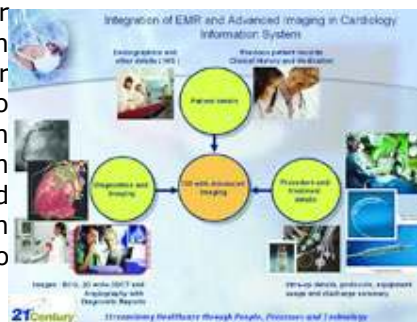


Turbocharging Cardiac Care through CIS with Advance Imaging & iEMR

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New hospitals with cardiac specialty are sprouting all over the country

If there is one growth indicator in India rising faster than the stock market Sensex, it is the ballistic rise in chronic lifestyle diseases. And amongst these killer diseases, cardiac diseases have taken the Numero Uno position. More than eight per cent of India's population i.e. a whopping 80 million are estimated to suffer from cardiac diseases. Genetic predisposition compounded by rapid urbanisation, economic prosperity, changes in diet and lifestyle amongst Indians is expected to further aggravate this situation.



It is a well-known fact that there is a major shortage of healthcare facilities, clinical skills and other resources to contain this national level crisis. New innovative treatments such genetic and stem cell therapy are still in infancy. Prevention and chronic disease management programmes to fight these diseases have a long way to go before they can make any impact; hence we have to depend on conventional cardiac care treatment.

If we just focus on 'coronary vascular diseases' which causes heart attack, the figures will speak for themselves. Angioplasty is a minimally-invasive procedure that clears the cholesterol block in the arteries supplying blood to the heart, while open heart surgery (CABG or OHS) bypasses the block by grafting some other healthy blood vessel! The estimated number of angioplasties per year is 45,000 whereas the figures for CABG is 30,000 in India. Table 1 below gives some scary facts about the challenges we face.

Parameter	Estimated
Indians suffering form cardiac diseases	8 crore
Newborns with cardiac diseases	2.25 lakh/yr
Average age of Indians suffering heart attacks	45 years
Average age of people suffering heart attacks in Western countries	65 years
Heart Attacks in those under 40 years	25 per cent
Indians requiring cardiac surgery	2.5 million/yr
Actual no of cardiac surgeries carried out	75,000

Challenges

It is obvious from the above table that, it is not possible to meet the humongous demand-supply gap of over 95 per cent of the cases going untreated just by increasing the number of cardiac hospitals, cardiologists, and cardiac surgeons. New hospitals with cardiac speciality are sprouting all over the country. Skilled surgeons and cardiologists are burning out trying to cope up with ever burgeoning patient load. However, this is not enough to meet the huge gap between demand and supply.

Information and communication technologies (ICT) have transformed our lives in every conceivable area, from banking to stockmarkets and from travel to entertainment, not to forget mobile communication. What is stopping ICT technologies from being used extensively in sophisticated knowledge-based clinical applications like laboratory systems, imaging systems, electronic medical records and telemedicine?

Important issues to be addressed by ICT solutions for clinical applications:

- They must deliver critical information in a manner that simplifies the job of overworked clinicians and paramedics. This is possible only if these applications are designed and validated by healthcare domain experts and not IT experts.
- They must be first implemented incorporating innovative and improved processes by champions willing to change conventional mindsets! This is a big change management exercise and unless this is handled effectively, no improvement is possible.
- They must be seamlessly integrated with all the other relevant systems like HIS and not behave like islands of super-efficiency.
- They must be cost effective and improve quality of patient care.
- They must help to improve the productivity of scarce and expensive resources like cathlabs, cardiac OTs and cardiac surgeons and cardiologists. To illustrate these facts it will be appropriate to study impact of innovative use of ICT in Cardiology Information Systems with Advanced Imaging and Imaging Electronic Medical Records (iEMR).

This clinical information system touches all information related to the patient and the episode. Demographics and administrative data is captured mostly in hospital information system and is linked to the clinical system of CIS. Specific clinical history and subsequent OP encounter details such as examination, medication, prescription, diagnostics etc get appended in the course of time. Finally, inpatient treatment details such as coronary intervention/surgery get added to the patient record. The benefits are that it is a reliable and structured way to store and retrieve the clinical and patient information in a structured manner in a very short time period. Powerful tool to analyse the information for education, academics, quality initiatives, research and performance measurement. Integrated with administrative processes to improve overall patient management and satisfaction.

Innovation is the Key

All these benefits are not possible without innovative use of technology, which support common sense requirements. Let's see how all these points apply to applications in a typical cardiac care. Three pillars of innovative use of technology on which such a system rests:

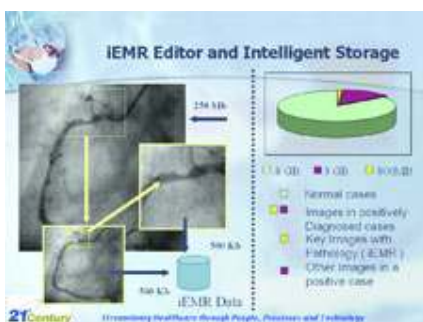
1) **Flexible EMR engine:** EMR present challenges to software professionals. On one hand is the need to provide a system that is rule driven, structured and with a need for outputs and Management Information System, while on other hand is the need for flexibility dictated by the esoteric body of knowledge and a structure that does not fit any precise standard. The way out of this is to have an EMR engine which can empower the doctor to define his own inputs with validations and outputs and statistical reports.

2) **Integration and holistic approach:** 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 contain 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.

No one can blame a cardiologist for interpretation based on limited data available in the middle of huge OP waitlist! All these details need to be digitised and united under one roof to demolish barriers for communications. Advanced image archival that integrate ECG waveforms, 2D echo and angiography images.

3) **Building clinical intelligence into the system:** Archival without planning storage and addressing efficient retrieval will create more problems that it aims to resolve. If one has to include the imaging records clinically intelligent storage needs to be planned.

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 be 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.

iEMR

Clinical intelligence can be extended further to extract clinically important portion from the imaging data. This automatically highlights pathology for consultants viewing summary. This also reduces the size of the data without losing any clinical information. Thus, iEMR reduces traffic on the data network and improves efficiency! Here's how it works for cardiology. As shown in the adjoining figure, a huge angio loop of 250MB containing only one block reduces to 1MB as the cardiologist can store only the details about block and ignore other details which has little or no clinical significance.

To summarise

The bottom line is that appropriate use of ICT technology can dramatically improve patient management and enhance the efficiency of the utilisation of the scarce/expensive resources through a properly structured cardiology information system that integrates with the Imaging Electronic Medical Records system.

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