

Evaluation of hematology and some biochemical serum factors following experimental unilateral ureteral anastomosis in dogs

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Abstract

Ureteral obstruction is a clinically important condition in dogs that often requires surgical intervention. Such procedures can lead to significant physiological changes, particularly in hematological and biochemical parameters. This study aimed to evaluate hematological alterations and selected serum biochemical factors following experimental ureteral anastomosis in dogs. Five healthy mixed-breed dogs (15–30 kg, aged 1.5–4.5 years) underwent left ureteral transection and end-to-end anastomosis using a simple interrupted suture pattern. Anesthesia was induced with thiopental sodium and maintained with halothane after premedication with acepromazine (Schwartz, 2022; Hardie & Kyles, 2004). Urine and venous blood samples were collected pre-operatively and on days 1, 3, 7, 14, 21, 28, 35, 42, and 90 post-surgery for urinalysis, complete blood count, hematocrit, and measurement of blood urea nitrogen (BUN), creatinine, uric acid, calcium, phosphorus, chloride, sodium, and potassium. Data were analyzed using repeated measures ANOVA and Tukey's post hoc test. Significant increases in BUN, creatinine, and neutrophil counts were observed at all post-operative time points. BUN and creatinine exceeded normal ranges on days 1 and 3. Phosphorus levels were significantly elevated on days 1, 3, 7, 14, 21, 28, and 35, while potassium levels increased significantly on days 1, 3, 7, and 14. Uric acid, calcium, chloride, and sodium changes were not statistically significant. Despite compensatory mechanisms by the kidney and contralateral ureter, certain biochemical changes are inevitable following unilateral ureteral surgery, highlighting the need for careful postoperative monitoring to prevent complications.

Key words: Anastomosis, Biochemical changes, Dog, ureter, Urinalysis

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References

- Abbas, M. T., Khan, F. Y., Baidaa, A., Errayes, M., & Al Haleem, H. (2008). Respiratory failure secondary to obstructive uropathy. *Journal of Clinical Diagnosis and Research*, 2(4), 1107.
- Adin, C. A., & Scansen, B. A. (2011). Complications of upper urinary tract surgery in companion animals. *Veterinary Clinics of North America: Small Animal Practice*, 41(5), 869–888.
- Aronson, L. R. (2020). Upper urinary tract urolithiasis. *Veterinary Focus*. Retrieved from <https://vetfocus.royalcanin.com/en/scientific/upper-urinary-tract-urolithiasis>
- Barthez, P. Y., Smeak, D. D., Wisner, E. R., Dibartola, S. P., & Chew, D. J. (2000). Ureteral obstruction after ureteroneocystostomy in dogs assessed by technetium Tc 99m diethylenetriamine pentaacetic acid (DTPA) scintigraphy. *Veterinary Surgery*, 29(2), 178–185.
- Bigham Sadegh, A., Shadkhast, M., Sharifi, S., & Mohammadnia, A. R. (2009). Ureteral segment replacement using an ovine fetal urachus duct (new xenogenic graft) in dogs. *Comparative Clinical Pathology*, 18(2), 125–129.
- Chevalier, R. L., Thornhill, B. A., Chang, A. Y., Cachat, F., & Lackey, A. (2002). Recovery from release of ureteral obstruction in the rat: Relationship to nephrogenesis. *Kidney International*, 61(6), 2033–2043.
- Cooper, E., & Scansen, B. A. (2020). Obstructive uropathy. In D. S. Bruyette (Ed.), *Canine and feline endocrinology* (Chapter 122). Wiley.
- Degner, D., Clarke, D., & Wormser, C. (2022). Ureteral obstruction. In L. R. Aronson (Ed.), *Veterinary surgery: Small animal* (Chapter 26). Wiley.
- Dekerle, B., Maurice, E., Decambron, A., Viateau, V., Maurey, C., & Manassero, M. (2022). Outcomes of 25 female dogs treated for ectopic ureters by open surgery or cystoscopic-guided laser ablation. *Veterinary Surgery*, 51(5), 568–575.
- El-Leithy, T. R. (2008). Ureterosigmoidostomy: A gold standard in orthotopic bladder era. *Research Journal of Medicine and Medical Sciences*, 3(2), 105–110.
- Geavlete, P. A. (Ed.). (2016). Notions of histology, anatomy, and physiology of the upper urinary tract. In *Handbook of endourology* Springer.
- Hall, L. W., Clarke, K. W., & Trim, C. M. (2001). *Veterinary anaesthesia* (10th ed.). W.B. Saunders.
- Hardie, E. M., & Kyles, A. E. (2004). Management of ureteral obstruction. *Veterinary Clinics of North America: Small Animal Practice*, 34(4), 989–1010.
- Hessels, L., Koopmans, N., Gomes Neto, A. W., Volbeda, M., Koeze, J., Lansink-Hartgring, A. O., Bakker, S. J., Oudemans-van Straaten, H. M., & Nijsten, M. W. (2018). Urinary creatinine excretion is related to short-term and long-term mortality in critically ill patients. *Intensive Care Medicine*, 44(10), 1699–1708.
- Hooi, K. S., Vachon, C., Martel, D. V., & Dunn, M. (2021). Retrospective evaluation of cystoscopic-guided laser ablation of intramural ectopic ureters in female dogs. *Journal of Veterinary Internal Medicine*, 36(1), 156–163.
- Inker, L. A., & Titan, S. (2021). Measurement and estimation of GFR for use in clinical practice: Core curriculum 2021. *American Journal of Kidney Diseases*, 78(5), 736–749.
- Johnson, C., Piegols, H., Lapsley, J., & Selmic, L. E. (2024). Unilateral nephrectomy in dogs is associated with a high rate of intraoperative and postoperative complications. *Journal of the American Veterinary Medical Association*, 262(6), 1–7.
- Kyles, A. E., Hardie, E. M., Wooden, B. G., Adin, C. A., Stone, E. A., Gregory, C. R., Mathews, K. G., Cowgill, L. D., Vaden, S., Nyland, T. G., & Ling, G. V. (2005). Management and outcome of cats with ureteral calculi: 153 cases (1984–2002). *Journal of the American Veterinary Medical Association*, 226(6), 937–944.
- Mayhew, P. D., & Berent, A. (2023). Ureteral ectopia and urinary incontinence. In E. Monnet (Ed.), *Veterinary surgery: Small animal* (Chapter 45). Wiley.
- Nwadike, B. S., Wilson, L. P., & Stone, E. A. (2000). Use of bilateral temporary nephrostomy catheters for emergency treatment of bilateral ureter transection in a cat. *Journal of the American Veterinary Medical Association*, 217(12), 1862–1865.

- Patil, N. N., Mottrie, A., Sundaram, B., & Patel, V. R. (2008). Robotic-assisted laparoscopic ureteral reimplantation with psoas hitch: A multi-institutional, multinational evaluation. *Urology*, 72(1), 47–50.
- Pavia, P. R., Berent, A. C., Weisse, C. W., Neiman, D., Lamb, K., & Bagley, D. (2018). Outcome of ureteral stent placement for treatment of benign ureteral obstruction in dogs: 44 cases (2010–2013). *Journal of the American Veterinary Medical Association*, 252(6), 739–748.
- Pozzi, A., Smeak, D. D., & Aper, R. (2006). Colonic seromuscular augmentation cystoplasty following subtotal cystectomy for treatment of bladder necrosis caused by bladder torsion in a dog. *Journal of the American Veterinary Medical Association*, 229(2), 235–239.
- Saberi Afshar, F., Koushyar, S., & Razi Jalali, M. (2007). Some serum biochemical alterations after urinary diversion with colonic segment in dog. *Iranian Journal of Veterinary Surgery*, 2(5), 45–51.
- Saygin, H., Ergin, I. E., Kirac, E., & Korgali, E. (2021). One method that can be applied in the ectopic ureter is uretero-ureterostomy: Case report. *Journal of Surgical Techniques and Procedures*, 5(1), 1044.
- Schwartz, P. (2022). Current concepts in urinary surgery. *Veterinary Clinics of North America: Small Animal Practice*, 52(2), 387–417.
- Siddighi, S., Yune, J. J., Kwon, N. B., Hardesty, J. S., Kim, J. H., & Chan, P. J. (2017). Perioperative serum creatinine changes and ureteral injury. *Urology*, 49(11), 1915–1919.
- Urie, B. K., Tillson, D. M., Smith, C. M., Brawner, W. R., Almond, G. T., Beard, D. M., Lenz, S. D., & Lothrop, C. D. (2007). Evaluation of clinical status, renal function, and hematopoietic variables after unilateral nephrectomy in canine kidney donors. *Journal of the American Veterinary Medical Association*, 230(11), 1653–1656.
- Wilson, D. R. (1977). Renal function during and following obstruction. *Annual Review of Medicine*, 28, 329–339.
- Wormser, C., Clarke, D. L., & Aronson, L. R. (2015). End-to-end ureteral anastomosis and double-pigtail ureteral stent placement for treatment of iatrogenic ureteral trauma in two dogs. *Journal of the American Veterinary Medical Association*, 247(1), 67–72.
- Yaxley, J., & Yaxley, W. (2023). Obstructive uropathy – Acute and chronic medical management. *World Journal of Nephrology*, 12(1), 1–9.
- Yang, J., Sun, B. G., Min, H. J., Son, Y. B., Kim, T. B., Lee, J., Oh, S. W., Kim, M. G., Cho, W. Y., Ahn, S. Y., Ko, G. J., Kwon, Y. J., Cha, J. J., Kang, Y. S., Cha, D. R., & Jo, S. K. (2021). Impact of acute kidney injury on long-term adverse outcomes in obstructive uropathy. *Scientific Reports*, 11, 23639.