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Radiological Manifestations and Imaging-Guided Interventions in Infectious Diseases:

(Review Artical)

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Abstract

Background: The frequency of emerging infectious illnesses has reached unprecedented levels, making it crucial to comprehend their management in an ever more interconnected global society.

Aim of Study: This study provides a comprehensive analysis of the existing literature on the use of radiography in the diagnosis and treatment of Ebola (EVD), Zika (ZVD), Chikungunya (CHIKF), H1N1, Middle East Respiratory (MERS), and Severe Acute Respiratory Syndrome (SARS) viruses.

Methods: An extensive literature search was performed using the PubMed database.

Results: Advanced methods are necessary to properly use portable imaging in EVD in order to avoid the transmission of illness inside a healthcare setting. Antenatal ultrasonography in ZVD has the capability to promptly identify fetal anomalies, enabling the provision of appropriate treatment and assistance to families afflicted by such conditions. Imaging is valuable for evaluating the degree of chronic CHIKF involvement and tracking the effectiveness of therapy. Chest radiography and CT scans are crucial for diagnosing and monitoring viral diseases that predominantly affect the respiratory system, such as H1N1, MERS, and SARS.

Conclusion: Radiology has a diverse function in developing infectious illnesses, necessitating knowledge of disease transmission and safe imaging methods, as well as understanding the imaging characteristics that impact clinical care.

Key Words: *Radiology – Review – Ebola (EVD) – Zika (ZVD) – Chikungunya (CHIKF) – H1N1 – Middle East Respiratory (MERS) – Severe Acute Respiratory Syndrome (SARS) viruses.*

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Introduction

EMERGING infectious diseases, as defined by the CDC, are diseases that have either increased in occurrence in humans over the past 20 years or have the potential to increase in the near future. This increase in prevalence can be attributed to factors such as increased international travel, the development of antibiotic resistance, and the expansion of industrialization and globalization in food production and distribution. Emerging infectious illnesses are now being identified at a concerning frequency of one per year, which is attributed to the appearance of new infectious agents or the resurgence of already known diseases **[1]**.

Aim of work:

This research investigates the effectiveness of several imaging modalities in assessing and treating newly occurring infectious illnesses. These include illnesses characterized by systemic symptoms resulting from infection with the Ebola, Zika, and Chikungunya viruses, as well as infections mostly affecting the respiratory system caused by the H1N1, MERS, and SARS viruses. Although Multi- and Extensively Drug Resistant Tuberculosis are significant emerging infectious diseases, this study does not cover this issue. The discussion will also include an approach to imaging in settings with limited resources, focusing on the essential safety measures needed to avoid the transmission of infectious pathogens inside healthcare facilities.

Ebola Virus Disease (EVD):

The Ebola viruses belong to the Filoviridae family and are a collection of RNA viruses. They were first discovered in humans in the Democratic Republic of Congo (previously known as Zaire) in 1976 **[2,3]**. Since its discovery, Africa has had sporadic epidemics of the virus, which may be attributed to population expansion and direct contact with

animals, leading to an escalated transmission rate. There are four viral strains in the genus Ebolavirus that induce illness in humans, with a collective average mortality rate of 50% [4]. Zaire Ebolavirus, which is highly pathogenic, has a mortality rate of 67%. It had a significant role in the West African Epidemic of 2013, originating in Guinea and rapidly spreading to Liberia and Sierra Leone. The epidemic reached its highest point in 2014 and concluded in 2016. It was the most extensive documented outbreak of Ebola Virus Disease (EVD), with more than 28,000 reported cases and 11,000 fatalities (although the actual scale of the outbreak is likely to have been underestimated) [3]. The Ebola Virus Disease (EVD) is now in progress, with more recent and lesser instances of outbreaks occurring in the Democratic Republic of Congo in 2018 [5]. African fruit bats are considered to be the primary host for humans and other primates.

The transmission of the Ebola virus occurs via the exchange of body fluids from individuals who are infected, and it enters new hosts through mucous membranes or damaged skin [6]. The incubation period ranges from 3 to 21 days, after which symptoms such as fever, intense headache, muscle pain, fatigue, diarrhea, vomiting, and, in extreme instances, bleeding occur [7]. An essential aspect of managing Ebola Virus Disease (EVD) is to effectively confine and control the highly transmissible virus. This involves conducting contact tracing, using personal protective equipment, and implementing proper burial procedures. The treatment involves providing assistance, such as administering intravenous fluids and replenishing electrolytes. In resource-limited settings, therapeutic options are frequently restricted to oral rehydration because to the unavailability of other supportive treatments such as mechanical ventilation and temporary hemodialysis, which are often used in rich countries [8]. In 2018, a genetically modified Zaire Ebola vaccine, which shown a high level of effectiveness against the Zaire strain, was used for the first time to halt an epidemic in the Democratic Republic of Congo.

The function of radiography in assessing and treating patients with EVD is restricted [8,9]. Imaging is more beneficial for monitoring supportive therapy rather than assessing the direct impact of the illness on particular organs, due to its systemic and non-specific symptoms [7,8]. While imaging may not be readily available in resource-limited situations, it becomes increasingly necessary when supporting interventions such as central venous access or mechanical breathing are accessible. Point of care ultrasonography (US) is beneficial in the installation of central venous catheters and in the evaluation of related problems, such as pneumothorax or deep venous thrombosis. Chest radiography is valuable for monitoring the condition of the heart and lungs, evaluating the positioning of central lines and endotracheal tubes, and deciding the need for invasive interventions such as endotracheal intubation [10].

When it is necessary to do imaging on patients with EVD and there are enough resources, the task of executing safe and effective techniques becomes a distinct problem. Due to the heightened security measures necessary for the secure acquisition of photographs, there is a need for more supplies and staff. The Ebola virus is transmitted by contaminated human fluids, which may remain viable on surfaces for a period of days to weeks. Prior to being used on additional patients, medical imaging equipment must undergo decontamination, which restricts the use of imaging modalities to portable methods such as radiography and ultrasound [6,8]. The use of CT and MRI scans would heighten the likelihood of transmission to patients and healthcare personnel and is often not accessible in locations impacted by EVD [11].

Emory University published their protocols in 2015 for safely obtaining portable US and chest radiographs in their Ebola isolation unit. The protocols involve a multi-step process that requires multiple staff members, multiple plastic coverings over imaging equipment, and the use of an anteroom to prepare and sanitize equipment entering or leaving the patient's room [8,12]. Several other hospitals have used such policies and effectively averted the transmission of the Ebola virus to healthcare personnel who were treating Ebola patients [7,9]. When creating a strategy for imaging Ebola virus patients, it is crucial to use materials that effectively eradicate the virus without causing harm to the medical equipment. Chlorine-based cleaning chemicals may lead to the degradation of the electrical contact plates in batteries and charging stations used in the United States [10]. It is preferable to have a completely digital technology that allows the x-ray detector to communicate pictures wirelessly. This would enable the equipment to stay in the patient's room for the whole duration of the therapy. However, this is often unavailable in regions impacted by EVD [7,8].

According to the World Health Organization (WHO), around 3-4% of Ebola patients are healthcare workers. This emphasizes the need of preventing the transmission of the virus inside hospital settings, known as nosocomial dissemination [13]. Reducing the interaction between hospital personnel and patients or contaminated body fluids is a crucial measure. While ultrasounds and radiographs are usually obtained by technicians, it is possible to teach other members of the treatment team to gather pictures. This may help reduce the risk of exposure [8].

In resource-limited settings, imaging patients with EVD is only done when there are special reasons to do so. This is done using portable ultrasound (US) and portable chest radiography. Imaging of

patients with this very infectious illness must follow rigorous criteria that ensure accurate diagnosis while minimizing the risk of spreading the virus.

Zika Virus Disease (ZVD):

The Zika virus is an arbovirus belonging to the Flaviviridae family. It was first discovered in 1947 when it was isolated from a macaque monkey in the Zika forest in Uganda. Subsequently, in 1952, it was also found in people. The virus, which was once limited to a region spanning from Africa to Southeast Asia, gradually expanded its reach to the Americas between 2007 and 2016 **[14]**. Prior to the major Zika virus disease (ZVD) pandemic in 2015, there were two minor outbreaks in Micronesia in 2007 and in Oceania in 2013-2014. The 2015 epidemic originated in Brazil and rapidly expanded over North, Central, and South America, as well as the Caribbean **[14]**. The pandemic spread, which occurred from 2015 to 2016, was assisted by anthropogenic climate change, resulting in higher temperatures and greater precipitation. The Zika Virus Disease (ZVD) impacted around 1.5 million individuals in Brazil, leading to more than 3800 instances of microcephaly **[14]**. The main mode of Zika virus transmission occurs when an individual is bitten by a mosquito that is infected with the virus, either the Aedes aegypti or Aedes albopictus species **[14]**. After being infected, transmission between humans may occur by vertical transmission (from an infected pregnant mother to the fetus) or sexual transmission **[15]**. Most infections occur without symptoms.

If ZVD is clinically evident, the symptoms are often moderate and non-specific, such as fever, maculopapular rash, conjunctivitis, arthralgias, and exhaustion, which may last for up to 1 week **[14]**. Congenital Zika syndrome may be caused by Zika virus infection in fetuses and neonates. Congenital infection leads to direct cellular damage to brain tissue, causing microcephaly and retinal impairment. It may also result in less frequent abnormalities such as congenital contractures and hypertonia. Zika infection in adults and older children may lead to various neurological symptoms, such as Guillain–Barre Syndrome and neuropathy **[16]**. The World Health Organization (WHO) advises maintaining constant alertness about the Zika virus infection, since it persists in spreading as a result of climate change, urbanization, and globalization **[17]**. Currently, there is no targeted treatment for Zika infection, however many vaccines started clinical studies in 2017.

The Zika virus poses an unequal danger to communities with fewer resources, since many of the nations it impacts do not have the necessary medical facilities to conduct diagnostic testing **[14]**. Distinguishing between Zika, Chikungunya, and Dengue infections is tough due to the extensive overlap in symptomatology. Without correct laboratory testing, it is difficult to differentiate between these endemic viral disorders. In ZVD, radiology primarily serves the purpose of prenatal screening for individuals who are suspected of having congenital infection. Prenatal ultrasonography enables timely identification of fetal anomalies linked with Zika virus and supports prompt provision of treatment and assistance to affected families, as stated in the WHO Zika Strategic Response Plan **[17]**.

Ultrasound (US) is highly ideal for prenatal screening in settings with low resources due to its safety, affordability, and ease of access as an assessment approach. The CDC advises that in cases of suspected congenital Zika syndrome, it is recommended to have ultrasound scans every 3-4 weeks in order to monitor the growth of the fetus and detect any evidence of infection or abnormal fetal development **[15]**. Microcephaly, which is defined as a head circumference more than two standard deviations below the average for the stage of pregnancy, is the most often seen result in prenatal ultrasounds. Nevertheless, the absence of prenatal normocephaly does not rule out the possibility of congenital Zika infection, since microcephaly may manifest postnatally. A research conducted in Colombia examined pregnant women who were proven to have Zika infection. The study discovered that there was a delay of 15 to 24 weeks from the time the mothers were diagnosed and the development of fetal microcephaly. The earliest identification of microcephaly occurred when the gestational age of the fetus was 24 weeks. Hence, it is necessary to do comprehensive fetal neuroimaging throughout pregnancy in instances where there is suspicion or confirmation of infection. This is because a normal fetal ultrasound before 24 weeks of gestation cannot rule out the potential development of congenital Zika syndrome.

The supplementary intracranial ultrasound findings include cerebral parenchymal atrophy and the accompanying enlargement of the ventricles, subependymal pseudocysts, anomalies in the eyes, and underdevelopment or absence of the corpus callosum, cerebellum, and brainstem **[18]**. Parenchymal calcifications may also arise, generally seen at the interface between gray and white matter. Additional findings on ultrasound that are not related to the nervous system are less precise and consist of increased brightness in the colon, enlargement of the liver and spleen with calcifications in the liver, and a condition called talipes equinovarus **[15,19]**.

Magnetic Resonance Imaging (MRI) offers a more comprehensive evaluation of the neurological symptoms associated with congenital Zika syndrome, whether seen before or after birth. Unfortunately, MRI is often unavailable in situations with restricted resources **[20]**. The MRI results are comparable to those of the ultrasound (US), but MRI offers a more distinct depiction of the patterns of cortical atrophy, white matter abnormalities associated with aberrant myelination, and underdevelopment of the corpus callosum, cerebellum, and brainstem (Fig. 1) **[18,21]**.

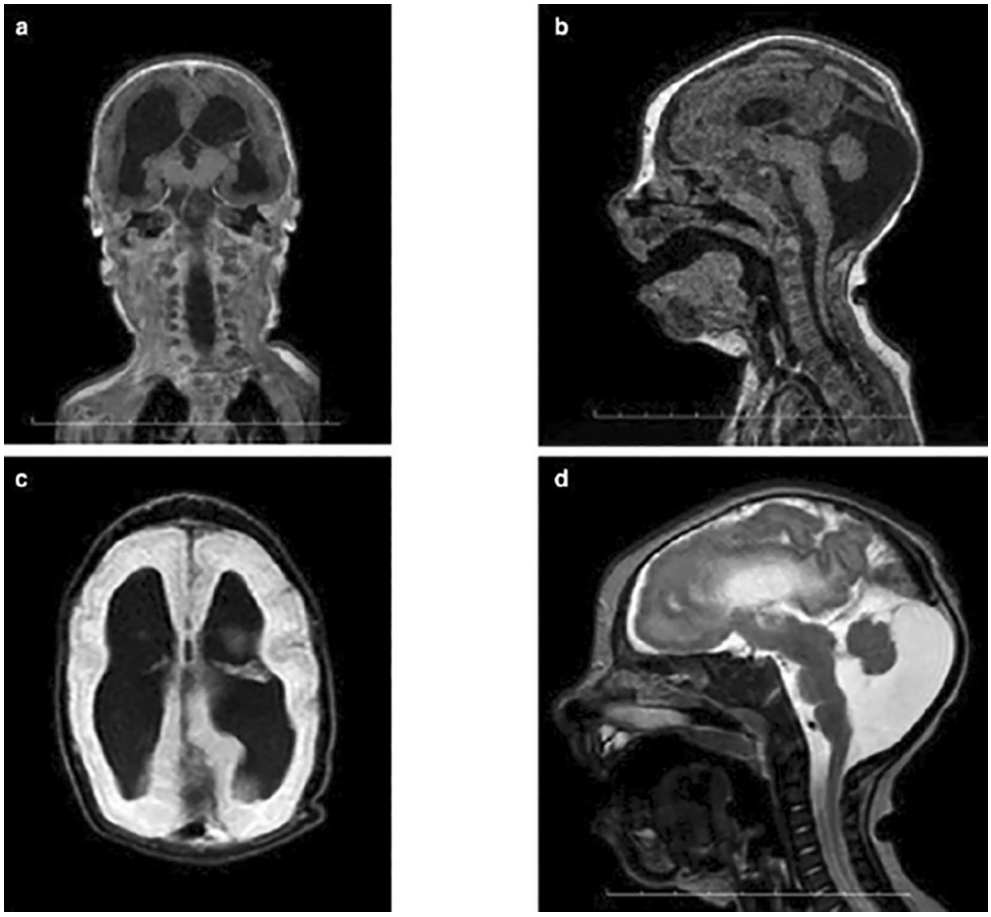

Fig. (1): An infant has been diagnosed with congenital Zika virus infection, which has resulted in widespread cortical atrophy and underdevelopment of the corpus callosum, cerebellum, and brainstem. The results are shown by a coronal fluid-attenuated T2, sagittal fluid-attenuated T2, axial fat-saturated T1, and sagittal T2 weighted MRI.

Postnatal Computed Tomography (CT) may also evaluate congenital abnormalities, however it is less readily available compared to ultrasound (US). Computed tomography (CT) is a very sensitive imaging technique used to identify calcifications in the tissue. Unlike ultrasound (US), CT does not rely on the presence of open fontanelles to provide clear images. CT is more economically viable and accessible than MRI, making it a more practical option in regions with limited resources. The computed tomography (CT) scans reveal the presence of abnormal calcifications in the brain tissue, which are characteristic of congenital Zika virus infection. These calcifications are often located at or below the intersection between the cortex and the medulla of the brain. Over time, these calcifications tend to diminish in both size and quantity. Additional discoveries include the consequential consequences of worldwide reduction in cerebral cortical volume, such as enlargement of the brain's ventricles, incongruity between the size of the skull and face, collapse of cranial bones with protrusion of the occipital bone, and diminutive fontanelles **[18,20]**. CT is especially valuable in monitoring for hydrocephalus after the fontanelles have closed, a condition that affects up to 40% of children and typically requires the implantation of a VP shunt **[20]**.

Unlike Ebola virus, the imaging of patients with Zika virus is not limited by infection control measures, since transmission of Zika virus only occurs via sexual or vertical transmission, rather than through direct human-to-human contact. Diagnostic ultrasonography, computed tomography (CT), or magnetic resonance imaging (MRI) may be conducted by following established safety protocols and using appropriate personal protection equipment. Radiology staff must possess knowledge of standard precautions, which encompass the correct utilization of personal protective equipment, proper adherence to contact and airborne precautions, and adherence to the "5 moments for hand hygiene": Prior to making contact with a patient; prior to any clean or aseptic procedure; following exposure to bodily fluids; following contact with a patient; and following contact with a patient's immediate environment **[22]**. Congenital Zika disease may significantly impact the development of the brain. Thorough risk assess-

ment and regular prenatal ultrasound evaluations may aid in the identification of fetal abnormalities, such as microcephaly and several other intracranial symptoms. If accessible, more sophisticated imaging methods like as CT or MRI may provide further details on brain abnormalities and track the development of issues after birth.

Chikungunya Fever:

Chikungunya fever (CHIKF) is a viral illness caused by an RNA virus belonging to the Togaviridae family. It is transmitted to humans by the bite of mosquitos, namely the Aedes aegypti and Aedes albopictus species. These mosquitos are also responsible for spreading the Zika and Dengue viruses. The term "chikungunya" in the Makonde language, spoken in southeast Tanzania and northern Mozambique, is "walking in a stooped posture," which accurately describes the intense joint pain experienced by those affected by the illness **[24]**. The virus was first obtained in 1955 after an epidemic occurred on the Makonde Plateau in 1952. Although sporadic outbreaks have taken place in Africa and Southeast Asia for the past five decades, significant outbreaks in Kenya in 2004 and in the west Indian Ocean region (Comoros, Mayotte, Mauritius, the Seychelles, and Reunion) in 2005 have resulted in a global rise in the prevalence of the disease, as well as an increase in travel-related infections in areas where the disease is not endemic **[23,25,26]**. Brazilian infections constitute 94% of all confirmed cases in the Americas, and there was also a significant epidemic during the 2016 Olympic Games in Rio de Janeiro **[27]**.

From a clinical perspective, CHIKF may be categorized into acute and chronic stages. The acute phase usually has a duration of 7 to 10 days and is characterized by symptoms such as fever, rash, intense joint pain affecting the hands and feet, and exhaustion (Fig. 2). Approximately 50% of patients progress to the chronic phase, also known as "chronic migratory rheumatism," during a period of 3 months to 3 years **[23,26,27]**. Elevated levels of prostaglandins enhance the activation of nociceptors, which heightens pain sensitivity and promotes the activity of osteoclasts, leading to the erosion of bone tissue **[28]**. Other areas where inflammation may occur include lymph nodes, skin, liver, and spleen **[29]**. The chronic stage of the illness usually affects the hands, wrists, and ankles in a distal, symmetric, and polyarticular manner **[23]**. Uncommon neurological consequences include seizure, encephalitis with reduced limb movements and extension of the foot, and neuropathic pain **[27]**. The diagnosis mostly relies on clinical assessment, which is further supported by biochemical confirmation. The treatment is mostly focused on alleviating symptoms and involves the use of anti-inflammatory drugs. At now, there is a lack of antiviral therapy and immunization options.

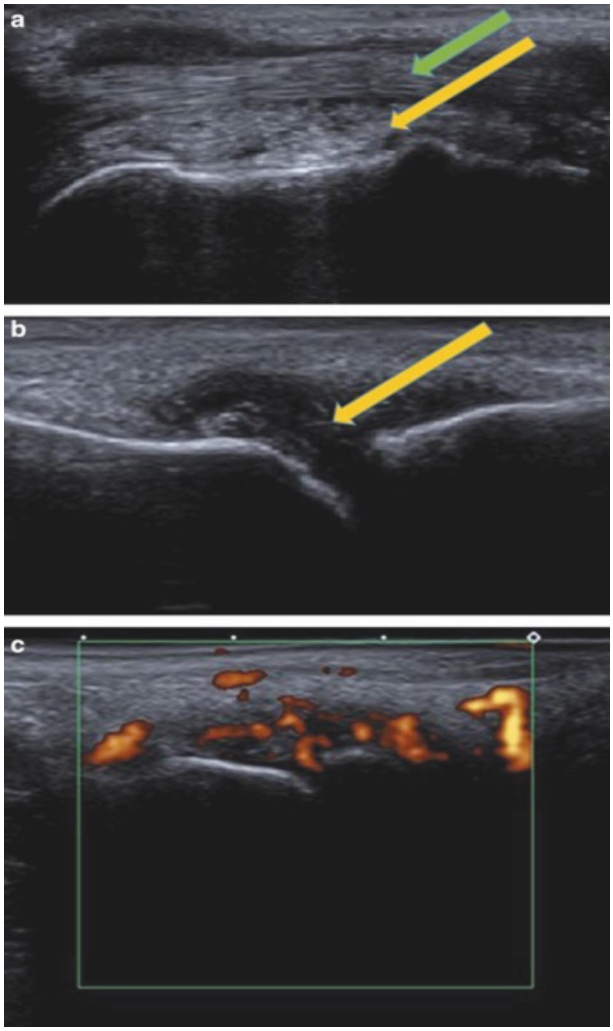

Fig. (2): A 22-year-old woman with Chikungunya fever arrived with a duration of 6 weeks with polyarthritis and a low-grade fever.

Musculoskeletal imaging, including radiography, ultrasound, and MRI, is valuable for evaluating the degree and scope of illness throughout the chronic stage. The abnormalities seen on hand radiographs include periarticular osteopenia (18%), osteoarthritis (14%), soft tissue edema (10%), and marginal erosions (2%) in rare cases **[27]**. An ultrasound examination reveals tenosynovitis affecting the small joints of the fingers, joint capsule swelling (84%), wrist fluid accumulation with non-compressible thickening of the synovial lining (74%), inflammation of the finger flexor tendons (70%), cellulitis, inflammation of the wrist extensor tendons (38%), and thickening of the median nerve (36%) **[23,27]**. The MRI shows comparable results, including inflammation of the tendon sheaths and fluid accumulation in several joints, however the presence of destructive alterations may be more noticeable **[24]**.

The neuroimaging findings of CHIKF are not specific and consist of limited diffusion and aberrant signal on fluid attenuation inversion recovery

(FLAIR) in the white matter of the frontoparietal lobes on MRI, with or without augmentation using contrast. These imaging results have similarities with various viral encephalitides, demyelinating illness, vasculitides, and cancer. Characteristic enlargement and clumping of the nerve roots of the cauda equina have been seen in the spine. However, similar findings may also be present in cases of West Nile Virus, arachnoiditis, and subarachnoid dissemination of tumor **[25]**.

H1N1 Viral Influenza:

H1N1 is an influenza A virus belonging to the orthomyxovirus family that emerged in Mexico in 2009. The first influenza pandemic of the 21st century resulted in the transmission of the illness to over 190 nations and territories, leading to an approximate total of 61 million cases **[30,31,32]**. The H1N1 2009 influenza virus emerged from the combination of many influenza strains, including two strains from pigs, one strain from birds, and one strain from humans. This led to the virus being often referred to as "swine flu" **[33]**. Unlike seasonal influenza, the pandemic H1N1 infection exhibited greater virulence in younger individuals, obese patients, and pregnant women. In August 2010, the World Health Organization (WHO) declared that the H1N1 2009 influenza virus had transitioned into the post-pandemic phase. It was predicted that the virus will continue to cause seasonal flu for many more years. In the 2013-2014 season, H1N1 was the main virus responsible for influenza-like disease, resulting in a notable level of sickness and death **[34]**. The clinical manifestations include of fever, cough, runny nose, difficulty breathing, muscle pain, and gastrointestinal problems. These symptoms may lead to various consequences, such as bacterial pneumonia or acute respiratory distress syndrome (ARDS) **[30]**. Despite being primarily self-limited, the illness resulted in 274,000 hospitalizations and 12,500 fatalities in 2009. The CDC also stated that 25% of hospitalized patients needed admission to the intensive care unit (ICU) **[31,32]**. The treatment regimen consists of providing supportive measures, administering antiviral medications to patients who are at a heightened risk of experiencing problems, and prescribing antibiotics to address any secondary bacterial infections.

Chest radiographs are often used to assess H1N1 illness. Approximately 56% of initial tests conducted on individuals infected with H1N1 provide normal results **[35,36]**. In more severe instances or as the illness advances, patients may have a fast development of bilateral ground glass opacities, consolidation, and reticular opacities, primarily in the middle to lower areas of the lungs **[36-41]**. The presence of radiographic abnormalities is directly related to the course of the illness. Specifically, the bilateral, diffuse, peribronchovascular consolidation is strongly associated with the requirement for mechanical ventilation and the development of Acute Respiratory Distress Syndrome (ARDS) **[41]**. Approximately 67% of patients who are admitted to the hospital with H1N1 will need mechanical breathing, as stated in reference **[41]**.

Middle East Respiratory Syndrome (MERS):

MERS is a respiratory sickness caused by a newly discovered zoonotic coronavirus called Middle East respiratory syndrome coronavirus (MERS-CoV). It was first identified in 2012 when a patient in Saudi Arabia died from a severe respiratory illness **[42]**. From 2012 forward, there have been significant outbreaks of the disease in Saudi Arabia, United Arab Emirates, and the Republic of Korea. The World Health Organization has received reports of 2279 confirmed cases from 27 different countries **[43]**. As of January 2019, there have been 806 documented fatalities, resulting in an overall mortality rate over 35% **[43]**.

Dromedary camels that are sick serve as the reservoir for the virus, and the most frequent way it spreads is from human to human via contaminated respiratory secretions, often in hospital settings **[43]**. From a clinical perspective, MERS may manifest in a wide range of conditions, ranging from no symptoms or moderate sickness to a quickly advancing respiratory ailment that leads to respiratory failure, septic shock, multiple organ failure, and ultimately death **[44]**. Children often exhibit milder symptoms, and mortality is a rare occurrence unless there are serious underlying health conditions **[45,46,47]**.

Imaging is essential for the timely detection of diseases, tracking their development, and assessing their prognosis. The severity of a disease may be predicted by analyzing radiologic characteristics using a quantitative chest radiograph (CXR) or CT six-zone grading system. Additionally, unfavorable prognostic signs can be identified by the identification of ancillary features.

According to reference **[44]**, the first chest X-ray shows abnormalities in 83% of patients. Ground glass opacity is the most prevalent abnormality in the parenchyma, seen in 66% of patients. Consolidation is the second most frequent abnormality, occurring in 18% of patients, followed by a combination of ground glass and consolidation, which is seen in 16% of patients. Peripheral abnormalities occur more often (58%) than central abnormalities (25%), with the right lower lung being the most usually affected area (73%). Patients usually exhibit fast advancement of radiologic abnormalities on serial CXR and CT scans.

Severe Acute Respiratory Syndrome (SARS):

SARS is a respiratory disease caused by a zoonotic RNA virus known as SARS-CoV, which belongs to the human coronavirus group 2b. This virus has several characteristics with MERS. Although the exact animal host is uncertain, it is believed that human transmission first took place via the masked

palm civet, due to significant human contact in outdoor Chinese marketplaces **[48,49]**. The first occurrence of the epidemic was documented in Guangdong Province in the People's Republic of China in 2002. It quickly spread to Hong Kong and subsequently to 33 other nations across five continents. Healthcare personnel had a higher rate of SARS infections, with the majority of exposures happening in hospitals. Upon the containment of the epidemic in 2004, there were a total of 8000 confirmed cases and an additional 800 recorded deaths. The severity of the disease was higher in older individuals, with a death rate exceeding 40% in patients aged 60 and above **[50]**.

SARS is characterized by flu-like symptoms, such as persistent fever and quickly worsening difficulty in breathing. Additionally, 20% of patients may also have watery diarrhea **[51]**. The World Health Organization (WHO) established certain criteria to assist in the diagnosis of Severe Acute Respiratory Syndrome (SARS), categorizing cases as either "suspected" or "probable". "Suspected" SARS was characterized by a high temperature (>38°C), respiratory difficulties/coughing, and substantial exposure to SARS. The term "probable" SARS refers to cases that are thought to be SARS and exhibit symptoms such as respiratory distress syndrome (RDS) or pneumonia as shown on a chest X-ray, or cases that are suspected to be SARS and have tested positive for the SARS-CoV virus in a laboratory assay **[52]**. Therefore, radiographic results were crucial in correctly categorizing and isolating individuals who may have had SARS. Supportive care is the primary form of treatment, since there are no particular antiviral medications or vaccines currently available.

The literature does not extensively document extrapulmonary radiographic symptoms of SARS, but SARS-CoV isolates have been discovered in the intestine, spleen, liver, lymph nodes, and kidneys during autopsies **[53]**. Reports indicate that osteonecrosis and reduced bone density have been seen in SARS patients who were administered high-dose corticosteroids **[54]**. Just as patients suspected of having MERS infection, it is crucial to isolate the patient afflicted with SARS in order to avoid transmission inside the hospital. It is necessary to conduct screenings of patients and ensure that they are properly segregated and wearing masks in order to safely do imaging and make a diagnosis. During the 2003 epidemic, 75% of SARS cases in Singapore were acquired in the hospital environment, specifically with 10 cases directly associated with the imaging department **[56]**. This emphasizes the need of promptly suspecting and isolating individuals, particularly within the imaging department.

Conclusion:

Imaging has a fluctuating but crucial function in the treatment of developing infectious illnesses. Emerging infectious illnesses often occur in areas with low resources, where the use of radiography and ultrasonography might aid in the early diagnosis and monitoring of disease consequences. When CT and MRI are accessible, they can aid in assessing the advancement of the illness. When dealing with extremely infectious diseases like SARS or Ebola, it is crucial to understand how the diseases are transmitted and follow proper disinfection practices during imaging to minimize the spread of the diseases inside healthcare facilities. Given the unexpected nature and quick spread of new disease outbreaks, it is crucial for radiologists to acknowledge the significant role that medical imaging may play in the worldwide transmission of these highly contagious disease agents.

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الظواهر الإشعاعية والتدخلات الموجهة بالتصوير فى الأمراض المعدية: مراجعة

الخلفية: وصلت تردد الأمراض المعدية الناشئة إلى مستويات غير مسبوقة، مما يجعل من الضروري فهم إدارتها فى مجتمع عالمي متصل بشكل متزايد.

هدف العمل: تقدم هذه الدراسة تحليلاً شاملاً للأدبيات الحالية حول استخدام التصوير الطبى فى تشخيص وعلاج فيروس إيبولا (EVD)، وفيروس زيكا (ZVD)، وفيروس تشيكونجونيا (CHIKF)، وH1N1، ومتلازمة التنفس الشرقية الوسطى (MERS)، ومتلازمة التنفس الحادة الشديدة (SARS).

الطرق: تم إجراء بحث شامل فى الأدبيات باستخدام قاعدة بيانات PubMed.

النتائج: من الضرورى استخدام طرق متقدمة لاستخدام التصوير المحمول في EVD لتجنب انتقال المرض داخل بيئة رعاية الصحة. يمتلك التصوير بالأمواج فوق الصوتية السريرية القدرة على تحديد بسرعة تشوهات الجنين فى ZVD، مما يتيح توفير العلاج المناسب والدعم للعائلات المصابة بهذه الحالات. يعتبر التصوير قيمة لتقييم درجة إصابة CHIKF المزمنة وتتبع فعالية العلاج. الصور الشعاعية للصدر والأشعة المقطعية ضرورية لتشخيص ومراقبة الأمراض الفيروسية التى تؤثر بشكل أساسى على الجهاز التنفسى، مثل H1N1، وMERS، وSARS.

الاستنتاج: يلعب التصوير الطبي دورًا متنوعًا في تطور الأمراض المعدية، مما يتطلب معرفة بنقل المرض وطرق التصوير الآمنة، بالإضافة إلى فهم الخصائص الإشعاعية التي تؤثر على الرعاية السريرية.