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Departments

Diagnosis and Treatment of Urolithiasis in Pet Rabbits

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Hypercalciuria ("Sludgy Urine")

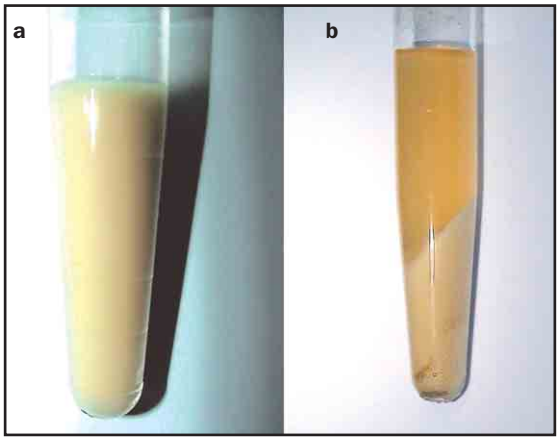

Fig 1. a) The high calcium intake of rabbits, their unique calcium metabolism and the alkaline pH of their urine may all contribute to the production of a dense yellowish-white urine that contains calcium carbonate precipitate. **b)** The same sample after centrifugation shows the sediment and normal urine components.

Fig 2. a) Pet rabbits are frequently presented for suspected bloody urine. If the coloration is uniform and reddish to brown, it may be a normal response to pigments from ingested vegetables. **b)** True bleeding contains what appear to be red or nearly black clots. Hematuria is not present in cases of hypercalciuria and is rarely present in cases of urolithiasis in rabbits.

Fig 3. The pet rabbit may be presented with severe chronic urine scalding in the inguinal area (shown here after shaving). This is due to a frequent stimulation to urinate and the painful difficulty in emptying the urinary bladder.

Fig 4. In cases of hypercalciuria, the dense urine can appear much like pouring fluid concrete. This sludge can be expressed out of the bladder manually. The rabbit is able to urinate the more fluid part of urine (see Fig 1b), but the sludge is retained, filling part of the bladder lumen.

Fig 5. Shown is the same urine after drying. The calcium carbonate crystals look like chalk powder.

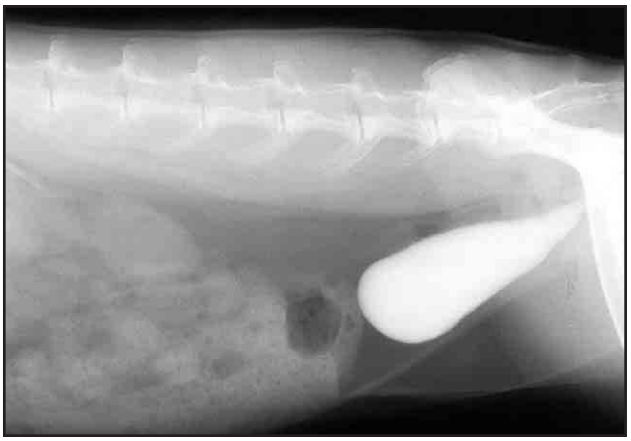

Fig 6. Sludgy urine is radiopaque, so this lateral radiograph of a rabbit affected by hypercalciuria looks as if it is a contrast cystogram. Therapy for hypercalciuria consists of fluid administration, periodic expression of the urinary bladder, bladder flushing under anesthesia and correction of the diet with the goal of reducing calcium intake.

Cystic Calculi

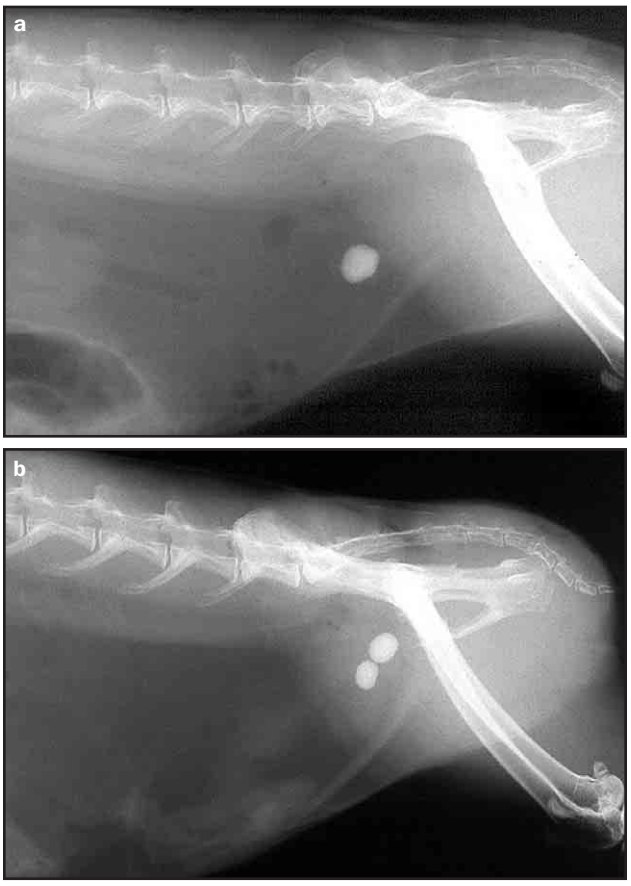

Fig 7. a) Cystic calculi are common in pet rabbits. Occasionally they may be an incidental finding on abdominal radiographs. Usually only one urolith is present, although it can be large compared to the size of the patient. **b)** Uroliths are composed of calcium salts (carbonate, oxalate, phosphate) and are radiopaque. More than one urolith may be present, but in the author's experience, this rarely occurs.

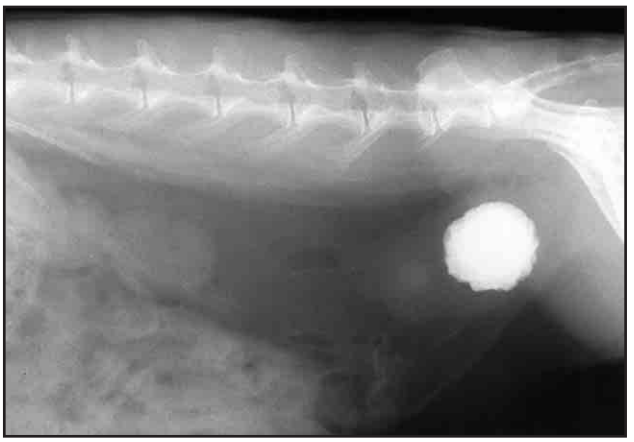

Fig 8. Cystic calculi can be extremely large due to the continuous deposition of calcium around the initial small urolith. The thickness of the urinary bladder is visible in this radiograph as an increased radiodensity.

Cystotomy

Fig 9. The rabbit is placed in dorsal recumbency and aseptically prepared for routine laparotomy. The skin incision is made on the midline between a point several centimeters caudal to the umbilicus and the cranial aspect of the pubis.

Fig 10. The subcutaneous tissues are dissected down to the linea alba. At this point, the large urolith and thickened urinary bladder may be palpated with the tips of the fingers through the abdominal muscle wall.

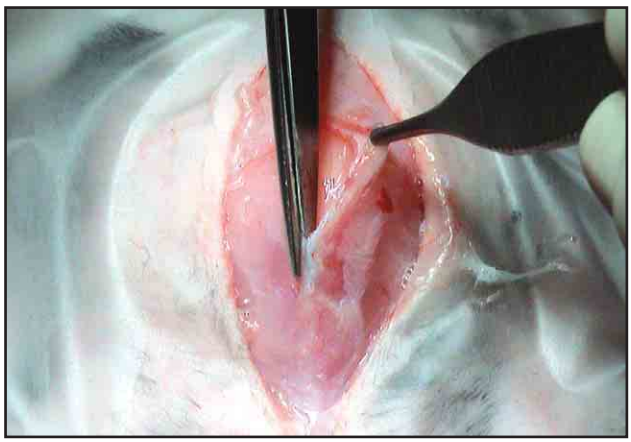

Fig 11. The linea alba is incised with a scalpel blade, paying careful attention to avoid incision of the distended urinary bladder. This complication is infrequent due to the presence of a large amount of fat overlying the bladder and the thickened bladder walls.

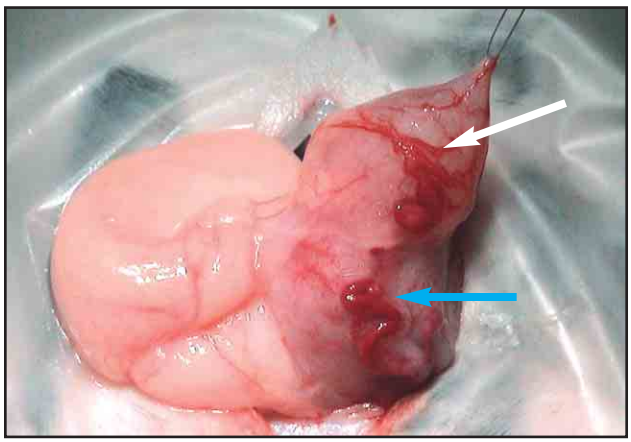

Fig 12. The urinary bladder is exteriorized and reflected cranially. A retention suture helps to position the bladder. In this case, only the cranial aspect of the bladder is filled with urine (white arrow), while the large urolith occupies most of the bladder lumen (blue arrow).

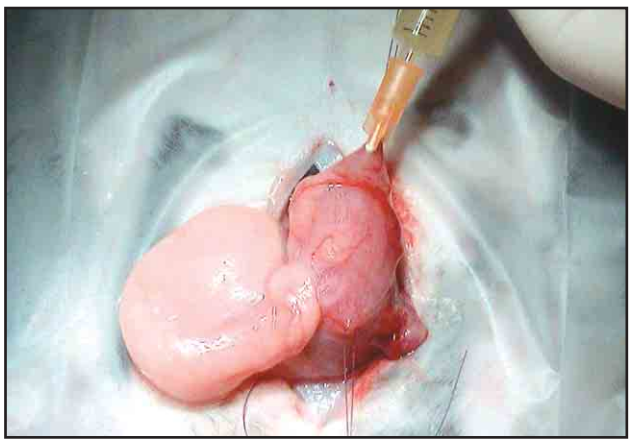

Fig 13. The urinary bladder is emptied by cystocentesis using a syringe and a 25-gauge needle.

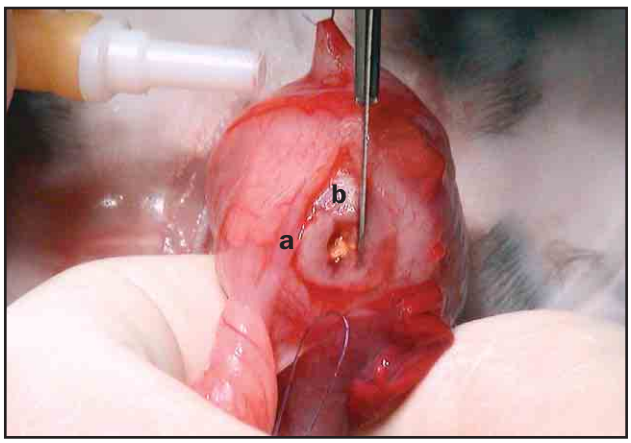

Fig 14. The ventral serosal and muscular layers (a) and the thickened mucosal layer (b) of the bladder are incised. The yellowish urolith appears under the incision.

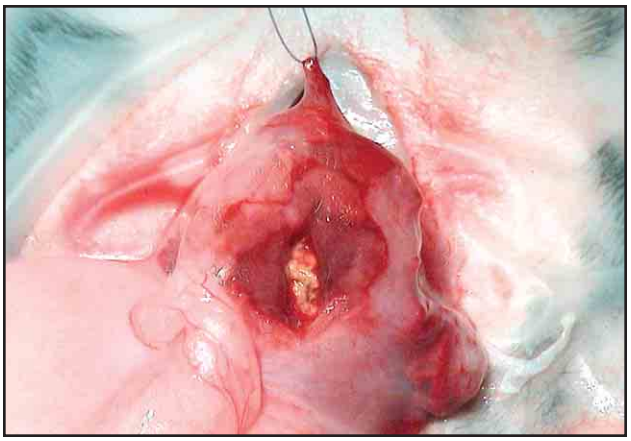

Fig 15. The initial cystotomy incision is extended cranially and caudally with small scissors. The mucosa appears very thickened and edematous due to chronic inflammation and prolonged adhesions to the urolith.

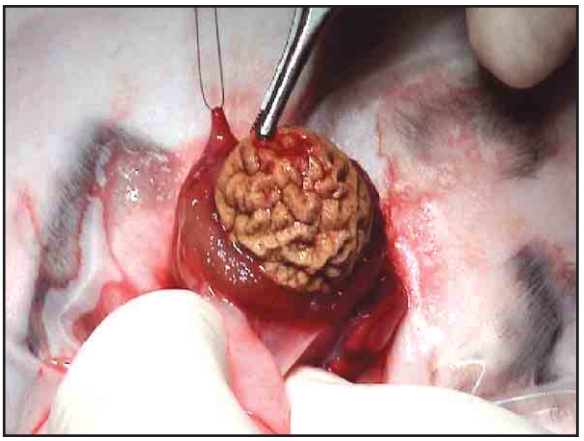

Fig 16. Forceps are used to grasp and withdraw the large urolith. Partial eversion of the mucosa occurs in these cases, and special attention must be paid to avoid lacerating it. The relatively smooth surface of the urolith is thrown into folds by contact with the bladder's thickened mucosal surface during stone enlargement.

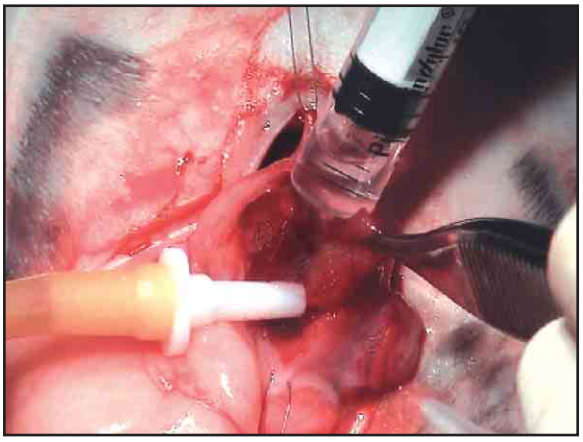

Fig 17. The urinary bladder and mucosal surface are thoroughly flushed with saline to remove blood clots and fine debris. Additional small uroliths or large-sized sand granules are usually not present. For this reason, urethral catheterization and retrograde flushing is not necessary in rabbits.

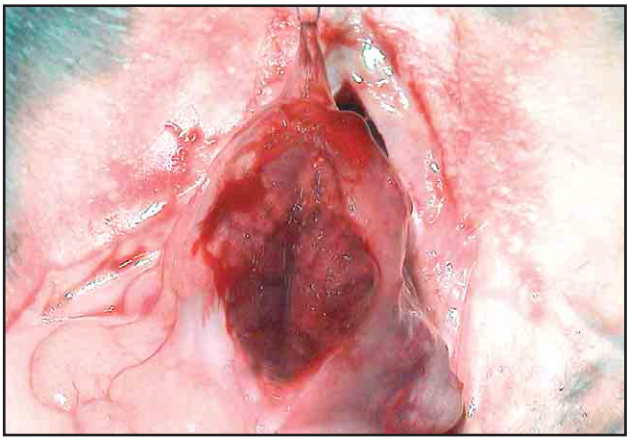

Fig 18. Shown is the appearance of the thickened edematous mucosal layer of the urinary bladder after extraction of the large urolith. Despite this markedly abnormal tissue, the author has not experienced postoperative surgical or clinical complications.

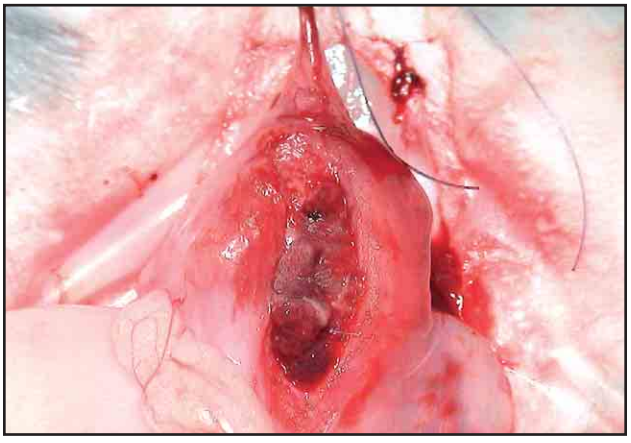

Fig 19. The mucosa is sutured in a continuous inverting pattern using 4-0 or 5-0 absorbable suture (e.g., PDS or Monocryl). In the author's experience, a continuous, as opposed to interrupted, pattern is sufficient to close this thickened mucosa.

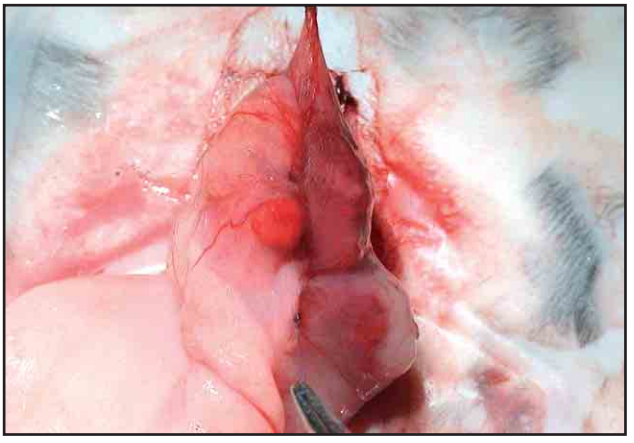

Fig 20. A second suture layer is placed as described above. In milder cases, when the mucosa is not so thickened, a single suture layer may be placed through the serosal, muscular and mucosal layers.

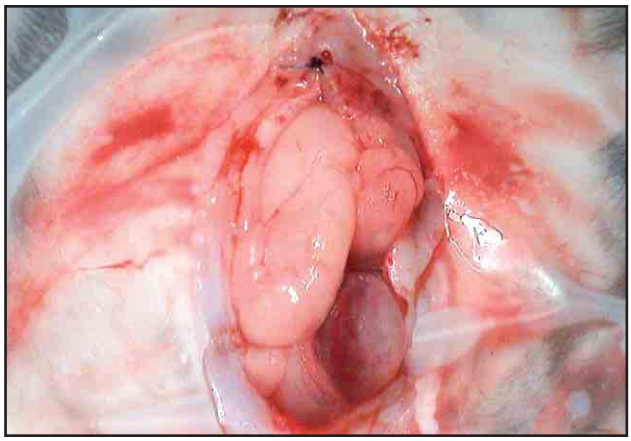

Fig 21. The closure is tested by injecting saline into the bladder and gently compressing it to check for leakage. Care must be exercised to inject the saline into the bladder lumen and not into the edematous mucosa. The bladder is then replaced into the abdominal cavity where it is covered by fat.

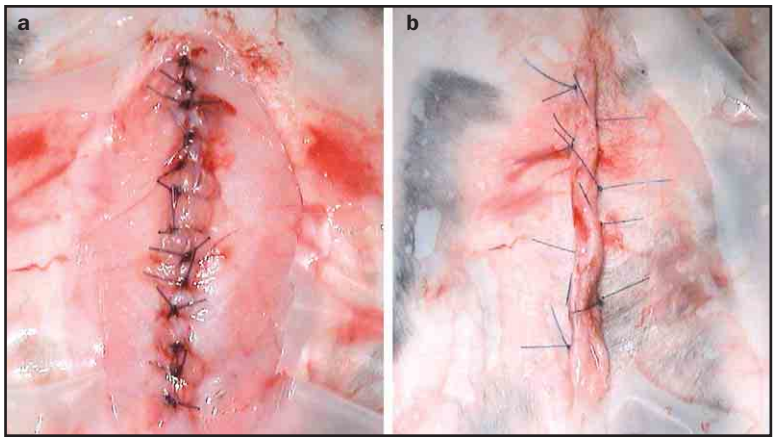

Fig 22. a) The abdominal wall and skin are closed in 2 separate layers using a simple interrupted pattern and absorbable 3-0 or 2-0 suture for the former and **b)** nonabsorbable 3-0 suture for the latter.

Fig 23. The macroscopic appearance of another large cystolith shows an aggregation of thousands of small uroliths.

Urethral Calculi

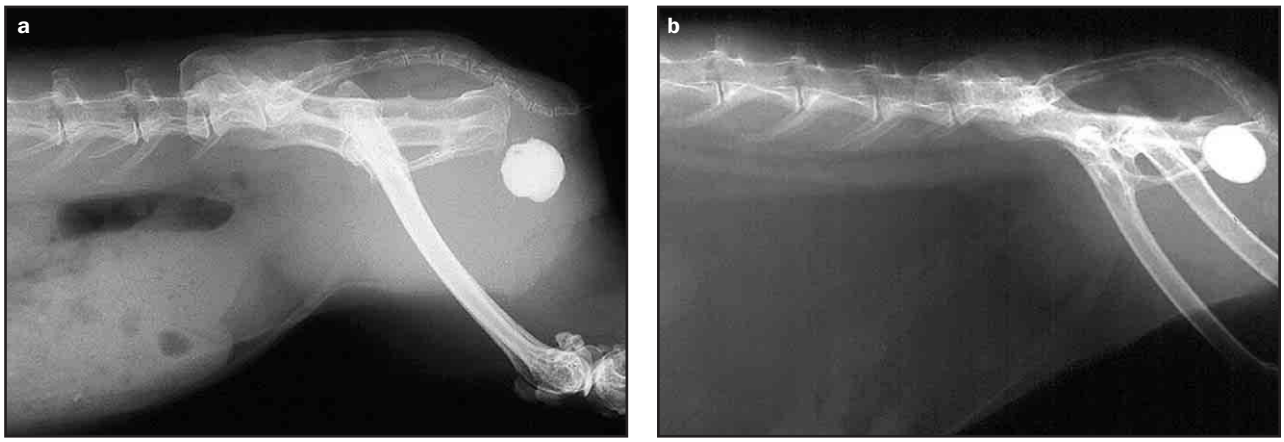

Fig 24. Plain radiographs of urethral calculi in **a)** a male and **b)** female pet rabbit. When urolithiasis is suspected, the abdominal radiograph should include the entire pelvis, or the urolith may remain undiagnosed.

Urethrotomy

Urethrolithiasis in rabbits has different features from the same disease in other companion animal species. In rabbits, the urethra is filled with a single large urolith rather than multiple small stones. Despite its large size, the stone does not usually cause complete obstruction, so the rabbit is able to urinate in drops. Thus, the condition is serious but is usually not an emergency. The history often includes urine scalding or indications of pain rather than an inability to urinate. Similar to a cystotomy, urethrotomy has a good prognosis in pet rabbits, and a dramatic improvement in clinical signs usually occurs within the first few days after surgery.

Fig 25. The inguinal and scrotal areas are shaved very gently to avoid accidental trauma to the thin skin in this area. The skin is gently scrubbed only once to prevent postoperative dermatitis.

Fig 26. Incision of the skin lateral to the penis and dissection of the subcutaneous tissue allow exposure of the body of the penis.

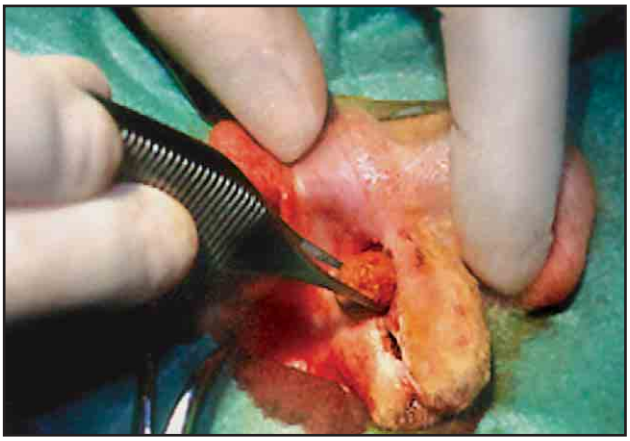

Fig 27. The penis is incised using a No. 11 scalpel blade. Palpation of the urolith helps to localize the incision site. Bleeding is easily controlled with cotton swabs. The urolith is grasped with forceps and extracted.

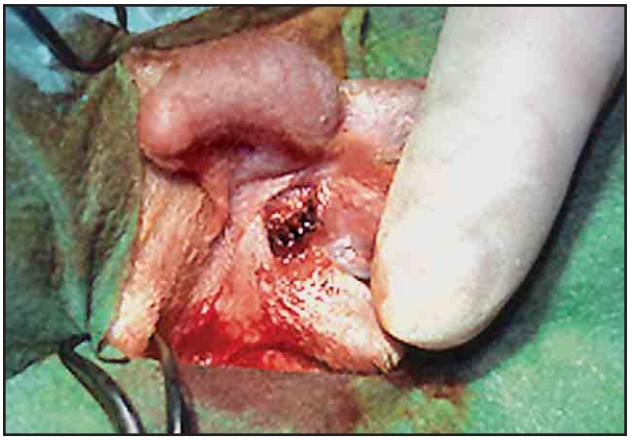

Fig 28. Closure of the urethra is performed in a simple continuous or interrupted pattern using 3-0 to 4-0 absorbable suture (Monocryl).

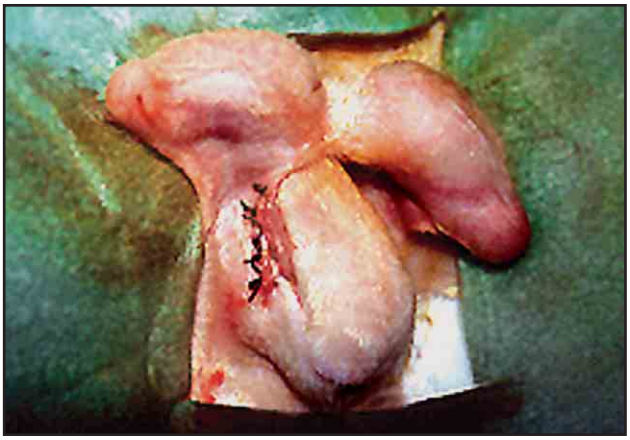

Fig 29. The skin incision is closed with 3-0 nonabsorbable or absorbable suture in a simple interrupted pattern. The author has seen no complications, such as urethral stenosis, subsequent to this surgery.

Nephrolithiasis

Abnormal deposits of calcium carbonate may also occur in the renal pelvis. This condition is more severe than the presence of uroliths in the bladder or the urethra, because nephroliths severely affect renal function. Nephrolithiasis is usually bilateral, even when apparent unilateral cases are diagnosed early. Prognosis is guarded to poor and related to renal function. Blood urea nitrogen, creatinine and phosphorus values are usually extremely elevated.

Fig 30. The pet rabbit affected by bilateral nephrolithiasis is presented with anorexia, depression, severe and chronic weight loss and dehydration.

Fig 31. A ventrodorsal radiograph shows bilateral nephrolithiasis. The left kidney is affected less severely than the right one.

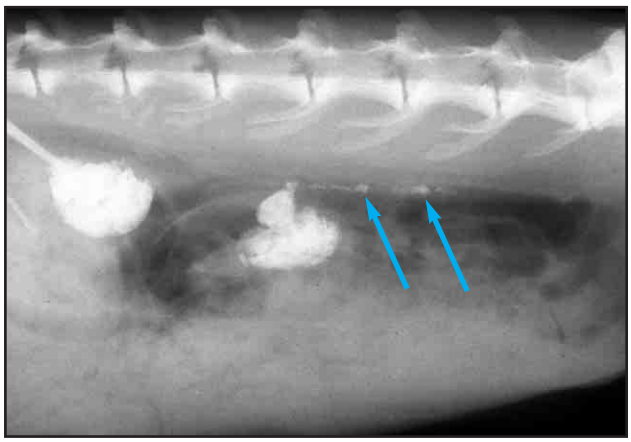

Fig 32. This lateral radiograph illustrates a severe case of bilateral nephrolithiasis. Two small uroliths are also present in the right ureter (arrows).

Photo courtesy of Claudio Bussadori, DVM

Fig 33. In this sonogram of the rabbit in Fig 32, intense hyperechogenicity of the right kidney and adjacent shadowing indicate nephrolithiasis.

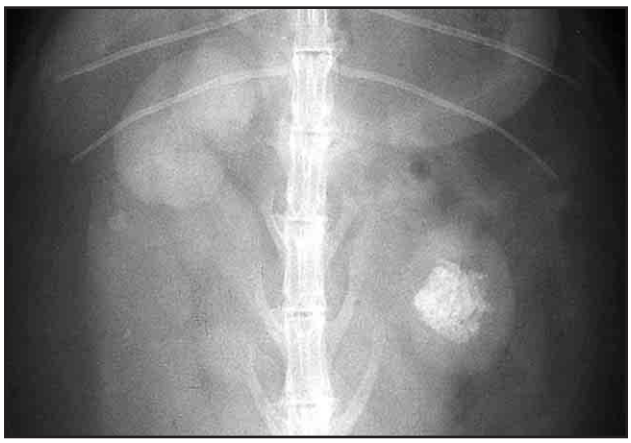

Fig 34. This ventrodorsal radiograph demonstrates left unilateral nephrolithiasis.

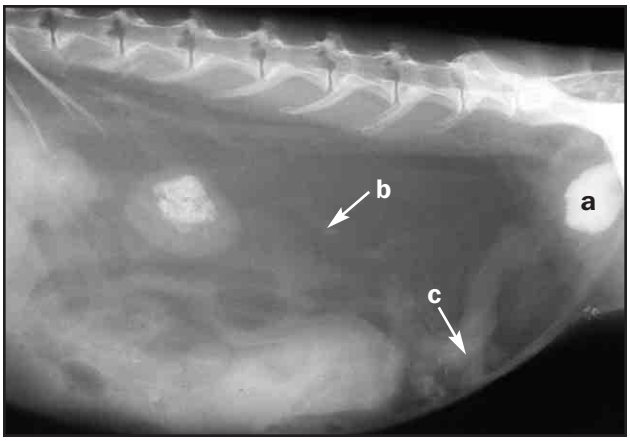

Fig 35. In cases of unilateral nephrolithiasis, an intravenous excretory pyelogram may give a relative indication of renal function. Shown is a lateral radiograph taken 15 minutes after injection of contrast medium. The contrast has already been excreted into the urinary bladder (a), indicating normal function of at least one kidney. The right ureter (b) also appears normal. Radiodensity of the vagina (c) is due to reflux of urine from the bladder.

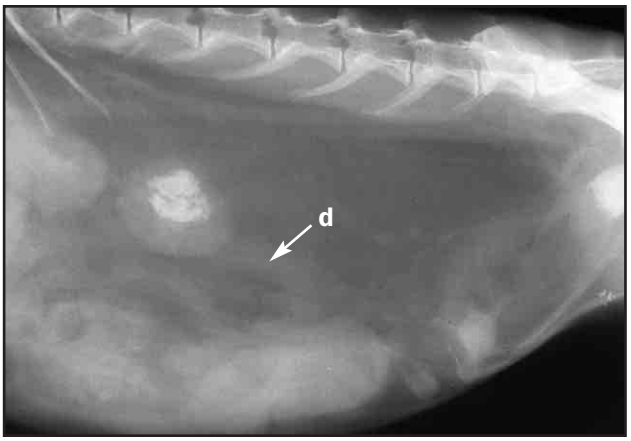

Fig 36. In this lateral radiograph taken 30 minutes after the injection of contrast, the left ureter (d) now appears to be dilated, and urine flow is delayed. In cases of unilateral nephrolithiasis, if one kidney appears to be functioning adequately, the surgical option of nephrectomy or nephrotomy to remove the urolith(s) from the affected renal pelvis may be considered.

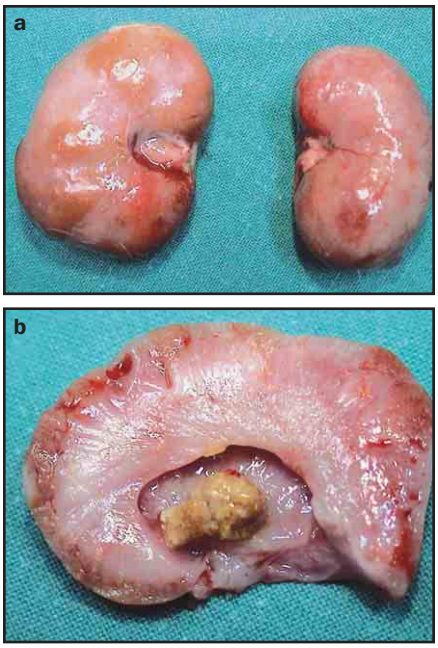

Fig 37. a) Macroscopic appearance of the kidneys of the rabbit assessed in Figs 34-36 after the patient died during surgery. The left kidney (left) is larger and more irregular than the right one (right). **b)** The left renal pelvis is dilated and contains the nephrolith. Uroliths in the kidneys are usually more friable than those in the urinary bladder.

RENAL CALCINOSIS is a peculiar form of nephrolithiasis affecting the entire renal parenchyma, including the cortex. From a pathologic point of view, this condition is more severe than renal pelvic urolithiasis. From a clinical standpoint, the disease severity and prognosis can be assessed after blood work and contrast radiography.

Fig 38. A plain ventral radiograph shows a bilateral case of diffuse renal calcinosis. Increased radiodensity is uniform throughout the kidneys, and discrete renal pelvic uroliths are not seen.

Fig 39. In this sonogram of another case of diffuse renal calcinosis, intense hyperechogenicity is apparent in both the renal cortex and collecting system.

Photo courtesy of Claudio Bussadori, DVM

Acknowledgements

The author appreciates the contributions of Maura Nardi, DVM, Germana Scerbanenco, DVM and Andrea Zatelli, DVM.

References and Further Reading

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