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CARDIAC

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TDI
TISSUE DOPPLER IMAGING

Tissue Doppler Imaging, TDI measures the velocity of myocardial wall motion at specific locations in the heart using the Doppler principle.

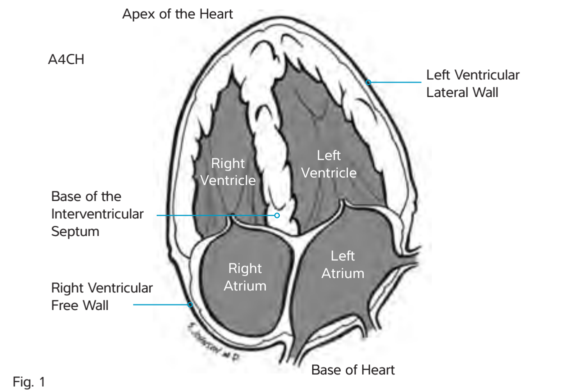

Fig. 1

Fig. 2

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TDI

TISSUE DOPPLER IMAGING

TDI is a tool used in the assessment of both systolic and diastolic ventricular functions of the heart. In sampling multiple locations of the heart's wall tissue, global and regional hemodynamic functions and events may be quantified and measured. TDI also aids in diagnosing major cardiac diseases such as; heart failure, coronary artery disease, acute myocardial infarction, and hypertension.

(S′) Above baseline – Peak systolic annulus velocities.

(E′) Below baseline – Peak diastolic annulus velocities in early ventricular filling.

(A′) Below baseline – Peak diastolic annulus velocities seen in late ventricular filling during atrial contraction. Also known as the atrial kick.

Required measurements:
Peak E′ Waveform, Peak A′ Waveform.

Performing measurement:
Obtain a Apical 4 Chamber view (A4CH) (Fig. 2).

- Place the Pulsed Wave Doppler (PWD) sample volumes on the septal near the annulus, activate PWD, freeze Doppler tracing (Fig. 3).
- Measure the Peak E′ and A′ Velocities – Save Calc.
- Repeat measurements for the left ventricular lateral wall and the right ventricular free wall in the A4CH views. (Fig. 4 and 5 respectively).
- Measurements may also be done in the A2CH view on the anterior and inferior walls (Not pictured).

* Normal values ranges for S and E′ velocities decrease with age while the A′ velocities increase with age.

* The ratios between the E and A velocities have also been shown to predict mortality and other cardiovascular events.

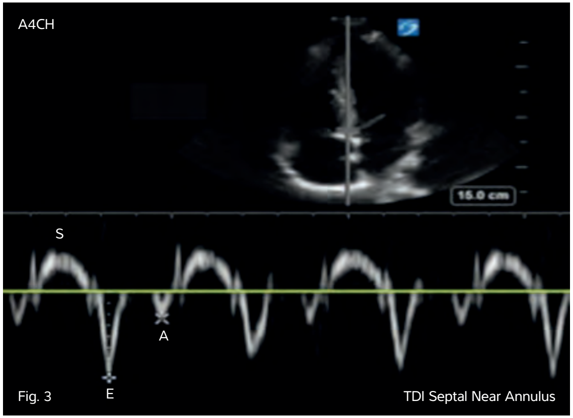

Fig. 3 TDI Septal Near Annulus

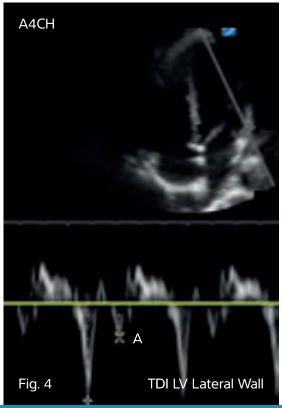

Fig. 4 TDI LV Lateral Wall

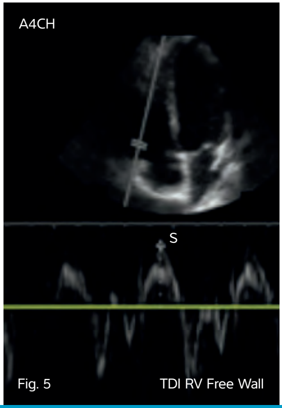

Fig. 5 TDI RV Free Wall

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TAPSE

TRICUSPID ANNULAR PLANE SYSTOLIC EXCURSION

The TAPSE calculation is used to help diagnose right ventricular dysfunction.

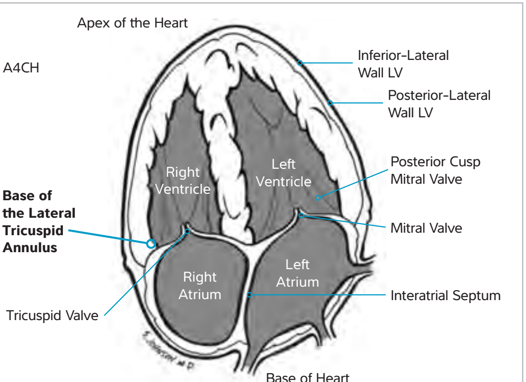

Fig. 1

Fig. 2

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TAPSE

TRICUSPID ANNULAR PLANE SYSTOLIC EXCURSION

TAPSE is the distance the right lateral tricuspid annulus travels towards the apex during the systolic phase of the heart (when the ventricles are emptying).

This measurement assumes that the entire right ventricle's longitudinal systolic function is represented by the height the base of the annulus travels during the emptying or systolic phase of the right ventricle and has been shown to have a good correlation to right ventricle ejection fraction.

TAPSE aids in the diagnosis of certain lung or right-sided heart disease such as; pulmonary hypertension, congested heart disease, ischemia, infarction, tricuspid valvular disease or left to right shunts.

Required measurement:
Max vertical height of lateral tricuspid annulus.

Performing measurement:
Obtain an apical four-chamber heart view (A4CH) (Fig. 2).

- Place the M-Mode curser through the base of the lateral tricuspid annulus (Fig. 3).
- Measure the vertical height using the TAPSE measurement tool. Measure at peak systole to the base of annulus (Fig. 4 and 5).
- TAPSE normal value: 16mm and greater.
- This is a vertical height measurement (noted in horizontal and vertical dotted lines (Fig. 5).

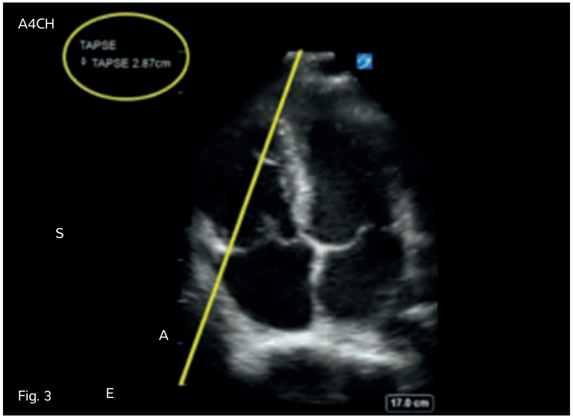

Fig. 3

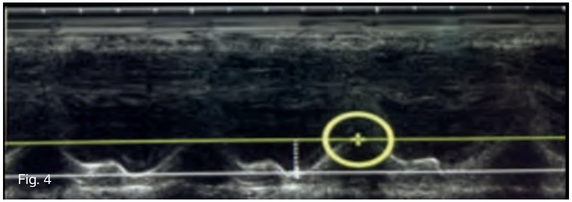
Fig. 4

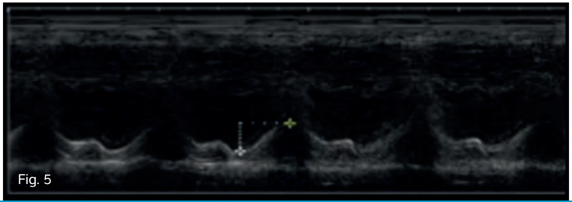
Fig. 5

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IVC COLLAPSE RATIO

ALSO KNOWN AS IVC COLLAPSIBILITY INDEX

IVC Collapse Ratio (%) Calculation

$$\frac{\text{Max IVC Diameter} - \text{Min IVC Diameter}}{\text{Max IVC Diameter}}$$

X 100 = % Ratio of IVC Collapse

IVC Collapse Ratio is used to assess the intravascular volume status of patients.

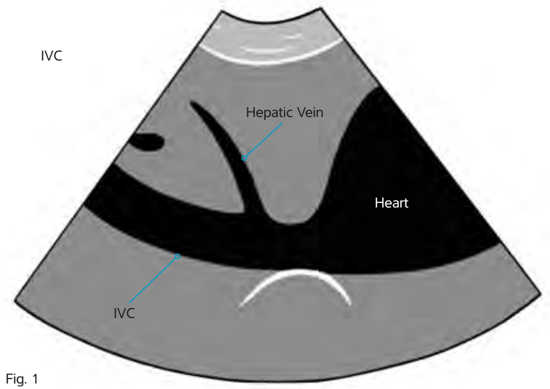

Fig. 1

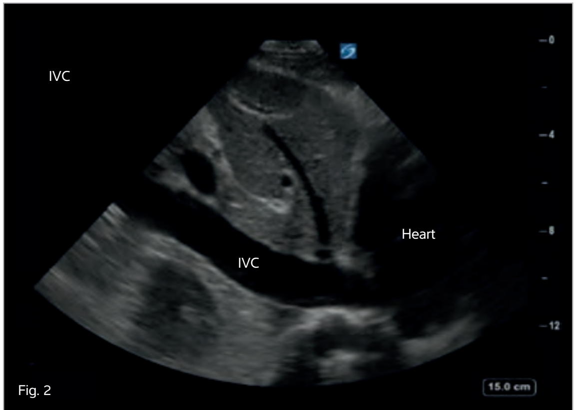

Fig. 2

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IVC COLLAPSE RATIO

Ultrasound imaging of the IVC is helpful when assessing patients for changes in volume status and can be valuable in cases of undifferentiated hypotension (Shock), hemorrhage, sepsis dehydration, heart failure or other abnormal volume states. The IVC collapsibility Ratio may also help estimate the Central Venous Pressure, (CVP) non-invasively or help in the monitoring of fluid removal during procedures.

In patients with volume overload the diameter of the IVC will be enlarged with little to no collapse with inspiration while patients with volume depletion will have a smaller IVC diameter with increased collapsibility of the IVC greater than 50% with spontaneous breathing. The percentage of collapse will be proportionally lower in higher intravascular volume states when compared to low intravascular volume states. This can be calculated and quantified by the IVC Collapse Ratio.

Required measurements:
Max IVC Diameter, Min IVC Diameter.

Performing measurement:

- Obtain a Subxiphoid view of the IVC in a longitudinal plane as it enters the heart. (Fig. 2) This measurement may be done using M-Mode (Shown) or 2D (Not shown).
- Place the M-Mode over the IVC 2 cm from where the IVC enters the right atrium, ensuring that it is perpendicular to the posterior wall. Freeze the image after one whole respiratory cycle.
- Using the IVC calculation package, measure the maximum diameter of the IVC and then with another set of calipers measure the minimum diameter of the IVC (Fig. 4).
- The Individual measurements and their percentage ratio will be displayed.

* The IVC Collapse Ratio is used to determine the volume status for spontaneously breathing non-ventilated patients only.

IVC Collapsibility Index

IVC Size (cm)	Respiratory Δ	RA Pressure mmHg
< 1.5	Total Collapse	0 – 5
1.5 – 2.5	> 50% Collapse	5 – 10
1.5 – 2.5	< 50% Collapse	11 – 15
> 2.5	< 50% Collapse	16 – 20
> 2.5	No Change	> 20

Fig. 3

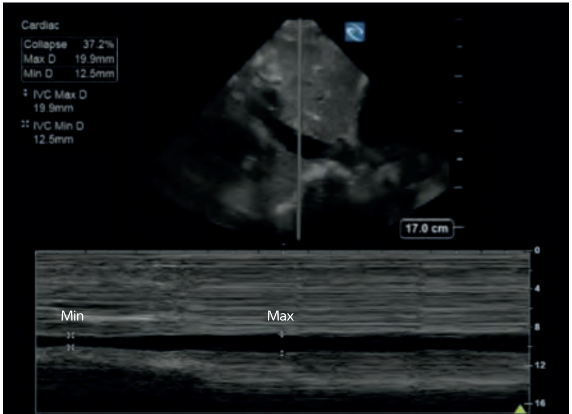

Fig. 4

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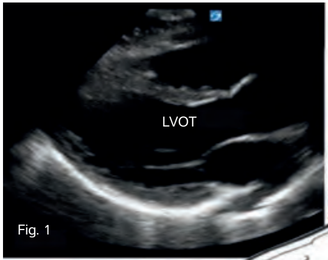
HEART RATE AND STROKE VOLUME

Heart Rate is the number of heartbeats per minute.

Stroke Volume is the amount of blood ejected with each beat.



PLAX

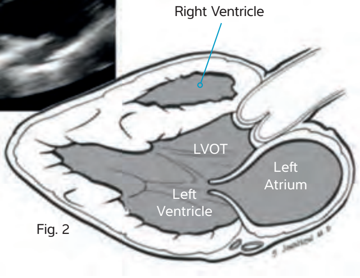
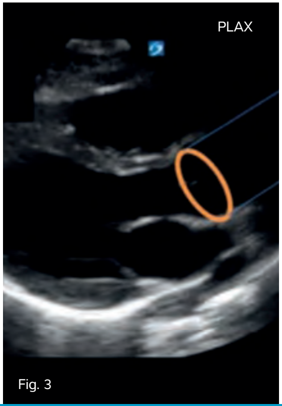


Fig. 2



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HEART RATE AND STROKE VOLUME

Heart rate is the number of heartbeats per minute. The normal range is 60-100bpm. Heart rate is the easiest way to compensate for a lower cardiac output. For example, if the heart is not pumping out as much blood with each beat as it should (50-90cc.), then the heart can beat faster to compensate for the lower output.

Stroke volume is the amount of blood ejected with each beat. The normal range is 50-90cc. Stroke Volume is a good way to measure left ventricular systolic function and because stroke volume varies in certain conditions and disease states, Stroke Volume is a key component to cardiac function. You need several measurements to calculate the stroke volume of the left ventricle.

Stroke Volume can be calculated by subtracting the end-systolic volume (ESV) from the end-diastolic volume (EDS) or (SV = EDV – ESV).

Another way to calculate SV is:
$LVOT^2 \times 0.785 \times LVOT\ VTI$.

Required measurements:
LVOT Diameter, LVOT VTI.

Performing measurement:

- Obtain a Parasternal Long Axis view (PLAX) (Fig. 1). Freeze image, cine back to open the aortic valve (AoV) at mid systole, select Calc, select CO, click on Left Ventricular Outflow Tract (LVOT), measure diameter in systole (Fig. 4).
- Measure HR by either M-Mode, Doppler, EKG leads or from a manual input in Patient Information screen.

  * HR taken from PSAX M-Mode (Fig. 5).
- In the A5CH view, place the PW Doppler sample in the LVOT just prior to the AoV (Fig. 6), activate PW Doppler, adjust baseline and scale to optimize aortic flow (below baseline). Freeze image, select LVOT VTI (Velocity Time Integral). Measure the waveform (Fig. 7) Save calculation.

  * Stroke Volume is an important factor in determining Cardiac Output and Ejection Fraction obtained by the Simpsons Method.

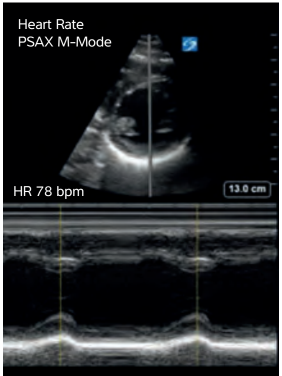

Fig. 5

Fig. 6

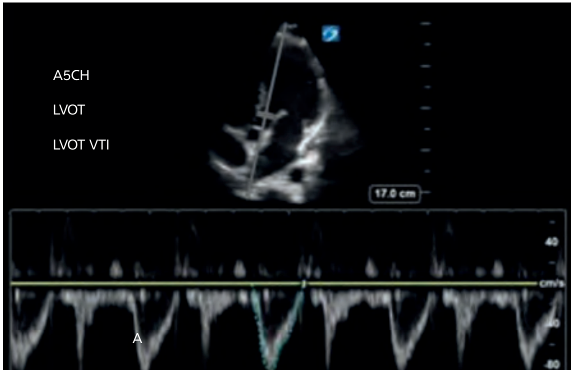

Fig. 7

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EF
EJECTION FRACTION
M-MODE MEASUREMENT

Ejection Fraction is a measurable calculation of the percentage of blood being pumped from the heart with every contraction.

Parasternal Short Axis

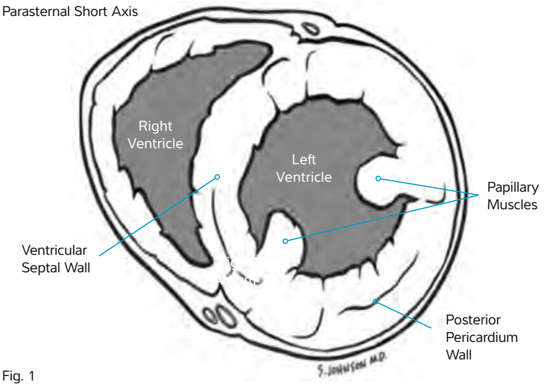

Fig. 1

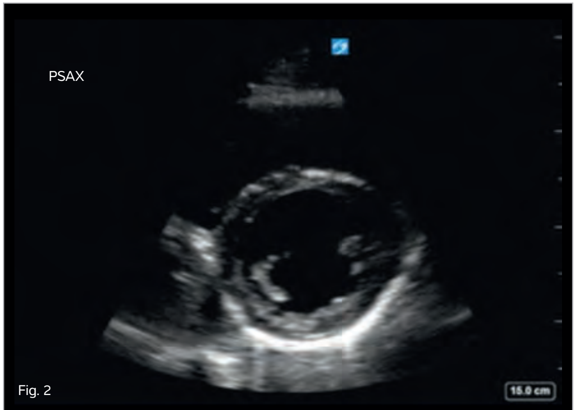

Fig. 2

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EF

EJECTION FRACTION M-MODE MEASUREMENT

Ejection Fraction (EF) measures how well the heart is pumping and can be used to determine the severity of systolic heart failure and it's etiologies such as: valvular heart disease, coronary artery disease, ischemia, infarction, Infectious or congenital heart disease.

Required measurements:
LVD in Diastole using M-Mode,
LVD in Systole using M-Mode.

Performing measurement:
Obtain a Short Axis (PSAX) (Fig. 2) view of the heart. This measurement may also be done in the Parasternal Long Axis view (PLAX).

- Place the M-Mode curser at the papillary muscle level above the mitral valve leaflet tips (Fig. 3).
- Activate the M-Mode (Fig. 4). Freeze the image of the left ventricle during the end diastolic phase of the Left Ventricle (LV) (at its fullest).
- Select the Ejection Fraction (EF) measurement tool, select Calc then LV, and select LVDd, (Left Ventricular Diameter in diastole). Measure the largest diameter of the left ventricle on the M-Mode waveform – Save calculation (Fig. 4).
- To measure in systole, scroll to the calculation LVDs, (Left Ventricular Diameter in systole). Measure the narrowest area of the left ventricle on the M-Mode waveform (systole) – Save calculation (Fig. 4).
- Both Ejection Fraction and Fractional Shortening are calculated from these measurements. Fractional Shorting (FS) is a measure of myocardial function and is calculated as the percentage of size the left ventricle changes from diastole to systole.
- Normal Ejection Fraction range values are: 55-70%.

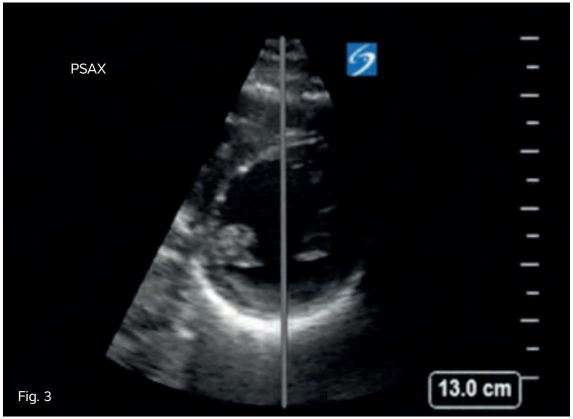

Fig. 3

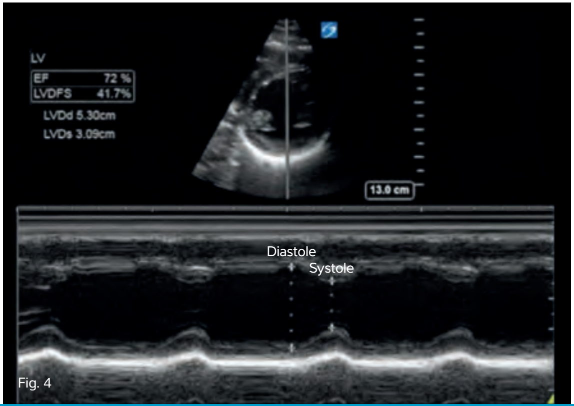

Fig. 4

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EF
EJECTION FRACTION
2D MEASUREMENT

Ejection Fraction is a measurable calculation of the percentage of blood being pumped from the heart with every contraction.

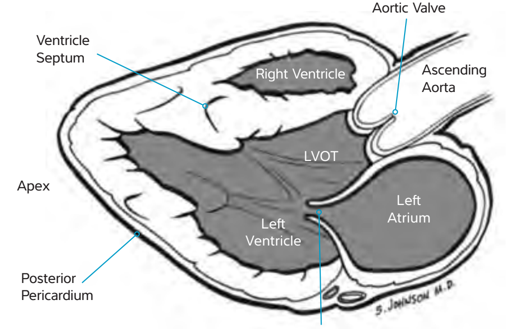

Fig. 1

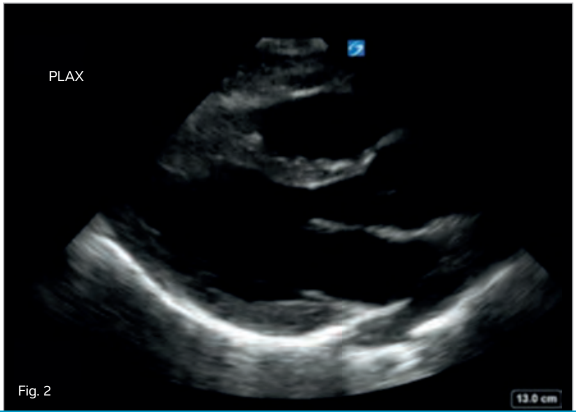

Fig. 2

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EF

EJECTION FRACTION 2D MEASUREMENT

Ejection Fraction (EF) measures how well the heart is pumping and can be used to determine the severity of systolic heart failure and it's etiologies such as: valvular heart disease, coronary artery disease, ischemia, infarction, Infectious or congenital heart disease.

Required measurements:
LVD in Diastole, LVD in Systole.

Performing measurement:
Obtain a 2D image in a Parasternal Long Axis view (PLAX) (Fig. 2). The Parasternal Short Axis (PSAX) view of the heart may also be used.

- For the 2D EF measurement, Freeze the image when the left ventricle is at it's fullest and when the mitral valves are open. (Diastole) (Fig. 2).
- Using the Ejection Fraction measurement tool, select Calc, then LV, select LVDd, (Left Ventricular Diameter in diastole) Measure the diameter of the left ventricle from the ventricular septum to the inner posterior myocardium being careful not to include the chordae tendinae (Fig. 3) – Save Calculation.
- Cine to where the heart is emptying and the mitral valve leaflets are closed (Systole) Select LVDs (Left Ventricular Diameter in systole) Measure again from the ventricular septum to the inner myocardium (Fig. 4) – Save Calculation.
- Both Ejection Fraction and Fractional Shorting are calculated from these measurements. Fractional Shorting (FS) is a measure of myocardial function and is calculated as the percentage of size the left ventricle changes from systole to diastole.
- Normal Ejection Fraction range values are: 55-70%.

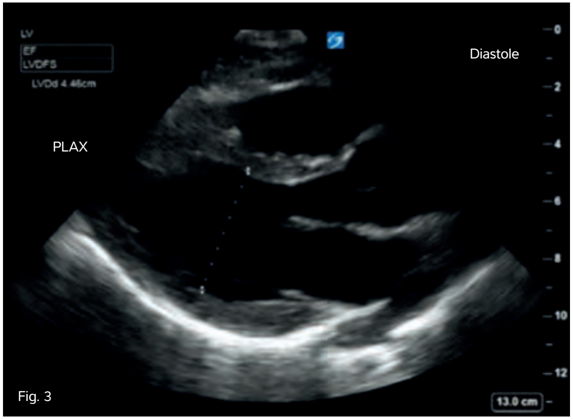

Fig. 3

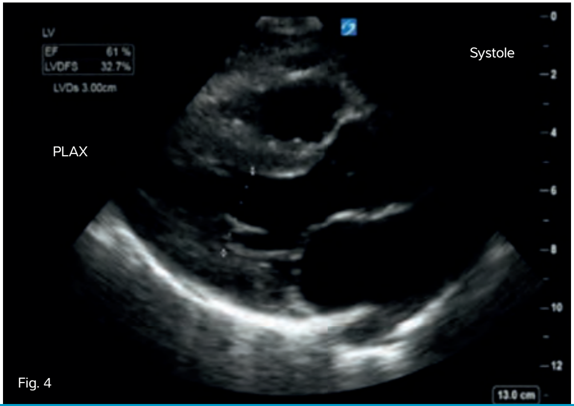

Fig. 4

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CO

CARDIAC OUTPUT

CO = SV x HR

Cardiac output is the total volume of blood pumped through the heart per minute (L/min) Cardiac Output (CO or Q) is equal to the Stroke Volume (SV) times the Heart Rate (HR).

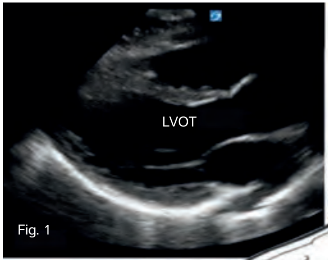

Fig. 1

PLAX

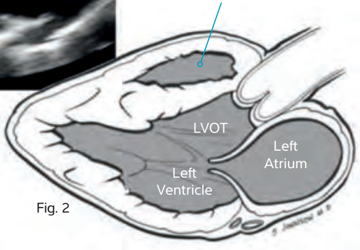

Fig. 2

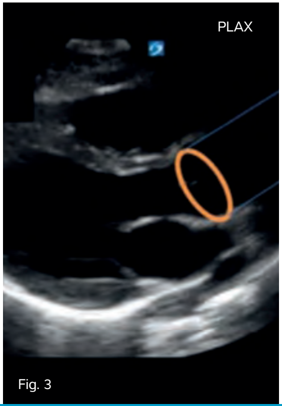

Fig. 3

Fig. 4

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CO

CARDIAC OUTPUT

Cardiac Output (CO) is an important indicator of how efficiently the heart can meet the demands of the human body. CO is used to assess hemodynamics and the monitoring of the body's fluid needs. It is also used to assess ejection fraction, discordances, hypovolemia, left sided heart failure and sepsis.

Required measurements:
LVOT Diameter, Heart Rate, LVOT VTI using PWD.

Performing measurement:

- Obtain a Parasternal Long Axis View (PLAX) (Fig. 1). Freeze image, cine back to open the aortic valve (AoV) at mid systole, select Calc, select CO, click on Left Ventricular Outflow Tract (LVOT), measure diameter in systole (Fig. 4).
- Measure HR by M-Mode, Doppler, EKG leads or from a manual input in the Patient Information screen.

  * HR taken from PSAX M-Mode (Fig. 5).
- In the A5CH view, place the PW Doppler sample in the LVOT just prior to the AoV (Fig. 6), activate PW Doppler, adjust baseline and scale to optimize aortic flow (below baseline) Freeze image, Select LVOT VTI (Velocity Time Integral) Measure the waveform (Fig. 7). Save calculation.
- Normal Cardiac Output is between 4-7 L/min. You will also need to index the cardiac output by dividing it by the patient's body surface area. This is important because a 300lb patient will need a higher cardiac output than a 100lb patient. The body surface area can be added on the Patient Information screen by adding the height and weight of the patient.

  * Newer SonoSite systems, Edge II and X-Porte 1.08 use the LVOT VTI in its calculations while older SonoSite systems use the AV VTI to trace the waveform.

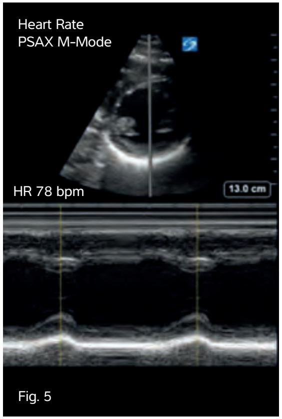

Fig. 5

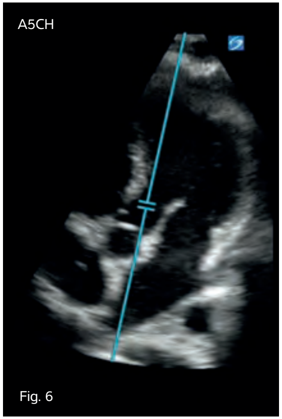

Fig. 6

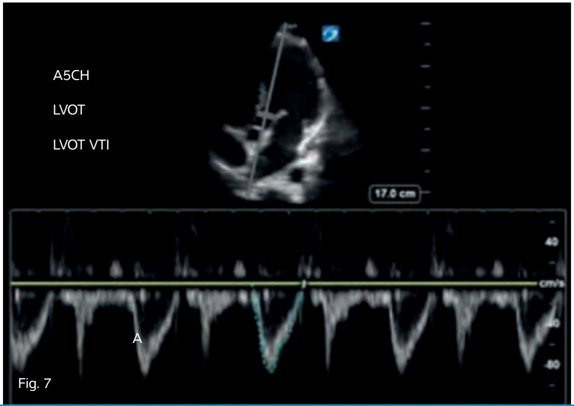

Fig. 7

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ATRIAL VOLUME

RIGHT AND LEFT ATRIUMS

Atrial volume is a measurement used to help determine the size of the atriums and can be an early predictor of certain disease states.

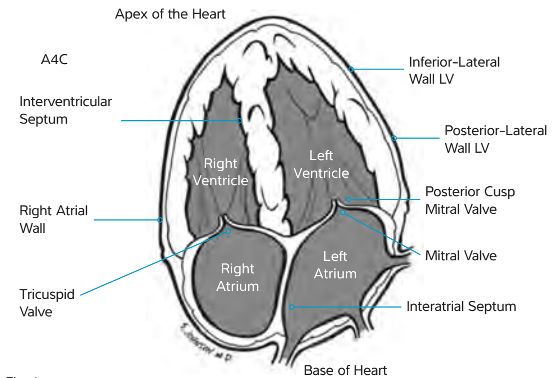

Fig. 1

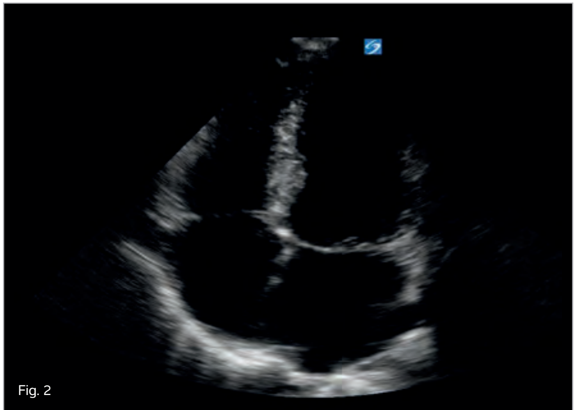

Fig. 2

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ATRIAL VOLUME

The left atrial size is a strong predictor of events and can help with the assessment of early left atrial dysfunction and in certain conditions an enlarged left atrium (LA) such as: atrial fibrillation, valvular heart disease, hypertension, heart failure or cardiomyopathy.

Right atrial enlargement is also a strong indicator for the severity of a disease or situations such as: tricuspid regurgitation, pulmonary hypertension, right side heart failure, or in acute events like pulmonary embolisms. In right atrial volume or fluid overload the IVC will also appear dilated.

Both the right atrium (RA) and left atrium (LA) may be measured by obtaining volume measurements using the Simpson method.

Performing measurement:
Obtain a Apical 4 Chamber view (A4CH) (Fig. 2) and Apical 2 Chamber view (A2CH) of your chosen atrium.

- Select atrial volume, using the A4CH, trace your chosen atrium (Fig. 3 and Fig. 4) – Save Calc.
- Select A2CH view and repeat the trace of the chosen atrium (Fig. 5) – Save Calc.
- Take both tracings at maximum atrial volume when the ventricles are in end-systole.
- Normal volume measurements for the LA: Women < 38mm, Men < 40mm.

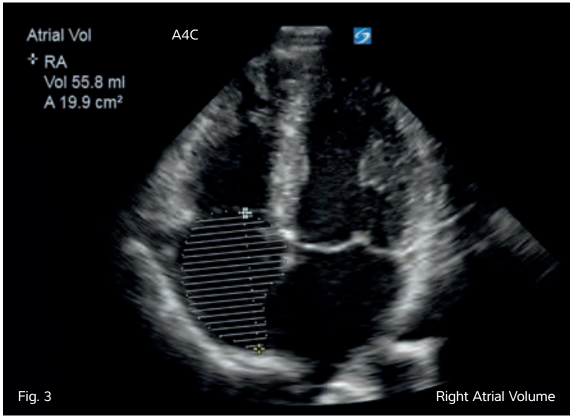

Fig. 3 Right Atrial Volume

Fig. 4 Left Atrial Volume

Fig. 5 Left Atrial Volume

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LVF

LEFT VENTRICULAR FUNCTION

(LVF USING MODIFIED SIMPSON'S)

A modified Simpson's rule is a reproducible volume quantification measurement of the LV chamber size and function. Volume assessments document the degree of LV enlargement and allow derivation of indices which describe its diastolic filling properties (e. g. – compliance) and systolic pumping properties (e. g. – ejection fraction).

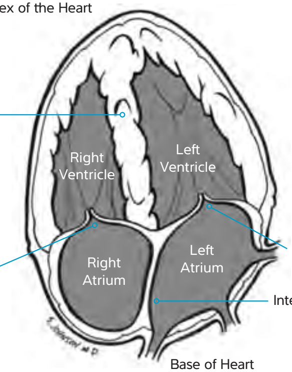

Fig. 1

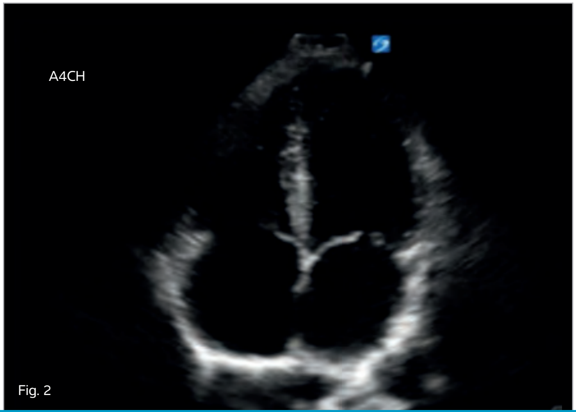

Fig. 2

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LVF

LEFT VENTRICULAR FUNCTION

Ejection Fraction by the Simpson's method measures how well the heart is pumping hemodynamically and can be used to determine the severity of systolic heart failure and etiologies such as: valvular heart disease, coronary artery disease, ischemia, infarction, Infectious diseases or congenital heart disease.

Performing measurement: A4C and A2C

- Obtain an apical 4 chamber view of the heart.
- Freeze the image when the left ventricle is at its fullest end-diastolic volume (EDV).
- Using the Ejection Fraction measurement tool, Select A4Cd, (LV EDV) Place the curser at the Mitral Valve (MV) annulus measuring the diameter across the annulus. Measure the length of the LV by placing the cursor at the apex of the heart. Activate the trace tab adjusting any side pods to accommodate any endocardial wall heart irregularities (Fig. 3) – Save Calculation.
- Cine back to locate the minimal contraction of the LV end-systolic volume (EDV). Repeat the same measuring process using the A4Cs calculation (Fig. 4) – Save Calculation.
- Calculations may also be done for the Apical 2 chamber view in both systolic and diastolic phases (Fig. 5 and 6).
- Ejection Fraction normal value: 55-70%.

Fig. 3 A4CH Diastolic

Fig. 4 A4CH Systolic

Fig. 5 A2CH Diastolic

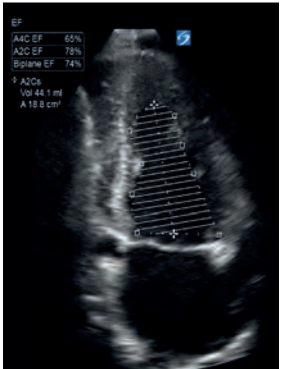

Fig. 6 A2CH Diastolic

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LVOT VTI

LEFT VENTRICULAR OUTFLOW TRACT – VELOCITY TIME INTEGRAL

Left Ventricular Outflow Tract – Velocity Time Integral or LVOT VTI is defined as the measurement of all the flow velocities across the Aortic Valve with each beat.

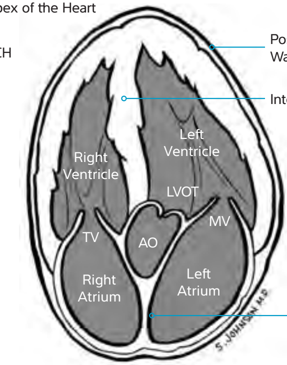

Fig. 1

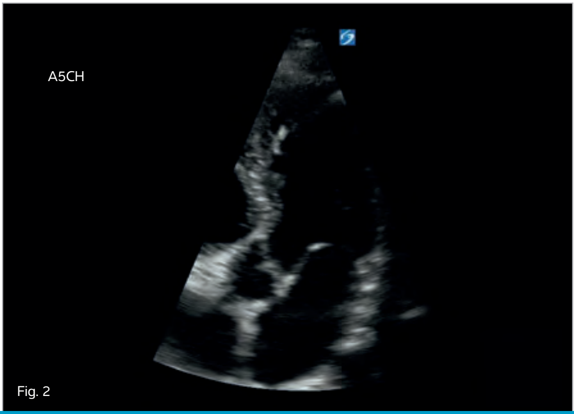

Fig. 2

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LVOT VTI

LEFT VENTRICULAR OUTFLOW TRACT – VELOCITY TIME INTEGRAL

LVOT VTI can be used to calculate the stroke volume through the Aortic Valve, which can be used to determine systolic function of the left ventricle.

Performing measurement:
Apical 5 Chamber view (A5CH)

- Obtain a A5CH view of the heart (Fig. 2).
- Activate the Doppler function, place curser at the Aortic Valve (AV) on the Left Ventricular (LV) side (Fig. 3).
- Activate the waveform tracing, adjusting the baseline, scale and gain as needed, freeze image at the end of the Doppler tracing.
- Select Calc, select LVOT/AV, select VTI and place the curser at the beginning of the AV at the baseline, trace the entire AV ending at the baseline (Fig. 4) set and save Calc.

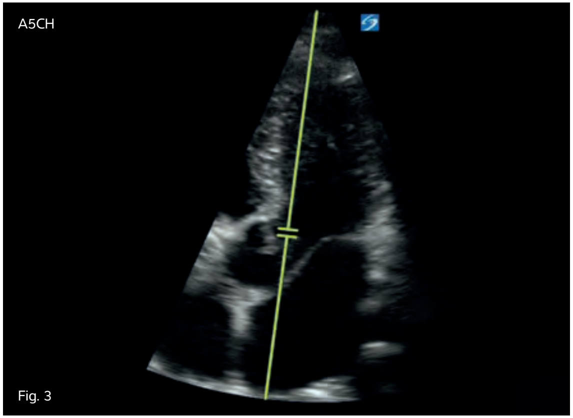

Fig. 3

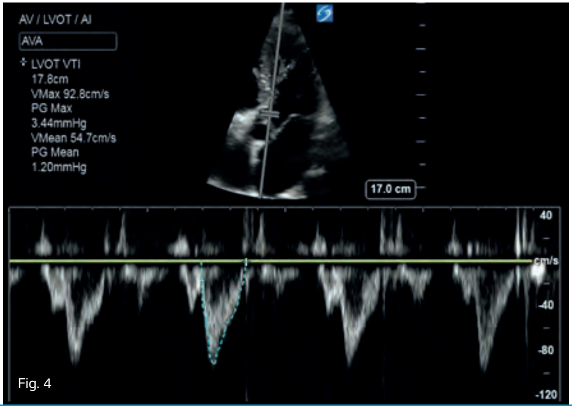

Fig. 4

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MV-DT

MITRAL VALVE DECELERATION TIME (MV-DT)

Mitral Valve Deceleration Time (MV-DT) is defined as how rapidly the flow velocity declines in early diastole and can be taken from the maximum E point to the baseline.

(E-Wave Deceleration Time = DT).

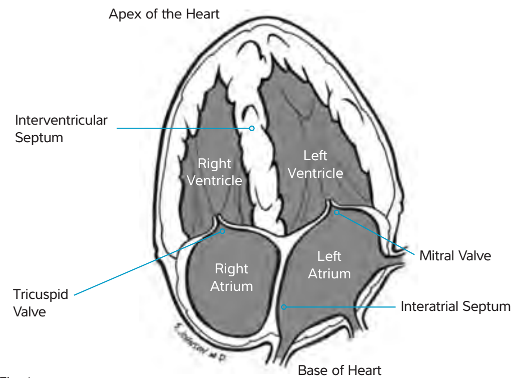

Fig. 1

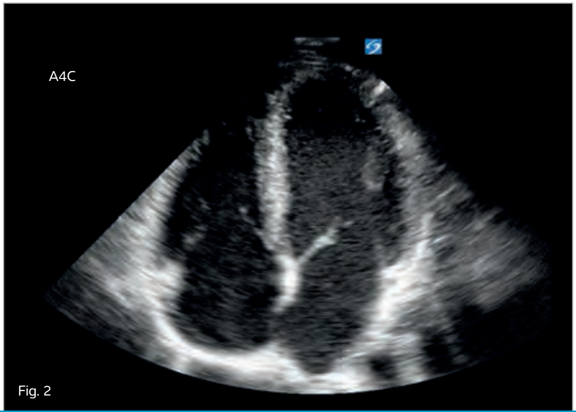

Fig. 2

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MV-DT

MITRAL VALVE DECELERATION TIME (MV-DT)

Deceleration Time (DT) aids in determining the presence and severity of diastolic dysfunction of the heart. In the presence of diastolic dysfunction, the left ventricle becomes stiffer as to impair proper filling and relaxation of the left ventricle prolonging the decline or deceleration time of blood flow across the valve. In grade 1 of diastolic dysfunction due to abnormal relaxation time the DT will increase but in grades 3 and 4 of diastolic dysfunction with restricted filling the DT will decrease. Causes of left diastolic dysfunction include: High blood pressure, aortic stenosis, diabetes, coronary artery disease, hypertrophic cardiomyopathy, increasing age or in any case of restricted filling of the left ventricle.

Performing measurement:

- Obtain a Apical 4 Chamber (A4C) view of the heart (Fig. 2).
- Activate the Doppler function, place pulse wave Doppler sample volume at the Mitral Valve leaflet tips on the left ventricular (LV) side (Fig. 3) Adjust the baseline, scale and gain as needed.

Freeze image at the end of the Doppler tracing.

- Select Calc, select MV, Select PHT and place the 1st curser at peak E wave, adjust 2nd curser following the slope to the baseline (Fig. 4).
- Normal values by age groups (yrs.): 16-20 = 142ms, 21-40 = 166ms, 41-60 = 181ms >60 = 200ms.

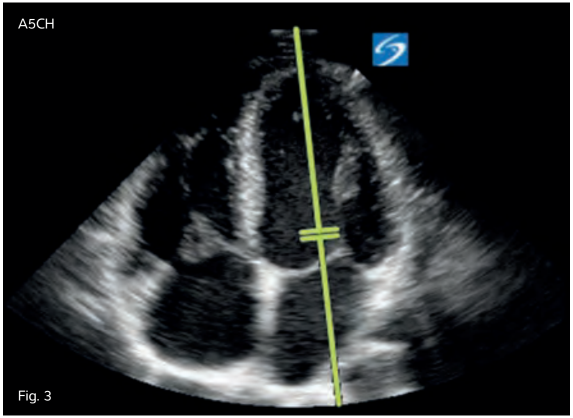

Fig. 3

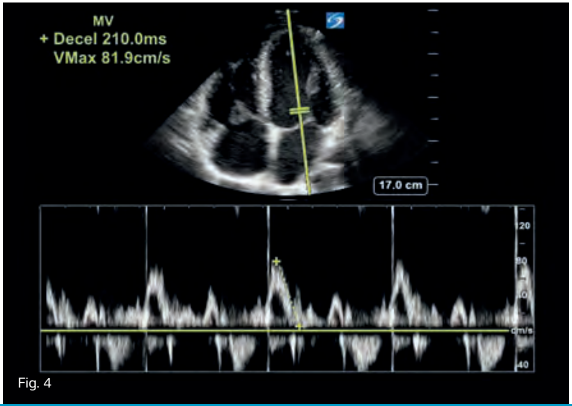

Fig. 4

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EPSS
E-POINT SEPTAL SEPARATION (EPSS)

E-Point to Septal Separation is a quantification of the Left Ventricular Ejection Fraction (LVEF) also known as Quick Ejection Fraction (EF).

Quick EF = 75.5 – (2.5 x EPSS mm) = EF%.

Parasternal Long Axis View of the Heart

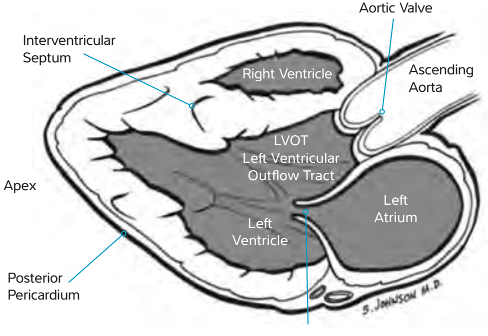

Fig. 1

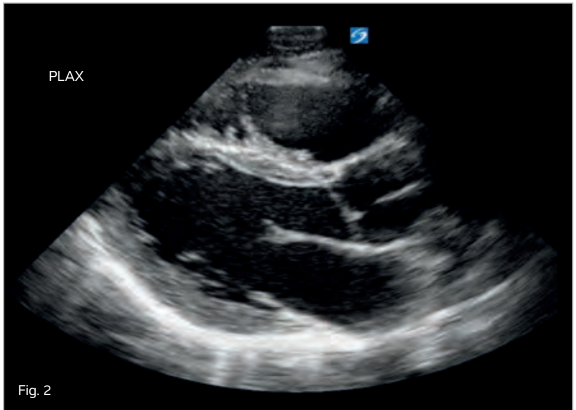

Fig. 2

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EPSS

E-POINT SEPTAL SEPARATION

EF is important for assessment of systolic function or dysfunction of the LV in the sick patient. Assessment can be performed by eye-balling it, Simpson's rule or EPSS which is a quick estimation of the EF from an M-Mode tracing. Symptoms and its various etiologies contribute to decreased LVEF such as; decompensation, hypotension, dyspnea, secondary valvular heart disease. Frequent EPSS follow–up (FU) exams can quickly assess patient improvement after treatment. Several pitfalls that can cause erroneous measurements are when a patient presents with Mitral Stenosis (MS), MV Calcifications, Aortic Insufficiency (AI) and LV Dilation.

Performing measurement:

- Obtain a Parasternal Long Axis view of the heart (PLAX) (Fig. 2).
- Place M-Mode curser at the anterior MV leaflet tip of the MV (Fig. 3).
- Activate the M-Mode tracing and freeze the image at the end of the strip. (Fig. 4).
- Measure the diameter from the peak E wave to the interventricular septum (IVS) (Fig. 4).
- Example: 75.5 – (2.5 x 5.0mm) = 63% (Fig. 4).
- EPSS Values with Ejection Fraction (EF):
  - Normal = < 5.0 mm
  - EF< 50% = EPSS > 10 mm
  - EF <30% = EPSS > 18 mm

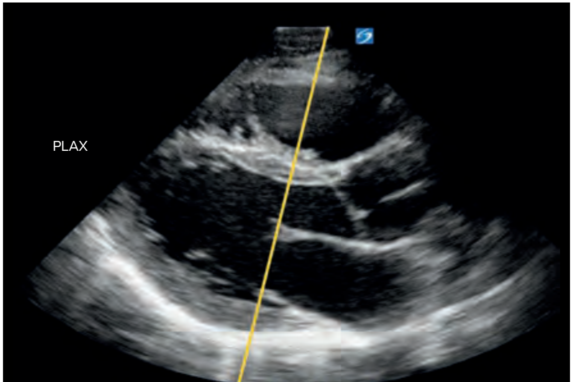

Fig. 3 Place M-Mode on Tip of Mitral Valve Leaflets

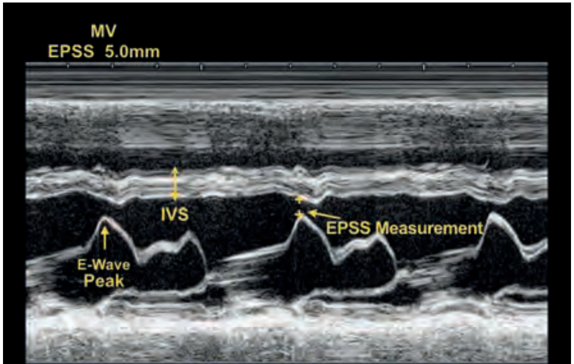

Fig. 4 E-Point Septal Separation (EPSS)

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MV-IVRT

MITRAL VALVE ISOVOLUMIC RELAXATION TIME (MV-IVRT)

Isovolumic Relaxation Time (IVRT) is the first phase of diastole. Its duration begins after Aortic Valve (AV) closure and lasts until the opening of the Mitral Valve. It is used as an indicator of Left Ventricle (LV) diastolic dysfunction.

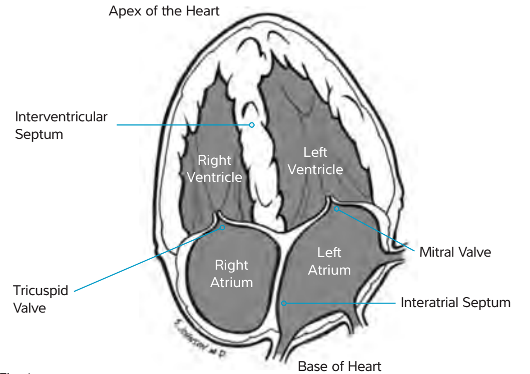

Fig. 1

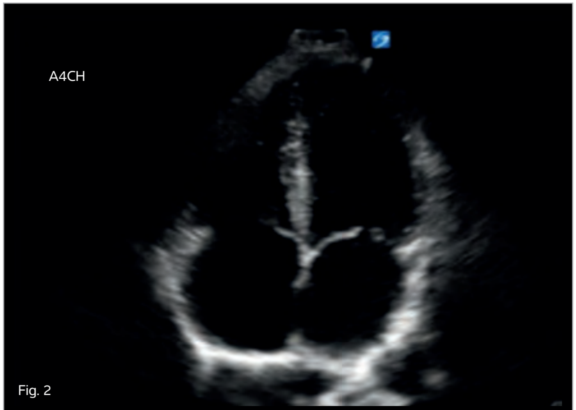

Fig. 2

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MV-IVRT

MITRAL VALVE ISOVOLUMIC RELAXATION TIME (MV-IVRT)

The mitral inflow visualizes the individual phases of the filling as well as the contribution of each individual phase if filling. As the MV inflow reflects the pressure difference between the atria and the ventricle, any abnormality of the diastolic pressure (as in the presence of diastolic dysfunction) in the chambers will affect the velocity and shape of the Doppler inflow signal. Specifically, diastolic dysfunction alters the relationship between early and late filling (E and A-Wave) (Fig. 3), how rapidly flow velocity declines in early diastole (E-Wave Deceleration Time (DT)) and how long it takes for the filling of the ventricle to start after the ventricle relaxes which is known as the IVRT (Fig. 3).

Performing measurement:

- Apical 4 Chamber view (A4C) (Fig. 2) and Pulsed Wave Doppler (PWD) (Fig. 4).
- Obtain a A4C view of the heart, the sample gate between the aortic outflow and mitral area (Fig. 4) Activate the PWD.
- Freeze the PWD strip to optimize the best tracing of the MV and AV. Under the calculation (Calc) package, choose MV, IVRT.
- Place 1st vertical line at the end of AV closure, 2nd vertical line at the MV opening – Save Calculation.
- IVRT normal value 70 +/- 12ms, 10ms longer for >40 years of age.

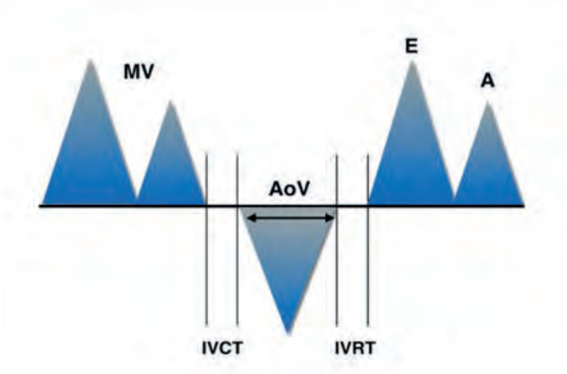

Fig. 3

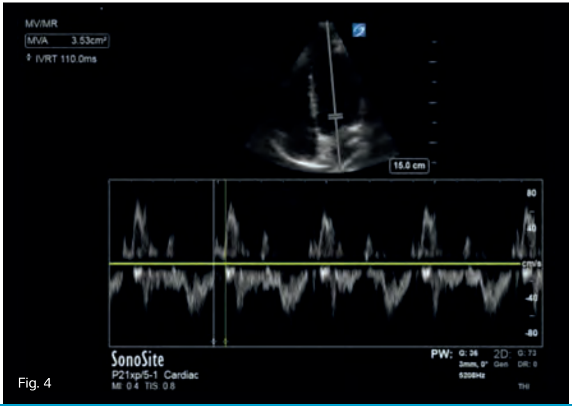

Fig. 4

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MV-PHT

MITRAL VALVE PRESSURE HALF TIME (MV-PHT)

Mitral Valve Pressure Half-Time (MV-PHT) is defined as the time needed for the peak pressure gradient to fall to half its value across the mitral valve.

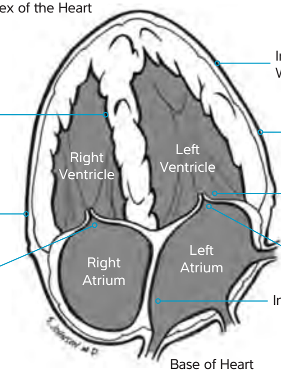

Fig. 1

Fig. 2

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MV-PHT

MITRAL VALVE PRESSURE HALF TIME (MV-PHT)

As the Pressure Half Time (PHT) is halved the velocity becomes equal to the peak velocity across the mitral valve divided by the square root of 2. As blood flows easier across the valve the pressure gradient falls. Narrowing of a valve as in Mitral Stenosis will lead to a high diastolic PHT, while wide regurgitant valve areas will lead to a low diastolic PHT.

PHT is directly proportional to the Deceleration Time (DT).

Performing measurement:

- Obtain an A4C view of the heart. (Fig. 2).
- Place the sample gate at the level of the MV on the ventricular side. (Fig. 4) activate (PWD).
- Freeze the PWD strip to optimize the best tracing of the mitral valve. Under the calculation (Calc) package chose MV, then PHT.
- Place the first caliper at the peak E wave, adjust the second caliper toward the baseline following the same angle as the E wave slope (Fig. 4) – Save Calculation.

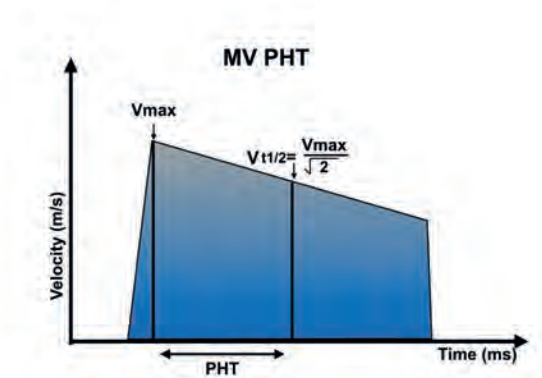

Fig. 3

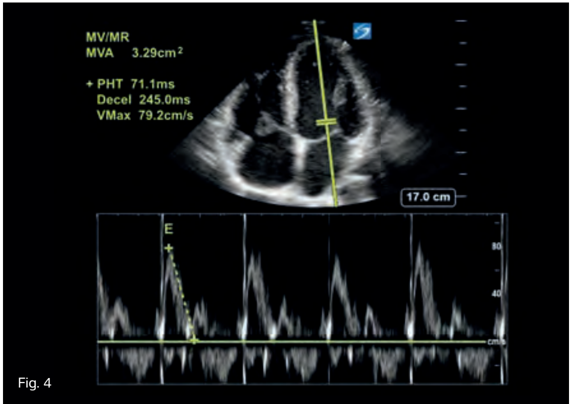

Fig. 4

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