Journal of Surgery
Lim ZLT, et al. J Surg 9: 11206
www.doi.org/10.29011/2575-9760.11206
www.gavinpublishers.com
Review Article

Literature Review: BK Viremia in Renal Transplant Patients and its Association with Micropapillary Urothelial Carcinoma

Zhong Li Titus Lim*, Lu Yu Kuo, Jason Jae Yeun Kim, Margaret Mansbridge, Handoo Rhee

Department of Urology, Princess Alexandra Hospital, 199 Ipswich Road, Woolloongabba, Queensland, Australia

***Corresponding author:** Zhong Li Titus Lim, Department of Urology, Princess Alexandra Hospital, 199 Ipswich Road, Woolloongabba, Queensland, 4102, Australia

Citation: Lim ZLT, Kuo LY, Kim JJY, Mansbridge M, Rhee H (2024) Literature Review: BK Viremia in Renal Transplant Patients and its Association with Micropapillary Urothelial Carcinoma. J Surg 9: 11206 DOI: 10.29011/2575-9760.011206

Received Date: 07 December 2024; **Accepted Date:** 12 December 2024; **Published Date:** 14 December 2024

Introduction

Kidney transplantation is a widely used treatment for end-stage renal disease, offering significant improvements in survival and quality of life. However, complications related to post-transplant infections, such as BK virus (BKV) infection, present substantial challenges. BK virus, a member of the polyomavirus family, is known to cause BK viremia and BK virus nephropathy (BKVN) in kidney transplant recipients. More recently, there has been increasing concern about the potential link between BK viremia and the development of Micropapillary Urothelial Carcinoma (MPUC), a rare and aggressive variant of urothelial carcinoma. This literature review examines the current understanding of BK viremia in renal transplant patients and explores the emerging association with MPUC.

BK Viremia in Renal Transplant Patients

BK virus is typically dormant in the kidneys and can reactivate in the context of immunosuppression, which is common in renal transplant recipients. BK viremia refers to the presence of BK virus in the bloodstream, and its management is crucial for preserving renal function and patient health. Studies have shown that BK viremia affects approximately 10-30% of kidney transplant recipients. Persistent BK viremia can lead to BKVN, characterized by inflammation and deterioration of kidney function, which can ultimately threaten graft survival [1]. The standard approach to managing BK viremia involves reducing immunosuppressive therapy and using antiviral agents, although these strategies are not always completely effective [2].

Association Between BK Viremia and Urothelial Carcinoma

Emerging evidence suggests a possible link between BK viremia and urothelial carcinoma, a type of cancer that originates in the urothelium, the tissue lining the bladder and other parts of the urinary tract. The association is particularly concerning given the immunocompromised state of kidney transplant recipients. An in vitro study by Zeng et. Al [3] used an animal model showing that immunosuppressed mice with BK viremia have a higher incidence of urothelial carcinoma compared to a control group. The study proposed that the chronic inflammatory environment created by persistent BK viremia might contribute to carcinogenesis in the urothelium. Chronic inflammation is a well-known risk factor for cancer, and the continuous presence of BKV in the bladder could potentially induce mutagenic changes leading to malignancy. A cohort retrospective study by Rogers et. Al [4] provided further evidence by demonstrating that patients with BKVN are at increased risk of developing bladder cancer. This research highlights the importance of regular screening and surveillance for urothelial carcinoma in kidney transplant recipients who exhibit signs of BK viremia or BKVN.

Micropapillary Urothelial Carcinoma

Micropapillary urothelial carcinoma is a rare and aggressive variant of bladder cancer that is characterized by distinct histological features, including small, papillary structures that can invade deeply into the stroma [5]. This variant is known for its

high propensity for early metastasis and poor prognosis compared to conventional urothelial carcinoma. Given its aggressive nature, identifying potential risk factors for MPUC is critical. While much research has focused on various etiological factors, there is emerging interest in the role of viral infections, particularly BK virus, in the development of MPUC.

Mechanistic Insights and Pathophysiology

The precise mechanisms linking BK viremia to urothelial carcinoma remain under investigation. It is hypothesized that the viral oncoproteins of BKV may play a role in disrupting cellular processes and contributing to carcinogenesis. According to a review by Kenan et. Al [6], BKV oncoproteins can integrate into the human genome and interfere with cell cycle regulation and promote cellular transformation, thereby increasing the risk of cancer development in chronically infected tissues. Additionally, the immunosuppressive environment associated with kidney transplantation may exacerbate the carcinogenic potential of BK virus. The lack of effective immune surveillance could allow for the accumulation of genetic mutations and the progression of precancerous lesions to malignant tumors [7].

Conclusion

BK viremia remains a significant concern in renal transplant recipients, primarily due to its potential to cause nephropathy and affect graft survival. The emerging evidence linking BK viremia with micropapillary urothelial carcinoma adds a new dimension to the management and surveillance of transplant patients. Given the aggressive nature of MPUC and the challenges in early detection, it is essential for clinicians to be aware of this potential association and consider routine screening for MPUC in patients with persistent BK viremia. Further research is needed to elucidate the mechanisms linking BK viremia to MPUC and to develop effective strategies for prevention and early detection of this aggressive cancer variant.

References

1. Hirsch HH, Randhawa P, AST Infectious Diseases Community of Practice (2013) BK polyomavirus in solid organ transplantation. Am J Transplant 4: 179-188.
2. Randhawa P, Brennan DC (2006) BK Virus Infection in Transplant Recipients: An Overview and Update. Am J Transplant 6: 2000-2005.
3. Zeng Y, Sun J, Bao J, Zhu T (2020) BK polyomavirus infection promotes growth and aggressiveness in bladder cancer. Virol J 17: 139.
4. Rogers R, Gohh R, Noska A (2017) Urothelial cell carcinoma after BK polyomavirus infection in kidney transplant recipients: A cohort study of veterans. Transpl Infect Dis 2017: 19.
5. Kumar D, Adeniran AJ (2022) Clinicopathological Review of Micropapillary Urothelial Carcinoma. Curr Oncol Rep 24: 603-610.
6. Kenan DJ, Mieczkowski PA, Burger-Calderon R, Singh HK, Nickeleit V (2015) The oncogenic potential of BK-polyomavirus is linked to viral integration into the human genome. J Pathol 237: 379-389.
7. Alexiev BA, Randhawa P, Vazquez Martul E, Zeng G, Luo C, et al. (2013) Drachenberg CB, Papadimitriou JC. BK virus–associated urinary bladder carcinoma in transplant recipients: report of 2 cases, review of the literature, and proposed pathogenetic model. Hum Pathol 44: 908-917.