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### Clinical Report

## Clinical and Radiological Report of a Soft Shell in a Tortoise (*Testudo graeca*)

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ARTICLE INFO	ABSTRACT
<p><b>Article History:</b></p> <p>Received 11 May 2023 Revised 6 June 2023 Accepted 10 June 2023 Online 10 June 2023</p> <p><b>Keywords:</b></p> <p>Reptiles Metabolic bone disease Tortoise Radiography</p>	<p>There are different types of metabolic bone diseases, and nutritional secondary hyperparathyroidism, or nutritional metabolic bone disease, is the most common one in turtles. This disease may cause deformities and paralysis of the posterior limb. In this article, we describe a tortoise (<i>Testudo graeca</i>) with soft shell syndrome and cloacal inflammation. A 1.5-year-old tortoise weighing 600 grams was referred to the faculty clinic for anorexia and inability to defecate. During the clinical examination, the shell was observed to be curvy and excessively soft when touched, along with swelling around the cloaca. Lateral and dorsoventral radiographs were performed to further evaluate the patient. This clinical report presents the clinical findings and radiographic profile of a soft shell in a tortoise.</p>

### Case Description

A 1-and-a-half-year-old male tortoise was referred to Urmia University Veterinary Hospital with a complaint of anorexia and non-excretion for two weeks ago. At the time of the initial examination, the animal weighed about 600 grams. The patient was kept at home and his diet consisted of lettuce, carrots, ice cream, and other vegetables. The patient was kept indoors without direct sunlight and no UV lamps were used. According to the history obtained from the owner, the tortoise has no history.

During the clinical examination, the patient was alert, however, despite the stressful conditions of the examination room, he kept his head and limbs outside the shell. The animal's lethargy and resistance to walking caught our attention. There was inflammation in the cloacal area and a partial crack between the separate parts of the carapace. The shell was also found to be excessively soft when touched (Figure 1).

Complete blood count (CBC) and blood serum profiles were not evaluated due to the unwillingness of the patient's owner. Lateral and dorsoventral radiographs was performed by using a digital

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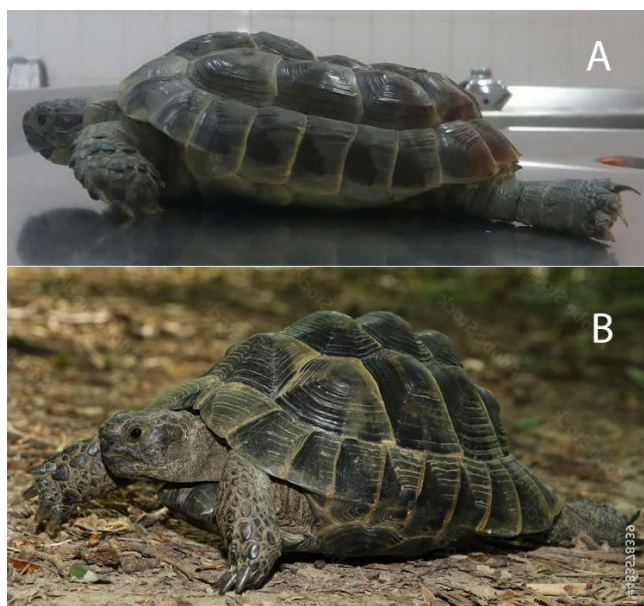
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radiography unite (SMAM X-Ray equipment, Mobile drive AR 30 and Konica Minolta AeroDR flat panel detector with CS-7 console software) to further evaluate the patient (Figure 2). There is a concave down aspect to the shell on the lateral and dorsoventral radiographs, which indicates increased pressure on the lungs and a decrease in lung volume. The distance between the shell plates, the external positioning of the organs and the head, and a significant increase in gas within the digestive system, particularly in the large intestine, as well as swollen soft tissues within the cloacal area, can be noted. Bone density was normal. A cloacitis diagnosis was made based on the clinical and radiographic findings of metabolic bone disease (MBD) disease with nutritional origin.



**Figure 1.** A: Left lateral photo from our reported tortoise. Note the dorsal shell depression and head and limbs outside the shell due to lethargy. B: normal tortoise shell shape.

### Treatment and Outcome

For the treatment of deformity and softness caused by nutritional MBD in this patient, calcium-zinc syrup drugs (10 mg/kg daily, PO), vitamin D<sub>3</sub> ampoule (100 IU/kg once a week, IM), and normal saline injection solution (10 to 20 ml/kg/day, SC), were administered to the patient. Also recommended for cloacal inflammation was amikacin (5 mg/kg, three doses every 48 hours, IM) and tetracycline topical ointment (every 12 hours).<sup>1</sup> Clinical examination a week later revealed a substantial improvement in the patient's overall condition. The patient's owner reported that the patient's appetite had returned to normal, and that the excretion pattern was normal.

### Clinical Relevance

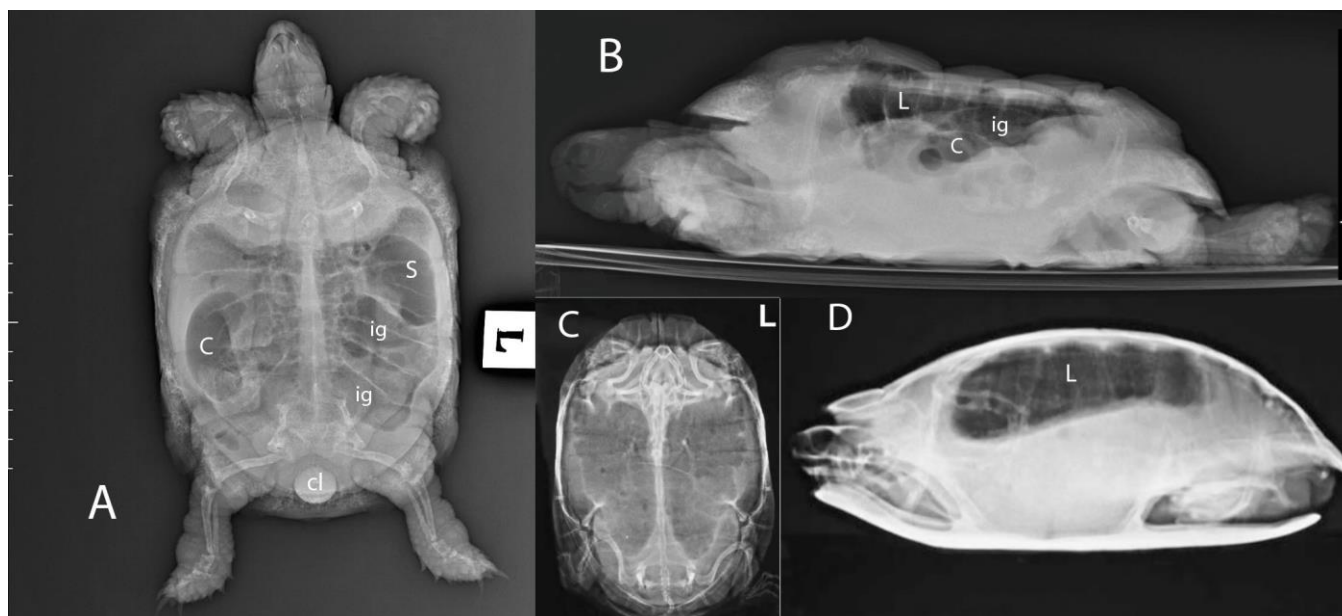
Metabolic bone disease refers to any metabolic defect that alters the morphology and function of bones. Metabolic bone disease can be classified into several types. Nutritional secondary hyperparathyroidism, also known as nutritional metabolic bone disease, is the most common metabolic bone disease in turtles. In turtles, secondary renal hyperparathyroidism is the second most common metabolic bone disease. This disease is sometimes referred to as renal metabolic bone disease. In turtles, other metabolic bone diseases are rare.<sup>2</sup> In young animals, secondary hyperparathyroidism occurs more frequently, and a high growth rate aggravates symptoms.<sup>3</sup>

The factors that cause the disease are nutritional deficiency of calcium or vitamin D<sub>3</sub>, imbalance of the ratio of calcium to phosphorus in the diet in such a way that excessive levels of phosphorus make calcium physiologically unavailable, and a decrease in available calcium leads to an increase in Parathyroid activity and reabsorption of calcium stored in the bone cortex.<sup>4</sup>

The intake of excessive dietary proteins during periods of rapid growth, anorexia, or abnormal metabolism of vitamin D<sub>3</sub> due to renal, hepatic, intestinal, or parathyroid disorder, as well as a lack of bile salts, may also decrease calcium absorption. The clinical symptoms of MBD vary according to the age and species of the patient. A soft shell, particularly the plastron, is the most common clinical finding in turtles. As a result of the excessive softness of the shell, it may not even be able to bear weight in some cases.<sup>3</sup>

The deformity caused by a repaired shell fracture may also increase as the animal grows.<sup>3</sup> In juveniles, fibrous osteodystrophy occurs when osteoclastic resorption of osteoid occurs and is replaced by cellular connective tissue.<sup>5</sup> Excessive protein supplementation in early life, and inadequate humidity may result in pyramidal shells.<sup>4</sup> There are often no obvious clinical signs of deformed shells in animals. However, sometimes the shell shape causes the turtle to drag on its skin while walking, resulting in scarring. This disease may cause deformities of the jaw and paralysis of the posterior limb.<sup>2</sup>

In severe cases, the widening of the pelvis can also lead to abnormal gait and the opening of the hind limbs, which can lead to pododermatitis, a condition caused by the abnormal erosion of the nails and toes. There are large calcium deposits in the bones of the shell, plastron, and organs of adult turtles. Therefore, they



**Figure 2.** Dorsoventral (A) and lateral with horizontal beam (B) radiographs from whole body of the tortoise. Note the depression of the shell and compression of the lungs, the increased intestinal gas, prominent cloaca, and all appendages outside the shell due to lethargy. C and D: Normal dorsoventral and lateral radiographs of a conscious red eared terrapin (*Trachemys scripta*), note the appendages inside the normal arched shape shell.<sup>3</sup> L; Lungs, C; Colon, ig; Intestinal gas, cl; Cloaca, S; Stomach.

often exhibit nonspecific signs of illness such as dystocia, anorexia, cloacal prolapse, abnormal fecal character, muscular weakness, collapse of the femoral head, renal compromise, hepatic lipidosis, and/or constipation.<sup>4</sup> Shell abnormalities may also affect the anatomical position and range of movement of the feet. In the early stages of metabolic disease, radiography is not a reliable or sensitive diagnostic test. However, digital radiography has corrected some technical errors as it increases image quality, reduces noise, removes artifacts, and enhances contrast.<sup>2</sup>

Radiography may reveal symptoms such as: Osteomalacia (deficiency of bone calcification in adults) is characterized by loss of bone density, thinning of the cortex, coarse trabecular pattern, radiolucent points, bending fractures, and bowing of the bones; osteoporosis (osteoid absorption more than formation) in the form of thinning of the cortex and increase of the medulla cavity;<sup>6</sup> soft tissue swelling of the neck and anterior limbs, pathological fractures of long bones, deformations of the carapace and plastron, and their connecting bridges.<sup>7</sup>

Calcium-to-phosphorus ratio less than 1:1 indicates nutritional MBD, particularly if hypocalcemia and hyperphosphatemia are present. In most cases, the total calcium level is normal.<sup>2</sup> In severe cases, ionized calcium is reduced.<sup>7</sup>

Correcting the diet's calcium-to-phosphorus ratio, applying ultraviolet light correctly, and taking calcium

and vitamin D supplements are necessary. All of the following vegetables have a positive Ca to P ratio and should be included in the recommended diet:<sup>1</sup> Romaine lettuce, Swiss chard, kale, beet greens, escarole, parsley, watercress, and green beans.

Our search did not find similar articles on radiographic feature of soft shell in tortoise, but normal radiographic appearance in adult tortoise and bone demineralisation in young was reviewed in general references.<sup>2,4,8,9</sup>

### Conflict of Interest

There is no conflict of interest to declare.

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