Mobile Teleradiology Using Handheld Devices – Enabling Immediate Diagnosis

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1. Background and perspective on teleradiology
2. Mobile teleradiology enablers
3. Value proposition/benefits
4. Clinical scenarios/applications
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Advances in imaging technology, although clearly desirable, inevitably result in ever-increasing size and complexity of image data sets.

The healthcare enterprise is becoming more complex and physically distributed.

Both referring physicians and patients have ever-increasing expectations with respect to service quality, timeliness, and convenience.

Economic and staffing constraints will always be significant.

Challenges in Radiology 2013

- Increasing need for emergency imaging
  - Cancer, Heart Disease and Stroke on the rise
  - Crowded cities, more trauma
  - Standard of care demands immediate diagnosis

- Global radiologist shortages worsening

- Clinical colleagues need/expect to view images in real time

Behind every challenge is a corresponding opportunity
US 1:10,000
India 1:100,000
Indonesia 1:1,000,000
Zambia 1:10,000,000
It’s all about TAT

...Everything is ‘stat’
Potential solutions

- To use technology innovation effectively
- To train more radiologists
- To work 24 x 7 x 365 ..... 
- ..... Cloning ?
In emergency care situations

- Web-based platform, centralized reporting
- Report available within 30 minutes - to anywhere in the world
- Makes the radiologist more efficient and productive
Teleradiology Technology

- **Workflow** - process efficiency
- **Collaboration** - communication efficiency
- **Mobility** - access efficiency
The Next Frontier:
Mobile Teleradiology
Greater than 85% of respondents used a smartphone, of which the iPhone was the most popular (56%).

The most commonly used app types were drug guides (79%), medical calculators (18%), coding and billing apps (4%). The most frequently requested app types were textbook/reference materials (average response: 55%), classification/treatment algorithms (46%) and general medical knowledge (43%).

The clinical use of smartphones and apps will likely continue to increase, and we have demonstrated an absence of high-quality and popular apps despite a strong desire among physicians and trainees.

This information should be used to guide the development of future healthcare delivery systems; expanded app functionality is almost certain but reliability and ease of use will likely remain major factors in determining the successful integration of apps into clinical practice.
Recent Enablers of mobile teleradiology

- Mobile devices with high resolution monitors
- Internet cloud
- 3G wireless connectivity
The iPad’s 9.7-inch display provides 1024 x 768-pixel resolution at 132 pixels per inch (PPI). The larger display allows images to be displayed at their native resolution.

The iPad has a maximum luminance of 270 cd/m², which is higher than the average of 150-200 cd/m² seen in commercially available displays.
Viewer features

- Radiologist can zoom and adjust the window level, contrast and brightness of the image.
- Actual DICOM data and not just JPEG snapshots.
Cloud-based Teleradiology

- Extreme Redundancy
- Universal Access
- Cost Savings
  - Eliminates high infrastructure setup costs
  - Pay-per-use model
3G wireless broadband

- 3rd generation mobile telecommunications
- Packet switching technology
- About 10x the speed of 2G (20 Mbps)
- Wireless dongle or SIM
Advantages

• Immediate diagnosis
• Highly portable
• Increased radiologist productivity
• Collaborative approach
• Improved clinician access to reports

• Early and more accurate treatment
• Potentially lifesaving
• Training potential...
Phone versus Tablet

• Tablet
  • more optimal for use by a radiologist in the emergency preliminary read setting

• Smartphone
  • better utilized by a clinician
  - For secondary review of a patient image already interpreted by a radiologist
  - To assist in treatment planning
  - For accessing patient reports
SCENARIO A

- Patient presents with chest pain and shortness of breath
- Radiologist has left the hospital
- Technologist sends the images to the cloud
- Images are viewed on mobile device by radiologist
- Diagnosis – pulmonary embolism
- Radiologist calls back the physician in the hospital and confirms diagnosis
- Heparin treatment is administered
• Patient presents with headache after a motorcycle accident
• Radiologist detects a subdural hematoma on CT and calls the neurosurgeon who is seeing patients in clinic
• Neurosurgeon views images on his mobile and determines that surgery is necessary
• Patient shifted to the OR for emergency surgery
ScENARIO C

- Patient presents with acute onset left sided weakness
- Stat CT scan is performed
- Radiologist in hospital detects early stroke and calls neurologist
- Neurologist views images on smartphone and confirms indication for thrombolysis, advises in-house Medical officer
- Thrombolysis is administered
Role of iPad validated in:

1. CT Brain: Acute stroke, intracranial hemorrhage
2. MRI Brain: Stroke
3. Chest radiographs – pneumothorax, lung nodule detection, tube placement, pulmonary TB
4. Chest CT – pulmonary embolism
Other benefits

Kerbside consults, clinical rounds

Voice recognition integration
Are tablets secure?

✓ Tablet applications for Radiology need to ensure they use the SSL protocol or VPN for transferring the medical images and the access to these images is login controlled.

✓ The images are not actually stored on the Tablet but are always accessed from the server through the login based interface. Login timeout restricts the amount of time that the images are physically displayed on the device’s monitor.

✓ Ultimately it is the responsibility of the radiologist or physician to ensure the physical security of his/her portable device.
Limitations

- Given the small screen size it is difficult to view two series simultaneously or compare the current study with the prior.

- It is somewhat difficult to measure very small lesions, esp those under 5 mm in size. As a result, the size of a ureteric calculus can be overestimated.

-Source: Internal survey of TRS radiologists
FDA Approved Apps

- MIM software
  - Mobile MIM
  - Feb 2011 (CT, MRI), Dec 2011 (US, CR)
  - can be “sub-optimal” for viewing detailed images

- Aycan Medical Systems
  - Aycan viewer
  - September 2012
  - should only be used for primary diagnosis when a full workstation is not available

Source: http://mobihealthnews.com
An ever-increasing Number of Apps?

- Depending on the intended use, the FDA may treat each type of device as a unique product, requiring its own review and clearance.

- Android is an open-source operating system that runs on dozens if not hundreds of different products from multiple manufacturers, each with differing display characteristics—and there are multiple versions of Android, too.

- It would be prohibitively expensive to seek FDA approval on all the popular Android devices.
Mobile teleradiology: Taking healthcare delivery to the next level
February 24, 2011

December 2010

As seen in the Western world over the past two decades, teleradiology has revolutionized emergency radiologic diagnosis, minimizing the waiting time for outpatient radiologic reports. It is now also making a significant impact on raising the quality of diagnosis in remote areas. The convergence of these two trends is bringing up another paradigm shift in the form of mobile teleradiology.

Imagine a patient at a hospital in a tier 2 city being brought into the casualty with a head injury caused by an accident. The Computed Tomography (CT) scan is obtained immediately and reported by the radiologist. At the same time, the images are flashed onto the mobile device of a neurosurgeon who is examining a patient at his clinic in another part of the city. The neurosurgeon looks on the scan and the

http://modernmedicare.co.in/1092/taking-healthcare-delivery-to-the-next-level.html

http://mobihealthnews.com/10894/study-app-as-accurate-as-imaging-workstation-for-stroke-diagnoses/


iPad 2 and iPhone 4: Is It Feasible to Assess Acute Stroke Using an Apple Mobile Device? Fernando Garcia Garcia MD, PhD et al presented at RSNA 2011

First among Equals: Comparison of Image Quality between iPad and PACS Workstation for Detecting Pneumothorax on Chest Radiographs. Supriya Gupta MBBS et al presented at RSNA 2011

The Challenge:
Radiologist shortages

Technology Innovation: Mobile E-learning on the Tablet
Conclusions

- Teleradiology is today an established paradigm in healthcare delivery, and plays a critical role in emergency medical diagnosis.

- Using Mobile technologies allows for shorter report TAT, collaboration, and clinician participation.

- Mobile technologies can also be used to leverage E-learning in radiology, obviating shortages of teaching faculty.
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