

# Epidemiology of invasive fungal infections in kidney transplant patients

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I recently read with great interest the review article “Epidemiology and treatment approaches in management of invasive fungal infections” by Kriengkauykiat et al<sup>1</sup> that was published in your journal. This review drew attention to the steadily growing number of invasive fungal infections (IFIs) that are due to the increasing number of severely immunocompromised patients. Despite advances in antifungal regimens in terms of prophylaxis and treatment, IFIs may lead to high mortality rates in solid organ recipients.

As Kriengkauykiat et al<sup>1</sup> mentioned, the incidence of IFIs after kidney transplantation is the lowest of all solid organ transplantations; furthermore, the prevalence of IFIs after kidney transplantation in Iran, Turkey, Kuwait, and India has been found to be 0.9%, 4%, 3.5%, and 14%, respectively.<sup>2</sup> In a large series of Iranian kidney transplant recipients, cumulative IFI incidence rate was nearly the same as that seen in developed countries (0.87%).<sup>2</sup> Although *Aspergillus* and *Candida* are responsible for more than 80% of IFIs in organ transplant recipients and zygomycosis represents a small amount of IFIs in kidney transplants (with incidence rates of 0.2%–1.2%), in our previous report zygomycosis accounted for 52% of all invasive mycoses.<sup>2</sup>

I agree that the occurrence of IFIs is highest in the first 6 months post-transplantation when immunosuppression is most intense. In our recipients, IFIs were most likely to occur within 1 year of renal transplantation.<sup>2</sup> According to the Transplant-Associated Infection Surveillance Network database, most zygomycosis infections occurred after the first 3 months after post-hematopoietic cell transplantation and at a median of 312 days following solid organ transplantation.<sup>1</sup> Zygomycosis frequently occurs within the first year after kidney transplantation, and is reported in 44%–59% of all of kidney transplant patients.<sup>3,4</sup>

As Kriengkauykiat et al noted, the overall 3-month and 12-month mortality rates of zygomycosis in hematopoietic cell transplantation were approximately 64%–72%. Moreover, despite being treated with appropriate antifungal agents, the mortality rate among kidney transplant patients was as high as 52%, mostly due to zygomycosis.<sup>2</sup> In addition, in a series of 25 renal recipients with zygomycosis, overall mortality rate was 52%, particularly in recipients with pulmonary infection (who had a 100% mortality rate); however, the mortality rate in those with the rhino-cerebral form of the disease was relatively low (31%).<sup>4</sup> Early diagnosis of invasive mucormycosis is imperative, and must be followed by prompt antifungal and surgical therapy. The mortality rate

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in patients who received antifungal therapy combined with aggressive surgical debridement as a result of early diagnosis was as low as 40%, which contrasts with the 100% mortality in those who did not undergo surgery.<sup>4</sup>

I would like to add the age of recipients to the list of risk factors for invasive fungal infections as noted in the review article of Kriengkauykiat et al. In a large retrospective study of fungal infection in kidney transplant recipients, it was found that patient age being greater than 40 was a risk factor for invasive fungal infection with zygomycosis.<sup>3</sup>

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## Authors' response

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The letter by Einollahi presented very interesting data. There were similarities to our review. However, there was a significant difference with regard to the proportion of invasive fungal infections caused by Zygomycetes in the Iranian renal transplant population (52%)<sup>1</sup> compared to reports in the literature.<sup>2</sup> Perhaps some of the reasons for this difference may be related to risk factors that may play a role in developing zygomycosis, such as diabetes mellitus<sup>3</sup> (6/11 in the Einollahi et al study<sup>1</sup>) or the use of antifungal agents such as voriconazole or micafungin.<sup>4,5</sup> Other possible risk factors include iron overload or use of iron chelators such as deferoxamine.<sup>6,7</sup> It would be interesting to know what antifungal agents these patients experienced prior to onset of zygomycosis or the presence of other risk factors.

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