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Animal Health Centre

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Final Report AHC Case: 14-5855

Last Updated: 09/29/16 1:42 PM
Pathologist: Stephen Raverty, DVM
Received Date: 12/08/14
Collected Date: 12/08/14
Client Ref No: J32

Veterinarian: **Dr. Marty Haulena**
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Submitter: **John Ford**
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Owner: **Pacific Bio Station J. Fo**
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Animal Data
Species: Killer Whale
Breed:
Sex: F
Age: Adult
Premise ID:

Case History

Submitted one adult Killer Whale for post mortem.

From Vancouver Island, posted December 6, 2014

J32

Final Diagnosis

MORPHOLOGIC DIAGNOSES:

1). Fetus and uterus: Fetal loss and decomposition with multifocal fibrinosuppurative endometritis, focal endometrial perforation, fibrinopurulent exudate, segmental compression, impaction and focal annular ulceration of the adjoining colonic segment, regional lymphadenopathy and marked splenomegaly
2). Uterus: Endometritis, severe, necroulcerative with abundant fibrinoserous to fibrinosuppurative exudate, multifocal to coalescing acute hemorrhage, variable intra to transmural microcavitations, occasional fibrin deposition and florid intralesional coccobacilli and focal perforation
3). Carcass: Emaciation, moderate, generalized with prominent stromal fibrous connective tissue and lateral vertebral processes (Gross diagnosis)
4). Cervix: Congestion, mucosal, moderate, multifocal with florid bacterial overgrowth and variable submucosal and intramural laminar edema with entrapped and displaced glandular elements
5). Epicardium, peripheral vasculature, adventitia and fibroadipose tissue: Hemorrhage, perivascular and septal, moderate, multifocally extensive, acute
6). Stomach, nonglandular compartment: Hyperkeratosis, orthokeratotic, marked, diffuse
7). Adipose tissue, multiple anatomic sites: Cytoplasmic condensation, mild to moderate, multifocal scattered fibroplasia (atrophy)
8). Lung: Edema, alveolar, moderate, multifocal, random, acute
9). Skeletal muscle, ventral abdomen: Fibrosis, endomysial, mild, multifocal with entrapment and effacement of myofibers
10). Skeletal muscle: Degeneration, myocellular, mild to moderate, multifocal to segmental
11). Tongue, muscularis: Microcavitations, moderate, multifocal to coalescing with occasional peripheral edema fluid
12). Tongue: Myocellular degeneration, mild, multifocal, random with plexiform fibrosis

13). Right thoracic wall: Hematoma, subcutaneous, moderate, focal (Gross diagnosis)
14). Teeth: Malalignment, moderate, focal (Gross diagnosis)

There are no significant lesions within the peripheral nerves, mammary gland (secretory), liver, lung, tonsil, oropharynx, spleen, peripheral vasculature, brain, colon, small intestine, lymph nodes, kidney, spinal cord, or ileum.

COMMENTS:

Post mortem change and bacterial overgrowth significantly hampered microscopic review of the sectioned tissues; however, the grossly noted endometrial perforation was borne microscopically and the adjoining margins of the defect were overlaid by abundant fibrinosuppurative to fibrinoserous exudate and florid intralesional Gram positive coccobacilli and fewer Gram negative rods. Initial bacterial invasion was most likely via the lower reproductive tract with retrograde extension into the calf bed. Based on composition and extent of the host cellular response, the perforation was ante-mortem and presumably provided a portal of initial bacterial colonization, proliferation and subsequent hematogenous invasion and septicemia of J32. The extent of post mortem change was more pronounced in the fetus, suggesting fetal loss prior to the demise of J32. As indicated in the AHC report 5856-14, there was breach presentation which likely accounts for fetal loss and associated sequelae. It was not possible to conclusively determine whether fetal loss may have occurred prior to, or during the dystocia. On consultation with anatomists and reproductive specialists, the fetus should turn in utero to a tail first presentation within 1-2 weeks of parturition, although rotation may sporadically occur as late as 1-2 days before and even just prior to birth. This would suggest that the fetus may have died prior to the expected time of turning around in-utero and thus prior to dystocia, or alternatively, could not have rotated into a normal prsentation and died as a result of dystocia.

There are anecdotal field observations of near term abortion, periparturient maternal loss and perinatal mortality in southern resident killer whales. From a population level perspective, adult females appear fecund and able to conceive with fetal loss between mid and late gestation. Early embryonic loss and fetal resorption cannot be discounted. Based on current necropsy records, no specific etiology or pathogenic mechanism has yet been identified from case material. Similar reproductive and perinatal losses have been reported in the St Lawrence beluga population, where census data suggests a historically depleted and persistently declining population (Lair et al, 2016). Ongoing recovery and post mortem examinations of stranded beluga indicate that dystocia and post-partum complications account for 40 percent loss of females between 8 and 19 and up to 20 percent of maternal mortality in animals greater than 19 years of age. In resident killer whale, females have a gestation of 15-18 months with births in the northeastern Pacific peaking between October and March, but calves have been recognized in each month of the year. In a case series in the 1980's perinatal or calf mortality (up to 6 months of age) was estimated at 43 percent and more recent census data for the southern residents suggests low fertility or infertility with significant perinatal and calf mortality. No calves have been reported in K pod since 2011 and for J and L pods, there have been on average fewer than 1 calf per year. There were no calves reported born in 2013 and for 2014, there were 2 documented neonates that subsequently died. In 2015 and 2016, there was a substantial increase in births, 7 live calves were in 2015 and 3 calves have been identified to date for 2016. Calf mortality includes both animals from 2014 and all 3 calves for 2016 (Wasserman et al, 2016). Although legacy persistent organic pollutants have been associated with reduced reproductive outcomes in a number of cetacean species, north resident and northeastern Pacific transient killer whales currently have higher contaminant loads and greater fecundity rates, suggesting that fetal loss may reflect a more complex and dynamic process involving nutritional stressors, infectious and other disease processes. For example, there have been at least 2 recovered dead perinates that presented in moderate nutritional condition with no indication of colostral consumption (no milk in the stomach or detectable antibody titers in post mortem heart blood) The lack of colostral consumption may suggest mismothering, maternal neglect or separation, failure to thrive, and other factors. Another neonate presented with a lethal congenital hiatal hernia.

In addition to the endometritis and generalized emaciation, multisystemic congestion was apparent likely related to agonal or terminal cardiovascular collapse secondary to septic shock. Aerobic culture recovered light to heavy growth of Edwardsiella tarda from multiple tissues with mixed growth of E tarda and Actinobacillus delphinicola from the lung. It is believed that E tarda comprise part of the normal gastrointestinal flora with microbial proliferation and tissue invasion typically associated with localized impairment of defences or generalized debility. This organism has been associated with septicemia and fibrinous peritonitis with J18 and juvenile killer whale that had impaled its oropharynx with a fish hook. Similarly, A delphinicola has more recently been recovered from a variety of tissues including the gastrointestinal tract of harbour porpoises and striped dolphins and the lung of a Sowerby's beaked whale stranded in Scotland. The bacterium featured genotypic homogeneity and tissue distribution varied between the sampled species. No significant pathology was identified in the case series and there is still some speculation as to its pathogenicity. Anaerobic culture isolated heavy growth of Eubacterium sp from the uterus and skeletal muscle and no anaerobes were isolated from the uterine mass. This bacterium has been recovered from pigs with cystitis-pyelonephritis complex (Actinobaculum suis), as well as ruminants with spontaneous meningitis and meningoencephalitis and neonates with septicemia and polyarthritis. The disease in swine initially presents with colonization and infection of the prepuce in males with clinical disease in females after venereal transmission. Trauma to the vagina during coitus or parturition facilitates bacterial invasion and subsequent cystitis and pyelonephritis. In J32, there was no gross, microscopic or cytology evidence of cystitis or pyelonephritis and the contribution of this bacterium to population health remains unknown. In sheep, a related bacterium, A pluranimalium has been recovered from placenta and fetal stomach contents in cases of sporadic abortion. The colonic, fecal impaction

may be attributed to extramural compression and luminal obstruction by the fetus, further exacerbating the decline in nutritional condition of J32.

No Campylobacter spp, Yersinia spp or Salmonella spp were cultured by selective or enrichment media and immunofluorescence of the hemorrhagic focus in the skeletal muscle proved negative for Clostridium septicum, C sordellii, C novyi and C chauvoei. Pooled tissues submitted for in house and to reference laboratories for molecular studies proved negative for Brucella sp (Illinois and AHC), Apicomplexa (tissue protozoa), canine distemper virus, morbillivirus (UC Davis, phosphoprotein P gene). HABs screening of amniotic fluid, bile, post mortem heart blood, feces, intestinal contents, stomach contents, and urine proved negative for domoic acid and saxitoxin. Urinalysis (PDS) disclosed a specific gravity of 1.020, pH 6.0, 4+protein, “normal” glucose, no ketones or bilirubin, strong reaction to blood, but no discernible intact red blood cells. Sediment analysis disclosed abundant polygonal to columnar epithelia, bacteria and small amounts of amorphic debris and no indication of active inflammation.

In the nonglandular gastric compartment, there was hyperkeratosis. In terrestrial animals, this change may be related to inappetence or anorexia, although similar microscopic alterations at different levels of the digestive tract have been associated with vitamin A deficiency and chlorinated napthalene toxicity in ruminants. This gastric mucosal change may have important implications as sections of blubber and adipose tissue from other anatomic sites, as well as skeletal muscle in J32 featured atrophy of fat cells (cytoplasmic condensation) and degeneration of myofibers with occasional intervening strands of fibrous connective tissue consistent with a catabolic state. The body condition of the dam may be related to the stage of gestation, infectious, inflammatory, toxicant, prey availability; prey quality, endocrine disruption, and other processes.

An Expert Panel was consulted August 23, 2016 and based on the size and full extension of the fetus, it was likely near term with an abnormal cranial presentation, in utero loss with subsequent uterine perforation and maternal septicemia. There were no apparent fetal folds along either flank which may suggest that the fetus had not turned or been in the normal tail first orientation prior to birth. The loss of the fetus may be attributed to dystocia, secondary to a breach presentation or partial exposure of the fetal rostrum through the vulva resulting in an ascending infection with sepsis and subsequent loss.

FINAL REPORT

Necropsy

An adult late to near term female killer whale, J32 “Rhapsody” is presented dead Dec 6, 2014 in moderate post mortem and fair body condition. The dermis and blubber throughout the abdominal and to a much lesser extent, thoracic region are thinned with prominent fibrous stroma and little oil oozes on cut surface. On lateral recumbency, the lateral vertebral processes are palpable and prominent. The abdomen is distended, taunt, and there is no perceptible fluid on ballottement. No milk is expressed from the mammary papillae and the mammary glands are compressed, firm and pale tan yellow. The teeth along the right lower jaw are removed and the exposed surfaces are smooth, linear and above the gingival mucosa. There is malalignment of left maxillary teeth 5 and 6. Throughout the ventrolateral aspect of the throat and left lateral aspect of the caudal abdomen, there is variably extensive cutaneous erythema with partial protrusion and eversion of the vagina and fetal rostrum through the urogenital orifice. The tongue is moderately swollen, mottle green red and protrudes a short distance beyond the limit of the rostrum. Within the right craniolateral region of the thorax, overlying the scapula, there is a 20-30 cm diameter subcutaneous hematoma which dissects a short distance into the adjoining skeletal musculature and fascia. The uterus is distended with a late, near term fetus; the curvilinear length of the uterus is 284 cm and maximum girth is 204 cm. The fetus extends into the left uterine horn and the rostrum abuts the left dorsocaudal aspect of the uterus, where there is a 3x5 cm oblong and longitudinal perforation of the endometrium with smooth margins and marked subendometrial and myometrial hemorrhage. Dark green brown exudate overlies and surrounds the defect and is expressed from the perforation on digital manipulation. Immediately cranial to the cervix within the mid ventrocaudal uterus, there is a prominent 10x15 cm transverse raised submucosal nodule which is overlaid by black red endometrium. The nodule protrudes up to a third the diameter of the cervical aperture; bilaterally symmetric swollen solitary 2 cm long papillae are within the dorsolateral aspect of the raised nodule. On cut surface, the nodule is dark red and glistening with centrally radiating and peripherally circumscribed fibrous connective stroma. The adjoining segment of distal colon is distended, firm, dorsally displaced and compressed by the uterus. The colonic contents are impacted, dry, firm and adherent to the mucosa; within the mid region of the affected colon, there is annular stricture and ulceration of the mucosa. There is little tan yellow mucoid chyme within the small intestine. The urinary bladder contains 25 cm of slightly turbid yellow white urine. There is massive enlargement of the spleen and the capsule is multifocally overlaid by fibrin and hemorrhage and there is marked lymphadenomegally of the perigastric, sublumbar and peri-renal lymph nodes. The biologic information of J 32 is below. There are no other apparent gross internal or external findings.

Biological Data
Total length, fluke notch 562 cm
Girth

Eye 250 cm
Axillary 364 cm
Maximum girth 384 cm

FETAL EXAM:

A 220 cm snout to tail notch length, 175 kg female near term killer whale fetus is presented dead, December 7, 2014, in moderate body and fair to poor post mortem condition. The animal is moderately fleshed. The dorsal fin is curved to the right and there is bilateral, ventromedial curvature of the distal flukes. The distal third of the mandible is truncated. The cranial sutures are detached with marked displacement of bone plates into the cranial vault with only 3-5 gm of liquefied brain tissue within the calvarium. The skin throughout the cranial and cervical regions is detached and retracted caudally, with prominent vertical folds. Multiple segments of small intestine and mesentery are herniated through the umbilicus. The thymus is well developed and within the cranial mediastinum, the lungs are uninflated and representative portions sink on immersion in formalin. The stomach contains approximately 15 ml of turbid, tan red slightly mucoid fluid (ingested placental fluid) and there is a moderate amount of meconium within the distal colon. The foraman ovale, umbilical arteries, and ductus arteriosus are patent. There are no other apparent gross internal or external lesions.

Biological Data
Weight (actual) 175 kg
Total length, fluke notch 220 cm
Girth
Eye 111 cm
Axillary 147 cm
Maximum girth 160 cm

COMMENTS:

Due to the degree of post mortem change, it is difficult to assess the sequence of events which contributed to fetal and maternal loss; the more advanced stage of decomposition in the fetus, endometrial perforation and associated inflammatory exudate suggests initial fetal loss with subsequent retrograde bacterial invasion from the lower reproductive tract, endometritis, focal perforation and secondary septicemia. The splenomegaly and lymphadenomegally are consistent with generalized sepsis. The endometrial perforation corresponded to a point of contact and possible impact with the fetal rostrum. There are no apparent gross lesions which may account for loss of the fetus; as there was little hemorrhage associated with the exposed umbilical margins, the hernia may have occurred at the time of initial loading of the carcass and uterus in the field or off loading at the laboratory. However, the possibility of in utero herniation secondary to dystocia or some other process cannot be entirely discounted. The nutritional status of the dam is reduced; however, this loss of condition likely reflects the cumulative effects of stage of pregnancy, cachexia related to chronic (or chronic active) inflammation in the uterus, generalized malaise and possible inappetence related to septicemia, and other factors. The implication of the nutritional status of J32 to the population is unknown. The segment of distal colon adjacent to the cervix is impacted and may represent physical compression of the contents by the uterus and fetus, dehydration, or some other process. The annular mucosal ulceration may have also facilitated secondary bacterial invasion. The subcutaneous hematoma in the right shoulder area is consistent with antemortem blunt force trauma; the overlying skin was intact with no evidence of abrasion or laceration. There was no apparent involvement of the underlying intercostal muscles, nor hemothorax or pulmonary hemorrhage. Ship strike, substrate impact, agonal thrashing and other processes may be considerations for this hemorrhage. The tooth malalignment is likely incidental and of limited consequence to prehension or mastication. Further evaluation is pending histopathology and ancillary studies.

GROSS DIAGNOSES:

1). Fetus and uterus: Fetal loss and decomposition with multifocal fibrinosuppurative endometritis, focal endometrial perforation, fibrinopurulent exudate, segmental compression, impaction and focal annular ulceration of the adjoining colonic segment, regional lymphadenopathy and marked splenomegaly
2). Carcass: Emaciation, moderate, generalize with prominent stromal fibrous connective tissue and lateral vertebral processes
3). Right thoracic wall: Hematoma, subcutaneous, moderate, focal
4). Teeth, 5 and 6: Malalignment, moderate, focal

Histopathology

Please refer to Morphologic Diagnoses.

Bacteriology

Aerobic Culture - Prod Resulted by: Jaime Osei-Appiah Verified by: Erin Zabek on 12/11/14 @ 12:46 PM

Specimen	ID	Isolate	Result	Level
Tissue	cervix	Edwardsiella tarda	Positive	4+
Tissue	cervix mass	Edwardsiella tarda	Positive	1+
Urine		Edwardsiella tarda	Positive	1+
Fluid	amniotic fluid	Edwardsiella tarda	Positive	4+
Uterus		Edwardsiella tarda	Positive	4+
Tissue	uterus horn	Edwardsiella tarda	Positive	2+
Colon		Edwardsiella tarda	Positive	4+
Lung		Edwardsiella tarda	Positive	3+
Lung		Actinobacillus delphinicola	Positive	3+
Isolate identified by DNA sequencing.				
Spleen		Edwardsiella tarda	Positive	4+
Small Intestine		Edwardsiella tarda	Positive	3+
Tissue	jejunum	Edwardsiella tarda	Positive	4+
Lymph Node		Edwardsiella tarda	Positive	2+
Uterus		Edwardsiella tarda	Positive	4+
Tissue	uterus mass	Edwardsiella tarda	Positive	1+
Brain		Edwardsiella tarda	Positive	4+
Fluid		Edwardsiella tarda	Positive	4+

Anaerobic Culture - Prod Resulted by: Jaime Osei-Appiah Verified by: Erin Zabek on 12/11/14 @ 12:46 PM

Specimen	ID	Isolate	Result	Level
Tissue	cervix mass		No Anaerobic Bacteria Isolated	
Tissue	uterus mass	Eubacterium sp.	Positive	4+
Eubacterium. sp. identified as E.moniliforme Isolate identified by DNA sequencing.				
Tissue	skeletal muscle	Eubacterium sp.	Positive	4+

Culture - Campylobacter Resulted by: Jaime Osei-Appiah Verified by: Erin Zabek on 12/12/14 @ 1:30 PM

Specimen	ID	Isolate	Result	Level
Colon			No Campylobacter sp. isolated	

Culture - Yersinia Resulted by: Jaime Osei-Appiah Verified by: Erin Zabek on 12/11/14 @ 12:46 PM

Specimen	ID	Isolate	Result	Level
Colon			No Yersinia sp. Isolated	

Culture - Salmonella Resulted by: Jaime Osei-Appiah Verified by: Erin Zabek on 12/11/14 @ 12:46 PM

Specimen	ID	Isolate	Result	Level
Colon			No Salmonella sp. Isolated	
Small Intestine			No Salmonella sp. Isolated	
Tissue	jejunum		No Salmonella sp. Isolated	

FA - C. chauvoei Resulted by: Jaime Osei-Appiah Verified by: Erin Zabek on 12/12/14 @ 1:31 PM

Specimen	ID	Test	Result
Tissue	skeletal muscle	FA - C. chauvoei	Negative

FA - C. novyi Resulted by: Jaime Osei-Appiah Verified by: Erin Zabek on 12/12/14 @ 1:31 PM

Specimen	ID	Test	Result
Tissue	skeletal muscle	FA - C. novyi	Negative

FA - C. septicum Resulted by: Jaime Osei-Appiah Verified by: Erin Zabek on 12/12/14 @ 1:31 PM

Specimen	ID	Test	Result
Tissue	skeletal muscle	FA - C. septicum	Negative

FA - Clostridium sordellii Resulted by: Jaime Osei-Appiah Verified by: Erin Zabek on 12/12/14 @ 1:31 PM

Specimen	ID	Test	Result
Tissue	uterus mass	FA - Clostridium sordellii	Negative
Tissue	skeletal muscle	FA - Clostridium sordellii	Negative

GNEG Resulted by: Jaime Osei-Appiah Verified by: Erin Zabek on 12/11/14 @ 12:50 PM

	Organism
Antibiotics	Edwardsiella tarda
	cervix
Enrofloxacin	s
Ceftiofur	s
Gentamicin	s
Neomycin	s
Ampicillin-Sulbactam	s
Sulphamethoxazole/Trimethoprim	s
Tetracycline	s
Florfenicol	s
Antibiotic Sensitivity legend: enr = Enrofloxacin, xnl = Excenel, cn = Gentamicin, bneo = Neomycin, sam = Ampicillin-Sulbactum, sxt = Sulfamethoxazole/Trimethroprim, tet = Tetracycline, ffc = Florfenicol	

Molecular Diagnostics

Apicomplexa Resulted by: Julie Bidulka Verified by: Tomy Joseph on 12/12/14 @ 8:30 AM

Specimen	ID	Test	Result

Tissue	tongue,hrt,ln,sk.musc	Apicomplexa	Negative

Test validation in progress.

Brucella spp. Resulted by: A Scouras Verified by: Tomy Joseph on 12/12/14 @ 5:11 PM

Specimen	ID	Test	Result
Tissue	sp,lg,ln	Brucella spp.	Negative

Test validation in progress.

Canine Distemper virus Resulted by: Julie Bidulka Verified by: Tomy Joseph on 12/12/14 @ 8:29 AM

Specimen	ID	Test	Result
Tissue	sp,lg,ln	Canine Distemper virus	Negative

Staff Comments:

Toxicology testing performed by Prairie Diagnostic Services (see att report).

Stephen Raverty, DVM
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END OF REPORT