



## Vertebral column deformity with curved cross-stitch vertebrae in Norwegian seawater-farmed Atlantic salmon, *Salmo salar* L.

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**Abstract:** Pathological changes in the vertebral column of farmed Atlantic salmon in Norway have been reported since the 1990s. Based on the characteristic radiographic findings, we here present a vertebral column deformity named "curved cross-stitch vertebrae" that mainly affects the middle aspect of the vertebral column. Sixty fish, from the west/northwest coast of mid-Norway, were sampled at slaughter and examined by radiography, computed tomography (CT), necropsy, macrophotography, and histology. The vertebral deformities were radiographically graded as mild, moderate, or marked. The main differences between these grades of changes were defined by increased curving of the peripheries of endplates, reduced intervertebral spaces, and vertical displacement of the vertebrae. The curved rims of endplates were located peripheral to a continuous and approximately circular borderline. The CT studies revealed small, multifocal, hypo-attenuating, round to crescent-shaped areas in the notochord, compatible with the presence of gas. Additionally, histology revealed that the axial parts of endplates had circular zones with perforations, through which either notochordal tissue prolapsed into the vertebrae or vascularized fibrochondroid proliferations extended from the vertebrae into the notochord. Inflammation was present in many vertebral bodies. To the best of our knowledge, this is the first report of gas in the notochord of fish.

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