



Clinical, laboratory and imaging features of COVID-19: A systematic review and meta-analysis

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although higher, was not significantly so. For patients admitted to ICU, there were also small differences. Sun et al. found 18.1% (95%CI 12.7–24.3%), however, we identified that 20.3% required intensive critical care (95%CI 10.0–30.6%). The major difference between both studies was in the last variable assessed i.e. the case fatality rate. Sun et al. report 4.3% (95%CI 2.7–6.1%) and we report a rate of 13.9% (95%CI 6.2–21.5%), which is significantly higher. Finally, Sun et al. only included studies, but not case reports, as we did, which provided additional consistent findings of the clinical, laboratory, imaging and evolution characteristics of patients with confirmed COVID-19.

Our results showed that there is still a need for more comprehensive clinical studies, including short and long -term follow-up cohort assessments. More studies from outside China, where there are more than 100 patients diagnosed with COVID-19, as is the case of South Korea, Italy, and Japan [59,60], will contribute to the growing volume of data, in addition to the growing number of studies appearing from China. Even more, the situation with the cruise ship Diamond Princess, docked in Yokohama, Japan, with 3711 passengers, approximately 20% of the infected, with 7 deaths, is also a valuable chance to better characterize COVID-19. Clinical evidence synthesized in this review is mainly derived from China, although for case reports, ten of the thirty-two countries with confirmed cases [7,12,29,30], have published some of them (Table 7). Further clinical data is crucial to elucidate the clinical spectrum of the disease. The clinical experience stemming from countries now dealing with an ever increasing number of cases such as Italy [61], Singapore, Hong Kong, Nepal [7], Iran, and Malaysia in the form of case reports, case series, or large observational studies will be most important. Up to now, regardless whether of report type (cross-sectional studies or case reports) the clinical findings are consistent, but more data are needed to define the risk factors for admission in ICU and for fatal outcomes. However, data suggest that older age and comorbidities play a vital role in influencing severe disease and negative clinical outcomes. These data would be useful to guide patient risk groups management in the current epidemic, especially in those countries about to receive cases, as is the situation in Latin America. COVID-19 cases have been confirmed in Brazil, Mexico, and in all the countries of South America, and in most of the Central America and the Caribbean subregions, as of the time of proofs correction (March 14, 2020) [62]. In these and other resource-constrained settings, e.g. Africa, supplies chains, including those for drugs, masks and personal protection equipment, will be challenged.

The results of this systematic review highlight the clinical, laboratory, and imaging findings that may assist clinicians anywhere in the globe in suspecting the possibility of COVID-19 infection in those with recent travel to areas with ongoing transmission or among contacts of confirmed cases. Early recognition of cases will allow clinicians to ensure adequate clinical monitoring, institution of supportive interventions, and preventing further transmission by implementing infection control measures [29,56,63]. There is a need for prospective studies to evaluate the epidemiology, pathogenesis, duration of viral shedding, and the clinical spectrum of disease associated with this emerging viral infection [29,56,63].

To effectively protect populations and healthcare workers in the face of arrival and spreading of this emerging viral pathogen, constant evaluation of available evidence is essential to guide clinical suspicion, diagnosis, management, and mitigation of transmission of COVID-19.

5.1. Limitations

This review has several limitations. Few studies are available for inclusion. Most are from China. Now urgently, data from Italy are required. It would be better to include as many studies with a broad geographic scope, to get a more comprehensive understanding of COVID19. More detailed patient information, particularly regarding clinical outcomes, was unavailable in most studies at the time of analyses; however, the data in this review permit a first synthesis of the

clinical and laboratory characteristics of COVID-19. Our systematic review and meta analysis found a CFR of over 13%. As we discussed earlier, the differences between the crude fatality rate (< 3.5%) and that found among hospitalized patients in the selected studies included here may be explained by the fact that cases requiring medical attention in hospitals consulted with a more advanced stage of disease.

6. Conclusions

Infection with COVID-19 is associated with significant morbidity especially in patients with chronic medical conditions. At least one-fifth of cases require supportive care in medical intensive care units, which is especially limited in most developing countries. **Despite the implementation of optimal supportive interventions, case fatality rate among hospitalized patients is more than 10%.** Similar to other viral respiratory pathogens, COVID-19 presents in the majority of cases with a rapidly progressive course of fever, cough and dyspnea. Important distinguishing factors are leukopenia and the rapid progression to ARDS. Eliciting a history of recent travel to areas with ongoing outbreaks of this emerging pathogen or contact with a confirmed case of COVID-19, should prompt clinicians to initiate isolation precautions and obtain laboratory confirmation. Additional research is needed to elucidate viral and host factors in the pathogenesis of severe and fatal infections.

Author contributions

AJRM and JACO formulated the research questions, designed the study, developed the preliminary search strategy, and drafted the manuscript. EGO, RV, YHR refined the search strategy by conducting iterative database queries and incorporating new search terms. EGO, RV, YHR, and AJRM searched and collected the articles. JACO, AJRM, and DKBA conducted the quality assessment. All authors critically reviewed the manuscript for relevant intellectual content. All authors have read and approved the final version of the manuscript.

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Ethical approval

Approval was not required.

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