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ANALYSIS OF SENSITIVITY AND SPECIFICITY OF COMPUTED TOMOGRAPHY AND REVERSE TRANSCRIPTASE POLYMERASE CHAIN REACTION IN DIAGNOSIS OF COVID-19- A REVIEW ARTICLE

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Abstract:

Introduction: *The coronavirus comes from the word "corona" which means "crown" in Latin. Coronavirus (CoVs) belongs to a very diverse class of enveloped, single-stranded RNA viruses. It causes many respiratory infections in humans, ranging from a mild cold to severe respiratory distress syndrome. To ensure a better and healthier prognosis in individual infected with COVID-19, a prompt diagnosing technique and treatment is very essential. The role of chest computed tomography (CT) and real-time polymerase chain reaction (RT-PCR) is essential in the early diagnosis of COVID-19 patients. However, because of low efficiency of the detection of viral nucleic acids, this method shows a lack of clinical performance for the diagnosis of COVID-19 disease. The goal of the study is to examine the clinical performance of CT and RT-PCR and assess the diagnostic value of chest CT scan and RT-PCR in COVID-19 patients suspected of having the virus.*

Methods: *The data/information for review article was collected from different literature available on Google Scholar, PubMed, Scihub and Radiopedia. A profound study of all the key words was conducted and relevant information was avidly collected. Technical aspect of the study was cited specifically from radiology literature.*

Results*: Of the 147 studies; 115 were selected based on inclusion and exclusion criteria, we found 60 studies after selecting the title and abstract. A full-text evaluation of 45 accepted studies found 1766 patients. A total of 1,766 patients underwent CT scans, of which 1,452 patients had COVID-19 positive chest CT and 959 of 1713 PCR results were positive. Recent research on diagnostic performance of CT chest and RT-PCR have been widely reported from various countries, according to the findings.*

Conclusion: *In this review article, we compare two diagnostic modalities computed tomography (Radiology) and reverse transcriptase polymerase chain reaction (MLT). The best modality for COVID-19 detection is CT scan because we review different published articles which are mentioned in the result. The sensitivity and specificity CT scan modality is more than PCR.*

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INTRODUCTION:

The coronavirus comes from the term "corona", which means "crown" in Latin. It can cause a variety of respiratory infections in humans, ranging from cold to severe respiratory distress syndrome. (Umakanthan et al., 2020). Coronavirus was tagged as novel corona virus in 2019 by the Chinese Center for Disease Prevention and Control, but due to its homology with SARS-CoV the International Committee on the Taxonomy of Viruses changed the name of virus to severe acute respiratory syndrome coronavirus-2 (SARS-COV-2). Subsequently, the World Health Organization (WHO) called the disease coronavirus disease (COVID-19) caused by SARS-CoV-2. (Mehta et al., 2021)

1.1 CORONA VIRUS: Coronaviruses (CoVs) belong to a very diverse class of enveloped, single strand RNA viruses. They cause a range of diseases in respiratory system, digestion system and nervous systems of human body and animals with different severity. (He, Deng and Li, 2020). The new coronavirus belongs to the β genus, 60-140 nm in diameter (Liu and Liu, 2020). Corona virus is spherical or pleomorphic which are enclosed by a club-shaped glycoprotein. Corona viruses are made up of 4 subtypes, the alpha, beta, gamma, and delta corona viruses. Some of the subtypes of corona viruses affect people while some affect animals. (Kumar, 2020). CoV is known to have the largest RNA genome originated from zoonotic sources, usually spread by interaction and droplets. (Umakanthan et al., 2020).

1.2 HISTORY AND ORIGIN: For the first time in history coronavirus was reported in 1960. According to a 2001 Canadian study, around 500 patients with flu-like symptoms were identified. Of these, 17 to 18 cases were confirmed by polymerase chain reaction. Corona was thought to be a harmless and non-lethal virus till 2002. In various countries numerous reports demonstrating the spread of corona viruses were published in 2003. Severe acute respiratory syndrome caused by corona resulted in over 1,000 deaths that were reported in 2003. After extensive training, the conclusion is drawn and the pathogenesis of the disease as coronavirus is understood and discovered. But a total of 8,096 patients were confirmed to have been infected with the coronavirus. Thus, the World Health Organization and the Centers for Disease Prevention and Control classified the "state of emergency" in 2004. Another study confirmed 50 patients Hong Kong with severe acute respiratory syndrome, including thirty, were infected with the coronavirus. In 2012, reports from Saudi Arabia showed several infected patients and deaths. Now, in 2019 COVID-19 was first identified and isolated from pneumonia patients in China and affect over 12 million people and results in over 4 million deaths worldwide. The patent is located in Wuhan, China. History and origins of microbiology. (Kumar, 2020)

1.3 COVID-19: Coronavirus disease (COVID-19) is an acute respiratory tract infection appeared at the end of 2019 (Wölfel et al., 2020). On March 11, 2020, WHO proclaimed the COVID-19 pandemic because of a significant increase in cases in China and around the world. This disease spreads through air droplets while patients cough or sneeze and affects primarily the lung parenchyma. Individuals with COVID-19 show a broad range of clinical symptom, ranging from asymptomatic infections to fatal and severe diseases. Although COVID-19 patients experience respiratory problems more likely. (Mehta et al., 2021)

1.4 TRANSMISION: An epidemiological study into the outbreak in Wuhan early found an initial link to a fish market where live animals were sold; most patients were worker in that fish market and most of them visited there. Later the Chinese government ordered to close the market for disinfection. As the epidemic progresses, interpersonal transmission has become the primary mode of transmission.

1.4.1 PERSON-TO-PERSON: The main route of spread of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is person-to-person spread. It is believed to happen through close contact primarily via respiratory secretions; the virus comes out. when the patients are coughing, sneezing or speaking can cause infection in healthy person if it comes into contact with the healthy persons' mucous membrane it can also happen when a person touches their mouth eyes or nose after touching a contaminated surface. Respiratory secretions usually cannot exceed two meters (about six feet). SARS-CoV-2 could be airborne under normal conditions is debatable. One of the studies described that SARS-CoV-2 grownup from tissue culture can last for at least three hours in experimentally prepared aerosols; Many studies had recognized RNA of virus in COVID-19 patients' room's air and aeriation systems, but no viable viral culture was accomplished in these studies. Some studies in which special images were taken to picture respiratory secretions suggest that it can be aerosolized in air and travel horizontally for more than two meters while talking, coughing or sneezing. Reflecting the current uncertainty about transmission mechanisms, recommendations for airborne precautions in healthcare settings vary from place to place; In general, air precautions are recommended when carrying out aerosol formation processes. (McIntosh, 2020)

1.5 CLINICAL MENIFESTATION OF COVID-19: The joint WHO-China report on COVID-19, the symptoms of COVID-19 were fully explored. Patients with COVID-19 have a fever, cough with or without sputum. Symptoms associated with respiratory system include shortness of breath, pharyngitis and sinusitis. Constitutional symptoms are muscle or bone pain, chills and headache. Diarrhea and nausea or vomiting are the symptoms associated with Gastrointestinal (GI) tract. More severe damage to lungs lead to acute respiratory distress syndrome (ARDS), and worsen septic shock. These complications mainly contribute to high mortality ratio in patients over the age of 60 and smoking history. One of the analyses in which 1458 patients were studied showed that the main comorbidities are diabetes, cerebrovascular diseases, cardiovascular and hypertension. (Kakodkar, Kakà and Baig, 2020).

The clinical presentation of severe COVID-19 cases is characterized by hypoxia, dyspnea, and pulmonary involvement. People diagnosed with COVID-19 can develop acute respiratory distress syndrome, organ dysfunction, shock, and fatality in severe situations. (Dennison Himmelfarb & Baptiste, 2020)

1.6 PREVENTION OF COVID-19: WHO recommends avoid Visiting to areas of high risk, interaction with people having symptoms, eating food from pandemic areas. They also recommend regular hand sanitization and personal protective equipment like masks for the purpose of prevention. (Sohrabi et al., 2020)

Only strict infection controlling techniques, such as the use of chemicals viricide or biocide to limit the virus's infection, can prevent CoV infection from contaminated objects. SARS-CoV-2 infection is currently being studied with a number of viricidal agents. High temperatures (30 to 40 ° C) reduced the persistence time of several pathogenic viruses, including CoV-2. SARS-CoV-2 can last up to 3 days on contaminated surfaces or objects. (Khokhar et al., 2020)

After visiting public areas ones must wash their hands thoroughly not less than twenty seconds. The use of soap or hand sanitizer is suggested. The virions enter the upper respiratory tract through eyes, nose or mouth so avoid touching these areas. Avoid interaction with those, who have got symptoms and avoid crowds or crowded places. Healthy people should stay at least six feet from symptomatic people. Healthcare professionals treating patients with COVID-19 need complete personal protective instrument, including a medical mask, gloves, surgical gown with long sleeves as well as eye protection.

Preservation of community contamination is accomplished through the closing of educational organizations, companies, air spaces and sporting events. Peoples over the age of 65 or those with chronic comorbidities, should also self-quarantine without symptoms to reduce the likelihood of contracting COVID-19. (Kakodkar, Kakà and Baig, 2020)

All people should follow these measures, but they should be emphasized in the elderly and especially those with chronic diseases (McIntosh, 2020)

It is essential to understand the virus completely, it's spread and the illness it causes, to prevent and control its transmission. CDC and WHO provide accurate and precise information to public regarding COVID-19. (Dennison Himmelfarb and Baptiste, 2020)

1.7 POPULATION AT RISK: The population generally sensitive to COVID-19 are high risk population. Although the risk factors for serious disease are still unclear, several factors or diseases

present further serious complications after infected with COVID-19, including people over 65, pregnant women, obesity, weak immune function (e.g., HIV-infected people, using immunosuppressive drugs for long period of time) and major chronic diseases such as DM, CVS disease, HTN etc. (Liu & Liu, 2020), (Ji et al., 2020), (Dennison Himmelfarb and Baptiste, 2020), (Adams, Katz and Grandpré, 2020)

Patients and the elderly living in long-term care facilities are particularly susceptible to COVID-19. Most of these properties are private, for-profit and chain-owned. Nearly 300,000 adults also attend daycare centers and would be at greater risk of infection if their center remained open. (Gardner, States and Bagley, 2020)

Patients with established diabetes were about twice as likely to develop severe COVID-19 as non-diabetics. Patients with diabetes have 3 times the hospital mortality rate after COVID-19 infection. (Mantovani et al., 2020), (Zhou et al., 2021), (Guo et al., 2020)

Excess amount of fat in the body is a condition commonly known as obesity. Obesity is a serious body condition that led to more susceptible condition like disease associated with cardiovascular system, respiratory system, and also causes fatty liver, hypertension, diabetes, depression and some type of cancer. Obese peoples are also at higher risk for developing severe COVID-19, which requires admittance to hospitals and mechanical ventilation. In logistic regression analyzes, the presence of obesity was increased approximately threefold with the risk of developing COVID-19. (Alberca et al., 2020), (Zhou et al., 2021), (Gao et al., 2020)

Several viruses are known to affect the mother and fetus during pregnancy with significant maternal outcomes, maternal mortality may be associated with premature birth, fetal growth restriction and prenatal death. (Wastnedge et al., 2021).

1.8 WHO ADVICE FOR HIGH-RISK POPULATION: WHO illustrated the following points for high-risk population.

- Frequent and regular washing of hands, and do not touch your eyes, nose or mouth.
- Top up your medications, get refills, or get 90 days of care (if your health plan allows) and provide the right care for a long time.
- Create an emergency contact list and store this information in one easy-to-find location.
- Consider using transportation services for medicines, food and other essential services.
- Eliminate perishable food and drink because many canned foods are high in sodium and follow the recommended diet as strictly as possible.
- Be active in house, continue exercises that can physically support you, such as jogging, stretching and walking.
- Exposed individual is advised to self-quarantine for 2 weeks to observe signs or symptoms of disease.
- Avoid travelling or visiting to crowds and limited interaction with other people i.e., social distancing.
- Listen to national or local guidelines on housing strategies for staying at houses and avoiding gatherings.

Additional attentions for people having cardiovascular problems:

- Commit a little time every day to meditate to manage stress, stay connected with friends and family and also improve sleeping pattern.
- Avoid visiting to hospitals and chose alternative paths such as e-counseling (telemedicine) telephone call, video conferencing for “visits” with doctors.
- Take ACE a prescription for coronary failure, high blood pressure and other heart disease.
- If you have a fever or sore throat, contact your doctor immediately and call helpline if you experience dyspnea or alarming signs of angina.
- If COVID-19 infection is present, consider the need for more intensive platelet inhibitor therapy in people with a history of coronary intervention. (Dennison Himmelfarb and Baptiste, 2020)

1.9 DIFFERENTIAL DIAGNOSIS: All viral infections (parainfluenza, respiratory syncytial virus, influenza, non-COVID-19 coronavirus, adenovirus, human metapneumovirus), bacterial infections and atypical organisms like chlamydia and mycoplasma, that affect respiratory system are included in differential diagnosis for COVID-19. COVID-19 cannot be identified clinically or by normal laboratory tests from these illnesses. (Bhatt et al., 2021)

1.9.1 RADIOLOGICAL DIFFERENTIAL DIAGNOSIS: COVID-19 is difficult to identify from MERS coronavirus, influenza A & B, Severe Acute Respiratory Syndrome -Corona Virus, cytomegalovirus, respiratory virus, adenovirus, and other bacterial and viral pneumonias caused by coronavirus illness in radiology. COVID-19 should

also be recognized from mycoplasma, bacterial, and chlamydial pneumonia. Although different pneumonias have specific imaging properties. The imaging features of COVID-19, bacterial pneumonia, viral pneumonias, and some lesions are similar. (Dai et al., 2020), (Floridi et al., 2020)

Simple GGOs and GGOs with consolidation, and grid-like alterations are the most common COVID-19 CT symptoms. Some symptoms of COVID-19 imaging are similar to other lung disorders, which is a limitation of CT imaging. Coronavirus illness 2019 has a variety of imaging symptoms at various stages, most of which are associated to pathogenesis, and only a few cases have a negative CT result in the early stages. (Dai et al., 2020)

For the improvement of diagnostic accuracy of COVID-19 and distinguish COVID-19 from other lung diseases, a CT scan must be used in conjunction with hematological examination, clinical features, and epidemiological history in clinical work. (Liu et al., 2020)

1.10 DIAGNOSTIC PROCEDURE: A positive result of novel CoV nucleic acid test is the standard procedure for detecting COVID-19, but some people could not be identified and treated on time because of delays in receiving test results or "false negatives" in certain reports. The use of CT chest while diagnosing COVID-19 is crucial which is helpful in early diagnosis. (Liu et al., 2020)

For a more thorough diagnosis, a computed tomography (CT) scan is required during the initial screening. Positive results of the respiratory system nucleic acid amplification test (NAAT) or blood samples utilizing reverse transcription using the RT-PCR confirm the diagnosis. Unfortunately, such technique of diagnosis is extremely limited:

- The detecting rate is very low whenever the viral density is low, resulting in false negative results.
- Only a positive diagnosis is possible; however, the severity and course of COVID-19 cannot be determined (conversely, CT images can reveal disease progression).
- The availability of chemicals could not keep up with the demand, for new goods in major firms, the quality of those items is being investigated and improved.
- The findings can take up to a day to arrive after sampling.

As a result, Chinese experts strongly advise using CT scans to diagnose COVID-19 in the current circumstances. An academic from the American Society for Radiation Oncology has recommended for the rapid introduction of a CT-based COVID-19 diagnostic approach as well as an increase in the high detection of severe acute respiratory syndrome Coronavirus 2. (SARS-CoV-2). The benefit of CT in diagnosing COVID-19 is obvious. If a patient has a positive imaging result but a negative NAAT result, the patient should be separated and treated as quickly as feasible. (Dai et al., 2020)

1.10.1 LABORATORY FINDINGS: A systematic review of 19 studies in China involving 2874 patients, 88% of whom were hospitalized, reported laboratory abnormalities seen in COVID-19, including an increase in serum C-reactive protein, lactate hydrogenase, alanine aminotransferase and aspartate aminotransferase. In association with coagulopathy, moderate prolongation of prothrombin time, mild thrombocytopenia and elevated D-dimer. However, most laboratory features are not specific and common in pneumonia. (Wiersinga et al., 2020), (Liu and Liu, 2020)

The most consistent laboratory findings with COVID-19 were the increased rate of lymphopenia, C-reactive protein, and erythrocyte sedimentation. (Umakanthan et al., 2020)

1.10.1.1 REVERSE TRANSCRIPTASE POLYMERASE CHAIN REACTION (RT-PCR): The polymerase chain reaction (PCR) is a powerful nuclear cell biology technology that allows for the rapid and efficient enzymatic multiplication of particular DNA sequence or RNA sequence from a range of sources in vitro. In clinical application, RT-PCR is a high sensitivity and specificity technique for amplifying a specific slice of RNA when it is translated into its DNA complement. RT-PCR and real-time RT-PCR assays can be utilized to increase sensitivity and accuracy in the diagnosis of primary and secondary diseases. (Bridge, 2017)

1.10.2 RADIOLOGY IN DIAGNOSIS OF COVID-19

1.10.2.1 CHEST X-RAY: The initial imaging modality utilized in the clinical suspicions of infectious respiratory disease to diagnose lung problems, evaluate extent and consequences, and check out other diagnoses is a chest X-ray (CXR). (Floridi et al., 2020)

1.10.2.2 COMPUTED TOMOGRAPHY: Clinical computed tomography (CT) was first used in neuroradiology in 1971 and was limited to axial brain imaging. It has evolved into a versatile full-body 3D scanning technology with numerous applications in cardiology, oncology, trauma, interventional radiology, and vascular radiology. Computed tomography is a technique that can be employed to diagnose and monitor patients, plan radiotherapy treatment, and detect healthy populations with risk factors. (Edyvean and Gelijns, 2013)

The most sensitive imaging method for detecting infectious illnesses of the lungs is chest computed tomography, particularly high-resolution computed tomography (HRCT). HRCT can be used to determine the degree and consequences of pneumonia with normal or non-specific Chest X-Rays finding, exclude structural lesion, and examine individuals with chronic or reoccurring lungs opacities. (Floridi et al., 2020)

2019-nCoV pneumonia has imaging signs that are similar to virulent pneumonia, although it has its own radiological characteristics. Some patients' imaging is fast shifting. (Liu and Liu, 2020)

Ground glass opacities, crazy paving pattern, bronchogram, smooth or irregular interlobular septal thickening, adjacent pleura thickening and poorly defined borders are the most typical patterns found on chest CT. COVID-19 considers chest CT scans to be a sensitive standard imaging device. (Umakanthan et al., 2020)

1.11 CASE DEFENITION: Proper case definition is critical for diagnostic evaluation and health care investigation when a new infectious illness appears. Tracking the number of cases over time is important in determining the prevalence rate and effectiveness of interventions. (Tsang et al., 2020)

The term “suspected cases” should be clearly defined. This is usually based on a record of traveling or interaction with sick people, as well as specific symptoms like pneumonia. The definition of a “suspected case” can vary from country to country and at different times during the outbreak. (Koh and Cunningham, 2020).

A confirmed case is one in which the microorganism causing the issue has been detected or identified using a specified lab test. (Tsang et al., 2020)

Positive results for SARS-CoV-2 utilizing RT-PCR in the upper respiratory airway, with or without lower respiratory airways sample tract, were considered as a confirmed case. (Kim et al., 2020)

Except there are evident alternatives deaths that could be related with the COVID-19 disease, (e.g., trauma), fatalities from COVID-19 are characterized as mortality from a medically compatible illnesses for surveillance purposes in a COVID-19 confirmed or suspected cases. Between disease and death, there can't be a full recuperation time. (Culp, 2020)

1.12 MANAGEMENT: Post mortem analysis of a series of COVID-19 infected patients revealed widespread alveolar damage in the presence of an inflammatory infiltrate that impairs gas exchange. (Sanmamed et al., 2021)

The purpose of respiratory support in Covid-19 is just to ensures that patients receive enough oxygenation as well as ventilation. Respiratory assistance prevents the patient's respiratory condition from worsening. The high flow nasal cannula (HFNC) has lately gained popularity as a breathing aid, but it might be beneficial for individuals with type 2 respiratory distress who have higher respiratory rate.

To attain this goal, patients experiencing mild and moderate respiratory insufficiency merely require extra oxygen and mucus clearance. Patients should only require minimum assistance to sustain needed oxygen levels, as hyperoxia (excess oxygen) has been linked to unfavorable outcomes. Patients with COVID-19 (SpO2 93%) do not require supplemental oxygen, supplemental oxygen is only recommended for patients with mild respiratory failure.

For severe respiratory failure, effective treatment is invasive positive pressure ventilation. (Liu and Liu, 2020)

1.12.1 DRUG TREATMENT: In confirmed or suspected cases of COVID-19, there is currently no data from a randomized controlled trial (RCT) to suggest specific pharmacological therapy. Nebulized inhalation of interferon α, hydroxychloroquine, oral lopinavir or ritonavir, chloroquine and remdesivir are all options. The concomitant use of three or more antiviral agents is not recommended. The European Medicines Agency has endorsed sympathetic usage of remdesivir for COVID-19. Antibacterial drugs, particularly broad-spectrum antibacterial agents, should not be used indiscriminately or inappropriately. Using corticosteroids in the treatment of ARDS is debatable. In patients with quickly advancing or severe illness, methylprednisolone is an effective

treatment option. Ibuprofen is helpful in temperature higher than 38.5 °C. Patients with risks for stress ulcers and internal bleeding may benefit from proton pump inhibitors or H2 receptor blockers. Patients experiencing dyspnea, coughing, wheezing, and respiratory distress syndrome should use anticholinergic medications that target M1 and M3 receptors. Patients with risk of intravenous embolism, heparin can be given without contraindications. (Liu and Liu, 2020)

There is currently no effective vaccination or antiviral medication for COVID-19. Abidole's efficacy and safety in individuals having COVID-19 are now being evaluated in a multicenter, randomized, controlled clinical investigation. Antipyretic therapy, like acetaminophen or paracetamol, is the very first medication for fever, while an expectorant, like guaifenesin, is used for a nonproductive cough. Patients who have respiratory distress, severe acute respiratory infection, shock or hypoxemia, need oxygen therapy right away. (Sohrabi et al., 2020), (Kakodkar, Kakà and Baig, 2020).

However, one of most recent and credible trial in COVID-19 patients found no strong evidence of chloroquine/hydroxychloroquine treatment's benefits. Indeed, the greatest study to date assessing the benefits and risks of treating COVID-19 patients with antimalarial medicines found no evidence that chloroquine or hydroxychloroquine alone or in combination with macrolides provided any advantage. Furthermore, this study of ninety-six thousand hospital patients from 6 continents found that many of those who received the medicine had a considerably increased risk of death and ventricular arrhythmias than those who did not receive it. (Umakanthan et al., 2020)

1.12.2 ROLE OF VACCINE: COVID-19 vaccine development is a top priority for researchers all around the world. At the end of August 2020, there were over 200 candidate vaccines in various stages of development. While there are currently 30 types of vaccines in clinical trial. Developing a new vaccine has been a lengthy process, typically lasting 10 to 15 years. The fastest vaccine development and approval is for mumps, which took about 5 years. Therefore, developing a COVID-19 vaccine in 12-24 months is obviously a challenge. (Sharma et al., 2021)

Various covid-19 vaccine development strategies include both traditional methods and new generation techniques. Throughout history, vaccines have contained inactivated whole viruses, attenuated viruses (less virulent but still immunogenic), or parts or subunits of the virus. For safety reasons, they are unlikely to test live vaccines for COVID-19, but a fully inactivated viral vaccine was made in preclinical primate studies. For this inactivated vaccine, an early-stage human experiment is underway in China. (Caddy, 2020)

Appropriate vaccination would be critical in limiting the virus's transmission and eradicating the virus from the hosts. (Umakanthan et al., 2020)

METHODS:

From June 2021 to the end of August 2021, we searched Google Scholar, PubMed, research gate, Scihub. The research is limited to the English language article. In terms of research strategy for the search "Diagnostic performance of chest computed tomography versus RT-PCR in patients with COVID-19"; The medical headings plus keywords listed below were used: "SARS-CoV-2" or "Severe acute respiratory syndrome coronavirus 2" OR "SARS Coronavirus-2" or "New coronavirus 2019" or "COVID-19" OR "Novel Coronavirus 2019" or "Polymerase Chain Reaction" OR "Reverse Transcriptase-Polymerase Chain Reaction" or "Computed Tomography" or "Diagnostic imaging techniques" or "Chest imaging in diagnosis of COVID-19" and “HRCT”

2.1 INCLUION CRITERIA: All research papers COVID-19 patients or suspected patients undergone chest CT scan, RT-PCR, from December 2019 to June 2021.

2.2 EXCLSION CRITERIA: All published research papers are excluded except COVID-19 (patients undergone chest CT scan, RT-PCR,) published articles.

2.3 STUDYESIGN: Literature review

2.4 STUD ETTINGS: Published article

2.5 STUDY DURATION: Four months

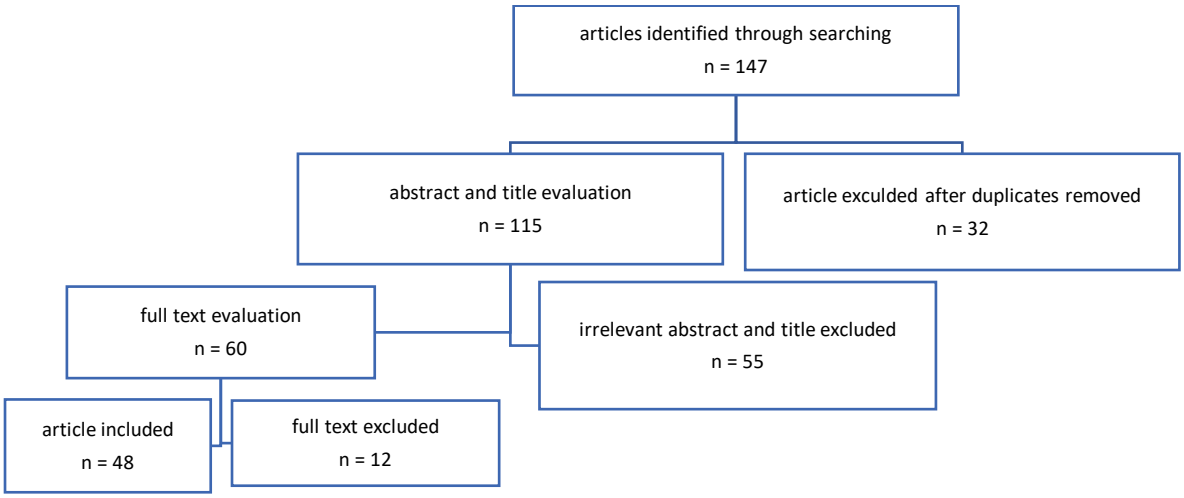

Figure 2.1: flow chart of study selection

RESULTS:

Study: 1		
	CT	**RT-PCR**
No of Participants	76	76
Positive Results	51	64
Negative Results	25	12
Sensitivity	65.6%	--
Specificity	25%	--
Citation	(Patients *et al.*, 2021)	
Study: 2		
	CT	**RT-PCR**
No of Participants	158	158
Positive Results	102	62
Negative Results	56	96
Sensitivity	97%	--
Specificity	56%	--
Citation	(Caruso *et al.*, 2020)	
Study: 3		
	CT	RT-PCR
No of Participants	36	36
Positive Results	35	30
Negative Results	1	6
Sensitivity	97.2%	84.6%
Specificity	--	--
Citation	(Long *et al.*, 2020)	
Study: 4		
	CT	**RT-PCR**
No of Participants	53	53
Positive Results	49	51
Negative Results	4	2
Sensitivity	--	--
Specificity	--	--
Citation	(Li and Xia, 2020)	

Study: 5		
	CT	**RT-PCR**
No of Participants	120	120
Positive Results	105	69
Negative Results	15	52
Sensitivity	94.2 %	--
Specificity	21.5%	--
Citation	(Kuzan, Bulut and Yiyit, 2021)	
Study: 6		
	CT	**RT-PCR**
No of Participants	193	193
Positive Results	110	83
Negative Results	83	110
Sensitivity	89.2%	--
Specificity	68.2	--
Citation	(Gietema *et al.*, 2020)	
Study: 7		
	CT	**RT-PCR**
No of Participants	1014	1014
Positive Results	888	601
Negative Results	126	413
Sensitivity	97%	--
Specificity	25%	--
Citation	(Ai and Lv, 2020)	
Study: 8		
	CT	**RT-PCR**
No of Participants	42	42
Positive Results	40	28
Negative Results	2	14
Sensitivity	--	--
Specificity	--	--
Citation	(Chen *et al.*, 2020)	
Study: 9		
	CT	**RT-PCR**
No of Participants	33	33
Positive Results	31	11
Negative Results	2	22
Sensitivity	--	--
Specificity	--	--
Citation	(Cheng and Lu, 2020)	
Study: 10		
	CT	**RT-PCR**
No of Participants	41	41
Positive Results	41	41
Negative Results	00	00
Sensitivity	--	--
Specificity	--	--
Citation	(Huang *et al.*, 2020)	

DISCUSSION:

Round about 2450 hundred thousand people have been infected with the covid-19 virus since its recognition in Dec 2019. Covid-19, which was caused by the SARS-Covid-2 virus, killed about 50 hundred thousand people around the world. Because there are no specific vaccinations or therapeutic medications available for Covid-19, it's critical to make an accurate

diagnosis early and separate infected individuals and healthy community. According to a new Chinese government guideline, RT-PCR or gene sequencing for respiratory or blood specimens are the most important indicators for confirming Covid-19, but there are a few limitation of RT-PCR including the collection of samples, transportation, and performance as well as less sensitive nucleic acid detection method, fluctuation in test accuracies, low viral load or inappropriate clinical samples while chest CT scans is very easy to perform and fast while diagnosing viral pneumonia caused by SARS-Covid-2 virus. Moreover, modern CT scans contributes a low radiation dose to the patients which is nearly equivalent to 5 to 6 radiographic scans as compared to conventional CT which on one examination gives a

very high radiation dose to the patients nearly equal to 500 radiographic examinations. The fast, accurate and early detection of a pandemic is necessary for control and treatment of a disease. Chest CT outperformed RT-PCR throughout the Covid-19 pandemic. because CT chest is more rapid, reliable and practical method of diagnosing Covid-19.

(Patients *et al.*, 2021) analyzed 76 patients from November 2020 till January 2021 with suspected Covid-19 from three different tertiary care hospital in Pakistan. They showed that the sensitivity of RT-PCR from nasopharyngeal swab samples is higher as compared to HRCT for Covid-19 diagnosis.

(Caruso *et al.*, 2020) reviewed medical data of 158 patients admitted to Sant' Andrea Hospital between March 4, 2020 and March 19, 2020 as part of a prospective study. A positive RT-PCR was found in 62 (39%) of the 158 individuals, whereas a positive chest CT result was found in 102 (64%) with a sensitivity of 97 percent.

(Patients *et al.*, 2021) find out that RT-PCR has higher sensitivity(65.5%) than chest CT scan in a research conducted in Pakistan while a research conducted in Sant Andrea hospital by (Caruso *et al.*, 2020) had different result CT scan of the chest has a better sensitivity than RT-PCR.

A retrospective study was conducted in Yichang Yilling hospital from January 20th, 2020 to February 8th, 2020 by (Long *et al.*, 2020) including 36 patients. This study showed 97.2% sensitivity of chest CT and 84.6% sensitivity of RT-PCR.
(Li and Xia, 2020) In Wuhan, China, conducted a retrospective cohort study with 53 individuals. All patients had a chest CT, with 49 of them being confirmed as having Covid-19, two being verified as having adenovirus, and two being misdiagnosed. Chest CT results confirmed the diagnosis 3 days prior than laboratories results. The positive CT findings shows ground glass opacities and consolidation are the 2 major signs of Covid-19 lesion. On CT scans ill-defined ground glass opacities or consolidation with vascular enlargement, air bronchogram sign, air trapping interlobular septal thickening appearing in crazy-paving pattern and reversed halo sign are all signs of COVID-19 lesions.

(Long *et al.*, 2020) performed a retrospective study in China and confirmed higher sensitivity of chest CT scan than RT-PCR for diagnosing Covid-19. In this study, chest CT had a sensitivity of 97.2 percent, but another study (Li and Xia, 2020) found that chest CT had a greater sensitivity than RT-PCR for diagnosing Covid-19.

While a retrospective study of 120 individuals between the dates 17 and 25 march, 2020 in the republic of Turkey by (Kuzan, Bulut and Yiyit, 2021) 69 of the 120 (57.5%) patients were positive by RT-PCR and 105 of 120 (87.5%) shows positive chest CT findings. Chest CT shows higher sensitivity i.e., 94.2% as compared to the sensitivity of RT-PCR.

From march 13th to march 24th ,2020 a prospective study was conducted in Netherland by (Gietema *et al.*, 2020) shows that in diagnosing COVID-19 RT-PCR had less sensitivity than chest CT. 193 symptomatic emergency department patients were included in this study in which 83 (43%) had a positive RT-PCR test and 110 (56.5%) had a positive chest CT resulting in a total sensitivity of 89.2%.

A retrospective study in Turkey was conducted by (Kuzan, Bulut and Yiyit, 2021) and shown us that RT-PCR had lower sensitivity than chest CT while diagnosing Covid-19. According to this result chest CT has 94.2% of sensitivity as compared to a prospective study performed in Netherland by (Gietema *et al.*, 2020) which shows that chest CT has 89.2% of sensitivity.

In a retrospective study between January 6 and February 6, 2020 in Wuhan, China, the performance level of CT chest in diagnosing Covid-19 was evaluated using RT-PCR as a reference's standard. A total of 1014 individuals were available for analysis. 601 Of the 1014 patients had RT-PCR positive test with a positivity rate of 59% and 888 patients of the total had a positive chest CT with a positivity rate of 88% and a sensitivity of 97% (Ai and Lv, 2020).

42 patients admitted to Zhong nan hospital Wuhan, China from 20th February to 9th February, 2020. These patients were retrospectively studied by (Chen *et al.*, 2020) and find out that 28 of 42 (66.6%) patients were tested positive for Covid-19 in feaces specimen while 40 out of 42 (95.24%) patients had abnormal chest CT scans and a lower sensitivity of RT-PCR than chest CT.

(Ai and Lv, 2020) performed a retrospective study in China and explained that chest CT has 97% of sensitivity while (Chen *et al.*, 2020) conducted a retrospective study in China and show that when diagnosing Covid-19 RT-PCR has lower sensitivity than CT chest.

(Cheng and Lu, 2020) retrospectively analyzed 33 suspected Covid-19 patients at Ruijin hospital Shangai from January 19 to February 6, 2020. They showed that 11 individuals have positive RT-PCR test for SARS-Covid-19 and 31 patients have abnormal CT chest and confirmed that chest CT has better sensitivity than RT-PCR.

On January 2, 2020, a hospital in Wuhan, China, admitted 41 patients. All of these patients were laboratory confirmed Covid-19 and the same result were shown when radiologic examination was performed. Bilateral, numerous, lobular, and subsegmental areas of consolidation are seen in ICU patients on admission, whereas bilateral ground glass opacities (GGO) and subsegmental areas of consolidation are seen in NON-ICU patients. (Huang *et al.*, 2020).

In a retrospective in China by (Cheng and Lu, 2020) also confirmed that RT-PCR has lower sensitivity than chest CT while diagnosing Covid-19. The same resulted was also supported by (Huang *et al.*, 2020) while performing a research in China.

One of the studies demonstrate that CT chest are essential to avoid missing the diagnosis of Covid-19 patients because of false negative RT-PCR. (Liu, Yu and Zhang, 2020)

Suspected patients having negative result of RT-PCR should be retested after 24 hours, according to the Chinese guideline Covid-19. If a patient has two negative RT-PCR tests, he or she must be discharged from the hospital because there is no suspicion of disease or clinical manifestation. (First, no date).

CONCLUSION:

In this review article, we compare two diagnostic modalities computed tomography (Radiology) and reverse transcriptase polymerase chain reaction (MLT). The best modality for COVID-19 detection is CT scan because we review different published articles which are mentioned in the result. The sensitivity and specificity of CT scan modality is more than PCR.

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