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Absent myocardial I-123 BMIPP uptake in a family

Eui-Hyo HWANG,* Akira YAMASHITA,** Hitoshi TAKEMORI,** Junichi TAKI,*** Kenichi NAKAJIMA,*** Hisashi BUNKO,**** Saburou NAKAMURA,** Takayuki IKEDA** and Norihisa TONAMI***

*Department of Radiology, Tsuruga City Hospital
**Cardiovascular Center, Tsuruga City Hospital
***Department of Nuclear Medicine, Kanazawa University, Faculty of Medicine
****Department of Medical Informatics, Kanazawa University, Faculty of Medicine

A 72-year-old woman with hypertension showed no sign of myocardial accumulation of ^{123}I-BMIPP, and ^{201}Tl and ^{123}I-MIBG scintigraphy demonstrated normal findings. Electrocardiography showed left axis deviation with inverted T waves in leads I, aV_L, V_{2-6} and QT prolongation. Coronary arteriography, two dimensional echo cardiography and laboratory data showed no abnormality. Her 66-year-old sister with non-insulin-dependent diabetes mellitus also had no myocardial BMIPP uptake, but had normal ^{201}Tl finding. ECG and chest film findings were normal. Laboratory data indicated slightly high fasted blood glucose, triglyceride and total cholesterol. Four sons of a 72-year-old woman also underwent BMIPP scintigraphy. No BMIPP uptake was also observed in her 2nd son (49 years old) and his electrocardiogram showed QT prolongation. Since these rare findings indicating no myocardial BMIPP uptake were seen in a family, we suspected that a hereditary myocardial metabolic abnormality accounted for them.

Key words I-123 BMIPP, hereditary abnormality, myocardial fatty acid metabolism

INTRODUCTION

IODINE 123-labeled 15-(p-iodophenyl)-3-R,S-methylpentadecanoic acid (BMIPP) has been proposed as a fatty acid probe for myocardial fatty acid utilization.[1] This tracer has been in wide clinical use in Japan since 1993, including ischemic heart disease, hypertrophic cardiomyopathy, dilated cardiomyopathy and vasospastic angina pectoris.[2–16] In all of these conditions BMIPP uptake usually shows regional abnormality, but a lack of myocardial uptake of BMIPP has been reported in a small subset of patients.[12,13] The mechanism of this process is still under investigation. We present three cases of non-visualized heart on BMIPP myocardial scintigraphy in a family.

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For reprint contact: Eui-Hyo Hwang, M.D., Department of Radiology, Tsuruga City Hospital, 1–6–60 Mishima-machi, Tsuruga, Fukui 914, JAPAN.

CASE REPORT

A 72-year-old woman has been treated for hypertension since 1988. Her history and that of her family were otherwise unremarkable. She was referred to our department for a routine myocardial scintigraphic study. BMIPP scintigraphy showed non-visualized myocardium on planar and SPECT images, and no abnormal findings in resting ^{201}Tl and ^{123}I-MIBG myocardial scintigraphies were noted (Fig. 1). There was left axis deviation with inverted T waves in leads I, aV_L, V_{2-6} and QT prolongation on the electrocardiogram (Fig. 2). There was no history of arrhythmia in her or the family. Chest X-ray films showed mild cardiomegaly (CTR 54%). Two dimensional echo cardiography demonstrated mild left ventricular dilatation (end-diastric left ventricular diameter was 59 mm) and normal wall motion. Coronary arteriography demonstrated no apparent coronary artery stenosis. Laboratory data showed no apparent abnormalities (blood glucose, insulin, free fatty acid and cholesterol are within normal limits).

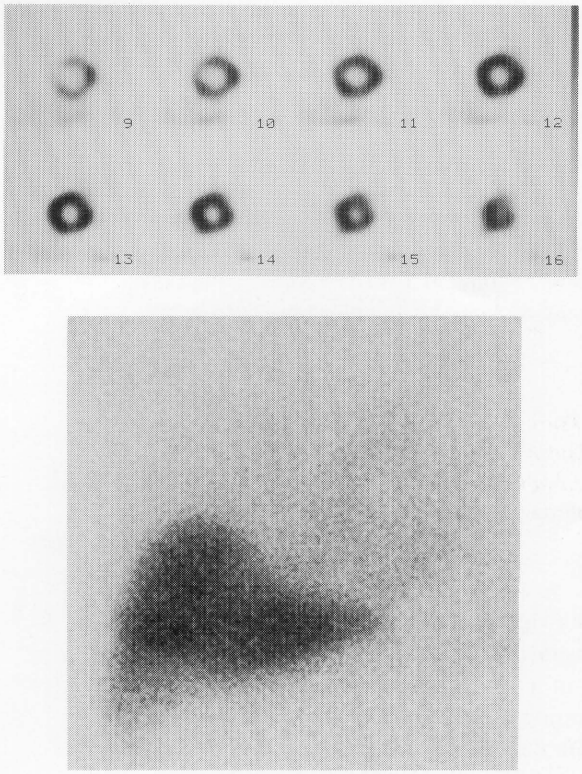

Fig. 1 Planar and SPECT images in a 72-year-old woman. Upper panel: resting ^{201}Tl SPECT reveals normal myocardial perfusion. Lower panel: BMIPP chest anterior planar image shows no myocardial uptake.

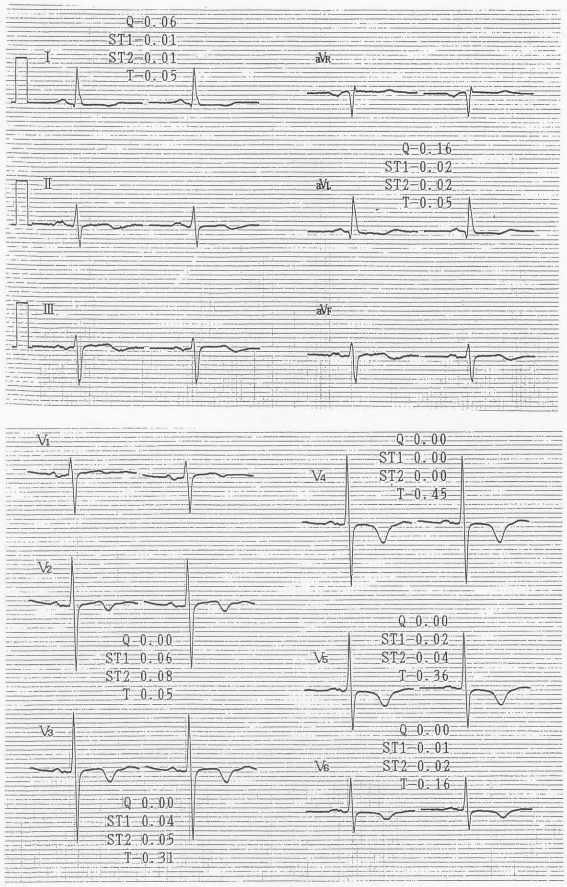

Fig. 2 Electrocardiogram in a 72-year-old woman. There is left axis deviation with inverted T waves in Leads I, aV_L, $V_{2\text{-}6}$ and QT prolongation (QTc: 535 ms).

Her 66-year-old sister with non-insulin-dependent diabetes mellitus (NIDDM) was also referred to our department. BMIPP scintigraphy revealed no myocardial visualization and Tl myocardial scintigraphy at rest was normal (Fig. 3). ECG and chest film findings were normal. Laboratory data showed high fasted blood sugar (158 mg/d*l*), triglyceride (263 mg/d*l*) and total cholesterol (241 mg/d*l*) (serum free fatty acids were not measured).

Four sons of the 72-year-old woman were also studied by us. Informed consent was obtained from all of them. The BMIPP scintigraphy of her 2nd son (49 years old) showed no myocardial uptake of the radiopharmaceutical. An electrocardiogram revealed QTc prolongation (Fig. 4), and other three sons' BMIPP scintigraphy and ECG showed almost normal findings. None of the laboratory data or chest films demonstrated abnormalities (Fasted blood sugar, triglyceride, serum free fatty acids and total cholesterol were within normal limits.) in these 4 subjects.

DISCUSSION

Fatty acids play a major role as energy sources for the normal myocardium at rest,[17] and in a certain pathological situation such as ischemia regional abnormalities of fatty acid utilization are observed. BMIPP, one of the radio-labeled branched fatty acid analogs, has been developed for myocardial metabolic imaging with SPECT. The exact uptake mechanism of this tracer is not fully understood, but its potential ability as a imaging agent for myocardial fatty acid metabolism has been demonstrated in many basic and clinical studies.[1–16] The myocardial accumulation of BMIPP depends on myocardial blood flow and correlates well with the intracellular ATP concentration and triglyceride synthesis.[14,15] In ischemic myocardium, discordant BMIPP uptake less than ^{201}Tl or ^{99m}Tc sestamibi has been reported.[2,7–13,16] Such discordance is often observed in areas exhibiting a wall motion abnormality.[2,8,10] Although the mechanism of such discordant BMIPP uptake is unclear, it may be due to metabolic alteration.[16] Hypertrophic cardiomyopathy also shows such discordance and fatty acid metabolic abnormality is suggested as a disease process.[4–6]

There are a few reports of non-visualized myocardium on ^{123}I-BMIPP myocardial scintigraphy. The incidence of no myocardial BMIPP uptake was reported to be 0.3–2%.[12,13] The exact mechanism of this phenomenon remains unclear. No apparent relationship has been confirmed between this phenomenon and certain factors supposed to interfere with myocardial fatty acids uptake,

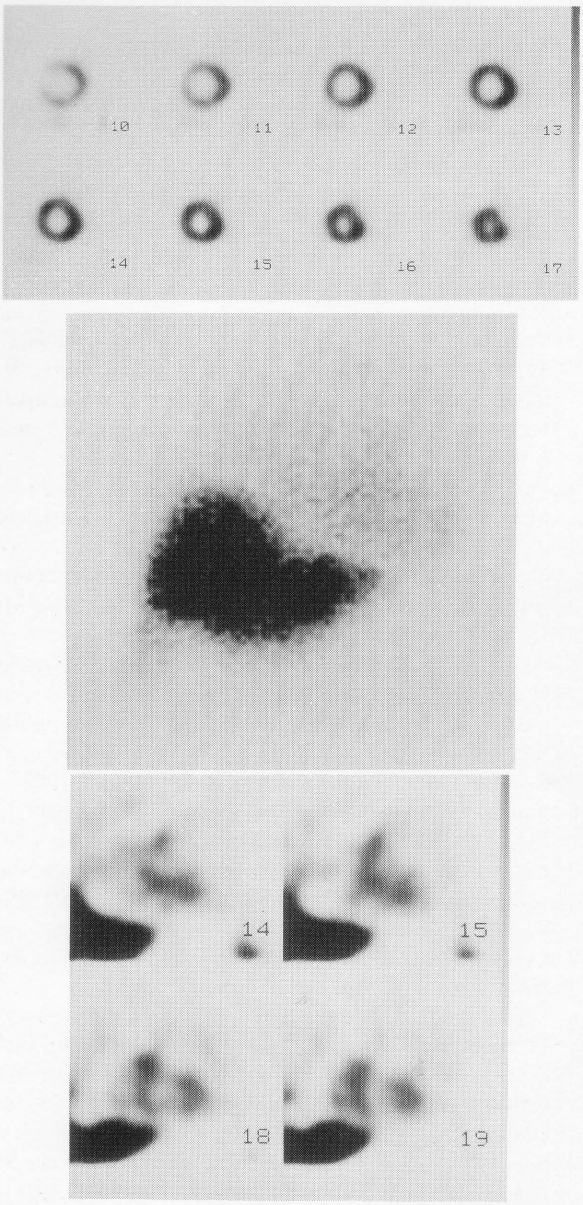

Fig. 3 Planar and SPECT images in a 66-year-old sister of 72 year-old-woman, Upper panel: resting ^{201}Tl SPECT reveals essentially normal myocardial perfusion. Middle and Lower panel: BMIPP chest anterior planar (middle) and SPECT (lower) images show no myocardial uptake and only blood pool activity can be seen.

such as blood glucose, serum insulin level, medications, serum fatty acids and specific heart diseases.[12,13] Although decreased BMIPP was observed in some patients with diabetes mellitus without coronary artery disease,[18] no accumulation pattern has not been reported as in this patient. Since this rare finding was seen in a family in the present study, myocardial BMIPP accumulation is likely to be related to hereditary factors. In the present cases, there were no definite findings indicating ischemia and cardiomyopathy, etc. But QT prolongations on the electrocardiogram were observed in two cases without BMIPP

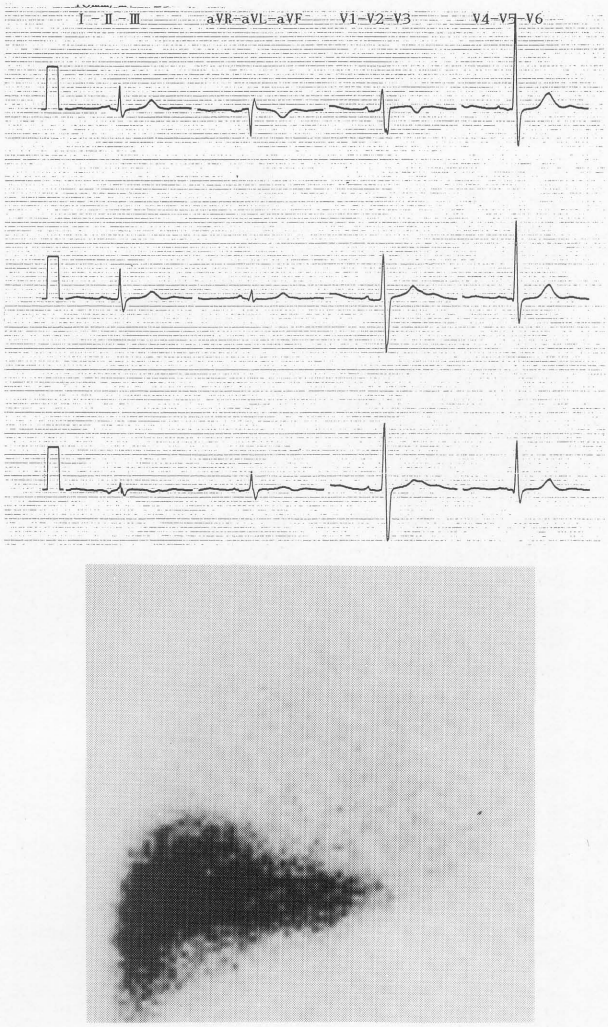

Fig. 4 Electrocardiogram and planar image in a 49-year-old man, the second son of 72 year-old-woman, Upper panel: Electrocardiogram reveals mild QTc prolongation (QTc: 464 ms). Lower panel: BMIPP chest anterior planar image reveals no myocardial uptake.

uptake, and whether this is related to the scintigraphic findings or not is yet to be elucidated. Recent studies have suggested the presence of membrane fatty acid transporters[19,20] but as yet there are no data on the relationship between BMIPP myocardial uptake and these transporters. To determine the exact mechanism of global BMIPP uptake abnormality, further investigations are necessary.

In conclusion, since the rare phenomenon of a lack of myocardial BMIPP was observed in a family, it was proposed that there is the possibility of an unknown hereditary fatty acid metabolic abnormality accounting for this phenomenon.

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