

관동맥질환에서 상지운동부하 Thallium-201 심근스캔의 진단율

고정석¹ · 이근¹ · 신규석¹ · 김서종¹ · 소군호¹
진교현¹ · 장진영¹ · 김성환¹ · 박성기²

Diagnostic Ability of Arm Exercise Thallium-201 SPECT in Detecting Coronary Artery Disease

Jeong Seok Koh, MD¹, Keun Lee, MD¹, Kyu Suck Sin, MD¹,
Seo Jong Kim, MD¹, Kun Ho So, MD¹, Kyo Hyeon Jin, MD¹,
Jin Young Jang, MT¹, Seong Whan Kim, MD¹ and Sung Ki Park, MD²

¹Department of Internal Medicine and ²Nuclear Medicine, Korea Veterans Hospital, Seoul, Korea

ABSTRACT

Background : Exercise testing is a standard noninvasive method used in the evaluation and management of patients with suspected coronary artery disease. However, patients with lower limb impairment are unable to undergo a standard bicycle or treadmill test. Alternative methods of exercise testing are needed for patients with vascular, orthopedic or neurologic conditions who cannot perform leg exercise. This study was aimed to determine the diagnostic accuracy of arm exercise thallium-201 SPECT for evaluating chest pain in patients unable to perform leg exercise. **Method :** Twenty-five anginal patients performed arm ergometry testing in conjunction with thallium-201 SPECT. Thereafter all underwent coronary angiography. **Result :** Significant coronary artery disease (≥ 50% stenosis) in at least one vessel was present in 22 (88%) of the 25 patients. The sensitivity of thallium-201 SPECT for detecting coronary artery disease was 91%, which was significantly higher than the 32% sensitivity found with the electrocardiographic response alone ($p < 0.001$). Thallium-201 SPECT yielded a sensitivity of 88, 86 and 100% for one, two, and three vessel diseases, respectively, and an 84% sensitivity and 81% specificity for detecting individual vessel stenosis. **Conclusion :** Arm exercise thallium-201 SPECT is useful for detecting coronary artery disease in patients unable to perform leg exercise. In addition, it provides an information regarding exercise tolerance. Therefore, this test appears to be reliable and useful and should be considered in the detection of coronary artery disease in nonambulatory patients. (**Korean Circulation J 1999;29(6):575-581**)

KEY WORDS : Arm exercise · Thallium-201 SPECT · Angina pectoris.

서 론

가



Fig. 1. The arm ergometry in operation.

1) , NYHA class ,
가 .
arm ergometer 25
가
가
2)3)
arm ergometer 4)
ST arm
ergometer가 가
thallium - 201 가
(TI - 201)
가
5)6)
Balady 7) 50
TI - 201 83%
78% 가
TI - 201
TI - 201 SPECT (Single Photon Emission
Computed Tomography)
Exercise protocol
Arm ergometer CYBEX MET300
(Fig. 1). TI - 201
가
3 28 watt
3 14 watt 가
12 . 50
30
stage가
3 1
가
가 ,
2 mm
ST , 10 mmHg
1 mm
ST J 0.08
TI - 201 SPECT
stage 1 TI - 201 3 mCi

대상 및 방법

대 상

1998 7 1998 11

관동맥조영술

TI - 201 SPECT

25

50%

분석 및 통계

\pm

Fisher's exact test

p

0.05

결 과

임상적 특징

25 47 83

62 \pm 9 . 40 가 1 , 50

가 8 , 60 가 11 , 70 가 4 , 80 가 1

24 , 1 .

Heart rate (beats/min)	
Rest	62 ± 16
Peak	118 ± 25
Systolic blood pressure (mmHg)	
Rest	113 ± 14
Peak	146 ± 26
Peak rate-pressure product (beats/min × mmHg × 10 ³)	
	17 ± 4
% Maximal heart rate	72 ± 16
Peak VO ₂ (ml/kg/min)	14 ± 3
Exercise capacity (METs)	3.9 ± 0.8

% max heart rate = percent of maximal heart rate attained
VO₂ = oxygen consumption, METs = metabolic equivalent

No. of diseased vessels	No. of patients	TI-201 SPECT	ECG
1	8	7 (88%)	2(25%)
2	7	6 (86%)	2(29%)
3	7	7 (100%)	3(43%)
Overall	22	20 (91%)	7(32%)

TI-201 : thallium-201
SPECT : Single Photon Emission Computed Tomography

Table 3. Diagnostic accuracy of arm exercise TI-201 SPECT according to coronary territory

	SEN (%)	SPE (%)	PPV (%)	NPV (%)
LAD (N = 17)	88	88	94	78
LCX (N = 14)	78	81	85	75
RCA (N = 12)	83	77	77	83
Overall	84	81	86	79

SEN : sensitivity

SPE : specificity

PPV : positive predictive value

NPV : negative predictive value

LAD : left anterior descending artery

LCX : left circumflex artery

RCA : right coronary artery

8
(36%) , 7 (32%) , 7
(32%)
43 17
(40%), 14 (32%), 12 (28%)

TI-201 SPECT

25 22(88%)

21 가 , 1

가

22 20

TI - 201 SPECT

TI - 201 SPECT

91%

32%

83%

(p<0.001).

83%, 84%, 84%

79%

3

89%

84%

가

Melin ⁶⁾

160

TI - 201 SPECT

TI - 201

88%, 86%, 100% (Table 2).

87%

84%

43

36

74%

70%

TI - 201 SPECT

TI - 201 SPECT

84%, 81%,

86%, 79%

Table 3

TI - 201 SPECT

Leppo

고 안

¹¹⁾

TI - 201

93%

80%

가 TI - 201 SPECT
가 TI -
201 SPECT
TI - 201 SPECT 62
91% 가 3.9METs 12
84% 81%
가 가
3 2 3.9METs
가 , 1 가 Arm ergometer¹⁾
TI - 201 SPECT
가 TI - 201 SPECT 12)
3 가
89%
TI - 201 가
TI - 201 가
TI - 201 13)
TI - 201 14)
Iskandrian 85% TI - arm ergometer Monark 868 Rehab, Cybex
201 가 TI - Cybex MET300 1 - 4)
TI - 201 Esquivel 15)
TI - 201 가 가
ST 12)
가
72% 3.9METs TI -
201 SPECT 91% 가
32%

가 (32%)

22 20 TI -

201 SPECT

TI - 201 SPECT 91%

(20/22)

32%(7/22) (p<0.001).

TI - 201 SPECT

88%, 86%, 100%

43 17 (40%),

14 (32%), 12 (28%)

TI - 201 SPECT

가 가

가

88%, 78%, 83% 88%, 81%,

77% 84%(36/43) 81%

(26/32)

요 약

결 론 :

연구 배경 :

가 TI - 201 SPECT

가

가

중심 단어 :

REFERENCES

- 1) Shaw DJ, Crawford MH, Karliner JS, Didonna G, Carleton RM, Ross J, et al. Arm-crank ergometry: A new method for the evaluation of coronary artery disease. *Am J Cardiol* 1974;33:801-5.
 - 2) Schwade J, Blomqvist G, Shapiro W. A comparison of the response to arm and leg work in patients with ischemic heart disease. *Am Heart J* 1977;94:203-8.
 - 3) Lazarus B, Cullinane E, Thompson PD. Comparison of the results and reproducibility of arm and leg exercise tests in men with angina pectoris. *Am J cardiol* 1981;47:1075-9.
 - 4) Balady GJ, Weiner DA, McCabe CH, Ryan TJ. Value of arm exercise testing in detecting coronary artery disease. *Am J cardiol* 1985;55:37-9.
 - 5) Bailey IK, Griffith LSC, Rouleau J, Strauss HW, Pitt B. Thallium-201 myocardial perfusion imaging at rest and during exercise. Comparative sensitivity to electrocardiography in coronary artery disease. *Circulation* 1976;55:79-87.
 - 6) Melin JA, Piret LJ, Vanbutsele RJM, Rousseau MF, Cosyns J, Brasseur LA, et al. Diagnostic value of exercise electrocardiography and thallium myocardial scintigraphy in patients without previous myocardial infarction: A
- TI - 201 SPECT
- 방 법 :
- 1998 7 1998 11
- 25
- Cybox MET300
- TI - 201 SPECT
- 201 SPECT 25
- 결 과 :
- 3.9METs
- 118 72%
- 25 22 (88%)
- (36%) , 7 (32%) , 7

- Bayesian approach. Circulation* 1981;63:1019-24.
- 7) Balady GJ, Weiner DA, Rothendler JA, Ryan TJ. *Arm exercise-thallium imaging testing for the detection of coronary artery disease. J Am Coll Cardiol* 1987;9:84-8.
 - 8) Ahmad M, Dubiel JP, Haibach H. *Cold pressor thallium-201 myocardial scintigraphy in the diagnosis of coronary artery disease. Am J Cardiol* 1982;50:1253-7.
 - 9) Heller GV, Aroesty JM, Parker JA, McKay RG, Silverman KJ, Als AV, et al. *The pacing stress test: Thallium-201 myocardial imaging after atrial pacing. Diagnostic value in detecting coronary artery disease compared with exercise testing. J Am Coll Cardiol* 1984;3:1197-204.
 - 10) Mahmarian JJ, Verani MS. *Exercise thallium-201 perfusion scintigraphy in the assessment of coronary artery disease. Am J Cardiol* 1991;67:2D-11D.
 - 11) Leppo J, Boucher CA, Okada RD, Newell JB, Strauss HW, Pohost GM. *Serial thallium-201 myocardial imaging after dipyridamole infusion: Diagnostic utility in detecting coronary stenoses and relationship to regional wall motion. Circulation* 1982;66:649-57.
 - 12) Detrano R, Janosi A, Lyons KP, Marcondes G, Abbassi N, Froelicher VF. *Factors affecting sensitivity and specificity of a diagnostic test: The exercise thallium scintigram. Am J Med* 1988;84:699-708.
 - 13) Iskandrian AS, Hakki AH. *Thallium-201 myocardial scintigraphy. Am Heart J* 1985;109:113-28.
 - 14) Iskandrian AS, Heo J, Kong B, Lyons E. *Effect of exercise level on the ability of thallium-201 tomographic imaging in detecting coronary artery disease: Analysis of 461 patients. J Am Coll Cardiol* 1989;14:1477-86.
 - 15) Esquivel L, Pollock SG, Beller GA, Gibson RS, Watson DD, Kaul S. *Effect of the degree of effort on the sensitivity of the exercise thallium-201 stress test in symptomatic coronary artery disease. Am J Cardiol* 1989;63:160-5.
 - 16) McCarthy CE, Balady GJ, Green AM. *A cost effective conversion of a supine exercise bicycle for arm ergometry (abstr). J Nucl Med tech* 1985;13:Ab4.