

Aortic valve imaging

Towards new standards in prosthetic valve endocarditis

AKADEMISK AVHANDLING

som för avläggande av medicine doktorexamen vid Sahlgrenska Akademien,
Göteborgs Universitet, kommer att offentligen försvaras i sal Kammaren,
Vita Stråket 12, SU/Sahlgrenska, Göteborg,
Fredag den 20 Maj 2016 kl 09.00

av

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Avhandlingen baseras på följande delarbeten:

- I. Fagman E, Perrotta S, Bech-Hanssen O, Flinck A, Lamm C, Olaison L, Svensson G.
ECG-gated computed tomography: a new role for patients with suspected aortic prosthetic valve endocarditis
Eur Radiol. 2012 Nov; 22(11): 2407-14
- II. Fagman E, Bech-Hanssen O, Flinck A, Lamm C, Svensson G.
Increased aortic wall thickness on CT as a sign of prosthetic valve endocarditis
Acta Radiol. 2016 Feb 6. DOI: 10.1177/0284185116628336
- III. Fagman E, van Essen M, Fredén Lindqvist J, Snygg-Martin U, Bech-Hanssen O, Svensson G.
¹⁸F-FDG PET/CT in the diagnosis of prosthetic valve endocarditis
Int J Cardiovasc Imaging. 2016 Apr; 32(4): 679-86
- IV. Fagman E, Flinck A, Snygg-Martin U, Olaison L, Bech-Hanssen O, Svensson G.
Surgical decision-making in aortic prosthetic valve endocarditis: the influence of ECG-gated computed tomography
Accepted for publication in European Journal of Cardio-Thoracic Surgery.



UNIVERSITY OF GOTHENBURG

Göteborg 2016

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Background: Aortic prosthetic valve endocarditis (PVE) is a disease with high mortality, and diagnosis is difficult. Transesophageal echocardiography (TEE) has been the mainstay imaging modality in the diagnostic workup, but TEE has diagnostic shortcomings. Thus, new imaging methods might improve the diagnostic workup of PVE.

Aims: I) To investigate the agreement in findings between electrocardiogram (ECG)-gated computed tomography (CT) and TEE in patients with aortic PVE. II) To identify a clinically useful cutoff value for aortic wall thickness to detect PVE. III) To compare ^{18}F -fluorodeoxyglucose (^{18}F -FDG) uptake around prosthetic aortic valves in patients with and without PVE and to determine the diagnostic performance of ^{18}F -FDG PET/CT in the diagnosis of PVE. IV) To investigate the value of ECG-gated CT in the surgical decision-making and preoperative evaluation in patients with aortic PVE.

Methods: In paper I, ECG-gated CT and TEE were compared in a prospective series of 27 patients with aortic PVE. In paper II, the aortic wall thickness on chest CT in patients with a prosthetic aortic valve with PVE ($n = 43$) and without PVE ($n = 260$) was compared. In paper III, ^{18}F -FDG uptake on PET/CT in patients with a prosthetic aortic valve with PVE ($n = 8$) and without PVE ($n = 19$) was compared. In paper IV, 68 aortic prosthetic valves with PVE were prospectively evaluated with ECG-gated CT and TEE. The impact of both modalities on surgical decision-making was studied, and the coronary arteries were evaluated with ECG-gated CT.

Results: In paper I, the strength of agreement [κ (95 % CI)] between ECG-gated CT and TEE was 0.83 (0.62–1.0) for wall thickening, 0.68 (0.40–0.97) for the presence of abscess/pseudoaneurysm, 0.75 (0.48–1.0) for valve dehiscence and 0.55 (0.26–0.88) for vegetation. In paper II, receiver operating characteristic (ROC) analysis yielded an area under the curve of 0.89 for aortic wall thickness in the detection of PVE beyond three months postoperatively. With a cutoff value of 5 mm, the sensitivity was 67% and the specificity was 95%. In paper III, visual analysis of ^{18}F -FDG PET/CT exhibited a sensitivity of 75% and a specificity of 84% for the diagnosis of PVE. ROC analysis of the Standardized Uptake Value ratio yielded an area under the curve of 0.90. In paper IV, 58 of 68 PVE cases had indications for surgery based on imaging findings. In eight of these cases (14%), there was an indication for surgery based on CT but not on TEE findings (all with pseudoaneurysms). In 11 cases (19%), there was an indication for surgery based on TEE but not on CT findings. In 31 of 32 patients with indication for preoperative coronary angiography, ECG-gated CT coronary angiography was diagnostic.

Conclusions: ECG-gated CT provides additional information over TEE regarding paravalvular extension of infection, which influences surgical decision-making. ECG-gated CT can in most cases replace invasive coronary angiography in the preoperative evaluation. Increased aortic wall thickness on CT ($> 5\text{ mm}$) beyond three months postoperatively is a sign of PVE with high specificity. The level of ^{18}F -FDG uptake in the aortic valve area on ^{18}F -FDG PET/CT shows good diagnostic performance in the diagnosis of PVE.

Keywords: prosthetic valve endocarditis, aortic valve endocarditis, ECG-gated CT, cardiac CT, ^{18}F -FDG PET/CT