Chapter 15

**ENDOCARDIAL GLOBAL NONCONTACT MAPPING (ENSITE™)**

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**INTRODUCTION**

Multisite epicardial activation mapping has advanced our understanding of arrhythmia mechanisms and has served as a valuable tool during arrhythmia surgery. Conventional endocardial mapping during percutaneous radiofrequency ablation procedures generally is performed using 1-3 catheters, each with a limited number of electrodes. In fact, some arrhythmias, such as AV nodal reentrant tachycardia, can be diagnosed and cured with radiofrequency ablation using only two quadrapolar catheters. However, current catheter-based mapping techniques have significant limitations when attempts are made to ablate complex arrhythmias, such as ventricular tachycardia in patients with a history of myocardial infarction.

Noncontact mapping has been developed to permit high-resolution global activation mapping of the endocardium without the need for endocardial contact. The technique is based on the ability to compute far-field endocardial electrograms from analysis of intracavitary potentials. This chapter reviews the commercially available Ensite 3000 noncontact mapping system developed by Endocardial Solutions, Inc. (St. Paul, MN) and describes its use during ablation of cardiac arrhythmias. Because the value of the mapping system is heavily dependent on the accuracy of the virtual electrograms and locator signal, a detailed review of published validation studies is also included.
1. DESCRIPTION OF ENSITE 3000™ NONCONTACT MAPPING SYSTEM

The Ensite 3000™ noncontact mapping system derives information from two sources - a multielectrode array (MEA) and a catheter locator signal. Data from these two sources are used to construct a high-resolution, three-dimensional graphical representation of endocardial activation using dynamic isochronal or isopotential color maps.

1.1 Multielectrode Array (MEA)

The MEA is designed to record cavitary potentials. The array is a mesh of 0.003-inch diameter polyimide-coated stainless steel wire that covers an inflatable 7.5-ml balloon (Figure 1). Sixty-four electrodes are created by removing a small amount of the insulation from the wires at specific locations. The MEA is mounted on a 9-French lumenal pigtail catheter that can be advanced percutaneously into any cardiac chamber over a 0.035 guidewire. Ring electrodes are positioned on the catheter with one distal and three proximal to the balloon.

Figure 1. The multielectrode array catheter. The 9 French pigtail catheter is shown with the balloon deflated and the protective sheath that has been advanced near the end of the catheter (Left). The wire mesh of 0.0003-inch diameter polyimide-coated stainless steel is visible on the surface of the inflated balloon (Middle). A photomicrograph is shown of one of the electrodes that are created by removing the insulation with a laser (Right).