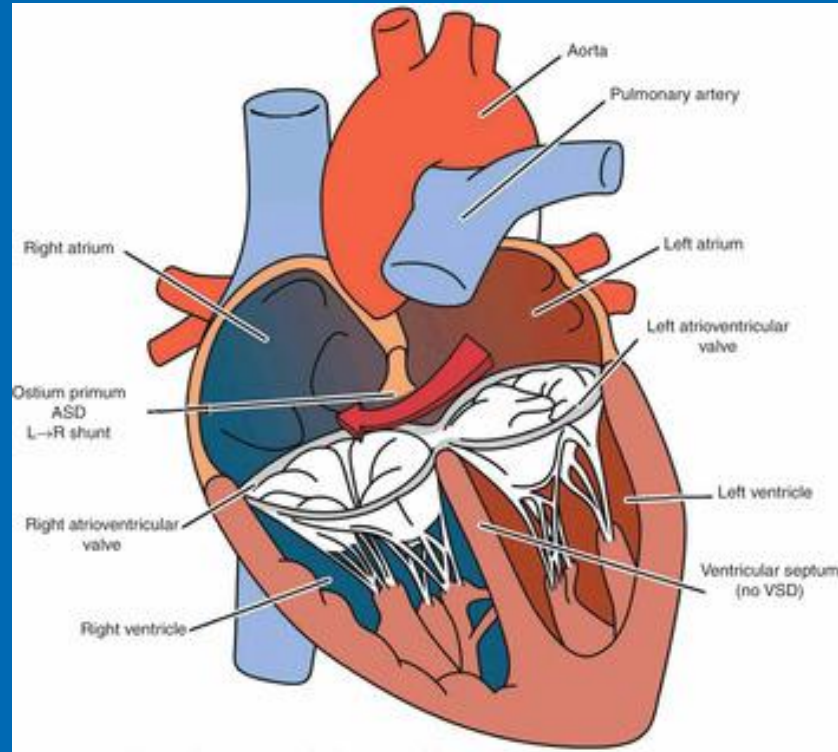


Sridharan, S., Price, G., Tann, O., Hughes, M., Muthurangu, V., Taylor, A.M. (2010). Atrial Septal Defect. In: Cardiovascular MRI in Congenital Heart Disease. Springer, Berlin, Heidelberg. https://doi.org/10.1007/978-3-540-69837-1_13



Physiology

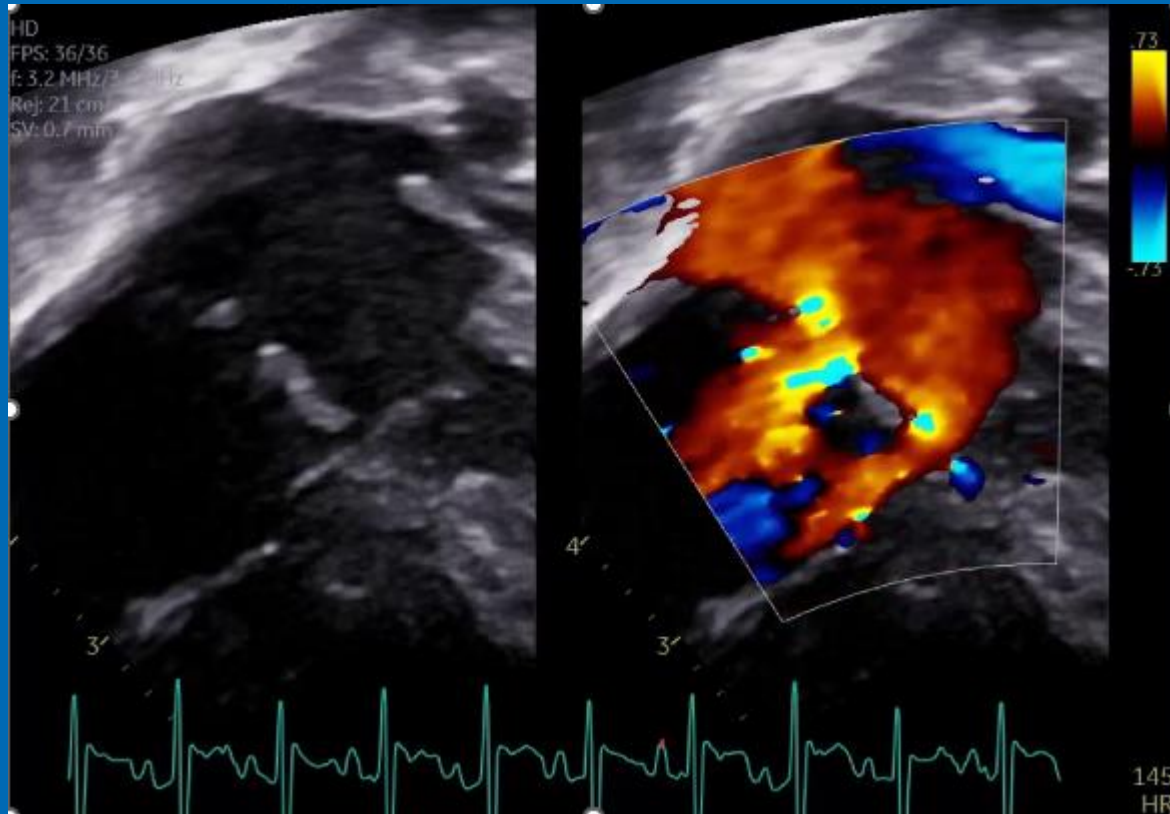
- Similar to secundum atrial septal defects
- Frequently associated with an atrioventricular septal defect which can make management and repair more complicated



Espinel AMM, Adler AC. Transitional Atrioventricular Septal Defect. In: Berenstain LK, Spaeth JP, eds. *Congenital Cardiac Anesthesia: A Case-Based Approach*. Cambridge University Press; 2021:20-24.

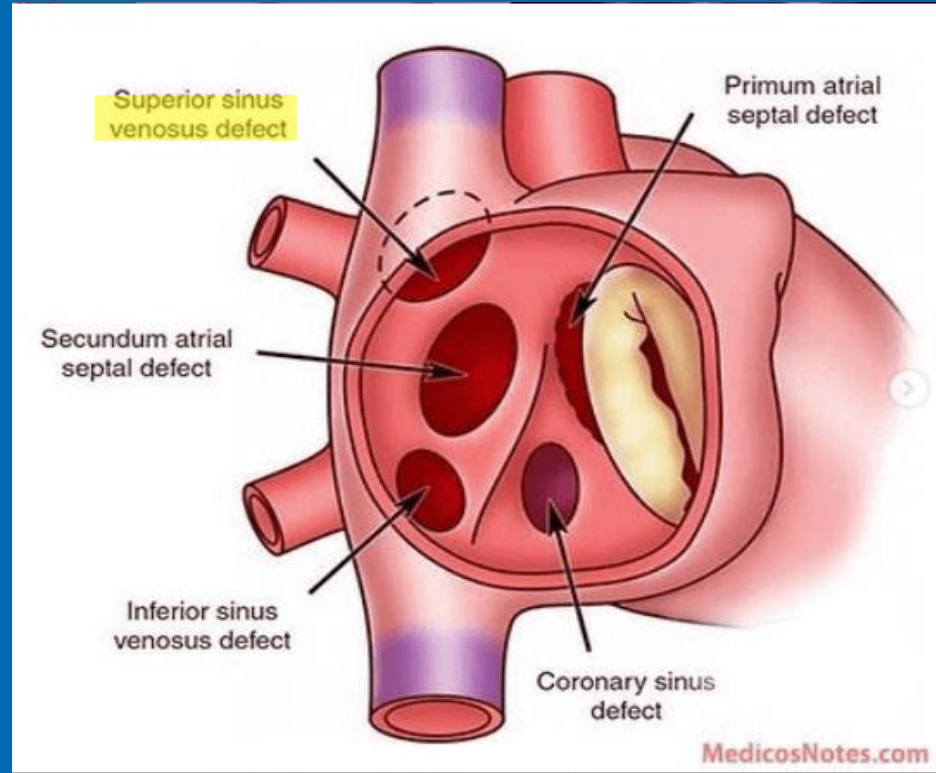


Primum ASD echocardiography



Sinus venosus ASD

Occurs outside the margins of the fossa ovalis and is due to a deficiency of the sinus venosus which separates the right pulmonary veins from the SVC, IVC and right atrium.

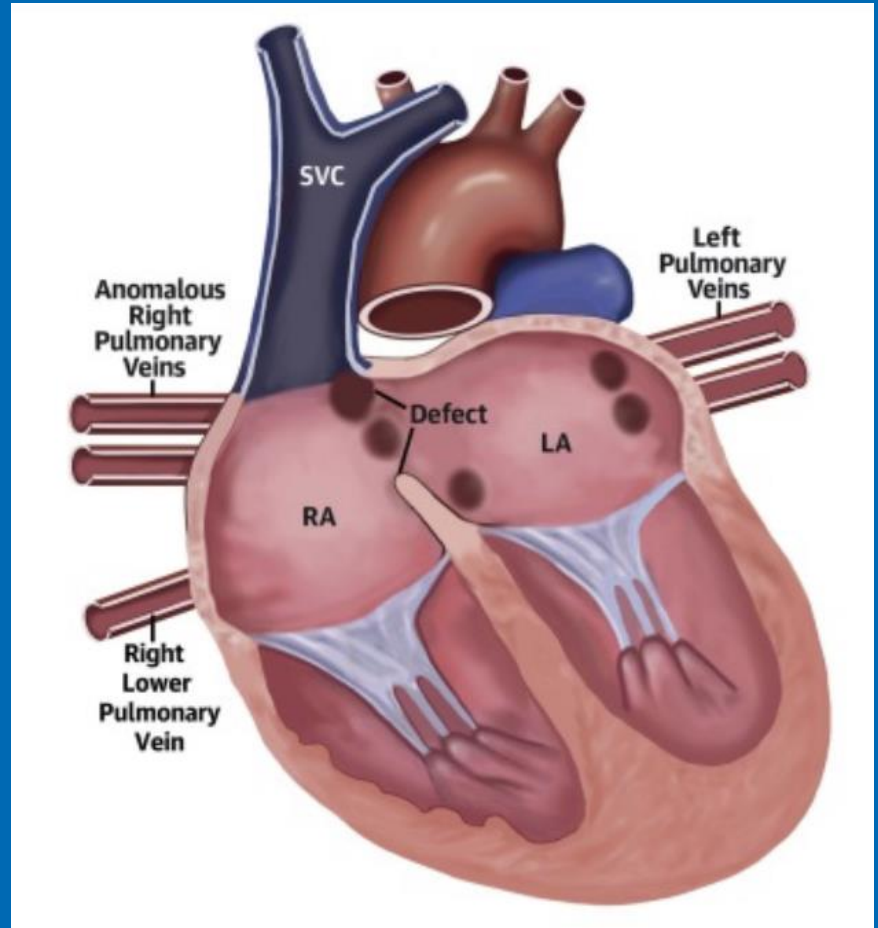


Sridharan, S., Price, G., Tann, O., Hughes, M., Muthurangu, V., Taylor, A.M. (2010). Atrial Septal Defect. In: Cardiovascular MRI in Congenital Heart Disease. Springer, Berlin, Heidelberg. https://doi.org/10.1007/978-3-540-69837-1_13



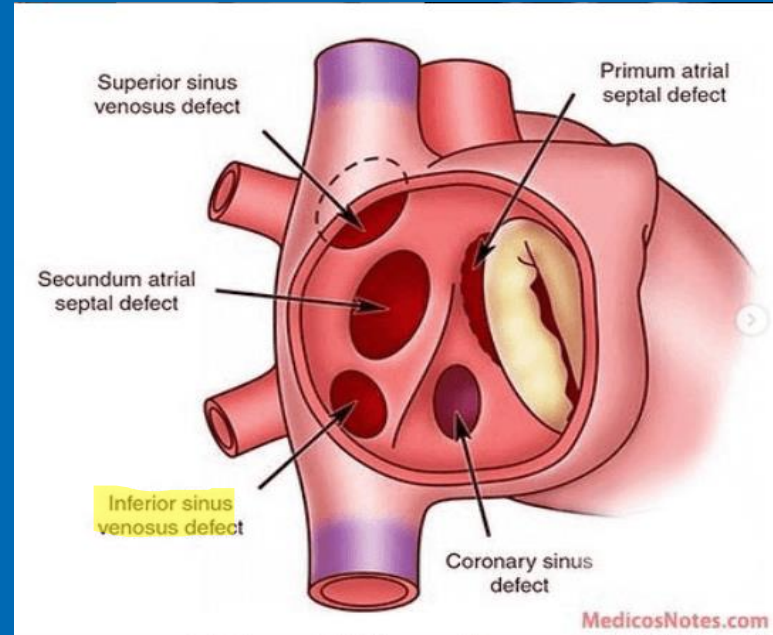
Physiology

Similar to other atrial septal defects, however is due to partial anomalous pulmonary vein return causing left-to-right flow.

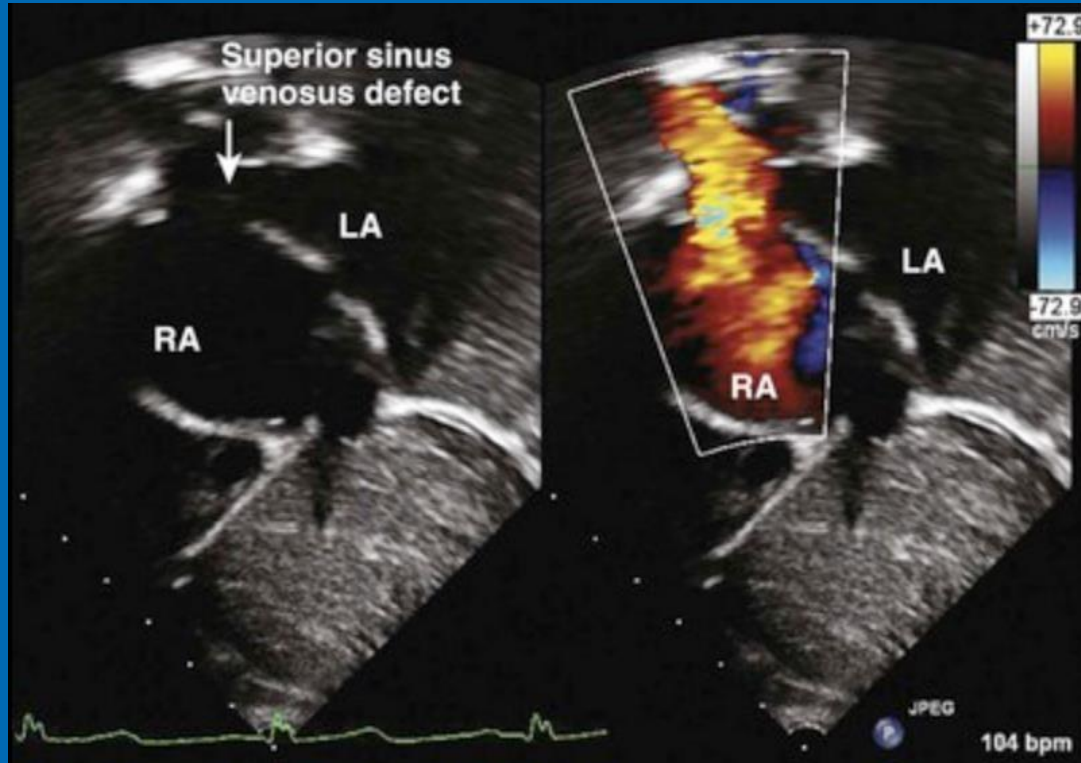


Inferior sinus venosus ASD

- Much more rare than superior sinus venosus ASD's
- Defect between the IVC and the atrial septum
- Less commonly associated with PAPVR

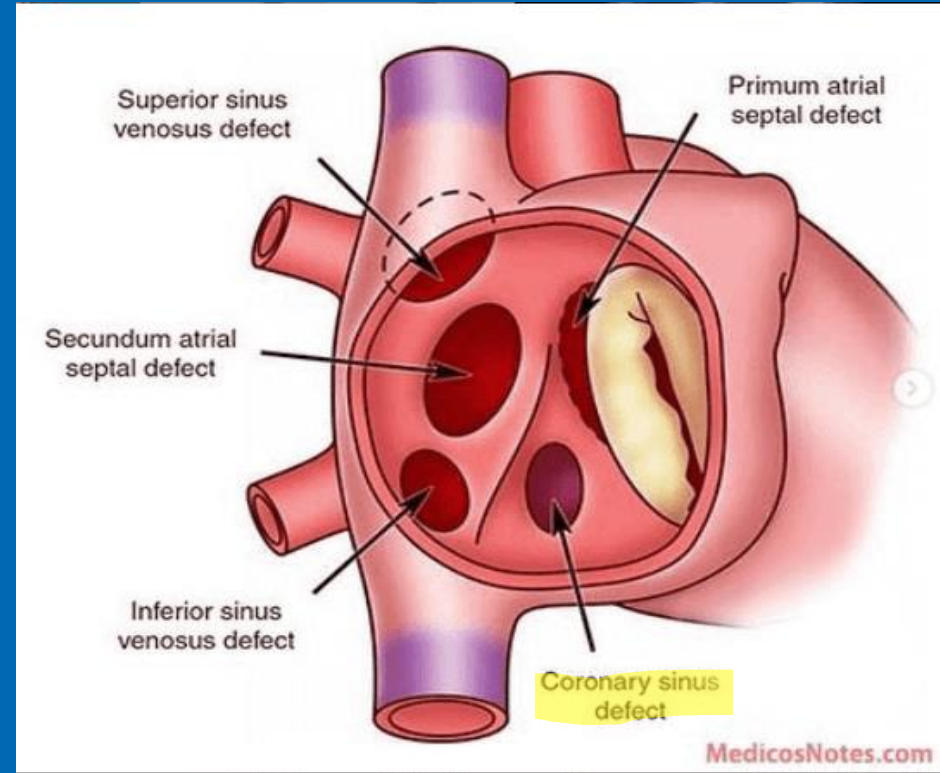


Sinus venosus ASD echocardiography



Coronary sinus ASD

The left horn of the sinus venosus forms the coronary sinus and failure of the wall between the left atrium and coronary sinus results in an unroofed coronary sinus.

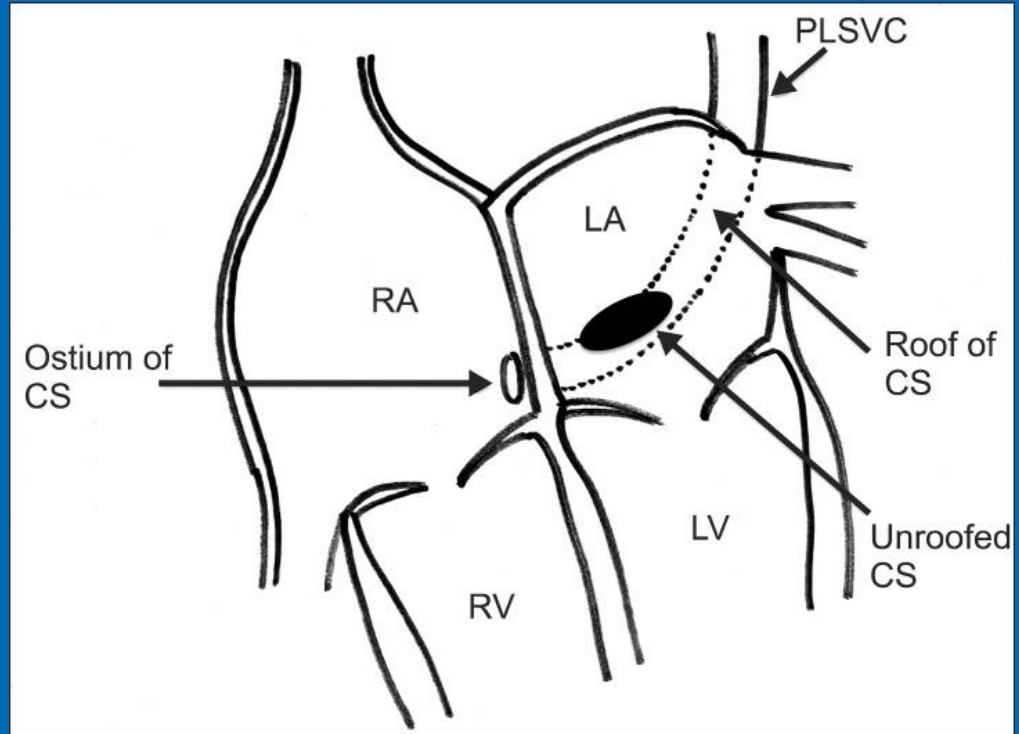


Sridharan, S., Price, G., Tann, O., Hughes, M., Muthurangu, V., Taylor, A.M. (2010). Atrial Septal Defect. In: Cardiovascular MRI in Congenital Heart Disease. Springer, Berlin, Heidelberg. https://doi.org/10.1007/978-3-540-69837-1_13

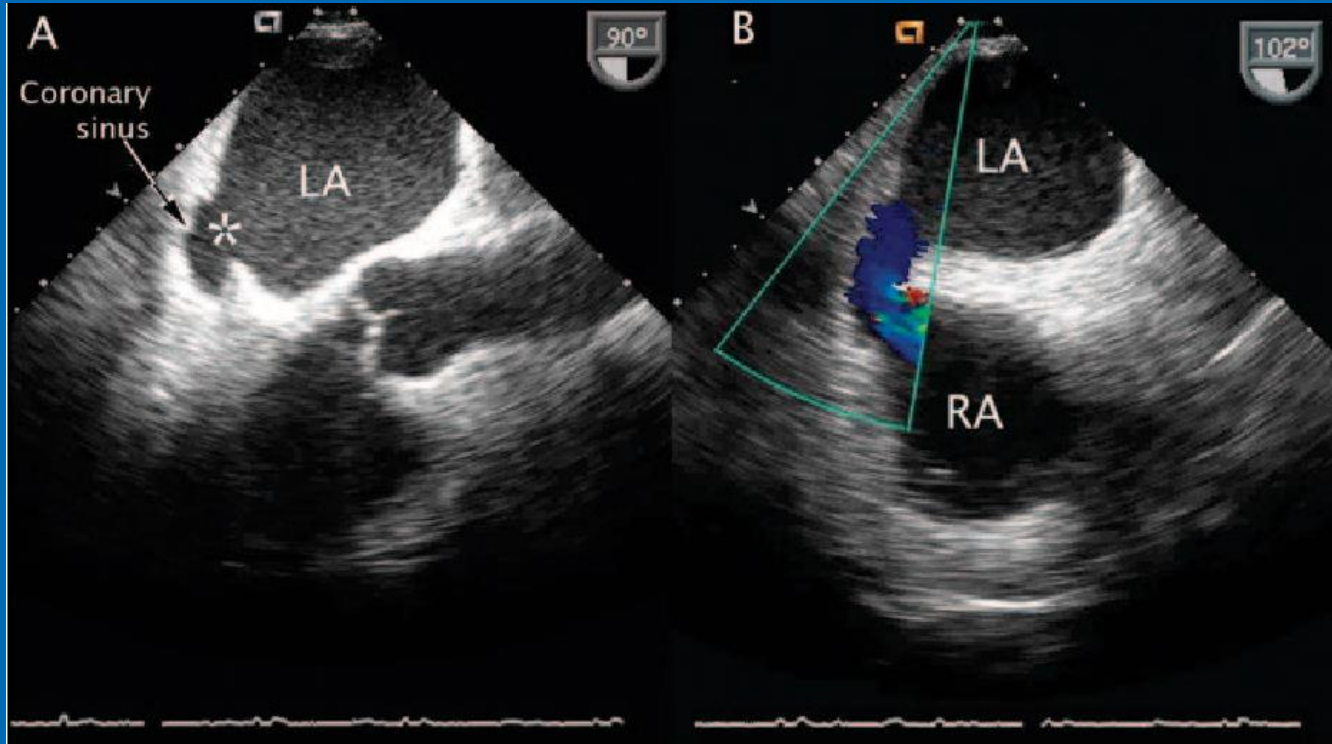


Physiology

Similar to other atrial septal defects. The unroofed coronary sinus allows for left-to-right flow through the coronary sinus.



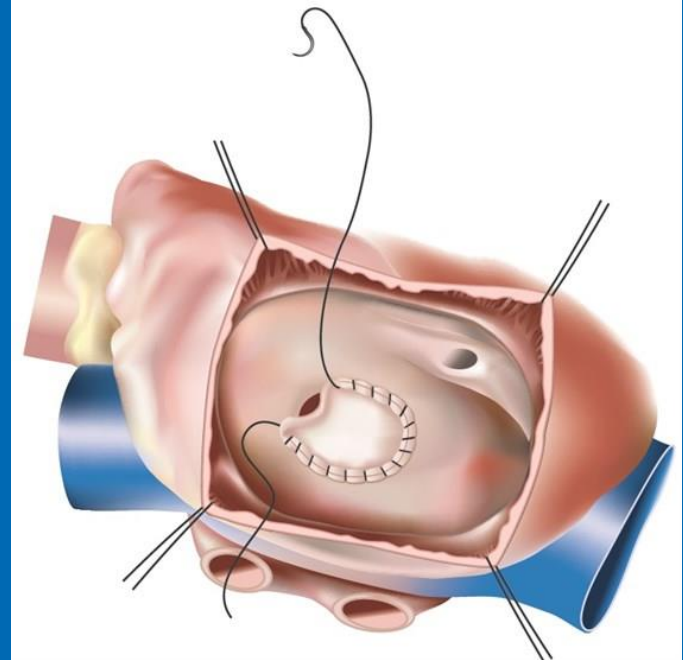
Coronary sinus ASD echocardiography



Repair

If the atrial septal defect is hemodynamically significant, this will require repair

Except for secundum ASD's (which can be closed with a catheter-based intervention depending on the rims), all other ASD's will require surgical repair



<https://adultctsurgery.ucsf.edu/patient/patient-education/minimally-invasive-atrial-septal-defect-asd-closure.aspx>



ASE GUIDELINES & STANDARDS

Guidelines for the Echocardiographic Assessment of Atrial Septal Defect and Patent Foramen Ovale: From the American Society of Echocardiography and Society for Cardiac Angiography and Interventions

Frank E. Silvestry, MD, FASE, Chair, Meryl S. Cohen, MD, FASE, Co-Chair, Laurie B. Armsby, MD, FSCAI, Nitin J. Burkule, MD, DM, FASE, Craig E. Fleishman, MD, FASE, Ziyad M. Hijazi, MD, MPH, MSCAI, Roberto M. Lang, MD, FASE, Jonathan J. Rome, MD, and Yan Wang, RDCS, *Philadelphia, Pennsylvania; Portland, Oregon; Thane, India; Orlando, Florida; Doha, Qatar; and Chicago, Illinois*

(J Am Soc Echocardiogr 2015;28:910-58.)



Summary

- 1) There are four types of atrial septal defects
 - 1) Secundum ASD
 - 2) Primum ASD
 - 3) Sinus venosus ASD
 - 4) Coronary sinus ASD
- 2) Ultimately, these can cause right heart dilation and associated findings over time secondary to volume overload
- 3) If hemodynamically significant, these will need to be repaired



Thank you!

