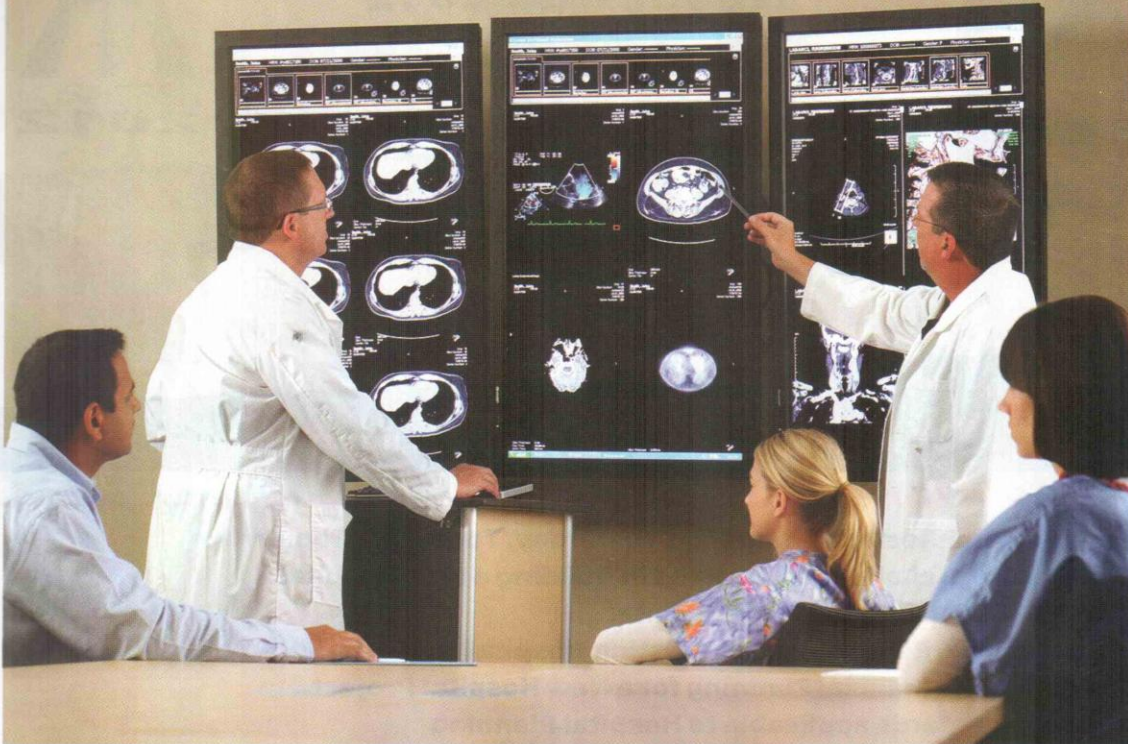


CASE STUDY



Improvement of patient care through Teleradiology

Teleradiology enables better physician collaboration, communication and consultation – in turn leading to better patient care, says **Dr. Arjun Kalyanpur**

The practice of Teleradiology, or the remote reporting of radiologic scans, has grown at a dramatic pace since the beginning of the new millennium, and has made tremendous impact on patient care worldwide. Having been involved in teleradiology over the past decade, our experience

has shown us that in essence, teleradiology has impact on all significant aspects of healthcare namely access, quality, timeliness, cost, communication and training.

Teleradiology has proved to be a boon to the healthcare industry and has impacted the delivery systems in a very positive man-

ner. Listed below are 10 examples of how teleradiology improves patient care:

Acute Emergency

Nowhere has teleradiology made greater impact on clinical patient outcome than in the emergency setting. In fact, the reason for the great boost in demand for

teleradiology services in the early 2000's was directly based upon the need for emergency reporting services by US hospitals. Until that time a radiology scan performed at night in a hospital was interpreted by the clinician on site at the hospital. It was only seen by a radiologist the next morning, unless the clinician

suspected an abnormality and called in a radiologist for a professional opinion. As Emergency physicians are not trained in CT interpretation, one can only surmise how many critical findings went undiagnosed till the next morning, in this scenario, and how many patients must have suffered the consequence. However around 1999, the US regulations changed, requiring that all studies needed to be interpreted contemporaneously by a radiologist for medico legal and reimbursement reasons.

Faced with a severe shortage of radiologists, that impacted most on night shift operations, radiology groups and hospitals began looking for alternatives and teleradiology presented a natural option. The need for such support very soon began to be felt in several other parts of the world where radiologist shortages prevail. At the same time, the technology applications such as multidetector row CT began to advance rapidly, so that conditions such as pulmonary embolism, aortic dissection, acute appendicitis and acute stroke could be detected immediately and noninvasively by CT. A number of trauma-related indications

also were revolutionised by CT imaging, such as spinal injury, facial fractures, visceral and vascular trauma. It is in these areas that teleradiology plays a critical role. By transmitting the images to the location of the radiologist instead of having the radiologist physically come to the hospital, the report turnaround time is kept to a minimum. The use of broadband technology has made such rapid image transfer

turnaround time as low as 15 minute for a stroke protocol CT performed diametrically across the world or 30 minutes for an indication such as suspected pulmonary embolism or aortic dissection.

Where there is no doctor present

The second area in which teleradiology makes a huge impact is in the setting of small towns

Appropriate medical treatment cannot be provided without accurate diagnosis, and teleradiology allows for an accurate diagnosis to be delivered to each and every citizen without them having to travel hundreds of miles in its quest

possible. And mobile wireless 3G technology allows for interpretation instantly by a radiologist from anywhere at anytime, even when on the go.

Having a centralised reading center further enhances the potential of such a process, using economies of scale and efficiency. In our organisation, thousands of examinations are interpreted every month for over 100 hospitals across the globe, with report

in remote parts of the country where radiologists are in short supply. Most radiologists are currently based in metropolitan cities, while on the other hand, the healthcare needs of the smaller towns are growing. As a result, imaging centers with CT and MRI scanners are coming up rapidly in these smaller locations; however there are either none or insufficient radiologists with expertise to interpret the imag-

ing studies. In such a situation, teleradiology offers significant benefit by bringing the images to radiologists who are available and competent to report the studies. It is a fact that appropriate medical treatment cannot be provided without accurate diagnosis, and teleradiology allows for an accurate diagnosis to be delivered to each and every citizen without them having to travel hundreds of miles in its quest.

Through our Telerad Foundation we have been supporting hospitals of the Ramkrishna Mission, in locations such as Itanagar Arunachal Pradesh. This hospital has the only CT and MRI scanner for the entire population of Arunachal Pradesh (1 million). Approximately 10,000 scans have been reported by our organisation for this hospital free of cost using teleradiology, with a link set up by our technology team via remote connection, without even a single physical visit. Similarly, we support hospitals in Vrindavan UP, as well as hospitals in smaller towns in Jharkhand, Chhatisgarh, Bihar, Haryana and Tamil Nadu.

Asia is not the only continent to benefit from teleradiology. We currently provide services to cen-



ters in Tanzania and Nigeria, in locations where radiologists are in extremely short supply, allowing for timely report turnaround. Telesonography is another tool which has great potential benefit in remote areas but its growth in India is unfortunately currently restricted by PNDT regulations.

Reduced waiting time

In countries like the UK, where the NHS was notorious for waiting times of weeks/months for outpatient reports, these times have been greatly reduced by the implementation of teleradiology. Allowing for the workflow to be evenly distributed to involve those radiologists who are less busy at any given time is a major productivity benefit of teleradiology. At multicenter imaging practices, teleradiology allows a radiologist at any one center to report simultaneously for all, so that no patient at any of the centers need wait for their report.

Our work with the Ministry of Health in Singapore has shown that teleradiology was able to reduce report turnaround time for Xrays at the Polyclinics run by the National Healthcare Group from 3 days to one hour. This has greatly benefited the people of Singapore who previously had to make two visits to the polyclinic — the first to see the doctor and the second to collect their report. Now at the same visit they can do both and receive their prescription as well, resulting in significant benefit in terms of workforce productivity.

Improved diagnostic quality

As radiology has evolved, developed and become increasingly complex, subspecialty radiology has become the order of the day. Teleradiology allows for the imaging studies to be routed to the subspecialist who is most qualified and appropriate for the type of examination; be it a joint MRI, a PET-CT, or a mammogram. This results in enhanced quality of reporting. Within a group



of radiologists reading off the same PACS workflow engine, the worklists can be defined in such a manner as to allow each radiologist to report only those cases in which they are specialised. In a large teleradiology practice such as ours, the subspecialists are able to support each other with consultations specific to their areas of expertise, such that in any situation, the highest quality is delivered for any individual report.

In the setting of emergency teleradiology, a genre of dedicated emergency teleradiologists has evolved who have the skill set to

the radiologist operating in the emergency environment while at the same time the level of communication is also improved upon. Hence, critical value results are delivered verbally, instantly, to anywhere in the world, in the global teleradiology model.

Optimised physician utilisation

By having a radiologist at a centralised reading center simultaneously interpreting scans for a number of emergency departments, maximum efficiency and rapid turnaround of reports is achieved 24x7. An interesting

broadband cable networks. Our organisation was among the first to pioneer this model with Board certified radiologists based in India, Israel, China and Europe reporting for the night shift of hospitals in the US.

This has two important benefits to patient care, namely a) the conversion of night to day improves the quality of service and of reports, as logically speaking, a radiologist working at 2 PM is clearly more competent to deliver care than at 2 AM. Additionally, b) the productivity benefit engendered by converting night work to day means that the same number of radiologists can now be more productive interpret more studies, (as opposed to radiologists working nights who typically work one week in two) thereby benefiting more patients and shortening report turnaround.

This international teleradiology model was recognised and validated in an editorial published in the New England Journal of Medicine in 2006 as being of great value to emergency health services in the US and other parts of the world. This is arguably the most potent benefit of teleradiology to patient care.

Teleradiology workflow systems have physician-specific functions that allow clinicians to tap into an imaging database conveniently while performing their clinical duties, without interruption

interpret a wide range of imaging modalities that are utilised in the emergency setting with the focus on providing the key information required for delivering appropriate urgent care and for making rapid triage decisions. Thus, the quality of reports is enhanced by the experience and expertise of

variation on this model was developed in the early 2000s, where the so-called nighthawk radiologist was positioned diametrically opposite the globe to allow for a night shift to be transformed into a day shift. This was made possible by the deployment of ultrahigh speed international

Lowers cost of patient care

Teleradiology is a digital process – and therefore by definition filmless, which by itself reduces cost significantly in terms of avoiding film utilisation, processing and physical archival. The process of teleradiology is enabled by web-based intelligent workflow which allows images to be automatically routed to the location where they can be interpreted most rapidly and accurately, thereby enhancing patient care. An efficient teleradiology workflow (such as Radspa, developed by TeleradTech, Bangalore) has been shown to increase radiologist productivity and efficiency by a factor of 20% or greater, allowing more patient scans to be interpreted and more prompt diagnosis, both beneficial from the patient's perspective.

A further benefit of teleradiology on patient care accrues from its economy of scale effect wherein a single radiologist can from a single location, interpret scans from multiple hospitals efficiently, obviating the need for redundant staffing by radiologists at each individual institution. This in and of itself has a tremendous impact on the cost of healthcare, as the cost of having a radiologist up all night at each of many hospital sites can be quite staggering. The support staff can also be scaled efficiently, including secretarial assistance in communicating essential results, and in terms of IT manpower utilisation, both also contributing to lowering the cost of patient care.

For better physician collaboration

Being a process that is conducted over broadband telecommunications networks, teleradiology is in essence a communication tool, and it carries with it the benefits of enhanced physician to physician communication that in today's world is an essential component of patient care. Organisations such as the US

Joint Commission mandate that all critical value exams (read: radiologic tests that have significantly abnormal results that may acutely impact on the patient's well being in the emergency setting) must be communicated physician to physician in a timely and thorough manner.

In the teleradiology environment, as/when significant findings are detected, they are instantly communicated to the treating physician by means of telephone, e-fax, or via secure access to a RIS. Only 50% of radiology is interpretation of the image, the other 50% is the effective and timely communication of its results. In the setting of acute stroke for instance, teleradiology allows for detection of acute CT findings and their communication to the neurologist within 15 minutes of the scan being performed. This is therefore one of the critical enablers of treatment within the golden window, when brain tissue can still be effectively salvaged by

clot-lysing medication.

Intelligent and collaborative teleradiology workflows such as Radspa also allow for virtual consultations whereby radiologists and physicians can view the same image of a scan contemporaneously and discuss the findings. This can greatly assist in the clinician's understanding of the extent of a patient's disease and allow for more appropriate treatment planning. Similarly, intelligent and collaborative teleradiology workflows allow radiologists to consult each other and obtain second opinions from other experts, in real time, without delaying the diagnostic process significantly. This in itself can greatly enhance the quality of diagnosis and thereby of patient care.

Enables clinician image access

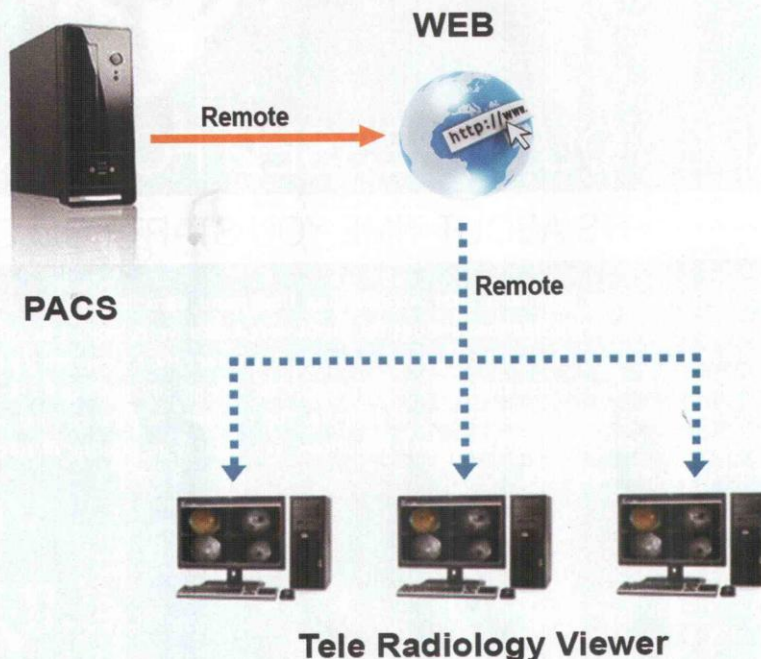
Teleradiology is not for radiologists alone but also for clinicians. Teleradiology workflow systems have physician-specific functions

that allow clinicians to tap into an imaging database conveniently while performing their clinic duties, without interruption.

Thus the clinician can, during hospital rounds or while in clinic view the scan of a patient who he/she has just finished examining, using either a desktop workstation, or more recently a mobile handheld device such as an iPad. Instant access to prior studies for comparison of disease progression is also enabled by teleradiology workflow systems, allowing for better clinical judgment.

Recent developments in teleradiology workflow includes data mining and medical information systems, which assist in medical decision making and analysis of diagnostic data, which in turn enhances patient care.

Seamless integration between radiology information/intelligence systems (RIS) and hospital information systems (HIS) using HL-7 interfaces means that the data transfer between the clinician and the radiologic databases is





smooth and efficient, allowing for far more optimal clinical practice.

Surgical planning via remote 3D postprocessing

An important corollary to radiologic reporting services is the remote 3D lab, which has leveraged information technology to supplement a scarce resource that of CT/MR technologists skilled in postprocessing of im-

age data. By transmitting the raw data images via teleradiology to a remote workstation, the labour intensive and time consuming postprocessing process can be moved offsite to a location where the skilled technologist is readily available, at lower cost to the healthcare system. The postprocessed imaging data is today an invaluable part of treatment planning, be it open surgery (example liver transplant) or

endovascular surgery (example aortic endovascular stent graft), or even radiation therapy. So in effect teleradiology allows high-end technical support services to be delivered efficiently and at a lower cost than the onsite model.

Enables next-gen E-training

An integral part of any teleradiology workflow is to permit identification of interesting teaching cases, and their subsequent archival in a manner wherein they can be retrieved in an instant to develop training materials. And by the nature of their practice teleradiology service providers have a large catchment area for their radiologic scans, which makes for a greater variety of clinical material - for example in our organisation we are reporting scans for patients in 15 countries across four continents, which leads to great variety in pathology and case material. And depending on the region

from where the scans originate, a greater than usual preponderance of complex and unusual cases tends to predominate, providing further value to students.

Conclusion

In summary, the 10 factors listed above are the essence of how teleradiology today impacts positively on patient care. Yet what has been achieved is only the tip of the iceberg - with far more potential to be realised. More such applications should and will emerge in the years to come, as technology evolves and improves further. Given the numerous problems and challenges that healthcare faces today, teleradiology is a ray of light that illuminates its future and provides hope for overall betterment of the healthcare delivery system. **HE**

The author is Chief Radiologist and Chief Pusher, Teleradiology Solutions Bangalore



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- What kind of air conditioning should my healthcare facility opt for?
- How do you create incentives for better performance of clinicians?
- What avenues are available to fund the expansion of your healthcare facility?

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Kodihalli
Bengaluru - 560008

Tel: 91 80 2521 3486/87
Fax: +91 80 2520 4141