

**MDCT IN AORTITIS:  
EARLY DIAGNOSIS AND FOLLOW-UP**

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**Abstract**

Purpose: Aim of the study was to analyze CT features and to classify abdominal aortitis starting from eight cases diagnosed in patients with aspecific abdominal pain, history of fever, weight loss and elevated laboratory markers of inflammation.

MM: We analyzed retrospectively eight cases of aortitis diagnosed in the period between July 2015 and October 2018 in our small town hospital. All eight patients underwent thorax and abdomen multidetector computer tomography with intravenous administration of contrast media.

Results:

Conclusion: Even if, nuclear medicine diagnosis is the gold standard in aortitis suspicion, in small town hospital MDCT with intravenous contrast media allows diagnosis and follow-up of abdominal aorta inflammation when severe but aspecific abdominal symptoms occurs.

According to anamnesis and laboratory exams, a correct classification can be performed to optimize medical and/or surgical therapy.

**Keywords:** *aortitis, Vasculitis, Takayasu Disease, MDCT, MR*

## Introduction

Aortitis is a subtype of vasculitis and identify a broad category of infectious or non-infectious diseases which induce inflammatory lesions on aortic wall.

The inflammatory response may be focal, affecting only the vessel wall, or it may be widespread, involving adjacent tissues (e.g. retroperitoneal fibrosis) or other vessels (e.g. giant cell arteritis).

In the literature, classifications are often proposed a simple classification on aortitis includes underlying rheumatologic and infectious disease, along with isolated aortitis [1].

Takayasu Arteritis and Giant Cell Arteritis (GCA) are the most common rheumatologic causes on non infectious aortitis, however an association has been observed between systemic lupus erythematosus, rheumatoid arthritis, spondyloarthropathies HLA b27 related, ANCA-associated vasculitis, sarcoidosis, Cogan's syndrome and Behcet's disease. The most common pathogens, which account for almost 40%, includes staphylococcus aureus and salmonella. Other bacteria involved are Treponema Pallidum, Tuberculosis, Listeria, Bacteroides Fragilis, Clostridium Septicum and Campylobacter Jejuni [2].

Aortitis also may present in isolation or accompany idiopathic retroperitoneal fibrosis or an inflamed abdominal aneurysm [3].

Clinical manifestation are not specific, as are laboratory findings, and varies across spectrum of symptoms and clinical signs, ranging thoracic, abdominal and dorsal pain, fever, weight loss, vascular insufficiency, valvular aortic insufficiency and acute aortic syndrome [4].

Clinical and imaging features, including the pattern of aortic involvement, help to distinguish between infectious and noninfectious etiologies. There is important overlap of imaging characteristics among aortitis causes, and so is important integrate the clinical picture with imaging findings [5].

Different imaging modalities are used in the evaluation on inflammatory and noninflammatory aortic disease. A multimodality imaging approach is important to assess the vessel wall and lumen. Imaging is also useful for surveillance of disease activity and treatment planning.

Multidetector Computed Tomography (CT) with and without intravenous iodized contrast is used for the

evaluation of aortic wall thickness, aortic diameter and mural calcification.

The non-enhanced scan is helpful to show intramural calcification and to exclude intramural hematoma. A contrast-enhanced scan of aorta and pulmonary arteries is the second step in the aortic assessment. Axial images in association with coronal and sagittal reformats are useful to study the extension of vessel wall involvement and abnormalities of aortic lumen [6].

Magnetic resonance (MR), similar to CT, supplies information on vascular wall and lumen with multiplanar and 3D-reformations, with the advantage of using no ionizing radiation. It is useful in evaluating stenosis, mural thickening or aneurism. also, is important to identify wall edema which has been related with the disease's activity.

Nuclear medicine imaging with fluorine 18 fluorodeoxyglucose positron emission tomography (18 FDG-PET-TC) is helpful in evaluation of inflammatory activity but limited in assessment of morphologic changes because of the relatively low special resolution.

Ultrasonography (US) is limited to show anatomic coverage of aorta. It is generally not utilized as a diagnostic modality for aortitis but is useful for the diagnosis of abdominal aortic aneurysm. Intransesophageal echocardiography has a key role in assessment of the aortic root and valve in the setting of aortitis on the ascending aorta associated with aortic insufficiency and aneurysm formation [7].

The aim of our study is to evaluate the role of CT in the diagnosis and follow-up of aortitis through the retrospective study of eight cases of aortitis in patients with abdominal pain, fever, weight loss and elevated laboratory markers of inflammation [8].

## Methods

We conducted a retrospective study on eight patients rushed to the emergency room for abdominal pain, fever and weight loss in recent months in the period between July 2015 e October 2018 in our small town hospital.

All of these patients (6 males and 2 females) between ages of 43 and 90 yo, mean 63.6 yo, had been underwent thorax and abdomen multidetector

computer tomography with intravenous administration of contrast media.

The CT exams were conducted by GE bright speed 16 slice through tri-phasic protocol including non enhanced CT of the chest and a contrast-enhanced scan after an injection rate of 3ml/s of contrast media (1,5ml/kg).

The analysis has been conducted by two radiologist with more than 10 years of experience and all images have been analyzed and post-processed with multiplanar and three-dimensional reconstructions evaluating the following parameters: wall thickening; stenosis vascular occlusions; mural contrast uptake; mass of periaortic soft parts; intramural gas; aneurysms; calcifications and mural thrombi.

### Results

These results are correlated with clinical and laboratory data including markers of inflammation, namely erythrocyte sedimentation rate (ESR) and c-reactive protein (CRP), a complete blood count, assessment of kidney and liver function and in some a rheumatologic panel, including anti-nuclear antibodies, anti-neutrophil cytoplasmic antibodies and rheumatoid factor.

According to anamnesis and laboratory exams, we have got a case of infectious aortitis in a patient with aortic prosthesis (Fig.1); five cases on non-infectious aortitis of which two patients with Takayasu arteritis, one with ANCA+ vasculitis, one with inflammatory aneurism (Fig.2) and one with retroperitoneal fibrosis (Fig.3). The last two cases have been identified as idiopathic disease (Fig.4).

Only in the first case, surgical procedure has been necessary to remove the prosthesis, in the other seven cases, medical therapy with Prednisone for four weeks and gradual reduction has been resolute. All patients has been underwent CT and/or MRI follow-up until resolution.

### Discussion

CT and computer-tomography angiography (CTA) are helpful for imaging aortitis and branch vessel arteritis due to peerless spatial resolution and scan time generally <60 sec.

CT scan provides information about mural thickening (i.e., >2 to 3 mm is considered diagnostic for aortitis) and inflammatory periaortic soft tissue changes, such as fat stranding.

CTA is able to assessment luminal and mural anatomy through the aid of different 3D reconstruction methods including maximum intensity projection, multiplanar reformatting (MPR) and volume rendering complement the standard sequential axial views. Maximum intensity projection and MPR allow a correct measurement of luminal caliber and characterization of dilation, ectasia, stenosis and occlusion of the aorta and its branches. Moreover these techniques are useful for evaluating the extension of thickening and presence of layering thrombus, and allow to make differential diagnosis with intramural hematoma and penetrating ulcer [9, 10].

CTA can identify complications of aortitis, such as pseudoaneurysm, aneurysm and thrombosis and guide the procedures of revascularization in those with arterial insufficiency causing claudication, intestinal angina, renal failure, cerebrovascular or refractory hypertension [11, 12].

CTA has become fundamental noninvasive angiographic technique of diagnosis for Takayasu arteritis. A “double ring” sign on postcontrast images due to high enhanced outer ring of inflamed media and adventitia surrounding poorly enhanced edematous intima is typical of Takayasu aortitis in the initial stages. Structural aortic changes, such as stenosis, thrombosis and occlusions, has a specificity and sensitivity of 95% and 100%, respectively, for the diagnosis of late-stage disease [13].

Extracranial giant cell arteritis is the most common cause of aortitis. A characteristic CT finding of extracranial giant cell arteritis is long segment thickening with smooth distal tapering associated with changes on the wall such as calcification and thrombosis.

Immunoglobulin G4-related aortitis may involve the abdominal aorta and the thoracic aorta and its branches, with dense and fibrous periarterial plaques.

Idiopathic aortitis, including chronic peri aortitis, idiopathic inflammatory aortic aneurysm and retroperitoneal fibrosis are well characterized in CT and CTA, where demonstrate an irregular aortic thickening with dense adhesions and a concentric enhanced soft tissue mass surrounding the vessels, often causing significant stenosis of the aorta and branches [14].

CT and CTA are able to readily identify complications of infectious aortitis. In addition to visualization of aneurysm, these techniques estimate wall thickening, contrast medium uptake in the wall, increased perivascular streaking and fluid accumulation and bubbles gas. Mycotic aneurysms appear as saccular or lobulated periaortic masses with periaortic fluid or soft tissue accumulation and, occasionally, gas collections. Aortic graft infections have findings similar to mycotic aneurysms in the peri graft tissue, and may be associated with pseudoaneurysm or aorto-enteric fistulae. Tuberculous aortitis is characterized by focal irregular mural thickening, with multiple, often saccular, pseudoaneurysms. Caseous necrotic may causing perforation and massive bleeding or perivascular hematoma [15].

### Conclusions

Even if, PET-TC diagnosis is the gold standard in aortitis suspicion and with MR is useful to monitor inflammatory activity and response to treatment, in small town hospital MDCT with intravenous contrast media allows diagnosis and follow-up of abdominal aorta inflammation when severe but unspecific abdominal symptoms occurs.

Etiological diagnosis can be performed taking into account other data such as sex, age, pathological anamnesis and clinical finding, since many of them are part of systemic disease.

CT and MR images can help to give important information about treatment and follow up the evolution of aortitis in the absence of nuclear medicine.

### References

1. Töpel I, Zorger N, Steinbauer M. Inflammatory diseases of the aorta. *Gefässchirurgie*. 2016
2. Svensson LG, Arafat A, Roselli EE, Idrees J, Clifford A, Tan C, et al. Inflammatory disease of the aorta: Patterns and classification of giant cell aortitis, Takayasu arteritis, and nonsyndromic aortitis. *J Thorac Cardiovasc Surg*. 2015
3. Reginelli A, Capasso R, Ciccone V, Croce MR, Di Grezia G, Carbone M, Maggialetti N, Barile A, Fonio P, Scialpi M, Brunese L Usefulness of triphasic CT aortic angiography in acute and surveillance: Our experience in the assessment of acute aortic dissection and endoleak, *International Journal of Surgery* 2016 Sep;33 Suppl 1:S76-84
4. Cuccurullo V, Cioce F, Sica A et al Gastroenteric diseases in the third millennium: A rational approach to optimal imaging technique and patient selection *Recenti Progressi in Medicina* 103(11):426-30
5. Romano S, Scaglione M, Gatta G et al. Association of splenic and renal infarctions in acute abdominal emergencies *Eur J Radiol* 2004 Apr; 50(1):48-58
6. Inoue D, Zen Y, Abo H, Gabata T, Demachi H, Yoshikawa J, et al. Immunoglobulin G4 related Periaortitis and Periarthritis: CT Findings in 17 Patients. *Radiology*. 2011
7. Reginelli A, Iacobellis F, Del Vecchio L, Monaco L, Berritto D, Di Grezia G, Genovese EA, Giganti M, Cappabianca S, "VFMS findings in elderly dysphagic patients: our experience" *BMC Surgery* 2013; 138 (Suppl2): 554
8. G. Di Grezia, G. Gatta, R. Rella, et al., "Abdominal Hernias, Giant Colon Diverticulum, GIST, Intestinal Pneumatosis, Colon Ischemia, Cold Intussusception, Gallstone Ileus, and Foreign Bodies: Our Experience and Literature Review of Incidental Gastrointestinal MDCT Findings," *BioMed Research International*, vol. 2017, Article ID 5716835
9. Paola Crivelli, Marcello Carboni, Rino Aldo Montella, Antonio Matteo Amadu, Stefano Profili, Maurizio Conti, Giovanni Battista Meloni. Gastroduodenal stenting: is still useful in the treatment of malignant obstruction? *La radiologia medica* 122 (8), 564-567
10. Faggian A, Alabiso ME, Serra N, Pizza NL, Iasiello F, Tecame M, Somma F, Rossi C, Di Grezia G, Feragalli B, Iacomino A, Grassi R "Entero-colpo-cysto-defecography vs supine entero-MRI: which one is the best tool in the differentiation of enterocele, elythrocele and edrocele?" *Journal Biological Regulators and Homeostatic agents* 2013 Jul-Sep; 27(3):861-8
11. Hartlage GR, Palios J, Barron BJ, Stillman AE, Bossone E, Clements SD, et al. Multimodality imaging of aortitis. *JACC: Cardiovascular Imaging*. 2014
12. Somma F., Faggian A, Serra N Bowel intussusceptions in adults: the role of imaging. *Radiol Med* 2015 Jan; 120(1):105-17

13. Cabero Moyano J, Andreu Magarolas M, Castañer González E, Gallardo Cistaré X, Belmonte Castan E. Nonurgent aortic disease: clinical-radiological diagnosis of aortitis. *Radiología*. 2013
14. Macedo TA, Stanson AW, Oderich GS, Johnson CM, Panneton JM, Tie ML. Infected Aortic Aneurysms: Imaging Findings. *Radiology*. 2004
15. Restrepo CS, Ocazonez D, Suri R, Vargas D. Aortitis: Imaging Spectrum of the Infectious and Inflammatory Conditions of the Aorta. *RadioGraphics*. 2011.



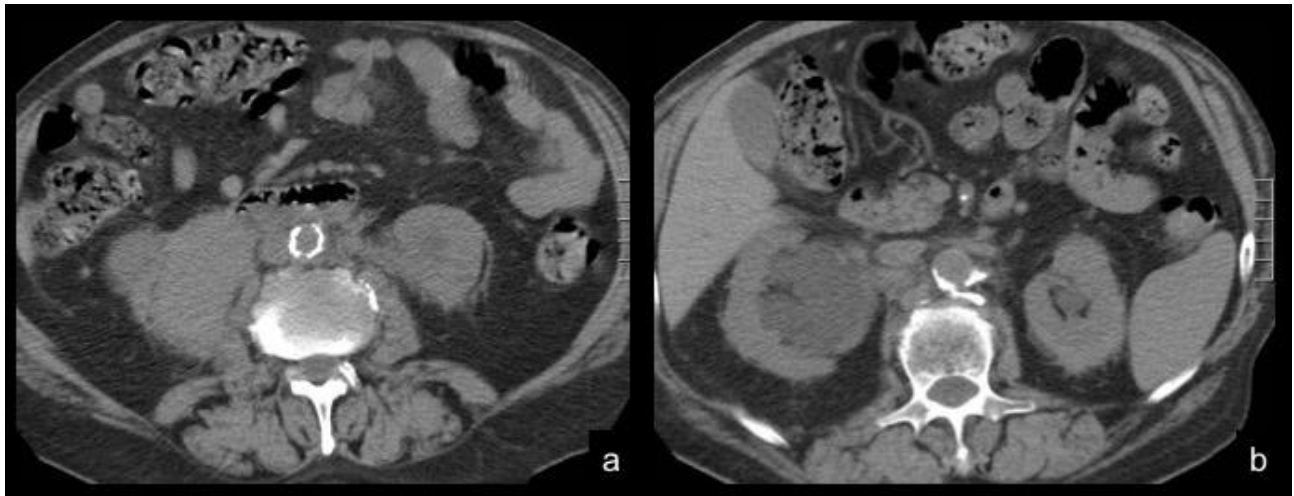
**Figure 1.** Contrast media abdomen CT in aortic phase  
SF, male, 71 yo: a case of infectious aortitis in a patient with abdominal aortic prosthesis.



**Figure 2.** Contrast media abdomen CT in axial plane (a); sagittal plane reconstruction (b); coronal plane reconstruction (c) DAT, female, 54 yo: a case of inflammatory abdominal aortic aneurism.



**Figure 3.** CT without contrast media  
CB, male, 90 yo, Abdominal aortitis due to retroperitoneal fibrosis



**Figure 4.** CT without contrast media  
SL, male, 78 yo Idiopathic abdominal aortitis

