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### The Role of Teleradiology in Emergency Radiology Provision

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#### Key Points

- *Teleradiology has had a major impact in decreasing report turnaround time, and in improving service levels in the emergency setting.*
- *Teleradiology in the emergency setting is usually associated with a strong peer review and quality assurance process. It has generated a cadre of specialised generalists, who excel in acute care interpretation. Hence report quality is enhanced.*
- *By using the centralised reading room coupled with the night-day model, radiologist productivity is increased and healthcare costs are reduced.*
- *In the emergency setting, communication levels between clinicians and radiologists remain high, commensurate with on-site radiology.*
- *The cons are related to insufficient adherence to regulations, corporatisation and predatory practices, which are economic and investor-driven rather than in the interests of patient care. Insufficient clinical history and large imaging datasets present a challenge.*

Teleradiology is today a word, which epitomises innovation in healthcare, symbolises efficiency in healthcare delivery, and represents a significant success story within the overall spectrum of telemedicine. From its early and fledgling days not much more than a decade ago, it has grown into a billion dollar industry, which has been the subject of business case studies at academic institutions while simultaneously providing significant value to patients, physicians, radiologists and entire healthcare systems.

Nowhere has teleradiology made greater impact than in the setting of emergency care, and it is this aspect that forms the focus of this article.

### **Impact of Teleradiology on Decreasing Report Turnaround Times and Improving Service Levels in the Emergency Setting**

The primary value proposition offered by emergency teleradiology is in the outsourced setting. A significant number of hospitals utilising teleradiology services in the United States (the first and to date the largest adopter of teleradiology) are small to mid-sized community hospitals. In these emergency rooms, prior to the adoption of emergency teleradiology, the scan often remained unreported until the next day, which could result in significant delays in treatment of critical conditions. Alternatively, the practice required the technologist to perform the CT scan and then wake up a radiologist at home in the middle of the night who had to come into the hospital each time to review the scan (and then work the next day). With the implementation of teleradiology systems the benefits have been dramatic. In the early days of our teleradiology practice, we repeatedly received feedback from emergency room physicians who commented on how much more preferable it was to work with a cooperative radiologist who was awake and desirous of providing, in comparison with the previously existing model. The service mindset of professionally run teleradiology companies has also led to higher service levels. Tight service level agreements between the hospital and the teleradiology service ensure very rapid report turnaround that benefits both the patient and the treating emergency physician. Thus, teleradiology has raised the bar for clinical service within the area of emergency care.

### **Clinical Role of Emergency Teleradiology**

The clinical entities which are most greatly impacted by emergency teleradiology include the most life threatening conditions, such as pulmonary thromboembolism, aortic dissection, ruptured aortic aneurysm, and acute stroke, in all of which the cost of delayed diagnosis can be catastrophically high. By creating a framework whereby all emergency scans are reported within a 30 minute time frame, with further electronic prioritisation of critical examinations as STAT (i.e., immediate) priority, teleradiology has allowed for immediate diagnosis of such conditions, which in turn facilitates early intervention and superior patient outcomes.

In the setting of acute stroke, teleradiology plays a critical role. The development of stroke centres at community hospitals across the US has allowed for early treatment of acute ischaemic stroke in keeping with the dictum 'Time is brain'. Teleradiology plays an important role in minimising the time to thrombolysis by allowing for immediate detection and communication of the earliest changes of acute ischaemia on CT scan within a few minutes of post scan completion. The teleradiologist can simultaneously define the patient subgroup wherein thrombolysis is contraindicated and further guide therapy. In emergency teleradiology practices such as our own, stroke examinations form an interesting and challenging subset. By reporting stroke examinations performed halfway across the world within a 10-15 minute timeframe, practices such as ours allow for continued success of hospital stroke programmes allowing them to meet their time compliances consistently and reliably.

### **Technology Advances**

Technology advances, such as the use of mobile devices, have further extended the reach and improved the efficiency of teleradiology, especially in acute stroke. Today, teleradiology is used by neurologists to view head CTs on their tablet devices and smartphones in the setting of acute stroke. The obvious corollary is that emergency teleradiology is now not restricted to radiologists' reading rooms, and can be accessed by physicians and radiologists while on the move, thereby enhancing their availability and productivity and decreasing time to diagnosis in the emergency setting.

Other technology paradigm shifts, such as the use of wifi and the Internet cloud have further strengthened teleradiology practice by allowing efficient image distribution that obviates any

potential delays in the emergency care environment.

### **Teleradiology in the Emergency Setting Enhances Report Quality**

Emergency teleradiology has engendered a cadre of specialised generalist radiologists, who excel in acute care interpretation. These radiologists have considerable expertise and experience in the diagnosis of acute conditions, as well as a comfort level in a wide range of modalities that renders them uniquely competent to fulfill their role. Their understanding of the needs of the emergency milieu also renders their reporting more focused and directed and hence, more relevant for the emergency setting. Thus, overall, reporting quality is enhanced in the setting of emergency teleradiology.

Furthermore, teleradiology services are intrinsically associated with a strong peer review process. First, many emergency teleradiology reports are delivered in a wet-read format, which is overread by an onsite radiologist the next day, effectively resulting in 100% peer review. Additionally, the competitive nature of the teleradiology market necessitates that providers of teleradiology services need to demonstrate high quality levels in order to retain their business. In our practice a significant amount of radiologist time is spent in peer review related activities, including CME, and our research into this area reflects the same focus. This is derived from the fundamental philosophy that teleradiology is only viable if it affords a quality of service that exceeds that which was otherwise/previously available on-site.

Further, the use of the day-night emergency teleradiology model promotes superior radiologic reporting quality as numerous studies have demonstrated that physician decision-making is superior by day than by night, for reasons of physiology and biorhythm.

### **Teleradiology Increases Radiologist Productivity and Diminishes Healthcare Costs**

The practice of emergency teleradiology is geared towards reporting efficiency, given that its primary goal is to generate and deliver an accurate and comprehensive report in the shortest possible time. This in turn promotes the most efficient usage of that most valuable commodity, radiologist time, which has the potential to greatly decrease systemic healthcare costs. Distribution of the caseload across the teleradiology enterprise ensures that radiologist time is never wasted and is most efficiently utilised, while at the same time accommodating for spikes and troughs in workload.

The reduction of healthcare costs by emergency teleradiology is further facilitated by the day-night model wherein teleradiologists are geographically based diametrically across the globe from the hospitals where they provide services, a model that was pioneered by our organisation, among others. This 'follow the sun' model ensures that the radiologist does not need to stay awake at night, which obviates the need for a night shift module (wherein a radiologist is only productive every alternate week, requiring time to restore biorhythms). In the day-night model however, the radiologist performs a day job and therefore works a full quota of days in a year, thereby delivering greater productivity for lesser cost.

### **High Communication Levels Between Clinicians and Teleradiologists**

In the setting of emergency teleradiology, most communication occurs via two media, electronic and verbal (telephonic). Given that within the healthcare enterprise today, a significant quantum of physician-physician communication is telephonic, the additional distance of the teleradiologist in no way detracts from the level of interaction. Similarly, collaborative workflows allow for simultaneous viewing and discussion of complex cases.

Critical values communications are frequent in emergency teleradiology, given that the clinical spectrum is primarily directed towards acute care. In contrast to the initial concerns that teleradiology diminishes verbal interaction, the quality of verbal communication is in fact enhanced by emergency teleradiology, since the physician and radiologist staffing patterns tend to parallel each other, allowing for strong, albeit virtual physician-radiologist relationships.

Teleradiology providers today utilise sophisticated workflow platforms that allow for efficient distribution of images and reports across the enterprise. These platforms are extremely sophisticated and may even outperform large enterprise type PACS. A combination of utilisation of e-faxing systems and online report access from the Radiology Information System allows for seamless connectivity between hospital and teleradiology centre. Coupled with messaging systems technology that alerts referring physicians to positive results, the entire electronic enterprise that forms the foundation for teleradiology is geared towards effective and efficient communication of positive and, in particular, critically positive results.

### **Emergency Teleradiology: The Cons**

Having listed the pros of emergency teleradiology it is necessary to also examine its cons.

Some teleradiology providers have in the recent past become increasingly corporatised and investor- or market-driven. With private equity investors actively seeking out funding opportunities and rapidly growing teleradiology firms who see value in taking external investment to rapidly scale, the stage has been set for aggressive growth and funding/investment in teleradiology. The issue with this is that it subjects teleradiology providers to influences that are determined and driven by financial constraints rather than the quality of care.

Competition and the pressure to grow rapidly and be profitable also lead to rapid changes in business model, which are not always desirable. Over time, emergency after hours teleradiology providers begin to provide 24 x 7 coverage with on-site staffing. The effect of this is to pit the teleradiology provider as a predatory antagonist pitted against the on-site radiologist, which is not a healthy situation. Teleradiology is meant to be a support for existing radiologic practice, and should not aim to replace the on-site radiology practice, which will always remain a critical part of the healthcare paradigm. In the United States, some large corporatised teleradiology providers have come under scrutiny for adopting practices that have led them to compete with, and potentially displace locally established clinical radiology practices.

One of the challenges that is currently faced in the practice of emergency teleradiology is the lack of relevant and comprehensive clinical data. All too often the clinical information provided is in the form of a cryptic 'abdominal pain' or 'trauma' with no reference to the specific location or nature of the pain/trauma, associated symptoms or relevant clinical examination, laboratory results or pertinent surgical history. Interpreting scans without the availability of relevant clinical information is not in the interest of optimal patient care. However, this is only a temporary challenge, as Health Level 7 (HL7) interfaces permit the extraction of relevant information from the hospital information systems (HIE) to be made available to an interpreting radiologist on their Radiology Information System (RIS), and so this negative will soon be history.

The evolution of increasingly large imaging datasets, in the era of ultrathin section, high resolution CT and MRI, also poses a potential challenge to emergency teleradiology. If the scan takes a longer time to transmit because of large file size, then this may potentially impact on the reporting time. However, solutions already exist in the form of technologies such as multi-threading routers and with the ever-increasing magnitude of high bandwidth connectivity spectrum, this too shall pass.

## **Conclusion**

In summary, the benefits afforded by emergency teleradiology by far outweigh the negatives, and the overall value proposition of teleradiology in the emergency setting remains sound and robust.

If practised conscientiously and, if permitted to grow and deliver its true value, emergency teleradiology has the potential for sustaining a paradigm shift that will truly benefit emergency medical care, enhance patient outcomes and save many lives.

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