Ask the Experts:
PAU: When Do You Intervene?

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Penetrating aortic ulcers (PAUs) are still a challenging entity to understand and treat effectively. Unlike more conventional pathologies, such as degenerative aneurysms and dissections, PAUs have features of both, yet are usually smaller and less impressive on imaging. As a result, this may cause lower levels of concern on the part of radiologists and referring physicians and decrease the likelihood for referral or consultation. Having said that, the paradox is that PAUs represent a focal disruption of the aortic wall that may have a greater propensity for rapid development, expansion, and rupture leading to acute aortic syndrome (AAS). In fact, PAUs account for a disproportionate number of cases of AAS, medical management is generally not effective, and timely intervention for symptomatic patients is almost always warranted. Therefore, PAUs actually deserve a higher level of attention and lower threshold for referral, especially when found incidentally on imaging prior to any onset of symptoms. As far as diagnosis is concerned, axial imaging remains the standard for PAU. Thin-slice CT and three-dimensional reconstruction provide sufficient detail to define the exact location, depth, extent of related atherosclerosis, and proximity of the defect to aortic branches. MRI/MR angiography have also been shown to be useful but have not been routinely adopted. Transesophageal echocardiography can be useful intraoperatively. The natural history of PAUs is unclear, but they can be associated with intramural hematoma, which likely poses a higher rupture risk and likelihood for intervention. Otherwise, if left untreated, PAUs likely progress to frank aortic dissection or saccular aneurysm formation.

The threshold for treatment still varies from practice to practice with no defined clinical guidelines or definitions. Symptomatic patients should be treated urgently. For asymptomatic patients, some clinicians still use a maximal aortic diameter measurement of ≥ 55 mm as a treatment threshold. Due the focal nature of the weakness in the aortic wall, we have adopted an axial measurement of the PAU itself from the true aortic wall to the deepest point of the ulcer to guide therapy. A distance ≥ 50% of the true aortic luminal diameter is a reasonable threshold for intervention. The association of an intramural hematoma or a pleural effusion/hemothorax would obviously lower the threshold for treatment. These objective measurements are factored in with other less defined criteria, such as location of the PAU relative to visceral vessels, character of the adjacent aorta, extent of coverage required, complexity of repair, access vessel anatomy, and overall health of the patient and their perioperative risk, etc. Fortunately, treatment is often fairly straightforward. Because the majority of PAUs occur in the descending thoracic aorta, they are often readily amenable to thoracic endovascular aortic repair. The technical conduct follows standard protocols for thoracic endovascular aortic repair to define proximal and distal landing zone diameters and lengths, required length of coverage, and proximity to the left subclavian and/or celiac artery. In many cases, a single stent graft can be used to cover the defect, with longer coverage and use of adjunctive snorkels reserved for more complex anatomy.

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One of the main challenges when deciding on endovascular intervention for thoracic aortic pathologies is the ability to differentiate between PAU, intramural hematoma, and acute dissection. The decision is further complicated by the clinical overlap between the conditions, collectively known as AAS. Sequential cross-sectional imaging may demonstrate progression from PAU to hematoma or dissection, although the likelihood and timing of such progression is unpredictable.

Patients with PAUs tend to be older when compared to patients with acute dissection, and they often have a history of atherosclerosis, smoking, and/or hypertension. The penetrating ulcer is often positioned on the distal arch or descending thoracic aorta, which means it is often relatively easily treated with limited endovascular coverage of the affected aorta. However, thoracic aortic intervention in a more elderly cohort needs to be a careful balance of risks and potential benefit.

Interdisciplinary expert consensus on PAU management demonstrated a low 3-year aortic-related event rate in patients treated medically and demonstrated no role for intervention in the asymptomatic patient. Poor outcomes from open surgery were also demonstrated. Endovascular intervention demands an individualized approach with consideration to early thoracic endografting in patients with hemodynamic instability, persistent pain, signs of impending rupture, and progressive periaortic hemorrhage on successive imaging studies.

I would therefore suggest careful clinical observation and repeat imaging within the first 7 days for symptomatic patients, with careful blood pressure control and analgesia. I would consider intervention if either clinical or radiologic signs progressed significantly during that period. I would not intervene in asymptomatic patients or in those whose signs and symptoms diminish or resolve within the first 7 days. I would arrange further cross-sectional imaging at 3 and 12 months thereafter to identify the relatively small group who develop chronic aortic problems.

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PAUs can be hard to define, difficult to assess, and sometimes challenging to treat. Despite the lack of high-quality data, some indications for intervention are not controversial and are generally accepted: PAUs in the ascending aorta, symptomatic PAUs, and progressing PAUs.

Asymptomatic PAUs may remain unchanged over decades, while others develop intramural hematoma, dissection, or rupture. One cannot predict which PAU will progress to complication based on anatomic features, and most PAUs will probably remain asymptomatic and harmless.

From a certain age, the presence of a PAU is a very frequent incidental finding if it is defined as a penetration of the intimal layer of the aorta. Most incidental PAUs can be managed conservatively with a control CT angiography after 3 and 12 months. If the PAU progresses or the patient develops symptoms, the general consensus is for invasive treatment, usually with endovascular techniques. Typically, a PAU in the descending thoracic aorta requires only a short tubular stent graft. If branch vessels are involved, treatment may require a hybrid repair or fenestrated and branched endografts. The complexity of the required interventional treatment is another important factor to take into account. To expand the application of endovascular treatment to every PAU may be tempting for the surgeon, but at present, there are not enough data on the natural history of this entity. ■