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Incidence and Severity of COVID-19 in Relation to Anti-receptor-binding Domain IgG Antibody Level after COVID-19 Vaccination in Kidney Transplant Recipients

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Abstract

Kidney Transplant Recipients (KTRs) are known to be at increased risk of severe outcomes from COVID-19 due to immunosuppression. With the emergence of COVID-19 vaccines, understanding the incidence and severity of breakthrough infections in KTRs and their association with anti-Receptor-Binding Domain (RBD) IgG antibody levels is critical for optimizing vaccination strategies in this vulnerable population. In this study, we investigated the relationship between anti-RBD IgG antibody levels after COVID-19 vaccination and the incidence and severity of COVID-19 in KTRs. A cohort of KTRs who received COVID-19 vaccination was monitored for breakthrough infections and anti-RBD IgG antibody levels were measured at regular intervals post-vaccination. Our findings provide insights into the effectiveness of COVID-19 vaccination in KTRs and highlight the importance of monitoring antibody responses for guiding vaccination strategies in immunocompromised individuals.

Keywords: Kidney transplant recipients • Immunosuppression • Vaccination • COVID-19

Introduction

Kidney Transplant Recipients (KTRs) constitute a vulnerable population at heightened risk of severe outcomes from COVID-19 due to their immunosuppressed status. The emergence of safe and effective COVID-19 vaccines has provided hope for reducing the burden of COVID-19 in this high-risk group. However, questions remain regarding the effectiveness of vaccination in KTRs, particularly in terms of breakthrough infections and the durability of immune responses. The Receptor-Binding Domain (RBD) of the SARS-CoV-2 spike protein plays a crucial role in viral attachment and entry into host cells, making it a key target for vaccine-induced immune responses. Anti-RBD IgG antibodies are an important component of the humoral immune response generated following COVID-19 vaccination, contributing to neutralization of the virus and prevention of infection [1].

Understanding the relationship between anti-RBD IgG antibody levels after COVID-19 vaccination and the incidence and severity of breakthrough infections in KTRs is essential for optimizing vaccination strategies and informing clinical management decisions. Previous studies have demonstrated impaired immune responses to vaccination in immunocompromised individuals, raising concerns about vaccine efficacy and the need for additional measures to protect this vulnerable population. In this study, we aimed to investigate the incidence and severity of COVID-19 in relation to anti-RBD IgG antibody levels after COVID-19 vaccination in KTRs. By monitoring breakthrough infections and measuring antibody responses at regular intervals post-vaccination, we sought to assess the effectiveness of COVID-19 vaccination in eliciting protective immunity in KTRs and identify factors associated with vaccine failure or waning immunity [2].

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Literature Review

Kidney transplant recipients face unique challenges in mounting an effective immune response to COVID-19 vaccines due to their underlying immunocompromised state. Studies have shown that immunosuppressive regimens, including calcineurin inhibitors, antimetabolites and corticosteroids, can impair vaccine-induced immune responses, leading to reduced antibody production and cellular immunity. As a result, KTRs may remain susceptible to breakthrough infections despite vaccination, highlighting the need for close monitoring of vaccine effectiveness in this population. Several studies have evaluated the humoral immune response to COVID-19 vaccination in KTRs by measuring anti-SARS-CoV-2 antibody levels, including anti-RBD IgG antibodies. While most KTRs develop detectable antibody responses following vaccination, the magnitude and durability of these responses vary widely among individuals. Factors such as time since transplantation, type and intensity of immunosuppression and concomitant use of other medications can influence vaccine immunogenicity and antibody kinetics in KTRs [3].

Emerging evidence suggests that anti-RBD IgG antibody levels may serve as a surrogate marker of vaccine-induced immunity and correlate with protection against COVID-19 in the general population. Studies have shown that higher antibody titers, particularly against the RBD of the spike protein, are associated with reduced risk of SARS-CoV-2 infection and severe disease. However, the correlation between anti-RBD IgG antibody levels and clinical outcomes in KTRs remains unclear. Several studies have reported breakthrough infections in vaccinated KTRs, highlighting the ongoing risk of COVID-19 in this population despite vaccination. However, the association between anti-RBD IgG antibody levels and breakthrough infections in KTRs has not been systematically evaluated. Understanding the relationship between antibody responses and clinical outcomes in vaccinated KTRs is crucial for identifying individuals at higher risk of breakthrough infections and optimizing vaccination strategies, such as booster doses or alternative vaccine regimens, in this vulnerable population [4].

Discussion

The findings of this study shed light on the incidence and severity of COVID-19 in Kidney Transplant Recipients (KTRs) following COVID-19 vaccination and the association with anti-Receptor-Binding Domain (RBD)

IgG antibody levels. Our results demonstrate that despite vaccination, KTRs remain at heightened risk of breakthrough infections compared to the general population, highlighting the importance of continued vigilance and targeted interventions in this vulnerable population. The incidence of breakthrough infections observed in our cohort underscores the need for ongoing monitoring and evaluation of vaccination strategies in KTRs. While COVID-19 vaccines have shown remarkable efficacy in preventing severe disease and hospitalization in the general population, their effectiveness in immunocompromised individuals, such as KTRs, may be attenuated due to blunted immune responses. The high incidence of breakthrough infections in our study suggests that additional measures, such as booster doses or alternative vaccination regimens, may be necessary to enhance protection in this population [5].

Moreover, our findings reveal a significant association between anti-RBD IgG antibody levels and the risk of breakthrough infections in KTRs. Patients with lower antibody levels post-vaccination were more likely to experience breakthrough infections, highlighting the importance of humoral immune responses in vaccine-mediated protection against COVID-19. These results underscore the potential utility of monitoring antibody responses to guide vaccination strategies and identify individuals who may benefit from additional interventions, such as booster doses or modified vaccine regimens. The observed variability in antibody responses among KTRs underscores the heterogeneity of immune responses in this population and highlights the need for personalized approaches to vaccination. Factors such as immunosuppressive regimen, time since transplantation and underlying comorbidities may influence vaccine-induced immune responses and contribute to inter-individual variability in antibody levels. Tailoring vaccination strategies based on individual risk profiles and immune status may help optimize vaccine effectiveness and reduce the risk of breakthrough infections in KTRs [6].

Conclusion

In conclusion, our study highlights the ongoing risk of breakthrough COVID-19 infections in Kidney Transplant Recipients (KTRs) despite vaccination and the association with anti-Receptor-Binding Domain (RBD) IgG antibody levels. The findings underscore the importance of monitoring vaccine effectiveness and immune responses in immunocompromised populations, such as KTRs, to guide vaccination strategies and mitigate the risk of breakthrough infections. Despite the overall effectiveness of COVID-19 vaccines in preventing severe disease and hospitalization, KTRs remain vulnerable to breakthrough infections due to immunosuppression. Our study demonstrates that lower anti-RBD IgG antibody levels post-vaccination are associated with an increased risk of breakthrough infections in KTRs, highlighting the critical role of humoral immunity in vaccine-mediated protection against COVID-19. Moving forward, efforts to enhance vaccine effectiveness and reduce the risk of breakthrough infections in KTRs should focus on several key areas. These include optimizing vaccination strategies, such as booster doses or alternative vaccine regimens, tailored to the individual immune status and risk profile of KTRs. Additionally, ongoing surveillance of breakthrough infections and immune responses in KTRs is essential for identifying emerging trends, informing public health policies and guiding clinical management strategies.

Acknowledgment

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Conflict of Interest

There are no conflicts of interest by author.

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