

**Whitepaper**

# **Cardiology Integration**

**Aniruddha Nene**

Principal Consultant-Imaging and Director

21st Century Health Management Solution Pvt. Ltd.

## Table of Contents

|  |   |
|--|---|
| Introduction.....  | 3 |
| Introduction to Cardiac Integration: A Clinician's Perspective ..... | 3 |
| Unified Digitization of Cardiology Data .....                        | 3 |
| Direct Benefits in Clinical Betterment.....                          | 4 |
| Summary Viewing In Consulting Chambers .....                         | 4 |
| Data Maintenance: Intelligent Storage Policies .....                 | 4 |
| Diagnostic Reporting with Images .....                               | 5 |
| Academic Data: Workshops / CME / Conferences .....                   | 7 |
| Benefits to the Patient .....  | 7 |
| Pre- Operative Counseling and Patient Awareness.....                 | 7 |
| Digital Record / EMR .....   | 7 |
| Benefits to the Hospital Management .....                            | 8 |
| Integration of Diagnostics with Administrative Modules .....         | 8 |
| Statistical Analysis .....   | 8 |
| Records of the Procedure for Evaluation and Auditing .....           | 8 |
| The Road Ahead .....   | 8 |
| Evolving Into Complete Digital System .....                          | 8 |
| Telemedicine for Second Opinion during the Surgery.....              | 8 |

## Introduction

It is a common observation in developed economies that rise in chronic lifestyle diseases is meteoric. And amongst these killer diseases, cardiac diseases have taken the Numero Uno position. Genetic predisposition compounded by rapid urbanisation, economic prosperity, changes in diet and lifestyle lack of adequate physical exercise is expected to further aggravate this situation. The mantra "Prevention is better than cure" is best applicable in case of lifestyle diseases. Preventive diagnostics helps a lot in early detection of the disease and can avoid a painful and risky course of treatment.

Advancement in the cardiac diagnostics are moving faster than one could imagine. A 128- slice-Cardiac-CT available today can scan a throbbing heart in a split second a workstation can reconstruct a 3D model of heart including small coronary vessels over the cardiac muscle. All this is done non invasively. While the clinical outcome of this remains a topic of debate in comparison with Coronary Angiogram, no one can deny the fact that imaging is getting more sophisticated than what we thought.

As the diagnostics are getting more sophisticated, need to cross correlate is naturally perceived strongly. Integration of digital data produced by medical equipment remains central to accurate diagnostics.

## Introduction to Cardiac Integration: A Clinician's Perspective

### Unified Digitization of Cardiology Data

A cardiologist has to deal with diversified clinical data such as OP consultation, ECG strips, 2D echo/ angiography loops, procedure plan etc. Clinically, every data is important as collectively it impacts the decision making. However, the records are all scattered. OP consultations are usually handwritten paper records and quite often no system can interpret or classify the contents. ECG strips are added to paper records. 2D echo loops most of the times are trapped in the machine itself and are rarely available as records in the form of video cassette or a CD. Angiography loops are typically provided in what is called as DICOM CD, which needs its own specific viewer software.

The cardiologist has to take a decision based on limited data available in case of emergencies! All these details need to be digitised and united under one roof to demolish barriers for communications. Unified digitization is aimed at integrating ECG waveforms, 2D echo and Radiography, CT scan Angiography images.

Digitization is first step, centralization is the next. CENTRALISED repository of the data must be linked to the PATIENT RECORDS and indexed to facilitate RETRIEVAL. It is timely and efficient retrieval that adds value to the imaging data. Key is to make this data available WHERE, WHEN AND HOW the clinicians and the other users in the hospital desire.

## Direct Benefits in Clinical Betterment

Integrated view intuitively works better to arrive at the differential diagnosis. If the individual test results are isolated it is likely that the consultant misses out on some aspect.

Integrated data is immensely useful for second opinion. It avoids the drudgery of logistics of patient file and communication needed to explain and the diagnostic findings. All the exams can be viewed in chronological manner highlighting finding of each examination in the work-list itself.

## Summary Viewing In Consulting Chambers

The digitization is naturally followed by processing. Many of the equipments have in-built processing tools. Digital integration can take full advantage of the capability of the equipment. For example the 3D reconstructed image, processed ECG waveform with automatically detected MI, arrhythmia, 2D echo measurements performed on the 2D echo etc can be incorporated in the integrated data, retaining those value adds.

Most of the times the processing is don only once on the machine conducting the diagnostic scan but the processed data is referred repeatedly lateron. Digital integration takes up the task of isolating the processed data and distributing it whenever demanded. This is referred as summary viewing.

## Data Maintenance: Intelligent Storage Policies

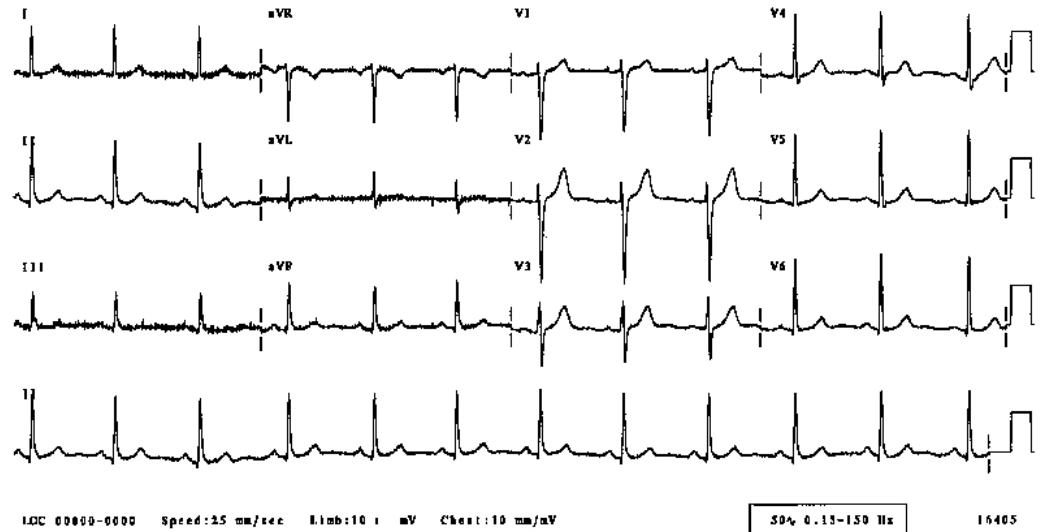
It is easy to understand clinically important imaging data is very little as compared to the total data produced. For example, a normal chest X-ray has very limited or no clinical value after 30 days from the interpretation. A chest X-ray of the patient in cardiac ICU if normal loses value may be in two days! On the other hand, a chest X-ray of a VIP or medico-legal case, even if normal, may have to preserved for long! The system has to incorporate clinical intelligence to plan lifespan of the imaging data.

As a matter of fact, without such intelligent storage planning, 2D echo tests are repeated in most of the hospitals. Just before a procedure (angioplasty or surgery) review of 2D echo is highly necessary. 2D echo test is always done on a patient during OPD before procedure takes place and it is just two-three months old data. Unfortunately, lack of intelligent storage results in repeated 2D echo test. It has been observed that in a 500 plus bed cardiac super-speciality hospital this could mean saving of three hours of a senior cardiologist and the machine for repeated procedure.

In case of ECG some of the implementations use scanning the strip and importing as image into the system. This approach is highly inefficient.

1. It is extremely cumbersome to scan ECG strips and the process is manual. Quality of scan varies depending on positioning of the strip and scanner settings.
2. If the strip is scanned as image, it captures the ECG waveform ( actual information needed ) along with the background area / grid ( the data that is almost 100 times in size as compared to the waveform ) is not a clinically meaningful data in itself! Use of

grid is only to have an idea about quantification of ECG graph values in case of abnormal ECG, which can be simulated through software if the standard calibrated value is displayed in the graph ( rectangular step in the right side of the following waveforms )



ECG digitization therefore offers exact reports as the machine would print otherwise on regular stationary in A4 size.

ECG waveforms can be acquired typically with RS232 interface, commonly referred as serial communication. Unlike imaging modalities ( 2D echo, Cath lab, Cardiac CT etc ) ECG is NOT covered in the DICOM standard till date. Each instrument has different communication protocol and integration meets the challenge of developing specific interfaces for each make.

However, the data acquired by serial communication in this manner, needs minimum size for storage and analyzable in future.

## Diagnostic Reporting with Images

Digital images are easy to include in a formatted report. Report of 2D echo including Doppler, M-mode images with measurements and 3D reconstructed images helps Cardiologist as well as patients / referring Doctor in terms of understanding the impression in a better way as depicted below.



## **Academic Data: Workshops / CME / Conferences**

Digital records of diagnostics can be used for academic purpose only if the system offers extensive utility to classify the data in flexible manner. The need of classification can be user specific. For example, a cardiologist may want to search 'Mitral Regurgitation' cases detected for between 2003 to 2007. Or ToF diagnosed new-borns between 1 week and 2 weeks of age at the time of 2D echo. The power of any archival is evident by effective retrieval. Cardiologists are too preoccupied to spare time for searching records that they need during academic activities such as conferences.

Apart from the necessity of having a quick 'search result' to meet the topic of the presentation, Cardiologists face a Herculean task to be able to edit the data in a presentable form within the allocated time span. Due to lack of suitable infrastructure, many deserving surgeons do not get opportunity to present their work and receive due acknowledgement for themselves and the institute they belong to. The all-in-one digital integration system solves this problem and one can make a complete presentation in single sitting that otherwise would take weeks and months with the help of multimedia professionals!

## **Benefits to the Patient**

### **Pre- Operative Counseling and Patient Awareness**

In the segment of healthcare, patient satisfaction is best measured in terms of the reduced anxiety levels to the patient and the relation accompanying the patient. A keen and knowledgeable patient always finds comfort with demonstration of the results and explanation of risks involved. Ideal form of such counseling is presentation of digital data / imaging of similar cases, accurately diagnosed and effectively treated within the hospital. Visual demonstrations are always more effective than clinical jargon.

### **Digital Record / EMR**

One picture speaks more than a thousand words. Since the digital integration ensured link to patient record it is very easy to convert the entire patient record into a CD / DVD. The records in CD / DVD can be used as future reference in case needed.

## Benefits to the Hospital Management

### Integration of Diagnostics with Administrative Modules

More and more hospitals are moving towards monolithic healthcare processes and data through integration. Interoperability is key to success and standards such as HL7 are leading healthcare IT systems to complete integration.

Cardiac imaging and digitization can integrate with EMR to render completeness to the healthcare records of a patient. Similarly it can integrate with the HIS to offer seamless integration with administrative processes.

### Statistical Analysis

Detailed classification of the procedures enables statistical analysis of the type of the procedure and the end result. This data can be used to plan up-gradation or expansion of cardiac diagnostics in optimal manner. Focus can be on either on high profit or on high frequency procedures.

### Records of the Procedure for Evaluation and Auditing

Complete records of the procedural details can be audited to bring out inefficiencies in the system. It can also track exceptional scanning skill as well as clinical errors; both of course are equally important.

## The Road Ahead

### Evolving Into Complete Digital System

The diagnostic digitization can extend to procedural integration such as PTCA and CABG. Angioplasty and open heart surgery are most commonly followed treatment for cardiac diseases. Entire procedural recording encompassing digital equipments such as patient monitors ventilators, OT light camera, microscope camera etc can be interfaced with the system.

### Telemedicine for Second Opinion during the Surgery

Digitization and high speed communication has made it possible to bridge the gap between demand and supply of advanced clinical skills for primary diagnosis. Telemedicine for ECG reporting and on-line transmission of cath lab loops is today possible, and patients can get best of the diagnostic opinion about clinical condition.



**Corporate Office:**

824, Corporate Business Centre,  
Nirmal Life Style Complex, LBS Road,  
Mulund West, Mumbai - 400 080. INDIA.  
Fax: + 91 22 2568 9711

**Innovation & Knowledge Centre:**

Parmeshwari Gardens Complex,  
Near Our Lady of Fatima Church, Majiwada Rd,  
Thane (West) - 400 601. INDIA.  
Fax: + 91 22 25303992

**Website:**

[www.21chms.com](http://www.21chms.com)

**Email:**

[Contact@21chms.com](mailto:Contact@21chms.com)

The information contained herein is of a general nature and is not intended to address the circumstances of any particular individual or entity. Although we endeavor to provide accurate and timely information, there can be no guarantee that such information is accurate as of the date it is received or that it will continue to be accurate in the future. No one should act on such information without appropriate professional advice after a thorough examination of the particular situation.

© 2010 - 21st Century Health Management Solutions Private Limited (21CHMS). All Rights Reserved. This work may not be used, sold, transferred, adapted, abridged, copied or reproduced in whole or in part in any manner or form or in any media without the prior written consent. All product names and company names and logos mentioned herein are the trademarks or registered trademarks of their respective owners.