Surgical removal of bladder stone in a sulcata tortoise
(Centrochelys sulcata): A case study

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Abstract. A 2 years old male sulcata (Centrochelys sulcata) tortoise presented to the clinic with problems of refuse to eat for 2 weeks, weaken, sleeping all day long and no defecated or urinating during last 1 week. The population is 24 tortoises in many species. Daily diets mainly on lettuce and cabbage. Clinical signs found during physical examination were closed eyelids, weakness and inactive. An X-ray imaging was presented and found a large white mass in urinary bladder. The diagnose was bladder stones or calculi vesicalis. Due to the size and the density of the bladder stones, a surgery intervention for bladder stones removal was conducted. Anesthesia using ketamine dose 30 mg/kg BW combine with xylazine dose 2 mg/kg BW injected intramuscularly. The surgery starts with cutting the plastron using a sterile dremel, opening the plastron and put the cutting plastron in saline water, opening the coelomic cavity by incising the abdominal muscles, finding the urinary bladder, incision the urinary bladder, removing the bladder stones, flushing the urinary bladder, suturing the urinary bladder, suturing the abdominal muscles, closing the plastron and applying the epoxy glue for covering the cutting plastron. Antibiotic enrofloxacine 10% with dose 5 mg/kg BW combine with antiinflamatory tolfenamic acid 4% and vitamin B complex all are injected intramuscularly once a day for 5 consecutive days. The tortoise was hospitalized and monitoring daily. The tortoise recover in day 4 after surgery, start eating and healing to normal activities in day 7.

Keywords: Centrochelys sulcata, bladder stone, surgical removal.

1. Introduction
Tortoises were popular pet reptile around the world. In Indonesia, especially at Special Region of Jogyakarta, the sulcata tortoise is the most popular tortoise pet due to the ease of captive breed tortoise to find in reptiles pet market [1]. The price is not too expensive and the fact that their body size can grow up to 60-80 cm long is very attractive for most of reptile lover. Based on data Raharjo et al. [1] during January-August 2020, the diseases of exotic animal patients show that turtles and tortoises have the highest cases (71,7%) compare to snakes (16,5%), iguanas (6,2%), lizards (4,1%), crocodyle (1%) dan gecko (05%).

African spurred tortoise or sulcata tortoise (Centrochelys sulcata) is native to Africa which the habitat has longer dry season than rainy season, with warm weather and low humidity all yearround [3]. In their natural habitat, their main diet is grass, enrich with fruit, leaves, bark and cactuses. When introduce and keep in Indonesia, they should undergo an adaptation with warm tropical weather and high humidity almost all yearround. In captivity, their main diets were lettuce, cabbage and allies. The
different environment especially the temperature and humidity forcing the body metabolism work hardly [4] and the main diets that consist more water and calcium lead to forming the bladder stones or calculi vesicalis [5].

There are two methods for diagnose the bladder stones in tortoises; palpation and X-ray imaging [6]. Palpation during physical examination was perform at the epicoelomic skin between [4]. Rolling back the tortoise and gently palpate in the soft spot by its rear legs [8]. To perform the palpation technique it need to knows the tortoise anatomy and be experienced at palpation [6,9]. Not every bladder stone can be found on palpation technique. The other more reliable method for diagnosing a bladder stone in a tortoise is to take an X-ray imaging. X-ray imaging result showing a white dense mass in the urinary bladder [4,6,9]. Sometimes the stones were so large that need to be broken into pieces for removing from the urinary baladder [10].

2. Case History
2.1 Signalement
 Centrochelys sulcata, ♂, 2 years, normal color and pattern

2.2 Anamneses
The tortoise refuse to eat for 2 weeks, the condition weaken and weaken, sleeping all day long, no defecating or urinating during last 1 week. The population is 24 tortoises in many species. Daily diets mainly on lettuce and cabbage.

2.3 Clinical Signs
The clinical signs during physical examination were closed eyelids, weakness and inactive, body scoring condition normal tend to thin (2,5 of 5 degrees), refuse for eating when trying to feeds.

2.4 Further examination
An X-ray imaging was performed at Animal Hospital Prof. Soeparwi, Faculty of Veterinary Medicine Universitas Gadjah Mada Jogjakarta, Indonesia. The X-ray imaging result showed a large dense mass in the urinary bladder (Figure 1).

![Figure 1. X-ray imaging show the bladder stone (arrow).](image)

2.5 Diagnose
Bladder stones or calculi vesicalis

2.6 Prognose
Fausta-dubius

2.7 Treatments
Bladder stone is a stone in the urinary bladder. It’s formed from urates deposit produced by kidneys when the calcium intake was excess. Once the urates deposit harden into stone, it can’t passed through
the uretra, then turn bigger and bigger. Surgical removal intervention will be the best route of bladder stone treatment in a tortoise [11,10,17].

Prior to surgery the tortoise was prepared to minimize anesthetic risks [12,13,15]. The surgery was perform for cutting the plastron or the bottom of the shell and remove the stone from the urinary bladder [13,14]. Most tortoises undergo the surgery showing fine post-operative reponses. Within 1-2 weeks hospitalization and good caring management after surgery, the tortoise will healing well back to normal.

In this case, due to the size and the density of the bladder stones, a surgical removal intervention was conducted. The tortoise anesthesied using ketamine dosage 30 mg/kg BW mixing with xylazine dosage 2 mg/kg BW injected intramuscularly [3,4,8,10]. The surgery treatment starts with cutting the plastron using sterile dremel, opening the plastron and put the cutting plastron into saline water, opening the coelomic cavity by incising the abdominal muscles, finding the urinary bladder, incision of the urinary bladder, removing the bladder stone, flushing the urinary bladder cavity, suturing the urinary bladder, suturing the abdominal muscles, closing the plastron and applying the epoxy glue for covering the cutting plastron.

The blade spins on the dremel at a high speed, making mechanical pressure onto the cut edge of the palstron may causing burning the plastron tissue, so sterile water needs constantly applied to the cut surface to minimize burning. The blade cuts should make an angle for facilitating replacement of the plastron when the surgery is complete. If the cut is vertical or no angel, the shell will falling into the abdominal or coelomic cavity making the incision site can’t heal anymore.

The piece of the cutting plastron is a living tissue, so it needs to put in saline water until it put back at the end of the surgery. The next layer find is the lining of the coelomic cavity and abdominal muscles. Gently cut the line and the abdominal muscles to exposure the intenal organs in the coelomic cavity and finding the urinary bladder. When the urinary bladder exposed, gently exteriorized through the hole in the plastron and packed off so no debris will falling into the coelomic cavity.

Before the bladder stone removed from the urinary bladder, a helping suture placed at two locations of the urinary bladder. The sutures attached to a hemostat and clamped to the towels for preventing the urinary bladder falling back into the coelomic cavity after the bladder stone was removed. Incising the urinary bladder until the bladder stone bulge out from the bladder. The bladder stones removed (Figure 2) out of the urinary bladder and flush the urinary bladder for removing all small fragments of bladder stone in the urinary bladder.

![Figure 2. The bladder stone removed.](image)

After the urinary bladder is clean up, then start suturing the urinary bladder. A special polydioxanone suture material is used for suturing the incised of the urinary bladder. This suture is very strong but causes minimal tissue reaction, and will slowly adsorbed over several months. The incision made in the tissue lining the cavity then sutured using the same type of suture material use at the urinary bladder. The muscular attachments to the cutting plastron of the shell will gradually reestableish by themselves underside of the cutting plastron.
The cutting plastron that was removed at the beginning of the surgery was kept moist by put it in saline water. Cleaning and drying the edge of the cutting plastron before the cutting plastron put back in place. When the cutting plastron is back in place, bone wax is used to help seal the edges. Special quick drying epoxy glue is poured onto the surface of the plastron (Figure 3a). This special glue will dried up in about 5 minutes, so it must be covering all of the cutting plastron before dried up. Once this epoxy glue dry and hardens it can’t be removed or reshaped anymore. The tortoise condition and the bladder stone after surgery shown in Figure 3b.

![Image](image.jpg)

**Figure 3.** Post operative surgery (a) Epoxy glue covered the plastron and the bladder stone (b) Tortoise condition and the bladder stone after surgery

Medical treatments after surgery were given antibiotic, antiinflammatory and vitamins. Antibiotic enrofloxacin 10% with the dosage 5 mg/kg BW combine with antiinflammatory tolfenamic acid 4% given 0,1 ml/kg BW and vitamin B complex given 0,2 ml/kg BW all are injected intramuscularly once a day for 5 consecutive days [4,10,13,15]. For maintain the hydration status, fluid therapy Ringer Lactat’s solution 20 ml/kg BW was given intracoelomic once a day for 3 consecutive days [1,14,17]. The tortoise put in a clean-warm room with a temperature of 28-30°C and humidity 55-65% after complete recovery from the anesthesia. The tortoise will stay hospitalized for a few days until it active and eating normally.

3. **Discussion**

One of the more common surgeries performed in tortoises is the removal of a bladder stone. Bladder stones was a common cases found on reptiles especially in tortoises and iguanas [5,21]. Some of these stones grow to tremendous size. Many other animals species get bladder stones too, but none of them forming a bladder stone as large as tortoise bladder stones. There were no specific symptoms when a tortoise suffered a bladder stone. Some of tortoises within bladder stone didn’t show any symptoms at all [13,17].

The common symptoms found on a tortoise with bladder stone are weaken, inactive, closed eyelids, nasal or eye discharge, poor appetite and lethargy [17,21]. Some of these stones are diagnosed as incidental findings when taking an X-ray or perform an examination for an unrelated problems with bladder stone. The tremendous size of some bladder stones indicates that the bladder stone may have been present for months or even years before being diagnosed [6,13].

The diagnoses of bladder stones in this case was proof with X-ray imaging which showing a large dense mass in the urinary bladder [11,15]. Bladder stones usually induced by excess of calcium intake in feed or dehydration condition for long period which makes the urates deposite from kidneys turn to crystalize in urinary bladder [11,14]. In this tortoise the bladder stones supposed to be exist for months before diagnosed. Surgery treatment is the best choice for removing the bladder stones from the urinary bladder due to the size and high density of the stones [16,14]. The anesthesia using ketamine combine with xylaxine was the common method in animal and safe using in reptiles surgery [3,4,8,12]. The polydioxanone sutures was choosen due to it strength and slow absorbed [13].
Post operative treatment is very important in reptile surgery [12,13]. As a poikilotherm or cold blooded animal, the immune system of tortoise will only working in preferred optimum temperature zone (POTZ), a range of temperature and humidity that tortoise resist for supporting the immune system. [2,5,6,16,20]. The best range of temperature for sulcata tortoise is 28-32°C and the best humidity is 45-65% [7, 15, 20]. During the hospitalisation, the temperature was set at 28-30°C and the humidity 55-65%. These temperature and humidity giving the best condition for the sulcata tortoise’s immune system for working to recover and heal in time.

After the surgery, antibiotic enrofloxacin 10% with the dosage 5 mg/kg BW combine with antiinflammatory tolfenamic acid 4% given 0,1 ml/kg BW and vitamin B complex given 0,2 ml/kg BW all are injected intramuscularly once a day for 5 consecutive days [4,10]. Antibiotic and antiinflammatory were given as preventif medicine for any secondary bacterial infection [9,12,13,21]. Vitamins and fluid therapy as supportive therapy for increasing the body metabolism and induce immune system work normally [9,12,13]. The tortoise was hospitalized and monitoring daily [7].

4. Conclusion
The diagnosed of bladder stones based on the results of anamneses, physical examination and X-ray imaging. Surgical removal treatment choosen as the best route and successfully removing the bladder stone. Hospitalizing with proper treatments of antibiotic, antiinflammatory, vitamins and fluid therapy combine with proper setting temperature and humidity giving a better results. The tortoise recover in day 4 after surgery and healing to normal activities in day 7.

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