

Case Report

Alternative Management of a Pediatric Case of Hemorrhagic Cystitis due to BK Virus: Use of Thulium Laser Coagulation

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Abstract

We report on a pediatric case of hemorrhagic cystitis due to BK virus in a patient with acute lymphoblastic leukemia who had undergone bone marrow transplantation. A very large hematoma that almost completely filled the bladder was aspirated using a morcellator via suprapubic percutaneous access, and a thulium laser was then used to cauterize extensive areas of diffuse uroepithelial bleeding. This combined minimally invasive procedure was successful in clearing the bladder hematoma and achieving hemostasis.

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1. Case report

A 4-yr-old boy with relapsing acute lymphoblastic leukemia (ALL) had undergone allogeneic bone marrow transplantation (BMT) in August 2020. Starting from the pretransplantation period, he has been receiving a combination of immunosuppressants and chemotherapeutics including anti-thymocyte globulin (ATG), etoposide, dexamethasone, and cyclosporine. A regimen of 3 d of equine ATG (30 mg/kg) and 1 wk of dexamethasone (10 mg/m²) was administered intravenously just before BMT. The patient's post-transplantation immunosuppressive medication comprised a daily dose of oral cyclosporine (15 mg/kg) and mycophenolate mofetil (600 mg/m²) and was supported with intermittent intravenous filgrastim. Subsequently, a broad-spectrum antibiotic and an antifungal agent were added because of fever and related culture results. During

the follow-up period, BK virus (BKV) was detected on serum DNA polymerase chain reaction in October 2020, which presented with hemorrhagic cystitis. A total of six doses of intravenous cidofovir were administered at a dose rate of 5 mg/kg twice a weekly. The patient's serum creatinine and urea levels were elevated at 0.89 mg/dl and 46 mg/dl, respectively. His platelet (75 000 /μl) and hemoglobin (6.5 g/dl) levels were low. Transfusion with one unit of erythrocytes and eight units of trombocytes was carried out. Urinary ultrasonography revealed a hematoma measuring 4.6 cm × 3.5 cm × 4 cm that almost filled the entire bladder lumen (Fig. 1).

A urine culture showed no evidence of any coexisting infection. Cystoscopy was performed under general anesthesia (inhalation anesthesia combined with 0.1 mg/kg pethidine hydrochloride and 2.5 mg/kg propofol) with a 4.5/6 Fr pediatric cystoscope (Richard Wolf GmbH, Knittlingen,



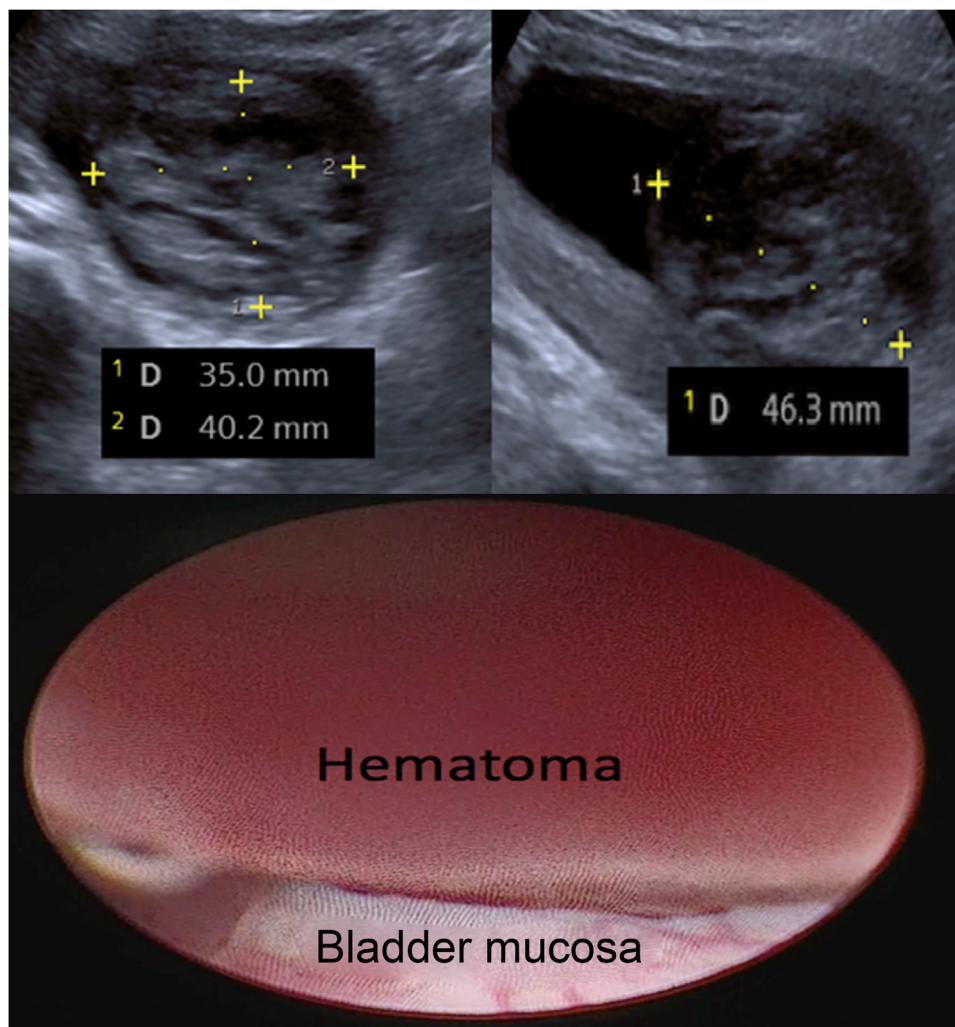


Fig. 1 – Ultrasonographic and cystoscopic views of the bladder hematoma.

Germany). The cystoscopic appearance showed hematoma and diffuse uroepithelial bleeding (Fig. 1). Suprapubic percutaneous access was achieved via a percutaneous access needle. A 0.035-mm sensor guidewire was placed through the access needle and a pediatric Amplatz dilator set was used to perform dilatation up to size 18 Fr to facilitate insertion of a suprapubic morcellator (Hawk Medical Instrument, Shenzhen, China). The giant hematoma was aspirated from the bladder with the aid of the morcellator under cystoscopic visual guidance (Fig. 2). After morcellation with sparing of the ureteral orifices, all bleeding areas diffusely evident on all sides of the mucosal surface (almost half of entire bladder surface) of the bladder were cauterized using a thulium laser (energy setting 35 W, 550 μ m fiber; 200 W-Cyber-TM; Quanta System, Samarate, Italy) via the pediatric cystoscope (Fig. 3).

The total procedure lasted for 57 min. At the end of the procedure, a three-way 18 Fr Foley catheter was placed through the suprapubic access and a two-way 10 Fr pediatric urethral Foley catheter was inserted through the urethra. Bladder irrigation was applied with 3000 ml of saline including 5 ml of 5% transamine during postoperative

day 0. The irrigation lasted for 12 h and the suprapubic catheter was removed on postoperative day 1. On postoperative day 1, control hemoglobin level was 10 g/dL. During follow-up, the patient's urine was clear and the urethral catheter was removed on postoperative day 3. There was no sign of hematuria during further follow-up.

2. Discussion

BKV, which is a member of the Polyomaviridae family, is usually acquired during childhood and shows a seroprevalence rate of 80–90% during adulthood. Its estimated seroprevalence is almost 50% among children younger than 5 yr [1]. BKV usually remains latent but may become active under conditions leading to immunosuppressions, such as solid organ transplantation or BMT [2]. BKV may be associated with nephropathy in 1–10% of renal transplant patients and hemorrhagic cystitis in 5–15% of patients who have received an allogeneic hematopoietic stem-cell transplant [1]. Donor-recipient gender mismatch, bone marrow as a stem cell source, class II and III thalassemia, use of busulfan plus cyclophosphamide plus ATG, graft versus host



Fig. 2 – Demonstration of the suprapubic access and use of the morcellator under cystoscopy guidance.

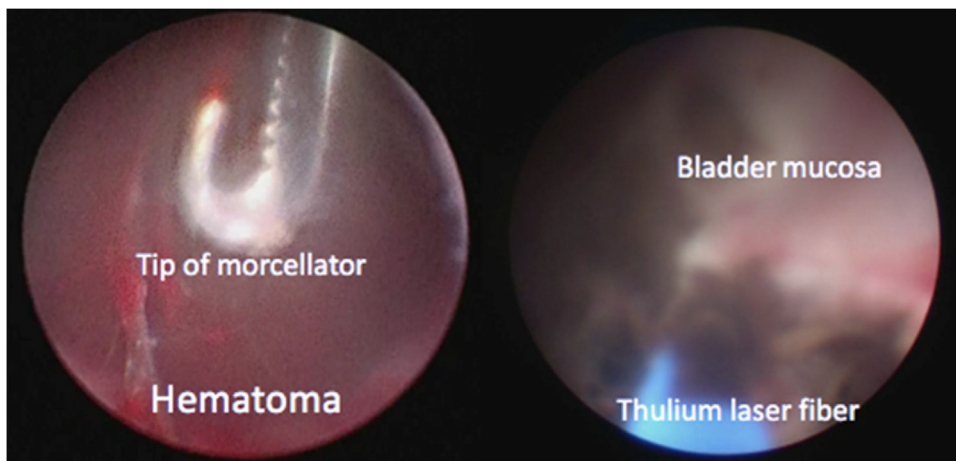


Fig. 3 – Cystoscopic demonstration of the morcellator and thulium laser cauterization.

disease (GVHD), use of prednisolone and cyclosporine during prophylaxis for GVHD, gancyclovir, and immunoglobulins are the main risk factors for BKV hemorrhagic cystitis [3]. Owing to receipt of multiple immunosuppressive treatments, our pediatric patient had high risk of BKV hemorrhagic cystitis. Further investigations revealed BKV infection as the etiology for his hematuria.

A urology consultation revealed ongoing hemorrhage and a giant hematoma inside the bladder lumen. Cidofovir is an effective tool against BKV, but systemic treatment may have unpredictable results and a high risk of nephrotoxicity [4]. Low-dose intravenous cidofovir or intravesical installation might be safer and preferable [5]. However, the quality of evidence for cidofovir treatment is low and the grade of recommendation is weak [6]. Other than cidofovir treatment, application of fibrin glue, hyperbaric oxygen therapy, leflunomide, sodium pentosan polysulfate, intravesical alum, and radiological embolization have been described

as alternative modalities for management of BKV hemorrhagic cystitis; however, their effectiveness remains unclear [6–8].

Laser applications in medical sciences have increased in popularity with technological advances in the past 20 yr. Various laser energies with different characteristics are available. Especially in the field of urology, there are a range of surgical interventions for which certain laser types have been successfully used. The main examples are interventions for urinary stones, endoscopic prostate enucleation, and bladder tumor resection. Holmium and thulium lasers are widely used in endourology because of their suitability for enucleation, vaporization, and coagulation [9].

In recent years, thulium laser has shown comparable and favorable outcomes as compared with holmium laser. Thulium lasers have properties that make them suitable for enucleation, evaporation, and vaporesction of prostate and bladder tumors [9,10]. It has major advantages such as

low tissue penetration (0.25 nm) and continuous laser energy [9,10] that result in better hemostasis and a low risk of peripheral tissue damage. Considering the risks of bladder perforation and perivesical tissue damage, thulium laser may be preferable in the pediatric population. Pediatric cystoscopic instruments are very thin (4–6 Fr) and are not suitable for supplying sufficient irrigation for bladder hematoma. Moreover, adult-sized resectoscopes (18–26 Fr) are not suitable for the urethral diameter in a 4-year-old child. We successfully treated our patient with our combined technique of hematoma morcellation and thulium laser coagulation.

In conclusion, this is the first case experience of use of a thulium laser and a morcellator in a combined minimally invasive procedure to clear bladder hematoma and achieve hemostasis in a patient with BKV hemorrhagic cystitis. In addition to their success in endoscopic interventions for benign prostatic hyperplasia and bladder tumors, thulium lasers are emerging as a useful tool in endourology and may be considered as an alternative to other modalities. Large patient series would be helpful for evaluating long-term results.

Conflicts of interest: The authors have nothing to disclose.

Ethical considerations: An ethical consent form was signed by the patient's responsible relative. Consent to participate and consent for publication were obtained from the participant's parent.

Data sharing statement: Preparation of this paper did not involve analysis of data.

References

- [1] Krajewski W, Kamińska D, Poterek A, et al. Pathogenicity of BK virus on the urinary system. *Cent Eur J Urol* 2020;73:94–103.
- [2] Ambalathingal GR, Francis RS, Smyth MJ, Smith C, Khanna R. BK polyomavirus: clinical aspects, immune regulation, and emerging therapies. *Clin Microbiol Rev* 2017;30:503–28.
- [3] Yaghobi R, Ramzi M, Dehghani S. The role of different risk factors in clinical presentation of hemorrhagic cystitis in hematopoietic stem cell transplant recipients. *Transplant Proc* 2009;41:2900–2.
- [4] Philippe M, Ranchon F, Gilis L, et al. Cidofovir in the treatment of BK virus-associated hemorrhagic cystitis after allogeneic hematopoietic stem cell transplantation. *Biol Blood Marrow Transplant* 2016;22:723–30.
- [5] Lee SS, Ahn JS, Jung SH, et al. Treatment of BK virus-associated hemorrhagic cystitis with low-dose intravenous cidofovir in patients undergoing allogeneic hematopoietic cell transplantation. *Korean J Intern Med* 2015;30:212–8.
- [6] Aldiwani M, Tharakan T, Al-Hassani A, Gibbons N, Pavlu J, Hrouda D. BK virus associated haemorrhagic cystitis. a systematic review of current prevention and treatment strategies. *Int J Surg* 2019;63:34–42.
- [7] Purves JT, Graham ML, Ramakumar S. Application of fibrin glue to damaged bladder mucosa in a case of BK viral hemorrhagic cystitis. *Urology* 2005;66:641–3.
- [8] Maken K, Bland DK. Hyperbaric oxygen for refractory hemorrhagic cystitis after stem cell transplantation: case report. *Undersea Hyperb Med* 2020;47:125–9.
- [9] Enikeev D, Shariat SF, Taratkin M, Glybochko P. The changing role of lasers in urologic surgery. *Curr Opin Urol* 2020;30:24–9.
- [10] Castellani D, Pirola GM, Pacchetti A, Saredi G, Dellabella M. State of the art of thulium laser enucleation and vapoenucleation of the prostate: a systematic review. *Urology* 2020;136:19–34.