Gadopentetate Dimeglumine as a Potential Alternative Contrast Medium During Percutaneous Coronary Intervention

— A Case Report —

Shinichi Furuichi, MD; Satoshi Yasuda, MD*; Yukio Arita, MD; Masami Miyawaki, MD;
Kei Nomura, MD; Hiroshi Nonogi, MD*; Takashi Shindo, MD

Background There have not been previous reports of patients undergoing percutaneous coronary intervention (PCI) using a gadolinium chelate.

Methods and Results A 74-year-old woman, who had a history of anaphylactic shock 4 times in response to iodinated contrast media despite preprocedural intravenous administration of hydrocortisone, was hospitalized because of unstable angina refractory to intensive medical treatment. Fully considering the risks of iodinated agents, digital subtraction coronary angiography and PCI were performed using gadopentetate dimeglumine without any side effects or complications.

Conclusions Gadolinium chelates can be an alternative contrast media during PCI in particular patients with contraindications to iodinated media. (*Circ J* 2004; 68: 972–973)

Key Words: Anaphylaxis; Coronary intervention; Gadolinium

Patients with a history of severe allergic reactions to iodinated contrast media present a serious dilemma to interventional cardiologists when diagnostic or interventional procedures are required. We report the case of a patient undergoing percutaneous coronary intervention (PCI) using a gadolinium chelate, which is widely used as a contrast agent in magnetic resonance imaging.

Case Report

A 74-year-old woman, who had histories of old inferior myocardial infarction, 3 coronary artery bypass graft operations and 11 PCIs, was hospitalized because of unstable angina pectoris. She had also had 4 episodes of life-threatening anaphylactic shock in response to iodinated contrast media including iohexol (Omnipaque 350, Nycomed, Oslo, Norway) and iomeprol (Iomeron 350, Eisai, Tokyo, Japan), despite preprocedural intravenous administration of hydrocortisone. Her chest pain attacks were accompanied by significant ST segment depression in leads I, aVL and V3–6, and refractory to intensive medical treatment with 10 mg/day of carvedilol, 80 mg/day of isosorbide mononitrate, 15 mg/day of nicorandil, 81 mg/day of aspirin and 1.5 mg/day of warfarin. Because this patient had a severe allergic reaction to iodinated agents, we performed coronary angiography (CAG) using gadopentetate dimeglumine

(Received May 31, 2004; revised manuscript received July 12, 2004; accepted July 29, 2004)

Division of Cardiology, Department of Medicine, Sumitomo Hospital and *Division of Cardiology, Department of Medicine, National Cardiovascular Center, Suita, Japan

Mailing address: Shinichi Furuichi, MD, Division of Cardiology, Department of Medicine, National Cardiovascular Center, 5-7-1 Fujishirodai, Suita 565-8565, Japan. E-mail: sfuruich@hsp.nvcc.go.jp

Fig 1. (Top) Digital subtraction coronary angiography showing severe stenosis in the midportion of the left anterior descending artery (arrow). (Bottom) Postprocedural angiography and intravascular ultrasound imaging showing no residual stenosis (arrow denotes the target site).

as a contrast agent (0.5 mol/L, Magnevist, Schering, Berlin, Germany). Because the dose used per procedure should be limited to 0.4 mmol/kg;^{1,2} diagnostic angiography was divided into 2 examinations of the patient who weighed 50 kg. Digital subtraction CAG revealed the development of a 90% stenosis in the midportion of the left anterior descending artery (LAD) and total occlusion of the radial artery graft to the LAD. Total occlusion of the proximal right coronary artery (RCA), a 90% stenosis of the gastroepiploic artery graft to the RCA and total occlusion of saphenous vein grafts to the first diagonal branch and the RCA were also found. We injected 5–10 ml of gadopentetate dimeglumine into the coronary artery over 2–3 s, which did not induce any ST segment depression or arrhythmias. Digital subtraction images were acquired at a rate of 7.5 frames/s in the setting of 75–96 kV and 640–800 mA.

Under intravascular ultrasound (IVUS) guidance using gadopentetate dimeglumine, we implanted a 2.5×13 mm stent (MultiLink Penta stent, Santa Clara, CA, USA) in the LAD lesion characterized as type A according to the American College of Cardiology/American Heart Association classification (Fig 1). The total dose used for PCI was kept within 40 ml; that is, 0.4 mmol/kg body weight. No adverse effects were observed with this procedure and she was eventually discharged in a stable condition.

Discussion

There have been reports of gadolinium-based contrast agents being used in cerebral angiography, transcatheter arterial embolization and peripheral angiography in patients with anaphylactoid reactions to iodinated contrast media;^{2–4} but to the best of our knowledge, this is the first report of a patient undergoing PCI using a gadolinium chelate.

The prevalence of anaphylactoid reactions to gadolinium chelates is reported to be extremely low at 0.0002–0.001%¹ and even though the risk of adverse reactions may increase 3–4-fold in patients with a history of anaphylactoid reaction to iodinated contrast media⁵ it remains quite low. Gadolinium-based contrast agents are also tolerated in patients with renal insufficiency, and may reduce the contrast-induced nephropathy that increases mortality rate during hospitalization.^{1,4–7}

The major limitation of gadolinium is its low radio-opacity, which makes the image contrast inferior and increases the total volume administered. The combined use of digital subtraction angiography and IVUS offers a

potential solution to the inherent limitations of gadolinium contrast angiography. Digital subtraction renders the angiographic images more distinct and IVUS is superior for demonstrating the detailed characteristics of the lumen–vessel wall interface.⁸ Using IVUS may also help reduce the total amount of gadolinium administered, which must be limited to 0.4 mmol/kg body weight.^{1,2}

We used gadopentetate dimeglumine because it has been well-tolerated in angiographic or interventional procedures reported by many others.^{1,2,4–6} Four gadolinium-based contrast agents, which contain 0.5 mol/L of gadolinium, are available in Japan. Gadopentetate and gadoterate are characterized as high osmolality and ionic structure, whereas gadoteridol and gadodiamide are low osmolality and have a nonionic structure. Further studies are required to determine which gadolinium chelates would be most suitable for use during CAG and PCI.

In conclusion, gadolinium chelates can be an alternative contrast media during PCI, particularly in patients with prior adverse anaphylactoid reactions to iodine or with impaired renal function.

Acknowledgment

We thank Dr Akira Itoh of Osaka City General Hospital for encouragement and critical reading of the manuscript.

References

1. Spinosa DJ, Kaufmann JA, Hartwell GD. Gadolinium chelates in angiography and interventional radiology. *Radiology* 2002; **223**: 319–325.
2. Arat A, Cekirge HS, Saatci I. Gadodiamide as an alternative contrast medium in cerebral angiography in a patient with sensitivity to iodinated contrast medium. *Neuroradiology* 2000; **42**: 34–37.
3. Kinno Y, Odagiri K, Andoh K, Itoh Y, Tarao K. Gadopentetate dimeglumine as an alternative contrast agent for the use in angiography. *Am J Roentgenol* 1993; **16**: 1293–1294.
4. Wagner HJ, Kalinowski M, Klose KJ, Alfke H. The use of gadolinium chelates for X-ray digital subtraction angiography. *Invest Radiol* 2001; **36**: 257–265.
5. Murphy JM, O'Hare NJ, Smiddy P, Molloy MP. Gadopentetate dimeglumine as a contrast agent in peripheral angioplasty: A case report. *Acta Radiol* 1998; **39**: 576–578.
6. Spinosa DJ, Matsumoto AH, Angle JF, Hagspiel KD. Use of gadopentetate dimeglumine as a contrast agent for percutaneous transluminal renal angioplasty and stent placement. *Kidney Int* 1998; **53**: 503–507.
7. Levey EM, Viscoli CM, Horwitz RI. The effect of acute renal failure on mortality: A cohort analysis. *JAMA* 1996; **275**: 1489–1494.
8. Fitzgerald PJ, Oshima A, Hayase M, Metz JA, Bailey SR, Baim DS, et al. Final results of the Can Routine Ultrasound Influence Stent Expansion (CRUISE) study. *Circulation* 2000; **102**: 523–530.