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Esophagostomy feeding in the early postoperative period in cats after ureterotomy for ureteral obstruction

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Abstract. The study presents the results of early postoperative esophagostomy feeding in cats after ureterotomy performed for ureteral obstruction, with initial creatinine levels around 1200 µmol/L. The aim of the study was to evaluate the effect of esophagostomy tube placement on recovery in the postoperative period in cats with ureteral obstruction. Two groups were formed: a control group consisting of 8 patients, and an experimental group consisting of 5 patients. Initial creatinine values were approximately 1200 µmol/L, urea values were ranged from 51 to 53 mmol/L. Drug therapy was identical in both groups and included analgesia, infusion therapy with crystalloid solutions (recalculated daily), and antibiotic therapy throughout the study period. In the experimental group, during the surgical intervention to eliminate urethral obstruction, a feeding tube was placed for esophagostomy feeding. Additionally, metoclopramide infusion at a dose of 1–2 mg/kg/day was included in the treatment protocol. Urea and creatinine levels were assessed before surgery and on days 3, 5, 7, and 14 postoperatively. The results demonstrated a clearly improved rate of reduction in azotemia in the experimental group. By day 14, urea levels in the experimental group were 6.5% lower than in the control group, and creatinine levels were 7.5% lower. On average, azotemia decreased 11% faster in the experimental group. Additionally, patients in the experimental group showed spontaneous appetite earlier (2.8 ± 0.4 days) compared to the control group (4.8 ± 0.5 days), which positively affected their overall condition. Early postoperative

esophagostomy feeding in cats with ureteral obstruction is therefore an important component of therapy, improving the dynamics of urea and creatinine reduction.

Keywords: treatment, blood test, early postoperative feeding, azotemia

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Introduction

Early feeding in the postoperative period in cats is one of the key factors affecting the quality and speed of recovery after surgery. Patients undergoing ureterotomy with creatinine levels exceeding 1000 µmol/L typically exhibit anorexia, vomiting, depression, and reduced activity [1, 2]. Prolonged absence of food intake increases the risk of hepatic lipidosis, whereas early nutritional support improves prognosis and accelerates recovery after surgery and discharge to outpatient care [3, 4]. Nutritional support is important for animals during recovery from disease or surgery. While many animals recover at home after mild illness or routine procedures, patients with more severe conditions require hospitalization. Early nutritional support improves prognosis and reduces hospitalization time in dogs [5]. Adequate intake of fluids, energy, and nutrients is critical during the first 14 days after trauma or disease onset [5]. It is important for an animal recovering from disease or surgery to receive nutrients to ensure optimal functioning of the gastrointestinal tract. Enteral nutrition is preferred over parenteral nutrition because intraluminal feeding stimulates gastrointestinal function [5].

It should be noted that after surgery and stabilization, acute renal failure often progresses to a chronic stage requiring lifelong therapy [6–10]. Standard protocols include infusion therapy (Sterofundin, Ringer's solution, Ionosteril), antibiotics, and analgesia [11–13]. Nutritional support, alongside infusion therapy, requires further study and development of protocols for postoperative management because postoperative cats often lack appetite due to pain, stress, nausea, and vomiting associated with azotemia [14]. Compared to other animals, cats have unique metabolic adaptations affecting their ability to maintain homeostasis under stress, disease, and starvation [15], including higher protein and amino acid requirements.

Currently, there are no studies on cats with ureteral obstruction and creatinine levels above 1000 µmol/L evaluating preventive esophagostomy placement for improved recovery.

The aim of the study is to evaluate the effect of esophagostomy tube placement on postoperative recovery in cats undergoing ureterotomy for ureteral obstruction.

Materials and Methods

Between January 2, 2025, and June 13, 2025, 13 cats with acute renal failure due to ureteral obstruction were admitted to the veterinary clinic "Alisavet." The animals were divided into two groups: a control group (8 patients) and an experimental group (5 patients). Cats in both groups had creatinine levels above 1000 μmol/L, indicating severe disease. In all cases, obstruction was caused by ureteral calculi leading to partial or complete blockage. All patients received antibiotic therapy during the first 7 postoperative days using amoxicillin with clavulanic acid at a dose of 20 mg/kg intravenously twice daily or subcutaneously once daily [15–18].

Cats received infusion therapy before and after surgery, using Sterofundin to correct dehydration and electrolyte imbalances [19–21].

At the same time, a deficient volume of circulating blood, ongoing losses and a maintenance volume of fluid were determined.

Fluid requirements were calculated as follows:

$$\text{Deficit volume} = \%\ \text{dehydration} \times \text{body weight (kg)} \times 8, \quad (1)$$

where 8 is a constant value.

Ongoing losses was calculated in the presence of diarrhea and vomiting according to the formula

$$\text{Ongoing losses} = 1.5 \times \text{body weight (kg)} \times 24, \quad (2)$$

where 1.5 and 24 are constants.

The maintenance volume was determined by the formula

$$\text{Maintenance volume} = (30 \times \text{body weight (kg)}) + 70, \quad (3)$$

where 30 and 70 are constants.

The total infusion volume was administered continuously over 24 hours, with daily recalculation.

In the experimental group, intravenous metoclopramide (1–2 mg/kg/day) was additionally administered to improve gastrointestinal motility during hospitalization.

All animals underwent ureterotomy: the affected ureter was exposed to visualize a calculus, a linear incision was made over the calculus, and after removal, a simple interrupted suture using non-absorbable polypropylene (USP 7/0) was applied. After that, the suture consistency was assessed and the surgical wound was closed in layers.

In the experimental group, an esophagostomy tube was placed during surgery. A Halsted hemostat was introduced into the esophagus via the oral cavity, the point of protrusion of the end of the instrument was palpated and externalized through a neck incision, by clamping the surgical Halstead through the wound opening, the end of the feeding tube was gripped and guided towards the oral cavity. After that, the end of the feeding tube was placed into the esophagus. Tube placement was confirmed radiographically and secured with a purse-string suture.

The tube was removed one day after the return of spontaneous appetite. The procedure was performed without anesthesia by removing the fixing suture material and pulling out the tube. The wound healed by secondary intention with daily treatment using 0.05% chlorhexidine and betadine.

Patients were monitored on the day of surgery and on postoperative days 3, 5, 7, and 14. Serum urea and creatinine levels were measured as indicators of renal function. Self appetite recovery was also assessed. Analyses were performed using a DRI–CHEM NX500 biochemical analyzer.

Statistical analysis was conducted using Microsoft Excel (Analysis ToolPak).

Results and Discussion

Clinical observations showed that nutritional support via esophagostomy during infusion therapy in the experimental group lasted 3–4 days, after which the tube was removed due to return of spontaneous appetite. Feeding began 6–8 hours after surgery. In the control group, appetite returned only on days 4–5.

Both groups showed similar trends in urea and creatinine reduction, but the experimental group demonstrated greater efficiency. In these patients, an improvement in the general condition was noted within 14 days, which correlated with the positive dynamics of blood parameters (Table).

Biochemical parameters of blood serum of cats in the postoperative period

Indicators	Time after surgery	Phl	Animal groups *M* ± *m*	
			1	2
Urea, mmol/L	Before surgery	3.28…10.24	51.8 ± 2.6	52.9 ± 2.5
	After surgery		47.5 ± 1.8	47.7 ± 1.1
	Day 3		40.9 ± 1.9	38.9 ± 1.1
	Day 5		38.0 ± 1.8	32.9 ± 0.6
	Day 7		27.3 ± 1.6	25.4 ± 0.7
	Day 14		13.1 ± 1.3	12.3 ± 1.1

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Creatinine, μmol/L	Before surgery	35…124	1190.6 ± 50.9	1179.6 ± 51.9
	After surgery		684.4 ± 50.7	680.2 ± 66.6
	Day 3		492.5 ± 38.7	479.6 ± 31.4
	Day 5		388.6 ± 21.5	350.4 ± 10.4
	Day 7		260.4 ± 16.7	235.6 ± 8.6
	Day 14		186.3 ± 13.8	173.6 ± 15.5
The day after surgery when self-appetite appeared			4.8 ± 0.5	2.8 ± 0.4

Note. PhI is a physiological indicator; $p < 0.05$ relative to Ph I.

Source: compiled by V.A. Lyust, Yu.A. Vatnikov, V.I. Semenova, and E.V. Kulikov.

Urea levels decreased sharply after surgery: by 9% in the control group and 10.9% in the experimental group, which indicates the success of resolving unilateral obstruction of the ureter.

The urea concentration gradually decreased on the following day after surgery. The level of urea decreased: on the 3rd day in the control group by 17% and in the experimental group by 22%, on the 5th day — by 7 and 18%, and on the 7th day — by 39 and 29%, respectively. By day 14, a decrease in the urea was observed, but it did not reach the physiological norm. There is a faster trend towards a decrease in azotemia from the time after surgery to the 5th day of observation, but on the 7th day it accelerated. By the end of the study, on day 14, urea levels in the control group were 6.5% higher than in the experimental one.

Creatinine levels decreased by 73% in both groups immediately after surgery, which indicates the success of resolving unilateral obstruction of the ureter. Already on the 3rd day, the creatinine level decreased in the control group by 29% and in the experimental group by 41%, on the 5th day by 26 and 36%, respectively, and on the 7th day — by 49% in both groups. By day 14, levels approached but did not reach reference values By the end of the study, on day 14, the creatinine level in the first group was 7.5% higher than in the second one.

Spontaneous feeding resumed earlier in the experimental group (2.8 ± 0.4 days) compared to the control group (4.8 ± 0.5 days).

In the experimental group, immediately after the operation, nutrition was performed through esophagostomy, and to improve peristalsis, patients received metoclopramide at a dose of 1–2 mg/kg/day intravenously. The early onset of self-feeding can be explained by the fact that food was supplied, which indirectly affected the work of peristalsis, and patients received prokinetics that contributed to the movement of chyme. In critically ill cats, metabolic changes include decreased insulin and increased glucose, lactate, cortisol, glucagon, norepinephrine, and free fatty acids [22, 23]. Glycogen stores are quickly depleted, especially given that cats have limited glycogen stores. It leads to increased proteolysis. Cats have high rates of protein metabolism and limited ability to suppress gluconeogenesis during protein

deficiency [24, 25]. With continued food shortage, energy is obtained almost entirely through accelerated proteolysis, which in itself is an energy-intensive process. The consequences of the ongoing loss of muscle mass include a negative impact on wound healing, immune response, general condition and, ultimately, on the overall prognosis [26].

However, it is worth noting that cats in the experimental group showed a lower rate of decrease in creatinine by 2.69% on the 3rd day and by 10.5% on the 5th and 7th days compared to the control one. Although subsequently, on the 14th day of the study, urea and creatinine levels began to converge again. With prolonged anorexia or starvation, the body begins to break down muscle protein to get energy. Creatinine is a breakdown product of creatine from muscle tissue, therefore, with active catabolism, its formation increases. With early postoperative feeding, energy needs are covered, catabolism slows down, for this reason, the creatinine level decreases not only due to improved filtration, but also due to a decrease in its production [26].

Conclusion

The study demonstrated that cats receiving esophagostomy feeding showed faster reductions in creatinine levels — on average 11% faster during the first 5 postoperative days. Although the rate equalized by day 7, by day 14 urea and creatinine levels remained about 7% lower in the experimental group. This is associated with earlier return of appetite due to esophagostomy feeding and metoclopramide administration. The control group began to consume food on average on the period of 4.8 days, in the experimental — 2.8 days. Early postoperative feeding via esophagostomy, combined with prokinetics, is therefore an important therapeutic component that accelerates the reduction of azotemia and promotes earlier voluntary food intake.

References

1. Fischer JR. Acute ureteral obstruction in cats: diagnosis, management options, and outcomes. *Advances in Small Animal Medicine and Surgery.* 2006;19(7):1–3. doi: 10.1016/j.asams.2006.06.010

2. Culp WT, Palm CA, Hsueh C, Mayhew PD, Hunt GB, Johnson EG, Drobatz KJ. Outcome in cats with benign ureteral obstructions treated by means of ureteral stenting versus ureterotomy. *Journal of the American Veterinary Medical Association.* 2016;249(11):1292–1300. doi: 10.2460/javma.249.11.1292

3. Center SA. Feline hepatic lipidosis. *Veterinary Clinics of North America: Small Animal Practice.* 2005;35(1):225–269. doi: 10.1016/j.cvsm.2004.10.002

4. Corbee R, Kerkhoven W. Nutritional support of dogs and cats after surgery or illness. *Open Journal of Veterinary Medicine.* 2014;4(4):44–57. doi: 10.4236/ojvm.2014.44006

5. Chung CK, Whitney R, Thompson CM, et al. Experience with an enteral-based nutritional support regimen in critically ill trauma patients. *Journal of the American College of Surgeons.* 2013;217(6):1108–1117. doi: 10.1016/j.jamcollsurg.2013.08.006

6. Hardie EM, Kyles AE. Management of ureteral obstruction. *The Veterinary Clinics of North America: Small Animal Practice.* 2004;34(4):989–1010. doi: 10.1016/j.cvsm.2004.03.008

7. Bartges JW, Kirk C, Lane IF. Update: management of calcium oxalate uroliths in dogs and cats. *The Veterinary Clinics of North America: Small Animal Practice.* 2004;34(4):969–987. doi: 10.1016/j.cvsm.2004.03.011

8. Berent AC. Ureteral obstructions in dogs and cats: a review of traditional and new interventional diagnostic and therapeutic options. *Journal of Veterinary Emergency and Critical Care (San Antonio).* 2011;21(2):86–103. doi: 10.1111/j.1476-4431.2011.00628.x

9. Cannon AB, Westropp JL, Ruby AL, Kass PH. Evaluation of trends in urolith composition in cats: 5230 cases (1985–2004). *Journal of the American Veterinary Medical Association.* 2007;231(4):570–576. doi: 10.2460/javma.231.4.570

10. Culp WT, Palm CA, Hsueh C, Mayhew PD, Hunt GB, Johnson EG, Drobatz KJ. Outcome in cats with benign ureteral obstructions treated by means of ureteral stenting versus ureterotomy. *Journal of the American Veterinary Medical Association.* 2016;249(11):1292–1300. doi: 10.2460/javma.249.11.1292

11. Bahn Zobbe V, Rygaard H, Rasmussen D, et al. Glucagon in acute ureteral colic: a randomized trial. *European Urology.* 1986;12(1):28–31. doi: 10.1159/000472572

12. Silverstein D. Daily intravenous fluid therapy. In: Silverstein DC, Hopper K. (eds.), *Small Animal Critical Care Medicine*. Saunders Elsevier, St. Louis, MO, pp. 271–275. doi: 10.1016/B978–1–4160–2591–7.10064-5

13. Degner D, Clarke D. Urinary obstruction: ureteral obstruction. In: *Small Animal Surgical Emergencies.* 2015. doi: 10.1002/9781118487181.ch21

14. Taylor S, Chan DL, Villaverde C, et al. 2022 ISFM consensus guidelines on management of the inappetent hospitalised cat. *Journal of Feline Medicine and Surgery.* 2022;24(7):614–640. doi: 10.1177/1098612X221106353 EDN: RSNTNV

15. MacDonald ML, Rogers QR, Morris JG. Nutrition of the domestic cat, a mammalian carnivore. *Annual Review of Nutrition.* 1984;4:521–562. doi: 10.1146/annurev.nu.04.070184.002513

16. Kyles AE, Hardie EM, Wooden BG, et al. Clinical, clinicopathologic, radiographic, and ultrasonographic abnormalities in cats with ureteral calculi: 163 cases (1984–2002). *Journal of the American Veterinary Medical Association.* 2005;226(6):932–936. doi: 10.2460/javma.2005.226.932

17. Snow SJ, Jutkowitz LA, Brown AJ. Trends in plasma transfusion at a veterinary teaching hospital: 308 patients (1996–1998 and 2006–2008). *Journal of Veterinary Emergency and Critical Care (San Antonio).* 2010;20(4):441–445. doi: 10.1111/j.1476-4431.2010.00557.x

18. Wormser C, Clarke DL, Aronson LR. Outcomes of ureteral surgery and ureteral stenting in cats: 117 cases (2006–2014). *Journal of the American Veterinary Medical Association.* 2016;248(5):518–525. doi: 10.2460/javma.248.5.518

19. Guidet B, Martinet O, Boulain T, et al. Assessment of hemodynamic efficacy and safety of 6% hydroxyethyl starch 130/0.4 vs 0.9% NaCl in severe sepsis: the CRYSTMAS study. *Critical Care.* 2012;16(3): R94. doi: 10.1186/cc11358 EDN: AZFRRR

20. Langston C, Eatroff A. Acute kidney injury. In: *August's Consultations in Feline Internal Medicine*,2016;7:483–498. doi: 10.1016/B978–0–323–22652–3.00050-5

21. Myburgh JA, Finfer S, Bellomo R, et al. Hydroxyethyl starch or saline for fluid resuscitation in intensive care. *The New England Journal of Medicine.* 2012;367(20):1901–1911. doi: 10.1056/NEJMoa1209759

22. Brown B, Mauldin GE, Armstrong J, Moroff SD, Mauldin GN. Metabolic and hormonal alterations in cats with hepatic lipidosis. *Journal of Veterinary Internal Medicine.* 2000;14(1):20–26. doi: 10.1892/0891-6640(2000)014<0020: mahaic>2.3.co;2

23. Rogers QR, Morris JG, Freedland RA. Lack of hepatic enzymatic adaptation to dietary protein levels in the adult cat. *Enzyme.* 1977;22(5):348–356. doi: 10.1159/000458816

24. Green AS, Ramsey JJ, Villaverde C, et al. Cats adapt protein oxidation to protein intake if requirements are met. *The Journal of Nutrition.* 2008;138(6):1053–1060. doi: 10.1093/jn/138.6.1053

25. Remillard RL. Nutritional support in critical care patients. *The Veterinary Clinics of North America: Small Animal Practice.* 2002;32(5):1145–1164. doi: 10.1016/s0195-5616 (02) 00050–5

26. Fascetti AJ, Mauldin GE, Mauldin GN. Correlation between serum creatine kinase activities and anorexia in cats. *Journal of veterinary internal medicine.* 1997;11(1):9–13. doi: 10.1111/j.1939-1676.1997.tb00066.x

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Эзофагостомальное кормление в ранний постоперационный период у кошек после уретротомии при обструкции мочеточника

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Аннотация. Приведены результаты раннего постоперационного эзофагостомального кормления у кошек после уретротомии на фоне обструкции мочеточника с входящими показателями креатинина в районе 1200 мкмоль/л. Цель исследования — оценить постановку эзофагостомы у кошек на восстановление в послеоперационный период после обструкции мочеточника. Создано 2 группы: контрольная, состоящая из 8 пациентов, и опытная — из 5 пациентов. Входные показатели креатинина были около 1200 мкмоль/л, показатели мочевины в пределах 51…53 ммоль/л. Медикаментозное лечение идентичное в двух группах: анальгезия, инфузионная терапия кристаллойдными растворами с перерасчетом каждый день и антибиотикотерапия в течение всего исследования. В опытной группе во время оперативного вмешательства по устранению обструкции в мочеточниках устанавливали пищевой зонд для кормления через эзофагостому, также дополнительно в терапию добавлена инфузия метоклопрамидом в дозировке

1–2 мг/кг/сут. До и после операции, на 3, 5, 7, 14 день оценивали показатели мочевины и креатинина. Результаты показали однозначно улучшенную динамику снижения азотемии в опытной группе. На 14 день исследования показатель мочевины в опытной группе был ниже на 6,5 %, чем в контрольной, как и показатель креатинина — на 7,5 %. В среднем показатель азотемии в опытной группе снижался на 11 % быстрее, чем в контрольной. Также пациенты из опытной группы показали самостоятельный аппетит на 2,8 ± 0,4 день (в отличие от контрольной (на 4,8 ± 0,5)), что положительно сказывалось на общем самочувствии пациентов. Кормление по эзофагостоме в ранний постоперационный период у кошек на фоне обструкции мочеточника показывает, что оно является важной составляющей в терапии и позволяет улучшить динамику снижения показателей мочевины и креатинина у пациентов.

Ключевые слова: лечение, анализ крови, раннее послеоперационное кормление, азотемия

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