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## Letter to the Editor

## SARS-CoV-2 and superimposed infection by trichomonads



Dear editor,

We have read the interesting recently published review describing the evaluation of co-infections in patients with coronavirus disease 2019 (COVID-19).<sup>1</sup> A letter to the editor has informed readers that fungal co-infections may be underestimated.<sup>2</sup> The author of the letter reports an unexpected finding of a high proportion of critically ill COVID-19 patients detected as also being carrier of *Pneumocystis jirovecii* by RT-qPCR.

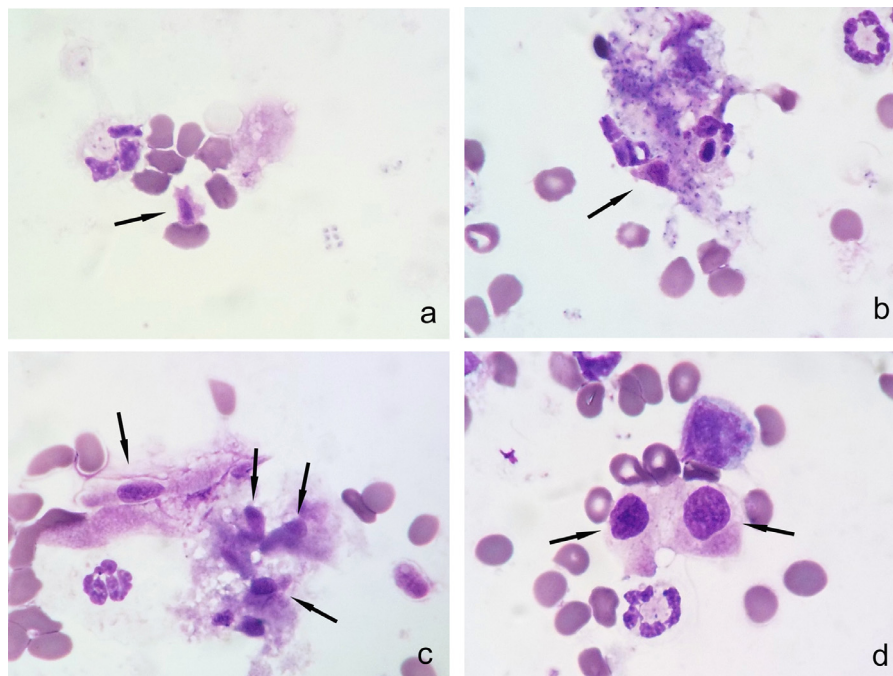
Moreover, no parasitic co-infection was observed in the thirty studies collected in the review. With this letter, we wish to inform clinicians, pathologists and parasitologists of the occurrence of superimposed infections by trichomonads during “common” acute respiratory distress syndrome (ARDS) and probably also during severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2).

More than ten years ago, in 2007, we reported frequent superimposed infection by trichomonads in ARDS.<sup>3</sup> Ninety consecutive bronchoalveolar lavage fluid (BALF) samples taken from 83 patients hospitalized in the same intensive care unit were retro-

spectively examined. Protists were detected in the BALF of 17/52 patients with ARDS. Only two of them also had *P. jirovecii* pneumonia (PjP).

In ARDS, local hypoxic conditions could be the main factor favouring the multiplication of trichomonads because the alveolar lumens are filled with fibrin and cellular debris. The deleterious action of trichomonads remains hypothetical, but the amoeboid morphology of the parasite argues in favour of aggressiveness,<sup>4,5</sup> and the question of a role in the limitation of recovery is raised. SARS-CoV-2 offers the same local conditions favouring the development of trichomonads. Thus, the presence of trichomonads should be considered, and their potentially deleterious role in SARS-CoV-2 should be evaluated by clinical trials.

Elsewhere, two years earlier, in 2005, we made the same observation of superimposed infection by trichomonads during PjP.<sup>6</sup> This observation was not made or commented on by others in the following years. Some readers even expressed doubt.<sup>7</sup> Nevertheless, this observation was also made earlier and was published in 2001.<sup>8</sup> The authors described “unidentified cells” almost exclusively in the BALF of patients infected with HIV. However, at that time, the cells described were considered human cells by the authors. The word



**Fig. 1.** Microphotographs from a case of *Pneumocystis pneumonia* (MGG stain, x 1000). Trichomonads are indicated by arrows. Fig. 1a–c: Trichomonads of small and medium size that can be easily identified. Fig. 1d: A large binucleated cell that cannot be interpreted without awareness of this amazing form.

"trichomonad" was not provided as an indexing keyword, and the report was forgotten.

It is too early to consider superimposed trichomonas infection as a systematic event or threat to all patients with alveolar injury during ARDS, SARS-CoV-2, or PjP. Clinicians need confirmation from the cytopathologist or parasitologist examining the BALF. Parasitologists recognize the mobile flagellated form of trichomonad in liquid medium. Cytopathologists recognize trichomonads in Pap smears, not by their flagella – not stained – but by their calibrated shape and weakly stained elliptical nucleus. Thus, on BALF slides stained with May-Grünwald Giemsa (MGG), the parasite does not appear familiar to either cytopathologists or parasitologists. In addition, it is present in the amoeboid form. Strange cells can attract the eyes of cytopathologists accustomed to human cells, which can be regarded as "foreign cells" or more aptly as "parasitic cells" (Fig. 1). However, no one can assist the cytopathologists, including parasitologists.

Apart from cases in which amoeboid forms of trichomonas are found under a microscope, mainly cases of PjP and ARDS, nested PCR is required. It should be noted that recent studies have shown that trichomonads colonize the lungs in other conditions and in healthy people.<sup>9</sup> Unexpected or unknown species can also be found.<sup>10</sup>

Struggling against the current COVID-19 pandemic, of which SARS is the major medical complication, the presence of trichomonas should not be overlooked or considered an anecdotal event. It seems fair to assess the potentially deleterious role of trichomonads in prospective clinical trials. Clinicians should inform their colleagues about this neglected parasite. Parasitologists and cytopathologists can only be convinced by pictures. It should be noted that routine MGG staining is the best way to identify amoeboid trichomonads and that even slides that are several years old can be examined retrospectively. The ideal way to convince observers is to show them pictures. Photomicrographs from different cases of *P. jirovecii* pneumonia and ARDS are provided as supplementary material in the online version of this letter (at <http://dx.doi.org/10.17632/3b9bb9vsn8.1>).

#### Declaration of Competing Interest

None

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