Computed tomographic anatomy of the head of the loggerhead sea turtle (Caretta caretta)

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Accepted 3 December 2005

Abstract

The heads of three loggerhead sea turtles were disarticulated and imaged immediately to minimize postmortem changes and then frozen and sectioned. For computed tomography (CT) imaging, the heads were positioned in ventral recumbency. Transverse CT images with soft-tissue window were obtained from the olfactory sac region to the temporomandibular joint region. After CT imaging, the heads were sectioned and the gross sections were compared to CT images, to assist in the accurate identification of the anatomic structures. Different clinically relevant anatomic structures were identified and labelled in two series of photographs (CT images and anatomic cross-sections). CT images provided good differentiation between the bones and the soft tissues of the head. The information presented in this paper should serve as an initial reference to evaluate CT images of the head of the loggerhead sea turtle and to assist in the interpretation of lesions of this region.

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Keywords: Computed tomography; Anatomy; Head; Sea turtle

1. Introduction

Two families and seven species of sea turtles are currently recognized (Pritchard, 1997). All species of sea turtles are included in the Red List of the World Conservation Union (IUCN/SSC, 2002). The IUCN emphasizes in its document entitled A Global Strategy for the Conservation of Marine Turtles (IUCN/SSC, 1995) the research on diseases of sea turtles from a multidisciplinary approach as a priority issue. Many veterinary surgeons are involved in sea turtle conservation in wildlife rehabilitation hospitals around the world, thereby contributing to improve the reptile’s medical management. Several diseases involving the head of sea turtles have been described. Meningeal hemorrhages, meningitis, and spinal cord compression, associated with traumatic lesions in the head due to boat strikes have been reported (Orós et al., 2005). Exudative salt gland adenitis is also frequently observed (Glazebrook and Campbell, 1990). Esophageal lesions associated with ingestion of fishing hooks (George, 1997; Orós et al., 2005) and crude oil are also observed (Lutcavage et al., 1997). Ocular fibropapilomas (Brooks et al., 1994) and oral and esophageal fibromas are common in several populations of sea turtles (Orós et al., 1999).

The introduction of X-ray computed tomography (CT) has revolutionized the practice of diagnostic imaging. CT has advanced significantly in veterinary medicine. In turtles, CT has been used in the diagnostics of metabolic bone diseases (Raiti and Haramati, 1997), aural abscesses (McKlveen et al., 2000), and a nodal mass in the chest (Garland et al., 2002). However, there is no published material describing the cross-sectional anatomy of the loggerhead sea turtle (Caretta caretta) in terms of CT and macroscopic sections.

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The objective of this study was to describe the post-mortem CT anatomy of the head of the normal loggerhead sea turtle (*Caretta caretta*) to optimize the diagnosis of head diseases.

### 2. Materials and methods

CT images of three normal subadult loggerhead sea turtles heads were selected. The turtles were euthanatized for medical reasons unrelated to diseases of the head. The heads were disarticulated at the level of atlanto-occipital joint and were imaged immediately to minimize postmortem changes. CT imaging was performed at the Radiodiagnostic Service of the Santa Catalina Clinic of Las Palmas de Gran Canaria using a third-generation CT equipment (Toshiba 600 HQ). The images were obtained in sagittal and transverse planes using the following parameters: exposure time, 1.8 s; 120 kVp; mAs, 220; with 1.0 cm slice thickness. A soft-tissue window (WL, 465; WW, 1880) was used. After CT exploration, the heads were frozen, and then sectioned using an electric saw to correspond with the CT images. All sections were cleaned and photographed. CT images that most closely matched each gross section were compared to the corresponding gross anatomic sections. In addition, literature of sea turtle anatomy (Gaffney, 1972; Frick, 1996; Wyneken, 2001) and *Nomina Anatomica Veterinaria* (Schaller, 1992) were used to identify the normal anatomy of the structures of the head.

### 3. Results

Clinically relevant anatomic structures were identified and labeled in the two photographs presented in Figs. 1–6 (CT soft-tissue window and anatomic section). Detailed anatomy of the head was acquired with a CT soft-tissue window. Thus, the bones of the skull (prefrontal, frontal, parietal, postorbital, supraoccipital, squamosal, quadratojugal, jugal, and maxilla), mandible (dentary, angular, surangular,
prearticular, splenial, and articular bones) and hyoid bones were easily identifiable because of the high CT density in cortical bone appearing white and the intermediate CT density in their medullary cavities. Cartilages of many bones and articular sutures were clearly detected and appeared grey. Air-filled structures of the respiratory (nasal cavity, glottis, and trachea) and digestive (oral cavity and esophagus) systems gave negligible CT-tissue density and appeared black. Muscles, salt glands, eyes and associated structures gave an intermediate CT density and appeared grey. The nervous structures (myelencephalon, cerebellum, optic lobes, olfactory bulb, and nerves) were clearly appreciated in this modality CT window (Figs. 1, 3–6).

4. Discussion

CT imaging is a noninvasive cross-sectional diagnostic technique that offers considerable advantages over traditional radiography: a lack of superimposition of the tissues and a higher differentiation of tissue densities. The use of CT imaging in exotic animals medicine is currently limited because of the expense, availability, and logistic problems of acquiring CT images in these animals (Raiti and Haramat, 1997; McKlveen et al., 2000; Garland et al., 2002).

Diagnostics of diseases, such as traumas, neoplasms, infections, inflammations and others involving the head of loggerhead sea turtles can be improved using CT imaging. CT provided excellent details of clinically relevant
anatomy and correlated well with the corresponding gross specimens. In CT, the grey scale is directly related to the radiation attenuation of the head structures. In addition, it provides excellent discrimination of soft tissues and mineralized tissues of the head (Fike et al., 1981; Kaufman et al., 1981; Feeney et al., 1991; Smallwood et al., 2002).

In our study, both soft-tissue window and gross section settings were compared in all images. The planimetric or sectional anatomy of the head in the loggerhead sea turtle allows a correct morphologic and topographic evaluation of the anatomic structures, which is a useful tool for the identification of the CT images. Sagittal images were used to evaluate the midline structures of the head. The anatomic relationships were appreciated most easily in the transverse planes.

With developing technology in the wildlife rehabilitation hospitals, CT imaging may soon become more readily available for exotic animals imaging. In the same way, it will be quite useful to be able to establish some reference points on the head of the loggerhead sea turtle, to scan only these selected parts during an experimental approach or to assist in the interpretation of lesions of this region.

References


