Correlation of Short Form-36, Energy Expenditure and Six-Minute Walk Test in Post Coronary Artery Bypass Graft and Post Percutaneous Coronary Intervention Patients

Watesinee Kaewkhuntee PhD*,
Wattana Jalayondeja PhD*

** Faculty of Physical Therapy, Mahidol University, Nakhon Pathom, Thailand*

Objective: *To investigate the correlation between Short Form-36 (SF-36) and exercise capacity including: 1) metabolic equivalents measured by an exercise stress test (METs of EST), 2) peak oxygen consumption (VO_2 peak), and 3) walking distances measured by a six-minute walk test (6MWT).*

Material and Method: *SF-36, EST and 6MWT were estimated at the sixth week after coronary artery bypass graft (n = 17) and percutaneous coronary intervention (n = 13) patients. Pearson's product-moment correlation was used to evaluate the relationship of parameters.*

Results: *Physical functioning scale of SF-36 showed moderate correlation with METs (r = 0.55, p<0.01), fair correlation with VO_2 peak of 6MWT (r = 0.46, p<0.05) and walking distance (r = 0.43, p<0.05). Bodily pain showed fair correlation with METs (r = 0.40, p<0.05) and walking distance (r = 0.45, p<0.05). Social functioning showed fair correlation with METs (r = 0.38, p<0.05). Report-health transition showed fair correlation with METs (r = 0.38, p<0.05) and walking distance (r = 0.41, p<0.05).*

Conclusion: *The physical domain of SF-36 that comprised physical function, role-physical, bodily pain and general health correlated with physical capacity of these post-operation groups (r = 0.49, p<0.001). Therefore, clinicians can use the SF-36 and 6MWT to evaluate functional capacity in addition to EST and indirect calorimetry conveniently.*

Keywords: *SF-36, Metabolic equivalents, Peak oxygen consumption, Six-minute walk test, Post coronary artery bypass graft, Post percutaneous coronary intervention*

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Patients with cardiovascular disease tend to refrain from exercise. They perceive that exercise leads to angina, dyspnea, and dizziness, thereby preferring to stay in bed with minimal activities[1]. For this reason, physical abilities are restricted. Even though some patients' angina subsides after medical and surgical treatments, some physical activities are inappropriate due to unstable cardiac function[2-4]. The restriction of functional capability may lead to poor quality of life (QOL) including the physical, emotional and social domains.

The QOL of cardiac patient is an important domain with which clinicians have to be concerned. Short Form-36 (SF-36 Thai version) is a popular QOL questionnaire for cardiac patients. It was translated by Krittayaphong and its reliability and validity is high[5-8]. Six-minute walk test (6MWT) is commonly used as an outcome measure of physical capacity in cardiac rehabilitation. The 6MWT reliability and validity are also high[9-11]. Moreover, when comparing the 6MWT with the two-minute walk test (2MWT), twelve-minute walk test (12MWT) and shuttle walk test (SWT), the result reveals that 6MWT is better tolerated and more accurately reflects activities for daily living (ADL) than other walk tests. Suman-Horduna[12] studied the QOL and functional capacity in patients with atrial fibrillation and congestive heart failure. The results showed similar improvements in QOL and functional capacity in those patients. To date, no study has been conducted of the relationship between SF-36, METs of EST, VO_2 peak, and walking distance by 6MWT in post revascularization of people

Correspondence to:
Jalayondeja W, Faculty of Physical Therapy, Mahidol University, 999 Phuttamonthon 4 Road, Salaya, Phuttamonthon, Nakhon Pathom 73170, Thailand.
Phone: +66-2-4415450 ext. 21601, Fax: +66-2-4415454
E-mail: wattana.jal@mahidol.ac.th

with coronary artery disease (CAD).

Therefore, the purposes of this study were to determine the correlations between SF-36 and METs of EST, VO_2 peak, and walking distance of a 6MWT in post coronary artery bypass graft (postCABG) and post percutaneous coronary intervention (postPCI) patients.

Material and Method

Subjects comprised six-week postCABG and postPCI, aged over 50 years, physical activity level in the New York Heart Association Functional Classification (NYHA Fc) I-II and able to understand verbal instructions, read, and write in Thai. Exclusion criteria included those who had contra-indication to exercise testing[13], verbal, hearing, or neurological deficits and any musculoskeletal problems affecting walking ability. The subjects understood and signed the written consent form approved by Siriraj Hospital, Mahidol University Institutional Review Board (SiIRBCOA NO. Si 342/2011).

QOL was measured by SF-36 (Thai version). Exercise capacity was estimated by 6MWT and EST at the sixth week post operation. Then the orders of both tests were random and during each test, subjects were allowed to rest at least 20 minutes or until vital signs returned to their baseline. EST was measured by Modified Bruce protocols. The reason to stop the test was fatigue. The 6MWT was performed along a 30-meter hospital hallway, before the 6MWT, the indirect calorimetry (Vmax Encore portable metabolic cart, Oxycon mobile, VIASYS Respiratory Care Inc, USA) was provided to the subjects to measure VO_2 peak using breath-by-breath mode. The equipment weighed 0.5 kg. Meanwhile, heart rate, blood pressure, oxygen saturation (SaO_2), RPE, and all related signs and symptoms were recorded.

Data of this study showed normal distribution by Kolmogorov-Smirnov Goodness of Fit Test. Pearson's product moment correlation was used to determine the relationship between SF-36 QOL scores, and physical capacity (METs, VO_2 peak of 6MWT, walking distance of 6MWT) parameters. The coefficient values were classified as good to excellent ($r>0.75$) moderate to good ($0.50 \leq r <0.75$), fair ($0.25 \leq r <0.5$) and little or no ($0.00 \leq r <0.25$) relationship[14].

Results

Subjects in the present study comprised postCABG (n = 17), and postPCI (n = 13) patients. The subject's characteristics are shown in Table 1. The correlation between SF-36 and exercise capacity is presented in Table 2, revealing moderate to good correlation between physical functioning and METs of EST ($r = 0.55$, $p<0.01$), and fair correlation between physical functioning and VO_2 peak of 6MWT ($r = 0.46$, $p<0.05$) and walking distance ($r = 0.43$, $p<0.05$). Bodily pain exhibited a fair correlation with METs of EST ($r = 0.40$, $p<0.05$) and walking distance ($r = 0.45$, $p<0.05$). Social functioning also exhibited a fair correlation with METs of EST ($r = 0.38$, $p<0.05$). A fair correlation was observed for report-health transition and METs of EST ($r = 0.38$, $p<0.05$) and walking distance ($r = 0.41$, $p<0.05$). When determined using SF-36 domain, a fair correlation was found between physical domain, including physical functioning, role-physical, bodily pain and general health, and METs of EST ($r = 0.49$, $p<0.01$) and VO_2 peak of 6MWT ($r = 0.43$, $p<0.05$). However, no correlation was found between emotional domain including vitality, social functioning, role-emotional and mental health and energy expenditure.

Discussion

Physical functioning scale of SF-36 had a positive correlation with METs of EST, VO_2 peak and walking distance of 6MWT in patients postCABG and postPCI. The METs of EST is a gold standard for evaluating functional capacity in cardiac patients. The functional capacity represents the maximum ability of the heart and lungs to deliver oxygen and muscle ability to extract the oxygen[15]. These results are similar to Boueri in 2001[15]. They reported that the SF-36 showed significant improvement in physical function, energy/fatigue, emotional role, mental health, and health change following pulmonary rehabilitation. Walking distance and forced expiratory volume in one second (FEV_1) correlated with physical functioning, physical role limitation, bodily pain, and general health in chronic obstructive pulmonary disease (COPD) patients. Bodily pain in this study had a positive correlation with METs of EST, which could have been caused by wound pain after operation because most postCABG patients' bypass graft involved the saphenous vein. The present study showed report-health transition and self-administered general health compared with the previous year's correlation with METs of EST. The results implied that the self-esteem of the patients could reflect the functional capacity in postCABG and postPCI patient.

Clinical implication

The findings provide a broader aspect for assisting physical therapists and other health care workers to manage CABG and PCI patients. Clinicians

Table 1. Subject characteristics

Characteristics	PostCABG (n = 17)	PostPCI (n = 13)
Sex		
Male (n)	12	9
Female (n)	5	4
Age (year), mean ± SD	59.94±6.53 range 50-71	61.92±7.33 range 51-75
Weight (kg), mean ± SD	64.86±13.42 range 51-104	68.78±8.51 range 54-91
Height (cm), mean ± SD	161.59±10.73 range 142-187	163.00±6.13 range 153-173
BMI (kg/m^2), mean ± SD	24.59±2.01 range 22.03-29.58	25.88±2.82 range 22.39-32.63

BMI = body mass index; CABG = coronary artery bypass graft; PCI = percutaneous coronary intervention

Table 2. Correlation of SF-36, METs of EST, VO_2 peak of 6MWT and walking distance

Short Form-36	METs		VO2 peak		Walking distance	
	r	*p*-value	r	*p*-value	r	*p*-value
Physical domain	0.49	<0.001**	0.43	0.02*	0.34	0.07
Physical functioning	0.55	<0.001**	0.46	0.01*	0.43	0.02*
Role-physical	0.24	0.19	0.18	0.35	0.17	0.37
Bodily pain	0.40	0.03*	0.34	0.07	0.45	0.01*
General health	-0.05	0.79	-0.11	0.58	-0.16	0.40
Emotional domain	0.16	0.40	0.12	0.53	0.10	0.62
Vitality	0.10	0.60	0.09	0.64	0.01	0.95
Social functioning	0.38	0.04*	0.32	0.08	0.30	0.11
Role-emotional	0.02	0.92	-0.05	0.80	-0.01	0.98
Mental health	0.04	0.83	0.07	0.71	0.01	0.96
Reported health transition	0.38	0.04*	0.36	0.05	0.41	0.03*

Physical Domain = Physical Functioning + Role-Physical + Bodily Pain + General Health; Emotional Domain = Vitality + Social Functioning + Role-Emotional + Mental Health
* = significant levelat *p*-value <0.05; ** = significant level at *p*-value <0.01

can use the SF-36 and 6MWT to evaluate functional capacity in addition to EST and indirect calorimetry conveniently.

Limitations

The limitations in the present study are described below. The small number of subjects resulted in a fair to moderate correlation between SF-36 and functional capacity (METs and VO_2 peak). The unclear understanding of questions in the emotional domain might have caused lowered scores that might not reflect the real situation of participants.

Conclusion

Regarding the SF-36 scale, physical functioning had a moderate to good correlation with METs of EST (r = 0.55). Therefore, SF-36 is useful to assess the exercise capacity of early stage postCABG and postPCI patients.

What is already known on this topic?

SF-36 is the common generic tool to evaluate the QOL in cardiac patients. The 6MWT is a worldwide and simple submaximal exercise test. VO_2 peak and METs of EST are the main parameters of functional capacity but are difficult to use clinically. At present, few studies have investigated the relationship of SF-36 and 6MWT among cardiopulmonary patients. In addition, a study of the relationship of SF-36, VO_2 peak of 6MWT and METs of EST in postCABG and postPCI patients would be beneficial.

What this study adds?

The results of the present study could explain

the correlation of SF-36 domains, VO_2 peak, walking distance of 6MWT and METs of EST in postCABG and postPCI patients. Therefore, clinicians can conveniently assess the exercise capacity using the SF-36.

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Potential conflicts of interest

None.

References

1. Pokathip S, Chirawatkul S. Perceptions of symptoms of myocardial infarction among I-Saan women: Ubonrachathani context. J Nurs Sci Health 2012; 35: 43-52.
2. Deturk WE, Cahalin LP. Cardiovascular and pulmonary physical therapy: an evidence-based approach. New York: McGraw-Hill; 2004.
3. Hirschhorn AD, Richards D, Mungovan SF, Morris NR, Adams L. Supervised moderate intensity exercise improves distance walked at hospital discharge following coronary artery bypass graft surgery—a randomised controlled trial. Heart Lung Circ 2008; 17: 129-38.
4. Sandau KE, Lindquist RA, Treat-Jacobson D, Savik K. Health-related quality of life and subjective neurocognitive function three months after coronary artery bypass graft surgery. Heart Lung 2008; 37: 161-72.
5. Krittayaphong R, Bhuripanyo K, Raungratanaamporn O, Chotinaiwatarakul C, Chaowalit N, Punlee K, et al. Reliability of Thai version of SF-36 questionnaire for the evaluation of quality of life in cardiac patients. J Med Assoc Thai 2000; 83 (Suppl 2): S130-6.
6. Leurmarnkul W. Health-related quality of life questionnaire development. Thai J Pharm Sci 2000; 24: 71-85.
7. Leurmarnkul W, Meetam P. Development of a quality of life questionnaire: SF-36 (Thai Version). Thai J Pharm Sci 2000; 24: 92-111.
8. Leurmarnkul W, Meetam P. Properties testing of the retranslated SF-36 (Thai Version). Thai J Pharm Sci 2005; 29: 69-88.
9. Guyatt GH, Sullivan MJ, Thompson PJ, Fallen EL, Pugsley SO, Taylor DW, et al. The 6-minute walk: a new measure of exercise capacity in patients with chronic heart failure. Can Med Assoc J 1985; 132: 919-23.
10. Sinclair RC, Batterham AM, Davies S, Cawthorn L, Danjoux GR. Validity of the 6 min walk test in prediction of the anaerobic threshold before major non-cardiac surgery. Br J Anaesth 2012; 108: 30-5.
11. Roberts E, Frederick K, Sykes K. Validity of the 6-minute walk test for assessing heart rate recovery after an exercise-based cardiac rehabilitation programme. Physiotherapy 2006; 92: 116-21.
12. Suman-Horduna I, Roy D, Frasure-Smith N, Talajic M, Lesperance F, Blondeau L, et al. Quality of life and functional capacity in patients with atrial fibrillation and congestive heart failure. J Am Coll Cardiol 2013; 61: 455-60.
13. American College of Sports Medicine. ACSM's guidelines for exercise testing and prescription. 7th ed. Philadelphia: Lippincott Williams & Wilkins; 2006.
14. Portney LG, Watkins MP. Foundations of clinical research applications to practice. 2nd ed. Upper Saddle River, NJ: Prentice-Hall; 2000.
15. McArdle WD, Katch FI, Katch VL. Essentials of exercise physiology 3rd ed. Philadelphia: Lippincott Williams & Wilkins; 2006.
16. Hsieh CB, Tsai CS, Chen TW, Chu HC, Yu JC, Chen DR. Correlation between SF-36 and six-minute walk distance in liver donors. Transplant Proc 2010; 42: 3597-9.
17. Boueri FM, Bucher-Bartelson BL, Glenn KA, Make BJ. Quality of life measured with a generic instrument (Short Form-36) improves following pulmonary rehabilitation in patients with COPD. Chest 2001; 119: 77-84.

ความสัมพันธ์ระหว่างคะแนนคุณภาพชีวิต SF-36 ค่าพลังงานที่ใช้ในการเดินสายพานและการทดสอบเดิน 6 นาทีในผู้ป่วยภายหลังได้รับการผ่าตัดทำทางเบี่ยงหลอดเลือดหัวใจโคโรนารีและผู้ป่วยภายหลังได้รับการเปิดหลอดเลือดหัวใจโคโรนารี

เวทสินี แก้วขันตี, วรรธนะ ชลายนเดชะ

วัตถุประสงค์: เพื่อศึกษาความสัมพันธ์ระหว่างคะแนนคุณภาพชีวิต SF-36 ค่าพลังงานที่ใช้ในการเดินสายพาน (METs of EST) การใช้ออกซิเจนสูงสุดในการเดิน 6 นาที (VO_2 peak of 6MWT) และระยะทางเดิน 6 นาที (6MWD)

วัสดุและวิธีการ: ทำการวัดคุณภาพชีวิตและความสามารถในการออกกำลังกายหลังการรักษา 6 สัปดาห์ ด้วยแบบสอบถามคุณภาพชีวิต SF-36 การเดินสายพานและการเดิน 6 นาทีในผู้ป่วยภายหลังได้รับการผ่าตัดทำทางเบี่ยงหลอดเลือดหัวใจ (n = 17) และผู้ป่วยภายหลังได้รับการเปิดหลอดเลือดหัวใจ (n = 13) และใช้ Pearson product-moment หาความสัมพันธ์ระหว่างตัวแปรทั้งหมด

ผลการศึกษา: แบบสอบถาม SF-36: ความสามารถด้านแรงกายมีความสัมพันธ์ระดับปานกลางกับMETs ($r = 0.55$, $p<0.01$), มีความสัมพันธ์ระดับต่ำกับ VO_2 peak of 6MWT ($r = 0.46$, $p<0.05$), และ 6MWD ($r = 0.43$, $p<0.05$) ความเจ็บปวดทางกายมีความสัมพันธ์ระดับต่ำกับ METs ($r = 0.40$, $p<0.05$) และระยะทางเดิน 6 นาที (6MWD) ($r = 0.45$, $p<0.05$) กิจกรรมด้านสังคมมีความสัมพันธ์ระดับต่ำกับ METs ($r = 0.38$, $p<0.05$) การรายงานสุขภาพที่เปลี่ยนแปลงมีความสัมพันธ์ระดับต่ำกับ METs ($r = 0.38$, $p<0.05$) และระยะทางเดิน 6 นาที (6MWD) ($r = 0.41$, $p<0.05$) เมื่อพิจารณาตามโดเมนพบว่าคะแนนด้านร่างกายมีความสัมพันธ์กับ METs ($r = 0.49$, $p<0.01$) และ VO_2 peak of 6MWT ($r = 0.43$, $p<0.05$) แต่ไม่พบความสัมพันธ์ของด้านจิตใจและค่าพลังงานที่ใช้ในการออกกำลัง

สรุป: แบบสอบถาม SF-36 ด้านร่างกายมีความสัมพันธ์กับความสามารถด้านแรงกายในผู้ป่วยภายหลังได้รับการผ่าตัดทำทางเบี่ยงหลอดเลือดหัวใจโคโรนารีและผู้ป่วยภายหลังได้รับการเปิดหลอดเลือดหัวใจโคโรนารี