

Review of: "Determination of probability of causative pathogen in infectious keratitis using deep learning algorithm of slit-lamp images"

EUNICE CURY

Potential competing interests: The author(s) declared that no potential competing interests exist.

The article deals with a proposal to use deep learning algorithm to identify pathogens that cause infectious keratitis, based on the analysis of slit-lamp images captured during the clinical examination of the patient.

This is an innovative proposal, of great importance for diagnosing the etiology of infectious keratitis, with the potential to reduce the impact of vision loss and blindness.

The application of the hybrid deep learning algorithm increases the probability score of identifying the infectious agent involved in keratitis, during the analysis of slit-lamp images. I don't have the technical knowledge to discuss the software used, but I noticed the care taken in getting the results as accurately as possible, using this technique that is already used in facial recognition, based on recording images at different angles and different levels of lighting, thus obtaining different degrees of resolution.

We know that most infectious keratitis is of bacterial etiology. The authors were careful to submit the result classified as bacterial to a second classifier, in order to obtain probability scores for *acanthamoeba*, fungi and herpesvirus, allowing an improvement in the diagnosis, since the association of different pathogens causing mixed infections is usual.

I understand that the algorithm's robustness validation criterion is satisfactory when submitting the 4306 images randomly divided into 3882 training images and 424 test images, so that different images of the same eyes were in the training or test group, but not in both.

Another advantage that I was able to observe is that the decrease in diagnostic efficacy was minimal when the algorithm was used to evaluate images without the use of fluorescein, which is used to observe the topography of the cornea. In microbiological practice, the use of fluorescein can negatively affect the quality of Gram stain. It is not always possible for the ophthalmologist to carry out different collections, due to the scarcity of material and due to the conditions of the cornea, during the infectious process. In this way, it would be possible to improve the resolution of the examination using the slit-lamp, without the application of fluorescein, and to perform the collection of scrapings from the lesion for microbiological analyses.

In the study of keratitis, there are different aspects that can interfere with the results and that can justify what the authors observed when comparing the performance of the algorithm to the performance of the specialists:

- 1- Difficulty in collecting corneal samples by ophthalmologists for making slides, with superficial collections that are not able to demonstrate the etiological agent; technical difficulties in performing the smear, which prevents adequate staining and interferes with the quality of observation by the laboratory
- 2- Technical difficulty of laboratory services in examining minimal samples such as those from the cornea and carrying out

specific research and cultures for fungi, bacteria and free-living amoebas, since they are not routine in many laboratories.

I understand that the use of the algorithm would reduce the impact of these factors that make the diagnosis of keratitis difficult, even in places that are farthest from specialized centers, providing physicians and patients with greater efficiency in diagnosis and treatment.

The authors acknowledge the limitations of the study, understanding that it may not be applicable in geographic regions that have epidemiologically different pathogenic species. However, it is known that these are the most common pathogens worldwide and, considering this fact, the application of the algorithm would reduce the difficulties related to the ophthalmologist, technical laboratory problems, difficulty in elucidating cases of mixed infection or identifying cases of herpesvirus, acanthamoeba and fungi.

Despite the limitations mentioned by the authors, I understand that the algorithm can be an important tool, which could be applied in a multicentric way in corneal reference centers, residency programs, for its improvement, which can have a great impact on reducing the complications of keratitis, corneal transplantation, loss of eye function, excresis, blindness and other complications.

As they well noted at the end of the article, “the development of the DL algorithm is important and could become the basis for the future development of slit lamp self-diagnosis, as well as the establishment of an efficient telemedicine platform for anterior segment diseases”.