J. Comp. Path. 2018, Vol. 163, 23–28

Available online at www.sciencedirect.com

ScienceDirect

ELSEVIER

www.elsevier.com/locate/jcpa

INFECTIOUS DISEASE: MINI REVIEW

Complex Gill Disease: an Emerging Syndrome in Farmed Atlantic Salmon (*Salmo salar* L.)

A. Herrero*, K. D. Thompson*, A. Ashby†, H. D. Rodger‡ and M. P. Dagleish*

** Moredun Research Institute, Pentlands Science Park, Bush Loan, Penicuik, † Fish Vet Group Ltd., 22 Carsegate Road, Inverness, Scotland, UK and ‡ Fish Vet Group Ireland, Unit 7b Oranmore Business Park, Oranmore, Co. Galway, Ireland*

Summary

Gill disorders have become a significant problem during the marine phase of farming Atlantic salmon (*Salmo salar* L.). The term complex gill disease (CGD) includes a wide range of clinical gill disease presentations generally occurring from the end of summer to early winter on marine Atlantic salmon farms. The gross and histological lesions observed are the resultant culmination of exposure to a mixture of environmental insults, pathogenic organisms and farm management practices. None of the three principal agents purportedly associated with CGD (*Desmozoon lepeophtherii*, salmon gill poxvirus or *Candidatus* Branchiomonas cysticola) have been cultured successfully in-vitro, so individual in-vivo challenge studies to identify their pathogenesis have not been possible. Studies of cohabitation of single pathogen-infected fish with naïve fish, and epidemiological investigations are required urgently to elucidate the roles of these pathogens and other factors in CGD.

© 2018 Elsevier Ltd. All rights reserved.

Keywords: Atlantic salmon; complex gill disease; pathology; salmon farming

Introduction

Gill disease in farmed Atlantic salmon (*Salmo salar* L.) during the marine rearing stage has become highly significant in recent years. In addition to gaseous exchange, fish gills are responsible for several additional critical physiological functions including osmoregulation, excretion of nitrogenous waste, pH regulation and hormone production. Compromised gill function can lead to significant economic losses due to poor food conversion performance, direct mortalities and, where medication is required, the cost of treatment. However, gill diseases are not notifiable, so the true extent of the problem remains unknown. The intimate contact between gills, which are very delicate compared with the integument, and the marine environment, results in their exposure to pathogens, toxins, particulate matter and organisms present within the farm net-pens, making them particularly susceptible to infection and physical damage. Several pathogens have been associated with gill disease, including parasites, viruses and bacteria, and the presence of non-infectious organisms, including harmful phytoplankton such as *Chaetoceros* spp. and certain zooplankton species, such as *Pelagia noctiluca*, are also important threats to salmon health as they can predispose fish to gill disease. Gill disease can be caused by a single pathogen, such as amoebic gill disease (AGD) caused by *Neoparamoeba perurans*. However, clinical disease often presents as a complex syndrome and the primary aetiology can be difficult to establish. The exact pathogeneses, respective roles and contributions of each of the known and putative pathogens present in cases of complex gill disease (CGD) has yet to be elucidated, primarily due to the lack of in-vitro models capable of isolating and

Correspondence to: M.P. Dagleish (e-mail: mark.dagleish@moredun.ac.uk).

0021-9975/$ - see front matter
https://doi.org/10.1016/j.jcpa.2018.07.004

© 2018 Elsevier Ltd. All rights reserved.

propagating the pathogens for use in in-vivo challenge studies.

Complex Gill Disease

The difficulty in establishing the cause of multipathogen and multifactorial gill disease has resulted in inconsistent classification. As such, no specific case definition exists currently. The term 'proliferative gill inflammation' (PGI) was used to describe recurrent gill disease outbreaks occurring in autumn in salmon farms on the southwest coast of Norway and mostly affecting smolts that had been transferred to the sea the previous spring (S1). Histological changes included epithelial cell proliferation, necrosis, inflammation and presence of vascular changes such as lamellar haemorrhage and/or lamellar thrombosis. Proliferative gill disease (PGD) is used as a non-specific term derived from examination of gross lesions in the salmon gill. In addition, the term PGD has been used by pathologists in the past to refer to histological proliferation (i.e. lamellar epithelial cell hyperplasia and fusion of adjacent lamellae), but this is also a non-specific term that describes neither a syndrome nor a disease. In salmon farms along Scotland's west coast, gill disease occurs during the same season as in Norway and has sometimes been referred to as PGD due to the proliferative histological features and uncertain aetiology. The gill disease presentation in Scotland is considered virtually synonymous with PGI in Norway, but with less pronounced inflammatory responses and inconsistent vascular changes. Similar gill disease has been reported in Ireland, Chile and Canada. Other terms, such as 'chronic gill disease' or 'autumn gill disease', have also been used, but due to the variability in the clinical presentation of gill disease no case definition has been established.

CGD is the term currently being used by those working in the field of fish health to refer to this varied syndrome of probable multifactorial aetiology and variable histopathology, and encompasses the syndromes referred to as PGI or PGD in articles published previously, and we wish to formally recognise this term in this review. CGD affects not only S1 smolts, but also other year classes of sea-reared salmon. The disease occurs typically from midsummer to the onset of winter and environmental insults by phytoplankton and/or zooplankton are frequently involved. Fish with CGD generally show non-specific clinical signs of gill dysfunction, such as swimming close to the water's surface or crowding together facing into the incoming current at the side of the pen, increased respiratory rate and/or effort and reduced appetite. Gross pathology is variable, but frequently includes some degree of swollen gill filaments, often accompanied by shortened gill filaments, gill mucus accumulation, petechial haemorrhages and variable degrees of filament pallor (Fig. 1). Lesions can be focal or diffuse and may be limited to a single gill arch or, more commonly, affect several to all gill arches in affected individuals. Cumulative mortalities during CGD outbreaks usually vary from 5% to 20%, but mortalities up to 80% have been reported in extreme cases.

Pathogens Involved in Complex Gill Disease

Several agents have been associated with CGD, but the exact role each contributes to the pathogenesis remains unknown. For example, Atlantic salmon paramyxovirus was detected in fish with PGI, but more recent studies have shown it is not consistently associated with the disease. Salmon gill poxvirus (SGPV) was described in sea-reared salmon in Norway in 2008, although poxvirus has been considered to contribute to gill disease cases in fresh water since the 1990s. Currently, SGPV is considered a significant pathogen of salmon during fresh water production, especially in fry. SGPV has also been associated with gill pallor, loss of body condition and high mortalities during smoltification immediately before and after seawater transfer. Histologically, the presence of apoptotic epithelial cells and chloride-cell hyperplasia in the gills are the main changes associated with SGPV infection (Fig. 2). The changes in the chloride cells suggest that SGPV could affect the smoltification process and predispose the fish to secondary infections by causing direct damage to the respiratory epithelium. Due to the severe proliferation of epithelial cells in gill diseases and

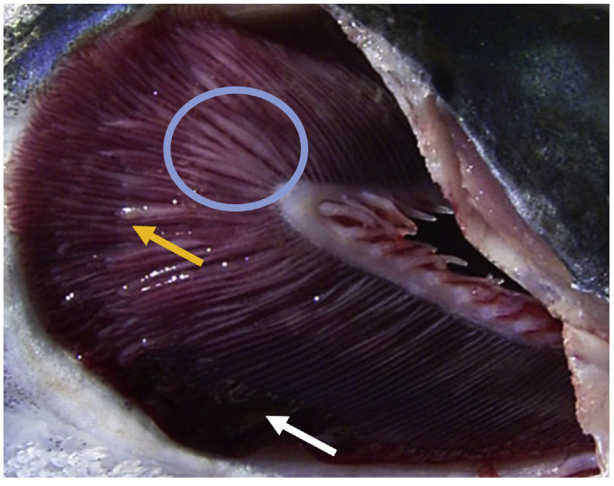

Fig. 1. Grossly thickened gill filaments (yellow arrow), haemorrhage (white arrow) and an amoebic gill disease lesion (blue circle) in a farmed Atlantic salmon.

Download English Version:

https://daneshyari.com/en/article/8500381

Download Persian Version:

https://daneshyari.com/article/8500381

Daneshyari.com