Appendix

# POCUS Resources

### Table A: The different views obtained from US, how they are obtained, and which structures can be seen. *Legend: RV: right ventricle, LV: left ventricle, LA: left atrium, AV: aortic valve, MV: mitral valve, AO: aorta, DA: descending aorta, TV: tricuspid valve, RVOT: right ventricular outflow tract.* Modified from Lee.

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| **View, steps and tips** | **Probe placement** | **Structures seen** | **Clinical Significance** |
| **Step 1: Parasternal long axis (PSLA or PLAX)** – Place probe at 4th intercostal space (males) or inframammary fold (females) and point toward patient’s right shoulder. | Cardiac Ultrasound Echocardiography Parasternal Long Axis View PSLA Hand PositionFigure : Probe placement for PSLA view | Parasternal Long Axis View Ultrasound Echocardiography Video eFAST FAST scan POCUSFigure: Structures seen in PSLA view | General condition of the heart including ejection fraction (EF) and the sizes of the ventricles.Optimize gain to visualize different chambers of heartOptimize depth to see the DA. |
| **Step 2: Parasternal short axis (PSSA or PSAX)** – From PSLA, rotate probe 90° clockwise, pointing towards left shoulder.Three main levels:1. Mid-papillary level2. Mitral valve level (Fish Mouth view)3. Aortic valve level (Mercedes Benz view) | Cardiac Ultrasound Echocardiography Parasternal Short Axis View PSSA Hand PositionFigure: Probe placement for PSSA view | |  |
| *Mid-papillary level* | Cardiac Ultrasound Echocardiography Parasternal Short Axis View PSSA PSAX Mid Papillary Probe PlacementFigure: Probe placement for mid-papillary level | Figure: Structures seen in PSSA view at mid-papillary level | Overall EF, right ventricular dysfunction, left ventricular wall motion abnormalities |
| *Mitral valve level (Fish Mouth view)* – from mid-papillary level, slide transducer towards sternum to the base of the heart. The mitral valve leaflets should come into view. | Cardiac Ultrasound Echocardiography Parasternal Short Axis View PSSA PSAX Mitral Valve Fish Mouth Probe PlacementFigure: Probe placement for mitral valve level | Figure: Structures seen in PSSA view at mitral valve level. The mitral valve resembles a fish mouth, hence the name. | Mitral valve function |
| *Aortic valve level (Mercedes Benz view)* – from mitral valve level, tilt the tail of the probe inferiorly and point it to the aortic valve. | Cardiac Ultrasound Echocardiography Parasternal Short Axis View PSSA PSAX Aortic Valve Level Mercedes Benz Sign Probe Placement POCUSFigure: Probe placement for aortic valve level | Figure: Structures seen in PSSA view at aortic valve level. The aortic valve resembles the logo for Mercedes Benz, hence the nickname. | Right ventricle, right atrium, left atrium, aortic valve, tricuspid valve and pulmonic valve |
| **Step 3: Apical views***Apical 4 chamber (A4C) view –*from PSSA, slide transducer to apex, pointing at the patient’s left side. Once at the apex, and as the left ventricle decreases in size, tilt the tail down towards feet. Females – point of maximal impulse (PMI) usually just under left breast. | Cardiac Ultrasound Echocardiography Apical 4 Chamber View A4C Hand PositionFigure: Probe placement for the beginning of apical views | Cardiac Ultrasound Echocardiography Apical 4 Chamber view A4C Ultrasound VideoFigure: Structures seen in A4C view. | Allows for hemodynamic assessment of the heart. Can view diastolic dysfunction, valvular regurgitation, cardiac output, etc.Optimize gain and depth to visualize the 4 chambers.\*May benefit from placing patient in left lateral decubitus position to reduce artifact and bring heart proximal. |
| *Apical 5 chamber (A5C) view –* “5th chamber” being the aortic valve and LVOT. From A4C, slightly tilt tail of probe back towards patient’s head (~5-10°) | Cardiac Ultrasound Echocardiography Apical 5 Chamber view A5C Ultrasound VideoFigure: A5C view, which enables the user to calculate CO | Helps obtain CO of left heart. |
| *Coronary Sinus view –* Usually accidental. Occurs when tail of transducer is tilted too much towards patient’s head; correct by tilting probe tail slightly towards patient’s feet for A4C view. | Cardiac Ultrasound Echocardiography Apical 4 Chamber view A4C with Coronary Sinus View  Figure: Coronary sinus view | May look like an atrial septal defect between the two atria – not real!Rarely will use this view intentionally but it is important to recognize to avoid misdiagnosing. |
| **Step 4: Subxiphoid (Subcostal) view –** bend patient’s knees, place probe under xiphoid process, pointing indicator to patient’s left. Need less downward pressure for clear image. | Cardiac Ultrasound Echocardiography Subxiphoid View Hand PositionFigure: Probe position for subxiphoid (subcostal) view | Subxiphoid View Ultrasound Echocardiography Video POCUS  Figure: Subxiphoid/Subcostal view using the liver as an acoustic window | Useful when having difficulty obtaining PSLA and PSSA views (common in patients with chronic obstructive pulmonary disease (COPD)) or during an extended focused assessment with sonography in trauma (E-FAST) scan |
| **Step 5: Inferior Vena Cava (IVC) view –** from subxiphoid view, with knees still bent, keep RA in view and locate IVC within liver and center on screen. Once centered, rotate transducer clockwise to point indicator towards feet | Cardiac Ultrasound Echocardiography IVC View Inferior Vena Cava Hand PositionFigure: Probe position for IVC view | IVC Inferior Vena Cava Cardiac Ultrasound Echocardiography Short to Long AxisFigure: IVC view going from short axis to long axisCardiac Ultrasound Echocardiography Inferior vena cava IVC View Illustration POCUSFigure: Graphic depiction of IVC viewIVC Inferior Vena Cava Cardiac Ultrasound Echocardiography Inspiration ExpirationFigure: IVC collapsibility test | Most common application. Estimates CVP and fluid tolerance.Measurements depend on whether patient is spontaneously breathing or mechanically ventilated.*Spontaneously breathing patient:* instruct patient to take deep breath or sniff. Maximum IVC diameter seen during expiration and minimum IVC diameter at inspiration.*Ventilated patient:* positive pressure has the opposite effect on the IVC. Maximum IVC diameter is during inspiration and minimum IVC diameter is seen during expiration. |

# ReferenceS

## Lee V, Dinh V, Ahn J, Deschamps J, Genobaga S, Lang A, et al. Cardiac ultrasound (echocardiography) made easy: step-by-step guide. In: Pocus 101 [Internet]. Available from: <https://www.pocus101.com/cardiac-ultrasound-echocardiography-made-easy-step-by-step-guide/#Step_1_Parasternal_Long_Axis_PSLA_View>