Anesthesia Information Management System in Cardiac Surgery

Mario Cossu, Pier Antonio Furfori, Alessandro Taddei, Maurizio Mangione, Paolo Del Sarto

G. Monasterio CNR/Tuscan Region Foundation
G. Pasquiniucci Heart Hospital, Massa, Italy

Abstract

A new Anesthesia Information Management System has been developed at Heart Hospital of G. Monasterio CNR – Tuscany Region Foundation in Massa. It is specialized in recording anesthesia-related perioperative patient data during cardiac surgery on either adult or pediatric patients. The system was aimed at integrating all patient data partly filled in by the operator, partly SQL-retrieved from the Hospital Information System, and partly gathered, by HL7, from Operating Room instrumentation. Software was developed in Java, achieving reliability and cross-platform capability. Operation reports for surgeon’s convenience are automatically created in the HIS medical record at start of surgery. HTML reports are provided and printed out. AIMS was introduced in ORs since March 2011, using medical-grade computers close to patient bed. This system could be potentially deployed to other institutions, not limiting to cardiac interventions.

1. Introduction

During the last 15 years the Hospital Information System (HIS) was developed at National Research Council (CNR), Institute of Clinical Physiology (IFC), first in Pisa for the integration of resources in Cardiology and later at G.Pasquiniucci Heart Hospital in Massa, specialized in Cardiology and Cardiac Surgery (both adult and pediatric). In 2007 IFC-CNR health-care activities converged into the “G. Monasterio Foundation” (FGM) by the joint effort of CNR, Tuscany Region and Universities (Fig.1). Given the amount of heterogeneous sources of patient data, both administrative and clinical, integration was crucial to allow comprehensive medical decision making, effective care planning and proper resource control. A networked information systems was implemented, based on three levels of data archiving (administration, clinical system and functional units, i.e. diagnostic laboratories, care units, Operating Rooms) and on two modalities for data exchange (middleware data integration into the central clinical database ARCA and Web distribution of health care information over the HIS network). The computer-network infrastructure, interconnecting GPH with the head institution in Pisa, allows achieving full access to patient information from any workstation. Secure Web technology was applied for distribution of health care information.

Figure 1. G. Monasterio CNR/Tuscan Region Foundation.

Figure 2. Patient data flows in cardiac surgery
repository. Thus, transition from paper-based towards electronic medical record (EMR) was achieved.

2. Anesthesia information system

A commercial system [1,2], integrated with HIS, was used during last ten years for documentation of anesthesia procedure during cardiac surgery operations.

The new AIMS has been fully developed at the Heart Hospital in Massa. It is specialized for recording anesthesia-related perioperative patient data during cardiac surgery on either adult or pediatric patients.

The AIMS is aimed at integrating patient data (clinical, instrumental and administrative) partly filled in by operator (anesthetist or anesthesia technician) through the Graphical User Interface, partly SQL-retrieved from Hospital Information System (Oracle), repository of patient electronic medical records, and partly gathered, by HL7 [3], from Operating Room instrumentation (monitors, anesthesia equipment and blood gas analyzer) (Fig.3).

Features
- Anesthesia database integrated with SIO (ARCA) (Oracle).
- Login to anesthesia record by personal account
- Software in Java, reliable and cross-platform.
- System specifications by anesthesia personnel.
- GUI, designed to ergonomics, divided into modules, according to tasks.
- Operation report for surgeon’s convenience automatically created in HIS EMR.

Figure 4. Main Graphical User Interface of AIMS: the diary in the middle and the event counters on the right, the tags for access to data views on the top, the diary filters on the bottom.

Graphical User Interface (data-entry)

Structured data entry (by buttons on the left of the main interface) is provided:
- patient data characterization and OR set up
- induction phase (from intubation to check lists)
- staff (anesthetists, technicians, nurses, surgeons)
- events (surgery, ECC,...)
- physiological parameters
- drug administrations (bolus/drip): computing dosages and quantities (Fig.6)
- fluid balance
- echocardiography and anesthesia reports

Graphical User Interface (information display)

Forms (accessing by tags on the top of main interface) for the representation of (Fig.5):
- list of anesthesia-related information (the diary)
- fluid balance.
- blood gas tests, ventilation, temperatures, blood pressures, heart rate, coagulation and monitoring parameters and/or trends (Fig.7).

Counters for timing of main phases (e.g. anesthesia, surgery, CEC)

**Printing**

HTML reports are created, SQL retrieving data from anesthesia database and printed out: “the anesthesia report”, i.e. the medical and legal document, and the “ICU report” addressed to personnel taking care of operated patient.

**Figure 5.** Data-entry, printing and log-out.

**Figure 6.** Recording and computing drug administrations (bolo and drip).

**Figure 7.** Blood gas reports are achieved via HL7 from the OR analysis equipment.
Figure 8. Printout of anesthesia record.

3. Conclusions

The new AIMS has been introduced for use in ORs since March 2011, using medical-grade computers close to patient bed. Bloog gas analyzers (Radiometer) were integrated by HL7v2.

HL7v3 data integration with monitoring (Fukuda) and CEC (Stocker) systems is under development.

This system, adopting advanced IT solutions (Java, HL7, database relational), could be potentially deployed to other institutions, not limiting to cardiac interventions.

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References


Address for correspondence

Mario Cossu and Alessandro Taddei
National Research Council and
G. Monasterio CNR-Tuscany Region Foundation
G. Pasquinucci Heart Hospital
Via Aurelia Sud
54100 Massa, Italy
mario.cossu@ftgm.it, taddei@ftgm.it