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Role of Telemedicine and Telegenetics Framework for the Management of Cancer Patients During the COVID-19 Pandemic

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Abstract: After the outbreak of 2019 novel coronavirus infection (2019-nCoV), the disease has been regarded as an extremely fast-spreading respiratory tract infection causing mortality worldwide. It appears that patients with life-threatening tumors or immunosuppressed patients are at a greater risk of developing more severe symptoms induced by COVID-19. Thus, all patients should be provided with reliable consults and clinical treatment. The emergence of lockdown situations in more countries has motivated all governments, healthcare services, and customers to further use on-line strategies in different areas with full access to healthcare. Telecommunications are beginning to be used in healthcare systems with the aim of providing a tailor specific approach to disease management. During the COVID-19 pandemic, antiviral drugs have failed to treat the disease, and no vaccine has been developed for the disease due to the pleiotropy and complexity of 2019-nCoV. Genome-base investigations have brought new insights for the development of drugs to diagnose COVID-19 and predict its severity. In this review paper, we proposed a broad framework and interdisciplinary of telemedicine and genomic information for better management of patients and medical care professionals at different locations. By using a global telehealth network, patients can be analyzed in a shorter time with lower costs, and better plans can be developed for the management of patients based on genetic profiles in different populations.

Keywords: Telemedicine; Telegenetics; Framework; COVID-19 pandemic; Cancer.

1. Introduction

After the outbreak of the 2019 novel coronavirus infection (2019-nCoV), the disease has been regarded as a highly infectious disease and an unpredictable invasive pathogen in the 21st century [1]. The World Health Organization (WHO) called this novel virus 2019-nCoV or COVID-19 at the end of the year 2019 due to its unknown function in the body of the affected person as well as the rapid deterioration of patients and multiple organ failure caused by the virus [2]. The growing pandemic of COVID-19 in different regions has led to the lockdown of a great number of cities in different countries to help stop the virus spread [3,4]. The transmission rate and pathogenicity of COVID-19 are much higher than those of the Middle East Respiratory Syndrome (MERS) and Severe Acute Respiratory Syndrome [5]. It is clear that patients with malignant and life-threatening tumors or immunosuppressed patients are at greater risk of being infected and developing more severe symptoms of pneumonia. Different

malignancy rates are associated with an increased COVID-19 mortality rate, and surveillance for individuals after COVID-19 is not warranted. Moreover, referring to a hospital or a clinical care center for receiving routine tests or drugs can increase the risk of spreading the disease and transmitting the virus to both patients and the health workforce, for these reasons, WHO has recommended all healthy people and patients with malignancy or any disease to stay at home. The reason is that no critical vaccine and drugs or nationwide screening programs are available at the current pandemic time for the control and prevention of COVID-19 infection [6].

Development of targeted therapies during the COVID-19 pandemic is difficult due to lack of COVID-19 screening programs, its complex etiology, its unpredictability compared to other respiratory viruses, and its fast spread, as well as lack of a high-quality COVID-19 registration system [7]. Due to these limitations and the need for early diagnosis of people infected with COVID-19, Iranian physicians designed a registration system for better management, follow-up, and next further research in March 2020 [8].

Although face-to-face or hospital visits are highly critical in patients with COVID-19, clinicians are evaluating new strategies to prevent the spread of the disease among themselves, healthcare workers, and patients during the pandemic situation. For these reasons, a rapid RNA-based COVID-19 diagnostic tool by Yang and et al. described [9]. During the pandemic, it is crucial that governments, healthcare systems, and public health agencies focus on the public health through home/distance monitoring to help slow down the transmission of the virus in communities, and also, for successful treatment of COVID-19 cases. Volunteer physicians are increasingly assisting the care of COVID-19 infected people with acute malignancy or disease complications. In this article, due to the lack of nationwide screening programs, the pleiotropy and complexity of 2019-nCoV, and the lack of drugs or vaccines for the COVID-19 treatment, we proposed a network for global telehealth communication and interdisciplinary between specialists with oncologists, molecular genetics specialists, psychologists, pharmacogenomics specialists, endocrinologists, medical informatics specialists, and telemedicine technologists, which can contribute to the reliable control of the infection and reduction of medical errors. This paper investigates; there is an urgent need for a telehealth network so that experts in various fields can collaborate with each other, and full access to healthcare services is provided for all people.

2. Development and application of telemedicine

Clinical telemedicine can have main advantages, including fewer patient contacts, effective clinical care, and reliable prescription of drugs for each person by consulting other physicians to manage medical practices for cancer patients at home during the COVID-19 pandemic [10]. Telemedicine is made up of two words: tele as a Greek word meaning “distance” and medicine or Mederi derived from Latin meaning “to heal”[11]. At first, it was one of the biggest challenges to convince both consumers and doctors to introduce and use telehealth medicine for providing healthcare services in hospitals [12]. With the urgent quarantine situation and isolation in some cities, healthcare systems, healthcare customers, and governments seek a new long-distance televideo caregiving [13]. Compared with other infectious diseases, the use of telemedicine for COVID-19 has become globally urgent in the 21st century [14]. In China and other countries, with increasing the mortality rate and due to the quarantine situation, WHO is broadly using telemedicine to prevent the spread of the infection among individuals and continue the delivery of healthcare services. Assessment and

scheduled target of medical treatment programs through telemedicine during all the cancer treatment phases are essential [15]. Electronic devices are used to improve physical performance and diet habits, as well as to check public health [15]. Telemedicine is an efficient technique currently used to treat various types of disorders like diabetes with controlling hyperglycemia, hypertension with controlling systolic and diastolic blood pressures, chronic heart failure, and pulmonary disease with consuming some drugs or self-management, and infectious diseases in distant rural regions [16-19]. Telecommunication has been used to facilitate communication, medical care, and clinical information relevant to both researchers and clinicians so that new information can quickly become available [20]. According to the World Bank Statistics, some regions (19%) in the United States are rural, but the worldwide average is about 30%, which is a spectrum from 0% rural (Hong Kong) to 74% rural (Afghanistan). With recent consolidations, a telemedicine network can have a huge global impact during crisis situations [21]. Telemedicine allows isolated patients to access healthcare services without driving long distances [22]. Telemedicine has the potential to merge several fields for global collaboration to facilitate access to clinical services and reduce the average patient discharge time [23]. However, recently, information on patients has been collected for transmission of large files, including computerized medical records, diagnostic reports, laboratory examination results, and CT scan/radiology reports via audio-video consultations, wireless networks, and mobile telecommunication tools [24]. Some clinical studies are underway to survey patient satisfaction and cost-effectiveness of teleordering in accessing healthcare services without wait time compared to face-to-face visiting [25].

3. Clinical applications of telegenetics

Telegenetics is the process of improving the stratification and timing of healthcare services by utilizing biological information and biomarkers on the level of molecular disease pathways, genomics, proteomics, and metabolomics for patients at risk with close access to healthcare [11]. Telemedicine and genomic medicine are two rapidly developing areas by new technologies [26]. It is a powerful medical service for showing diseases like cancers, unknown genetic disorders, congenital diseases, and mental retardation, and also, for identifying individuals with susceptibility or resistance to some diseases for genetic family risk assessment [27]. These approaches provide a positive response and high-speed data rates to access medical team-work from all over the world to receive genomic clinical services. It is unanimously believed that 2019-nCoV is far more unpredictable than other respiratory viruses. At first, symptoms of COVID-19 appeared in the alveoli air lung, and many doctors focused on treating pneumonia and inflammatory reactions to help patients breathe. However, it has been recently revealed that COVID-19 can attack the body from the brain to the toes, and its symptoms can appear in several organs [28]. Respiratory tract infections have been associated with an increase in the risk of inflammation, cytokine storms, and ischemic in other organs in a short time. Among these malignancy tumors, patients with lung malignancy are at a greater infection risk [29]. Cancer is a silent illness in humans, and various types and mechanisms of cancer have different genetic characteristics or architectures [30,31]. Many doctors have attempted to treat inflammatory reactions and their capacity to cause blood clots. They also attempt to help patients in the breathing process. Recently, more attention has been paid to the human genome, and also, to variation between individuals in different populations that contribute to the susceptibility to COVID-19 or is associated with the severity of the disease [32]. New small molecules and biomarkers that are free in blood or biofluids play important roles in the

regulation and pathogenesis of the virus in host cells[33,34]. Assessment of the target gene is desired in molecular epidemiology, drug development, and diagnostic, prognostic, and predictive biomarkers for COVID-19. Human genome variations and polymorphisms in angiotensin-converting enzyme2 (ACE2) receptors in lung cells have a potential impact on drug actions or effects in every individual, and also, on the susceptibility or resistance to COVID-19 [17,35]. Cancers have a heterogeneous nature, and many genes are involved in the development of different cancers [36]. Moreover, biomarkers and metabolites profiling plays an important role in the control of different cells during physiological and pathological processes as well as metabolic pathways of cancer. Evaluation of small molecules profiling is a prominent tool to identify differences in normal cellular courses and different stages of cancer on a paper or with a simple, smart device. These small molecules as a valuable genomic resource are available in all the body fluids such as plasma, serum, blood, saliva, amniotic fluid, and urine [33,36]. A recent study by Song's group described paper-based nucleic acid virus detection tools by employing a loop-mediated isothermal amplification assay. A nasal sample can be collected by patients at home, and then, results can be recorded with a smartphone application and shared with doctors or healthcare systems via the Internet [9]. A small amount of such samples allows patients to receive on-line standard treatment drugs at home based on their disease. This has the potential to extend personalized medicine and clinical services to enhance global health collaborations for managing patients with genetics profiles, diet habits, and race-based and geographical distribution [37,38].

4. Bioinformatics analysis

Bioinformatics analysis is a potentially beneficial tool for the identification of correlations between multiple gene expressions and proteome analysis to diagnose or detect susceptibility to COVID-19 infection. It has contributed to the development of molecular infection by revealing new pathways to diagnosis, prevention, and treatment for both basic and clinical investigations in COVID-19 infection.

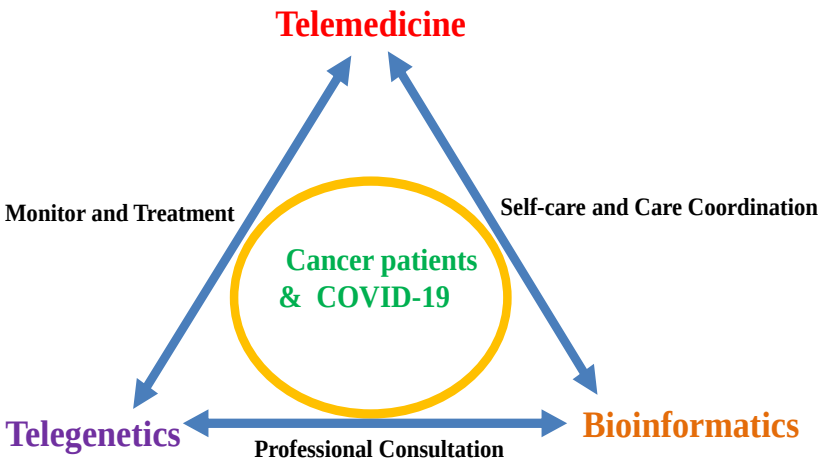

Figure 1. Telemedicine, telegenetics, and bioinformatics study for cancer patients during the COVID-19 pandemic.

This current technology has an emerging role in fighting COVID-19, evaluating family-health risk assessment, preventing infectious diseases, and making efforts to access global collaboration based care coordination and public health management worldwide (Fig 1) [25]. The recent mortality rate of COVID-19 has been reported differently in different countries due to the genome variation impact. This variation has led to the development of a framework and

an algorithm to estimate the appropriate dose of drugs for an individual based on genetic information and clinical data studied from a broad population base [37]. Bioinformatics-based strategies such as next-generation sequencing and array-based profiles have brought new insights for genomic investigations involving COVID-19 infection [39,40]. Both genetic counseling and bioinformatics are essential for managing race-based cancer patients with genetic profiles during the COVID-19 pandemic. Screening and counseling for patients are rapidly temporary connectivity conducted using video teleconferencing or a digital network with an attached video camera and microphone [41].

5. Conclusions

The number of infected cases of COVID-19 increases rapidly throughout the world, and more patients will require easy-to-use and reliable testing or consulting to reduce unnecessary transportation and the need to travel to medical health centers, thereby lowering the risk of spreading the infection. In this regard, a global communication network for healthcare professionals has the potential to extend personalized medicine and organize large files to distribute knowledge about the impact of genome variations on drug responses. Thus, healthcare professionals can design new appropriate drugs or vaccines for patients in different regions to enhance global health collaborations, reduce symptoms, and increase the quality of life. Patients with different organ malignancies or with underlying chemotherapy are at greater risk for severe COVID-19 infection and, ultimately, death. Exploring opportunities for the combination of telemedicine with telegenomics and precision medicine during the COVID-19 pandemic includes improving welfare for cancer patients under medical treatment, resulting in the expansion of the decision process between patients and providers of healthcare programs. Interdisciplinary clinical programs utilizing telemedicine, bioinformatics, and genomics to merge these fields have also been developed for global collaboration and fighting against this unknown virus.

The use of web-based professional visiting or training has been a hot topic on cancer in all patients. Telehealth networks are innovative tools that can provide connections between clinicians and patients via a social network. It can facilitate the quality and safety of patient care with rapidly disseminating scientific knowledge.

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Conflicts of Interest

The authors declare no conflict of interest.

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