10 tips for routine cardiac MR

Application Tip

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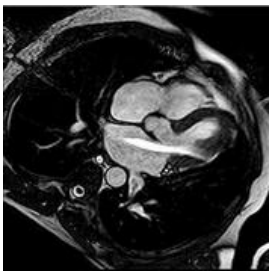
Tip 1: Use Vector cardiogram (VCG) for faster setup and better image quality

R-peak detection is critically important in cardiac MR. Sub-optimal ECGs will yield poor quality scans - it's better to spend a few more minutes on the ECG setup. This may result in fewer scans, but acceptable diagnostic quality. VCG, however, uses a different R-peak detection algorithm that is far more robust and setup is easier and faster.

VCG lead setup:
easier and far more robust than conventional three-lead ECG.

Tip 2: Use PlanAlign for suitable scan alignment

PlanAlign is a tool that prevents unwanted in-plane rotations associated with double-oblique planning. It re-aligns the image with the tabletop so that the images are suitably aligned with the tabletop and, accordingly, with the patient's back.



No PlanAlign

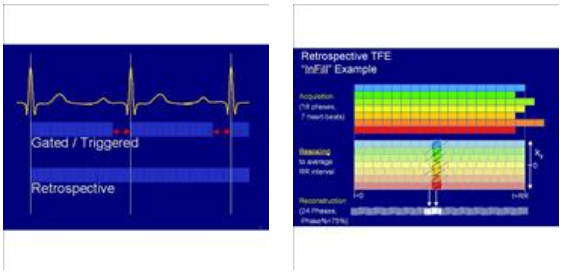
PlanAlign

Tip 3: Use TFE default shot mode for easy scan definition

20 In breath-hold cine scans, TFE factor is among several parameters that determine the number of phases in a scan. When the TFE 'shot mode' is set to 'default' the system automatically calculates the TFE factor from the patient's heart rate, the desired number of phases and the TR.

Tip 4: Use Retrospective TFE and InFill to cover the complete cardiac cycle

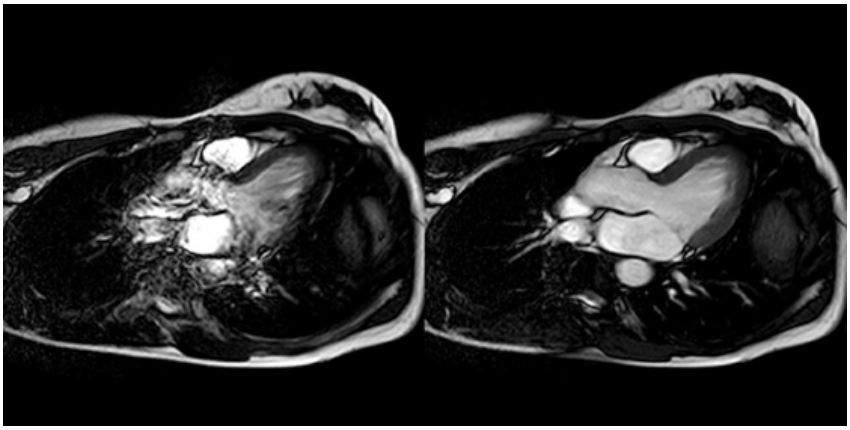
The clinical benefit of true retrospective TFE is that cine scans performed in a breath-hold cover the whole cardiac cycle, including late diastole and early atrial contraction. New reconstruction algorithms can reconstruct more phases than were acquired during the scan (InFill), resulting in smoother movies and better visualization of cardiac wall motion.



Tip 5: Use volume shim for optimized flow compensation

Balanced TFE, a frequently used method in cardiac MR, utilizes built-in flow compensation. The success of this flow compensation, however, depends greatly on the B0 homogeneity. Therefore, the application of a targeted shim volume placed over the great arteries and the ventricles reduces the occurrence of flow artifacts.

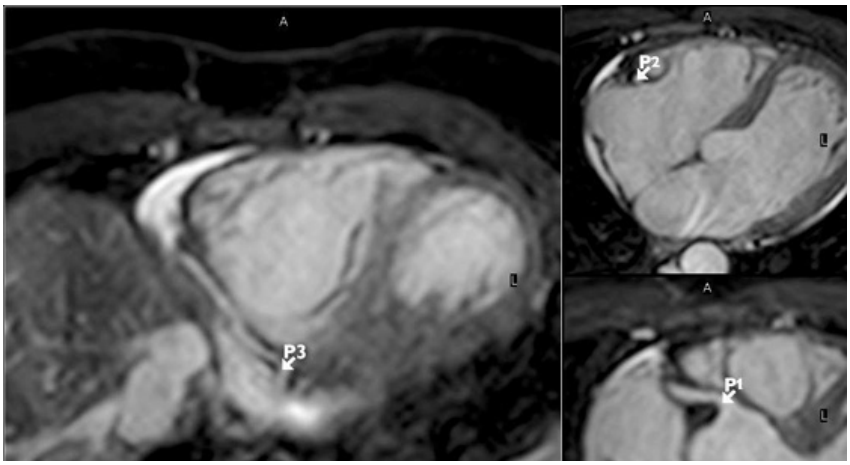
Images with (right) and without (left) volume shim.
Volume shim reduces flow artifacts.



Tip 6: Use three-points planscan for easy and accurate coronary artery planning

Three-points planscan (3PPS) can be used on a low-resolution 3D scan to plan the coronary artery of interest. Place one point at the origin, the second point halfway down and the third point at the peripheral end of the artery. Then, scroll through the slices again to confirm that the stack indeed covers the whole coronary artery.

The imaging plane is defined by placing three points in different slices.



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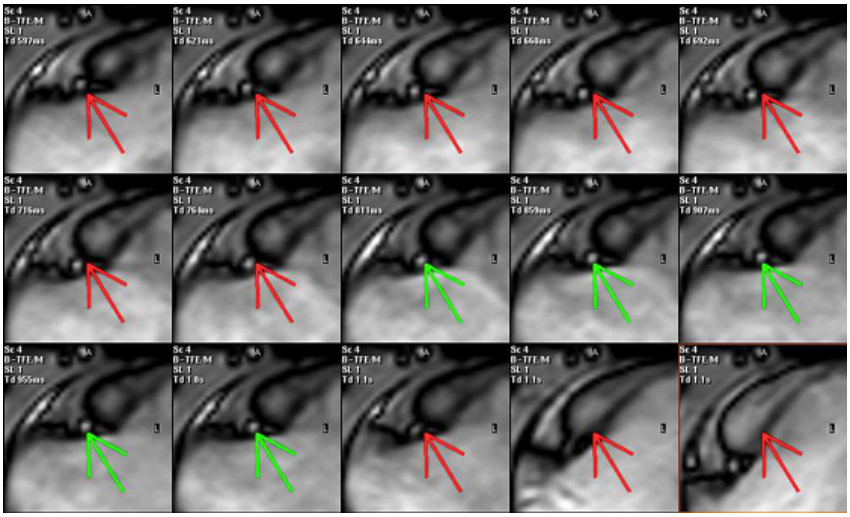
The imaging plane is defined by placing three points in different slices.

Tip 7: Use combined approach for robust coronary artery acquisition timing

SENSE, retrospective TFE, InFill and halfscan can be combined to acquire a cine scan with high temporal resolution. Scroll through all the phases to watch for the moment in diastole where the coronary artery stops moving. Use this point for the trigger delay in the highresolution scan. Scroll further and watch for the moment that the artery is about to move again. Subtracting the trigger delay from this yields the shot duration. The shot duration in the high-resolution scan can be controlled using the TFE factor.

Determination of trigger delay and shot duration using a high-temporal-resolution cine scan. Green arrows indicate phase where the coronary artery does not move.



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Determination of trigger delay and shot during
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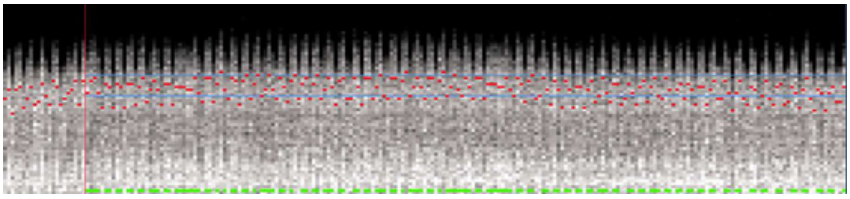
Tip 8: optimize navigator efficiency with navigator window width

When using a navigator, only data acquired during expiration should be accepted; data acquired during inspiration should be rejected. Efficiencies of 40%-80% percent are normal. When the efficiency exceeds 80%, decrease the navigator window width to prevent data acquired during inspiration from being included in the scan. When efficiency drops below 40% opening the window increases the efficiency.

Navigator display: red dots mark the navigator sample points, the blue points outline the gate window, the green dots at the bottom indicate the accepted TFE shots.



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Navigator display

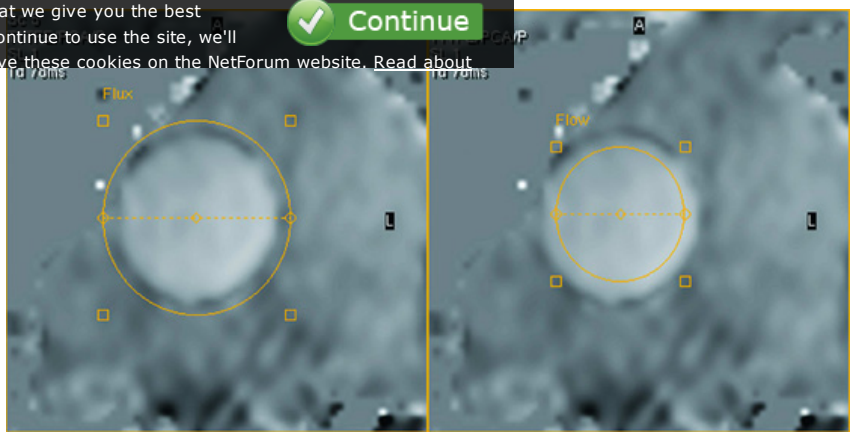
Tip 9: Use careful ROI positioning in flow quantification

If the aim is to measure the amount of blood flowing through a vessel (flux), make sure that the whole vessel is included in the ROI. In this case, the area of the ROI is larger and the average velocity is lower but the flux (the area multiplied with the velocity) remains unchanged.

When the aim is to measure the maximum velocity, take care to avoid including noise pixels located near the vessel wall. Make sure that the ROI is located inside the vessel. In doing so, the minimum and maximum values represent pixel locations inside the vessel.

Left:
Large ROI for measuring flux

Right:
Smaller ROI for max. velocity



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ROI size

Tip 10: Use time slots wisely

When cardiac MR is not part of the daily routine, a double slot is frequently reserved for the patient. However, it is recommended to use the first slot to optimize parameters to increase scanning efficiency during the second, or patient, slot.