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Comparative Investigation of Spot Kit Versus RTPCR in COVID Active Patients

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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Review Article

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ABSTRACT

On 31 December 2019, numerous pneumonitis occurrences of pneumonitis of uncertain origin, in Wuhan city, People's Republic of China. The previously unknown origin was identified and designated the 2019 new Coronavirus in January 2020. WHO eventually dubbed it Coronavirus disease 2019 (COVID-19). The infection has been identified as Coronavirus-2, which causes severe acute respiratory illness (SARS-CoV-2). It was crucial to control the rapid evolving SARS-CoV-2-associated Coronavirus disease 2019 pandemic. In order to do so, highly sensitive and specific lab diagnostic assessments like RTPCR and Genome sequencing helped in identifying the cases at an early stage which further helped increasing the rate of survival. With time multiple tests were formulated which aided us but a need for the best and more accurate one was still needed. Some of these tests were quick but had a lower level efficacy while the old tests were accurate but are really slow. In this review article, we have formulated a comparative investigation of spot kit versus RTPCR in COVID active Patients from case reports, original investigation articles published by PubMed and Google scholar. With the help of these articles we have come a the best possible conclusion. The conclusion came out as COVID-19 patients found positive by RTPCR but negative by spot kit are uncommon to be infectious.

Keywords: COVID-19; SARS-CoV-2; lab diagnostic assessments; RTPCR; spot kit.

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1. INTRODUCTION

Multiple occurrences of pneumonitis with an uncertain origin have been observed in the city of Wuhan, People's Republic of China, since December 2019. A formerly uncertain -cyclotron virus was discovered using unbiased sequencing of patient samples. A novel Coronavirus has been discovered in human airway epithelial cells. SARS CoV2, which origins Coronavirus Disease, was discovered in cells and named SARS CoV2 (COVID)-19. COVID-19, like MERS-CoV and SARS-CoV, is a member of the Coronavirus family that infects humans.(1) Previous research has revealed that the great majority of COVID-19 Patients had been exposed to the Wuhan epidemic area. Fever and cough were among the symptoms in institutionalized Patients. Imaging is crucial in the diagnosis and evaluation of disease [1-8]. In recent months, the COVID-19 breakout has had a significant impact on in medical institution settings. This opinion discusses current concerns and challenges in the lab detection of the Coronavirus 2 that causes severe acute respiratory syndrome (SARS-CoV-2). Reverse transcription-quantitative PCR (RT q PCR) utilizing nasopharyngeal (N) swabs, throat (T) swabs, or saliva is the gold standard for COVID-19 diagnosis As there are studies mentioning about APOL1 gene as a "high-risk gene", patients presenting with collapsing glomerulonephritis should be tested for the inheritance of the gene , if the patient is an African descendent. More comparative studies and researches based on evidences must to done to expand the knowledge about the mechanisms of renal damage, development of AKI and role of APOL1 gene. Journals on renal involvement in SARS-CoV-2 infected children are very few until now, which should be considered an important topic to be researched on, as it would be of great help in future incidences . Since December, a paramount of research has been done to find ways to bring down the morbidity and mortality associated with this viral infection. The wait for a vaccine forces the world to find alternative methods to decrease this morbidity. Research has proven that if renal damage can be prevented or managed at the right time, it can prove to save lives and reduce deaths caused by this vicious virus [2-8]. However, the RTPCR assessment is not fast (it typically takes 3 to 4 hours for conclusion to arrive), and it needs specialized lab equipment and skilled technicians, while antigen assessments are simple and could be assessment routinely in in hospital setting labs. We present you a comparative investigation b/w Rapid Antigen Test (RAT) and RTPCR technique.

2. CONTRAST BETWEEN RTQPCR AND THE ANTIGEN ASSESSMENT

2.1 Investigation 1

2.1.1 Patients and samples

The Institutional Review Board of the Yamanashi Central Medical Institution's Genome Research Committee authorized a study in which 323 nasopharyngeal swabs were collected from individuals at Yamanashi Central Medical institution. Cotton swabs and viral transport medium were used to capture all samples in UTM1 (Copan Diagnostics, Murrieta, CA, USA). Until nucleic acid extraction, the viral transport medium were kept at 4^0C. Within 2 hours of collecting swabs, total nucleic acids were extracted.

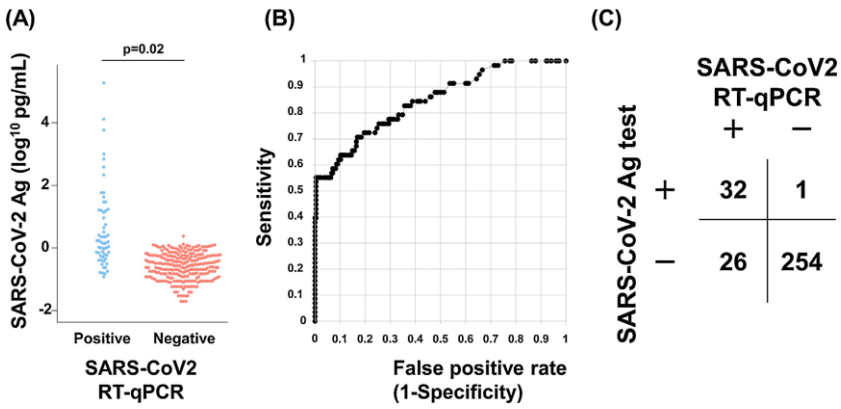

Fig. 1. Study investigation graph

2.2 Investigation 1 Outcome

RTqPCR was used to determine the antigen assessment on 313 nasopharyngeal swabs, with 58 positive samples from 11 infected Patients and 255 negative samples from 215 non-infected persons. The antigen assessment was performed on these samples in a blinded manner.

The PCR-positive samples had a median antigen level of 1.56 pg/mL (range 0.02–094,095 pg/mL), while the PCR-negative samples had a median antigen level of 0.27 pg/mL (range 0–2.3 pg/mL) (Fig. 1A).The PCR-positive samples had a substantially higher mean antigen level than the PCR-negative samples (p = 0.32, Student's t-assessment, Fig. 1A).

Receiver operating characteristic (ROC) curve analysis were used to estimate the cutoff antigen level for determining S A R S - C o V - 2infection status. The accuracy achieved its pinnacle when the antigen level limit was set to 1.31 pg/mL. The antigen assessment has an AUC value of 0.868 +0.034, indicating that it accurately recognized SARS-CoV-2, according to ROC studies (Fig. 1B).

True-positive, false-positive, true-negative, and false-negative findings were 32, 1, 254, and 26 correspondingly (Fig. 1C).The antigen assessment detected S A R S - C o V - 2infection status with a sensitivity of 55.2 percentage and a specificity of 99.6 percentage when the RTqPCR findings were utilized as a reference. The antigen assessment and RTqPCR had a 91.4 percentage (286/313) overall concordance.

2.3 Investigation 2

RTPCR was used to evaluate various types of tissues from 235 individuals with confirmed COVID-19 in a investigation by Wang et al. Only 156 (22%) of 398 pharyngeal swabs were found to be positive. They only took eight nasal swabs, and five (64%) of them were positive. Wang et colleagues also looked at broncho alveolar lavage (BAAL) fluid and sputum samples, which were found to be positive in 93 percentage and 72 percentage of Patients, respectivel [9,10].

2.4 Investigation 3

Patients

Between September 2nd and October 7th, 2020, 412 Patients with in medical institution setting suspicion of COVID-19 (median antigen 41 years, range 11 years, 68 percentage female) were enrolled in this prospective investigation, with 427 adults (median antigen 26 years, range 19 to 21 years) and 85 children (16 years old, median 11 years, range 1 to 16 years) attending primary care centres of the Clnico-Malvarrosa Health Department in Malvarrosa (Spain). Only Patients who had similar indications or symptoms in the previous week were included in the investigation. The INCLIVA Research Ethics Committee of the Medical institution Clnico-de-Valencia (HCU) gave its approval to the project.

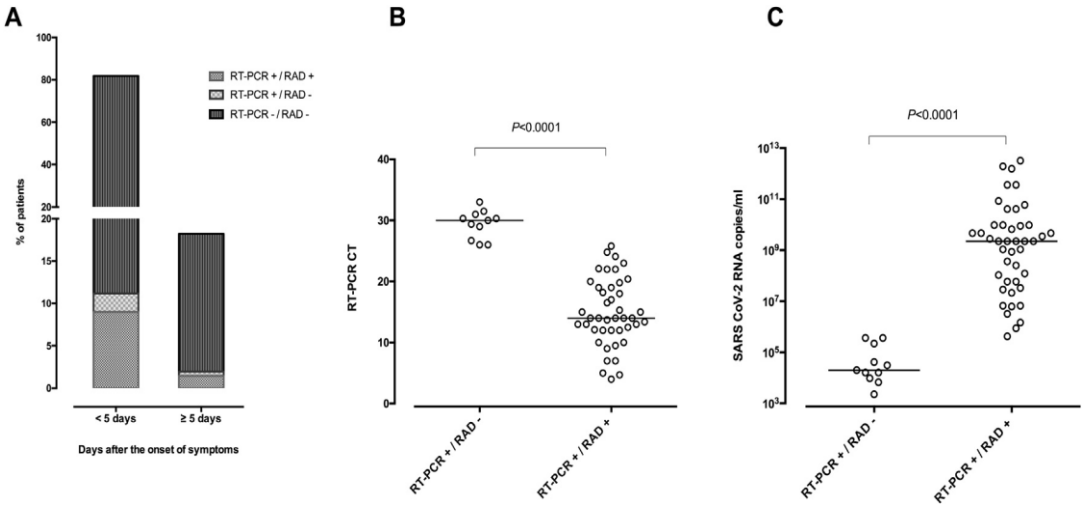

Fig. 2. Study investigation

The various variant forms which were testified in India have caused a great , enormous expansion in the amount of registered cases. Evolving alternates not only caused panic among public, increment in transmissibility, death rate and unwholesomeness , but also have the capacity to conceal identification by preceding indicative assessments, which can possibly Interrupt the demonstration, analysis and cure, possess the ability to cause superimposed on infection of same type in previously infected and recovered healthy individuals, and immunized individual gets the disease they are vaccinated against

2.5 SARS COV-2 Assessment

In a study conducted in 2020 by the Turkish society of nephrology, it was mentioned that among the 578 COVID-19 patients on whom the study was conducted,13.3-35.7% patients were in need of kidney replacement therapy(KRT). 70.5% of the 578 patients had hypertension,43.8% had diabetes mellitus and 37.6% had chronic kidney disease as comorbidities. The Reactive airway disease (RAD) evaluation was performed immediately following sample collection, as per the manufacturer's instructions (reading at 15 min). There are seven recognized coronaviruses that are known to cause human infections, most of them belong to Betacoronavirus except the first two (229E and lNL63) which belong to Alphacoronavirus. This virus comprises of a nucleocapsid, surrounded by an envelope. It measures 120 nm in size; has a helical symmetry. It possesses 4 structural proteins and 16 nonstructural proteins and several other accessory proteins. Nucleobases consists of a positive-sense The envelope is lipoprotein in nature; the lipid part is host-derived into which a number of proteins are embedded such as: Spike protein (S): Helps in the attachment to the host cells. Neutralizing antibodies are produced against S protein are protective in nature [11,12].

2.6 SARS CoV-2 Culture

Before being processed for culture in Vero E6 cells, samples obtained in UTM were kept at e80 C for up to 2 weeks. RTPCR confirmed the presence of SARS COV-2.

2.7 Analyses Statistical

The antigen agreement between the RAD assessment and RTPCR was investigated using Cohen's k statistics. To compare median differences, the Mann-Whitney U-test was utilized. Using receiver operating characteristic (ROC) curves, the SARS CoV-2 RTPCR cycle threshold (CT) and RNA loads that best differentiate b/w RTPCR/RAD and RADe samples were identified. On both sides, P values of less than 0.05 were considered significant. For statistical analysis, SPSS version 25.0 was utilized (SPSS, Chicantigeno, IL, USA) [13].

2.8 Investigation 3 Outcome

Out of 412 Patients, 43 (10.4%) assessment positive by RTPCR and RAD, while 358 (86.9%) assessment negative by both methods, with 11 individuals having discordant outcomes (RTPCR/RAD) (2.7 percentage). The two methods were in good antigen agreement (k 0.87, 95 percentage CI 0.79e0.94). RAD's overall specificity and sensitivity were both 100% (95 percentage confidence interval: 98.7e100%) and 79.6% (95 percentage confidence interval: 67.0e88.8%), respectively. Patients with 5-day in medical institution setting regimens had (14) slightly higher sensitivity (80.4 percentage, 95 percentage CI 66.8e89.3 percentage) (Fig. 2A).

Adults had higher sensitivity (82.6 percentage, 95 percentage confidence interval 69.3e90.9 percentage) than children (62.5 percentage , 95 percentage CI 30.6e86.3 percentage) [14].

For an estimated prevalence of 5% and 10% (the incidence of COVID-19 in our Health Department throughout the investigation period was within that range), the overall RAD negative predictive value was 99 percentage (95 percentage CI 97.4e99.6) and 97.9% (95 percentage CI 95.9 98.9), respectively (the incidence of COVID-19 in our Health Department during the investigation period was within that range).

In RTPCR/RAD samples, CT values were substantially higher and SARS COV-2 RNA burdens were significantly lower (p 0.001) than in R T - P C R/RAD samples (Fig. 2B,C). With a sensitivity and specificity of 100 percentage, ROC curve analysis revealed that the R T - P C RCT 25 and S A R S - C o V - 2RNA loads >5.9 log10 copies/mL criteria best differentiated b/w R T - P C R/RAD and R T - P C R/RAD samples. The overall RAD sensitivity was, as expected, exactly proportional to the R T - P C RCT values (S A R S - C o V - 2RNA loads) [15].

B/w R T - P C R/RAD Patients (median 3 days, range 17 days) and R T - P C R/RAD Patients (median 3 days, range 17 days), the period from symptom start to sampling did not differ (p 0.86) (p 0.86) (p 0.86) (p 0.86) (p 0.86) (p 0.86) (p 0.86) (p 0.86) (p 0.86) (p 0.8 (median 2 days, range 1e6 days).

S A R S - C o V – 2 was isolated from all three samples returning R T - P C R/RAD outcomes (CT 4, 14, and 16), despite the fact that all 11 samples giving discordant R T - P C R/RAD outcomes assessment negative by culture.

2.9 Investigation 4

At the beginning stage of most of the symptomatic cases. Most patient reach at the critical stage because of failure in functioning lungs and various symptoms caused by it. In lungs, ACE-2 receptors are highly expressed on type-II alveolar cells. These cells normally produce pulmonary surfactants which lower the alveolar surface tension. In COVID patient damage to type 2 alveolar leads to reduced production of surfactants, as a result of which alveoli tends to collapse. The air liquid interphase is perturbed to fluid retention in the interstitial space. In contrast, 36 of 51 initial R T - P C R assessments were positive (71 percentage) [16-18].

The entry of SARS-CoV-2 in lung can cause an non controllable human body immune response. The high cytokine leads to various disturbance in normal functioning of body like impaired gas exchange, endothelial damage, vessel dilatations, failure of multiple organ. Acute respiratory symptoms with high mutation power is infecting millions of people. Therefore the study of various variants can assist all to recognized the pathogenesis of infection, the symptoms, progression of disease, study and better treatment by framing a memory for body immune response system to fight better against the infection. Isolation of virus, viral culture and sequencing plays a major role in identification and various mutants forms of virus. This article reviews the diagnostic approach and sequencing for emerging virus for change in nucleotide and genome or change of spike protein. Thus this study will act as reference for biological study and keeping track on infectious agent [19-26].

3. CONCLUSION

This virus is mostly disseminated by respiratory droplets and fomites. Hand washing, using face masks, and keeping social distance are the most prevalent prevention methods. Therapeutics and vaccine development are focusing on antibodies that can neutralize SARS-CoV-2 and prevent illness. When the virus's genetic sequence was discovered in early January 2020, vaccine research began.50 SARS-CoV-2 candidate vaccines were in clinical review and 162 were in preclinical development as of October 19, 2020, out of 212 SARS-CoV-2 candidate vaccines being developed across the world. SARS-CoV-2 specific neutralizing antibodies are found in varying amounts in various populations (Nabs).Plasma cells and memory B cells are important in both original infection and long-term protection against reinfection. Vaccines provide protection against COVID-19 by eliciting immune responses to the SARS-CoV-2 spike antigen. Inactivated vaccines are made by growing SARS cov2 vaccine on Vero cells in cell culture. Live attenuated vaccines are made by creating a genetically weakened form of the virus that only replicates to a limited amount, producing no sickness but eliciting immune responses comparable to those elicited by natural infection.

The results of case study demonstrate that IgM is the first antibody to rise in individuals after vaccination as it is the first line of defense , however IgG titers are the maximum in number especially in age groups of 18-36 , then as age advances the number of the titer decreases with almost negligible response in adults > 76 years of age. COVID-19's current, unprecedented worldwide outbreak has underlined the need of lab identification of human Coronavirus contamination in order to prevent the spread and properly treat patients who have a significant infection. This topic has addressed current difficulties regarding S A R S - C o V - 2 assessment. For early diagnosis or screening, an NP swob is preferred over an OP swob because it delivers better diagnostic results, is more patient-friendly, and is safer for the operator. To boost sensitivity, an NP swob may be combined with an OP swob, but this would need twice as many swabs. Consequences such as: Tissue damage and necrosis Further recruitment of leukocytes Impaired gas exchange, which leads to reduced Blood oxygenation and tissue hypoxia. Endothelial damage of pulmonary vasculature, Leading to vasodilation, microvascular thrombosis and hemorrhage and hypercoagulability Allows passage of fluids from the blood vessels to lungs which leads to pulmonary edema. These infiltrates in lungs appears as ground glass appearance in chest

imaging. Cytokines can also induce damage to organs of body such as heart kidney, heart , liver ,most of the vital organs. There occur several events such as sepsis, shock , and multiorgan failure , kidney damage and cardiac injury. In patients with severe disease, if the initial screening test is negative, the need for further testing or bronchoscopy must be noted. The ultimate outcome was R T - P C R-proven. Patients with COVID-19 who use a spot kit and test negative for negative are unlikely to be infectious.

DISCLAIMER

The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

CONSENT

It is not applicable.

ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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