Supplementary Materials

Supplementary Video 1: Overview of the notched aorta at different pressure steps until dissection. Transverse slices of 5 scans (0 mmHg, 100 mmHg, 200 mmHg, 300 mmHg, and 0 mmHg after dissection) are shown. The pressure present inside the aorta is indicated on the top left corner. The aortic wall and intimal tear are indicated, as well as the false and true lumen after dissection. The isotropic voxel size is 3.02 µm.

Supplementary Video 2: Real-time aortic dissection recorded using radiographic images. The complete dissection of the sample can be observed when the critical pressure is reached. The dissection length follows an exponential curve as shown in Figure 7.

Visualization of the descending aorta with conventional computed tomographic

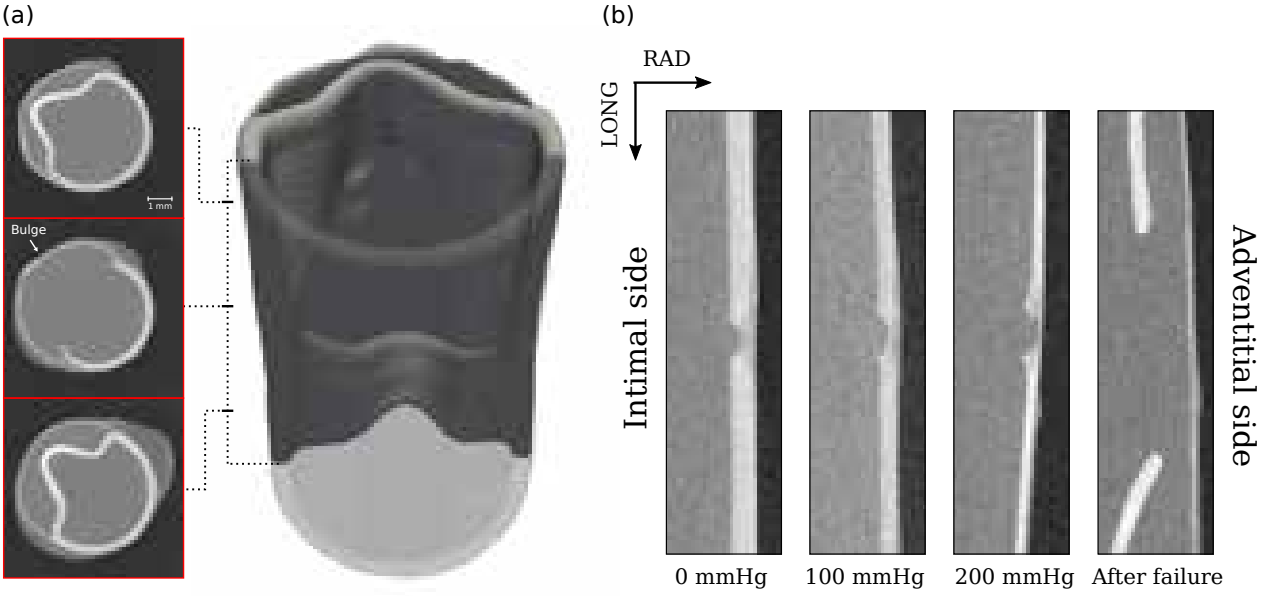

Figure S1: **(a)** Three-dimensional segmentation of a representative specimen with a circumferential notch after aortic dissection. Three cross-sections were displayed at different locations along the longitudinal axis. The length of the portion of the specimen observed here is 8.75 mm. The outer wall presents a bulge in the middle cross-section. **(b)** Front view of the aortic wall with a focus on the notch at different pressures and after propagation of the dissection along the aorta. The intimal side is on the left whereas the adventitial side is on the right. The sample dissected at a critical pressure of 477 mmHg

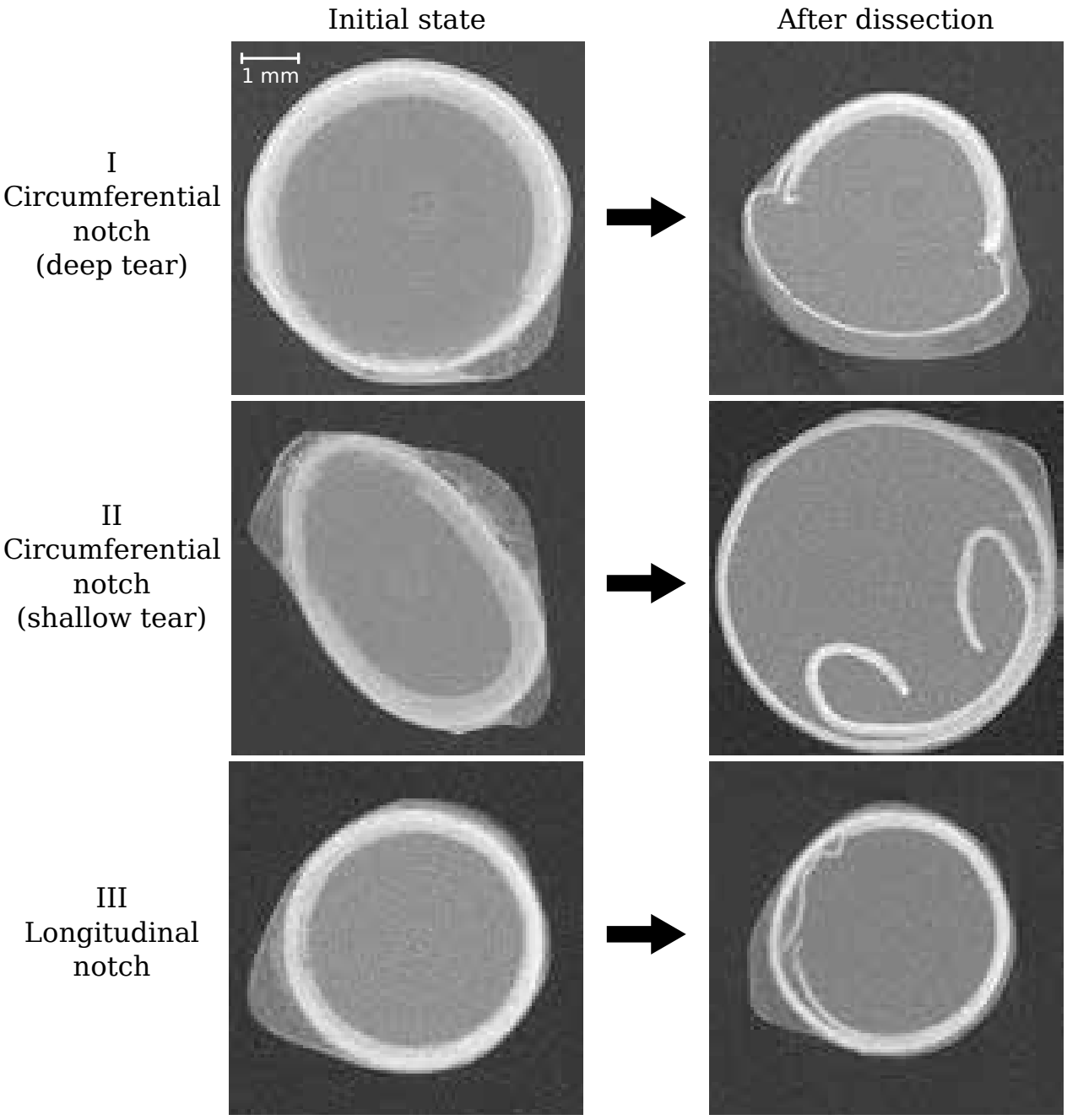

Figure S2: Cross-sections of three specimens at the beginning of the inflation test and after propagation of the dissection. Three different types of initial notches are presented. The initial and final scans were taken at 0 mmHg of pressure. The images show the middle of the sample, where the depth of the notch is the highest. The specimens were named I, II, and III for simplicity. The positions of the notches are bottom in sample I, top-left in sample II, left in sample III. In specimen I, the propagation followed a similar path to the one presented in Figure 3. In sample II the notch propagated on a large part of the circumference but also in the radial-longitudinal plane along the segment. In sample III the notch propagated also in the circumferential direction and in the radial-longitudinal plane.

Influence of intercostal arteries on dissection propagation

During the preparation of the sample, the notch was made between the intercostal arteries in order to avoid any interferences with the dissection. Due to the field of view, it was rarely possible to see the aortic dissection interact with a branch. However, in one of the samples, the dissection was stopped in the circumferential direction by an intercostal artery, leading to the rupture of the aortic wall near the branch ostium, as shown in Figure S3.

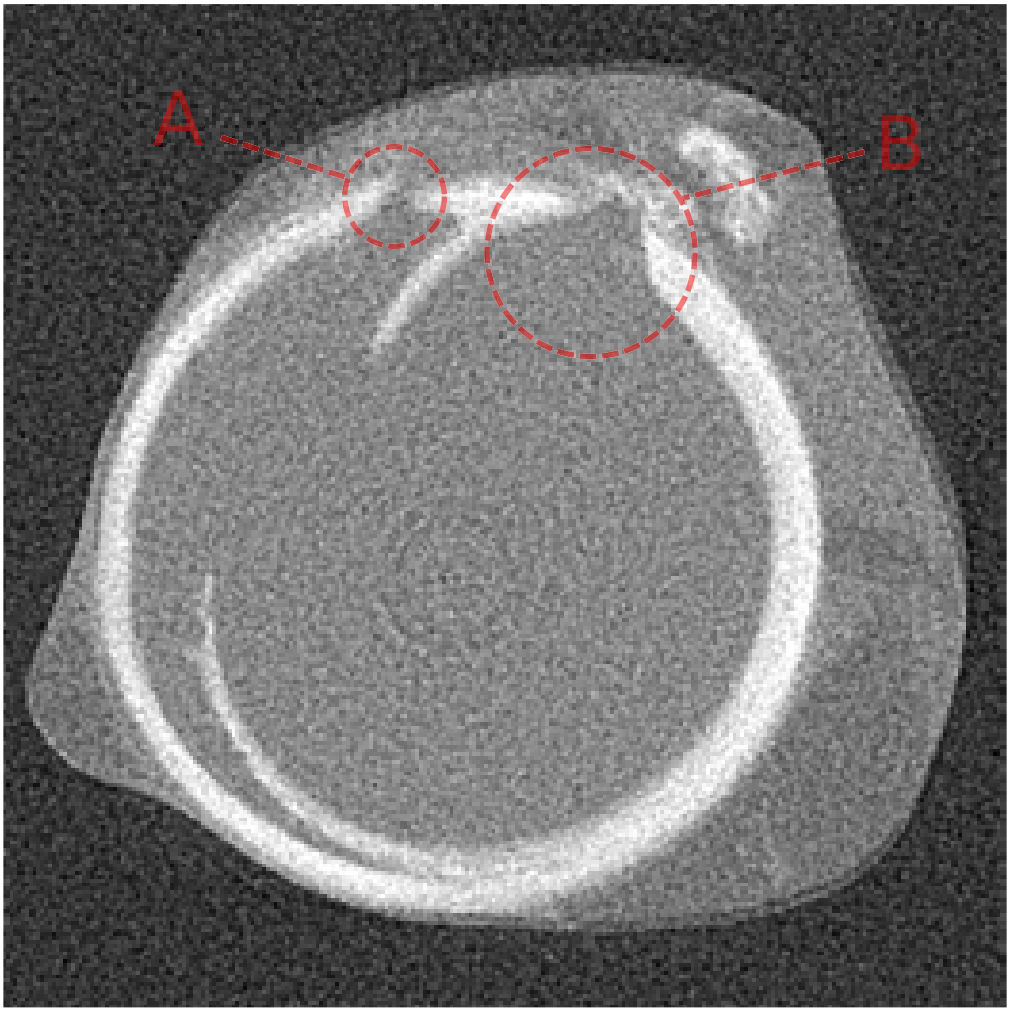

Figure S3: Cross-section of a dissected sample. The circumferential propagation of the notch was stopped by an intercostal branch (B). As a consequence, the wall ruptured near the small branch (A). Conversely, the propagation of the notch in the longitudinal direction was not affected.

Visual artifacts in obtained CT scans

Some visual artifacts are present on the obtained images due to the characteristics of X-ray CT imaging and reconstruction, and should not be interpreted as structural elements of the aortic segments. In particular, a white outline surrounds the outer envelope due to the sudden change in refraction index, and should not be mistaken with the adventitial layer. Besides, white streaks and bands can be seen in heterogeneous regions (e.g. presence of air bubbles) and also surrounding the outer wall. These artifacts are present in Figure 1, 2, 3, 4, 5. 6. Finally, ring artifacts can be seen in Fig. S2 and S3.