



English

Using Ultrasound to Manage COVID-19 Related Lung and Cardiac Complications

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Read This First

This document contains imaging instructions and information about pertinent to healthcare professionals engaged in the diagnosis and management of COVID-19 patients. It includes information on management of lung infections, including COVID-19 pneumonia, and related cardiac complications. The information applies to Philips ultrasound systems, including EPIQ series, Affiniti series, Lumify, CX50, and Sparq ultrasound systems and to off-cart solutions like QLAB Advanced Quantification Software. Information that applies only to a specific ultrasound system is marked as such.

For further COVID-19 information, such as symptoms, diagnosis, testing, prevention, and clinical management, please see the guidelines of the U.S. Centers for Disease Control and Prevention (CDC), the World Health Organization (WHO), or physician professional organizations.

This document extends and enhances the information contained in the user information provided with your ultrasound system. For the other safety information and procedures, see your system user information set.

For more information from Philips regarding COVID-19, please visit:
philips.com/healthcare/medical-specialties/covid-19

Read This First

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COVID-19 Lung Complications

Ultrasound has shown benefit in imaging pneumonia affecting the peripheral lung tissue^{10,11}.

Transducers for Scanning Lungs

To scan the lungs for evidence of COVID-19, use the following transducer types:

Transducer Types for Lung Scans

Transducer Type	Characteristics
Curved	<ul style="list-style-type: none"> • Low frequency • Deeper penetration • Large field of view • Enables visualization of consolidations and B-lines across multiple rib spaces
Linear	<ul style="list-style-type: none"> • Higher frequency and higher resolution • Useful for smaller patients • Best for examining the pleural layer interfaces • Useful for procedural guidance
Sector (Phased Array)	<ul style="list-style-type: none"> • Low frequency • Deeper penetration • Useful for lung imaging that involves intercostal access • Useful any time the workflow involves cardiac examination

Transducers for Lung Scans by System

Transducer Type	Lumify	EPIQ	Affiniti	CX50	Sparq
Curved	C5-2	C5-1, C9-2, mC7-2	C5-1, C6-2, C9-2, mC7-2	C5-1	C5-1, C5-2

Transducer Type	Lumify	EPIQ	Affiniti	CX50	Sparq
Linear	L12-4	L12-3, L12-5, eL18-4, L18-5	L12-3, L12-4, L12-5, eL18-4, L18-5	L12-3	L12-4, L12-5
Sector	S4-1	S4-2, S5-1, X5-1	S4-2, S5-1, X5-1 ¹	S4-2, S5-1	S4-2, S5-1

1. 2D only on Affiniti systems

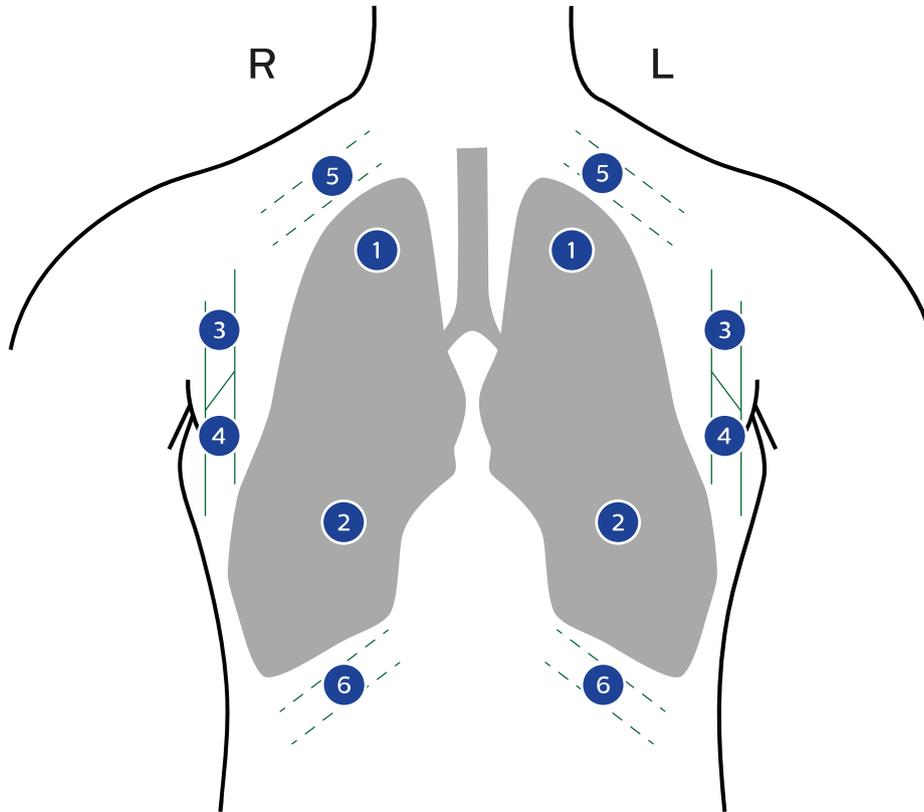
Recommended Scan Protocols

There are two common approaches to scanning lungs:

- Six-point lung ultrasound
- Four-point lung ultrasound, used in the bedside lung ultrasound in emergency (BLUE) protocol

Six-Point Lung Ultrasound

In six-point lung ultrasound^{5,14}, the scan area is divided into six areas, the superior and the inferior points over the anterior, lateral, and posterior. This yields a total of twelve interspaces over the entire thorax.

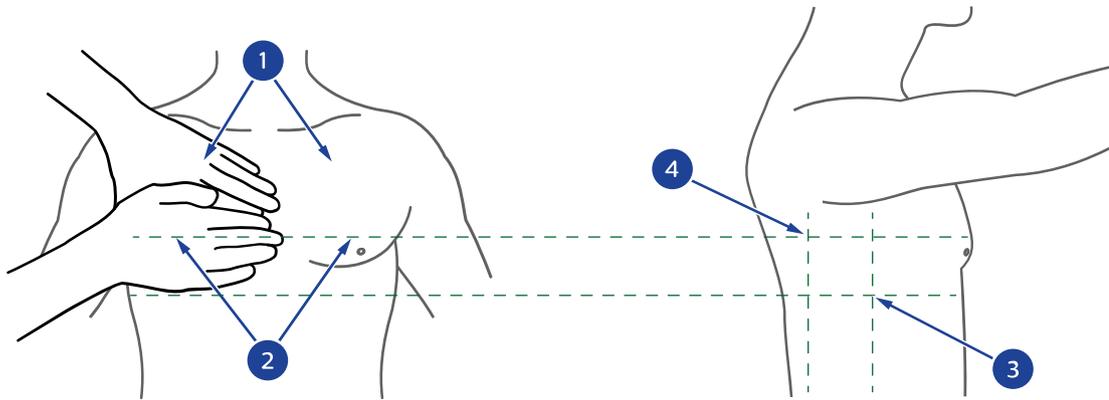


Six-Point Lung Ultrasound

- | | |
|---|-----------------|
| 1 | Anterior upper |
| 2 | Anterior lower |
| 3 | Axillary upper |
| 4 | Axillary lower |
| 5 | Posterior upper |
| 6 | Posterior lower |

Four-Point Lung Ultrasound

The four-point protocol (BLUE protocol)^{3, 8} scans four points with both transverse and longitudinal views for a total of eight interspaces over the entire thorax. The arrow (1) shows the post-axillary line.



Four-Point Lung Ultrasound

As the figure shows, points 1 and 2 are located by placing the hands horizontally over the anterior chest with the upper fifth finger abutting the clavicle. The digits of both hands are together and the nails are at mid-chest.

- Point 1 is located between the third and fourth finger of the upper hand. This is the mid-clavicular line at approximately the second intercostal space.
- Point 2 is located in the middle of the palm of the lower hand. The lower fifth finger is approximately at the lower anterior border of the lung. This represents the phrenic line, the anterior axillary line at approximately the fifth intercostal space.
- Point 3 is along the phrenic line at the mid-axillary line.
- Point 4 is also called the posterolateral alveolar pleural syndrome (PLAPS) point, and is the most posterior point along the diaphragm. It is below point 2 on the posterior axillary line.

The recommended scan protocol is as follows:

- Scan all four points with both transverse and longitudinal views, if applicable.
- Acquire a three- to five-second loop at each scan point.

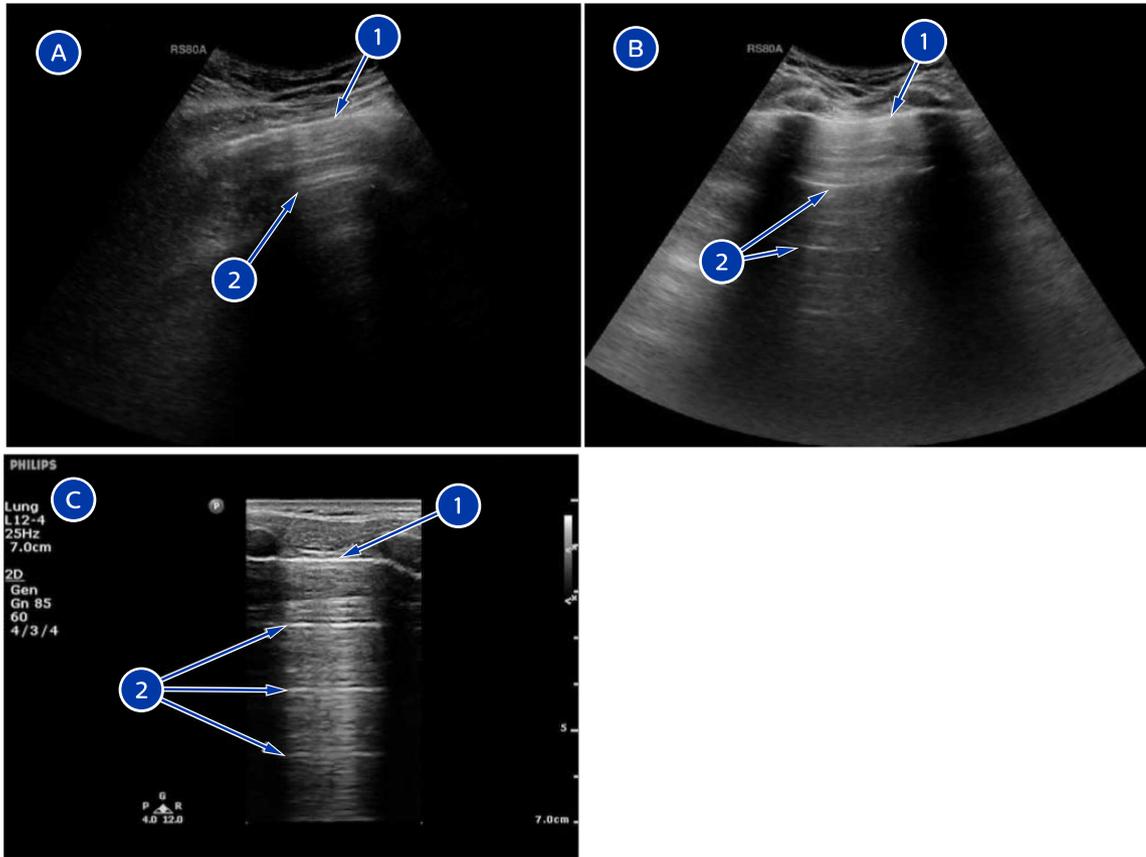
- Label each loop or image with the appropriate annotations.

Lung Ultrasound Examples

Normal Lungs in Ultrasound Images

When scanned from a transverse view with a curved array, normal lungs show smooth pleural lines and A-lines. When scanned from an longitudinal view with a curved array, normal lungs show a "bat sign." Scans with a linear array also show smooth pleural lines.⁹

- The pleural line is the first horizontal, curvilinear, hyperechoic line below the ribs, and represents the interface between the parietal and visceral pleura. Normal pleural lines should be continuous, smooth lines.
- The A-lines are horizontal, hyperechoic lines that are equidistant repetitions of the pleural line.
- Lung sliding is seen as a shimmering line in loops or live imaging as the visceral pleura slide against the parietal pleura during respiration.
- The "bat sign" is a pattern created by two ribs and the pleural lines. The "wings" of the bat are shadows created by the ribs.



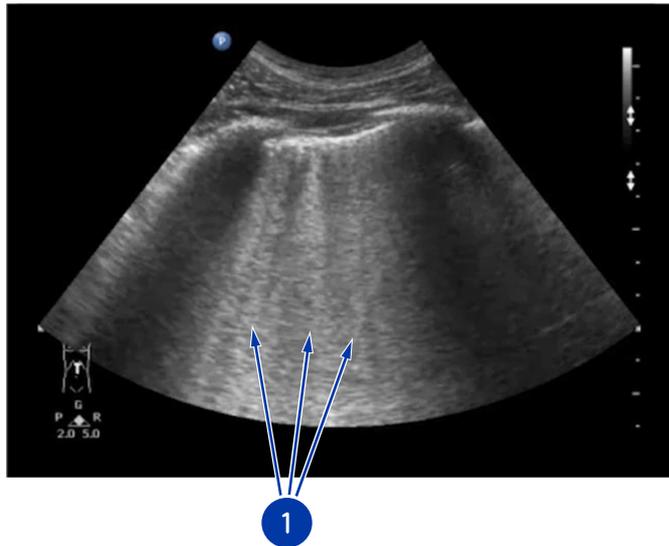
Normal Lung Scans

- | | |
|---|---|
| A | Normal lung transverse view with a curved array |
| B | Normal lung longitudinal view with a curved array. This image shows the "bat sign." |
| C | Normal lung with a linear array |
| 1 | Pleural line |
| 2 | A-lines |

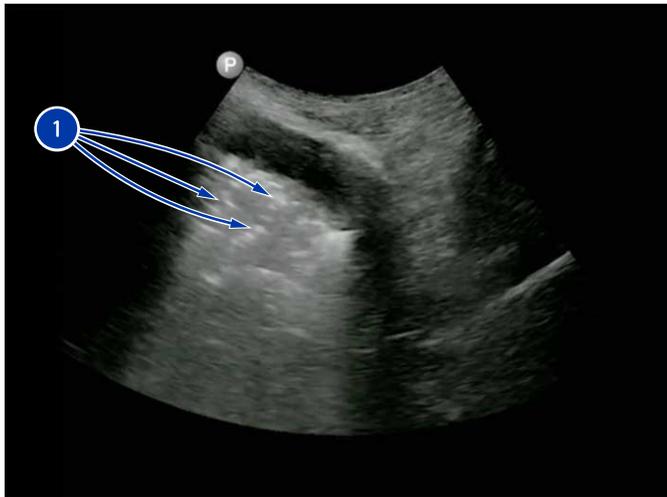
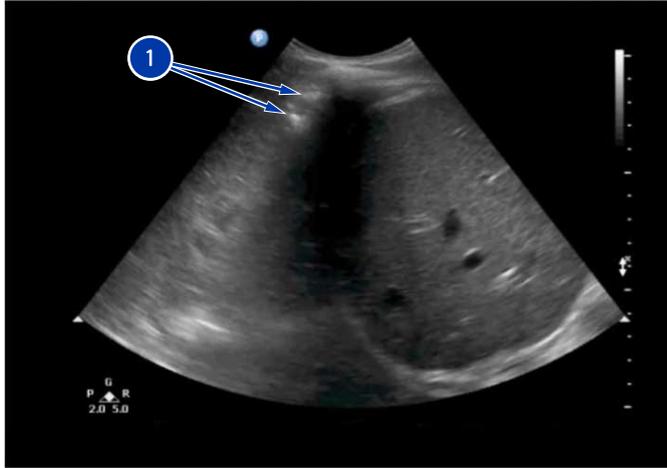
Lung Ultrasound Images from Patients Diagnosed with Pneumonia

The following lung ultrasound image findings are present in typical pneumonia patients.^{2,9}

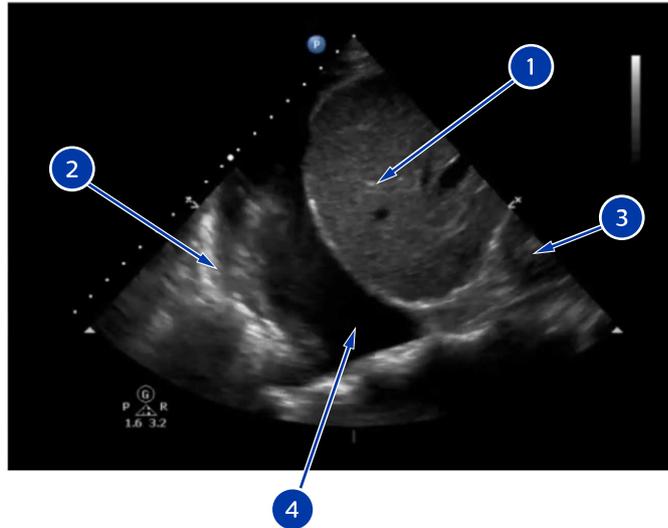
- Abnormalities in the pleural line.
- B-lines are a laser-like, vertical, hyperechoic artifacts that originate at the pleural line, obliterate A-lines, and move with lung sliding. B-lines in ultrasound images are usually produced by ultrasound waves that propagate through widened, fluid-filled septa that are present in parenchymal diseases such as pneumonia. In the image that follows, B-lines (1) are seen below the pleural lines. This pattern is sometimes called "lung rockets" or "comet tails."



- Consolidation is an area of normally compressed lung tissue that has filled with liquid instead of air. In pneumonia, consolidation appears as a large, compact mass that does not lose volume as the patient breathes. The images that follow show consolidation (1).



- Pleural effusion is a buildup of excess fluid between the layers of pleura outside the lungs. The image that follows shows the liver (1), lung (2), and kidney (3) of the patient, along with the pleural effusion (4).



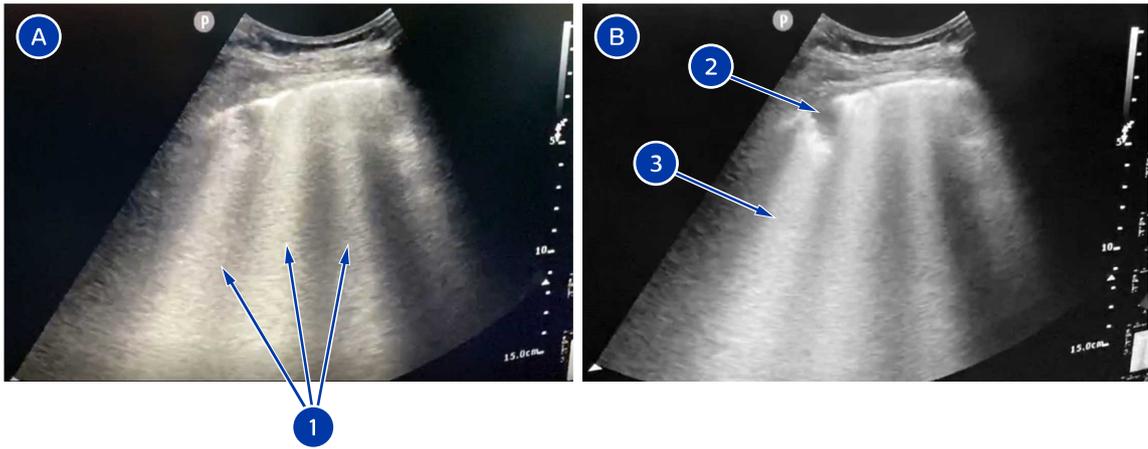
Lung Ultrasound Case Presentations of COVID-19 Pneumonia

The following ultrasound image features and appearances are related to COVID-19^{1, 5, 13}:

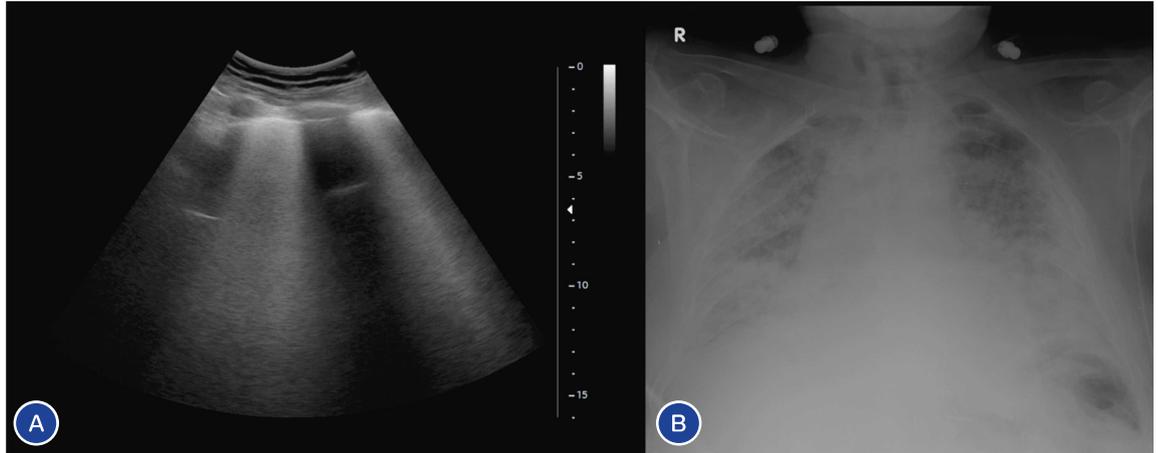
- Thickening of the pleural line and irregularities in the pleural line.
- B-lines in a variety of patterns, including focal, multi-focal, and confluent.
- Consolidations in a variety of patterns, including multi-focal small, non-translobar and translobar with occasional mobile air bronchograms.
- Appearance of A-lines during the recovery phase.

The following images show how to recognize these features.

Case 1 shows typical lung ultrasound images of patients with COVID-19 pneumonia. Image A shows confluent B-lines (1). Image B shows a small consolidation (2) as well as B-lines (3).



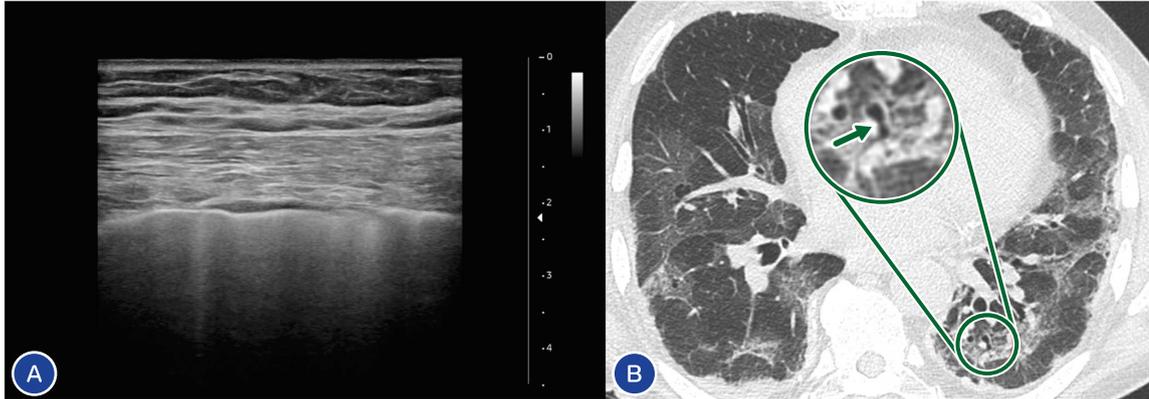
Case 2^{13,*} shows an ultrasound scan (A) and an x-ray (B) of the same patient. Image A shows simultaneous coexistence of multiple lung B-lines and A-lines. Image B shows bilateral lung opacities, especially in the peripheral areas.



Case 3^{13,*} shows an ultrasound scan (A) and three CT scans (B, C, and D) of the same patient. Image A shows B-lines without horizontal reverberation and small areas of consolidation. Image B shows bilateral and diffuse ground-glass opacities. Images C and D show more evidence of the same indications.



Case 4^{13, *} shows an ultrasound scan (A) and a CT scan (B) of the same patient. Image A shows an irregular pleural line and multiple B-lines. Image B of the same region shows ground-glass opacities and consolidations with an air bronchogram (arrow).



* Case 2, 3, and 4 are reprinted from *Eur. J. Radiol. Open*, Vol. 7, Lomoro P, Verde F, Zerboni F, et al., "COVID-19 pneumonia manifestations at the admission on chest ultrasound, radiographs, and CT: single-center study and comprehensive radiologic literature review," Copyright 2020, with permission from Elsevier.

Potential Use of Lung Ultrasound Imaging in COVID-19 Pneumonia Management

You can use lung ultrasound imaging in the following situations:^{4, 5, 7}

- Point-of-care diagnosis
- Triage of pneumonia-symptomatic patients for CT scans or other radiological imaging
- Prognostic stratification and monitoring of patients with pneumonia based on the extension of specific patterns and their evolution toward the consolidation phase
- Managing patients with regard to ventilation and weaning
- Evaluating the effect of therapeutic measures

- Examine patient breathing with lung ultrasound

Base the use of ultrasound imaging in COVID-19 pneumonia management on professional judgement of clinical situations and institution guidelines.

Lung Imaging Settings for Specific Ultrasound Systems

Lumify Presets

Lumify has a dedicated lung preset on all supported transducers. Select the transducer, select the **Lung** preset, and start scanning.

EPIQ and Affiniti Transducers and Presets

On EPIQ and Affiniti systems, you may want to create your own Quick Save preset for scanning lungs. The following table shows the recommended settings for scanning lungs with EPIQ and Affiniti transducers:

Transducers and Settings for Lung Scans on EPIQ and Affiniti Systems

Transducers	Starting Preset	AutoSCAN	Depth	Focal Zone	SonoCT	Harmonics	XRES	Persistence
C5-1 C6-2 (Affiniti only)	Ped Abd	Off	10 cm	Superficial (about 2 cm)	Off	Off	--	Off or low
mC7-2	Abd Res	Off	10 cm	Superficial (about 2 cm)	Off	Off	Off	Off or low
C9-2	Ped Abd	Off	10 cm	Superficial (about 2 cm)	Off	Off	--	Off or low

Transducers	Starting Preset	AutoSCAN	Depth	Focal Zone	SonoCT	Harmonics	XRES	Persistence
L12-3 L12-3ERGO L12-4 (Affiniti only)	LE Arterial or Arterial	Off	10 cm	Superficial (about 2 cm)	Off	Off	Off	Off or low
L12-5	LE Arterial or Arterial	Off	8 cm (maximum)	Superficial (about 2 cm)	Off	Off	Off	Off or low
L18-5	LE Arterial or Arterial	Off	7 cm (maximum)	Superficial (about 2 cm)	Off	Off	Off	Off or low
eL18-4	LE Arterial or Arterial	Off	10 cm (maximum)	Superficial (about 2 cm)	Off	Off	Off	Off or low
S4-2	Abd Gen	--	10 cm	Superficial (about 2 cm)	--	Off	--	Off or low
S5-1	Abd Gen	--	10 cm	Superficial (about 2 cm)	--	Off	--	Off or low

Creating a Quick Save Preset on EPIQ and Affiniti Systems

1. Touch the transducer name.
2. Touch the preset on which you want to base your Quick Save preset.
3. Adjust the system controls to create the settings for your preset. (You can select an imaging mode, an image orientation, the number of focal zones, and so on.)
4. Swipe the touch screen, from right to left, to view the next page.

5. Touch **Save Preset**.
 - For the **Quick Save Label**, type the name of the new preset.
 - For **Calculation Package**, select a calculation package.
 - For **Annotation/Body Marks**, select the annotation and body mark you want as the defaults.
6. Click **OK**.

COVID-19 Cardiac Complications

COVID-19 patients are at increased risk for cardiac complications¹². Respiratory strain can also lead to cardiac dysfunction. A cardiac ultrasound exam can help in evaluating the effects that disease progression may have on heart function. Point-of-care cardiac ultrasound procedures for COVID-19 patients include minimizing the risk of virus transmission for the medical team.

- Rapidly acquire views necessary to assess cardiac function
- Measure and assess cardiac function off cart

Bedside Echocardiographic Protocol for COVID-19 Patients

COVID-19 cardiac complications affect the left and right heart functions. Therefore, the timely application of echocardiography to assess the heart functions, including its volume capacity, is extremely critical.¹²

According to ASE recommendations, to monitor the disease progression and hemodynamic of patients with COVID-19, use bedside echocardiography to evaluate the following:

- Left heart function
- Right heart function
- Cardiac hemodynamics
- Pericardial effusion

For the most up-to-date ASE guidelines on COVID-19, refer to www.asecho.org/covid-19-resources

Custom Exam Protocols (Smart Exams)

To limit the infection risk when evaluating COVID-19 patients using echocardiography reduce the scanning time while ensuring that the needed information is obtained. To assist with that, you can tailor Smart Exam protocols (or custom exam protocols) to provide the following:

- Automatic mode switching
- User-specified image acquisition sequence
- Reduced operator interaction with the ultrasound machine



Smart Exam on an EPIQ Ultrasound System

Creating a Custom Exam Protocol on EPIQ and Affiniti Systems

1. Touch the name of the transducer you want to use and select a preset.
2. Touch **Protocol**.

3. In the left pane of the imaging display, click the **Protocol** tab.
4. Do one of the following:
 - In the protocols list, right-click the protocol on which you want to base your custom protocol, and click **Duplicate** or **New**.
 - In the protocols list, select the protocol on which you want to base your custom protocol, select an application, and touch **Create** or touch **Duplicate**.

NOTE

When entering a name for a custom protocol, do not use any of the following characters: \, /, *, ?, ", <, or >.

5. In the **New Protocol** dialog box, type a name for your custom protocol.
6. Click **Edit**, make the changes you want for your protocol, and click **OK**.
 - Select **Beats** or **Time** for the **Method**.
 - Select **Prospective** or **Retrospective** for the **Acquisition Type**.
 - Select **View** or **Sequential** for **Display By**.
 - To start DVD recording during a protocol, select **DVR Autostart**.
 - To start a timer during a protocol, select **Timer Autostart**.
 - To enable **Imaging Mode Auto**, select **Automatic Imaging Mode Switching**.
 - To enable you to advance the view manually, set **View Advance** to **Manual**.
7. To make your custom protocol available for multiple applications, select the application in the **Available** list of the **Edit Protocol Properties** dialog box, click  to move the application to the **Selected** list, and click **OK**.
8. In the protocols list, expand the protocol by clicking the plus sign (+), if necessary.
9. In the **Protocol** tab, select a view and make your changes or click **Create view** and select your choices. Repeat for other views as necessary.

- If you selected an imaging mode that supports 3D, click **3D** and then select a **3D Mode**.
 - Select a **View Name**.
 - Select the **Imaging Mode** for the view.
 - Select an **Acquisition Type**.
 - If you selected **Loop** from the **Acquisition Type** menu, select a **Length**.
 - Enter a **Rotational Angle**.
 - Enter a **Label**.
 - Add a body marker.
10. To change the order of protocols or views in the list, select one and click  or  to move it. You can also click the protocol or view in the list and drag it to the new position.
11. When you are done creating the protocol, click or touch **Save Protocol**.

Creating a Custom Exam Protocol on Sparq and CX50 Systems

1. Press **Setup** (CX50) or  (Sparq).
2. Click the **Protocols** tab.
3. Do either of the following:
 - To create a protocol from scratch, click **Create Protocol**. (If **Create Protocol** is not displayed, exit the setups, end the protocol that is currently loaded, and begin with step 1 of this procedure.)
 - To create a protocol based on a default system protocol, click **Load Protocol**. In the **Load Protocol** dialog box, select the protocol on which you want to base your custom protocol, and click **OK**. Click **Edit Protocol**.
4. To adjust views in the protocol, do any of the following:
 - To add a new view, click **Add New View**, enter information for the view in the view properties area, and click **Add**.
 - To add a new view, enter information for the view in the view properties area and click **Add**.

- To add a view based on an existing view, select the view, make changes in the view properties area, and click **Add**.
 - To modify an existing view, select the view, make changes, and click **Modify**.
 - To rename a view, select it, change the **Anatomic Name**, and click **Modify**.
 - To change the order of views in the protocol, select one and drag it to the desired position in the list.
 - To change the order of views in the protocol, select a view and click **Move Up** or **Move Down**.
 - To delete a view, select the view and click **Delete View**.
 - To remove all views from the protocol, click **Clear All Views**.
5. To customize views in the protocol, do any of the following, and then click **Modify**:
 - To specify an imaging mode, select an option from the **Mode** menu.
 - To specify an image type, select **Frame** or **Loop** from the **Image Type** menu.
 - To specify an annotation associated with a view, type in the **Annotation** field.
 - To change measurements associated with the view, click **Analysis**.
 - To change body markers associated with the view, click **Body Marker**.
 6. Click **Save Protocol**.
 7. Click **Create New**.
 8. In the **Create New Protocol** dialog box, enter a name for the protocol and click **Save**.

NOTE

When entering a name for a custom protocol, do not use any of the following characters: \, /, *, ?, ", <, or >.

9. Click **Close**.

Transducers for Cardiac Scanning

Transducer Types for Cardiac Scans

Transducer Type	Characteristics
Sector (Phased Array)	<ul style="list-style-type: none"> Use multiple transducers in different frequency ranges depending on body habitus, size, and age Useful any time the workflow involves cardiac examination Can also be used for lung imaging

Transducers for Cardiac Scans by System

Transducer Type	Lumify	EPIQ	Affiniti	CX50	Sparq
Sector	S4-1	S5-1, S9-2, S8-3, S12-4, X5-1	S4-2, S5-1, S8-3, S12-4, X5-1 ¹	S4-2, S5-1, S8-3, S12-4	S4-2, S5-1

1. 2D only on Affiniti systems

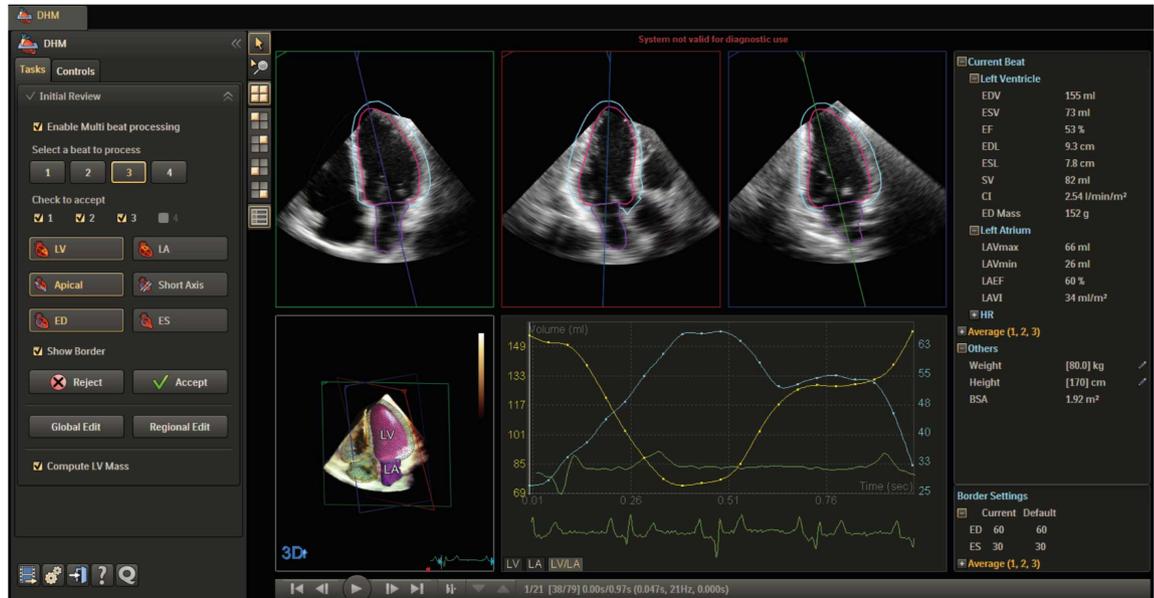
Off-Cart Measurement and Analysis

Philips offers many quantification applications for measuring the anatomy and function of the LV and RV.

Dynamic HeartModel

DHM measures LV volume and ejection fraction using 3D imaging.

- Provides full cycle cardiac quantification
- Shows moving contours for left ventricle (LV) and left atrium (LA) volumes
- Offers measurement of LV mass, cardiac index, and complete LA volumes and index
- Multi-beat analysis allows you to analyze different beats and average the results with the same acquisition



Dynamic HeartModel Results

Image Acquisition for Dynamic HeartModel

On an EPIQ 7, EPIQ CVx, or EPIQ CVxi Ultrasound System, you must use the **HM ACQ** acquisition mode with the X5-1 transducer to acquire images for DHM. Images acquired with the **HM ACQ** acquisition mode are labeled **3D HMQ**.

The performance and results obtained depend upon the quality of the image data that you intend to analyze. The following can improve image quality and your quantification results:

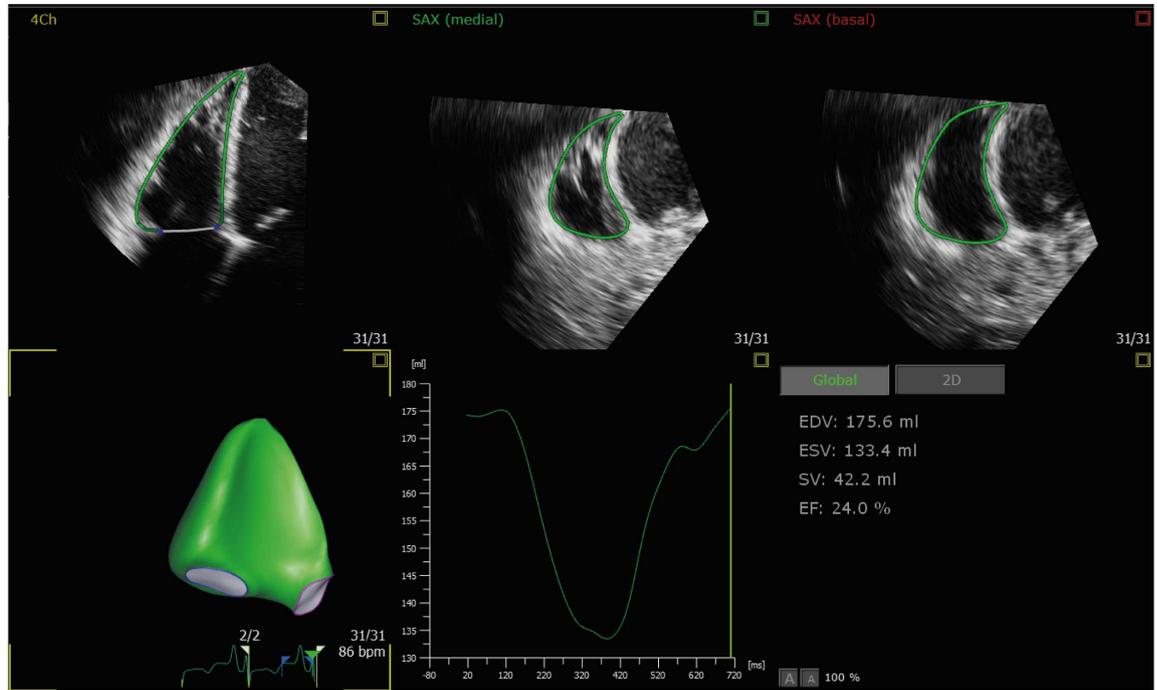
- Use the **Adult Echo** or **Echo Pen** preset and a good ECG signal. Acquire one or more heartbeats.
- Obtain an apical four-chamber view with the depth set to include the entire left atrium.

Cardiac Quantification 3D Auto RV

3D Auto RV measures RV volume, ejection fraction, and strains using 3D imaging.

The RV quantification tool for clinical routine work, pulmonary hypertension and right-sided heart failure, 3D Auto RV allows complete evaluation of the RV and combines 3D and 2D values including EDV, EDVi, ESV, ESVi, EF and SV, RVLS, TAPSE, and FAC. 3D Auto RV helps to overcome the RV complexity by calculating standard values based on a 3D surface model. A detailed and easy-to-follow workflow allows you to adapt the proposed contour quickly and easily.

- Increase your diagnostic confidence by visualizing the complex RV shape in 3D
- Calculate RV data based on a complex 3D surface model
- Validated model of the RV
- Display model in combination with 2D planes for a better control
- Automated 2D measurements with every 3D analysis available for DICOM SR and TXT formats
- 3D measurement results: RV EDV, EDVi, ESV, ESVi, EF, and SV
- 2D measurement results: TAPSE, distances and FAC
- Additional strain values: RVLS free wall and septum



3D Auto RV Results

Image Acquisition for 3D Auto RV

To acquire images for the 3D Auto RV Q-App, use an EPIQ 7, EPIQ CVx, or EPIQ CVxi Ultrasound System with a Cardiac Quantification 3D Auto RV license, in the **HM ACQ** acquisition mode, with the X5-1 transducer. The system must have an 3D Auto RV license to generate 3D data sets that can be analyzed using the 3D Auto RV Q-App. Images acquired with the HM ACQ acquisition mode are labeled **3D HMQ**. The 3D Auto RV Q-App requires a minimum of 10 frames per cardiac cycle and a minimum frame rate of 10 frames per second.

**WARNING**

The complete anatomy of the right ventricle must be acquired and must be visible in the data set. Measurements may be inaccurate if the right ventricle chamber is not clearly seen in the acquired loop.

The performance and results obtained depend upon the quality of the image data that you intend to analyze and the user accepted contours. The following can improve image quality and your quantification results:

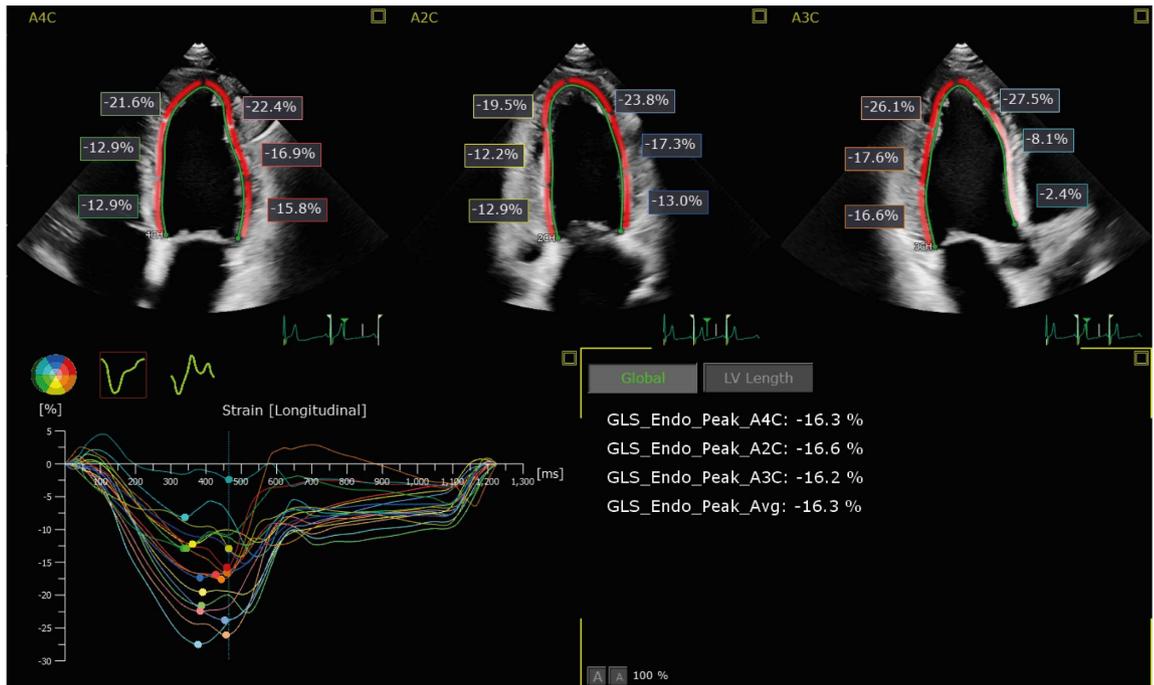
- Use the **Adult Echo** or **Echo Pen** preset and a good ECG signal. Acquire one or more heartbeats.
- Obtain an apical four-chamber view with the right ventricle focused under view.

AutoStrain LV

AutoStrain LV measures global and regional LV strain using 2D imaging.

- Automated 2D longitudinal strain quantification
- Objective assessment of left ventricle global function and regional wall motion deformation and timing using TOMTEC 2D speckle tracking technology
- One-button-push global longitudinal strain
- Automated view recognition and labeling with manual correction
- Automated contour detection and placement
- Image orientation selection
- Ability to analyze images with or without ECG
- Ability to analyze non-native data images
- Fast speckle tracking on three apical images at once
- Peak longitudinal strain for each apical view and global average
- Automated R-AVC with manual correction

- 18 segments peak-systolic longitudinal strain bull's-eye display
- 18 segments end-systolic longitudinal strain bull's-eye display
- 18 segments time-to-peak longitudinal strain bull's-eye display
- 18 segments waveform display for three apical views
- 6 segments waveform display for each apical view
- Measurement data exported in Report and DICOM SR



AutoStrain LV Results

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Image Acquisition for AutoStrain LV



WARNING

The complete anatomy of the left ventricle must be acquired and must be visible in the data sets. Measurements may be inaccurate if the left ventricle chamber is not clearly seen in the acquired loop.

The performance and results obtained depend upon the quality of the image data that you intend to analyze. The following can improve image quality and your quantification results:

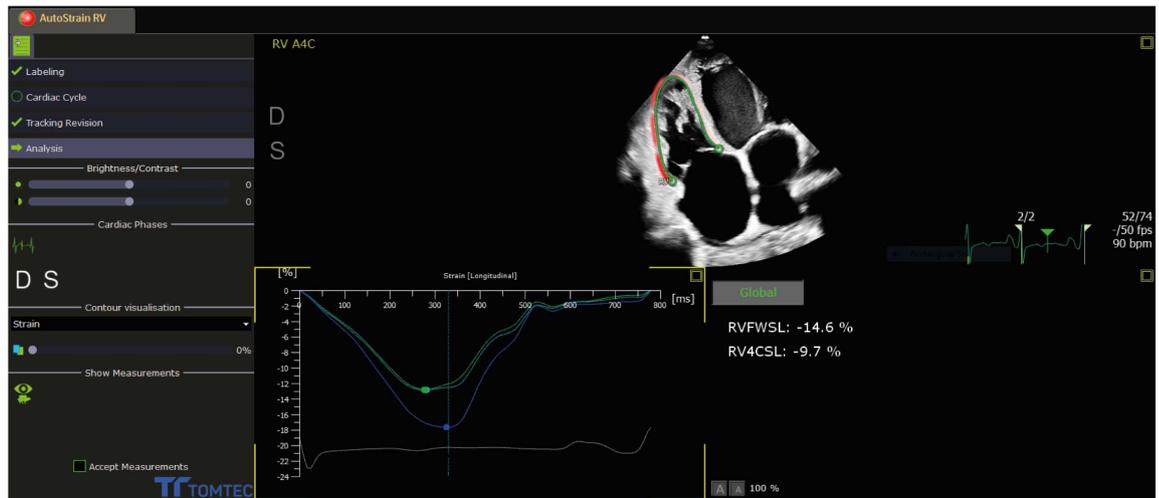
- Acquire one or more heartbeats.
- For automatic strain analysis, capture three loops of the heart in apical four-chamber (A4C), apical two-chamber (A2C), and apical long-axis (A3C) views.
- Whenever possible, you can ask the patient to suspend breathing for a few seconds during image acquisition to minimize translation of the heart.
- Ensure that the apical views are not foreshortened.
- Use the gain and threshold settings on your ultrasound system to ensure that you acquire good endocardial borders.
- Ensure the acquisition is left-ventricle only and that all of the left ventricle chamber is clearly seen in the acquired loop.
- Acquire a left-ventricle view at a reduced depth to focus on the left ventricle cavity. This reduces the likelihood of foreshortening and minimizes errors in endocardial border tracing.
- Eliminate artifacts from the surroundings of the heart. Items such as rib artifacts and shadowing inhibit the tracking accuracy.
- Use a high frame rate during acquisition.

AutoStrain RV

AutoStrain RV measures global and regional RV strain using 2D imaging.

AutoStrain RV allows fast and easy assessment of RV deformation analysis using 2D speckle tracking according to the Strain Task Force standardization consensus report.

- Measurements exported to DICOM SR
- RV free wall strain longitudinal
- RV global 4-chamber strain longitudinal
- Additional results available on the UI and as .txt export
- Segmental peak-systolic or end-systolic longitudinal strain of three free wall segments



AutoStrain RV Results

Image Acquisition for AutoStrain RV



WARNING

The complete anatomy of the right ventricle must be acquired and must be visible in the data sets. Measurements may be inaccurate if the right ventricle chamber is not clearly seen in the acquired loop.

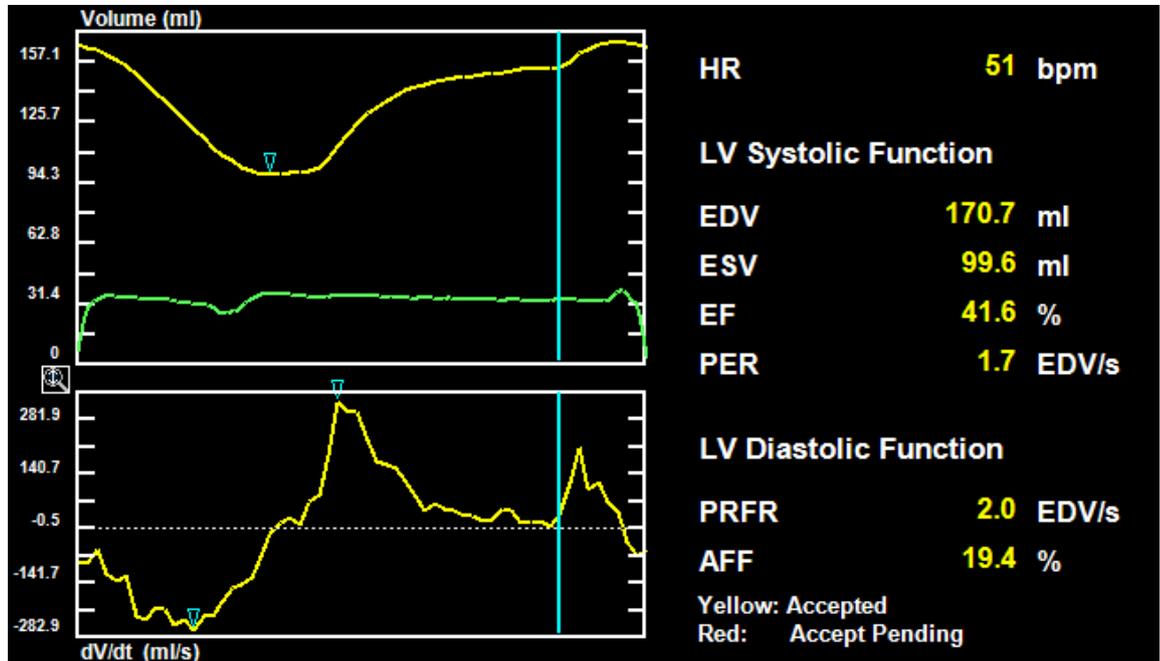
The performance and results obtained depend upon the quality of the image data that you intend to analyze. The following can improve image quality and your quantification results:

- Acquire one or more heartbeats.
- Ensure the acquisition is right-ventricle centric, 2D loop, typically RV under LV.
- Ensure that all of the right ventricle is clearly seen in the acquired loop and it is not foreshortened.
- Whenever possible, you can ask the patient to suspend breathing for a few seconds during image acquisition to minimize translation of the heart.
- Use the gain and threshold settings on your ultrasound system to ensure that you acquire good endocardial borders.
- Eliminate artifacts from the surroundings of the heart. Items such as rib artifacts and shadowing inhibit the tracking accuracy.
- Use a high frame rate during acquisition.

Auto 2D Quantification

Auto 2D Quantification measures LV volume and ejection fraction using 2D imaging.

- Left ventricle analysis from 2D and biplane images
- Quantification of native and non-native images
- Quantification of non-ECG images
- Automated border detection for cardiac chambers and vessel cavities
- Computation of area, LV volumes, and advanced parameters for LV systolic and diastolic function including fractional area change (FAC), ejection fraction (EF), peak ejection rate (PER), peak rapid filling rate (PRFR), and atrial filling fraction (AFF)
- Single-plane volume measurements based on Simpson's Single Plane Method of Disks (MOD)
- Biplane volume measurements based on Simpson's Biplane Method of Disks (MOD)



a2DQ Results

Image Acquisition for a2DQ

The performance and results obtained depend upon the quality of the image data that you intend to analyze. The following can improve image quality and your quantification results:

- Use a good ECG signal and acquire one or more heartbeats.
- Whenever possible, ask the patient to suspend breathing for a few seconds during image acquisition to minimize translation of the heart.
- Ensure the apical views are not foreshortened.
- Use the gain and threshold settings on your ultrasound system to ensure you acquire good endocardial borders.
- Set the gain levels high during acquisition to ensure a good dynamic range.

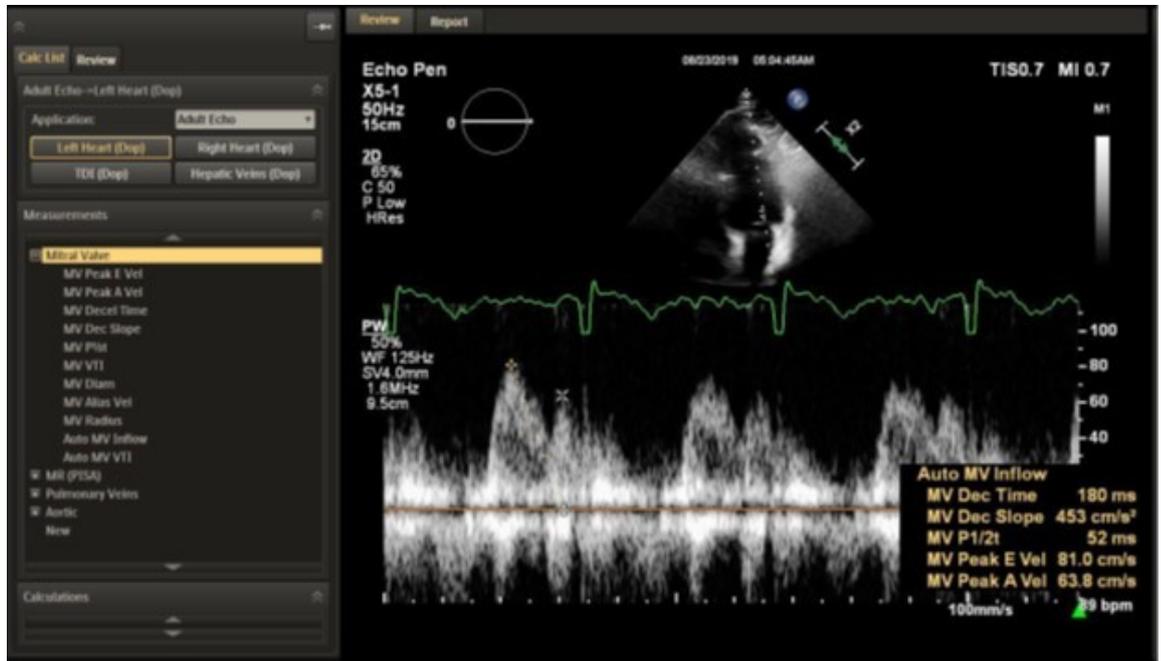
- Ensure all cardiac structures are clearly and completely within the data volume.
- Eliminate artifacts from the surroundings of the heart. Items such as rib artifacts and shadowing inhibit the tracking accuracy.
- Use a high frame rate during acquisition.
- Avoid out-of-plane motion on the short-axis image.
- XRES processing can be on or off.

NOTE

To achieve the best results for off-cart analysis, select the **2D Native Data** export option on EPIQ, Affiniti 70, and Affiniti 50 systems. Non-native data may also be used. When non-native data is used, you need to enter cardiac cycle data manually. In LV AP3 views, the AVC time may be calculated by the system when you click **Compute**. Confirm the aortic valve closure in the loop before you accept the results.

Doppler Measurements

- Peak velocity
- Velocity-time integral
- De-acceleration time



Doppler Measurements on an EPIQ Ultrasound System

Availability of Cardiac Solutions

Cardiac Solutions on Philips Ultrasound Systems and Software

	EPIQ	Affiniti	Sparq	CX50	QLAB
a2DQ	X	X	--	X	X
Dynamic HeartModel	X	--	--	--	X
AutoStrain LV	X	X	--	--	X
AutoStrain RV	X	--	--	--	X

	EPIQ	Affiniti	Sparq	CX50	QLAB
3D Auto RV	X	--	--	--	X
Doppler measurements	X	X	X	X	--
Custom exam protocols (Smart Exams)	X	X	X	X	--

Post-Scan Cleaning and Disinfection



WARNING

Clean and disinfect the system, transducers, cables, and accessories and for Lumify, the tablet, after every use. Follow the directions in *Care and Cleaning of Ultrasound Systems and Transducers*, and use the appropriate cleaners and disinfectants specified in *Disinfectants and Cleaning Solutions for Ultrasound Systems and Transducers*. Those documents are available on your system's user information disc or USB media and on the following website: philips.com/transducercare

NOTE

You can bag and sheath the transducer and the entire Lumify Ultrasound System, which makes cleaning and disinfection easier.

NOTE

The Sparq Ultrasound System has a sealed glass control panel, with no buttons or knobs, for ease of cleaning.

U.S. Centers for Disease Control and Prevention (CDC) recommends using disinfectant products that meet the EPA's criteria for use against SARS-CoV-2⁶, which are expected to be effective against COVID-19. Philips has not tested the biological effectiveness of those products. Before you use a cleaner or disinfectant on your ultrasound system or transducer, see *Disinfectants and Cleaning Solutions for Ultrasound Systems and Transducers* to see which are compatible with your system and transducers.

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