Acute Arterial Occlusion

If acute occlusion of the abdominal aorta or branch vessels occurs, two causes have to be considered: (1) embolization and (2) dissection.

Embolization

Embolization is most common in elderly patients with atrial fibrillation, a history of myocardial infarction, and aortic aneurysm. Embolization from the heart or thoracic aorta may cause acute subtotal or total occlusion of the celiac artery, superior mesenteric artery (SMA), inferior mesenteric artery (IMA), or the renal arteries. The most common causes of embolization are:

- atrial fibrillation;
- thoracic aortic aneurysm;
- myocardial infarction with mural thrombus formation;
- advanced aortic arteriosclerosis;
- perforating arteriosclerotic ulcer;
- hypercoagulability syndrome.

The symptoms of acute ischemia are dependent on the involved vascular territory. Embolization to the liver or spleen may cause acute right or left upper abdominal pain. Acute mesenteric ischemia typically causes severe abdominal pain and bowel paralysis. Embolization to the kidney results in flank pain, hematuria, and hypertension. In any case, severe elevation of serum lactate dehydrogenase levels points to the ischemic nature of the acute pain. In case of complete ischemia without a sufficient collateral circulation, the warm ischemic time tolerated by the abdominal organs is <6 h. Therefore acute diagnosis and therapy are mandatory.

The primary diagnosis is made by CT with contrast enhancement injected at a concentration of 300-400 mg iodine/mL and at an injection rate of 4 mL/s, with a total bolus volume of 80-120 mL. A bolus care technique with a delay of 20-40 s is used. The CT settings are 2-mm collimation, pitch = 2, with a reconstruction interval of 1 mm. In the arterial phase, the obstructing embolus and the ischemic territory can be visualized. In the delayed phase, residual perfusion through the collateral arteries may be demonstrated.

Interventional treatment with a thrombectomy device and/or local intra-arterial fibrinolysis with recombinant tissue plasminogen activator (loading dose 10 mg, infusion dose 5 mg/h) or urokinase (loading dose 250,000 IU, infusion dose 100,000 IU/h) together with a glycoprotein IIb/IIIa antagonist (Aciximab: loading dose 0.25 mg/kg, infusion dose 0.125 mg/kg/h) is one option. The other option is surgery, which may be faster, enables inspection, and, if necessary, resection of the ischemic organs.

Dissection

Patients with chest trauma, chronic severe hypertension, or a connective tissue disease such as Marfan syndrome or Ehlers-Danlos syndrome are vulnerable to aortic dissection. Acute type A and B aortic dissection may cause dynamic compression of the true lumen of the aorta by the pressurized false lumen. This can result in acute ischemia of the liver and spleen, the bowel, and one or both kidneys. The dissection plane may also run into one of the arteries perfusing the organ, thereby causing obstruction of the true lumen.

There are several options in the interventional treatment of dissection. First, in case of dynamic compression of the true aortic lumen, occlusion of the proximal entry into the false lumen with an aortic stent graft will decompress the false lumen and result in re-opening of both the true lumen of the aorta and the side branches (Fig. 1). Second, in case of static compression due to a side-branch dissection, stent placement in the true lumen of the organ artery will reconstitute organ perfusion. Third, in case of organ perfusion through the false lumen, balloon fenestration of the intimal flap will re-establish flow into the malperfused territory.

Chronic Arterial Oclusive Disease

In young patients, potential causes of chronic arterial occlusion are fibromuscular disease, Takayasu arteritis, and Recklinghausen neurofibromatosis. In elderly patients, the primary cause of chronic arterial occlusive disease is arteriosclerosis.
Mesenteric Artery Stenosis

Between the three large mesenteric arteries (celiac artery, SMA, IMA) there are two main collateral pathways: (1) the pancreatico-duodenal arteries and the arc of Buehler, between the celiac artery and SMA; (2) the arc of Riolan and the marginal artery of Drummond, between the SMA and IMA. Therefore, an obstruction of at least two mesenteric arteries is necessary to cause ischemic symptoms. The typical clinical symptom is abdominal angina, with abdominal pain in 94% of patients, post-prandial cramps in 86%, weight loss in 74%, abdominal bruit in 70%, and diarrhea.

The primary diagnosis is made by computed tomography angiography (CTA), magnetic resonance angiography (MRA), or by intra-arterial catheter angiography of the abdominal aorta in a lateral projection. Interventional treatment consists of percutaneous transluminal angioplasty (PTA) with or without secondary stent placement in at least one of the obstructed arteries.

The causes and symptoms of chronic arterial occlusion depend on the obstructed artery and its location. In

Fig. 1 a-f. Complicated type B aortic dissection. CT demonstrating (a) primary entry tear of type B aortic dissection and (b) compression of true lumen of the aorta. c Aortic angiogram showing true and false lumen of type B dissection. d Aortography showing compression of the true lumen, with malperfusion of the superior mesenteric and renal arteries (“floating visceral sign”). Aortography (e) after stentgraft implantation and closure of primary entry tear, and (f) following stent graft implantation, which demonstrates spontaneous revascularization of the visceral arteries.