

Evaluation of the eye diseases seen in Loggerhead Sea turtle (*Caretta caretta*)

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SUMMARY

Fifteen Loggerhead turtles (*Caretta caretta*) admitted to the First Aid, Treatment and Rescue Application and Research Centre between 2011 and 2012 underwent systematic ophthalmological examination. They have got injury of traumaticum in its cranium. Of these animals, six presented various ocular problems in a total of nine eyes: two catarrhal conjunctivitis, two purulent conjunctivitis, three keratitis, two blepharitis and two corneal lacerations. From macroscopic examination, these ocular problems were seen to have been associated with clinical signs such as chemosis, exophthalmos, blepharospasm, mucopurulent discharge, conjunctival hyperemia and diffuse corneal opacity. Histopathological examination also detected an infiltration of macrophages, plasma cells and lymphocytes, mainly mononuclear cells in corneal stroma. *Aeromonas* spp. was isolated in eye swabs of the purulent conjunctivitis cases. All cases successfully recovered following topical and parenteral antibiotic treatments combined with systemic vitamin A and balanced fluid-electrolyte administrations.

Keywords: *Caretta caretta*, Eye diseases, Loggerhead sea turtle

RÉSUMÉ

Description des maladies oculaires rencontrées chez les tortues caouannes (*Caretta caretta*)

Quinze tortues caouannes (*Caretta caretta*) admises à notre centre de sauvegarde et de recherche entre 2011 et 2012 ont subi un examen oculaire systématique. Parmi ces animaux, six présentaient divers problèmes oculaires tels que deux conjonctivites catarrhales, deux conjonctivites purulentes, trois kératites, deux blépharites et deux lacérations cornéennes. À l'examen macroscopique, ces problèmes oculaires sont associés à des symptômes comme chémosis, exophtalmie, blépharospasme, écoulement mucopurulent, hyperémie conjonctivale et opacité de la cornée. L'examen histopathologique a également détecté une infiltration de macrophages, la présence de cellules plasmiques et les lymphocytes des cellules mononucléaires principalement dans le stroma cornéen. *Aeromonas* spp. a été isolé et identifié dans les cas de conjonctivite purulente. Tous les cas ont récupéré avec succès après traitement antibiotique topique et parentéral combinés avec un traitement systémique avec de la vitamine A et une administration de fluides et d'électrolytes.

Mots-clés : *Caretta caretta*, maladies oculaires, tortues marines, caouannes, ophtalmologie

Introduction

Except for some case reports in sea turtles such as keratoconjunctivitis [1,5,6], parasitic conjunctivitis [3], blepharitis [1,4], fibropapilloma [1,6,7], cataract [8], heterophilic scleritis [5], corneal ulceration [9] and keratitis [5,10], to our knowledge, the studies focused mainly on symptoms, but diagnosis and treatment of the eye diseases of this species appeared to be lacking.

The majority of ocular disorders encountered in sea turtles are located in the primary and accessory tear glands, the eyelids and the eyeballs and are primordial for nourishment and vital behavior [9]. Traumatic factors are considered as the underlying cause of many eye diseases in sea turtles. Because the affected areas carry a great risk of contamination, local and systemic infections may follow [11]. Hypovitaminosis can also predispose sea turtles to several infectious diseases including keratitis, conjunctivitis, and ocular metaplasia [11,13].

In sea turtles, the anterior ocular segment, i.e. the cornea and lens, can be evaluated better with direct ophthalmoscopic

examination, whereas the posterior segment such as the retina is better examined using indirect ophthalmoscopic methods [11]. The clinical symptoms of eye diseases can be primary or secondary. Important primary symptoms are exophthalmos, enophthalmus and strabismus. Secondary symptoms usually occur gradually and result from anatomical and functional changes of the globus [7]. Sea turtle conjunctivitis can successfully be treated with topical tetracycline applications. However, due to high risk of septicemia, it is recommended to combine topical treatment with systemic antibiotic administration [4,11]. Concurrent oral and/or parenteral vitamin A therapy has also been suggested [12,13].

At present, information concerning eye diseases of sea turtles is inadequate, and presents a challenge to many veterinary practitioners all over the world in particular in areas with sea turtle populations. Thus, any original information obtained through studies in this field can be highly invaluable [1].

The objectives of this study were to identify the eye diseases of Loggerheads brought to the Department of Sea Turtles First Aid, Treatment and Rescue Research and

Application Center (DEKİYM), reveal in detail aetiology, clinical signs, diagnosis and treatment of the identified diseases, address current problems, contribute to the present knowledge, encourage future studies and contribute to global sea turtle species conservation.

Materials and Methods

CLINICAL EXAMINATION

Fifteen Loggerheads presented to DEKİYM between 2011 and 2012. "The turtle captured South of Hatay, mediterranean sea (between 35°50' N, 35°50' W and 36°33' N, 36°07'W)" Initial examination started with evaluations of eyelids, palpebral reflexes and tear flow and existence of chemosis and blepharospasm. This was followed by careful examinations of the conjunctiva, cornea, sclera and pupil. The anterior and posterior segments of the eyeball were assessed with direct and indirect ophthalmoscopy, turning the recess disc from -3 up to +20 dioptries. Where infection was suspected, swabs were taken for bacteriological culture.

HISTOPATHOLOGY

Cases (n°1, 4, 6) with a history of purulent conjunctivitis, keratitis and corneal perforation respectively, underwent necropsy and the eye globes and adnexia was submitted for histopathological examination.¹ The samples were embedded in paraffin blocks, successively sectioned (5 µm thickness), stained with haematoxylin and eosin (H & E) (Luna, 1968) and evaluated under light microscopy (Olympus CX31).

MICROBIOLOGY

Conjunctival swabs were cultured first on blood agar plate as double series, which were then incubated in aerobic media at 25 C° and 37 C° for 2-3 days. The colonies produced were identified using bacteriological and biochemical tests [14,15].

Results

Following clinical examination of fifteen Loggerheads, nine eyes (30%) from six animals (40%) were diagnosed with five different ocular diseases: catarrhal conjunctivitis (case no: 2), purulent conjunctivitis (case no: 2), keratitis (case no: 3), blepharitis (case no: 1) and corneal perforation (case no: 2). As Loggerheads have deep orbits and strict communications between the palpebral, conjunctiva and sclera (Figure 1a) these characteristics were found to restrict ocular examinations. For this reason ocular examinations is done more difficult and limited ocular examination in this species among the previously mentioned ocular diseases, only conjunctivitis was bilateral. It caused severe blepharospasm and chemosis in all eyes with that condition and was also associated with blepharitis and keratitis in one eye. In the case with purulent conjunctivitis, blepharospasm and chemosis were complicated with severe mucopurulent discharge, exophthalmos and traumatic eyelid injuries (Fig. 1b-e).

A predator crab was found attached to the eyelid with blepharitis (case no 4) and it were taken manually. Reason for blepharitis, keratitis and corneal perforation, were detected various foreign objects. Corneal opacity extending from the

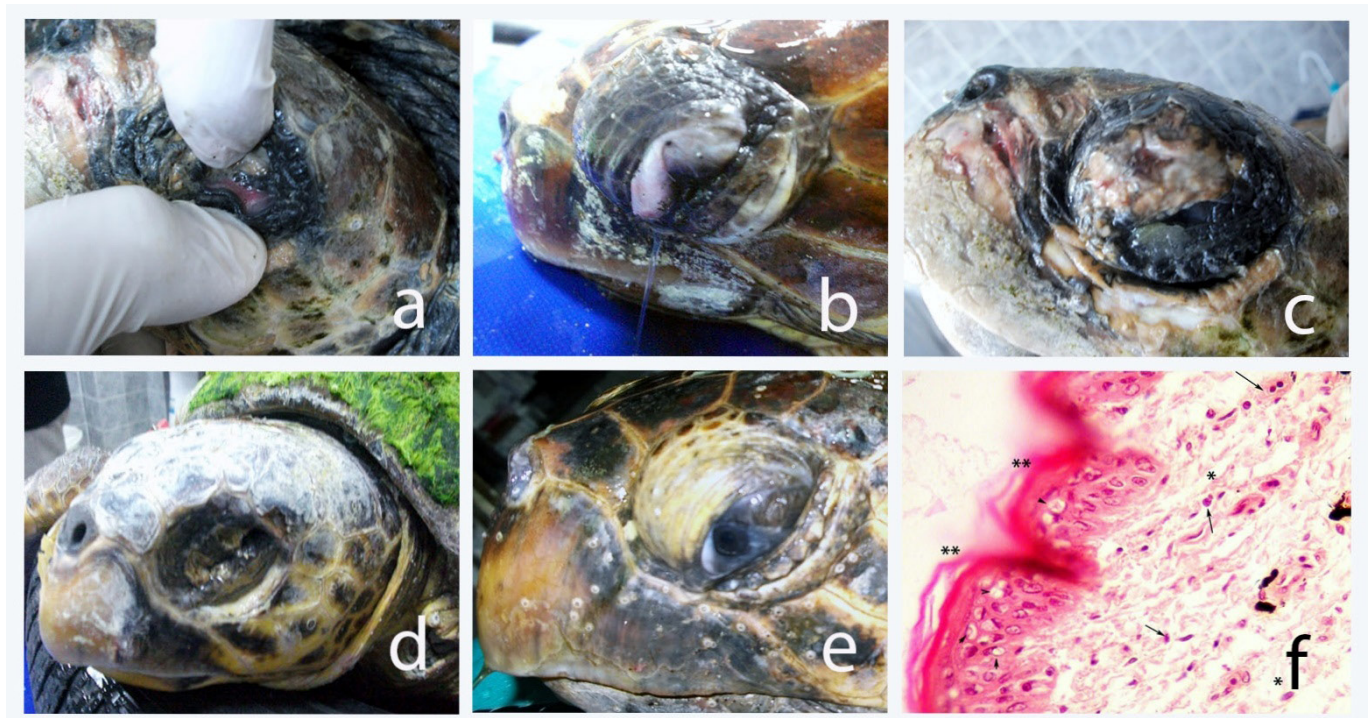


FIGURE 1: Eye diseases of the Loggerheads sea turtles (*Caretta caretta*) living in the north-eastern coast of the Mediterranean between 2011 and 2012 (A) Opening the palpebrae and examining the conjunctiva. (B) Conjunctivitis and mucopurulent lacrimation. (C) Blepharitis and keratitis. (D) Shrunken eye globe with corneal perforation. (E) Keratitis. (F) Keratinization in multi layered stratified epithelia (**), hydropic degeneration in the epithelia (arrow heads), edema in stroma (*) and inflammatory cell infiltration (arrows) consisted of lymphocyte and macrophages, Haematoxylin and Eosin (H&E X 40).

medial cantus to almost midcornea in case 5 and stationary corneal opacities situated on lateral cantus in cases 3 and 4 were revealed. In a case with corneal perforation, the globe had lost its tension with a resultant sunken appearance (Fig. 1c-d). In this case, the perforated corneal surface was covered with a fibrin clot formed by humor aqueous of the size of a pea grain. All clinic observations are summarized in Table 1.

At necropsy, it was determined corneal opacity and ulcerative tissues in keratitis and blepharitis cases, respectively. Purulent discharge from extraocular tissues was expressed during harvesting the globe of case 2, which died 45 days after treatment for conjunctivitis. In the case with corneal perforation, accumulation of coagulated aqueous humor was seen on the cornea. On histopathological evaluation of cases conjunctivitis (case no 2 and 4), epithelial hyperplasia, inflammatory cell infiltration and conjunctival hyperemia were observed. Inflammatory infiltrates included mainly heterophilic leucocytes gathered predominantly around the sub-epithelial blood veins dispersed between fewer numbers of macrophages and lymphocytes. In cases with keratitis, the corneal stroma appeared edematous and contained mononuclear (plasma cells and macrophages) cell infiltration (Fig. 1f).

Aeromonas spp. was isolated only in cases with purulent conjunctivitis.

TREATMENT

After irrigation of the eyes with 3% boric acid, all cases received topical 0.3% tobramycin (tobrex ophtalmique 5ml) or oxytetracycline HCl + Polymyxin B sulphate ophthalmic solution (terramycine) 3 drops BID as well as parenteral 1000 IU vitamin A per week. In cases with blepharitis,

topical ointment (terramycine) was also applied twice a day to the eyelid wounds. To prevent secondary infection and improve general condition of the cases, daily 40 mg / kg cephalosporin, 100ml 5% dextrose, 150 ml isotonic solution were administered parenterally along with the topical medication. All blepharitis, keratitis and conjunctivitis cases responded well to the prescribed treatment.

Discussion

The majority of eye diseases reported on sea turtles include sporadic case presentation, mainly including metaplasia and conjunctivitis [2,4]. Although there is adequate information about the consequences of traumatic insults on eye diseases in sea turtles [2,4,6,16,17] the literature concerning the symptoms, diagnosis and treatment methods of these diseases appeared is poor [2,4]. In this study, ocular diseases such as keratitis, conjunctivitis, corneal perforation and blepharitis in sea turtles was evaluated for the first time with a multidisciplinary approach of clinical, microbiological, pathological.

Metaplastic diseases are reported to be common in green sea turtles (*Chelonia mydas*) [1,2,4-7,9,16], contrary to Loggerheads which are predisposed to other eye disease as far as the present study result is concerned. This situation indicates that Loggerheads may be more resistant to metaplasia as compared to green sea turtles (*Chelonia mydas*). Due to deep orbits and tight attachment between the palpebral, conjunctiva and sclera, Loggerhead eyes present difficulties to a complete ocular examination. Therefore, the many primary signs of orbital diseases such corneal ulcer and phthisis bulbi in this species may go unrecognized. Blepharospasm and, fibrous ocular discharge may increase [10]. Similar problems were determined in this present study. Additionally this

Case	W	Age	D/E	Reason	Place	Kind of Epip.	Epip.	Op.	Exh.	F.P.	Ulcer	Chem.	Blp.	Hyp.	See	Edm.	Pain	Trea.
C.Conj (Case1)	50	35	D	T,M	Blt	Mucopurulent	+++	---	++	+++	---	++	+++	+++	+++	++	+++	+++
P.Conj. (Case 2)	35	18	D	T,M	Blt	Purulent	+++	---	++	++	---	++	++	++	+++	++	++	++
Keratitis (Case 3)	32	20	D	T	Right	Mucopurulent	+++	++	++	++	---	++	++	++	++	++	++	++
Keratitis (Case 4)	30	22	D	T,M	Right	Mucopurulent	+++	++	+++	++	++	++	++	++	++	++	++	++
Keratitis (Case 5)	35	25	D	T	Left	Mucopurulent	+++	++	++	++	---	++	++	++	++	++	++	++
C. Perf. (Case 6)	26	30	D	T	Left	Mucopurulent	+++	++	---	+++	++	++	+++	++	---	++	+++	++
Blepharitis (Case 3)	32	20	D	T	Left	Mucopurulent	++	---	+++	++	++	++	+++	++	+++	+++	+++	+++
Blepharitis (Case 4)	30	22	D	T	Right	Mucopurulent	+++	++	+++	++	+++	+++	+++	++	++	++	+++	++

D/E= Female/male, Epip.= Epiphora, Op=Opacity, Exh.= Exophthalmus, F.P.=Photophobia, Chem.=Chemosis, Blp=Blepharospasm, Hyp=Hyperemia, Edm=Edema, Trea= Treatment, T= Traumatic, M= Metabolic, Blt=Bilateral, W= Weigth, C.Conj.= Conjunctivitis catarrhalis, P. Conj.= Purulent Conjunctivitis, C.Perf.= Corneal perforation, +++: at high degree, ++: at moderate degree, +: at low degree, -: None/No/Not existent

TABLE I: The clinical findings in the eye diseases of the Loggerheads sea turtles (*Caretta caretta*) that living in the north-eastern coast of the Mediterranean between 2011-2012

study found that ocular diseases could readily be overlooked if routine ocular examination was not associated with careful systematic evaluation.

It was found that turtles with eye diseases appeared healthy, with normal blood parameters [10]. Incidence of eye diseases reported in Loggerhead ranged from 8.6% [16] to 7.53% [5] in the present study, nine eyes (30%) from six animals (40%) were diagnosed with five different ocular diseases. 30% in the present study after evaluation of a total of 30 eyes out of fifteen cases following thorough ophthalmological and systematic examinations. These values show the presence of great differences between the present and former two studies [5,16]. The difficulty of thorough ophthalmic examination in this particular species may lead to many ocular diseases going unnoticed with an outcome of low incidence.

The etiology of many ocular diseases in sea turtles are not well defined, inflammatory infections, malnutrition, and genetic predisposition are often primary causes of ocular problems [8,18] and traumatic wounds are the most common predisposing factor to many ocular diseases [2,4,6,16,17]. In our study it was understood that the blepharitis was formed due to human-induced injury or predator crab bites, the corneal perforation was caused by traumatic effects, keratitis and conjunctivitis were formed due to metabolic, traumatic, and malnutrition causes during the period when Loggerheads drifting in the sea.

During physical examination, ocular symptoms like lacrimation, enophthalmus and blepharospasm were considered as signs of dehydration [9]. In our cases lacrimation and dehydration were determined. Enophthalmus was seen in a case with corneal perforation. Fibrous exudate was seen to be associated with blepharitis and yellowish purulent discharge with keratoconjunctivitis [1, 16]. The present study showed that many cases presented mucopurulent ocular discharge rather than fibrinous exudate; yellowish purulent discharge was only seen in extraocular adnexia during necropsy. In a study on the upper respiratory tract diseases of desert turtles, symptoms such as hyperemia, chemosis and excessive lacrimation have been documented [19]. These symptoms were found in our cases not as the symptoms of any respiratory system disease but as the symptoms of the eye diseases. Clinical signs found in the eyes of the present cases conform to the primary and secondary symptoms revealed [7]. Symptoms like pain and edema in the palpebrae, and chemosis in the conjunctiva revealed [19] and researcher [16] were also determined in our cases with conjunctivitis, keratitis and blepharitis.

As mentioned, a limited number of studies exist focusing primarily on eye disorders. Because many cadavers presented for necropsy are usually not fresh and highly dehydrated, the findings are less reliable, a possible reason of the low number of field reports [1,2]. Some studies [10] revealed the presence of diffuse, chronic heterophilic inflammation areas and inflammatory cell infiltration in the cornea of Gopher

tortoises (*Gopherus polyphemus*) with keratitis. Others [5] reported the existence of large quantities of heterophils leaked from the corneal stroma toward the conjunctiva in heterophilic keratoconjunctivitis and a large number of mixed inflammatory cells in corneal stroma associated with epithelial loss in ulcerative keratitis. In the available study, histopathological examination showed vascularization, epithelial hyperplasia and inflammatory cell infiltrations, predominantly heterophil (neutrophil) leucocytes around the sub epithelial blood veins dispersed with few numbers of macrophage and lymphocytes in the eye. Keratitis cases macroscopically presented diffuse opaque corneas, of which the stromas were microscopically observed to be edematous and contain mononuclear cell infiltration of lymphocytes, plasma cells and macrophages.

In the present study, a few gram (+) and gram (-) pathogen or opportunist microorganisms were microbiologically isolated. In one study [5] *Pseudomonas* spp., *Staphylococcus* spp., and *Achromobacter* spp were isolated in cases with keratoconjunctivitis and keratitis. Presence of yellowish discharge on the cornea may indicate keratoconjunctivitis or ulcerative blepharitis and also be related to traumatic laceration of cornea or secondary bacterial infection [1]. It is suggested that secondary bacterial infections can result in keratoconjunctivitis and *Pseudomonas aeruginosa* and *Flavobacterium* spp. may cause ulcerative blepharitis [16]. In another study, only *Aeromonas* spp. was bacteriologically isolated and identified in purulent conjunctivitis cases. As this type of microorganism is accepted as the natural flora of aquatic species, the authors suggested that it may only cause an infection with preexisting tissue destruction and conjunctivitis.

It was seen that fibrous discharge in Gopher tortoises (*Gopherus polyphemus*) eye could not be easily removed despite a thorough wash of the orbita and its surroundings with the sterile physiologic serum [10]. The ocular epithelia tissues were found to be very susceptible to A hypovitaminosis [11,13] and in such a condition, peritoneal and/or oral vitamin A application, administration of systemic and topical antibiotic preparations and balanced dietary intake were advised for treatment purpose [4]. Researchers [11] revealed that conjunctivitis responds well to topical oxytetracycline and complicated traumas to enrofloxacin or ceftazidime injections. In the present study, topical application of 3% boric acid and tobramycin and parenteral application of vitamin-A and cephalosporin (40 mg/kg/day) produced quite successful outcome in all clinic cases.

As a result, this is the first study which evaluates in detail the ocular conditions of Loggerhead turtles in Turkey and is expected to make a positive contribution to veterinary practice here and the rest of the world. The study also suggests that eye diseases in sea turtles is of vital importance and thus veterinary practitioners should be more actively involved in first aid and treatment procedures of this species in order to improve prognosis.

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