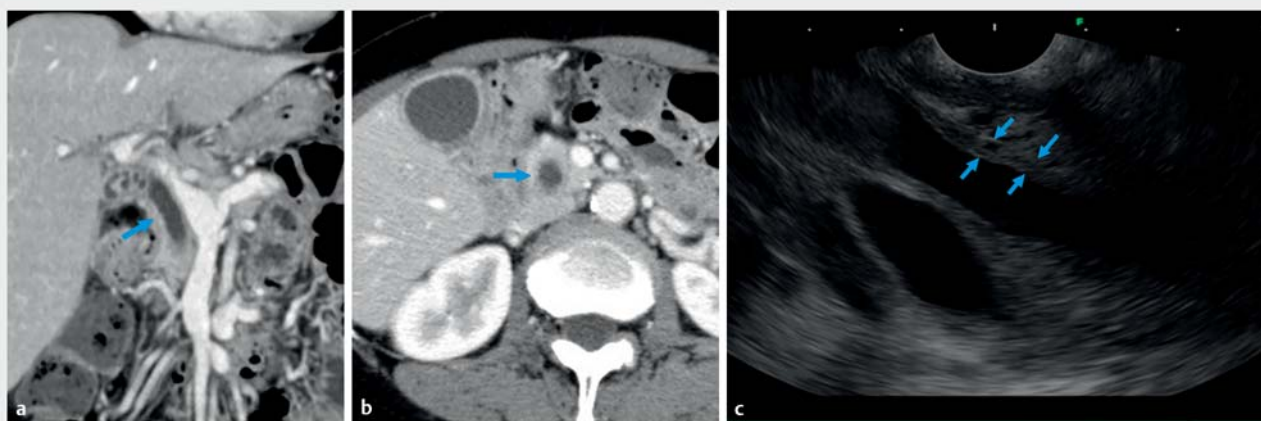


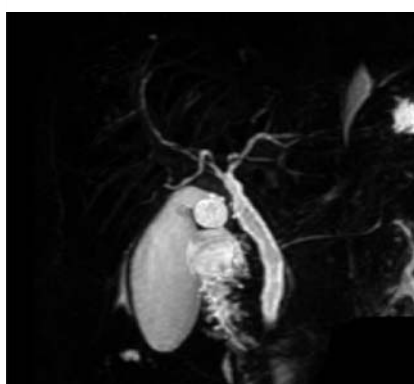
## Cholangioscopic appearance of circular folds in immune-related adverse event cholangitis



► **Fig. 1** Imaging studies showed dilation and diffuse thickening of the common bile duct (arrows). **a, b** Computed tomography. **c** Endoscopic ultrasonography.

Immune checkpoint inhibitors (ICIs) are increasingly being used for various indications in cancer. However, because they affect the immune system, their use may lead to immune-related adverse events (IRAEs). The use of nivolumab is associated with the IRAE cholangitis, which has no established countermeasures [1]. The cholangioscopic findings of cholangitis are nonspecific and include erosion, ulceration, and hemorrhage [2, 3]. We report a case of cholangitis showing circular folds on cholangioscopy.

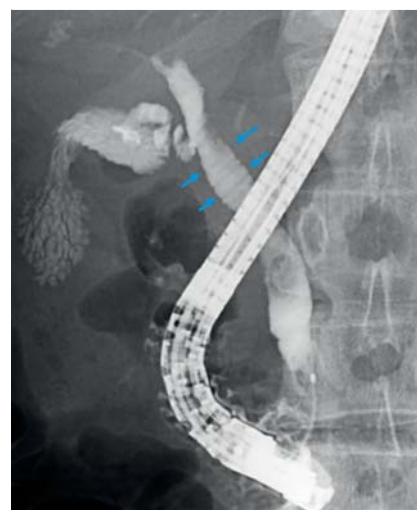
A 68-year-old woman developed fever and elevated hepatobiliary enzymes 2 months after starting pembrolizumab treatment for lung cancer. Computed tomography and endoscopic ultrasonography showed dilation and diffuse thickening of the common bile duct (CBD) (► **Fig. 1**). Magnetic resonance cholangiography showed CBD dilation without intrahepatic bile duct dilation (► **Fig. 2**). Cholangiography showed dilation and shaggy appearance of the CBD (► **Fig. 3**). Cholangioscopy revealed red, edematous circular folds with hemispherical protuberances in the CBD (► **Video 1**). The pathological analysis of the CBD indicated lymphocytic and eosinophilic infil-



► **Fig. 2** Magnetic resonance cholangiography showed dilation of the common bile duct without dilation of the intrahepatic bile duct.

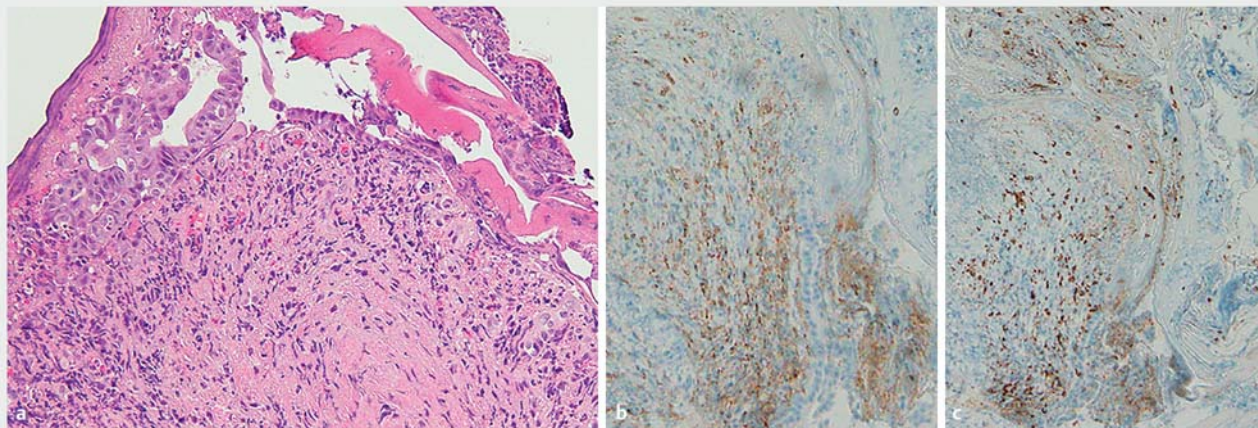
tration below the bile duct epithelium. CD4+ and CD8+ lymphocytes were seen in similar frequencies (► **Fig. 4**). She was diagnosed with cholangitis and treated with 0.8 mg/kg/day prednisolone on day 15 after symptom onset. Thereafter, the fever and elevated hepatobiliary enzymes rapidly improved.

Notably, cholangitis may be confused with ICI-related liver injury, making diagnosis difficult based on imaging findings alone. In our patient, cholangioscopy in-



► **Fig. 3** Cholangiography showed dilation and shaggy image of the common bile duct.

icated edematous circular folds of the CBD mucous membrane, and cholangiography revealed a shaggy CBD wall. Bile duct wall thickening suggests abnormal lymphocytic infiltration. In patients who develop bile duct dilation with thickness on computed tomography and/or endoscopic ultrasonography after ICI treatment, cholangioscopy with biopsy and



► **Fig. 4** Pathological findings of the common bile duct. **a** Chronic active inflammatory cells such as a lymphocytes, acidophiles, neutrophils in the stroma right under the epithelium were revealed with hematoxylin and eosin staining. CD4+ cells (**b**) and CD8+ cells (**c**) were seen in similar frequencies.



► **Video 1** Cholangioscopy showed edematous circular folds with redness and hemispherical protuberance on the common bile duct.



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CD4/8 staining may be helpful for the early diagnosis of cholangitis.

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## Competing interests

The authors declare that they have no conflict of interest.

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