Integrating the Healthcare Enterprise
White Paper

Integration Profiles for the Electrophysiology Lab

This white paper provides the reader with information regarding several IHE Cardiology Profiles appropriate to the electrophysiology ablation / implantation lab. Although the technical specification of these Profiles is complete, their application to the EP lab use cases is beyond the scope of the Year 2 (2006) IHE demonstrations.

In addition to the Profiles described in this document, there are two other IHE Cardiology Profiles specifically applicable to Electrophysiology: Urgent Implantable Rhythm Control Device Identification Profile (PDQ-IRCD) and Implantable Cardiac Device Interrogation (ICDI) Profile. These Profiles are described in separate white papers.

Problem Statement:
In electrophysiology laboratory ablation procedures, specialized catheters are placed into the heart to identify and eliminate sources for arrhythmia. The EP lab is also used to implant and adjust cardiac rhythm control devices (pacemakers, cardioverter-defibrillators, and cardiac resynchronization therapy devices).

The EP lab is a multi-modality mix of many types of equipment from many manufacturers. As many as eight systems from different manufacturers may typically participate in a procedure (see Table 1). In current practice, these systems are unconnected islands, each managing its piece of the patient clinical record.

Integration of this data would result in increases in efficiency and reduce the potential for medical errors.

Increases in efficiency are especially critical due to the rapidly increasing demand for EP procedures and devices, and the limited availability of trained clinical professionals in the field.

Table 1 - Systems used in EP Lab

Hospital electronic health record / vital signs / clinical lab data
Access to outpatient EHR data
Scheduling system
ECG acquisition and management
EP waveform recording equipment / catheter sensors
Procedure event logging
Stimulator
Fluoroscopy / angiography
Intracardiac echocardiography
Radiofrequency energy generator
Cryotherapy devices
Defibrillators
Specialized mapping systems
Access to prior imaging studies
Implantable device programmers (manufacturer specific)
Report dictation / transcription / signature / distribution
Registry data entry
Charge posting

As electronic healthcare records (EHR) come to reality, it is critical to ensure that all of the patient and order identifying information is correct so that patient records may be accurately submitted to an EHR.

Use Cases:

When the patient arrives at the EP department, there is a preoperative evaluation, including review of information generated from prior office visits (history and physical, consultation, orders, consent, and laboratory analysis). Additional data will be generated by the nurse in the preoperative area (procedure day laboratory values, electrocardiogram, and vital signs). Today, much of this data is available only in hard copy (often by fax from other facilities).

For an ablation procedure, the patient is brought to the electrophysiology laboratory. The patient's demographic data is reentered into the recording system, the fluoroscopy system, the intracardiac echocardiographic system, and any specialized mapping systems that will be required for the procedure. Data from the medical record, such as allergies and laboratory values, are frequently reentered into the

procedural record to document that the information has been "reviewed." In some cases, the procedural record may be separate from the system that records electrophysiologic data. A wide array of specialized equipment is used during an ablation procedure. Data is acquired from each of these systems independently without any time synchronization. Any documentation of simultaneous acquisition of information from various pieces of equipment must be entered manually in the procedural record. During the procedure, review of data must be evaluated on each individual piece of equipment. For example, if an important event occurred at time X:XX, data from the recording equipment, imaging equipment, and mapping equipment must be queued separately to X:XX and reviewed sequentially. Finally, raw data from each system is stored in a variety of formats (optical disc, hard drive, tape) near the electrophysiology laboratory. However, a summary of specific data from the procedure (usually paper) is kept in a separate folder in the hospital (usually the cardiology offices) and is often not part of the medical record.

To summarize, for the simplest electrophysiologic/ablation studies, current hospital information "systems" will typically generate:

- a paper copy of the dictated report
- a paper copy of important hemodynamic or electrophysiologic data
- an optical disc of electrophysiologic data
- a disc of fluoroscopic data
- a disc of echocardiographic imaging data.

The same EP lab is also often used for device implantation. For this reason, manufacturer specific programming systems are necessary in the electrophysiology laboratory. Currently data from these programmers can only be saved as paper and are often kept separately from the medical record in a procedure report. Unfortunately, this important data from implant is not available to the follow-up physician. Minimal implant information (device and lead identification) is separately sent to the manufacturer at the time of implant procedure. Information on explanted devices and abandoned leads is often not included. In patients that have undergone multiple implants, information on implanted leads or devices is not available or incorrect. This may have important consequences for patient safety in the setting of device and lead recalls/warnings. Finally, if the patient in the U.S. received an implantable defibrillator, clinical data and device information is entered manually on a form and sent to the Medicare/CMS database. Other countries, such as Sweden, have other databases which require different sets of data.

IHE Profiles for the EP Lab:

IHE has defined several Integration Profiles that can help manage the diverse information needs of the EP lab.

- The ***Cardiac Catheterization Workflow Profile (CATH)*** provides for coordination of the various modalities in the cath / EP lab, including waveform recording, imaging, mapping, and logging. Under this Profile, all systems

operate on a single synchronized time clock, automatically use the same patient and procedure identifiers without data re-entry, and store their data to a single archive in non-proprietary formats. Workflow is managed with real-time in-progress status from the lab to the departmental information system. The entire exam data set can be retrieved by any appropriately configured workstation.

- The ***Retrieve Information for Display Profile (RID)*** provides a standardized Web-based means for any system to access documents from a hospital EHR system. Such documents could include history and physical, advance directives, current medications, and other similar documents typically reviewed preoperatively.
- The ***Cross-Enterprise Document Sharing – Medical Summary Profile (XDS-MS)*** defines a mechanism to securely share care record summaries between referring and specialist institutions through a Regional Health Information Organization. These can be used both on referral to the EP lab for implant or ablation, and on discharge as a summary of the procedure for the following cardiologist.
- Now under development are EP specializations of the ***Evidence Documents Profile (ED)*** that will define standard templates of EP lab data to facilitate cross-vendor exchange, longitudinal patient care, and extraction of critical parameters for outcomes research.

For more information on each of these related Profiles, please see the individual white papers.

Importance of the IHE Process:

IHE provides a collaborative forum in which clinical professionals and manufacturers of clinical systems can agree on a standards-based approach to solving critical patient safety and efficient care delivery problems. Moreover, IHE provides a program for testing, the "Connectathons", through which implementations adhering to the IHE Profiles can be validated, thus speeding the deployment of the Profiles' capabilities.

Electrophysiology lab systems are expected to begin testing at the 2007 Connectathons, and products with IHE Profile compliance may possibly become available later that year.

Purchasing Using IHE:

One of the key concepts of IHE is the ability to definitively describe interfaces with a single sentence. Using the statements below mitigates the need for hundreds of pages of technical documentation, interface engines, and on-site testing. For example, the following statements should be included in any request for proposal (RFP):

"The **EP Recording System** shall support the IHE Cardiac Catheterization Workflow Profile as the Acquisition Modality and Evidence Creator Actors."

"The **Cardiology Information System** shall support the IHE Cardiac Catheterization Workflow Profile as the Department System Scheduler/Order Filler Actor."

"The **Cardiology PACS** shall support the IHE Cardiac Catheterization Workflow Profile as the Image Manager and Image Display Actors."

Other related Profiles to consider include Urgent Implantable Rhythm Control Device Identification (PDQ-IRCD), Implantable Cardiac Device Interrogation (ICDI), Displayable Reports (DRPT), Evidence Documents (ED), Retrieve ECG for Display (ECG), Retrieve Information for Display (RID), Portable Data for Imaging (PDI), and Cross Enterprise Document Sharing (XDS).

Summary:
IHE Integration Profiles improve patient care and access to information in the clinical environment. It is worth your time to learn more about IHE. See www.ihe.net or www.acc.org/ihe.htm.

Consider joining the "IHE Cardiology Users' Group" which holds web seminars, teleconferences, and other educational opportunities on an informal basis. For more information, send an email to ihe@acc.org.