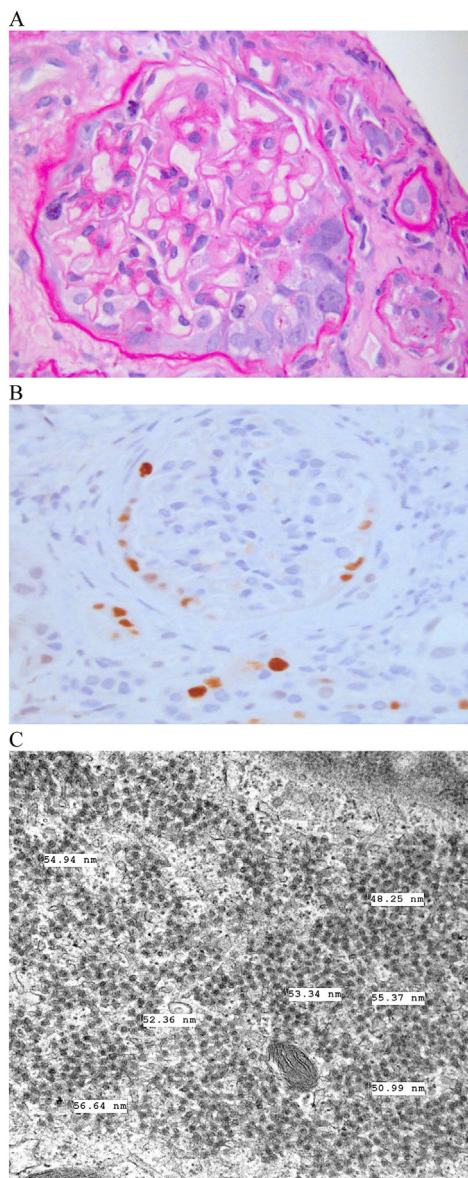




## A Unique Case of Invagination of BK Polyomavirus-Infected Tubular Cells into Bowman's Space in a Heart Transplant Patient With Acute Kidney Injury

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**Figure 1.** (A) The Bowman's space shows invagination of large infected tubular cells with mitosis, atypia, and enlarged nuclei with amorphous inclusions and "ground-glass" appearance (original magnification,  $\times 40$ ; periodic acid–Schiff stain). (B) Invagination of SV40-positive tubular epithelial cells within the Bowman's space (original magnification,  $\times 40$ ; immunohistochemistry). (C) Clusters of nonenveloped particles corresponding to BK virions (original magnification,  $\times 40,000$ ; transmission electron microscopy).

A heart transplant recipient in his 60s with ischemic cardiomyopathy presented with worsening kidney function and BK virus viremia. He was previously treated with a high dose of steroids because of acute T-cell mediated rejection. On presentation, the individual was normotensive (121/82 mm Hg). Investigations showed a serum creatinine concentration of 4.6 mg/dL compared with a baseline of 1.5 mg/dL, hyaline casts in urine microscopy, a urine albumin-to-creatinine ratio of 40.7 mg/g, a serum BK virus polymerase chain reaction result of 9,900,000 copies/mL. Calculated panel reactive antibody results were 0% for human leukocyte antigen class I and class II. A kidney biopsy demonstrated invaginated tubular epithelial cells infected by BK virus into the Bowman's space with classic nuclear inclusions, and the tissue tested positive for SV40, which was also confirmed by electron microscopy (Fig 1).

Classically described in kidney allografts, BK virus-associated nephropathy (BKVAN) is increasingly recognized in native kidneys of other nonkidney solid organ transplants; however, it is still rare. Only a few cases of BKVAN in heart transplant recipients have been reported.<sup>1,2</sup> The prevalence of BKVAN in this population is not known, in part because it is not commonly tested for. Although viral cytopathic changes are mostly detected in tubular epithelial cells, glomerular involvement may occur in up to 24% of patients with BKVAN.<sup>3</sup> Intrarenal reflux in BKVAN has been reported.<sup>4</sup> However, to our knowledge, no previous reports of invaginated tubular epithelial cells infected by BK virus into the glomerular Bowman's capsule have been previously described.

### ARTICLE INFORMATION

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## REFERENCES

1. Viswesh V, Yost SE, Kaplan B. The prevalence and implications of BK virus replication in non-renal solid organ transplant recipients: a systematic review. *Transplant Rev.* 2015;29(3):175-180.
2. Shah A, Kumar V, Palmer MB, et al. Native kidney BK virus nephropathy, a systematic review. *Transpl Infect Dis.* 2019;21(4):1-11.
3. Chen XT, Deng RH, Yang SC, et al. Pathological characteristics of BK polyomavirus-associated nephropathy with glomerular involvement. *Ann Transl Med.* 2020;8(15):923.
4. Kawanishi K, Honda K, Koike J, et al. A preliminary study into the significance of intrarenal reflux in BK virus nephropathy after kidney transplantation. *Transplant Direct.* 2016;2(2):1-9.