Endoscopically guided removal of cloacal calculi in three African spurred tortoises (*Geochelone sulcata*)

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Case Description—3 female African spurred tortoises (*Geochelone sulcata*) of various body weights (0.22, 0.77, and 2.86 kg [0.48, 1.69, and 6.29 lb]) were examined because of reduced food intake and lack of fecal output. Owners reported intermittent tenesmus in 2 of the tortoises.

Clinical Findings—Physical examinations revealed no clinically important abnormalities in the tortoises. Cloacal calculi were diagnosed on the basis of radiography and cloacoscopy in all 3 tortoises. One tortoise had another calculus in the urinary bladder.

Treatment and Outcome—Tortoises were anesthetized, and cloacal calculi were removed by use of a cutting burr (plain-fissure cutting burr and a soft tissue protector mounted to a dental handpiece that had a low-speed motor and a straight nose cone) and warm water irrigation with endoscopic guidance. Complete removal of calculus fragments was achieved by use of forceps and irrigation. In 1 tortoise, removal of the cloacal calculus was staged (2 separate procedures). In another tortoise, a second cloacal calculus (which had been located in the urinary bladder during the first examination) was successfully removed 25 days after removal of the first calculus. All 3 tortoises recovered uneventfully, and serious complications secondary to removal of the cloacal calculi were not detected.

Clinical Relevance—Cloacoscopy combined with the use of a low-speed dental drill and warm water irrigation should be considered a simple, safe, and nontraumatic treatment option for removal of obstructive cloacal calculi in tortoises. (*J Am Vet Med Assoc* 2012;240:869–875)

A 2.86-kg (6.29-lb) approximately 2-year-old female African spurred tortoise (*Geochelone* (Centrochelys) *sulcata*; tortoise 1) was brought to the Tai Wai Small Animal and Exotic Hospital, Hong Kong, China, by its owner because of a 5- to 7-day history of reduced appetite, lack of fecal output, and intermittent straining to defecate or urinate (tenesmus). The tortoise had been kept in a glass tank (114.3 × 45.7 × 45.7 cm) that had a heat lamp (75 W) located over the center of the tank and another infrared heat lamp located over 1 end of the tank. Air temperature in the tank ranged from 30° to 32°C (86° to 90°F [no temperature gradient]). The tortoise had been exposed to a full-spectrum UVB light source (unknown specifications), and the owner had immersed the tortoise for 20 minutes in shallow tap water approximately every 7 days. The diet had consisted of green leafy vegetables (bok choy and choy sum) and commercial pellets formulated for tortoises (unknown brand).

Physical examination revealed no clinically important abnormalities in tortoise 1. The oral cavity was not examined because sedation would have been required.

Abbreviation	
LRS	Lactated Ringer's solution

Evaluation of a dorsoventral survey radiograph revealed a round mineral opacity in the pelvic canal (suspected to be an obstructive cloacal calculus) and gas distention of the gastrointestinal tract (**Figure 1**). A blood sample (0.5 mL) was collected from the brachial venous plexus. Plasma biochemical analyses[a] were performed, which revealed mild hyperuricemia (11.1 mg/dL; reference range, 2.1 to 10.5 mg/dL). The PCV, total solids concentration, and estimated WBC count (determined by use of previously reported methods[1]) of the blood sample were within the respective reference ranges. Fifty milliliters of balanced LRS was administered SC in the prefemoral (inguinal) fossa. Anesthesia was induced 45 minutes later by use of midazolam (2.0 mg/kg [0.9 mg/lb], SC), medetomidine (0.15 mg/kg [0.068 mg/lb], SC), ketamine hydrochloride (2.5 mg/kg [1.14 mg/lb], SC), and morphine (1.0 mg/kg [0.45 mg/lb], SC). A light plane of anesthesia was achieved, and the tortoise continued to spontaneously breathe. The respiratory rate and pulse rate were monitored, and the palpebral and corneal reflexes as well as jaw tone were regularly assessed as part of the anesthetic monitoring protocol.

Tortoise 1 was placed in dorsal recumbency at an angle of approximately 30° (tail positioned below the head). A 30° 18-cm × 2.7-mm rigid videoendoscope in a 3.5-mm-diameter operating sheath[b] was inserted into the cloaca (**Figure 2**). Videoendoscopic images were recorded by use

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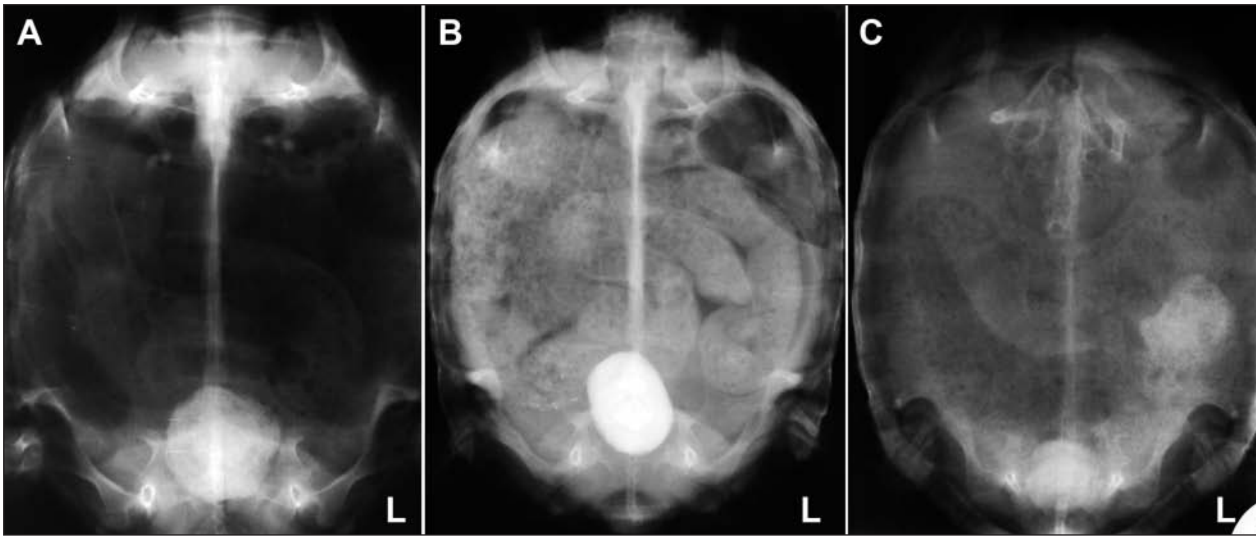

Figure 1—Dorsoventral survey radiographic images of 3 African spurred tortoises (*Geochelone sulcata*) with cloacal calculi. A—A 2.86-kg (6.29-lb) approximately 2-year-old female African spurred tortoise (tortoise 1) that was brought to the hospital by the owner because of decreased appetite and fecal production and tenesmus. Notice the intestinal tympany. B—A 0.77-kg (1.69-lb) approximately 2-year-old female African spurred tortoise (tortoise 2) that was brought to the hospital by the owner because of decreased appetite and fecal production. Notice the severe intestinal constipation and tympany and cranial displacement of the stomach. C—A 0.22-kg (0.48-lb) female African spurred tortoise (tortoise 3) of unknown age that was brought to the hospital by the owner because of decreased appetite and fecal production and tenesmus. Notice the cystic calculus. L = left.

Figure 2—Photograph of a tortoise showing insertion of a rigid endoscope and low-speed dental burr into the cloaca.

of a mobile endoscopy unit with an integrated image processing module.[c] An IV infusion set was connected to each of the 2 ingress ports of the operating sheath. The other ends of the IV infusion sets were connected to 1-L fluid bags (suspended approx 50 cm above the tortoise), which had been partially opened at the top end to allow them to be refilled with warm (approx 25°C [77°F]) tap water during the procedure. Water was delivered to the operating sheath by gravity flow. Both ingress ports of the operating sheath were opened simultaneously, which allowed cloacoscopy and irrigation of debris (which tended to impair visibility) to be simultaneously performed. Initially, the flow rate of the water was adjusted by partially closing the ports on the operating sheath to maintain visibility during cloacoscopy; to improve visibility during the later stages of removal of the calculus, both ingress ports on the operating sheath were completely opened to allow maximum flow of water. Fluid was allowed to egress out the cloacal opening.

During initial cloacoscopic examination of tortoise 1, a firm, white object was found in the cloaca and was identified as a calculus. A plain-fissure cutting burr and a soft tissue protector[d] were mounted to a low-speed (20,000 revolutions/min) motor dental handpiece[d] that had a straight (1:1 reduction) nose cone.[d] Under endoscopic guidance, the cutting burr was inserted into the cloaca and used to assist with fragmentation of the calculus (**Figure 3**). Initially, the burr was used to create a hole in the center of the calculus. The hole was progressively widened and deepened until the edges of the calculus could be grasped with Babcock forceps, and the calculus was carefully crushed into small fragments. Use of the burr caused complete loss of visibility within 5 to 10 seconds, because debris from the calculus became suspended in the irrigation water. Therefore, drilling of the calculus was performed in short (5- to 10-second) pulses followed by high-volume water irrigation until visibility improved. Because of the cranial location of the calculus in the cloaca, it was difficult to insert the burr deep enough into the cloaca to allow destruction of the entire calculus. After approximately 1 hour, the procedure was terminated because of scheduling constraints and swelling of the cloacal mucosa. Radiography revealed that approximately 20% of the cloacal calculus had been removed. The cloacal calculus appeared to be narrower in diameter than it had been before the procedure, possibly allowing it to pass into the caudal portion of the cloaca. Ointment[e] was applied intracloacally, and meloxicam (0.2 mg/kg [0.09 mg/lb], SC) and LRS (25 mL, SC) were administered to the tortoise. Atipamezole (0.75 mg/kg [0.34 mg/lb], SC) and flumazenil (0.05 mg/kg [0.023 mg/lb], SC) were administered to antagonize medetomidine and midazolam, respectively, and the tortoise was able to ambulate within 15 minutes after antagonist administration. The tortoise was discharged from the hospital later that same day.

The owner returned tortoise 1 to the hospital 3 days later for a second attempt at complete removal

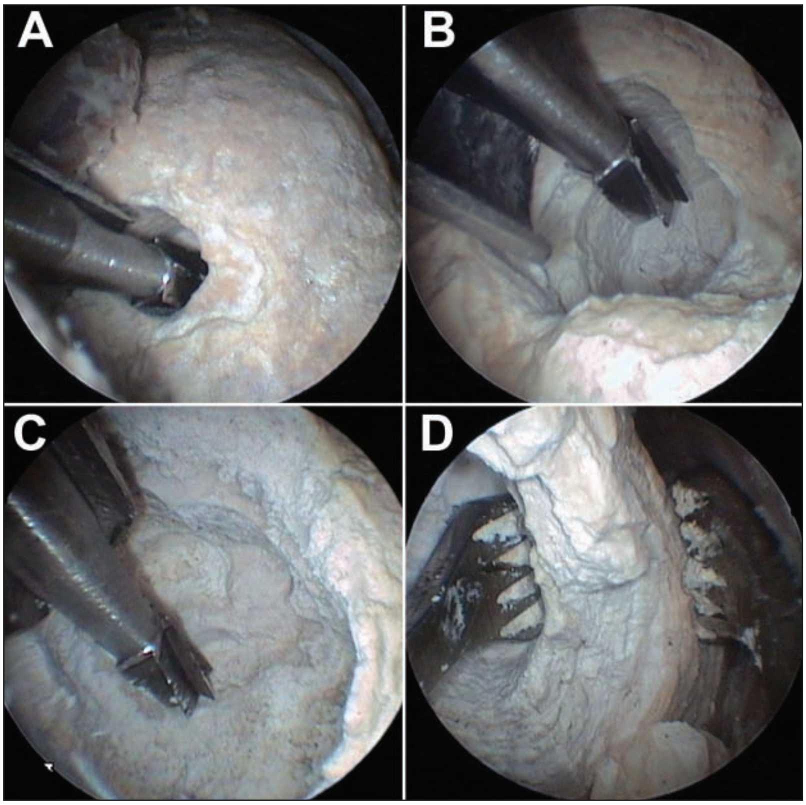

Figure 3—Photographs depicting destruction and removal of cloacal calculi by use of warm water irrigation and cloacoscopy in a tortoise. A—A central drill hole is being created by use of a plain-fissure cutting burr with a soft tissue protector. B and C—The drill hole is being gradually widened and deepened by use of the burr. D—Babcock forceps are being used to fragment the cloacal calculus.

of the cloacal calculus. According to the owner, the tortoise had eaten within 1 day after the first procedure; no feces had been observed; however, small pieces of firm, white material had been passed. During physical examination, the tortoise was bright and alert and no cloacal swelling was observed. The tortoise was anesthetized by use of midazolam (2.0 mg/kg, SC), medetomidine (0.2 mg/kg, SC), and morphine (1.0 mg/kg, SC). Removal of the cloacal calculus was performed by use of the same endoscopically guided technique that had been used during the first procedure for this tortoise. Within approximately 35 minutes after starting the second procedure, the cloacal calculus was completely removed. Diagnostic cloacoscopy was performed after the calculus was removed. A large focal area of the dorsal cloacal wall was covered by a thick layer of membranous material (**Figure 4**), which was easily removed by use of grasping forceps. There was mild hemorrhage from the underlying cloacal mucosa after removal of the membranous material. Endoscopic examination of the urinary bladder and rectum revealed no abnormalities. Atipamezole (0.75 mg/kg, SC) and flumazenil (0.05 mg/kg, SC) were administered to the tortoise, and the animal ambulated within 10 minutes after antagonist administration. The tortoise was discharged from the hospital later that same day. Ointment[e] was prescribed to be applied topically to the cloaca by the owner every 24 hours for 3 days. A single dose of meloxicam (0.2 mg/kg, SC) was administered. The tortoise started to eat the day after the second procedure and defecated within 7 days after complete removal of the calculus.

A 0.77-kg (1.69-lb) approximately 2-year-old female African spurred tortoise (tortoise 2) was brought to the hospital by its owner because of a 6-day history of lack of fecal output. The tortoise had a normal appetite until the day before it was brought to the hospital, at which time it had become anorexic. The amount of activity of the tortoise had not changed. The tortoise had been kept in a glass tank (70 × 30.5 × 30.5 cm) in which the temperature was approximately 28°C (82°F). The owner was unable to provide information on the temperature gradient in the tank; however, an infrared heat lamp (turned on 24 h/d) had been placed over the tank. A full-spectrum UVB light (unknown specifications) had been placed over the tank. The tortoise had been offered a diet that mainly consisted of lettuce, miscellaneous fresh greens, and commercial pellets formulated for tortoises (unknown brand); no other nutritional products had been offered.

Physical examination revealed mild swelling of the cloacal opening in tortoise 2. The interior of the cloaca and the oral cavity were not examined at that time because sedation would have been required. Evaluation of a dorsoventral radiograph of the tortoise revealed that a round mineral opacity was located in the pelvic canal, the large intestine was filled with fecal material, and the stomach was distended with gas and displaced cranially (Figure 1). The tortoise was treated with LRS (20 mL, SC, in the prefemoral fossa). Morphine (2.0 mg/kg, SC) and midazolam (1.0 mg/kg, SC) were administered so that the physical examination could be completed and venipuncture could be performed. A blood sample (0.3 mL) was collected from the brachial venous plexus, and plasma was obtained from the sample. Plasma biochemical analyses[a] were performed, and PCV, total solids concentration, and estimated WBC count in the blood sample were determined. The PCV, total solids concentration, and estimated WBC count were within the respective reference ranges. Results of plasma biochemical analyses[a] revealed mild hyperuricemia (11.1 mg/dL; reference range, 2.1 to 10.5 mg/dL).

One hour after the physical examination and blood and plasma analyses were completed, anesthesia was induced in tortoise 2 by administration of medetomidine (0.15 mg/kg, SC) and ketamine (5 mg/kg [2.3 mg/lb], SC). Warm water irrigation and endoscopy of the cloaca were performed, a cloacal calculus was found, and the calculus was removed by use of the same technique that was used for tor-

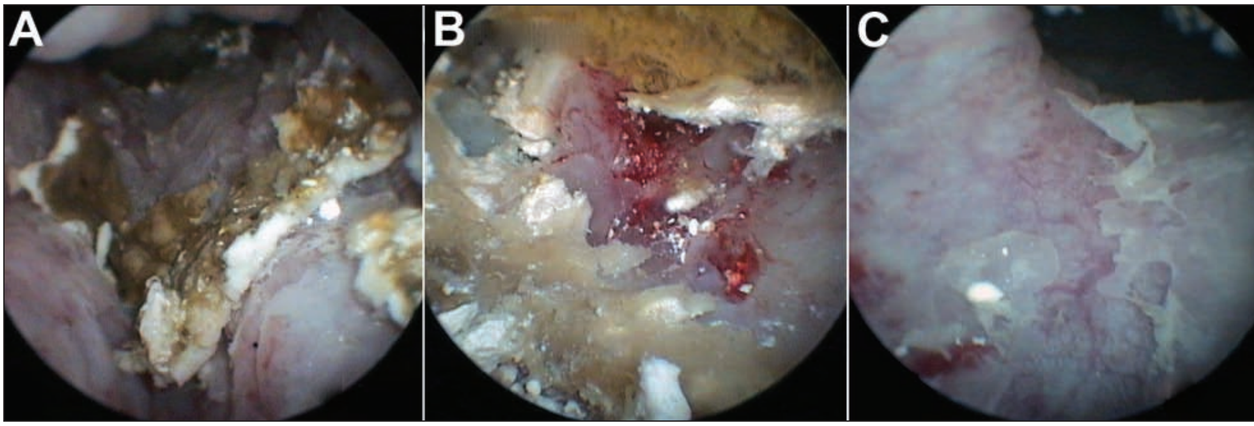

Figure 4—Photographs depicting findings of diagnostic cloacoscopy that was performed after complete removal of cloacal calculi from the 2 tortoises in Figure 1. A—Thick membranes covering the cloacal mucosa in tortoise 1. B—Hemorrhage is evident after partial removal of the membranes covering the cloacal mucosa in tortoise 1. C—Mild superficial sloughing of the cloacal mucosa in tortoise 2.

toise 1. Complete removal of the cloacal calculus was achieved approximately 45 minutes after the start of the procedure. Diagnostic cloacoscopy performed after calculus removal revealed mild superficial damage to the cloacal mucosa (Figure 4). The rectum and urinary bladder were examined endoscopically, and no abnormalities were observed. A dorsoventral radiograph was acquired after termination of cloacoscopy. Evaluation of the radiograph confirmed that the cloacal calculus had been completely removed. Atipamezole (0.75 mg/kg, SC) and flumazenil (0.05 mg/kg, SC) were administered and the tortoise ambulated within 15 minutes afterward. The tortoise was treated with LRS (15 mL, SC), and ointment[e] was topically applied in the cloaca. The tortoise was discharged from the hospital later that same day, and the owner reported that it started to eat and defecate 2 and 7 days after discharge, respectively.

A 0.22-kg (0.48-lb) female African spurred tortoise (tortoise 3) of unknown age was brought to the hospital by its owner because of a white mass that intermittently protruded from the cloaca. The tortoise had been anorexic for 3 days, and straining to defecate or urinate had been observed for 1 day prior to admission to the hospital. The tortoise had not passed feces during the previous 3 days. The amount of activity had been normal. The tortoise had been housed in a glass tank (70 × 70 × 70 cm) in which there was a temperature gradient (25° to 32°C [77° to 90°F]). A full-spectrum UVB light source (unknown brand) had been placed over the tank, and a hiding box was available to the tortoise at the side of the tank that had a lower temperature. The owner had been immersing the tortoise in shallow water for 30 minutes once daily. The tortoise had been offered commercial pellets[f] formulated for tortoises and leafy greens. The diet had been supplemented with calcium powder (unknown brand and amount) once per week.

During physical examination, no clinically important abnormalities were detected in tortoise 3 and it passed urine and urates. Evaluation of a dorsoventral radiograph of the tortoise revealed one round mineral opacity in the cloaca and another in the urinary bladder (Figure 1). The tortoise was anesthetized by use of midazolam (2.0 mg/kg, SC), medetomidine (0.15 mg/kg, SC), ketamine (2.5 mg/kg, SC), and morphine (1.5 mg/kg [0.68 mg/lb], SC). Warm water irrigation and endoscopy of the cloaca were performed. A cloacal calculus was found, and the calculus was removed by use of the same procedure that was used for tortoises 1 and 2. Diagnostic cloacoscopy performed after removal of the cloacal calculus revealed that there was no clinically important damage to the cloacal mucosal. Another calculus was found in the urinary bladder during cystoscopy (consistent with radiographic findings), and the urinary bladder mucosa was grossly normal. It was not deemed feasible to introduce the burr into the urinary bladder and stabilize the calculus sufficiently for destruction without causing iatrogenic damage to the urethra and urinary bladder. The duration of the procedure was approximately 30 minutes. Atipamezole (0.75 mg/kg, SC) and flumazenil (0.05 mg/kg, SC) were administered, and the tortoise ambulated within 20 minutes after antagonist administration. The tortoise was treated with LRS (6 mL, SC, in the prefemoral fossa) and meloxicam (0.2 mg/kg, SC). The tortoise was discharged from the hospital the morning after the procedure. The owner reported that the tortoise started to eat and defecate the day after discharge.

Tortoise 3 was reevaluated 25 days after the initial evaluation because of a firm, white stone-like object that was trapped in the cloacal opening. The tortoise had not defecated for 2 days prior to this evaluation. However, its appetite and activity were considered normal. Physical examination revealed a firm, white object in the cloacal opening, which was consistent with a cloacal calculus. The cloacal opening was mildly swollen and erythematous. Physical examination did not reveal any other abnormalities. The cloacal calculus was removed by use of the same anesthetic protocol and endoscopically assisted procedure that had been used during the first procedure in this tortoise. The duration of the procedure was approximately 30 minutes. Diagnostic cloacoscopy performed after removal of the calculus revealed that there was no damage to the cloacal mucosal. The tortoise recovered rapidly from anesthesia and was discharged later that same day.

Discussion

The noninvasive technique for removal of cloacal calculi described in the present report included warm water irrigation and endoscopy of the cloaca and the use of a low-speed motor dental handpiece and burr. This procedure offered substantial benefits for removal of obstructive cloacal calculi in tortoises, compared with other (more invasive) treatment options. These benefits included avoidance of tissue trauma; shorter anesthesia and recovery times; fewer signs of pain; excellent visibility of cloacal structures and calculi; less risk of iatrogenic damage; opportunity for a veterinarian to completely examine the cloaca, urinary bladder, and rectum; and reduced cost of the procedure (because sterility did not need to be maintained and the duration of the procedure was short).

The cloaca is the distal terminus of the gastrointestinal, reproductive, and urinary systems in tortoises; therefore, calculi that obstruct the cloacal lumen can cause obstruction of multiple organ systems.[2] Cloacal calculi are caused by migration of cystic calculi (commonly referred to as bladder stones) from the urinary bladder to the pelvic canal; the calculi become wedged in the cloaca. These calculi develop in a variety of reptilian species and are typically composed of urate salts.[3–5] Urinary calculi are common in captive chelonians and have been reported in free-ranging reptiles.[6,7] The underlying cause of the formation of urinary calculi in chelonians is unknown, although several factors have been thought to contribute to their formation, including vitamin deficiencies, calcium deficiency, and excess protein and oxalates in the diet.[3] Other causes, such as bacterial infections of the urinary bladder and remnants of suture left within the bladder after surgery, have also been reported.[3] Urinary calculi are most commonly found in tortoises that are native to arid climates.[7–11] Because the urinary bladder of chelonians is the primary organ responsible for postrenal osmoregulation and fluid storage, chronic dehydration (which causes delayed or insufficient emptying of the bladder) might contribute to formation of cystic or cloacal calculi.[12]

Reptiles that have obstructive cloacal calculi require intervention for removal of the calculi and resolution of the obstruction. However, few treatment options have been reported for resolution of obstruction caused by calculi in reptiles. The intrapelvic location of the cloaca in tortoises makes surgical intervention for removal of cloacal calculi challenging. Approaches for removal of urinary calculi in chelonians include plastron osteotomy,[3,10,13–15,g] coeliotomy via the prefemoral fossa,[16,i] and removal via the cloacal opening with or without the aid of endoscopy.[9,11,h]

Plastron osteotomy provides access to the entire coelomic cavity and might enable the removal of cystic calculi and cloacal calculi during the same procedure.[13,15] However, plastron osteotomy is a highly invasive surgical procedure during which a rectangular piece of shell and bone is temporarily removed from the plastron. The procedure is associated with prolonged anesthesia and healing.[13,15] Postsurgical signs of pain are assumed to be more substantial with a plastron osteotomy, as tissue trauma is extensive. Postsurgical complication rates are associated with the skill of the surgeon, and dehiscense, necrosis, and infection of the bone flap are possible complications after plastron osteotomy.[13,17,g]

The surgical approach to the chelonian coelomic cavity via the prefemoral fossa is a less invasive alternative to plastron osteotomy, is associated with a substantially shorter healing time, and is thought to cause less pain.[15,18,i] However, access to and visibility in the coelomic cavity are often limited and endoscopic guidance is usually required when a prefemoral fossa approach is used.[18–20] Also, it is less likely that large cloacal or cystic calculi can be completely removed by use of this surgical approach; therefore, when the prefemoral fossa approach is used, calculi must be fragmented prior to removal, which can be time-consuming and may increase the risks of contamination of the coelomic cavity and trauma to the urinary bladder.

An approach through the cloacal opening is the least invasive method for removal of cloacal calculi. The major limitation of this approach is limited access to and visibility in the cloaca. Although successful removal of cloacal calculi via the cloacal opening has been reported, iatrogenic damage to the cloaca can occur.[9,11] The use of a rigid endoscope for evaluation of the cloaca provides a method by which the risk of iatrogenic damage during removal of calculi can be minimized. Cloacoscopy is a useful technique for the diagnosis and treatment of intracloacal disorders in reptiles.[20–23] Cloacoscopy allows complete examination of the cloaca, urinary bladder, and rectum during a procedure. Although some authors[20,22,23] have reported that cloacoscopy can be performed without the use of chemical restraint, anesthesia or sedation is typically required to perform cloacoscopy in chelonians.

Endoscopically guided removal of a cloacal calculus in an African spurred tortoise (6.3 kg [13.9 lb]) has been reported.[h] In contrast to the 3 tortoises of the present report, the cloaca in that tortoise was not irrigated with saline (0.9% NaCl) solution or water during the procedure. During removal of cloacal calculi with the burr, there was a considerable amount of fine debris from the calculi in the tortoises of the present report. High-volume water irrigation of the cloaca with warm tap water and intermittent use of the burr greatly enhanced visibility of cloacal structures during cloacoscopy in these tortoises; visibility was enhanced because irrigation caused dilation of the cloaca (which increased the distance between the cloacal tissues and endoscope) and allowed continuous removal of debris.[22] By use of this technique, damage to cloacal tissues could be evaluated and the need for systemic or topical medical treatments could be determined. Although sterile saline solution is generally recommended for irrigation during cloacoscopy,[18,19,21,22] the use of sterile fluids was not necessary because cloacoscopy is a nonsterile procedure. Warm tap water is considerably less expensive than sterile saline solution for irrigation during cloacoscopy, and its use reduced the overall cost of the procedure.

Because endoscopically assisted removal of cloacal calculi by use of a low-speed motor dental handpiece and burr was a relatively nontraumatic technique for removal of cloacal calculi (compared with plastron osteotomy or prefemoral fossa coeliotomy), the tortoises of the present report recovered more quickly from the procedure than would be expected if other more traumatic techniques had been used. After cloacoscopy, mild swelling of the cloacal opening and mucosa was observed in 2 of the 3 tortoises of the present report. This swelling was likely a result of repeated introduction of the burr and endoscope, which may have led to irritation of tissues. Iatrogenic damage to the cloaca was not detected during any of the procedures in the 3 tortoises of the present report. Although the burr could have caused severe damage to the cloacal tissues if the procedures had not been carefully performed, the direct view of the cloaca (enabled by use of the endoscope) and use of the soft tissue protector minimized the risk of iatrogenic trauma. Compared with removal of calculi via the cloacal opening without the aid of endoscopy,[9,11] the risks of iatrogenic damage were greatly reduced by use of cloacoscopy as described in the present report.

Compared with surgical approaches, the endoscopically guided technique for calculus removal via the cloacal opening reported here required a shorter duration of anesthesia. Anesthesia for plastron osteotomy procedures typically lasts for several hours, although the anesthetic time required for a surgical approach via the prefemoral fossa can be shorter than that.[18] In the 3 tortoises of the present report, the total time required for the procedures ranged from 30 minutes to 1 hour, depending on the location and size of the cloacal calculus. However, as described in tortoise 1, a second procedure might be required to completely remove cloacal calculi. The anesthetic drug combinations that were used in these 3 tortoises were selected on the basis of the authors' personal experience because, to the authors' knowledge, there have been no studies reported in peer-reviewed journals on the use of anesthetic drug combinations in African spurred tortoises. The anesthetic protocol described in the present report did not require vascular access because the drugs were administered SC between a forelimb and the neck. The anesthetic drugs used were partially or completely reversible, and use of inhalation anesthetics was not necessary. By antagonizing the effects of midazolam and medetomidine, rapid (within 10 to 20 minutes after administration of the antagonists) recovery from anesthesia was achieved. Rapid recovery from anesthesia allowed discharge of the tortoises from the hospital within a few hours after removal of cloacal calculi. Rapid recovery from anesthesia and discharge from the hospital likely contributed to a faster return to normal behavior, food intake, and defecation in these tortoises. Because a combination of midazolam and medetomidine was used, the dose of ketamine was reduced or it was eliminated from anesthetic protocols. Because ketamine is the only nonreversible drug that is used in many of the reported anesthetic protocols for chelonians, administration of a low dose of ketamine or its deletion from an anesthetic protocol may contribute to rapid recovery from anesthesia, as was found in the tortoises of the present report.

Cloacoscopy in combination with the use of a low-speed motorized dental burr and high-volume water irrigation appeared to be a simple, safe, effective, economical, and minimally invasive technique for removal of cloacal calculi in the tortoises of the present report. This technique may be a preferred treatment method, compared with surgical or non–endoscopically guided techniques, for the removal of cloacal calculi in chelonians.

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a. VetScan Avian Reptilian Profile Plus, Abaxis Inc, Union City, Calif.
b. 64019BA and 67065C, Karl Storz Veterinary Endoscopy America Inc, Goleta, Calif.
c. Tele Pack Vet, Karl Storz Veterinary Endoscopy America Inc, Goleta, Calif.
d. iM3 Inc, Vancouver, Wash.
e. Panalog ointment, Fort Dodge Animal Health, Fort Dodge, Iowa.
f. Natural Grassland Tortoise Food, Zoo Med Laboratories Inc, San Luis Obispo, Calif.
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