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Review Article

Imaging in Takayasu arteritis

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1. Introduction

Takayasu arteritis (TA) is a large vessel vasculitis characterized by inflammation of aorta and its main branches, which ultimately results in stenosis, and/or aneurysms of the involved vessels. The diagnosis of TA at present is largely dependent on characteristic imaging findings due to absence of a specific biomarker and technical limitation of obtaining the tissue for histopathology. Conventional angiography has been most widely used for diagnosis of TA till now. However, in recent times, many more imaging modalities including non-invasive ones are being tested in TA. The following sections deal with the various imaging modalities used in TA in the decreasing order of usage in clinical practice.

2. Conventional angiography (CA)

Percutaneous intravascular angiography is the gold standard investigation for the diagnosis of TA. Lesions in TA often occur at or close to the point of origin of primary branches of the aorta. Localized narrowing or irregularities of arterial lumen are the earliest lesions detectable by angiography which may proceed to stenosis or complete occlusion. Vessels may be dilated to form aneurysms.[1,2] Skip lesions are one of the characteristic angiographic findings in cases where stenosis of the involved vessel is a presentation. Complete peripheral angiogram including pulmonary and coronary arteriography is recommended for complete evaluation of disease extent.[1,2]

Angiographically, TA has been classified into five broad types according to the vessels involved; type 2, however, has 2 subtypes[3,4]:

Type I: involves only the branches of the aortic arch.
Type IIa: involves ascending aorta, aortic arch, and its branches.
Type IIb: affects ascending aorta, aortic arch and its branches, and thoracic descending aorta.
Type III: involves the descending thoracic aorta, the abdominal aorta, and/or the renal arteries. The ascending aorta, the aortic arch, and its branches are not affected.

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Table 1 – Showing frequencies of angiographic subtypes of TA in different geographic ethnic populations.

Country	Type I (%)	Type IIa (%)	Type IIb (%)	Type III (%)	Type IV (%)	Type V (%)
Turkey ($n = 248$)[8]	32	6.9	3.2	3.2	3.7	51
Mexico ($n = 110$)[9]	19	3	4	4	2	69
India ($n = 102$)[3]	7	1	6	3	28	55
Japan ($n = 80$)[3]	24	11	10	0	1.3	54
Thailand ($n = 63$)[10]	0	0	11	3	19	67
Columbia ($n = 35$)[11]	34	11	6	0	20	29
Brazil ($n = 32$)[12]	21	4	0	4	14	57

Type IV: involves only the abdominal aorta and/or renal arteries.

Type V: has combined features of Type IIb and IV.

Additionally, involvement/sparing of the coronary and/or pulmonary arteries are indicated as C (+/−) and/or P (+/−), respectively.

Type V has been documented as the commonest type in several series (Table 1).[5–7]

Advantages of CA over other imaging modalities include accurate assessment of central aortic pressures. Coronary arteries are best visualized with CA. The simultaneous vascular interventions are feasible with this modality alone (Figs. 1–3).

Invasive nature of the procedure is the main limitation of CA. Exposure to radiation dose is significantly high in CA and it requires iodinated contrast material. It is also difficult to perform in young children and in patients with high degree of vascular stenosis. CA does not provide information about the vessel wall and thus may not be a modality to image early cases of TA in pre-stenotic phase.[13,14] In addition, CA does not differentiate the cause of vascular narrowing, which may be due to acute intramural inflammation or chronic wall fibrosis.[15]

3. Digital subtraction angiography

Digital subtraction angiography (DSA) is a time-tested imaging modality to assess vessel luminal changes and guide interventional procedures in TA.[16] Serial DSA is used in the follow-up of patients with TA when new lesions and/or worsening of existing lesions need to be assessed.

The advantages of DSA over CA include background subtraction of bones and soft tissues. Computerized post-processing applications like adjustment of windows and magnification are possible. Definition of small arterial structures can be maximized by the use of higher dose of contrast material.[17,18] Magnified view of images also provides additional detail in DSA, which is helpful in diagnosis.

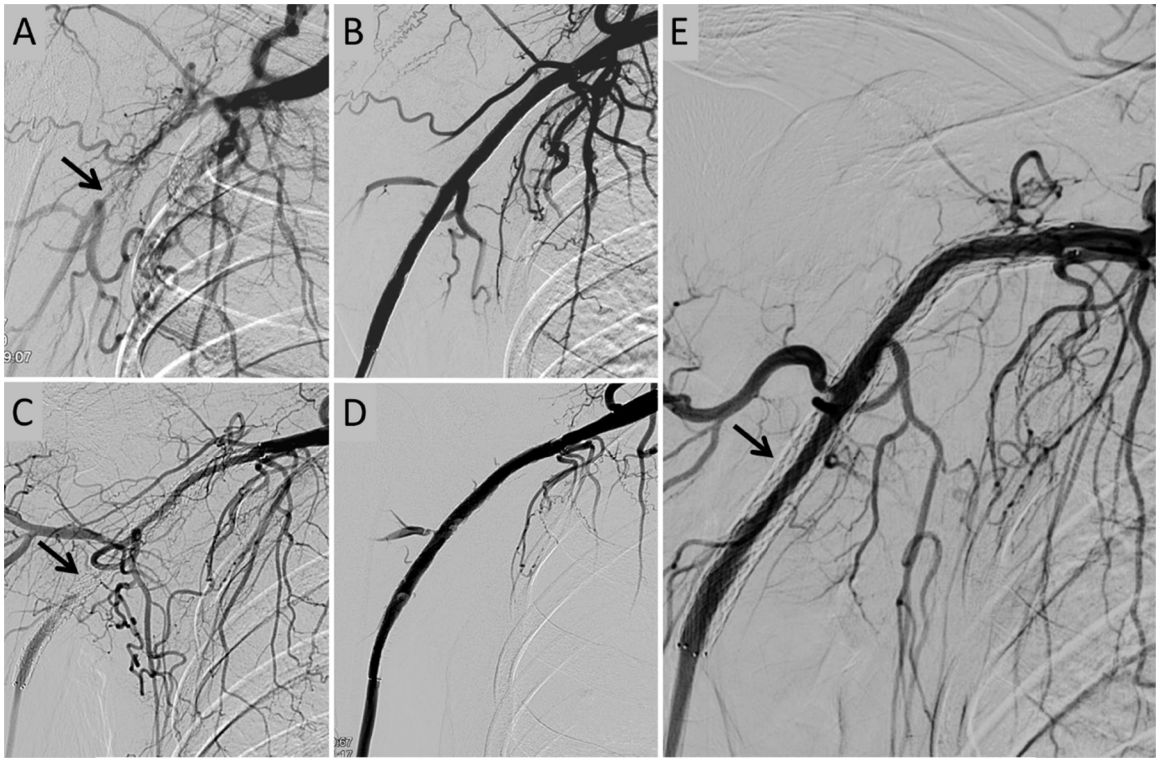

Fig. 1 – (A) Right subclavian-axillary artery occlusion (arrow) in a 28-year-old female with Takayasu arteritis. (B) Good immediate outcome after percutaneous recanalization and stenting. (C) Follow-up angiogram after 9 months showing severe in-stent restenosis (arrow). (D) Outcome after balloon angioplasty showing restoration of vessel lumen. (E) Follow-up angiogram after 3 years showing good mid-term outcome and minor intimal hyperplasia (arrow).