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Histological evidence of a connection between true and false lumen in spontaneous coronary artery dissection

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ABSTRACT

The pathophysiological mechanism underlying spontaneous coronary artery dissection remains unclear. Although an endothelial-intimal disruption is assumed to be involved as either a primary or secondary event, the presence of a tear in the coronary intima has not been histologically presented, to our knowledge. We present three autopsy cases of spontaneous coronary artery dissection in which histopathological examination revealed an intimal tear and connection between true and false lumen in the area of the dissection.

The pathophysiological mechanism underlying spontaneous coronary artery dissection (SCAD) remains unclear [1]. According to the outside-in theory, the primary event is an intramural hemorrhage, probably due to rupture of a micro-vessel traversing the *tunica media*. This pressurized intramural hematoma, creating a false lumen, may then rupture into the true lumen to create an apparent tear. The second hypothesis states that an endothelial-intimal disruption is the primary event, allowing blood from the true lumen to enter the *media*, creating a false lumen. However, the presence of a tear in the coronary intima and a connection between the true and false lumen have not been histologically presented, to our knowledge. The largest histopathological study to date, including 36 autopsy cases of SCAD, did not find any structural abnormalities of the coronary intima or internal elastic lamina [2].

We present three autopsy cases of SCAD in which histopathological examination revealed an intimal tear in the area of the coronary artery dissection. The first case is a 53-year-old female with no relevant medical history who underwent emergency coronary artery bypass grafting for myocardial infarction due to SCAD. After 3 weeks, treatment was stopped due to postoperative complications. Autopsy confirmed the presence of SCAD of the left main coronary artery (with connection between true and false lumen) extending to the left anterior descending artery (LAD) and left circumflex artery (Fig. 1). The *tunica media* at the site of intimal rupture appeared relatively thin, thereby potentially creating a vulnerable site for the rupture to occur. We cannot completely rule out that a coronary artery intervention may have caused the connection. However, this seems less likely as we did not find any other significant stenosis explaining the initial massive myocardial infarction.

The second case is a 44-year-old female with DEPDC5-related epilepsy who presented with therapy-refractory ventricular arrhythmias. Postmortem investigation showed multifocal dissections in the LAD, first diagonal artery (with connection between true and false lumen) and the posterior interventricular artery with associated myocardial infarction (Fig. 2). At the site of the intimal tear, fibrinoid necrosis and a mixed chronic inflammatory infiltrate were observed. From our previous work we may conclude that this inflammation is a time dependent and localized healing response to the injury, rather than a causal vasculitic process [2].

The third case is a 44-year-old male with no relevant medical history who suffered out-of-hospital cardiac arrest. Autopsy revealed a SCAD in the right coronary artery with associated myocardial infarction and hemopericardium (Fig. 3). In each case, the intima, internal elastic lamina, and media were disrupted, thereby resulting in a connection between true and false lumen. None of

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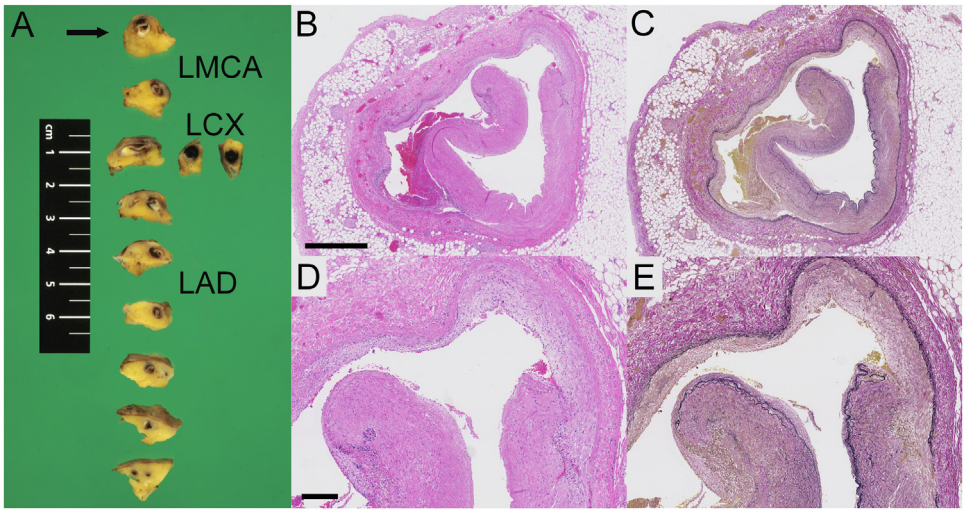

Fig. 1. Patient 1. (A) Gross of SCAD of left main coronary artery (LMCA) extending to the left anterior descending (LAD) and circumflex (LCX) arteries. Arrow indicates the level of the connection between true and false lumen. (B and C) Histology of LMCA at the level of the connection. Hematoxylin and eosin and elastic van Gieson stains. Bar = 1 mm. (D and E) Higher magnification of rupture of intima and media inducing a connection between true and false lumen. Note a disruption of the internal elastic lamina. A "neointima" is covering the surface area of the false lumen, concordant with the 3-week interval between dissection and death of the patient. Bar = 200 µm.

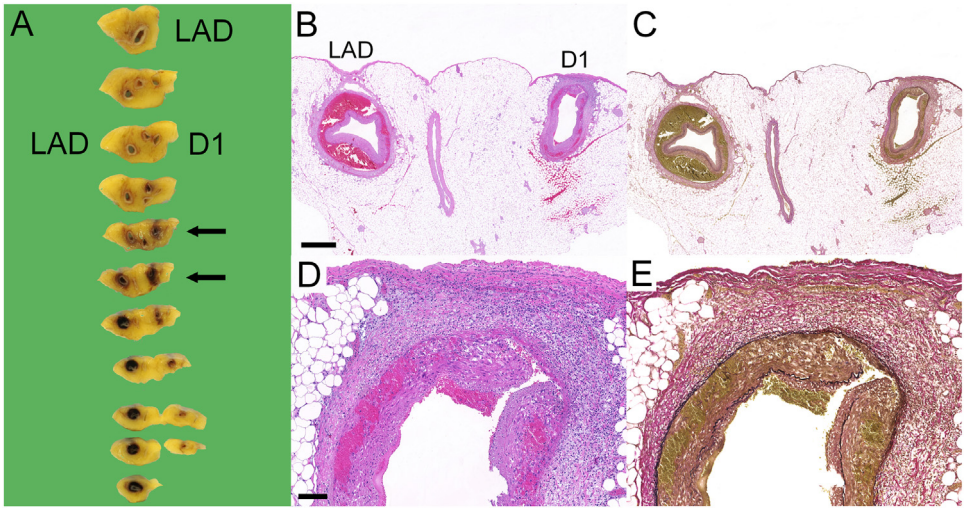

Figure 2. Patient 2. (A) Gross of SCAD in LAD and first diagonal artery (D1). Arrow indicates the level of the connection between true and false lumen. Note that at the level of split off of the D1 from the LAD there is no SCAD, indicating that there is no connection between the SCADs in both arteries. (B and C) Histology of LAD and D1. Bar = 1 mm. (D and E) Higher magnification of D1 with intimal tear and fibrinoid necrosis in the wall with adventitial reactive inflammation. Bar = 100 µm.

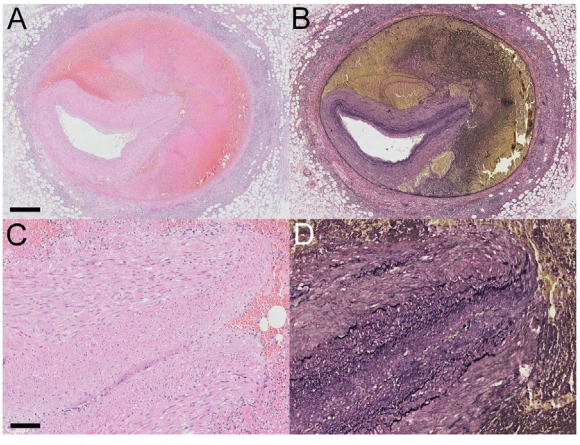

Figure 3. Patient 3. (A and B) Histology of right coronary artery with intramural hematoma and rupture with opposed walls and narrowing of lumen. Bar = 0.5 mm. (C and D) Higher magnification of area with rupture and connection between true and false lumen. Bar = 100 µm.

the patients showed evidence of fibromuscular dysplasia in the coronary arteries.

Intracoronary imaging studies using angiography and optical coherence tomography have demonstrated the presence of fenestrations between the true and false lumen in SCAD [3–5]. These fenestrations were found to occur after the development of the intramural hematoma. Furthermore, these studies provided evidence of false lumen pressurization, suggesting secondary intimal rupture due to high pressure in the false lumen. Our findings in patient 2 support this theory as we observed three separate areas of SCAD in three arteries and only in one artery a connection between true and false lumen. This also makes it more plausible that the intimal rupture is a secondary event that occurs in some cases. The presence of an intimal tear in SCAD may also carry a protective effect, possibly by decompression of the intramural hematoma in the coronary lumen [5].

Our observations for the first time, to our knowledge, histologically confirm the presence of an intimal tear in some cases of SCAD that probably is a secondary event following an intramural hematoma.

Declaration of Competing Interest

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