

Comparison Between Tc99m MIBI And Tc99m HM-PAO Imaging For The Muscle Perfusion In Patients With Diabetes Mellitus*

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SUMMARY

Aim: Although it is announced that Tc99m MIBI could be used in muscle perfusion, the role of Tc99m HM-PAO is not clear in this area. To investigate this role, MIBI and HM-PAO (exercises, rest) scintigraphy were performed on 10 Diabetes mellitus (bilateral claudication) and 10 normal patients on different days.

Material and method: After 15 mCi MIBI and 10 mci HM-PAO were administered following the intravenous dipyridamole, exercise and rest static calf imaging were obtained. Rectangular region of interest was drawn over the calf muscle symmetrically and Exercises Capacity Index (ECI) was calculated from that counting data (ECI = Exercises count - Rest count / Exercises count).

Findings: When compared with control values, MIBI and HM-PAO were normal in 6 and high in 4 patients. 2 patients were normal in MIBI and lower in HM-PAO. 4 patients were lower in MIBI and normal in HM-PAO. In case the collateral circulation could occur in patient with normal and lower value, angiography and doppler ultrasonography were performed on 6 patients.

Conclusion: However, none of those patients had collateral circulation. Our study didn't give sufficient results with either radiopharmaceuticals yet we suggest that more patients should be studied with treadmill test instead of dipyridamole infusion.

Keywords: Tc99m MIBI, Tc99m HM-PAO, Muscle perfusion

ÖZET

DİABETES MELLİTUS'LU HASTALarda KAS PERFÜZYONU GÖRÜNTÜLEMESİNDE Tc-99m MİBİ İLE Tc-99m HM-PAO'NUN KARŞILAŞTIRMA

Amaç: Tc99m MIBI'nin kas perfüzyonunda kullanılabilirliği bildirilmesine karşılık, Tc99m HM-PAO'nun bu alandaki rolü açık değildir. Bu amaçla 10 kontrol, 10 diabetes mellituslu hastaya ayrı günlerde Tc99m MIBI ve Tc99m HM-PAO çalışması yapıldı.

Gereç ve yöntem: Intravenöz dipiridamol verilmesini takiben 15 mCi MIBI ve 10 mCi HM-PAO verilerek egzersiz, 4 saat sonra da statik balfır kas imajı alındı. Her iki balfır kas üzerine simetrik olarak çizilen ROI'ler yardımıyla egzersiz kapasite indeksi hesaplandı.

Bulgular: EKI = Egzersiz sayım-İstirahat sayım/Egzersiz sayım. Kontrolle katıştırıldığında: toplam dört hastada EKI MIBI ve HM-PAO normal, dört hastada ise yükseltti. İki hastada EKI MIBI ve HM-PAO normal, dört hastada ise yükseltti. İki hastada MIBI EKI normal iken HM-PAO EKI düşüktü. Dört hasta MIBI'de düşük, HM-PAO'da normal EKI değerlerine sahipti.

Sonuç: Normal ve yüksek değerli hastalara yapılan doppler ultrasonografi ve anjiografide kollateral dolaşım görüntülenmedi. Bu sonuçlara göre biz daha fazla hasta ile ve intravenöz dipiridamol yerine treadmill testi kullanarak çalışmanın genişletilmesini öneriyoruz.

Anahtar Kelimeler: Tc99m MIBI, Tc99m HM-PAO, Kas perfüzyonu

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INTRODUCTION

Conventional contrast arteriography has been used for assessing peripheral arterial disease. While it offers the anatomic details of vessels, arteriography provides little or no information concerning small vessel disease, muscle viability or collateral blood supply (1,2). Therefore, in patients with peripheral arterial disease there is a need for information at the microcirculation blood flow level to the muscle prior to therapeutic intervention. Radionuclide studies, on the other hand, show perfusion in tissue. For this purpose, radiopharmaceuticals may be classified into two groups; particulates, such as Tc99m macroaggregates, Tc99m labelled serum albumine or red blood cells, In-111 transferrin, Tc99mO₄, Tc99m DTPA, Tc99m PYP, and those radionuclides taken up by the muscles directly proportioned to their perfusion, such as K43, Na24, TI201 and radiopharmaceuticals that show free diffusion and clearance from tissues according to the blood flow such as Xe133, I-131 iodoantipyrine. All the methods mentioned above have several major limitations. Labelled particulates require arterial injection, which is relatively invasive; and principle radiation of I-131, Xe133 and TI201 are not optimal for Anger camera imaging. A new product, Tc99m MIBI, which was developed primarily as a myocardial perfusion agent has also proven valuable for skeletal muscle perfusion studies (3). This agent enters skeletal muscle tissue by passive diffusion and remains there for a prolonged period of time due to binding to intracellular protein and a relatively small amount of redistribution. Although it is known that Tc-99m HMPAO is taken up by muscle tissue (4) its role in muscle disease studies in this area are limited. We, therefore, conducted a study to determine whether semiquantitative Tc99m MIBI and Tc99m HM-PAO leg scintigraphy could provide an adequate evaluation of leg perfusion in normal control cases and diabetes mellitus patients with bilateral claudication.

MATERIALS AND METHODS

Muscle perfusion of the lower extremities was examined in 20 patients. 10 patients (mean age; 53.6 ± 7.5 year old, 6 male, 4 female) referred for myocardial perfusion scintigraphy with a low probability of coronary heart disease and negative ECG test results served as the control group. The control subjects had no physical signs or subjective complaints of peripheral arterial disease in the lower extremity. The remaining 10 patients (mean age; 51.4 ± 6.8, 7 male, 3 female) were symptomatic and

described bilateral claudication pain. All patients had diabetes mellitus.

For skeletal muscle scintigraphy, Tc99m MIBI (Institute of Isotopes, Hungary) was prepared according to the manufacturer's instructions and used after radiochemical purity was measured. Following intravenous injection of 10 mCi Tc99m MIBI during rest, the subjects were recalled for imaging 45-60 min. later.

A PHILIPS digital gamma camera detector, fitted with a low energy, high resolution colimator, positioned posteriorly, over both calves was used to acquire word type images (5 min., 128 x 128) onto a Philips computer.

On the same day, Dipyridamole infusion (0.56 mg/kg) was preferred and 25 mCi Tc99m MIBI was injected iv. at 8-10 min. Exercises imaging was made 45 min. later.

Tc99m HM-PAO rest and exercises imaging were obtained as MIBI imaging in different days (exercises 20 mCi, rest 10 mCi).

Imaging Analysis: Two rectangular region of interest (ROI) were drawn over both calf symmetrically, then mean counts within these ROI were used to calculate the exercises capacity index (ECI)= E-I / E x 100

Where, E-average ROI counts of exercises and I average ROI counts of initial rest studied were used to express the perfusion difference between rest and exercises state and to identify the magnitude of the hyperemic response to a physical activities. Left-right ratio wasn't used because of bilateral muscle disease.

RESULTS

Visual assessment of images didn't show any abnormalities because of bilateral calf muscle disease of diabetes mellitus.

TABLE I: ECI values for MIBI in control groups

PATIENT NO	ECI	
	LC	RC
1	0.52	0.47
2	0.64	0.63
3	0.82	0.82
4	0.72	0.74
5	0.89	0.89
6	0.53	0.53
7	0.67	0.61
8	0.65	0.61
9	0.89	0.90
10	0.62	0.60
MEAN ± SD	0.69 ± 0.13	0.68 ± 0.14

TABLE II: ECI values for HMPAO in control groups

PATIENT NO	ECI	
	LC	RC
1	0.18	0.19
2	0.43	0.43
3	0.12	0.15
4	0.36	0.36
5	0.31	0.33
MEAN ± SD	0.28 ± 0.13	0.29 ± 0.12

Table I and table II show ECI values for MIBI and HMPAO in control groups

TABLE III: ECI values for MIBI and HMPAO in diabetes mellitus patients

PATIENT NO	MIBI		HMPAO	
	LC	RC	LC	RC
1	0.61	0.64	0.10*	0.08*
2	0.70	0.68	0.03*	0.05*
3	0.37*	0.31*	0.22	0.26
4	0.28*	0.36*	0.15	0.19
5	0.46*	0.44*	0.18	0.19
6	0.26*	0.30*	0.32	0.28
7	0.86*	0.84*	0.63*	0.66*
8	0.90*	0.91*	0.48*	0.46*
9	1.01*	1.03*	0.66*	0.69*
10	1.04*	1.08*	0.71*	0.68*

* Out of control mean ± sd.

Table III shows ECI values for MIBI and HM-PAO in diabetes mellitus patients.

Values which was out of control mean ± SD was considered as abnormal. When compared with control values, there was 2 normal, 4 low, 4 high values in MIBI studies and 4 normal, 2 low, 4 high values in HM-PAO studies, respectively. Six patients with normal and high ECI values had also normal

values by doppler ultrasonography which could asses collateral flow (1 normal, 3 high in MIBI; 2 normal, 2 high in HM-PAO). Two patients who had low values in MIBI study had collateral flow in doppler ultrasonography study.

DISCUSSION

Thallium-201 (Tl201) scintigraphy reflects local blood flow perfusion and has been performed for the assessment of ischemic heart disease. At present, Tl201 scintigraphy is used as a noninvasive approach to evaluating peripheral vascular disease (5), especially the healing potential of an ischemic ulcer of the foot (6). In a Tl201 leg studies, Siegel et al. showed that there was significant increases in muscle perfusion with exercises(7).

The main purpose of this study was to show the use of Tc99m MIBI and Tc99m HM-PAO in skeletal muscle perfusion to identify arterial disease of the lower extremities.

In contrary our results, Sayman et al. showed that Tc99m MIBI scan was a simple and accurate diagnostic procedure (8) but their semiquantitative results were not sufficient as statistically. We didn't use treadmill exercises test because patients had bilateral claudication pain. Our results that uncorrelated with doppler ultrasonography may due to effectiveness of dipyridamole in lower extremities. Lower extremities disease in diabetes mellitus is not only a blood flow disease but also is a metabolism disturbance that may destroy the exercise capacity distribution of MIBI and HM-PAO. Therefore, distribution of MIBI and HM-PAO may be complex phenomena.

Our study didn't give sufficient results with either radiopharmaceuticals yet we suggest that more patients should be studied with treadmill test instead of dipyridamole infusion.

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