Normal bile duct findings using peroral cholangioscopy-guided probe-based confocal laser endomicroscopy (with video)

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Key words
capillary network just beneath the bile duct epithelium, Miami Classification, Normal bile duct, POCS-guided pCLE, reticular network of thin dark branching bands.

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Abstract

We encountered a case of wall thickening of the bile duct in a 69-year-old man. Endoscopic retrograde cholangiopancreatography (ERCP) was performed for detailed examination. When an area considered to be the healthy bile duct was examined by peroral cholangioscopes (POCS) (SPYGlass DS), the vascular network was observed. POCS-guided, probe-based confocal laser endomicroscopy (pCLE; CholangioFlex, Cellvizio; Mauna Kea Technologies, Paris, France), performed using the fluorescein-dripping method on this area, showed a reticular network of thin dark branching bands, which were presumed to be a collagen bundle or lymphatic vessels according to the Miami Classification. However, 8 μm-diameter objects thought to be red blood cells were observed inside the bands, which were considered to correspond to the vascular network observed on POCS. A biopsy specimen of this site was taken. The histological examination demonstrated capillaries just beneath the bile duct epithelium. Thus, the histology also suggested the presence of the vascular network. In this study, we obtained findings that cannot be explained in terms of the Miami Classification, which we describe here with a video.
useful because we can carry out pCLE under the direct view of POCS. pCLE of the region of interest under POCS guidance and directed biopsy are required to ensure that pCLE findings can be accurately matched up with biopsy tissue.

In this study, we performed POCS-guided pCLE and direct biopsy of the healthy bile duct and used the Miami Classification for diagnosis. However, we obtained findings that cannot be explained in terms of the Miami Classification, which we describe here with a video.

**Case report**

We encountered a case of wall thickening of the bile duct in a 69-year-old man. ERCP was performed for detailed examination (Video S1, Supporting information). The cholangiography did not show any bile duct abnormalities (Fig. 1a). When an area considered to be the healthy bile duct was examined by POCS (SPYGlass DS), a vascular network was observed (Fig. 1b). POCS-guided pCLE performed by the fluorescein-dripping method on this area showed a reticular network of thin dark branching bands, which were presumed to be a collagen bundle or lymphatic vessels according to the Miami Classification (Fig. 1c,d). However, 8 μm-diameter objects thought to be red blood cells were observed inside the bands (Fig. 1d), which were considered to correspond to the vascular network observed on POCS. A biopsy specimen of this site was taken. The histological examination demonstrated capillaries just beneath the bile duct epithelium, which were further confirmed by the CD34-positive and D2-40-negative immunohistochemistry (Fig. 1e–h). Thus, the histology also suggested the presence of the vascular network. The pCLE image seemed to reflect the histological findings. We referred the patient to his previous doctor for follow-up. We asked him or her to contact us if any change occurred. Although about 1 year has passed, there are no changes in this patient so far.

**Discussion**

In previous studies, the authors presumed that the dark branching bands corresponded to lymphatics or thin collagen bundles. In this case, we confirmed that the vascular network observed using POCS corresponded to dark branching bands observed using pCLE. Moreover, we confirmed the presence of 8 μm-diameter objects inside the bands, presumed to be red blood cells. Because we obtained the biopsy specimen under direct view of POCS, we believe that the vascular network observed under POCS, the dark branching bands seen under pCLE, and the biopsy specimen are roughly the same. However, we cannot completely rule out the possibility that lymphatic or collagen fiber may present as such under pCLE. We should conduct further studies to prove these findings.

In summary, the reticular network of thin, dark, branching bands according to the Miami Classification may have actually represented the capillary network just beneath the bile duct epithelium, which needs to be confirmed by further studies.

![Figure 1](image-url)

(a) The cholangiography did not show any bile duct abnormalities. (b) When an area considered to be the healthy bile duct (a) pink arrow) was examined by peroral cholangioscopy (POCS), a vascular network was observed. (c,d): POCS-guided, probe-based confocal laser endomicroscopy (pCLE; CholangioFlex, Cellvizio; Mauna Kea Technologies, Paris, France), performed using the fluorescein-dripping method on this area, showed a reticular network of thin dark branching bands; 8 μm-diameter objects thought to be red blood cells were observed inside the bands (pink arrow). (e) The histology of the biopsy demonstrated capillaries just beneath the bile duct epithelium, which was detached artificially (HE, orig. Mag. x400). (f) Immunostaining of CD34, which was positive for the capillaries beneath the epithelium (orig. Mag. x400). (g) Immunostaining of CK7, which was positive for the artificially detached bile duct epithelium (orig. Mag. x400). (h) Immunostaining of D2-40, indicating the absence of lymphatic channels beneath the epithelium (orig. Mag. x400).
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Supporting information

Additional supporting information may be found in the online version of this article at the publisher’s website:

Video S1. The cholangiography did not show any bile duct abnormalities. When an area considered to be the healthy bile duct was examined by peroral cholangioscopes (POCS) (SPYGlass DS), a vascular network was observed. POCS-guided pCLE, performed using the fluorescein-dripping method on this area, showed a reticular network of thin dark branching bands, which were presumed to be a collagen bundle or lymphatic vessels according to the Miami Classification. However, 8 μm-diameter objects thought to be red blood cells were observed inside the bands, which were considered to correspond to the vascular network observed on POCS. A biopsy specimen of this site was taken.