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“Corona Virus”: A Review Article

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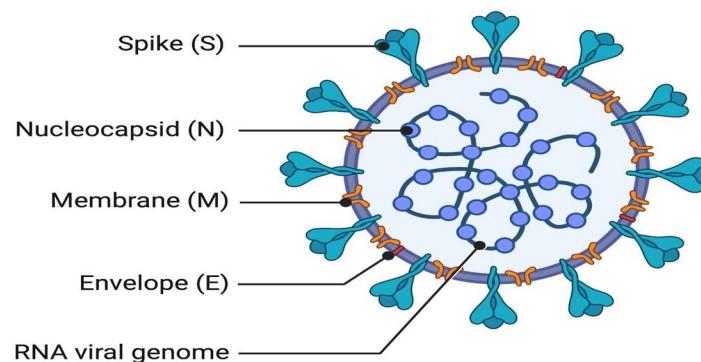
Abstract: Corona viruses are a category of enveloped viruses from the corona virus family, different by their large non-segmented positive -sense, single strand RNA genomes. These viruses can cause a spectrum of illnesses, ranging from the cold to more severe conditions such as SARS and MERS. March 2020 health organization declared the pandemic of the SARS -COV-2 virus, which first appeared in late 2019, a global pandemic situation arose. An analysis of existing scholarly works illuminates various aspects of the resulting disease, COVID -19, including its history, symptoms, epidemiology, clinical features, diagnosis, therapeutic approaches, and prevention strategies.

Keywords: Corona virus, pathogenesis, Treatment and Prevention, clinical features, Transmission, Social Distance SARS, MERS.

I. INTRODUCTION

The COVID-19 pandemic saw a decline in cases in India from September 2020 to early January 2021, following the first wave. However, the arrival of the second wave brought a surge in cases and transmission, leading to higher fatalities. India became a significant epicenter of this second wave, driven by the spread of viral variants. Ongoing research and updates on SARS-CoV-2 are crucial for managing the current pandemic situation. The global outbreak of COVID-19 originated in China in December 2019, rapidly escalating into a world wide health crisis. The World Health Organisation (WHO) declared the COVID-19 outbreak a global public health emergency on January 30, 2020. India's first COVID-19 case was reported on January 27, 2020, in Kerala. Since then, the country has seen considerable variability in case reporting across different regions. Case detection primarily relies on SARS-CoV-2 antigen testing through Real-Time Reverse Transcription Polymerase Chain Reaction (RT-PCR) assays. Human cells contain angiotensin-converting enzyme (ACE2) receptors, which facilitate SARS-CoV-2 entry, particularly in the lower respiratory tract. Classification-wise, SARS-CoV-2 belongs to the beta-corona virus genus, comprising viruses that typically infect animals like bats and can occasionally transmit to humans, sometimes resulting in severe respiratory infections. Ongoing research and updates on SARS-CoV-2 are crucial for managing the current pandemic situation effectively. The virus targets human cells via the angiotensin-converting enzyme-2 (ACE2) receptor, predominantly found in the lower respiratory tract. SARS-CoV-2 belongs to the beta-corona virus genus, which typically infects animals like bats and pangolins. While often causing mild respiratory issues in humans, certain strains can lead to severe infections. Key Aspect ACE2 receptor: SARS-CoV-2's entry point into human cells. Beta-corona virus genus: The viral family behind SARS-CoV. Animal origins: Many corona viruses infect animals, sometimes transmitting to humans. Vaccine development: Understanding the virus's structure and behavior informs vaccine design. Treatment strategies: Staying updated on SARS-CoV-2's mechanisms helps develop effective treatments. Public health measures: Accurate information enables targeted interventions to control the pandemic.

Coronavirus Structure



II. SYMPTOMS

Most common symptoms of COVID-19 are

- Fever.
- Dry cough.
- Fatigue.

Other symptoms that are less common and may affect some patients include

- Loss of taste or smell.
- Nasal congestion.
- Conjunctivitis (also known as red eyes).
- Sore throat.
- Headache.
- Muscle or joint pain.
- Different types of skin rash.
- Nausea or vomiting.
- Diarrhea.
- Chills or dizziness.

Symptoms of severe COVID-19 disease include:

- Shortness of breath.

Convert into another word

ChatGPT said:

Here's your paragraph rewritten using different wording while keeping the meaning the same:

The most frequently observed signs of COVID-19 include:

- Elevated body temperature (fever)
- Persistent dry cough
- Tiredness or general fatigue

Additional, less frequent symptoms that may appear in some individuals are:

- Loss or alteration of the sense of taste or smell
- Blocked or runny nose
- Eye inflammation (conjunctivitis or “pink eye”)
- Sore or irritated throat
- Head pain or headache
- Muscle aches or joint discomfort
- Various forms of skin eruptions or rashes
- Nausea or episodes of vomiting
- Loose stools or diarrhea
- Feeling chills or light-headedness

Indicators of severe COVID-19 infection may include:

- Difficulty in breathing or shortness of breath

III. EPIDEMIOLOGY

COVID-19 Transmission and Epidemiology

Transmission

COVID-19 can affect anyone, as it's primarily spread through respiratory droplets from coughing and sneezing by symptomatic individuals. Transmission can also occur from asymptomatic individuals and before symptoms appear.

Coronavirus Characteristics

Coronaviruses can jump from animals to humans and infect people. There are seven known human coronaviruses (HCoVs), with some identified in the 1960s and others more recently. About 2% of the population carries coronaviruses, which account for 5-10% of acute respiratory infections.

COVID-19 Epidemiology

The COVID-19 pandemic spread rapidly worldwide, primarily through respiratory transmission. Key aspects include:

1. Global spread: COVID-19 originated in China and spread to nearly all continents.
2. Exponential growth: Cases increased rapidly in the initial months.
3. Respiratory transmission: The primary mode of transmission is through respiratory droplets.
4. Viral shedding: Understanding viral shedding is crucial for tracking and controlling the spread.

Case Trends

The number of COVID-19 cases grew exponentially after initial reports, with countries like India experiencing a rapid surge in cases from January 2020 to mid-March 2020. Understanding COVID-19 Transmissibility

Basic Reproduction Number

The basic reproduction number (R_0) is a key parameter that estimates a virus's intrinsic transmissibility. It's a model-based metric that varies depending on the epidemiological context.

Epidemiology's Role

Epidemiology is crucial in studying SARS-CoV-2, involving systematic analysis of COVID-19 cases' distribution, patterns, and determinants within populations. By investigating transmission routes, risk factors, and disease outcomes, epidemiologists gain valuable insights into the virus's behavior and impact.

Key Aspects

1. Transmission dynamics: Understanding how the virus spreads.
2. Risk factors: Identifying factors that increase susceptibility.
3. Disease outcomes: Analyzing the impact on populations.

Importance

Epidemiology informs public health strategies, policy decisions, and resource allocation to mitigate the pandemic's impact.

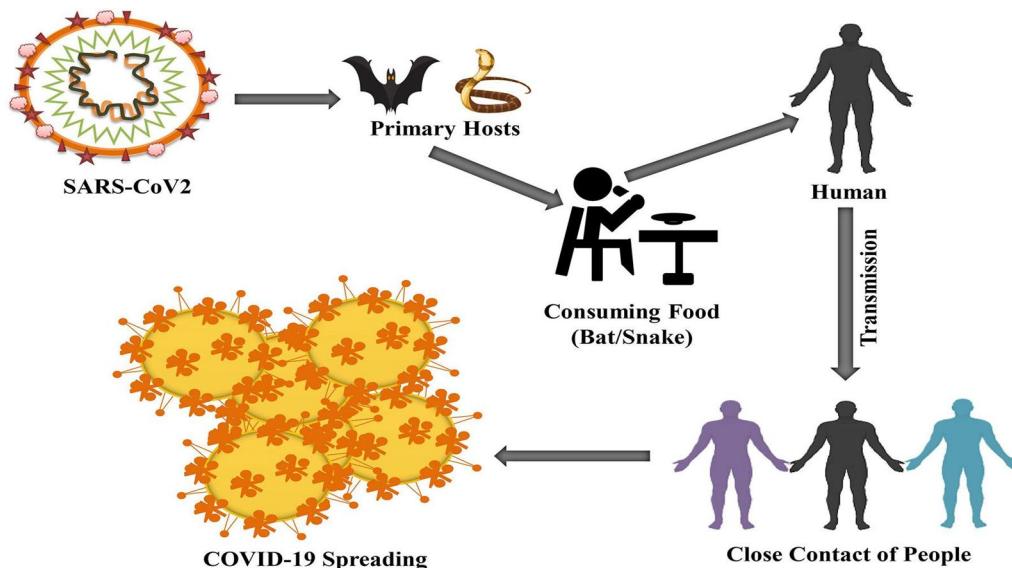


Figure 1: show the transmission

The exact duration of infectivity for COVID-19 patients is uncertain. Research suggests that viral load in oropharyngeal secretions peaks during the early symptomatic stage. Patients can continue to shed the virus even after symptoms resolve. A study in China found the median duration of viral shedding 20 days among survivors, with a range of 17-24 days. Mild cases tend to clear the virus quickly, while severe cases can experience prolonged shedding. Additionally, studies using respiratory and fecal sampling have shown that viral shedding can persist in stools for over four weeks, even when respiratory samples test negative.

IV. DIAGNOSIS

A. Diagnosis of Coronavirus Disease 2019 (COVID-19)

Diagnosing COVID-19 involves a combination of clinical evaluation, laboratory tests, and imaging studies. Here's a detailed overview:

B. Clinical Evaluation

- Medical history and physical examination
- Symptoms such as fever, cough, shortness of breath, and fatigue
- Exposure to confirmed cases or high-risk areas

C. Laboratory Tests

- Reverse Transcription Polymerase Chain Reaction (RT-PCR): considered the gold standard for diagnosing COVID-19
 - Detects SARS-CoV-2 RNA in respiratory specimens, such as nasopharyngeal swabs or sputum
- Antigen Detection Tests: rapid diagnostic tests that detect SARS-CoV-2 antigens
 - Can be used for point-of-care testing, but may have lower sensitivity than RT-PCR
- Serological Tests: detect antibodies against SARS-CoV-2
 - Can be used to diagnose past infections or monitor immune responses

D. Imaging Studies

- **Chest X-rays:** can show lung abnormalities, such as ground-glass opacities
- Computed Tomography (CT) Scans: can provide more detailed images of lung damage
 - May be used to assess disease severity and monitor progression

E. Diagnostic Criteria

- World Health Organization (WHO) and Centers for Disease Control and Prevention (CDC) guidelines recommend using a combination of clinical evaluation, laboratory tests, and imaging studies to diagnose COVID-19

F. Diagnostic Approaches for COVID-19

Molecular Diagnostic Tests

- RT-PCR: detects SARS-CoV-2 RNA
- Loop-mediated isothermal amplification (LAMP): rapid, point-of-care test

G. Serological Tests

- Enzyme-linked immunosorbent assay (ELISA): detects antibodies against SARS-CoV-2
- Rapid diagnostic tests (RDTs): detect antibodies or antigens

H. Imaging Studies

- Chest X-rays: assesses lung abnormalities
- CT scans: provides detailed images of lung damage

I. Challenges and Limitations

- False-negative results: can occur due to various factors, such as low viral load or poor sample quality
- False-positive results: can occur due to cross-reactivity or contamination
- Variability in test performance: different tests may have varying levels of sensitivity and specificity.

J. Laboratory Tests

- Molecular Diagnostic Testing: RT-PCR (Reverse Transcription Polymerase Chain Reaction) is the gold standard for diagnosing COVID-19 ¹.
 - Detects SARS-CoV-2 RNA in respiratory specimens, such as nasopharyngeal swabs or sputum.
 - High sensitivity and specificity.
- Antigen Testing: Rapid diagnostic tests that detect SARS-CoV-2 antigens ².
 - Less sensitive than RT-PCR, but faster and more convenient.
 - Useful for screening and early detection.
- Serology Testing: Measures antibodies against SARS-CoV-2 ³.
 - Useful for determining past infection or vaccine response.
 - Not suitable for diagnosing acute infection.

K. Imaging Studies

- Chest X-ray: Helps identify pneumonia or other lung abnormalities.
- Computed Tomography (CT) Scan: More sensitive than X-ray for detecting lung involvement ⁴.

L. Diagnostic Criteria

- WHO Criteria: Clinical symptoms, epidemiological risk factors, and laboratory confirmation.
- CDC Criteria: Similar to WHO criteria, with additional emphasis on laboratory testing.

M. Challenges and Limitations

- False Negatives: Can occur due to low viral load, poor sample quality, or timing of testing.
- False Positives: Can occur due to contamination, cross-reactivity, or laboratory errors.

N. Future Directions

- Point-of-Care Testing: Rapid, portable, and affordable diagnostic tests for use in resource-limited settings.
- Multiplex Testing: Simultaneous detection of multiple pathogens, including SARS-CoV-2 and other respiratory viruses.

V. TREATMENT

COVID-19 treatment strategies have evolved significantly since the pandemic's onset. Here's a comprehensive overview of the current treatment approaches:

A. Pharmacological Treatments

- Antiviral Medications
 - Remdesivir: Inhibits viral replication by targeting RNA-dependent RNA polymerase. It's approved for hospitalized patients with severe COVID-19 and those requiring supplemental oxygen ¹.
 - Molnupiravir: Another antiviral medication that has shown promise in treating COVID-19 by inhibiting viral replication ².
 - Corticosteroids
 - Dexamethasone: Reduces inflammation and mortality in hospitalized patients requiring oxygen supplementation or mechanical ventilation. It's recommended for patients with severe COVID-19 ^{1 3}.
 - Immunomodulators
 - Tocilizumab: An interleukin-6 receptor antagonist that can reduce mortality in hospitalized patients with severe COVID-19. It's often used in combination with corticosteroids ^{1 2}.
 - Baricitinib: A Janus kinase inhibitor that can reduce mortality in hospitalized patients with COVID-19. It's used in combination with corticosteroids ¹.

B. Supportive Care

- Oxygen Therapy: Essential for managing hypoxemia in patients with severe COVID-19 ³.
- Fluid Management: Careful fluid administration to avoid overload and maintain electrolyte balance.
- Anticoagulation: May be considered for patients at high risk of thrombosis ⁴.

C. Monoclonal Antibodies

- Bamlanivimab/Etesevimab: A combination therapy that has shown efficacy in reducing hospitalization rates in mild to moderate COVID-19 patients ⁵.
- Casirivimab/Imdevimab: Another combination therapy that has demonstrated effectiveness in treating COVID-19 ⁵.

D. Convalescent Plasma Therapy

- Involves administering plasma from recovered COVID-19 patients to neutralize the virus. Its efficacy is still being studied ^{3 2}.

E. Vaccination

- Preventative vaccines have been developed and are crucial in reducing transmission rates and severe illness ³.
- COVID-19 vaccines have been instrumental in controlling the pandemic. Here's a detailed overview of the different types of vaccines, their efficacy, and recommendations.

F. Types of COVID-19 Vaccines

- mRNA Vaccines
 - Pfizer-BioNTech (Comirnaty): Uses nucleoside-modified messenger RNA to encode the SARS-CoV-2 spike protein, stimulating an immune response.
 - Moderna (Spikevax): Employs a similar mRNA approach to Pfizer-BioNTech, encoding the perfusion-stabilized spike protein of SARS-CoV-2.
- Viral Vector Vaccines
 - AstraZeneca (ChAdOx1 nCoV-19): Uses a chimpanzee adenovirus vector to express the SARS-CoV-2 spike protein, inducing an immune response.
 - Johnson & Johnson (Ad26.COV2.S): Employs a recombinant adenovirus type 26 vector to deliver the SARS-CoV-2 spike protein gene.
- Protein Subunit Vaccines
 - Novavax (NVX-CoV2373): Contains recombinant spike protein nanoparticles and Matrix-M adjuvant proteins to elicit an immune response.

G. Efficacy of COVID-19 Vaccines

- Pfizer-BioNTech: 95% efficacy in preventing COVID-19, with high efficacy across demographic subgroups.
- Moderna: 94.5% efficacy in preventing COVID-19, with consistent efficacy across demographic subgroups.
- Johnson & Johnson: 67% efficacy in preventing moderate to severe COVID-19.
- Novavax: 90.7% efficacy in preventing COVID-19 in children aged 5-11 years.

H. Recommendations for COVID-19 Vaccination

- CDC Recommendations: Updated COVID-19 vaccines are recommended for individuals aged 5 years and older.
- Dosing Guidelines:
 - Pfizer-BioNTech: 3 doses for children aged 6 months to 4 years, with 3-8 weeks between doses 1 and 2, and at least 8 weeks between doses 2 and 3.
 - Moderna: 2 doses for individuals aged 18 years and older, with 4-8 weeks between doses.
 - Novavax: 2-dose primary series for individuals aged 12 years and older, with 3-8 weeks between doses.

VI. PREVENTION

A. COVID-19 Prevention Strategies

Preventing COVID-19 requires a multi-faceted approach that includes individual and community-level measures. Here's a comprehensive overview of the prevention strategies:

B. Personal Protective Measures

- Mask Use: Wear masks in public places, especially in crowded areas or when interacting with people outside your household [1].
- Hand Hygiene: Frequently wash hands with soap and water or use hand sanitizers [2].

- Physical Distancing: Maintain a distance of at least 6 feet from others to reduce transmission risk [3].
- Avoid Close Contact: Limit close contact with people who are sick or have been exposed to COVID-19.

C. Community-Level Measures

- Vaccination: Get vaccinated against COVID-19 to protect yourself and others [4].
- Testing and Contact Tracing: Get tested if symptoms arise, and cooperate with contact tracing efforts to prevent further transmission [5].
- Social Distancing Measures: Implement social distancing measures in public places, such as reducing capacity or closing non-essential businesses [3].

D. Environmental Measures

- Surface Cleaning: Regularly clean and disinfect high-touch surfaces to reduce transmission risk [2].
- Ventilation: Improve ventilation in indoor spaces to reduce airborne transmission [1].

E. Public Health Measures

- Travel Restrictions: Implement travel restrictions or quarantine measures to slow the spread of COVID-19 [3].
- Gathering Restrictions: Limit gatherings and events to reduce transmission risk [5].
- Communication: Provide clear and timely communication about COVID-19 risks, prevention measures, and updates.

VII. CONCLUSION

The COVID-19 pandemic has presented significant challenges to global health, economies, and societies. Through a comprehensive review of the literature, this article has highlighted the key aspects of COVID-19, including its epidemiology, pathogenesis, diagnosis, treatment, prevention, and vaccination strategies.

A. Key Takeaways

- COVID-19 is a highly transmissible disease caused by the SARS-CoV-2 virus.
- Older adults and individuals with underlying health conditions are at increased risk of severe illness and mortality.
- Prevention measures, such as mask use, hand hygiene, and physical distancing, are crucial in reducing transmission.
- Vaccination has been instrumental in controlling the pandemic and reducing severe illness and mortality.

B. Future Directions

- Continued research is needed to understand the long-term effects of COVID-19 and the impact of emerging variants.
- Global cooperation and investment in public health infrastructure are essential for preparedness and response to future pandemics.
- Efforts to address health inequities and ensure equitable access to vaccines and treatments are critical.

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