

Freezing motions of the intimal flap after acute aortic dissection with ECG-gated CT angiography

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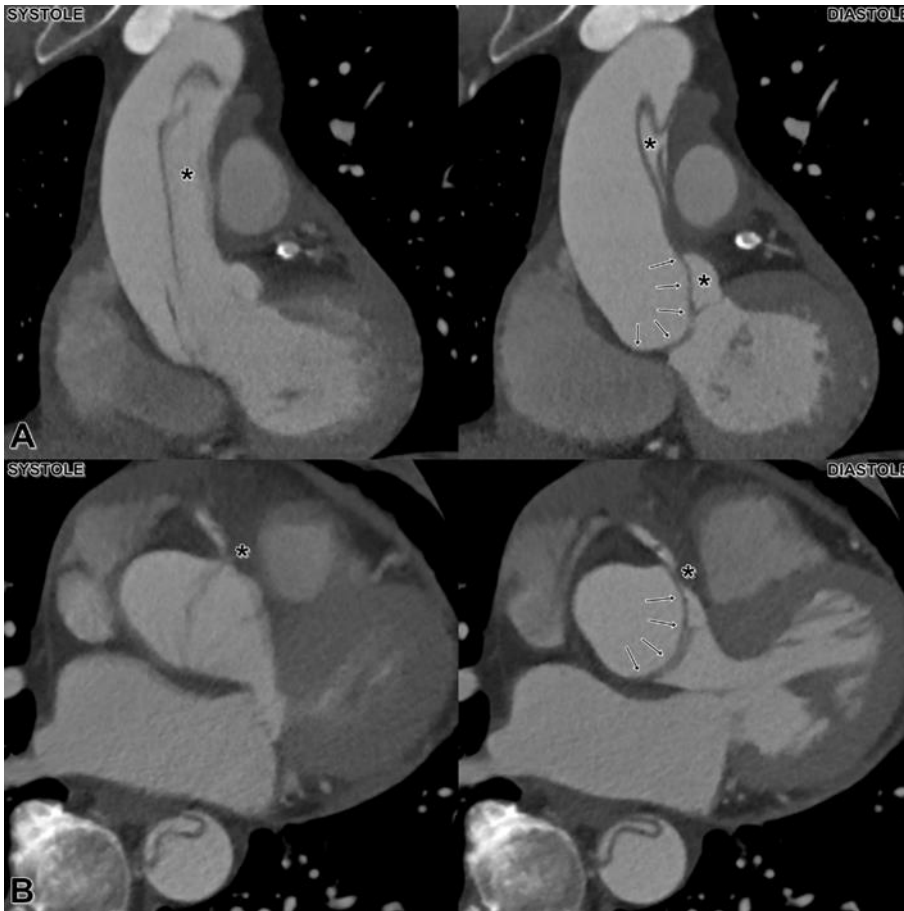
Brief title: Intimal motions in acute aortic dissection

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CT angiography is the gold standard imaging modality in acute aortic dissection. Recent achievements in technology made image acquisition quick enough for the ECG-gated angiography of the whole aorta during one breath-hold. Latest versions of iterative image reconstruction algorithms and low-noise x-ray detectors resulted in significant dose and/or image noise reduction, both being comparable to conventional non-ECG-gated scans (1). This huge progression in non-invasive diagnostic testing allows us to clearly visualize the undulating intimal flap in acute aortic dissection and to accurately assess side-branch involvement and ostial anatomy (2). Understanding the motion characteristics of the intimal septum is fundamental in the planning of targeted interventions which can lead to better prognosis. In this collage, we demonstrate the typical patterns of intimomedial membrane motion at those specific levels of the thoracic and abdominal aorta requiring special attention when evaluating acute aortic dissection with ECG-gated CT angiography.

Keywords: restrospective gating, dynamic CT, dynamic stenosis

Figure 1. Coronal and axial views of the aortic root



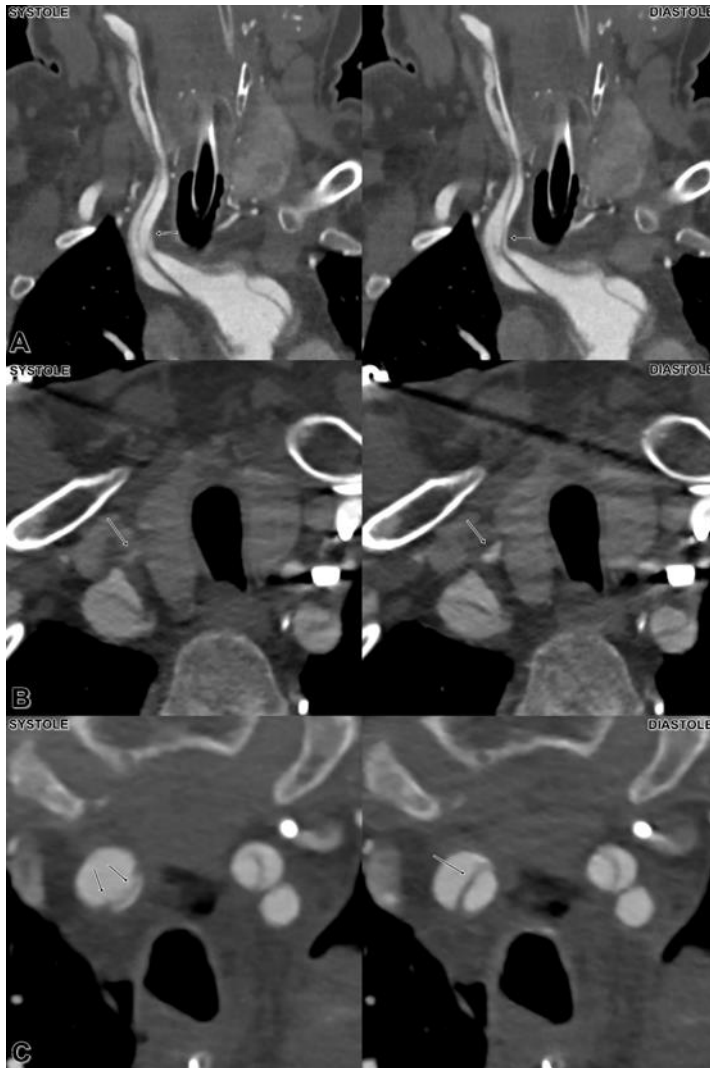
As aortic dissections involving the ascending aorta require urgent surgical intervention, there is usually no need of sophisticated anatomical evaluation preoperatively. However, properly done ECG-gated CT angiography of the aortic root can help to identify patients at high risk of fatal complications. A series of images reconstructed in the same phase of the R-R cycle can eliminate or reduce motion artefacts that usually appear in the region of the aortic root. A static image of the systolic phase can show a patent true lumen and stenotic right coronary ostium. Functional datasets can reveal the instability of the aortic root: the diastolic collapse of the true lumen (**A**, asterisk, movie), the prolapse of the intimal flap onto the aortic valve leaflets (**A** and **B**, arrows) and the diastolic occlusion of the right coronary ostium (**B**, asterisk, movie).

Figure 2. Axial and oblique views of the thoracic and abdominal aorta



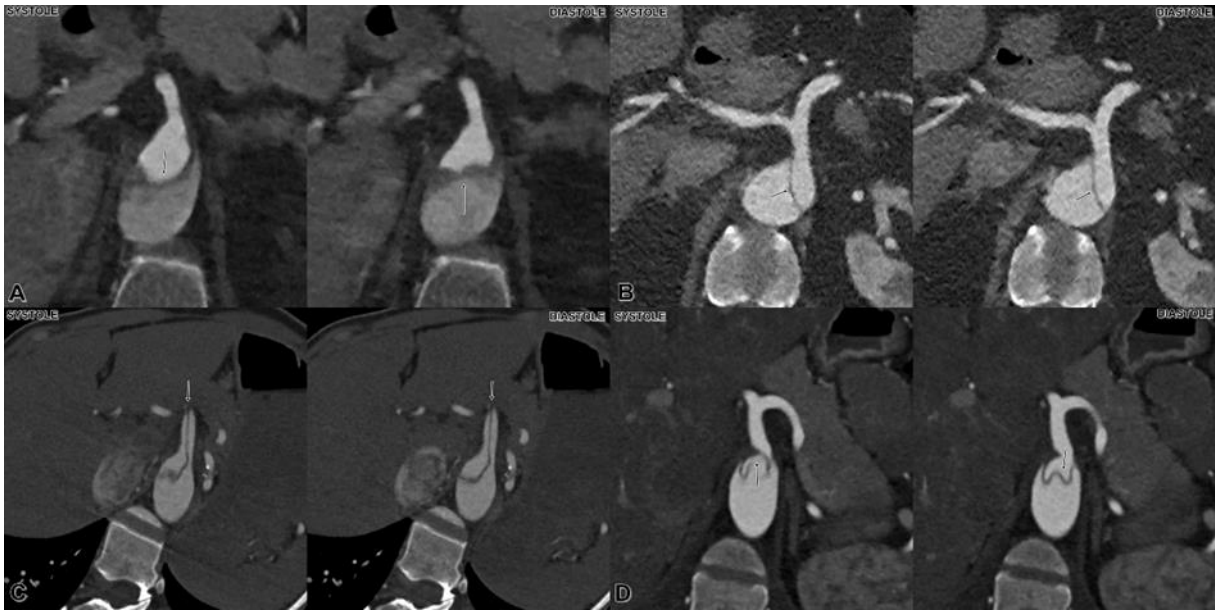
Patent true and false lumen is found in most cases of acute dissection with a mild diastolic expansion of the latter both in the thoracic and abdominal segments (**A**, asterisk, movie). A systolic collapse of the true lumen in the abdominal segment of the aorta can impair visceral perfusion (**B**, arrows, movie). Wide fenestrations of the upper abdominal aorta can lead to static collapse in the infrarenal segment, usually coupled with lower limb ischemia (**C**, arrow, movie).

Figure 3. Coronal and axial views of the supraaortic vessels



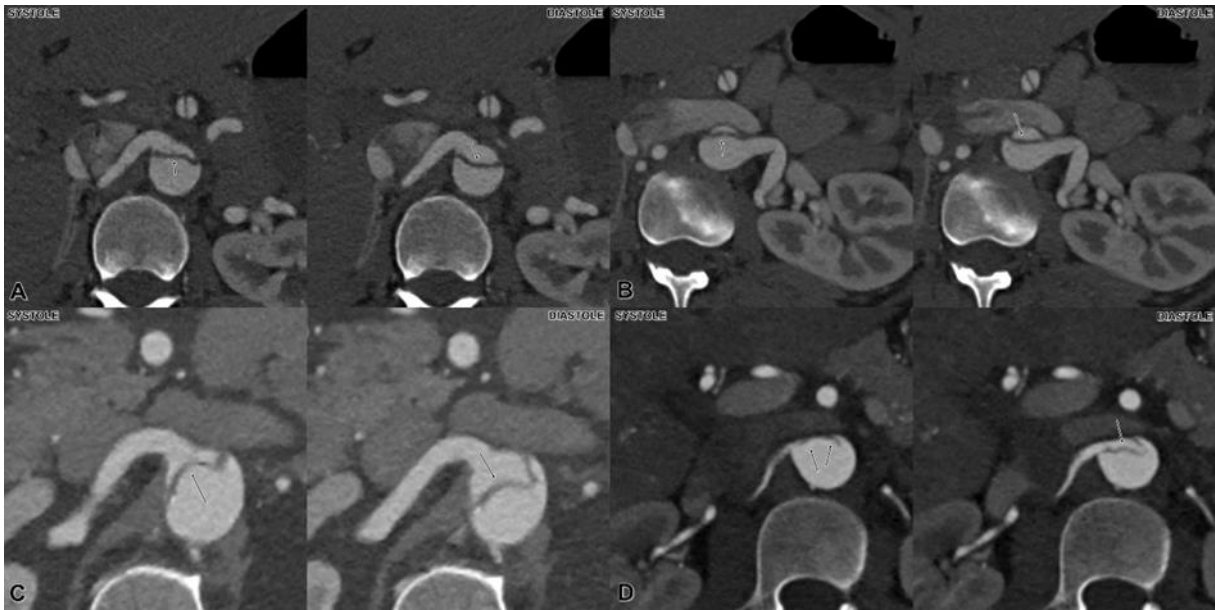
Supraaortic extension is usually of major concern as planning the access sites for selective antegrade cerebral perfusion is essential. Also, decision has to be made whether or not there is a need of carotid revascularization. Usually there is a partial diastolic collapse of the true lumen at the proximal third of the common carotid artery (**A**, arrow, movie). Depending on the morphology of the ascending aortic and arch intimal membrane, there may be a restriction of the inflow of the true lumen and/or increased inflow of the false lumen during systole, leading to partial systolic collapse in the brachiocephalic trunk (**B**, arrow, movie) or complete systolic collapse in the common carotid artery (**C**, arrows, movie).

Figure 4. Axial views of the celiac trunk and the superior mesenteric artery



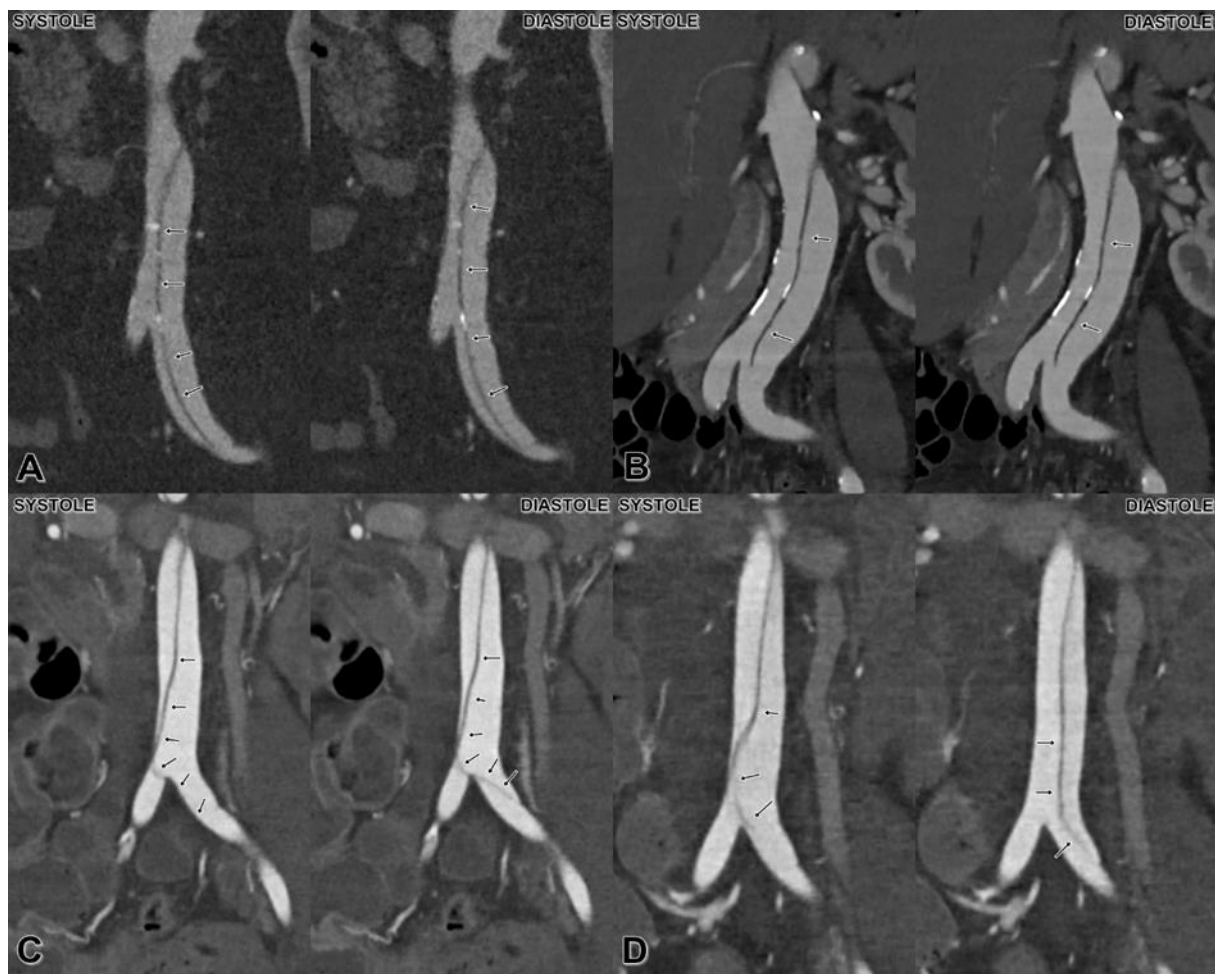
Usually there is a mild diastolic collapse in the true lumen, without any hemodynamic effect (**A**, arrow, movie). The attachment line of the intimomedial membrane is in the close proximity of the visceral ostia in the majority of cases. This is not always associated with impaired perfusion. A non-mobile intimal flap between a patent true and false lumen is a sign of comparable pressure levels on the two sides of the dissection membrane – end-organ ischemia is unlikely (**B**, arrow, movie and **C**, arrow, movie). Peculiar fenestrations and refenestrations can be coupled with the systolic collapse of the true lumen, with the intimal flap prolapsing onto the visceral ostia (**D**, arrow, movie).

Figure 5. Axial views of the renal arteries



At least one renal artery ostium is often affected by the dissection (usually the right side). Close proximity of the intimomedial membrane is not always associated with impaired perfusion, a stable membrane and patent lumina generally means good perfusion (**A**, arrow, movie, and **B**, arrow, movie). Partial (**C**, arrow, movie) or complete (**D**, arrows, movie) systolic collapse can also be found, usually leading to renal insufficiency and/or hypertension.

Figure 6. Coronal views of the aortic bifurcation



Various morphology can be found at the level of the aortic bifurcation depending on the localization of the distal reentry. Patent lumina and stable intimal flap is unlikely to cause limb ischemia, extending into the common iliac artery (**A**, arrows, movie) or not (**B**, arrows, movie). Inadequate inflow of the true lumen can cause the intimomedial membrane to prolapse onto one of the common iliac artery ostia, leading to a systolodiastolic stenosis and lower limb ischemia (**C**, arrows, movie). Increased perfusion of the true lumen after ascending aortic reconstruction in the same case is associated with the regression of limb ischemia: only a systolic stenosis is present (**D**, arrows, movie).

References

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