

Final Report AHC Case: 10-1442

Last Updated: 05/05/10 2:07 PM

Pathologist: Gary D. Marty

Received Date: 04/12/10

Collected Date: 04/06/10

Client Ref No: 7703

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Animal Data

Species: Atlantic Salmon

Breed:

Sex:

Age:

Premise ID:

Case History

Submitted formalized Atlantic salmon tissue for Histopathology and fresh tissue for PCR for IHN, VHS and ISA and tissue culture.

Saltwater entry: 2010 S1. Euthanized: No. Prior submission - Yes, 7701 (2010-1368). DOD: April. 6, 2010.

Fresh dead collected from recent mortalities. Samples submitted had hem on liver, pyloric caeca, swim bladder and in muscle. No bacterial growth on samples taken from these fish. Sent 4 histo and 2 PCR/tissue culture.

Final Diagnosis

1a. Trunk kidney: renal tubular epithelial necrosis, with interstitial fibrin, multifocal, subacute, mild (slide 4), moderate (slide 2), severe (slides 1, 3)

1b. Trunk kidney: hydropic degeneration of renal tubular epithelial cells, diffuse, acute, moderate (slides 1, 2), severe (slides 3, 4)

1c. Trunk kidney: intratubular hemorrhage and fibrin, with hemorrhage within the urinary space, multifocal, moderate (slide 1), severe (slide 4)

2a. Liver: hepatic necrosis, acute, focal, moderate (slide 2)

2b. Liver: sinusoidal congestion, with intracytoplasmic spherical golden to amphophilic inclusions, acute, moderate, focal (slides 2, 4), multifocal (slides 1, 3)

2c. Liver: hepatocellular cytoplasmic vacuoles, diffuse, mild (slide 2), moderate (slides 1, 3, 4)

3. Mesenteric adipose tissue: capillary congestion/hemorrhage, focal, moderate (slide 3), multifocal, moderate (slides 2, 4)

4. Trunk kidney: renal tubular mineralization, multifocal, with dilated tubules and tubular epithelial hyperplasia (nephrocalcinosis), moderate (slide 2)

Final Comment: These fish died from changes that are most severe in the kidney but also include systemic vascular damage. Differentials include infectious disease and toxin exposure; electrocution seems less likely because lesions that might be associated with electrocution (kidney hemorrhage) do not affect all fish. Comments on specific lesions follow:

Renal tubular epithelial necrosis results from acute damage to renal epithelial cells; damage is reversible if the basement membrane is spared (as in this case). Mild cases are fairly common in debilitated fish. Fibrosis in this case is evidence that the necrosis is at least 48 hours old. Renal tubular epithelial necrosis was fairly common among fish sampled in 2009 as part of the Ministry's Fish Health Auditing and Surveillance Program: Atlantic salmon (prevalence = 12% ; n = 511); the cause was not determined in many cases. Differentials include exposure to toxins (e.g., bacterial toxins, algal toxins, heavy metals, or aminoglycoside antibiotics such as gentamicin). PCR results rule out a common cause in saltwater, VHSV.

Hydropic degeneration of renal tubular epithelial cells is evidence of acute damage. Affected cells are swollen by irregular clear cytoplasmic vacuoles. This type of change is rare in renal tubular epithelial cells of cultured salmonids. Potential causes include exposure to toxins or periods of hypoxia followed by reperfusion.

Renal intratubular hemorrhage and fibrin is evidence of damaged glomeruli or other renal vessels. In this case, the hemorrhage is often within tubules that are lined by deeply basophilic epithelial cells (i.e., regenerative epithelial cells). Hemorrhage in the urinary space is evidence that glomeruli are the source of the hemorrhage. This is an unusual lesion that I have seen only 3 other times (before 2010-1368, MH7701), all with Marine Harvest cases and all about the same time of year: 2008-1098 (MH6605), 2008-1462 (MH6615), 2009-1433 (MH7214). The fish have no evidence of infectious disease other than hemorrhage; is there any chance that these fish were electrocuted?

Hepatocellular necrosis can be caused by inadequate vascular perfusion (e.g., as occurs with harmful algal blooms or hypoxia) or direct cytotoxicity from viral or bacterial infections (e.g., viral hemorrhagic septicemia virus, *Renibacterium salmoninarum*, or *Piscirickettsia salmonis*); the cause is not determined in most cases. This case has no obvious organisms, but it is associated with the focus of congestion. Lack of proliferative lesions in the biliary system is evidence against a chronic toxic cause for the hepatic necrosis. Hepatic necrosis is somewhat common in salmon that die in marine net pens, in 2009 affecting 12% of the 514 Atlantic examined as part of the Province's Fish Health Auditing and Surveillance Program.

Multifocal sinusoidal congestion in the liver is a nonspecific vascular lesion. Differentials include algal toxins, substances released from inflammatory cells or bacteria, and infection with VHSV (ruled out in this case by PCR); the cause is usually not determined. Sinusoidal congestion is one of the classic lesions associated with ISAV infections, but ISAV has never been identified in British Columbia. I have seen sinusoidal congestion in farmed rainbow trout fed rancid feed with high mycotoxin concentrations (unpublished data). The golden to amphophilic cytoplasmic inclusions in hepatocytes are large, up twice the size of hepatocyte nuclei. The inclusions are probably remnants of ingested erythrocytes (this type of inclusion has not been described with any salmon virus).

Hepatocellular cytoplasmic vacuoles vary from round (possible lipid) to angular (possible glycogen or fluid). In Atlantic salmon livers sampled as part of the Province's Fish Health Auditing and Surveillance Program, prevalence of these vacuoles steadily increased from 42% in 2006 to 50% in 2007 and 55% in 2008, but then decreased back to 43% in 2009. The change in vacuole prevalence might be related changes in the proportion of plant-based components in commercial feeds. At least some types of vacuoles might be normal; their effect on growth and feed conversion is unknown.

Distension of capillaries in the mesenteric adipose tissue is often part of the inflammatory response to many infectious diseases; hemorrhage sometimes occurs in severe cases. In British Columbia, mesenteric congestion and hemorrhage is most commonly associated with VHSV (ruled out in this case by PCR) and bacterial infections, and sometimes it seems to be associated with a vaccine reaction; the cause is sometimes not determined.

Renal mineralization is common in cultured fish species; when moderate or severe, the condition is termed nephrocalcinosis. The lesion is not considered fatal, although feed conversion may be adversely affected. The pathogenesis is not fully understood, but renal mineralization has been experimentally reproduced through high carbon dioxide levels, magnesium deficiency, selenium toxicity, and a diet low in minerals (source, "Systemic Pathology of Fish", Second edition, 2006, edited by H. Ferguson). Clinically, renal mineralization is most commonly associated with high carbon dioxide levels.

Histopathology

Formalin-fixed tissues from 4 juvenile Atlantic salmon were submitted in 4 cassettes for histopathology. Slide #s 1 - 4 are labeled in the same order as client #s 1 - 4. Organs included on most slides - heart, liver, spleen, head kidney, trunk kidney, intestinal ceca, mesenteric adipose tissue. All organs were examined. Organs not listed elsewhere have no significant lesions.

Quality control: Liver autolysis: mild (slide 3), moderate (slides 2, 4), severe (slide 1). Organs have no postfixation dehydration and no acid hematin deposits.

Measures of physiologic condition:

Hepatocellular glycogen: none (slides 1, 2, 3, 4)

Mesenteric adipose tissue: abundant (all 4 slides)

These measures of physiologic condition are consistent with fish that had been healthy but were not eating full rations at least two days before they died.

Molecular Diagnostics

PCR - IHNV Resulted by: A Scouras Verified by: Dr. J. Robinson on 04/14/10 @ 11:26 AM

Specimen	ID	Test	Result
Tissue	7703-1	PCR - IHNV	Negative
Tissue	7703-2	PCR - IHNV	Negative

PCR - ISA Resulted by: A Scouras Verified by: Dr. J. Robinson on 04/14/10 @ 11:26 AM

Specimen	ID	Test	Result
Tissue	7703-1	PCR - ISA	Negative
Tissue	7703-2	PCR - ISA	Negative

PCR - VHSV Resulted by: A Scouras Verified by: Dr. J. Robinson on 04/14/10 @ 11:26 AM

Specimen	ID	Test	Result
Tissue	7703-1	PCR - VHSV	Negative
Tissue	7703-2	PCR - VHSV	Negative

Virology

Tissue Culture Resulted by: Hughes, Giselle Verified by: Dr. J. Robinson on 05/05/10 @ 2:07 PM

Specimen	ID	Isolate	Result	Level
Tissue	7703-1		No viruses isolated	
Tissue	7703-2		No viruses isolated	

Staff Comments:

Interim report (PDF version) with histopathology and PCR results sent to MH fish health staff via Outlook attachment by GD Marty, Thu 2010-04-15 1:54 PM

History of Communication

Date	To	Description
05/06/10 4:31 PM	Morrison, Diane - fax	bc report generated
05/10/10 10:58 AM	Marine Harvest Canada - e-mail	Case Invoiced



Gary D. Marty
D.V.M., Ph.D., Diplomate A.C.V.P.

These results relate only to the animals or items tested.

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