
ORGAN WEIGHTS OF GREEN TURTLES STRANDED IN THE HAWAIIAN ISLANDS

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Introduction

Fibropapillomatosis (FP) is a neoplastic and debilitating transmissible disease of green turtles (*Chelonia mydas*) that has emerged as a serious threat worldwide, including the Hawaiian Islands. Previous studies of FP in Kaneohe Bay on the island of Oahu have shown severe tumor affliction as having a significant impact on green turtle growth rates (Balazs *et al.*, 2000). Many turtles with severe FP also have poor body condition. In Hawaii, stranded turtles debilitated with FP are evaluated for possible rehabilitation. If prognosis for survival is deemed poor by two independent veterinary exams, turtles are humanely euthanized and a thorough necropsy is performed. During previous necropsies of severely tumored turtles, the liver and spleen showed gross evidence of shrinkage. We set out to quantify the degree of internal organ shrinkage by weighing organs and relating organ weights to degree of tumor severity.

Methods

Reports from the public, as well as from county, state, and federal personnel on six major inhabited Hawaiian Islands (Kauai, Oahu, Maui, Molokai, Lanai, and Hawaii) form the basis for initiating a response to collect a stranded turtle and acquire relevant data (Murakawa *et al.*, 2000). Once collected, the turtles are measured, weighed, and assigned an overall subjective tumor score of 0 (no tumors), 1 (lightly), 2 (moderately), or 3 (heavily tumored) based on the size and number of tumors on the animal (Work and Balazs, 1999). In March 2000 we began weighing the major organs during necropsies of stranded turtles evaluated as euthanasia cases (n = 58) or freshly dead turtles considered to be viable for histopathological analysis (n = 16). The heart, liver, lungs, kidneys, spleen, and brain were each weighed separately using an electronic scale. Organs with tumors were omitted.

Analysis of variance was conducted to compare mean organ weights among tumor scores using the SAS System for Windows v. 8.02. In cases of significant differences, pair-wise comparisons were done using t-test comparisons with an alpha of 0.05.

Results

Tumor score 2 and 3 turtles had significantly lower liver, kidney, and spleen weights than turtles with tumor score 0 and 1 (Figures 1a-c). Heart weight was significantly lower for tumor score 2 animals versus tumor score 0 and 1 (Figure 1d). No significant difference in weights existed between the four FP groups for the other organs (lungs and brain).

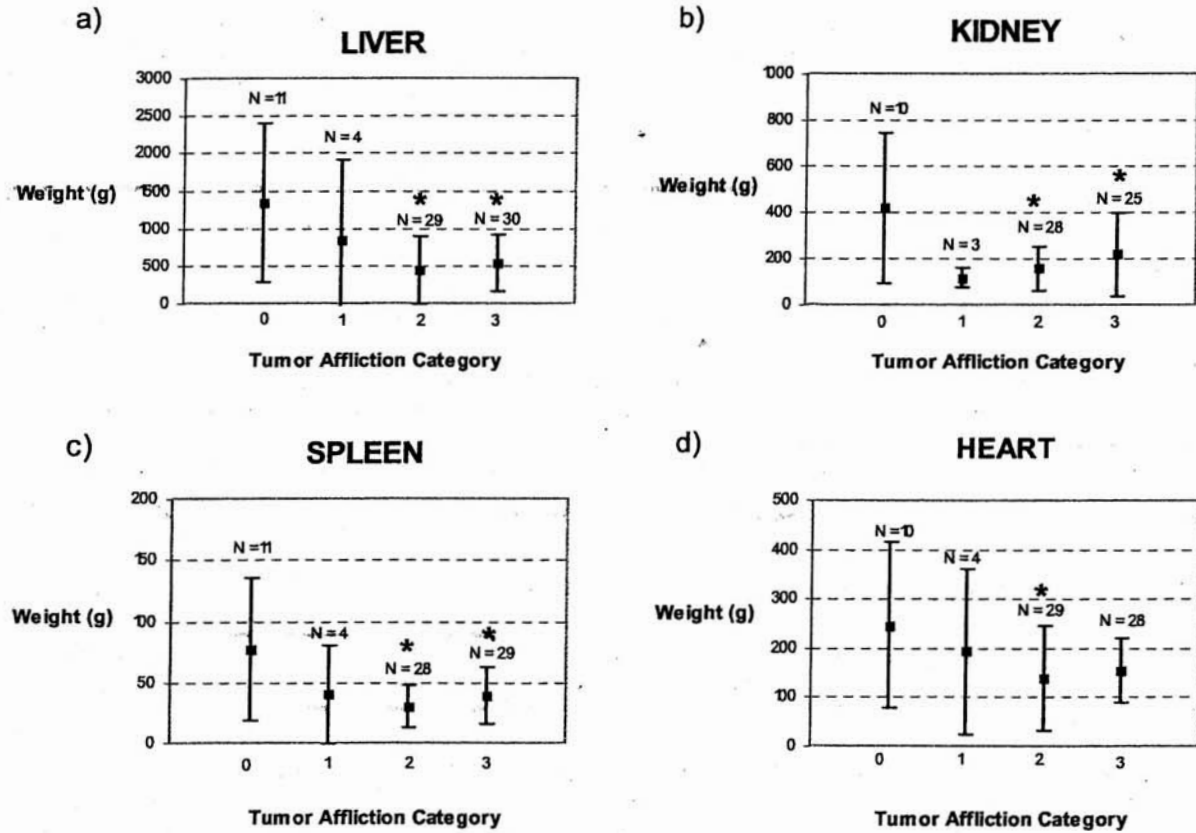


Figure 1a-d. Mean weight of organs for each tumor affliction category for liver (a), kidney (b), spleen (c), and heart (d) respectively. Standard deviations are shown as bars from the mean and sample sizes (N) are shown over each data point. * = Significant difference at alpha = 0.05.

Table 1. Mean body percentage of organ weights for non-tumored green turtles, N=11.

Weight class	Mean weight	Heart	Liver	Lungs	Spleen	Kidneys	Brain
10.0 - 29.9 (kg) N=5	16.6 (kg)	107 (g) 0.6%	361(g) 2.2%	235 (g) 1.4%	24 (g) 0.1%	91 (g) 0.6%	2 (g) 0.01%
50.0 - 69.9 N=2	62.8	391 0.6%	1456 2.3%	987 1.6%	132 0.2%	484 0.8%	6 0.01%
70.0 - 89.9 n=2	81.8	407 0.5%	2431 3.0%	1162 1.4%	98 0.1%	568 0.7%	7 0.01%
90.0 - 109.9 n=2	93.2	350 0.4%	2591 2.8%	1415 1.5%	140 0.2%	867 0.9%	6 0.01%

No significant difference existed between the mean straight carapace length and the four FP tumor score groups examined. Of the 74 turtles necropsied, 11 turtles (15%) ranging from 10.5 to 93.2 kg were non-tumored and showed little to no change of organ/body weight ratios with increasing size (Table 1).

Discussion

In Hawaii, green turtles with severe fibropapillomatosis are often debilitated due to primary and secondary effects of tumors. Aguirre et al. (1995) and Work et al. (2001) concluded that turtles with severe FP were stressed and immunosuppressed based on hematology, blood cortisol levels, and white cell function assays. The likelihood of turtles becoming bacteremic with increasing FP reinforces the hypothesis that FP causes immunosuppression (Work et al., 2003). In addition, the presence of oral tumors in Hawaiian green turtles tends to impair normal breathing and feeding ability thus leading to greater debilitation (Aguirre et al., 2002). With all of these factors affecting turtles with FP, it is logical to conclude the internal organs could be affected as well. Our study reveals that liver, heart, and kidney weights were significantly lower for tumor score 2 and 3 animals versus tumor score 0 and 1. Not only does the liver aid in metabolic functions of carbohydrates and proteins, but it also plays a role in the removal of toxins from the blood. The spleen contributes to immunological activity by acting as a blood filter and providing a source of immune cells, while the kidneys function to excrete metabolic wastes. Overall, each of these organs either contributes to the excretion of toxins and wastes within the body or plays an important role in immune status.

There is also evidence that many turtles with FP are in very poor body condition. Atrophy (shrinkage) of liver and spleen are common sequelae to severe emaciation in wildlife and would explain our finding in liver and spleen. It is likely that the kidneys would also respond similarly. Heart weight was found to be significantly lower for tumor score 2 animals versus tumor score 0, 1, and 3. Given that the heart weight was closely tied to body weight rather than FP score, it is likely that lower weight of this organ was simply a reflection of body weight. Although the body weight did not show a significant difference for tumor score 3 as compared to non-tumored turtles, the lower trend in body organ weights in tumor score 2 and 3 animals suggested that FP had an impact on the internal organs of turtles in these two tumor categories. Additional studies could focus on the correlation between emaciation and organ weights to gain a greater perspective on the relationship between tumor severity and body condition.

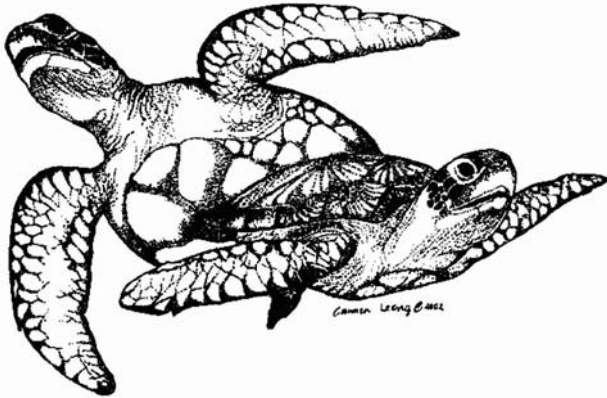
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NOAA Technical Memorandum NMFS-SEFSC-536

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Compiled by: Nicolas J. Pilcher

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March 2006