Mini Review
Volume 12:2, 2023

Journal of
Micro Biology and Diagnosis

ISSN: 2161-0703 Open Access

The COVID-19 Challenge for a Clinical Microbiology Department

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Abstract

In a real-world scenario, quantify the workload and cost overload caused by the COVID-19 pandemic in a Clinical Microbiology laboratory. In the COVID pandemic, we compared the number of samples received, their distribution, human resources, and the budget of a Microbiology laboratory to the same months the previous year. The total number of samples processed in the Clinical Microbiology laboratory increased 96.70% from March to December 2020, representing a 127.50% increase when expressed as samples1000 admissions. The virology and serology departments bore the brunt of the increased workload. Despite the addition of new employees, the number of samples processed per technician increased by 12.5%. Microbiology incurs an additional cost of 6,616,511 euros.

Keywords: SARS Cov-2 • Clinical microbiology • PCR

Introduction

Clinical Microbiology Departments had to adapt their structure in a very short period of time to respond to an unprecedented massive diagnostic demand for a new disease (COVID-19). We were not able to find reports quantifying the change for Clinical Microbiology Departments in aspects like variation in type of samples, human resources and cost until now. This paper compares the pandemic workload in our Microbiology Department to the same time period the previous year. Changes in sample submission, personnel, and laboratory budget are all evaluated. We hope that our experience will be useful to other laboratories as they plan for potential future epidemics. We were unable to find reports quantifying the change for Clinical Microbiology Departments in areas such as sample variation, human resources, and cost until now. This paper compares our Microbiology Department's pandemic workload to the same time period the previous year. Changes to sample submission, personnel, and the laboratory budget are all assessed. We hope that our experience can help other laboratories plan for potential future epidemics [1].

Literature Review

The greatest variety of techniques emerged during the first months of the pandemic, coinciding with the greatest scarcity of products on the market. With the exception of the very early days, when RUO tests were used, we have always used CE marked systems. Samples were considered positive when at least two different targets were amplified using multiplex kits or combinations of kits. Positive and negative controls provided by the corresponding manufacturers, as well as laboratory own controls consisting of previously characterized, diluted, and aliquoted samples, were always included in the runs. From May to June 2020 we used the system as an extraction system, and QuantStudio-5 as a therocycler as a standard technique, as well as the geneXpert system by cepheid [2,3].

The pandemic of coronavirus disease 19 (COVID-19) has had a negative impact on antimicrobial resistance, resulting in an increase in the spread of multidrug-resistant microorganisms in hospital settings. This is due primarily to three factors. The first is based on contact isolation measurements in COVID-19 areas that were frequently unattended by healthcare providers due to resource and space constraints. The second factor is that COVID-19 patients are at a higher risk of invasive procedures such as mechanical intubation and prolonged hospitalization, as well as being colonised and infected by MDR agents. Finally, the widespread use of antibiotics to treat potentially overlapping bacterial infections increased the risk of antimicrobial resistance [4].

Discussion

Among these, carbapenem-resistant Acinetobacter baumannii is one of the most important Gram-negative bacteria associated with antimicrobial resistance. Its multiple resistance mechanisms, such as outer membrane modification, efflux pumps, resistance acquisition, and biofilm formation, are to blame for the difficulty in treating infections and life-threatening conditions. The World Health Organization added this bacterial species to the list of bacteria for which new antibiotics are urgently required and have a critical priority level in 2017.Indeed, CR-Ab infections have a high morbidity and mortality rate. On the one hand, this is frequently related to the severity of the underlying diseases that characterised hospitalised patients, but it should be noted that the therapeutic options available for the treatment of CR-Ab infections are limited [5].

Clinical data on its efficacy in treating severe CR-Ab infections is scarce and contradictory. While the "CREDIBLE-CR" trial found higher rates of mortality at 14 and 28 days in patients with severe CR-Ab infections treated with cefiderocol versus the "best available therapy," many observational studies and case reports highlighted the potential benefits of cefiderocol use on mortality and microbiological cure. However, because there are no large and homogeneous randomised clinical trial results available, more clinical data on the use of cefiderocol in severe CR-Ab infections are urgently needed to definitively assess its efficacy and reach consensus among the various guidelines.

From medical health records, we collected demographic, clinical, and laboratory data. We also recorded the length of stay, the ward number, and the type of comorbidities. The Kidney Disease: Improving Global Outcomes (KDIGO) guidelines were used to define acute kidney injury. All antibiotic combinations used in colistin or cefiderocol-based antibiotic regimens were documented. Finally, we documented the duration of antibiotic treatment. We should mention that there was a shortage of ampicillin/sulbactam during the first part of the study period. As a result, sulbactam is not included in the antibiotic combinations used to treat cefiderocol.

As a result, treating CR-Ab infections has become difficult, and a gold-standard therapy is still lacking. Furthermore, the mortality rate of CR-Ab infection ranges from 45% to 70%. The overall 30-day mortality rate in our cohort was 43%, with a higher mortality rate observed in patients treated with cefiderocol-based regimens compared to those treated with colistin-based regimens, despite the

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Received: 02 February, 2023; Manuscript No. jmmd-23-95661; **Editor Assigned:** 03 February, 2023; PreQC No. P-95661; **Reviewed:** 16 February, 2023; QC No. Q-95661; **Revised:** 21 February, 2023, Manuscript No. R-95661; **Published:** 28 February, 2023, DOI: 10.37421/2161-0703.2023.12.393

lack of a statistically significant difference. Even after accounting for propensity scores, no benefits were found with cefiderocol-based treatment. Furthermore, the microbiological cure rate was comparable between the two treatment groups [6].

Conclusion

In conclusion, our findings appear to temper the initial excitement expressed in previous studies of CR-Ab infections treated with cefiderocol. However, given their limitations, our findings should be interpreted with caution. Nonetheless, we believe that cefiderocol should be used with caution. It can be used in clinical scenarios where its inherent advantages can be maximized, such as when other alternatives have been shown to be ineffective, for salvage therapy, or when the risk of colistin toxicity is unacceptable. More prospective and randomised clinical trials are needed to demonstrate the new molecule's high efficacy and whether it should be combined with other agents in CR-Ab infections.

Acknowledgement

None.

Conflict of Interest

None.

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How to cite this article: Marín, Mercedes. "The COVID-19 Challenge for a Clinical Microbiology Department." *J Med Microb Diagn* 12 (2023): 393.