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 infiltration 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 indicated 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

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

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

**Fig. 3** Cholangiography showed dilation and shaggy image of the common bile duct.
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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Fig. 4 Pathological findings of the common bile duct. a Chronic active inflammatory cells such as 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.