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Abstracts' Service

Pathophysiology, Transmission, Diagnosis, and Treatment of Coronavirus Disease 2019 (COVID-19): A Review

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Importance. The coronavirus disease 2019 (COVID-19) pandemic, due to the novel severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), has caused a worldwide sudden and substantial increase in hospitalizations for pneumonia with multiorgan disease. This review discusses current evidence regarding the pathophysiology, transmission, diagnosis, and management of COVID-19.

Observations. SARS-CoV-2 is spread primarily via respiratory droplets during close face-to-face contact. Infection can be spread by asymptomatic, presymptomatic, and symptomatic carriers. The average time from exposure to symptom onset is 5 days, and 97.5% of people who develop symptoms do so within 11.5 days. The most common symptoms are fever, dry cough, and shortness of breath. Radiographic and laboratory abnormalities, such as lymphopenia and elevated lactate dehydrogenase, are common, but nonspecific. Diagnosis is made by detection of SARS-CoV-2 via reverse transcription polymerase chain reaction testing, although false-negative test results may occur in up to 20% to 67% of patients; however, this is dependent on the quality and timing of testing. Manifestations of COVID-19 include asymptomatic carriers and fulminant disease characterized by sepsis and acute respiratory failure. Approximately 5% of patients with COVID-19, and 20% of those hospitalized, experience severe symptoms necessitating intensive care. More than 75% of patients hospitalized with COVID-19 require supplemental oxygen. Treatment for individuals with COVID-19 includes best practices for supportive management of acute hypoxic respiratory failure. Emerging data indicate that dexamethasone therapy reduces 28-day mortality in patients requiring supplemental oxygen compared with usual care (21.6% vs 24.6%; age-adjusted rate ratio, 0.83 [95% CI, 0.74-0.92]) and that remdesivir improves time to recovery (hospital discharge or no supplemental oxygen requirement) from 15 to 11 days. In a randomized trial of 103 patients with COVID-19, convalescent plasma did not shorten time to recovery. Ongoing trials are testing antiviral therapies, immune modulators, and anticoagulants. The case-fatality rate for COVID-19 varies markedly by age, ranging from 0.3 deaths per 1000 cases among patients aged 5 to 17 years to 304.9 deaths per 1000 cases among patients aged 85 years or older in the US. Among patients hospitalized in the intensive care unit, the case fatality is up to 40%. At least 120 SARS-CoV-2 vaccines are under development. Until an effective vaccine is available, the primary methods to reduce spread are face masks, social distancing, and contact tracing. Monoclonal antibodies and hyperimmune globulin may provide additional preventive strategies.

Conclusions and relevance. As of July 1, 2020, more than 10 million people worldwide had been infected with SARS-CoV-2. Many aspects of transmission, infection, and treatment remain unclear. Advances in prevention and effective management of COVID-19 will require basic and clinical investigation and public health and clinical interventions.

Risk of SARS-CoV-2 transmission by aerosols, the rational use of masks, and protection of healthcare workers from COVID-19

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Objectives. To determine the risk of SARS-CoV-2 transmission by aerosols, to provide evidence on the rational use of masks, and to discuss additional measures important for the protection of healthcare workers from COVID-19.

Methods. Literature review and expert opinion.

Short conclusion. SARS-CoV-2, the pathogen causing COVID-19, is considered to be transmitted via droplets rather than aerosols, but droplets with strong directional airflow support may spread further than 2 m. High rates of COVID-19 infections in healthcare-workers (HCWs) have been reported from several countries. Respirators such as filtering face piece (FFP) 2 masks were designed to protect HCWs, while surgical masks were originally intended to protect patients (e.g., during surgery). Nevertheless, high quality standard surgical masks (type II/IIR according to European Norm EN 14683) appear to be as effective as FFP2 masks in preventing droplet-associated viral infections of HCWs as reported from influenza or SARS. So far, no head-to-head trials with these masks have been published for COVID-19. Neither mask type completely prevents transmission, which may be due to inappropriate handling and alternative transmission pathways. Therefore, compliance with a bundle of infection control measures including thorough hand hygiene is key. During high-risk procedures, both droplets and aerosols may be produced, reason why respirators are indicated for these interventions.

Coronavirus disease 2019: What we know?

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In late December 2019, a cluster of unexplained pneumonia cases has been reported in Wuhan, China. A few days later, the causative agent of this mysterious pneumonia was identified as a novel coronavirus. This causative virus has been temporarily named as severe acute respiratory syndrome coronavirus 2 and the relevant infected disease has been named as coronavirus disease 2019 (COVID-19) by the World Health Organization, respectively. The COVID-19 epidemic is spreading in China and all over the world now. The purpose of this review is primarily to review the pathogen, clinical features, diagnosis, and treatment of COVID-19, but also to comment briefly on the epidemiology and pathology based on the current evidence.

Physical distancing, face masks, and eye protection to prevent person-to-person transmission of SARS-CoV-2 and COVID-19: a systematic review and meta-analysis

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Background. Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) causes COVID-19 and is spread person-to-person through close contact. We aimed to investigate the effects of physical distance, face masks, and eye protection on virus transmission in health-care and non-health-care (eg, community) settings.

Methods. We did a systematic review and meta-analysis to investigate the optimum distance for avoiding person-to-person virus transmission and to assess the use of face masks and eye protection to prevent transmission of viruses. We obtained data for SARS-CoV-2 and the betacoronaviruses that cause severe acute respiratory syndrome, and Middle East respiratory syndrome from 21 standard WHO-specific and COVID-19-specific sources. We searched these data sources from database inception to May 3, 2020, with no restriction by language, for comparative studies and for contextual factors of acceptability, feasibility, resource use, and equity. We screened records, extracted data, and assessed risk of bias in duplicate. We did frequentist and Bayesian meta-analyses and random-effects meta-regressions. We rated the certainty of evidence according to Cochrane methods and the GRADE approach. This study is registered with PROSPERO, CRD42020177047.

Findings. Our search identified 172 observational studies across 16 countries and six continents, with no randomised controlled trials and 44 relevant comparative studies in health-care and non-health-care settings (n=25 697 patients). Transmission of viruses was lower with physical distancing of 1 m or more, compared with a distance of less than 1 m (n=10 736, pooled adjusted odds ratio [aOR] 0.18, 95% CI 0.09 to 0.38; risk difference [RD] -10.2%, 95% CI -11.5 to -7.5; moderate certainty); protection was increased as distance was lengthened (change in relative risk [RR] 2.02 per m; pinteraction=0.041; moderate certainty). Face mask use could result in a large reduction in risk of infection (n=2647; aOR 0.15, 95% CI 0.07 to 0.34, RD -14.3%, -15.9 to -10.7; low certainty), with stronger associations with N95 or similar respirators compared with disposable surgical masks or similar (eg, reusable 12-16-layer cotton masks; pinteraction=0.090; posterior probability >95%, low certainty). Eye protection also was associated with less infection (n=3713; aOR 0.22, 95% CI 0.12 to 0.39, RD -10.6%, 95% CI -12.5 to -7.7; low certainty). Unadjusted studies and subgroup and sensitivity analyses showed similar findings.

Interpretation. The findings of this systematic review and meta-analysis support physical distancing of 1 m or more and provide quantitative estimates for models and contact tracing to inform policy. Optimum use of face masks, respirators, and eye protection in public and health-care settings should be informed by these findings and contextual factors. Robust randomised trials are needed to better inform the evidence for these interventions, but this systematic appraisal of currently best available evidence might inform interim guidance.

The need of health policy perspective to protect Healthcare Workers during COVID-19 pandemic. A GRADE rapid review on the N95 respirators effectiveness

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Protecting Health Care Workers (HCWs) during routine care of suspected or confirmed COVID-19 patients is of paramount importance to halt the SARS-CoV-2 (Severe Acute Respiratory Syndrome-Coronavirus-2) pandemic. The WHO, ECDC and CDC have issued conflicting guidelines on the use of respiratory filters (N95) by HCWs. We searched PubMed, Embase and The Cochrane Library from the inception to March 21, 2020 to identify randomized controlled trials (RCTs) comparing N95 respirators versus surgical masks for prevention of COVID-19 or any other respiratory infection among HCWs. The grading of recommendations, assessment, development, and evaluation (GRADE) was used to evaluate the quality of evidence. Four RCTs involving 8736 HCWs were included. We did not find any trial specifically on prevention of COVID-19. However, wearing N95 respirators can prevent 73 more (95% CI 46-91) clinical respiratory infections per 1000 HCWs compared to surgical masks (2 RCTs; 2594 patients; low quality of evidence). A protective effect of N95 respirators in laboratory-confirmed bacterial colonization (RR = 0.41; 95%CI 0.28-0.61) was also found. A trend in favour of N95 respirators was observed in preventing laboratory-confirmed respiratory viral infections, laboratory-confirmed respiratory infection, and influenza like illness. We found no direct high quality evidence on whether N95 respirators are better than surgical masks for HCWs protection from SARS-CoV-2. However, low quality evidence suggests that N95 respirators protect HCWs from clinical respiratory infections. This finding should be contemplated to decide the best strategy to support the resilience of healthcare systems facing the potentially catastrophic SARS-CoV-2 pandemic.

Unique epidemiological and clinical features of the emerging 2019 novel coronavirus pneumonia (COVID-19) implicate special control measures

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By 27 February 2020, the outbreak of coronavirus disease 2019 (COVID-19) caused 82 623 confirmed cases and 2858 deaths globally, more than severe acute respiratory syndrome (SARS) (8273 cases, 775 deaths) and Middle East respiratory syndrome (MERS) (1139 cases, 431 deaths) caused in 2003 and 2013, respectively. COVID-19 has spread to 46 countries internationally. Total fatality rate of COVID-19 is estimated at 3.46% by far based on published data from the Chinese Center for Disease Control and Prevention (China CDC). Average incubation period of COVID-19 is around 6.4 days, ranges from 0 to 24 days. The basic reproductive number (R0) of COVID-19 ranges from 2 to 3.5 at the early phase regardless of different prediction models, which is higher than SARS and MERS. A study from China CDC showed majority of patients (80.9%) were considered asymptomatic or mild pneumonia but released large amounts of viruses at the early phase of infection, which posed enormous challenges for containing the spread of COVID-19. Nosocomial transmission was another severe problem. A total of 3019 health workers were infected by 12 February 2020, which accounted for 3.83% of total number of infections, and extremely burdened the health system, especially in Wuhan. Limited epidemiological and clinical data suggest that the disease spectrum of COVID-19 may differ from SARS or MERS. We summarize latest literatures on genetic, epidemiological, and clinical features of COVID-19 in comparison to SARS and MERS and emphasize special measures on diagnosis and potential interventions. This review will improve our understanding of the unique features of COVID-19 and enhance our control measures in the future.