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Hematology and plasma chemistry profile of a stranded green turtle (*Chelonia mydas*) from diseased to rehabilitated status in Taiwan

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Abstract

A green sea turtle (*Chelonia mydas*) was found stranded in Keelung City, Taiwan. Initial blood work revealed high levels of CK, BUN, creatinine, uric acid, as well as low PCV, and calcium levels. After 14 mo of care, the LDH, CK, creatinine, uric acid, calcium and PCV values were found to be within normal ranges. Due to paucity of reports of consecutive blood profile data in green sea turtle, these data are considered to be useful as clinical references in green turtles.

Key words: hematology, plasma chemistry, green sea turtle.

Introduction

The green sea turtles (*Chelonia mydas*) is listed as an endangered species by the International Union for Conservation of Nature (IUCN), and has also been under protection of the Taiwan Wildlife Animals Protection Laws since 1989. Green sea turtles have a global migratory behavior with the most important nesting and feeding grounds located in the tropics (Pritchard, 1997). The main island of Taiwan is surrounded by different water areas that may suite the various needs of green sea turtles throughout their life history; the East China Sea to the north, the Taiwan Strait to the west, the Philippine Sea to the south, and the Pacific Ocean on east coast. Many sea turtles live around the islands of Taiwan or migrate through these areas (Cheng and Chen, 1997).

In addition to threats of infectious diseases, green sea turtles are also facing various anthropogenic threats such as habitat loss, pollution, fishing and incidental capture (Mann, 1978, Cheng and Chen, 1997, Godley et al., 1999, Mascarenhas et al., 2004, Chaloupka et al., 2008). The number of stranded turtles alive in Taiwan was estimated to be about 16 turtles per year from 1997 to 2005; observations listed in decreasing frequencies were through incidental capture, ashore stranding, by-catch by fishing hooks and floating on the surface that were reported by fishermen or coast guards (Kuo, 2006). Appropriate medical treatments and rehabilitation care is needed for these stranded turtles to limit this as a bottleneck throughout the sea turtle life history. The sea turtle rescue team, including veterinarians, sea turtle biologists and aquarium management personals, plays an important role to achieve these tasks.

For understanding the health status of sea turtles, blood profiles are commonly used for clinical references and to evaluate health conditions. Many research groups have reported reference values with regard to blood profiles using specimens collected cross-sectionally from green sea turtles (Whiting et al., 2007, Flint et al., 2010, Fong et al., 2010). In this report, we recorded consecutive blood profile data of an adult male green sea turtle during the period from the diseased status through rehabilitation. These data are considered to be useful as clinical references in green sea turtles.

Case Report

A green sea turtle (*Chelonia mydas*) was found stranded on a rocky beach in Waimu Shan, Keelung City, northern Taiwan. It was brought to an aquaculture tank at the National Taiwan Ocean University for first-stage care and observation in the process of rehabilitation. The turtle had a curved carapace length of 91.9 cm, a tail length of 35 cm, and weighed 89.4 kg. These characteristics indicate that the individual was an adult male (Limpus and Chaloupka, 1997; Hamann et al., 2006). Physical examination showed that the green sea turtle was depressed, anorexic, and suffering from a buoyancy disorder. Barnacles and algae were found on the dorsal carapace. Clinical examination revealed a fracture on the dorsal carapace (Fig. 1). Pneumonia was also detected in a radiographic examination (Fig. 2).

On the first day of treatment, therapy included the administration of enrofloxacin (10 ml IM) and 50% glucose (20 ml IV). A blood sample was collected from the dorsal cervical sinus (Fig. 3) to obtain a complete blood count and plasma biochemical data. The initial hematological profile revealed high levels of lactate dehydrogenase (LDH) (4735 U/L), creatine kinase (CK) (10801 U/L), blood urea nitrogen (BUN) (46.1 mg/dl), creatinine (0.36 mg/dl), uric acid (1.9 mg/dl), as well as low packed cell volume (PCV) (17%), and calcium levels

Fig. 1. Fracture of the adult green sea turtle's dorsal carapace.

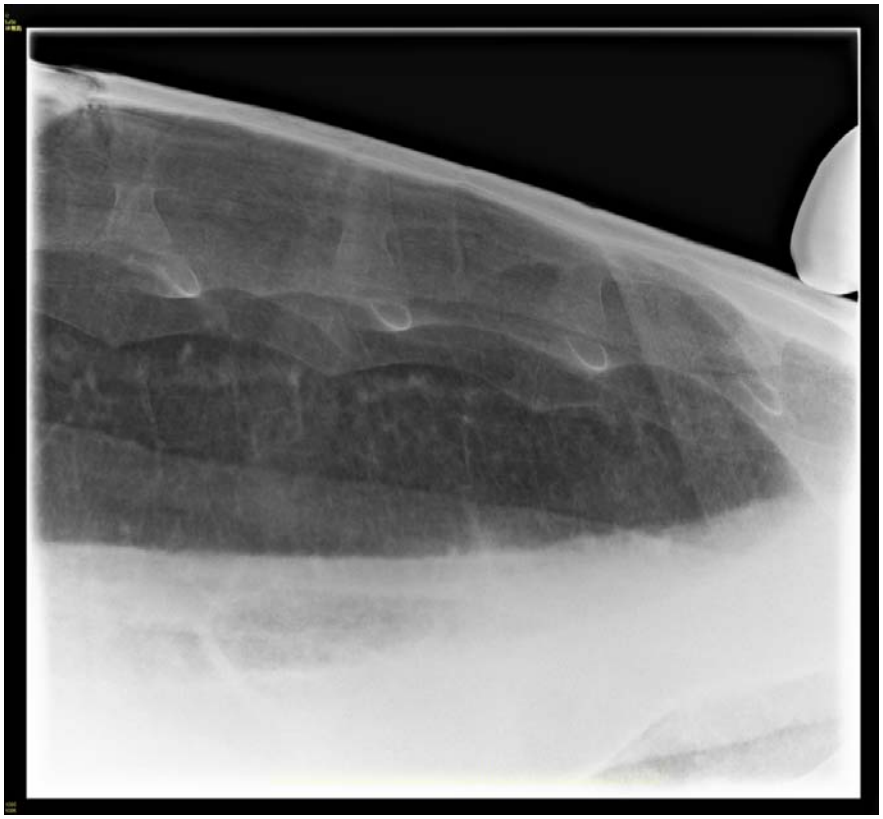

Fig. 2. Radiograph of the adult green sea turtle showing pneumonia.

Fig. 3. Blood collection from dorsal cervical sinus of the adult green sea turtle.

(5.6 mg/dl) (Fong et al., 2010, Flint et al., 2010).

On Day 20 of the treatment period, the turtle was brought to the aquarium at the National Museum of Marine Biology and Aquarium. In a physical examination, the sea turtle was unresponsive and possessed limited muscle strength. The turtle was subsequently administered Ampicillin (50 ml/kg body weight every 12 hr SC) and Amikacin antibiotic treatments (2.5 to 5 ml/kg of body weight every 48 hr IM), and also provided nutritional support and fluid therapy. Fluid therapy included injections of Glucamethi (5ml every 12 hr SC), B-complex (1ml every 12 hr SC), Moriamin-sn (10ml every 12 hr SC) and Lactate Ringer`s (40ml every 12 hr SC). The carapace wound was thoroughly cleaned using Povidone iodine every 12 hrs.

On Day 27 of the treatment period, Ampicillin was discontinued, following positive results from bacterial cultures and sensitivity tests. However, treatment with Amikacin (2.5 to 5ml every 72 hr SC) and fluid therapy were continued.

On Day 75, a blood test revealed a serious case of leukocytosis. Thus, for 28 days Amikacin was substituted with Ceftazidime. By day 103, a hematology test revealed that white blood cell counts

had nearly returned to normal levels. Antibiotic treatment was subsequently switched back to Amikacin (2.5 to 5 ml/kg body weight every 48 hr IM).

After approximately 6 months of injection therapy, the sea turtle began eating and swimming normally. At that time, we determined that the carapace lesion had healed and the buoyancy disorder had been resolved. However, the turtle was held in the hospital to receive further intensive care and blood work. After 7 months the LDH, CK, creatinine, uric acid, calcium and PCV values were found to be within normal ranges. Moreover, the turtle had a healthy appetite and was behaving normally. However, BUN had still not returned to normal levels (Fig. 4).

Discussion

This report presents the first blood profile illustrating the complete rehabilitation of a diseased green sea turtle in Taiwan.

Whiting (2007) reported that clinically sick green sea turtles had significantly lower PCV values than healthy turtles (Whiting et al., 2007). Moreover, the lower PCV found in stranded turtles is indicative of chronic conditions, such as poor nutrition, persistent infection or parasitic disease, a related immune deficiency, or a combination of these health problems (Deem et al., 2009). Conversely, longer migrations could lead to dehydration, which would increase PCV (Perrault et al., 2012).

Stranded loggerhead turtles have

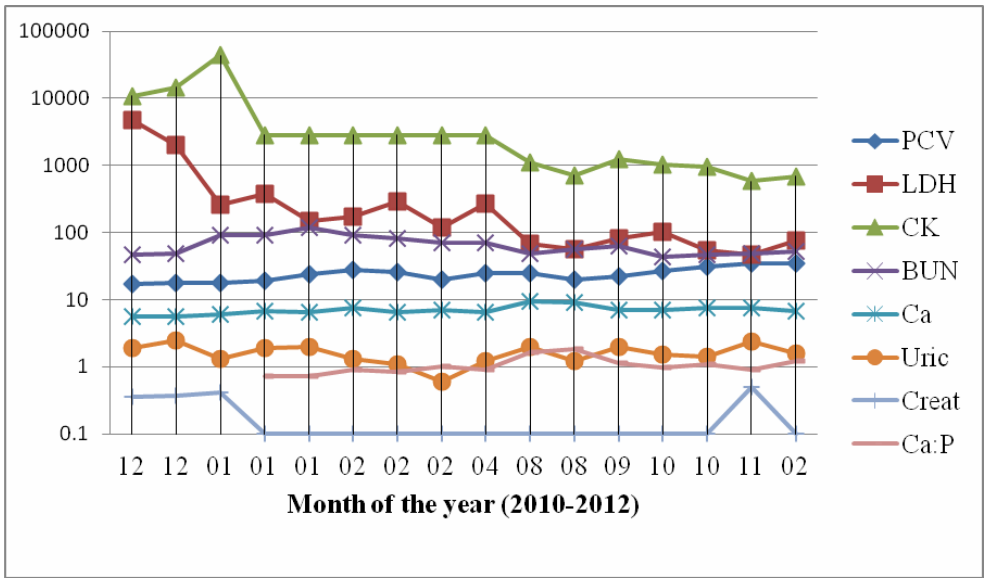

Fig. 4. Plasma biochemistry values of the adult green sea turtle plotted across time through the rehabilitation period.

significantly higher CK values than nesting and foraging loggerhead turtles (Deem et al., 2009). CK is associated with skeletal muscle activity (Whiting et al., 2007), and increases following a muscle injury (Deem et al., 2009) or external injury (Perrault et al., 2012). The higher CK levels observed in this study may have been caused by the carapace fracture.

Increased LDH and phosphorus levels have been reported in unhealthy green turtles (Flint et al., 2010). Elevated LDH is likely associated with cellular muscle damage (Harris et al., 2011).

Elevated BUN values have also been reported in stranded loggerhead turtles (Deem et al., 2009). All BUN values found in this study were higher than those previously reported for wild populations of adult green sea turtles in Taiwan (Fong et al., 2010). High BUN values may be indicative of dehydration, renal compromise, or muscle catabolism (Campbell, 2006). However, BUN levels are considered to have only limited diagnostic value for reptiles (Perrault et al., 2012).

Creatinine concentration is normally low in reptilia (<1mg/dl) (Wynekenet al., 2006), because it is not actively secreted or reabsorbed by the kidney tubules (Wilkinson, 2004). In general, low creatinine concentrations were reported for the adult male green sea turtle throughout the rehabilitation period.

Uric acid is the product of protein and non-protein nitrogen catabolism in reptiles. It has been cited as the best indicator of renal compromise in reptilia (Campbell, 2006). However, uric acid is neither sensitive nor specific to any renal disease, as a large portion of kidney function must be lost before a rise in uric acid can be observed (Anderson et al., 2011). The uric acid levels (1.1 ~ 2.5 mg/dL) of the green sea turtle in this study fell within the healthy range described by Anderson et al. (2011). Goldberg et al. reported that the blood of carnivorous reptiles contains elevated levels of uric acid (2011). Therefore, our findings may have been a result of the meat diet preferred by this turtle.

The initial reduction in plasma calcium levels in this adult green sea turtle turtle may have been due to the anorexic condition or decreased intestinal absorption (Anderson et al., 2011). However, following recovery, the Ca:P ratio was found to be 1.2. This value is congruous with the finding of Divers that healthy reptiles possessing a Ca:P ratio exceeding 1.0 (2000).

This case report provides information that could help veterinarians to more effectively interpret laboratory results and improve treatment techniques for sick or injured sea turtles.

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臺灣擱淺綠蠵龜的血液及血漿生化:從傷病到復原

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摘 要

一隻擱淺綠蠵龜被發現於基隆。血液檢查數據顯示creatine kinase (CK)、blood urea nitrogen (BUN)、creatinine 及 uric acid 等數值皆偏高；而packed cell volume (PCV) 與calcium 則是偏低。經過14個月的照護治療，各項數值皆恢復至正常範圍。治療過程中連續監測綠蠵龜的血液與血漿生化等各項數值所獲得的結果，可提供獸醫師做爲傷病綠蠵龜預後評估之參考。

關鍵詞：血液學，血漿生化，綠蠵龜。