Radiology to the Rescue: Our Role in Global Disasters and Local Emergencies

Throughout history, radiology has played a paramount role in the provision of diagnostic and therapeutic services on both a global and local scale. From pandemics to natural disasters, radiology has acted as the cornerstone of care in crisis, acting not only as a diagnostic tool but a provider of pivotal information that shapes patient outcomes. This essay explores the indispensable role of radiology in local emergencies and global disasters, highlighting its unique contributions.

Radiology in Global Health Crisis: Provision in Pandemics

Radiology plays a pivotal role in managing global health crises, particularly pandemics, where its function extends beyond diagnosis to include grading disease severity, monitoring disease progression, and identifying complications, all of which are crucial for optimising patient outcomes. In pandemics, where novel pathogens present unknown challenges, radiology can shed light on disease and offer critical insights that inform clinical decision making, as demonstrated during the COVID-19 pandemic.

The primary diagnostic tool, real-time reverse transcriptase PCR (RT-PCR) from nasopharyngeal swabs, offered high specificity but variable sensitivity, ranging from 80-90%, potentially leading to false negatives. A study published in *The British Medical Journal* reported that RT-PCR tests missed approximately 20% of COVID-19 cases, particularly in the early stages of infection [1]. In contrast, research published in *The Lancet* highlighted that CT scans had a sensitivity of around 91% for detecting COVID-19 pneumonia [2]. Furthermore, radiology was essential in measuring disease severity and identifying potential sequelae, such as pulmonary fibrosis. For instance, ground-glass opacities and consolidations on chest CT scans provided crucial information on the extent of lung damage. A study published in *Clinical Radiology* revealed that 15% of COVID-19 patients developed long-term lung abnormalities, more readily detectable through imaging than RT-PCR alone [3].

Radiology also enabled the monitoring of disease progression, offering early insights into complications such as acute respiratory distress syndrome (ARDS) and thromboembolic events. A cohort study from *The British Journal of Radiology* demonstrated that regular chest CT imaging helped tailor treatment plans for over 500 patients, where early detection of complications significantly impacted patient outcomes, particularly as ARDS increased mortality rates [4].

The pandemic's demands on radiology resources and time were unprecedented, yet radiology adapted by developing innovative strategies, including the integration of artificial intelligence (AI) and mobile imaging units. AI-driven tools, such as those developed by UK-based Kheiron Medical Technologies, processed thousands of chest CT scans daily, identifying key abnormalities and predicting patient outcomes. For example, AI algorithms achieved over 85% accuracy in detecting COVID-19 pneumonia and predicting disease severity, which was crucial for resource allocation and treatment prioritization in overburdened healthcare systems [5]. Additionally, portable imaging technologies played a vital role. Mobile X-ray units and handheld ultrasound devices were deployed across

numerous UK hospitals, enabling timely and accurate diagnoses for patients in isolation or overwhelmed healthcare settings. The use of mobile X-ray units in London hospitals during the pandemic's peak highlighted their value in providing rapid assessments, particularly in intensive care units (ICUs) where traditional imaging methods were less accessible [6].

Radiology in Natural Disasters: From Rapid Reponses to Surveillance Scanning

Radiology plays an integral role in the response to natural disasters, acutely in providing rapid diagnosis and long term with its monitoring and surveillance capabilities. Mobile imaging units enable rapid on-site detection of injuries in field hospitals during emergencies. This was exemplified during the 2010 Haiti earthquake, when the International Atomic Energy Agency (IAEA) deployed eight mobile X-ray units to Port-au-Prince. These units were essential for swiftly diagnosing injuries such as internal bleeding and for managing conditions resulting from displacement, such as respiratory tract infections [7].

Similarly, during Hurricane Harvey in 2017, the Harris Health System's mobile units conducted over 2,000 X-rays and ultrasounds in shelters, temporary clinics, and field hospitals set up for displaced populations, facilitating immediate diagnosis and treatment [8]. The use of teleradiology was also critical during the hurricane, as it allowed remote interpretation of images from inaccessible locations and led to a 50% increase in workload, alleviating the burden on local healthcare providers [9].

The 2018 Sulawesi earthquake and tsunami in Indonesia further demonstrates the role of radiology in the triage and prioritisation of patients with severe internal injuries. Doctors Without Borders (Médecins Sans Frontières) utilized handheld ultrasound devices to perform Focused Assessment with Sonography for Trauma (FAST) exams, enabling quick detection of internal bleeding which was essential for timely surgical intervention [10]. Furthermore, innovative solutions have allowed radiology to adapt to the challenges of natural disasters. For instance, during Hurricane Maria in 2017, solar-powered imaging units provided essential support amid widespread power outages [11].

Beyond the acute use of imaging, radiology plays a unique role in the aftermath of a disaster as it can aid in monitoring long term impact. This is demonstrated by the 2011 Fukuskima Daiichi nuclear disaster where whole-body counter (WBC) scans were used to measure levels of radioactive isotopes. Similarly, radiological surveillance initiatives such as The Fukushima Health Management Survey (FHMS) used thyroid gland ultrasound scans to detect thyroid abnormalities. Such initiatives helped to mitigate the anxiety of survivors by providing objective information, alleviating the psychological burden of the disaster [12]. These interventions emphasise the multifaceted role of radiology in both immediate and ongoing public health efforts.

Radiology in Local Emergencies: Mass Casualty Management

In mass casualty events, radiology has demonstrated remarkable adaptability, tailoring its techniques to meet the unique challenges of each disaster. The role of radiology in forensic search and rescue operations was notably highlighted during the 2001 World Trade Centre attacks. High-resolution CT scans were crucial in locating and analysing victims trapped

under debris, as discussed in the *Journal of Forensic Sciences* (2010). This imaging technology was instrumental not only in identifying victims but also in providing much-needed closure for affected families. Similarly, the 2015 Nepal earthquake demonstrated the vital role of portable imaging in triage. Field-deployed X-ray and ultrasound devices enabled rapid assessment of injuries, allowing medical teams to prioritize life-threatening conditions such as severe fractures and internal haemorrhages. Weller et al. (2017) highlight how these portable imaging technologies helped streamline the triage process, ensuring that critical cases received immediate attention while less severe injuries were managed appropriately [13]. On a wider level, data from these field imaging units contributed to effective resource allocation by identifying areas with the highest injury severity, improving the overall efficiency of emergency management.

Radiology in Major Sporting Events: Powering Performance

In large scale sporting events, where athletes are at high risk of injury, onsite radiology services are paramount in ensuring timely diagnosis and treatment and thus the safety of high performing athletes. During the 2012 London Olympics, the on-site team conducted over 500 imaging studies to manage a range of injures such as fractures, dislocations and soft tissue damage. A study published in *The British Journal of Sports Medicine (2013)* found that the immediate access to imaging was crucial in enabling rapid decisions to be made about whether athletes were able to continue competing safely or if immediate medical attention was required [14]. Similarly, radiology plays a preventative role in sporting events where pre-competition screenings enable the detection of conditions that predispose athletes to injuries. This was the case in the 2014 Winter Olympics where MRI screenings pre-competition identified athletes with asymptomatic injuries, which allowed them to receive early medical treatment and reduced the incidence of serious injury during the competition [15].

Furthermore, radiology played not just a reactive role to injury but a performance enhancing role in the 2016 Rio de Janeiro Olympics where MRI techniques were used to identify early stress injuries and muscle fibre microtears enabling the medical team to implement more nuanced therapies and allow athletes to perform at their most optimal condition [16]. Furthermore, radiology continually adopts new techniques to meet the demands of pressurized environments, as demonstrated during the 2018 PyeongChang Winter Olympics. A study published in *Radiology* (2019) discusses the use of cloud-based systems, which allowed imaging data from the events to be shared to remote specialists worldwide, gaining real-time expert consultation on complex cases. This is an example of how radiology was able to utilise advancements in technology to provide quality care in a pressured and high stakes environment such as a major sporting event [17].

Conclusion

The role of radiology is multifaceted, from disease detection to mass casualty management, it is paramount to public health protection. Radiology can act as a universal visual language, providing clarity in crisis. Harnessing the power of technological advancements to create innovative medical solutions allows radiology to adapt to challenging situations. With the

field ever-evolving, radiology will only continue to be at the forefront of critical events worldwide.

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