

개인용 컴퓨터를 이용한 기능 유관성 관상동맥 협착증의 삼차원 심장스펙트 사진과 64채널 전산화 단층 혈관촬영사진과의 융합

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Fusion of 3D Cardiac SPECT and 64-Channel-CT Angiography Using Personal Computer in Functionally Relevant Coronary Artery Stenosis

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Image fusion is fast catching attention as Wagner¹⁾ pointed out in his 2006 version of the recent progress and development presented at the annual meeting of Society of Nuclear Medicine. Prototypical fusion of bone scan and radiograph was already attempted at in 1961 when Fleming et al.²⁾ published an article on strontium-85 bone scan. They simply superimposed dot scan on radiograph enabling simultaneous assessment of altered bone metabolism and local bone anatomy. Indeed the parallel reading of images of bone scan and radiography, CT, MRI or ultrasonography has been practiced in nuclear medicine long since.³⁾ It is fortunate that recent development of computer science and technology along with the availability of refined CT and SPECT machines has permitted us to open a new avenue to digitally produce precise fusion image so that they can readily be read, exchanged and disseminated using internet. Ten years ago fusion was performed using *Bresstrahlung* SPECT/CT⁴⁾ and it is now achievable by PET/CT^{5,6)} and SPECT/CT software⁷⁾ and SPECT/CT hardware.⁸⁾ The merit of image fusion is its feasibility of reliable assessment of morphological and metabolic change. It is now applicable not only to stationary organs such as brain and skeleton but also to moving organs such as the heart, lung and stomach. Recently, we could create useful fusion image of cardiac SPECT and 64-channel CT angiograph. The former provided myocardial metabolic profile and the latter vascular narrowing in two patients with coronary artery stenosis and myocardial ischemia. Arterial stenosis was severe in Case 1 and mild in Case 2. (Nucl Med Mol Imaging 2007;41(3):252-254)

Case presentation

Case 1

Patient was a 78-y-old woman with chronic heart problem that caused chest pain, arrhythmia and exertional dyspnea. Coronary angiography performed for stent insertion revealed marked stenosis of proximal segment of the left anterior descending artery (LAD) and the ostia of the left circumflex artery and diagonal branch. A stent was

instituted in LAD (Fig. 1A).

Six months later 3D coronary angiograph was obtained using a SOMATOM Sensation 64 CT system (Siemens, Germany) after contrast injection. 3D angiography portrayed marked constriction of the opening and proximal segment of the left circumflex artery (LCX, right upper arrow) and the ostium of the diagonal branch (DB). The proximal part of LAD was kept open by an indwelling stent (*stent*). The heart was scanned post iv injection of 15 mCi of ^{99m}Tc-tetrofosmin for the resting phase SPECT and additional 25 mCi for adenosine-induced stress SPECT using an E.CAM/e.soft camera (Siemens Medical Solutions, USA). The 3D surface image of the left ventricle showed indigo discoloration (30% of normal) in the apical wall, dark purple discoloration (45%) in the apical-anterior wall

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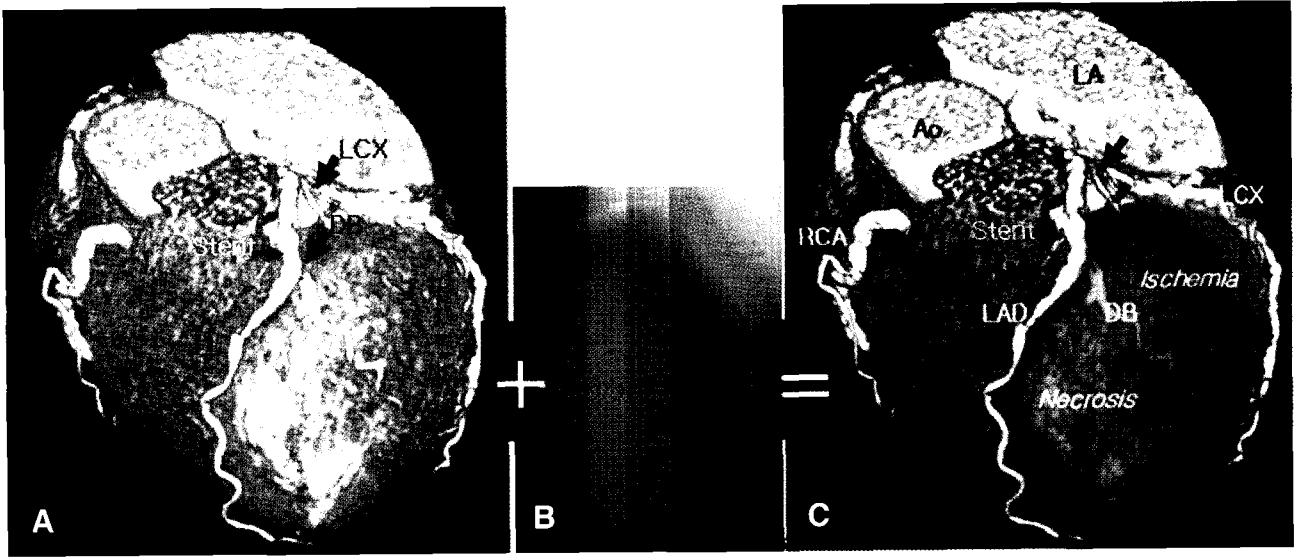


Fig 1. (A) 64-channel 3D cardiac surface/coronary artery CT shows stenoses, (B) ^{99m}Tc -tetrofosmin SPECT of left ventricle shows necrosis and ischemia and (C) if fusion of (A) and (B). LCX, DB, LAD, RCA=left circumflex artery, diagonal branch artery, left anterior descending artery, right coronary artery. Ao, LA=aorta, left atrium. Arrows denote stenoses and insert details stenosis in proximal LCX. A stent has been instituted in the middle LAD.

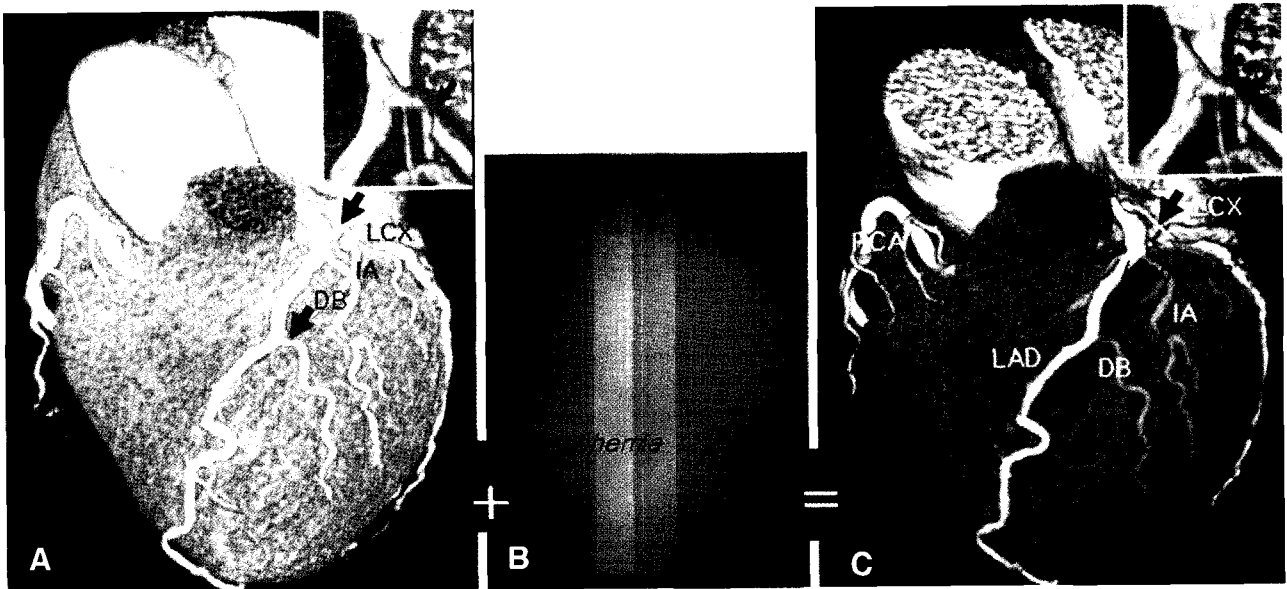


Fig. 2. (A) 64-channel 3D cardiac surface/coronary artery MDCT, (B) Myoview SPECT of left ventricle with stress induced ischemia and (C) fusion of (A) and (B). LCX, DB, LAD, RCA=left circumflex artery, diagonal branch artery, left anterior descending artery, right coronary artery. Arrows denote stenoses and inset in (C) details stenosis. (ywbahk@hanmail.net 2006)

and light purple discoloration (60%) in the anterior wall suggesting myocardial necrosis, marked ischemia and mild ischemia, respectively (Fig. 1B). Two images were fused using a commercial photoshop with manual fitting (Fig. 1C).

Case 2

Patient was a 79-y-old man with arrhythmia and possible sick sinus syndrome. Cardiologist advised him to implant a pacemaker. The imaging studies were carried out for that purpose. 64-channel 3D CT angiography (Fig. 2A)

showed mild stenosis in the proximal part of the left circumflex artery (*LCX*; right upper arrow) and in the ostium of the diagonal branch (*DB*). Intermediate artery was not narrowed (*IA*). The heart was imaged post iv injection of 15 mCi of ^{99m}Tc -tetrofosmin for the resting phase SPECT and additional 25 mCi for adenosine-induced stress SPECT. 3D surface image of the left ventricle showed stress induced purple discoloration (65% of normal) in the apical wall (*lower ischemia*) and apical-anterior wall (*upper ischemia*) denoting stress induced myocardial ischemia (Fig. 2B). Images were fused using a commercial photoshop with manual fitting (Fig. 2C).

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References

1. Wagner HN. From molecular imaging to molecular medicine. 2006 SNM Highlights Lecture. *J Nucl Med* 2006;47:13N-39N.
2. Fleming WH, McIraith JD, King R. Photoscanning of bone lesions utilizing strontium 85. *Radiology* 1961;77:635-6.
3. Bahk YW. Combined Scintigraphic and Radiographic Diagnosis of Bone and Joint Diseases. 3rd ed. Heidelberg Berlin New York:Springer, 2006.
4. Parsai EI, Ayyangar KM, Dobelbower RR, Siegel JA. Clinical fusion of three-dimensional image using Bremsstrahlung SPECT and CT. *J Nucl Med* 1997;38:319-24
5. Beyer T, Townsend DW, Brun T, et al. A combined PET/CT scanner for clinical oncology. *J Nucl Med* 2000;41:1369-79.
6. Townsend DW, Beyer T. A combined PET/CT scanner: the path to true image fusion. *Br J Radiol* 2002;75:Spec No:S24-30.
7. Keidar et al. Quoted from Wagner Jr. HN.¹⁾
8. Gaemperli et al. Quoted from Wagner Jr. HN.¹⁾