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Source: Journal of Wildlife Diseases, 10(4) : 370-376

Published By: Wildlife Disease Association

URL: https://doi.org/10.7589/0090-3558-10.4.370

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SURVEY OF DISEASES IN FREE-LIVING CALIFORNIA SEA LIONS

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Abstract: Fifty-one diseased California sea lions, *Zalophus californianus*, that stranded on southern California beaches were examined by necropsy. Pneumonia and mucoid bronchiolar obstruction, secondary to infestation with the lungworm *Parafilaroides decorus*, were the predominant lesions but other findings are presented. Bacterial isolations and identifications were attempted when indicated and antibiotic sensitivities were noted. Comments are included on the diagnosis and treatment of the more commonly found diseases.

INTRODUCTION

The finding of young diseased California sea lions along the southern California coast has been commonplace[4,5] particularly during the months from May through December. Most of these animals range in age from 15 to 20 months, the age group sought after by zoos, aquariums and research institutions. They indicate the spectrum of diseases young sea lions are exposed to on the rookeries, thus the diseases which the clinician might expect to see in his newly acquired animals.

MATERIALS AND METHODS

Fifty-one California sea lions were examined by necropsy during the months September 1972, through January 1973. Of these, three were over 2 years of age, 40 were between 15 and 20 months, and eight were between 3 and 6 months old.

The beached sea lions were captured with a throw or hoop net and placed in a cage for transfer to a quarantine facility. A routine physical examination was performed, including radiography, during which halothane anesthesia was usually required.[6] Blood was taken routinely from the caudal gluteal vein using a 1½ inch 20 gauge needle on a 12 ml syringe. A complete blood count was performed and where indicated serum chemistry determinations were made. When respiratory disease was suspected, a bronchial culture was made on anesthetized animals using an equine culture swab.[1] Feces were examined by flotation and by direct microscopic observation. All thoracic and abdominal organs of dead animals were removed through a midline incision for complete examination. Structures within the head were also examined. Cultures were routinely placed on blood agar and incubated at 37C. Antibiotic sensitivities were determined using sensitivity discs.[1] Tissues from all body organs were collected and histologic examination performed.

RESULTS

The diseases encountered in the California sea lion are listed in Table 1. The predominant lesions were in the respiratory tract; 33 of 43 animals were infested with the lungworm identified as *Parafilaroides decorus*.[2] Two common grossly identifiable sequellae to lungworm infestation, pneumonia and mucoid bronchiolar obstruction, were present in 20 and 25 cases, respectively. A histologic diagnosis of pneumonitis was made in 34 of 43 animals. Table 3 represents the spectrum

[1] Uterine culture swab—Albion Laboratories, Clearfield, Utah 84015, USA.

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of pulmonary diseases observed on histologic examinations. In nearly every case lungworms were present. The prevalence of gastric nematode infestation (*Contracaecum osculatum*) in the post-weanling animals was high with at least 25 of 41 animals infested despite anthelmintic therapy in those animals that lived long enough to be treated with thiabendazole.[2]

Ten cases of gastric ulceration were found. They were usually associated with *Contracaecum* infestations in which the worms were attached to the denuded submucosa. Two such perforating ulcers resulted in secondary fibrinous purulent peritonitis. There was one case in which perforation occurred in the proximal colon, with associated hemorrhagic colitis. Liver flukes (*Zalophotrema hepaticum*) were present in eight of 43 weanling animals, but no associated liver lesions were noted. Of 20 adult parturient California sea lion cows examined as part of another study, seven had flukes in bile ducts and four of these had liver disease (biliary duct and parenchymal necrosis). Abscesses were found in eight animals; four were subdermal and four were deep. In suckling sea lions, five of eight had subdermal abscesses. Three animals had nephritis; one subadult male was confirmed histologically as a case of leptospirosis. Two tumors were found, one incidental benign nephroblastoma in a 16 month old animal and one squamous cell carcinoma with lymphatic metastasis in an adult female.

TABLE 1. Categorization of autopsy findings in sick free-living California Sea Lions relative to age groupings.

Group (Age)	>27 Mo.	15-20 Mo.	3-6 Mo.
No. of Animals (Total)	3	40	8
Lung Worm Positive	1	32	1
Pneumonia — Pneumonitis	1	33	5
Pneumonia (Gross)	0	20	3
Mucoid Bronchial Obstruction	0	25	1
Pleuritis	0	2	0
Gut Perforation with Peritonitis	1	2	0
Renal Disease	1	1	1
Hepatic Disease	0	2	2
Abscess (Subdermal)	1	3	5
Abscess (Deep)	1	3	1
Liver Flukes	1	6	0
Gastric Nematodes	2	24	0
Gastric Ulcers	1	9	0
Tumors	1	1	0
Congenital Defects	0	2	0
Encephalitis	0	1	1
Subcutaneous Emyhysema	0	2	0
Open Diagnosis (No Histology)	1	2	0

[2] Thibenzole—Merch and Company, Inc., Rahway, New Jersey, USA.

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TABLE 2. Distribution of histologic findings in the respiratory tract of sick, free-living California Sea Lions relative to age groupings.*

Group (Age)	Number	Lungworm Infestation		Congestion Hemorrhage	Bronchial Inflammation	Diffuse Pneumonitis	Micro-Abscesses	Alveolar Damage	Edema
		Adult	Larvae						
15-20 Mo.	P72030	+1	+2	+2	+4	+4	+4	+4	+1
	P72030	+1	+1	+1	+3	+2	+3	+3	+1
	P72036	+4	+3	+4	+4	+4	+4	+4	+4
	P72033	+2	+3	+3	+4	+3	+1	+2	+2
	P72035	0	0	+4	+3	+3	0	+2	+3
	P72017	+2	+1	+4	+3	+3	0	+2	+3
	P72037	0	0	+2	0	+1	0	0	0
	P72031	+2	+1	+2	+3	+3	+1	+3	+2
	P72041	+2	+1	+3	+4	+4	+3	+3	+2
	P72042	+3	0	+4	+4	+2	0	+2	+4
	P72040	+4	+4	+3	+4	+4	+4	+4	+3
	P72054	+4	0	+3	+1	+2	0	0	+2
	P72053	+4	+4	+3	+4	+4	+3	+4	+3
	P72052	+2	0	+1	+3	+3	0	+3	+3
	P72051	+3	+4	+2	+4	+3	0	+3	+4
	P72050	+3	+2	+3	+4	+4	+2	+4	+2
	P72048	+4	+4	+3	+4	+4	+4	+4	+4
	P72047	+3	+4	+3	+3	+4	+1	+4	+4
	P72046	+4	+4	+4	+4	+1	0	+1	+3
	P72024	+2	+2	+2	+3	+2	0	+2	+2
	P72030	+1	0	+1	+2	0	0	0	0
3- 6 Mo.	P71002	0	0	+4	+3	+3	0	+4	+3
	P71003	0	0	+4	+4	+4	+4	+4	+4
	P71004	0	0	0	0	0	0	0	0
	P72026	0	0	+4	+3	+3	0	+2	+2
	P72027	0	0	0	0	0	0	0	+1
	P72028	0	0	+2	+2	+1	0	0	+2
	P72029	+1	0	+3	+4	+4	+4	+4	+4

* Histologic examinations performed by Richard Conklin, M.D., Houston, Texas.

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Two congenital disorders were found, in one the superior capsular surface of the spleen was fused to the inferior capsular surface of the liver, and in the other unilateral renal aplasia was associated with compensatory hypertophy of the remaining kidney. Two cases of neurologic disease were found, encephalomyelitis in a yearling and meningitis in a pup.

The suckling pups appeared to have a high predisposition to non-specific bacterial disease which is likely secondary to starvation and reduced immunologic capability.

Bacteriology

In Table 3, bacterial identifications are listed according to site of infection. Though there was a wide variety of organisms, in cases of pneumonia the majority of the bacteria were gram-negative, and in cutaneous abscesses the bacteria were usually gram-positive. There appeared to be a higher prevalence of pulmonary infection due to *Escherichia coli* and *Klebsiella pneumoniae* as compared with other organisms.

DIAGNOSTIC TECHNIQUES

Commonly practiced diagnostic techniques may be applied to sea lions. Restraint and anesthesia require cautions since animals with respiratory disease commonly have a severely restricted ventilating capacity.

Pulmonary disease in young stranded sea lions can be diagnosed readily by several methods. Thoracic auscultation and percussion provide information relating to the degree of air flow, the presence of fluid or mucus in the airways, and the possible presence of lung consolidation. Radiographic examination can demonstrate areas of pneumonia, consolidation, congestion, etc. Blood analysis, particularly a complete blood count, can confirm a diagnosis and may provide information relating to the degree and duration of involvement as well as other useful information. Direct microscopic examination of feces, or mucus collected from the mouth or nares may reveal the presence of the first or second stage larvae from the lungworm. The nasal mite, *Orthohalorachne diminuata* may also be found in mucus from the nares. When a diagnosis of pulmonary disease has been

TABLE 3. Bacterial identifications according to site of infection in sick, free-living California Sea Lions.*

Lung		Abscess (Subdermal)		Abscess (Deep)	
Organism	No.	Organism	No.	Organism	No.
Escherichia coli	4	*Escherichia coli*	1	*Escherichia coli*	1
Klebsiella pneumoniae	4	*Acinetobacter parapertussis*	1	*Citrobacter* sp	2
Serratia sp	3	*Alcaligenes faecalis*	1	*Corynebacterium pyogenes*	1
Salmonella sp	1	*Micrococcus* sp	1	*Micrococcus* sp	1
Alkalescens-dispar	1	*Staphylococcus* sp	3		
Pseudomonas sp	1	*Streptococcus* sp	1		
Citrobacter sp	1				
Acinetobacter woffi	1				
Micrococcus sp	2				
Staphylococcus aureus	1				
Staphylococcus sp	1				

* Identifications made by William G. Gilmartin and George A. Antonelis, Naval Undersea Center, San Diego, Calif.

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made, a bronchial culture can be obtained by inserting a standard equine uterine culture swab through an endotracheal tube in an anesthetized animal, swabbing the bronchial mucus distal to the tube opening.

A fecal flotation should be used to diagnose the presence of gastrointestinal helminth parasites.[a]

THERAPY

When lungworms and their sequellae are present, a complete treatment program must include therapy for 1) the bacterial pneumonia or pneumonitis, 2) the bronchial obstruction due to increased mucus secretion, and 3) reduction or elimination of the lungworm infestation. Table 4 illustrates antibiotic sensitivities for organisms identified in Table 3.

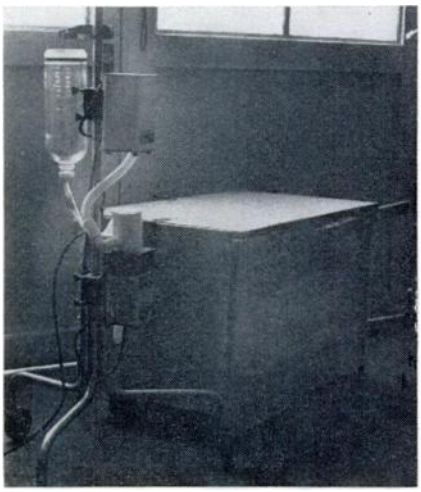


FIGURE 1. Ultrasonic nebulizer and enclosed cage utilized for vapor therapy.

Mucoid obstruction has been treated with at least partial success with mucolytic agents[3] and bronchodilators[4] administered as a vapor with the animal confined in an enclosure measuring 2 feet x 2 feet x 4 feet (Fig. 1). With this therapy, the affected animal commonly coughs up large quantities of mucus. The effects of this therapy are temporary however. Orally administered expectorants[5] have not proved successful. Irrigation and suction under anesthesia have been attempted with only limited success. In treating the lungworm and its larvae, levamisole hydrochloride[6] (oral) and levamisole dihydrogen phosphate[7] (intramuscular or subcutaneous) have been tested. When the manufacturer's recommended dose of 7.9 mg/kg bodyweight is doubled and the drug given intramuscularly there appears to be a dramatic effect on larvae and there is a suggestion in the preliminary tests that there is some effect on the adult worms as well. There is a larvicidal effect to a lesser extent when the drug is given in the manufacturer's recommended dose by the oral or subcutaneous routes. The longevity of *P. decorus* is not known but in animals experimentally infested, larvae were still present in the feces and viable adult worms were still present in large numbers within the pulmonary alveoli after 1 year. The worm is apparently voided from the host within several years as very few sea lions over 4 years of age are found to be infested.

Stranded sea lions are usually undergoing starvation and dehydration in addition to having large infestations of gastro-intestinal parasites, therefore, a program of supportive vitamins, fluids, anthelminthics, etc., is indicated. Any superficial abscesses present must be treated (refer to Table 4).

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[3] Mucomyst—Mead-Johnson Laboratories, Evansville, Indiana 47721, USA.

[4] Isuprel—Winthrop Laboratories, New York, New York 10016, USA.

[5] Quadrinol—Knoll Pharmaceutical Company, Whippany, New Jersey 07981, USA.

[6] Tramisol—American Cyanamid Company, Princeton, New Jersey 08540, USA.

[7] Ripercol—American Cyanamid Company, Princeton, New Jersey 08540, USA.

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TABLE 4. Summarization of bacterial antibiotic sensitivities relative to site of infection in sick, free-living California Sea Lions.*

Antibiotic	Pneumonia		Subdermal Abscess	
	Sensitive	Resistant	Sensitive	Resistant
Tetracycline[1]	14	6	8	0
Furadantin[1]	16	4	8	0
Neomycin[1]	18	2	7	1
Dihydrostreptomycin[2]	12	8	6	2
Penicillin G[1]	2	18	4	4
Coly-Mycin[1]	13	7	1	7
Lincocin[1]	2	18	4	4
Cephalothin[1]	16	3	7	0
Chloramphenicol[1] [2]	15	5	7	1
Erythromycin[2]	4	16	6	2
Ampicillin[2]	4	10	6	1
Polymyxin B[1]	10	4	4	3
Kanamycin[1]	11	1	6	1
Gentamycin[1]	12	0	6	0

[1] Difco Laboratories, Detroit, Mich. (lowest concentration sensitivity discs).

[2] Baltimore Biological Laboratory, Cockeysville, Md. (lowest concentration sensitivity discs).

* Tests made by William G. Gilmartin and George A. Antonelis, Naval Undersea Center, San Diego, Calif.

CONCLUSIONS

Most free-living sea lions are exposed to a wide variety of pathogenic bacteria and are susceptible to infections by these. Since most of these animals have multiple lesions, there is a diagnostic challenge in sorting them out. In many, disease has become so extensive that treatment is of little or no consequence. The identification of an etiologic agent and an antibiotic sensitivity for it is always the best way to approach a therapeutic regimen.

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Received for publication 25 February 1974

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