Aortic Branch Artery Pseudoaneurysms Accompanying Aortic Dissection. Part III: Natural History

Paul Cronin, MD, MS, Ruth C. Carlos, MD, MS, Ella A. Kazerooni, MD, MS, Aine Marie Kelly, MD, MS, Himanshu J. Patel, MD, G. Michael Deeb, MD, and David M. Williams, MD

ABSTRACT

Purpose: To document the natural history of branch artery pseudoaneurysms (BAPs), which are sequelae of aortic dissection with false lumen thrombosis that have been distinguished anatomically from penetrating ulcers.

Materials and Methods: Serial computed tomography (CT) scans in 50 patients with at least two CT scans greater than 1 month apart were retrospectively studied. Mean follow-up was 29 months, with longitudinal analyses of 119 BAPs. Changes in BAPs, false lumen thrombosis, and aortic diameter were assessed.

Results: No patient had an aortic rupture or other poor outcome. All BAPs eventually disappeared (ie, thrombosed), with 50% thrombosed within 18 months. Aortas were ectatic, with a mean diameter of 36 mm. There was no statistically significant change in total aortic diameters; however, there was a significant increase in true lumen diameters ($P < .0001$) and a significant decrease in false lumen thickness ($P < .0001$) at the level of the BAP over time (mean 50% reduction in maximum thickness of thrombosed false lumen). There were no significant associations between BAP thrombosis and vertebral level, presence of more than one BAP, presence of branch artery in communication with the BAP, history of smoking, diabetes mellitus or hypertension, or treatment with β-blockers, other antihypertensive medication, statins, or anticoagulation therapy. After controlling for other variables, BAPs were less likely to thrombose if an ulcerlike projection was present ($P = .003$), in men ($P = .02$), in subjects with hypertension ($P = .04$), and in older patients ($P = .05$).

Conclusions: Most BAPs spontaneously thrombose, and associated intramural hematoma regresses/disappears. Isolated BAPs were not associated with poor clinical outcomes.

ABBREVIATIONS

BAP = branch artery pseudoaneurysm, IMH = intramural hematoma, ULP = ulcerlike projection

Computed tomography (CT) scans of aortic dissection with thrombosed false lumens, including intramural hematoma (IMH), frequently exhibit collections of contrast material within the otherwise thrombus-filled false lumen. These collections are frequently referred to as "penetrating ulcers" or "ulcerlike projections" (ULPs; our preference), although, in practice, the phrase has become less specific than the penetrating atherosclerotic ulcer defined and confirmed histologically in the landmark study by Stanson et al (1). The clinical significance of these lesions has been emphasized by his and other groups, who have observed higher rates of aortic enlargement and rupture in dissections with ULPs than in those without (1–5). The defining characteristic of a ULP is a defect in the aortic intima and media, through which a crater fills with contrast material on a CT scan or aortogram. Recently, a group of periluminal contrast agent collections were distinguished from ULPs based on the absence of this ulcerlike defect, a circumferential distribution around the aorta indistinguishable from branch artery origins, and an association with small aortic branch artery

From the Divisions of Cardiothoracic Radiology, Department of Radiology (P.C., E.A.K., A.M.K.), Abdominal Radiology, Department of Radiology (R.C.C.), Vascular and Interventional Radiology, Department of Radiology (D.M.W.), and Department of Cardiac Surgery, Cardiovascular Center (H.J.P., G.M.D.), University of Michigan Medical Center, B1 132G Taubman Center/5302, 1500 E. Medical Center Dr., Ann Arbor, MI 48109-5030. Received October 27, 2011; final revision received March 28, 2012; accepted March 30, 2012. **Address correspondence to** P.C.; E-mail: pcronin@med.umich.edu

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origins, and were called branch artery pseudoaneurysms (BAPs). Several publications defined these lesions and distinguished the imaging features of ULPs from those of BAPs (6,7). Although the original publications (6,7) suggested a generally benign course of these lesions (and described treatment of several clinically troublesome instances as well), relatively little has been published on the long-term follow-up of BAPs.

Recently, Wu et al (8) described a series of 65 patients with acute chest pain, CT appearance of IMH, absence of aortic wall ULPs, and follow-up for a median of 1.2 months. In this group, there were 18 patients with a total of 56 BAPS, including 10 patients with 40 BAPs at presentation, 11 patients who developed 15 new BAPs, and four patients in whom 11 BAPs regressed during follow-up. During follow-up, 57% of BAPs showed complete resorption and 29% showed incomplete resorption (14% had interrupted follow-up because of surgery or death). Further analysis showed that age younger than 70 years and IMH wall thickness greater than 10 mm were associated with the development of BAPs. BAPs with larger transmural diameter and a connection with an intercostal or lumbar artery were associated with incomplete resorption (8).

The purpose of the present study was to document the natural history of aortic BAPs identified on CT scans in a larger cohort (N = 50) with more BAPs (N = 119) and with a longer follow-up, 93 months. The purpose was also to assess the mean total aorta diameter and change in size of the total aortic diameter, mean change in aortic true lumen diameter, and mean change in false lumen thickness over time at the level of the BAP. This has not been previously assessed to our knowledge. We also assessed the effects of demography and medical comorbidities on BAP thrombosis.

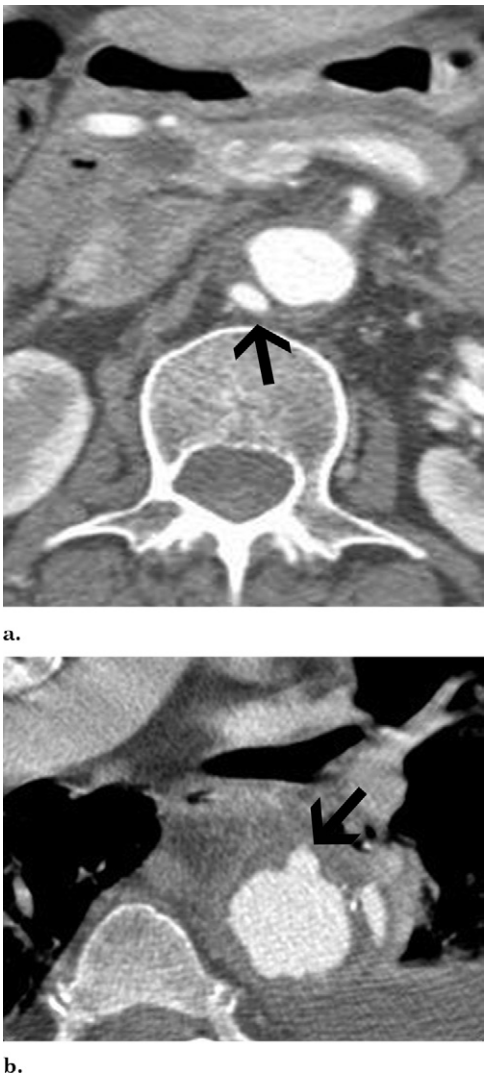

Figure 1. **(a)** A contrast-enhanced CT image in a 75-year-old man shows a BAP (arrow) arising posteromedially within the abdominal aorta at the level of the superior mesenteric artery. BAPs on CT imaging are small collections of contrast material that are isodense with the aorta true lumen during the arterial phase of imaging and do not appear to communicate with the aortic true lumen. **(b)** A contrast-enhanced CT image in a 72-year-old man shows a ULP at the one o'clock position (arrow), with characteristic gaping communication between the IMH and the aortic true lumen. The collection at the three o'clock position tracked to a second ulcer 2 cm caudal. ULPs on CT imaging are defined as a localized out-pouching of contrast medium, isointense with the aortic lumen, with a wide-mouthed (> 3 mm) communication between the contrast medium collection and aortic lumen.

MATERIALS AND METHODS

The institutional review board approved the structure of this retrospective study and the collection of data. Cases of aortic dissection with thrombosed false lumen and periaortic contrast agent collections identified on CT scans at our institution between July1990 and June 2010 were reviewed. Patients who underwent surgical repair of their aortas were excluded from analysis. All scans were evaluated by a fellowship-trained cardiothoracic radiologist with 8 years of experience.

Definitions

A thrombosed false lumen was defined as aortic wall thickening with attenuation compatible with thrombus, having no contrast enhancement in the aortic wall on the CT image obtained after the injection of intravenous contrast material, and having a smooth interface between the lumen and aortic wall. On intravenous contrast material–enhanced CT scans, BAPs are defined as contrast material–filled spaces within an otherwise thrombosed false lumen. These periaortic contrast material collections are isointense with the aortic lumen, but with an apparent absence of communication on CT with the aortic lumen. Demonstration of an aortic branch artery (eg, intercostal, lumbar, bronchial, or pericardial artery) exiting the contrast material collection confirms the diagnosis of an aortic branch artery pseudoaneurysm (**Fig 1a**) (6–8). A ULP on CT imaging was defined as a localized "out-pouching" of contrast material, isointense