Detection by Intracoronary Near-Infrared Spectroscopy of Lipid Core Plaque at Culprit Sites in Survivors of Cardiac Arrest

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ABSTRACT: With an estimated 300,000 cases occurring per year in the United States alone, sudden cardiac death remains a major public health problem and in many cases is the first manifestation of coronary artery disease. Autopsy studies have established that the causative event in many cases of sudden death is rupture of an intracoronary lipid core plaque with subsequent thrombus formation. Until recently, identification of lipid core plaque in vivo has not been possible; however, a combined near-infrared spectroscopy (NIRS) and intravascular ultrasound (IVUS) catheter has become available that can detect lipid core plaque in patients undergoing coronary angiography. In this report, we present findings in 5 patients who experienced a documented sudden cardiac arrest, were successfully resuscitated, and then were studied with intracoronary NIRS-IVUS to assess the extent and location of lipid core plaque. Although the detection of lipid core plaque at the culprit site in victims of sudden death is not novel, the novelty of the present report is that NIRS permitted identification of the large lipid core plaque underlying sudden cardiac arrest in vivo, a finding in striking accord with prior autopsy observations implicating ruptured lipid core plaque in the pathogenesis of sudden cardiac death.

Key words: near-infrared spectroscopy, lipid core plaque, sudden cardiac death

In this report, we present findings in 5 patients who experienced a documented sudden cardiac arrest, were successfully resuscitated, and were then studied with intracoronary NIRS-IVUS to assess the extent and location of lipid core plaque. Whereas in 1 case the cardiac arrest occurred in the emergency room while awaiting transfer to the catheterization laboratory, the other 4 cases were out-of-hospital cardiac arrests, including 2 cases that occurred prior to first medical contact. In all 5 cases, NIRS identified the presence of a large lipid core plaque in the culprit segment (Figure 1).

Although the detection of lipid core plaque at the culprit site in victims of sudden death is not novel, the novelty of the present report is that NIRS permitted identification of the large lipid core plaque underlying sudden cardiac arrest in vivo, a finding in striking accord with prior autopsy observations implicating ruptured lipid core plaque in the pathogenesis of sudden cardiac death. Consistent with prior in vivo studies linking lipid core plaque detected by NIRS to culprit lesions across the spectrum of acute coronary syndromes, including in ST-segment elevation myocardial infarction (STEMI), non-STEMI and unstable angina, the present observations provide evidence that lipid core plaque detected by NIRS is also implicated in the most extreme presentation of acute coronary syndrome — sudden cardiac death.

References
Figure 1. Angiographic and near-infrared spectroscopy (NIRS) findings in 5 victims of sudden cardiac arrest. Shown are the electrocardiographic, angiographic, and NIRS findings in 5 patients who survived an episode of cardiac arrest. Cases I-IV were out-of-hospital cardiac arrests, whereas in case V the cardiac arrest occurred in the emergency room while awaiting transfer to the catheterization laboratory. All patients were successfully resuscitated and taken to the catheterization laboratory. In each case, initial angiography demonstrated an obvious culprit lesion (arrow) and NIRS revealed the presence of a large lipid core plaque within the culprit segment (white box). The culprit vessel was the left anterior descending coronary artery in 4 cases and the right coronary artery in 1 case. In all cases, the maximum lipid core burden index in 4 mm (maxLCBI4mm) was >400.