Cardiac hemodynamics in PCI: effects of ischemia, reperfusion and mechanical support
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CHAPTER

Effects of left ventricular unloading on reperfusion-related AIVR in acute myocardial infarction

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Accelerated idioventricular rhythm (AIVR) often occurs in the setting of acute myocardial infarction, specifically after reperfusion. We studied the direct left ventricular (LV) dynamic effects of AIVR compared with sinus rhythm. Furthermore, we observed an interesting finding of LV unloading on the occurrence of AIVR.

Reperfusion-Related AIVR

A 76-year-old female (patient 1) with no previous cardiac history presented with an acute anterior ST-segment elevation myocardial infarction 4 hours after onset of symptoms. The CKMBmax was 311 μg/L and maximal Troponin T was 8.3 μg/L. Coronary angiography revealed a normal right and circumflex coronary artery and an occluded left anterior descending coronary artery (LAD). After successful PCI with TIMI 3 flow, recurrent episodes of AIVR were observed. Simultaneously assessed left ventricular pressure (P_LV) and volume (V_LV) by conductance catheter during AIVR revealed instantaneous changes in LV dynamics (Figure 1, panel A, B, and C [left]).

LV Unloading

A 68-year-old male (patient 2) with no previous cardiac history presented with an acute anterior ST-segment elevation myocardial infarction 1½ hours after onset of symptoms. The CKMBmax was 340 μg/L and maximal Troponin T was 6.2 μg/L. Coronary angiography revealed diffuse 3 vessel disease including an occluded LAD. After successful
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Panel C: left and middle. Immediate AIVR-induced (from A to B) reduction of both $P_{LV}$ and $V_{LV}$. Note the direct systolic effects induced by AIVR, whereas diastolic function curve remained unchanged. Cardiac output decreased (4.0 to 3.4 L/min), as well as $\frac{dP}{dt_{\text{max}}}$ (1164 to 942 mm Hg/s), and stroke work (4.7 to 3.3 mm Hg.L). Panel C: right. After placement of an IABP, AIVR immediately returned to sinus rhythm (SR) with positive effects on LV dynamics: $\frac{dP}{dt_{\text{max}}}$ increased compared to SR and to AIVR (974, 816 and 495 mm Hg/s, respectively), stroke volume and ejection fraction increased, and afterload decreased as indicated by a decreased end-systolic $P_{LV}$.

Panel D. Reperfusion-related AIVR was terminated by unloading the LV by an IABP, illustrated by the $P_{LV}$ recording.

PCI with TIMI 3 flow, persistent AIVR compromised LV dynamics (Panel C: middle). Therefore, an IABP, at a 1:1 assist ratio, was placed for cardiac support (Panel C: right). Consequently, AIVR immediately returned to sinus rhythm and vice versa (Panel D).

Our observations show immediate AIVR-related decreases in cardiac output, contractility and stroke work. LV unloading directly led to a return to sinus rhythm, presumably by a reduction in wall stress.