

## CASE REPORT

# Diagnosis of myocardial contusion after blunt chest trauma using $^{18}\text{F}$ -FDG positron emission tomography

M PAI, MD

Department of Radiology, College of Medicine, Ewha Womans University, Ewha Mokdong Hospital, 911-1 Mok-dong, Yangchun-gu, Seoul 158-710, Republic of Korea

**ABSTRACT.** Cardiac contusion is an infrequent complication of blunt chest trauma. The definite diagnosis of myocardial contusion is complex and needs a number of examinations such as electrocardiography, echocardiography, cardiac enzyme and radionuclide perfusion scan. We present a patient who had a blunt chest trauma from a car accident resulting in an acute myocardial infarction without injury to coronary arteries. The non-viable myocardium was diagnosed with  $^{18}\text{F}$ -fluorodeoxyglucose positron emission tomography (FDG PET) combined with  $^{201}\text{Tl}$  perfusion single photon emission tomography (SPECT). This is the first report of FDG PET for the diagnosis of myocardial contusion in blunt myocardial trauma.

Received 6 March 2005  
Revised 10 May 2005  
Accepted 18 May 2005

DOI: 10.1259/bjr/17221499

© 2006 The British Institute of Radiology

Cardiac contusion is usually caused by blunt chest trauma arising from car accidents or falling injuries. The reported incidence of cardiac contusion in patients with blunt chest trauma ranges between 3% and 56% depending on the diagnostic methods [1–4]. Acute myocardial infarction is a rare but serious complication after blunt chest trauma and is usually caused by injuries to coronary arteries such as coronary thrombosis, laceration, fistula and pseudoaneurysm [1, 5, 6]. A number of methods have been employed to diagnose cardiac contusion and to predict the associated complications. Electrocardiography, echocardiography and cardiac enzymes are routine and additional coronary angiography or  $^{201}\text{Tl}$  myocardial perfusion single photon emission tomography (SPECT) have been used to localize the injured myocardial walls [7].

$^{18}\text{F}$ -fluorodeoxyglucose positron emission tomography (FDG PET) is known to have great advantages in the assessment of myocardial viability [8]. There has been no report citing findings of myocardial FDG PET in patients with blunt chest trauma [1]. We report a case of acute myocardial infarction without coronary artery injuries after a blunt chest trauma, in which myocardial viability status was evaluated by FDG PET combined with  $^{201}\text{Tl}$  perfusion SPECT.

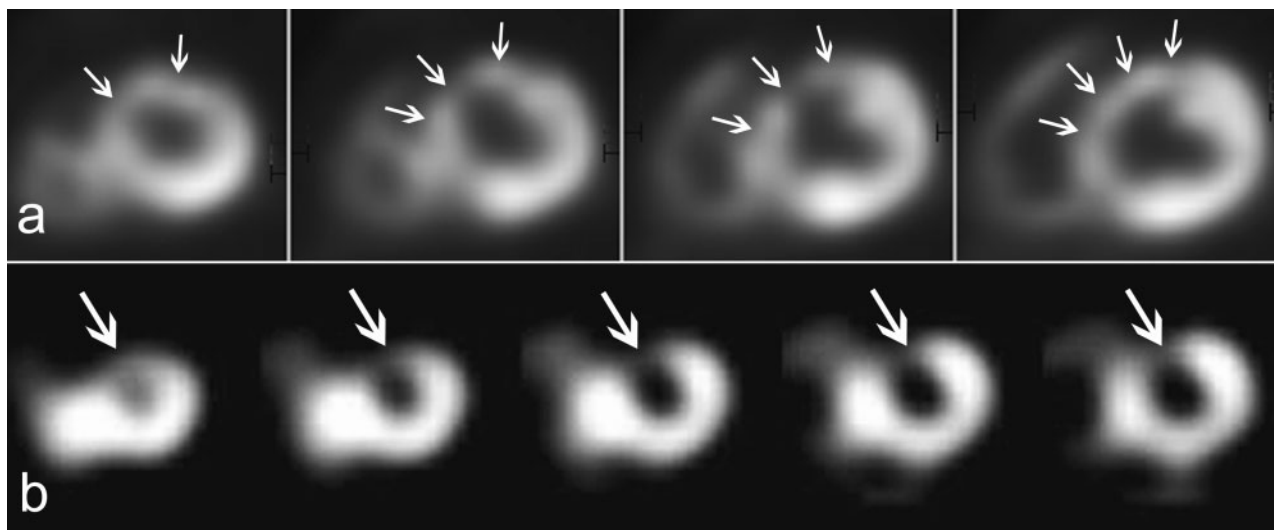
### Case report

A 45-year-old previously healthy, “10 packs a year cigarette smoking man” with no other risk factors for ischaemic heart disease was admitted to hospital after a car accident, in which he had been hit by the steering wheel on his anterior chest. On arrival, he complained of chest pain and dyspnoea. On physical examination, no evidence of hypotension or arrhythmia was found. He was diagnosed with fractures of sternum and bilateral costochondral

junctions with bone scan. The electrocardiography showed sinus rhythm and non-specific T-wave inversion in leads V3–6. The serum creatinine kinase was  $221 \text{ U l}^{-1}$  with a slight elevation of MB fraction ( $6.7 \text{ ng ml}^{-1}$ ). Echocardiography revealed normal cardiac dimensions and hypokinesia of the anterior wall with ejection fraction of 51%. However, coronary angiography showed no evidence of coronary artery disease. For the assessment of myocardial viability, FDG PET scan (Allegro; Phillips Medical Systems, Best, The Netherlands) was performed after intravenous administration of 370 MBq (10 mCi) of  $^{18}\text{F}$ -FDG with usual oral glucose loading method [9]. A metabolic defect was noted in the anteroseptal wall on FDG PET corresponding to the perfusion defect on  $^{201}\text{Tl}$  SPECT (ECAM; Siemens, Knoxville, TN) (Figure 1). This matching defect is consistent with myocardial infarction arising as a consequence of blunt chest trauma in the context of normal coronary arteries. On 8 month follow-up studies of  $^{201}\text{Tl}$  SPECT and echocardiography, there was no improvement of perfusion and left ventricular wall motion abnormality.

### Discussion

Early diagnosis of cardiac lesions following blunt trauma is essential but there remains no sensitive test for myocardial contusion. Although the true diagnosis of contusion can only be established by direct inspection of myocardium [10], in the majority of cases, the diagnosis of cardiac contusion with myocardial injury is made on the basis of elevated creatinine kinase-MB fraction, which is not predictive of the complications of cardiac contusion [11, 12]. Myocardial regulatory contractile proteins such as troponin I and T are considered to be sensitive and specific for myocardial injury [2], despite problems with timing of blood sampling after trauma.



**Figure 1.** Short axis slice of (a) myocardial  $^{18}\text{F}$ -fluorodeoxyglucose positron emission tomography (FDG PET) and (b)  $^{201}\text{Tl}$  single photon emission tomography (SPECT) demonstrated perfusion-metabolic matching defect in anteroseptal wall (arrows), indicating non-viable myocardium.

Echocardiography can be used as a screening tool for ventricular dysfunction which is one of the most serious complications of cardiac contusion but is often hampered by a suboptimal ultrasound window [13]. There are a few reports that blunt chest trauma may lead to acute myocardial infarction caused by coronary artery dissection, thrombosis or fistula [6, 14, 15]. Contused myocardial tissue is histologically characterized by intramyocardial haemorrhage, oedema and necrosis of myocardial muscle cells, which are similar to the findings of acute myocardial infarction [10]. In the assessment of myocardial viability, FDG PET has been used as the method of choice for the diagnosis of non-viable, infarcted myocardium. In this study, FDG PET identified the exact extent and location of the injured tissue by describing non-viable myocardium despite the presence of normal coronary arteries. The presence of infarction was confirmed by the lack of improvement in myocardial perfusion and wall motion at 8 month follow-up studies by  $^{201}\text{Tl}$  SPECT and echocardiography. This is the first report to use FDG PET for diagnosis of myocardial contusion after blunt chest trauma in a patient with normal coronary artery.

In conclusion, FDG PET helped to identify the contused myocardium as a result of perfusion-metabolism matching defect suggesting non-viable infarcted myocardium. FDG PET may be useful in early decision making for patients with blunt chest trauma in a case with indistinct laboratory and imaging findings.

## References

- Sybrandy KC, Cramer MJ, Burgersdijk C. Diagnosing cardiac contusion: old wisdom and new insights. *Heart* 2003;89:485-9.
- Collins JN, Cole FJ, Weireter LJ, Riblet JL, Britt LD. The usefulness of serum troponin levels in evaluating cardiac injury. *Am Surg* 2001;67:821-5.
- Karalis DG, Victor MF, Davis GA, McAllister MP, Covalesky VA, Ross JJ Jr, et al. The role of echocardiography in blunt chest trauma: a transthoracic and transesophageal echocardiographic study. *J Trauma* 1994;36:53-8.
- Bertinchant JP, Polge A, Mohty D, Nguyen-Ngoc-Lam R, Estorc J, Cohendy R, et al. Evaluation of incidence, clinical significance, and prognostic value of circulating cardiac troponin I and T elevation in hemodynamically stable patients with suspected myocardial contusion after blunt chest trauma. *J Trauma* 2000;48:924-31.
- Salmi A, Blank M, Slomski C. Left anterior descending artery occlusion after blunt chest trauma. *J Trauma* 1996;40:832-4.
- Marcum JL, Booth DC, Sapin PM. Acute myocardial infarction caused by blunt chest trauma: successful treatment by direct coronary angioplasty. *Am Heart J* 1996;132:1275-7.
- Maenza RL, Seaberg D, D'Amico F. A meta-analysis of blunt cardiac trauma: ending myocardial confusion. *Am J Emerg Med* 1996;14:237-41.
- Ghesani M, Depuey EG, Rozanski A. Role of  $^{18}\text{F}$  FDG positron emission tomography (PET) in the assessment of myocardial viability. *Echocardiography* 2005;22:165-77.
- Tamaki N, Yonekura Y, Konishi J. Myocardial FDG PET studies with the fasting, oral glucose-loading or insulin clamp methods. *J Nucl Med* 1992;33:1266-8.
- Tenzer ML. The spectrum of myocardial contusion: a review. *J Trauma* 1985;25:620-7.
- Keller KD, Shatney CH. Creatine phosphokinase-MB assays in patients with suspected myocardial contusion: diagnostic test or test of diagnosis? *J Trauma* 1988;28:58-63.
- Biffi WL, Moore FA, Moore EE, Sauaia A, Read RA, Burch JM. Cardiac enzymes are irrelevant in the patient with suspected myocardial contusion. *Am J Surg* 1994;168:523-7.
- Miller FAJ, Seward JB, Gersh BJ, Tajik AJ, Mucha P Jr. Two-dimensional echocardiographic findings in cardiac trauma. *Am J Cardiol* 1982;50:1022-7.
- Yoon SJ, Kwon HM, Kim DS, Hong BK, Kim DY, Cho YH, et al. Acute myocardial infarction caused by coronary artery dissection following blunt chest trauma. *Yonsei Med J* 2003;44:736-9.
- Kahn JK, Buda AJ. Long-term follow-up of coronary artery occlusion secondary to blunt chest trauma. *Am Heart J* 1987;113:207-10.