

Time-to-peak Circumferential Strain Distinguishes between Stunned and Infarcted Myocardium

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Objective:

Previous studies have shown post-systolic shortening during ischemia. We aimed to study whether time-to-peak circumferential strain (SC) can distinguish between stunned and infarcted myocardium.

Methods and Results:

Ten pigs underwent left anterior descending artery (LAD) occlusion for 90 minutes followed by reperfusion up to 60 days. Echocardiography was performed at baseline, at 90 minutes of occlusion and after 2 hours, 30 and 60 days of reperfusion. The short axis scans were post-processed by a speckle tracking program to measure the SC, radial strain (SR) and time-to-peak SC. Subsequently, the pigs were sacrificed, and histological analysis for infarct transmuralities was performed. Transmurality was scored: 0=viable, 1=scar<25%, 2=75%>scar>25%, 3>75%.

The segmental SC and SR were homogeneous at baseline. After 90 minutes of occlusion and 2 hours of reperfusion the SC and SR were reduced for all segments due to infarction and stunning (baseline: SC:-19.2±2.3%, SR:48.7±12.0%, 90min: SC:-13.1±4.5%, SR:23.0±6.6%, 2hrs: SC:-13.4±3.0%, SR:17.5±8.2%, P<0.001), however, the time-to-peak SC was longer for the infarcted segments than for the stunned segments at 90 minutes of occlusion in 23% and at 2 hours of reperfusion in 27% (P<0.05). At 30 and 60 days following reperfusion, time-to-peak SC could detect the large scars at the anterior wall (P<0.05), while peak SC detected smaller scars at the lateral wall as well (P<0.05). The SR failed to distinguish between normal, stunned and infarcted myocardium at any time.

Histological analysis showed that the main injury was at the anterior wall (scored 2 or 3), anterior septum and lateral wall (scored 1 or 2).

Conclusion:

At the acute stage of myocardial infarction, the time-to-peak SC can distinguish between infarcted and stunned myocardium, however, when stunning is over, it is better to use the peak SC as a detector for myocardial infarction.