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Sonothrombolysis in ST-Segment Elevation Myocardial Infarction Treated With Primary Percutaneous Coronary Intervention

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ABSTRACT

BACKGROUND Preclinical studies have demonstrated that high mechanical index (MI) impulses from a diagnostic ultrasound transducer during an intravenous microbubble infusion (sonothrombolysis) can restore epicardial and microvascular flow in acute ST-segment elevation myocardial infarction (STEMI).

OBJECTIVES This study tested the clinical effectiveness of sonothrombolysis in patients with STEMI.

METHODS Patients with their first STEMI were prospectively randomized to either diagnostic ultrasound-guided high MI impulses during an intravenous Definity (Lantheus Medical Imaging, North Billerica, Massachusetts) infusion before, and following, emergent percutaneous coronary intervention (PCI), or to a control group that received PCI only ($n = 50$ in each group). A reference first STEMI group ($n = 203$) who arrived outside the randomization window was also analyzed. Angiographic recanalization before PCI, ST-segment resolution, infarct size by magnetic resonance imaging, and systolic function (LVEF) at 6 months were compared.

RESULTS ST-segment resolution occurred in 16 (32%) high MI PCI versus 2 (4%) PCI-only patients before PCI, and angiographic recanalization was 48% in high MI/PCI versus 20% in PCI only and 21% in the reference group ($p < 0.001$). Infarct size was reduced (29 ± 22 g high MI/PCI vs. 40 ± 20 g PCI only; $p = 0.026$). LVEF was not different between groups before treatment (44 ± 11% vs. 43 ± 10%), but increased immediately after PCI in the high MI/PCI group ($p = 0.03$), and remained higher at 6 months ($p = 0.015$). Need for implantable defibrillator (LVEF ≤30%) was reduced in the high MI/PCI group (5% vs. 18% PCI only; $p = 0.045$).

CONCLUSIONS Sonothrombolysis added to PCI improves recanalization rates and reduces infarct size, resulting in sustained improvements in systolic function after STEMI. (Therapeutic Use of Ultrasound in Acute Coronary Artery Disease; NCT02410330). (J Am Coll Cardiol 2019;73:2832–42) © 2019 by the American College of Cardiology Foundation.