RCA (Rapid Cardiac Assessment) is a goal directed examination to assess cardiac function in the compromised patient. The concept of critical care goal directed echocardiography by non cardiologists has been gaining momentum over the last 2 decades. It has leant itself to multiple catchy acronyms including FADE (Focused Assessment Diagnostic Echocardiography)\(^1\), RACE (Rapid Assessment Cardiac Echocardiography) and FOCUS (FOcus Cardiac UltraSound).\(^2\)

The examination can be performed in minutes and traditionally involves five views:

- Subxiphoid view
- Parasternal long axis
- Parasternal short axis
- Apical 4 chamber view
- IVC assessment

Further views in the parasternal, apical and subxiphoid windows can be employed when one or more of the windows are suboptimal, these are discussed towards the end of the module.

The role of the RCA in the shocked patient is to answer specific clinical questions:

Is this patient shocked because of:
- poor LV function?
- pericardial effusion/tamponade?
- obstruction from PE?
- hypovolaemia?

Disadvantages of RCA

- Suboptimal images are frequent in the very population the assessment is used in; particularly
  - Tachyarrhythmia
  - Too unwell to tolerate positioning
  - Emphysema
  - Obese

- Operator dependant

- The process of gaining proficiency is more involved than other emergency department adopted bedside goal directed ultrasound such as FAST and AAA scanning
Cardiac Probe and Conventions

The probe used in echocardiography is the phased array probe. Unlike in conventional ultrasound where the marker is oriented to the left of the field, in echocardiography the marker is oriented on the right side. The implication for this is that you need to orient the probe such that the marker is towards the patient’s left.

Cardiac Windows and Planes

There are a number of windows that are employed in echocardiography. The windows used in RCA are the parasternal, apical and subcostal windows. It is not uncommon for a patient to have good views in only certain windows – for example, they may have very good parasternal long and short axis views but poor apical views. Given this it is important to be competent at attaining images in all windows.

Acoustic Windows in Echo

![Acoustic Windows in Echo]
Within each window there are a number of cardiac planes which can be visualised depending on the orientation of the probe. For instance, in the parasternal window you can visualise the heart in its long axis and short axis. You should always view a structure in multiple planes to best appreciate its form and function.
Performing a RCA - Step 1: Subxiphoid View

The subxiphoid view is typically performed first. It is the best view to assess for pericardial effusion. This view should be performed with the patient lying flat.

**Procedure:**

Place the ultrasound probe transversely with marker to the patient’s left in the epigastrium.

Apply gentle downward pressure while aiming the probe towards the heart. Try to use the liver as an acoustic window, by sliding the probe towards the patient’s right side to include a cut of the liver in the near field of your image.

The image is almost always improved with inspiration.

From Yale Atlas of Echocardiology http://www.yale.edu/imaging/echo_atlas/views/index.html
Step 2 : Parasternal long axis (PLAX) view

A good parasternal long axis view can answer most clinical questions. It can be used to assess LV function and is one of the better views to do so. It can also be used to compare the right and left sides of the heart, to visualise the aortic root and to assess for pericardial effusion. This view is best performed in a steep left lateral position, however in the unstable patient it is usually performed lying flat.

Procedure:
Place the ultrasound probe in the 3\textsuperscript{rd}/4\textsuperscript{th}/5\textsuperscript{th} intercostal space so the marker is towards the patient’s right shoulder or roughly in the 11 o’clock orientation.

Try to aim the ultrasound beam through the intercostal space close to the sternal edge hugging the lower rib.

A shortened ventricle is often improved with a small amount of counter clockwise rotation of the probe.

From Yale Atlas of Echocardiology http://www.yale.edu/imaging/echo_atlas/views/index.html
Step 3: Parasternal short axis (PSAX) view

The parasternal short axis view enables you to look at the LV in cross section allowing a good estimation of ventricular function. You may also see an overloaded RV ‘pancaking’ resulting in a distorted D shaped LV.

Procedure:

The ultrasound is rotated clockwise 90° from the PLAX position.

The beam can be tilted superiorly to include the aorta in cross section and inferiorly to visualise the apex.

Much like the PLAX view, positioning in the steep left lateral position can improve the window.

From Yale Atlas of Echocardiology http://www.yale.edu/imaging/echo_atlas/views/index.html
Step 4: Apical 4 chamber (A4C) view

The apical 4 chamber view allows you to visualise all heart chambers as well as the atrioventricular valves. It is the best view to compare the right heart to the left. Normally, the RV cavity should be roughly half the size of the LV and the apex should be comprised largely of the LV. If the RV size approaches or is larger than the LV and/or it forms the apex of the heart rather than the LV it is likely that the right heart is overloaded.

Procedure:
From the PSAX position with the marker roughly in the 2 o’clock position, slide the probe to overlie the apex beat impulse.

You may need to slide the probe more inferiorly and laterally to ensure the image isn’t foreshortened.

This is an example of acute RV overload. The RV size approaches that of the LV. Also note that the apex is comprised of the RV and not the LV as is demonstrated in the normal image below.

From Yale Atlas of Echocardiology http://www.yale.edu/imaging/echo_atlas/views/index.html
Step 5 : IVC Assessment

Volume assessment can be estimated through viewing the size and change in diameter of the IVC during the respiratory cycle. You can use the cardiac probe or the curvilinear (abdominal) probe to assess the IVC calibre. In a spontaneously breathing patient the diameter of the IVC should decrease with inspiration. Pronounced respiratory collapse suggests hypovolaemia. No respiratory variation in a larger diameter IVC is consistent with raised RAP.

**Procedure:**
With the probe in the longitudinal plane, visualise the IVC entering into the RA.

Using M mode makes it easier to appreciate the difference in calibre in inspiration and expiration.

<table>
<thead>
<tr>
<th>IVC Size</th>
<th>Collapse %</th>
<th>CVP</th>
</tr>
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<tbody>
<tr>
<td>&lt; 2cm</td>
<td>&gt; 50%</td>
<td>&lt; 10</td>
</tr>
<tr>
<td>&gt; 2cm</td>
<td>&lt; 50%</td>
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Additional Views

Additional views can be obtained in the parasternal, apical and subxiphoid windows to visualise regions of the heart which may be obscured if certain windows are suboptimal. They are routinely employed in a more detailed echocardiography study. It is helpful to be familiar the techniques – although a RCA can be performed without ever using these additional views.

Parasternal Short Axis : aortic view

From the traditional PSAX position, aiming the probe more superiorly brings the aorta in cross-section into view. This may be helpful to better appreciate the aortic root diameter if unable to be visualised in PLAX.

Parasternal Short Axis: apical view

From the traditional PSAX position, directing the probe more inferiorly allows you to visualise the LV in its entirety to the apex. This allows a better appreciation of LV contractility, including the assessment of RWMAs.

Apical Long Axis

This view gives much the same information as the PLAX, however is obtained in the apical window. From the Apical 4 Chamber View the probe is rotated counter clockwise approximately 90 degrees. The marker is typically close to the 12 o’clock position.
The short axis of the heart can also be visualised from the subxiphoid window. Simply rotate the probe counter clockwise until the marker is in the 12 o’clock position.
The minimum requirements for documentation as listed in the American Society of Echocardiography Consensus Statement on Focused Cardiac Ultrasound in the Emergent Setting are\(^2\):

- date and time of study,
- name and hospital ID number of patient,
- patient age (DOB) & gender,
- indication for study,
- name of person performing study
- findings
- limitations & recommendations for additional studies
- impression
- name of person who interpreted study
- date and time the report was signed
- mode of archiving the data.

At the Princess Alexandra Hospital Emergency Department to improve the documentation of bedside ultrasound – a RCA datasheet sticker is available for use.
Accreditation Requirements

Within the Princess Alexandra Hospital Emergency Department, to meet the accreditation requirement for Rapid Cardiac Assessment one must:

1. attend an instructional course which meets the criteria listed in ACEM P61 Policy on Credentialing for Echocardiography in Life Support

2. perform 25 examinations
   a. 5 of which need to be clinically indicated
   b. 5 of which need to be directly supervised by an echo sonologist or accredited practitioner in the department

3. correctly interpret a further 25 examinations from the PAH Emergency Dept RCA database

Ongoing accreditation requirements are:

1. perform 25 examinations annually or attend an accredited course as a refresher

2. undertake 4 hours CPD annually relating to basic echo
**RCA Protocol**

The conventional RCA algorithm is to commence in the subxiphoid window before progressing to the parasternal and apical windows. The IVC is typically assessed last.

The ability to obtain good views is often window dependent. It is unusual for the unstable patient to have good views in all windows.

The art to this scan is to get the best views you can to answer the clinical question within the limits of the available windows and patient manoeuvrability.

RCA can be performed in the arrested patient receiving CPR where it is performed during the 10 second pulse check. The presence of cardiac activity is encouraging that ROSC may be achievable. Where as the absence of cardiac motion portends a grim prognosis.\(^6\)

**Tips & Tricks RCA**

- If your patient can tolerate positioning, the parasternal views are much improved in a steep left lateral position.

- Don’t forget many images are improved at different stages of the respiratory cycle. Asking a patient to breathe in and hold their breath can improve many views, particularly the subxiphoid view.

- Use the liver as an acoustic window if you are having trouble achieving an adequate subxiphoid view.
The RCA examination in the shocked patient should be considered an extension of the primary survey in all hypotensive patients. With practice the assessment should take no longer than a few minutes.

Repeat examination is useful to assess response to therapy.

RCA in the haemodynamically stable patient should be used with caution. It should be remembered as with all limited bedside studies that it is a goal directed examination. In particular it should not be performed to answer clinical questions which are outside of the scope of the study. In these cases a formal echo should always be requested.
Further Reading


References

1. Marum S and Price S. ‘The Use of Echocardiography in the Critically Ill; The Role of FADE (Fast Assessment Diagnostic Echocardiography) Training.’ Current Cardiology Reviews, 2011; 7:197-200


