Practical Cardiac Rehabilitation Phase 2

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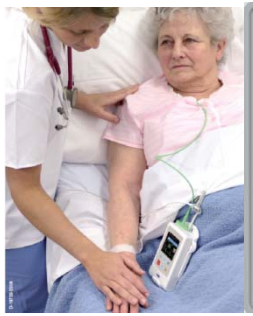


Exercise and Cardiovascular Benefit

- ลดอัตราการตาย (mortality) 20-25%
- มีแนวโน้มช่วยลดอัตราการกลับเป็นซ้ำของโรค (morbidity, non fatal recurrent cardiac event)
- คุณภาพชีวิตที่ดีขึ้น (quality of life)
- หลอดเลือดตีบลดลง (regression of disease) :

  > 2,200 kcal/wk = เดินเร็ว 1 ชม. X 7วัน/wk
- Improve VO2 max, myocardial VO2
- Improve CV risk factors

Goal CR phase 2

- เพิ่มสมรรถภาพทางร่างกาย จิตใจโดยการให้โปรแกรมการออกกำลังกายที่เหมาะสม
- เพิ่มความสามารถในการประกอบกิจวัตรประจำวัน
- ทำให้ผู้ป่วยสามารถกลับไปทำงานได้เร็วขึ้น
- ให้ผู้ป่วยเข้าใจและเห็นความสำคัญของการลดปัจจัยเสี่ยงเพื่อลดการเกิดโรคซ้ำ
- เพื่อให้สมาชิกในครอบครัวรับทราบถึงบทบาทในการร่วมรักษา

Cardiac Rehabilitation Phase2

- Hospital based
- Centre based

- Home based

BMJ

RESEARCH

Home based versus centre based cardiac rehabilitation: Cochrane systematic review and meta-analysis

Hasnain M Dalal, honorary clinical lecturer,[1] general practitioner,[2] Anna Zawada, senior analyst,[3] Kate Jolly, senior lecturer in public health and epidemiology,[4] Tiffany Moxham, information specialist,[5] Rod S Taylor, associate professor in health services research[5]

- 2010
- AMI, angina, HF, coronary revascularisation
- 12 studies (1938 participants)
- Most studies recruited patients with a low risk
- Mortality, morbidity, QoL, modifiable risk factor

Exercise capacity

	Home based CR		Centre based CR		Standard mean difference (random 95% CI)	Weight (%)	Standard mean difference (random 95% CI)
	Mean (SD)	Total	Mean (SD)	Total			
Arthur 2002[36]	5.22 (2.1)	113	5.21 (2)	109		8.9	0.00 (-0.26 to 0.27)
Bell 1998[30]	7.29 (2.81)	91	7.1 (3.12)	91		8.7	0.06 (-0.23 to 0.35)
Carlson 2000[32]	7.4 (1.5)	34	6.8 (1.7)	29		6.9	0.37 (-0.13 to 0.87)
Dalal 2007[21]	9.66 (3.1)	60	7.68 (2.8)	44		7.8	0.66 (0.26 to 1.06)
Daskapan 2005[34]	23.6 (7.4)	11	23.3 (6.8)	11		4.5	0.04 (-0.80 to 0.88)
Gordon 2002 (community)[26]	1.6 (2.2)	40	1.6 (2.1)	22		6.8	0.00 (-0.52 to 0.52)
Gordon 2002 (supervised)[26]	0.9 (1.9)	49	1.6 (2.1)	22		6.9	-0.35 (-0.86 to 0.15)
Jolly 2007[22]	391.3 (162.11)	191	407.4 (157.6)	179		9.3	-0.10 (-0.30 to 0.10)
Kassaian 2000[25]	8.9 (2.9)	60	12.4 (2.7)	65		7.9	-1.24 (-1.63 to -0.86)
Marchionni 2003[24]	3650.67 (3957.23)	74	3509.33 (3343.82)	79		8.5	0.04 (-0.28 to 0.36)
Miller 1984 (brief)[27]	8 (1.5)	33	7.9 (1.3)	31		7.0	0.07 (-0.42 to 0.56)
Miller 1984 (expanded)[27]	7.9 (1.5)	33	8.9 (1.4)	30		6.9	-0.68 (-1.19 to -0.17)
Sparks 1993[37]	1900 (400)	10	1950 (150)	10		4.2	-0.16 (-1.04 to 0.72)
Wu 2006[35]	22.9 (3.6)	18	24.2 (4.4)	18		5.7	-0.32 (-0.97 to 0.34)
Total (95% CI)		817		740		100.0	-0.11 (-0.35 to 0.13)

Test for heterogeneity: $\tau^2=0.15$, $\chi^2=60.91$, df=13, P<0.001, $I^2=79\%$

Test for overall effect: z=0.91, P=0.36

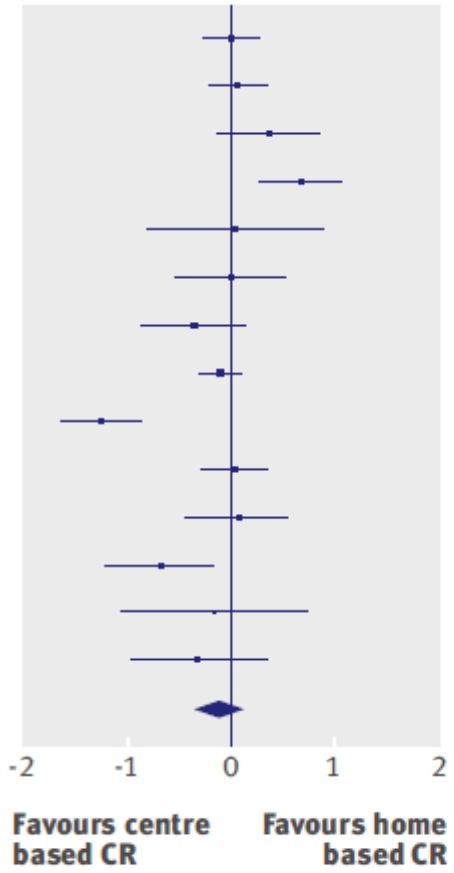

Fig 2 | Exercise capacity with home based and centre based cardiac rehabilitation (CR) at 3-12 months of follow-up

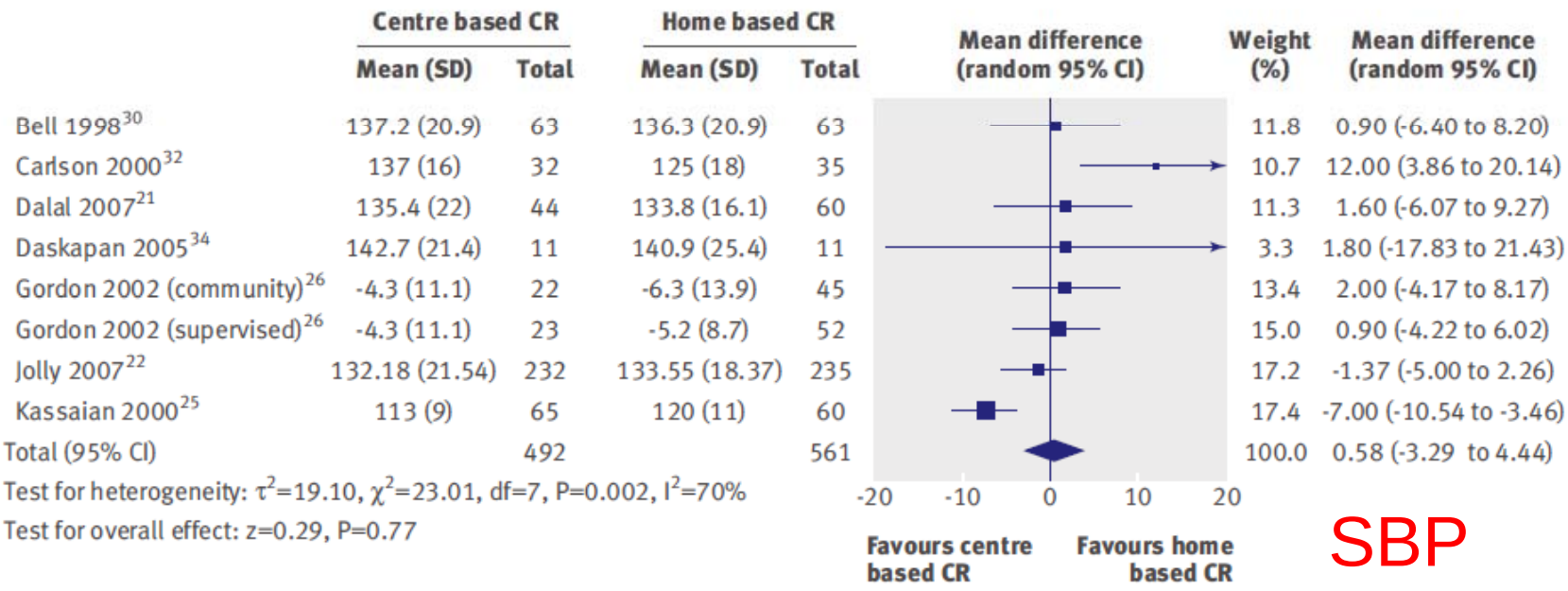

Fig 3 | Systolic blood pressure with home based and centre based cardiac rehabilitation at 3-12 months of follow-up

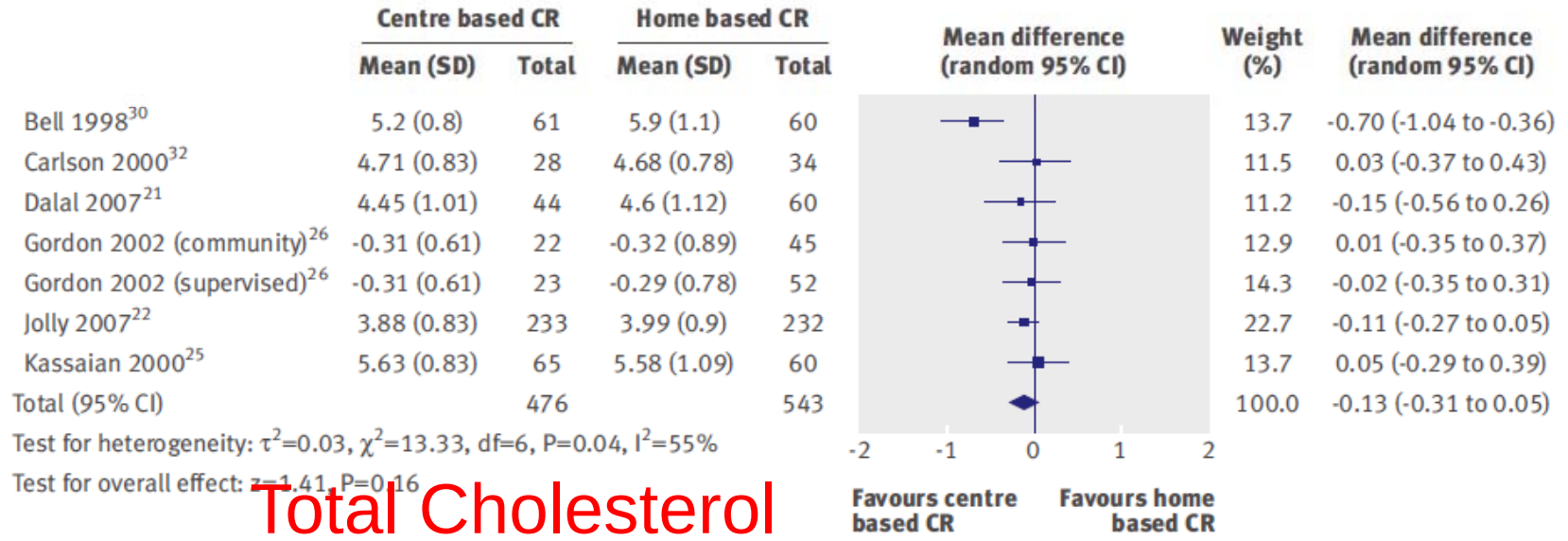

Fig 5 | Total cholesterol (mmol/l) with home based and centre based cardiac rehabilitation at 3-12 months of follow-up

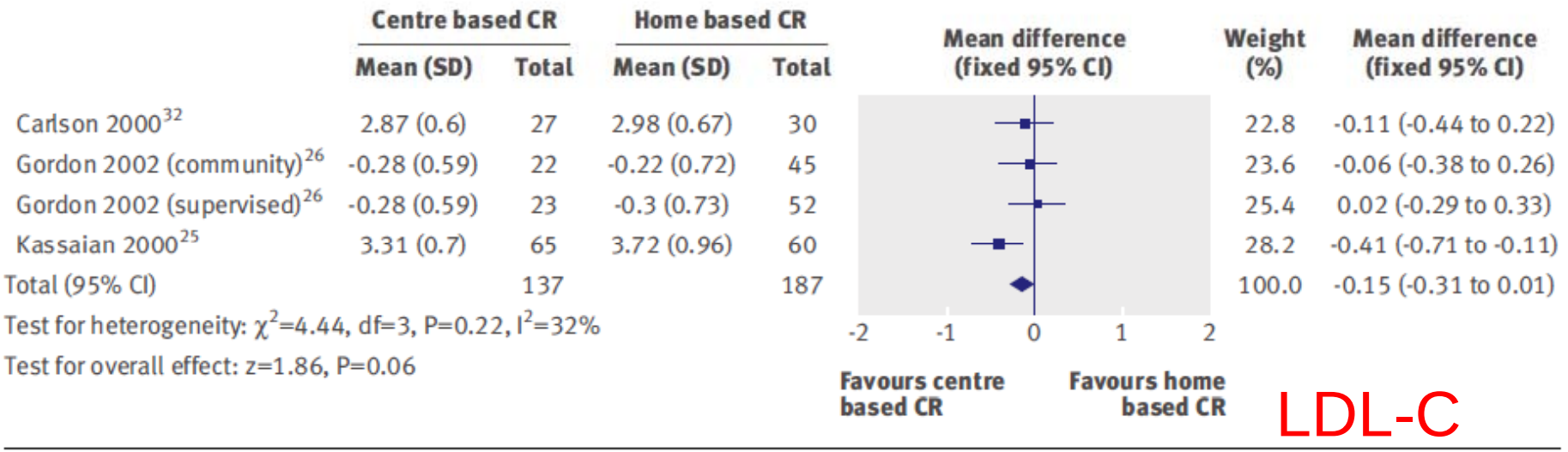

Fig 7 | Low density lipoprotein cholesterol (mmol/l) with home based and centre based cardiac rehabilitation at 3-12 months of follow-up

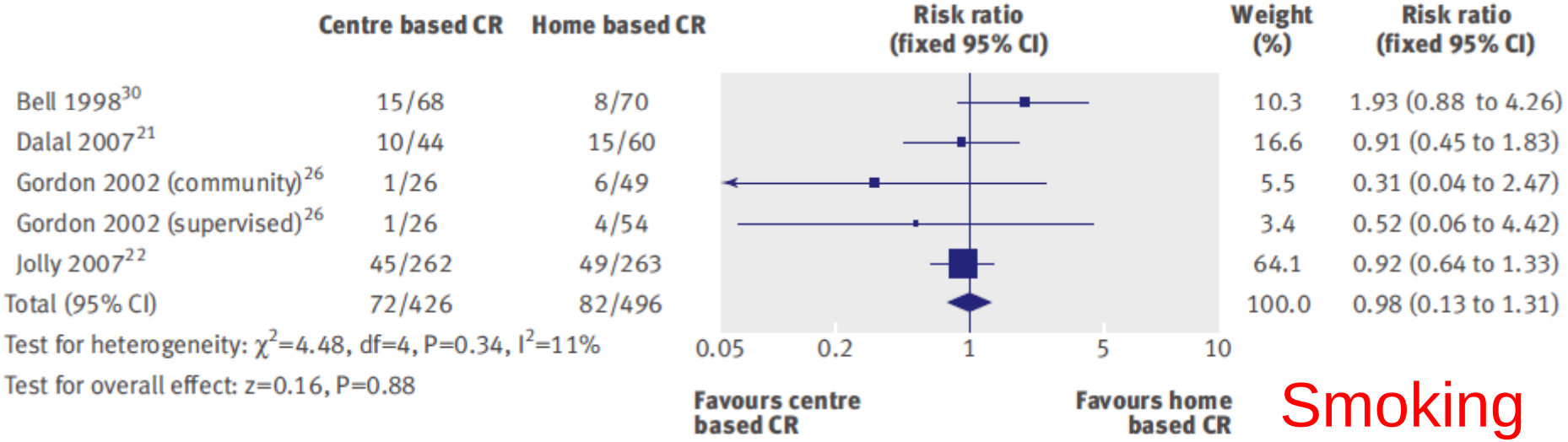

Fig 9 | Relative risk of smoking with home based and centre based cardiac rehabilitation at 3-12 months of follow-up

Mortality

	Centre based CR	Home based CR	Risk ratio (fixed 95% CI)	Weight (%)	Risk ratio (fixed 95% CI)
Bell 1998[30]	12/152	7/99		64.5	1.12 (0.46 to 2.74)
Dalal 2007[21]	4/60	1/44		8.8	2.93 (0.34 to 25.35)
Daskapan 2005[34]	1/15	0/14		3.9	2.81 (0.12 to 63.83)
Jolly 2007[22]	3/263	3/262		22.9	1.00 (0.20 to 4.89)
Total (95% CI)	20/490	11/419		100.0	1.31 (0.65 to 2.66)

Test for heterogeneity: χ^2=1.00, df=3, P=0.80, I^2=0%

Test for overall effect: z=0.76, P=0.45

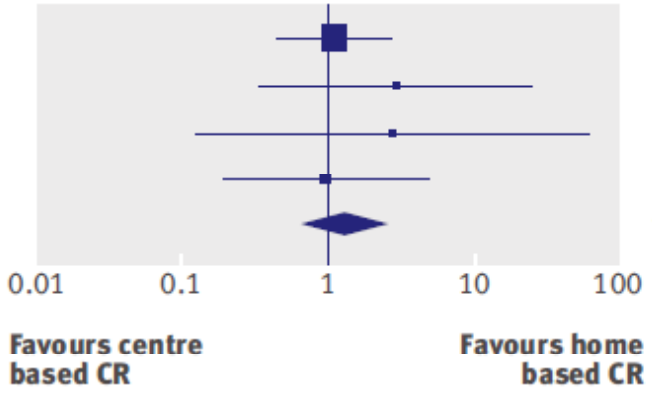

Fig 10 | Mortality with home based and centre based cardiac rehabilitation at 3-12 months of follow-up

Conclusion

- Home and centre based forms of cardiac rehabilitation seem to be equally effective in improving clinical and HRQoL outcomes in patients with a low risk
- The choice of participating in a more traditional supervised centre based or home based programme should reflect preference of individual patient

Phase 2

- OPD approach
- Exercise prescription
  - without EST
  - with EST
- Exercise undersupervision with telemetry monitoring

OPD approach

- Assess current functional status
- Detect complication or new problems affecting exercise program
- Assess home exercise program
- Advice activity
- Risk factor modification
- Patient’s goal

History

- Case ?, S/P, Post opกี่สัปดาห์ , Risk for exercise, Underlying, Medication, Investigation
- Cardiac rehabilitation phase I
- อาการทั่วไป
- NY Functional class, dyspnea ผิดปกติ?
- Chest pain
  - angina (cardiac cause)
  - non cardiac : แผล, costochondritis, MFPs, GERD, pulmonary
- ปัญหาอื่นๆ เช่น ปวดขา → หาสาเหตุ, อ่อนเพลีย (fatigue)

Functional class	METs
I	>7
II	5-6
III	3-4
IV	1-2

Characteristics of patients at high risk for exercise participation (any one or combination of these findings places a patient at high risk)

- Presence of complex ventricular dysrhythmias during exercise testing or recovery
- Presence of angina or other significant symptoms (e.g., unusual shortness of breath, light-headedness, or dizziness at low levels of exertion [<5 METs] or during recovery)
- High level of silent ischemia (ST-segment depression ≥2 mm from baseline) during exercise testing or recovery
- Presence of abnormal hemodynamics with exercise testing (i.e., chronotropic incompetence or flat or decreasing systolic BP with increasing workloads) or recovery (i.e., severe postexercise hypotension)

Nonexercise Testing Findings

- Rest ejection fraction <40%
- History of cardiac arrest or sudden death
- Complex dysrhythmias at rest
- Complicated myocardial infarction or revascularization procedure
- Presence of congestive heart failure
- Presence of signs or symptoms of postevent/postprocedure ischemia
- Presence of clinical depression

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Safety of Monitoring Exercise for Early Hospital-based Cardiac Rehabilitation

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Objective To survey the cardiovascular complications induced by cardiac monitoring exercise during 10 years of our cardiac rehabilitation (CR) clinic and report on the safety of monitoring exercise training for early hospital-based CR.

Table 2. Cardiovascular Events during Monitoring Exercise

	Sessions of exercise
Angina without ECG abnormality	17 (1/820 exercise hours)
ECG abnormalities without symptom	31 (1/449 exercise hours)
Angina with ECG abnormalities	12 (1/1,161 exercise hours)
Abnormal hemodynamic responses	10 (1/1,393 exercise hours)

ECG: Electrocardiogram

Table 4. Exercise Risk Stratifications* in Patient who Developed Cardiovascular Events during Monitoring Exercise

Risk	Sessions of exercise (%)
High	52 (75.5)
Intermediate	10 (14.3)
Low	7 (10.2)

*Exercise Risk Stratification according to the guidelines of AACVPR (American Association of Cardiovascular & Pulmonary Rehabilitation), ACC (American College of Cardiology), and AHA (American Heart Association)

arm
Annals of Rehabilitation Medicine

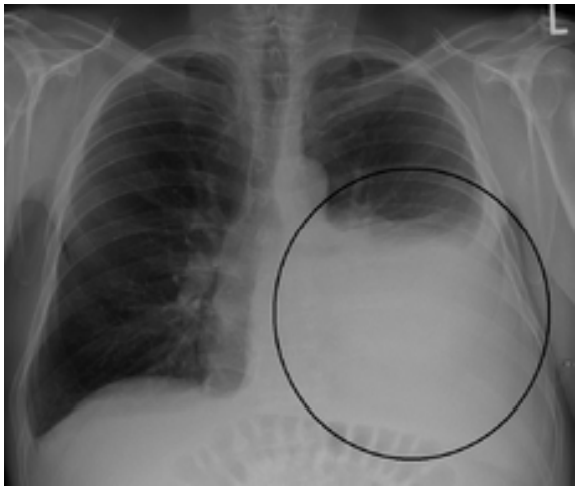
History

- Case ?, S/P, Post opกี่สัปดาห์ , Risk for exercise, Underlying, Medication, Investigation
- Cardiac rehabilitation phase I
- อาการทั่วไป
- NY Functional class, dyspnea ผิดปกติ?
- Chest pain
  - angina (cardiac cause)
  - non cardiac : แผล, costochondritis, MFPs, GERD, pulmonary
- ปัญหาอื่นๆ เช่น ปวดขา → หาสาเหตุ, อ่อนเพลีย (fatigue)

Functional class	METs
I	>7
II	5-6
III	3-4
IV	1-2

History

- Home exercise program (log book)
  - ทำได้ตามโปรแกรมหรือไม่
  - เหนื่อยจากอะไร : เจ็บแผล, deconditioning, กินไม่ได้, พักผ่อนน้อย, CHF, arrhythmia, Lung ex COPD, Pleural effusion



Home exercise program

Week	Duration (Min)	Distances (m.)	Frequency	Speed
1	5-10	250	2	ทอดน่อง
2	10-15	500	2	สบาย ๆ
3	15-20	1,000	2	สบาย ๆ
4	20-25	1,500	2	สบาย / เร็ว
5	25-30	1,500	2	สบาย / เร็ว
6	30-40	2,000	1-2	สบาย / เร็ว

Walking exercise

Speed (mile/hr)	METS
2	3
3	4
4	5
5	8

1 ก้าว = 50 cm.

1 mile = 1.6 km

Treadmill (0%incline)

Speed MPH	1.7	2.0	2.5	3.0	3.4	3.75
Speed km/hr	2.7	3.2	4.0	4.8	5.4	6.0
METs	2.3	2.5	2.9	3.3	3.6	3.9

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P.E.

- BW, BMI, Waist circumference
- BP, HR คลำ pulse, Oxymetry (ช่วยประเมินอาการเหนื่อย)
- Heart : ejection systolic murmur over aortic region → AS
- Lung : decreased BS, wheezing, rhonchi, crepitation, pericardial rub
- Tender point
- Surgical wound
- Shoulder ROM



- Extremities : <u>บวม</u>, ปวดขา → คลำ pulse, เท้า (DM), balance
- Cognitive

Contraindications

- Unstable angina
- Resting systolic BP (SBP) >200 mm Hg or resting diastolic BP (DBP) >110 mm Hg that should be evaluated on a case-by-case basis
- Orthostatic BP drop of >20 mm Hg with symptoms
- Critical aortic stenosis (i.e., peak SBP gradient of >50 mm Hg with an aortic valve orifice area of <0.75 cm^2 in an average-size adult)
- Acute systemic illness or fever
- Uncontrolled atrial or ventricular dysrhythmias
- Uncontrolled sinus tachycardia (>120 beats·min^{-1})
- Uncompensated CHF
- Third-degree atrioventricular (AV) block without pacemaker
- Active pericarditis or myocarditis
- Recent embolism
- Thrombophlebitis
- Resting ST-segment depression or elevation (>2 mm)
- Uncontrolled diabetes mellitus (See Chapter 10 for additional information on exercise prescription recommendations for individuals with diabetes mellitus.)
- Severe orthopedic conditions that would prohibit exercise
- Other metabolic conditions, such as acute thyroiditis, hypokalemia, hyperkalemia, or hypovolemia.

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C/I for cardiac rehabilitation

- Medical problem : Heart, Lung, VV, orthopedic
- V/S : BT, BP, HR
- EKG ล่าสุด : rate, arrhythmia, STT change(>2mm)
- Echo : critical AS?
- Lab : BS, K

All of these contraindication need to be treated and controlled before starting exercise program

Secondary Prevention

- Smoking → Cessation
- BP → <140/90 mmHg

  <130/80 mmHg if DM, CKD
- Lipid Mx → LDL-C <100 mg/dL

  <70 mg/dL (very high risk = DM, Metabolic synd)

  if TG >200 → non HDL-C (TC minus HDL) <130
- Diabetic Mx → HbA1C <7%
- Weight Mx → BMI <25 kg/m2

  → Waist circumference (iliac crest)

  Men <40 inch (102 cm)

  Women < 35inch (88 cm)

คนไทย

BMI < 23 kg/m2

WC < 90 cm (M)

< 80 cm (W)

AHA/ACC 2006

Management

- แก้ไขปัญหาความผิดปกติ
- ชะลอการออกกำลังกาย เช่น มีข้อห้าม, แผล infected graft ที่ขา
- ให้ความมั่นใจเรื่อง exercise, activity
- แนะนำการปรับการออกกำลังกายที่เหมาะสม
- Risk factor modification = Secondary prevention
- ชักชวน supervised exercise with continuous telemetry monitoring (จำนวนครั้งขึ้นกับ risk ผู้ป่วย)

Key variables to be considered Exercise prescription

- Risk stratification
- Exercise capacity
- Anginal threshold
- Cognitive and psychological impairment
- MSK limitation
- Premorbid activity level
- Personal fitness goal

Exercise prescription without EST

- Uprising (Increment) over Resting HR
  - + 20 bpm
  - Gradually step up of THR : 20 → 30 → 40
  - Progression : Duration (>30 min → เพิ่ม Intensity)
  - Adjust intensity (speed) by supervised exercise with telemetry
- 20-35 bpm → moderate intensity

  30-55 bpm → high intensity
- RPE ≤ 13

Borg (Rate Perceived Exertion)

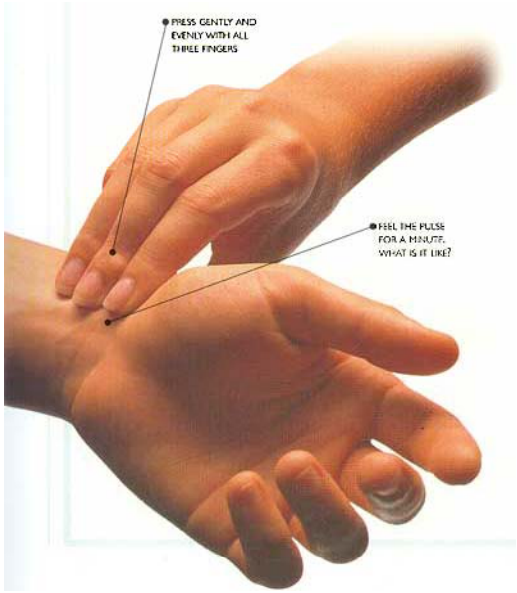
6	
7	Very, very light
8	
9	Very light
10	
11	Fairly light
12	
13	Somewhat hard
14	
15	Hard
16	
17	Very hard
18	
19	Very, very hard
20	

PMK RPE

- 7 = ไม่เหนื่อย
- 9 = เหนื่อยน้อย
- 11 = เหนื่อยปานกลางค่อนข้างเล็กน้อย
- 12 = เหนื่อยปานกลางพอดี
- 13 = เหนื่อยปานกลางค่อนข้างมาก
- 15 = เหนื่อยมาก

Exercise prescription without EST

- เครื่องวัดความดันอัตโนมัติ แนะนำ HR rising + RPE
- สอนจับชีพจร แนะนำ HR rising + RPE
- RPE

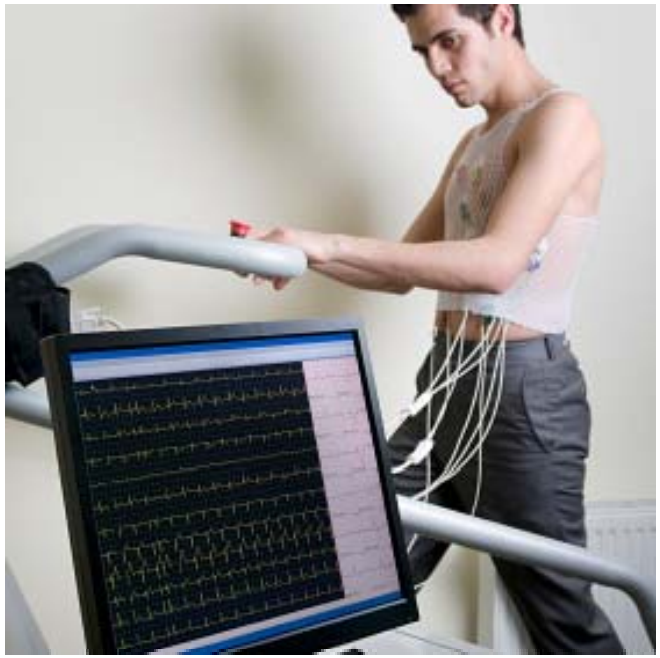


The Borg Scale	
6	No exertion at all
7	Extremely light
8	
9	Very light
10	
11	Light
12	
13	Somewhat hard
14	
15	Hard (heavy)
16	
17	Very hard
18	
19	Extremely hard
20	Maximal exertion

HR monitoring

Pedometer

- 1 mile = 1500-2000 steps
- For health benefit →
  > 10,000 steps/day



Exercise prescription with EST

EST in Cardiac Rehabilitation

- Risk (for exercise) stratification
- Exercise prescription
- Evaluate functional capacity
  - Setting vocational activity limit, advice activity
  - Return to work
  - Therapeutic assessment
- Diagnosis
  - Ischemia following event or procedure
  - Exercise-induced arrhythmia

EST

- Low level submaximal
  - 70% of predicted maximum HR
  - peak HR of 120 beats/min
  - peak MET level of 5
  - before D/C can quantify functional activity tolerance
- Symptom-limited maximal
  - 85% of predicted maximum HR
  - Safely performed at 4 wk after CABG
  - to complete risk factor stratification
  - before resumption of a physically demanding job (METs)
  - Exercise prescription

EST

Contraindications to Exercise Stress Testing

Absolute

- Acute myocardial infarction (within 2 days)
- High-risk unstable angina
- Uncontrolled cardiac arrhythmias causing symptoms of hemodynamic compromise
- Symptomatic severe aortic stenosis
- Uncontrolled symptomatic congestive heart failure
- Acute pulmonary embolus or pulmonary infarction
- Acute myocarditis or pericarditis
- Acute aortic dissection

Termination EST

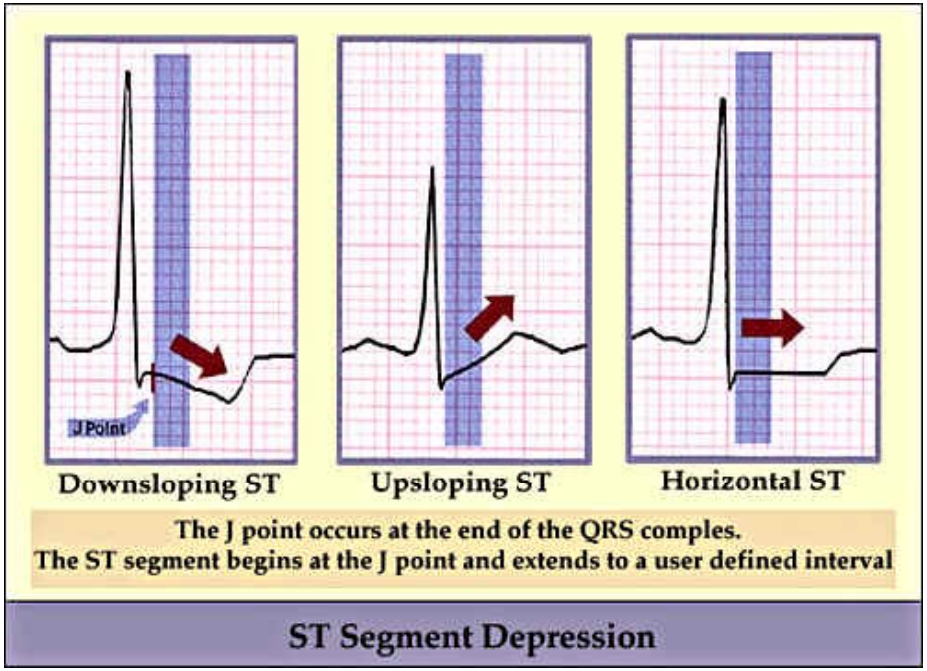
- Achieve target HR (85% of predicted maximum HR)
- Positive ischemia

Absolute

- Drop in SBP of >10 mm Hg from baseline, despite an increase in workload, with ischemia
- Moderate to severe angina
- Increasing nervous system symptoms (e.g., ataxia, dizziness, or near-syncope)
- Signs of poor perfusion (cyanosis or pallor)
- Technical difficulties in monitoring electrocardiogram or SBP
- Subject's desire to stop
- Sustained VT
- ST elevation >1.0 mm in leads without diagnostic Q waves (other than V1 or aVR)

Positive Ischemia

- ST depression >1mm from PR level (isoelectric line) ต่อเนื่อง 3 beat, 2 lead ขึ้นไป
  - Downsloping
  - Horizontal or flat
  - Upsloping
- ST elevation >1mm from ST level
  - ใน lead ที่ไม่มี Q ในขณะพัก
  - ใน lead อื่นนอกเหนือจาก aVR และ V1
  - บ่งบอก transmural ischemia, พบน้อยขณะทำ EST



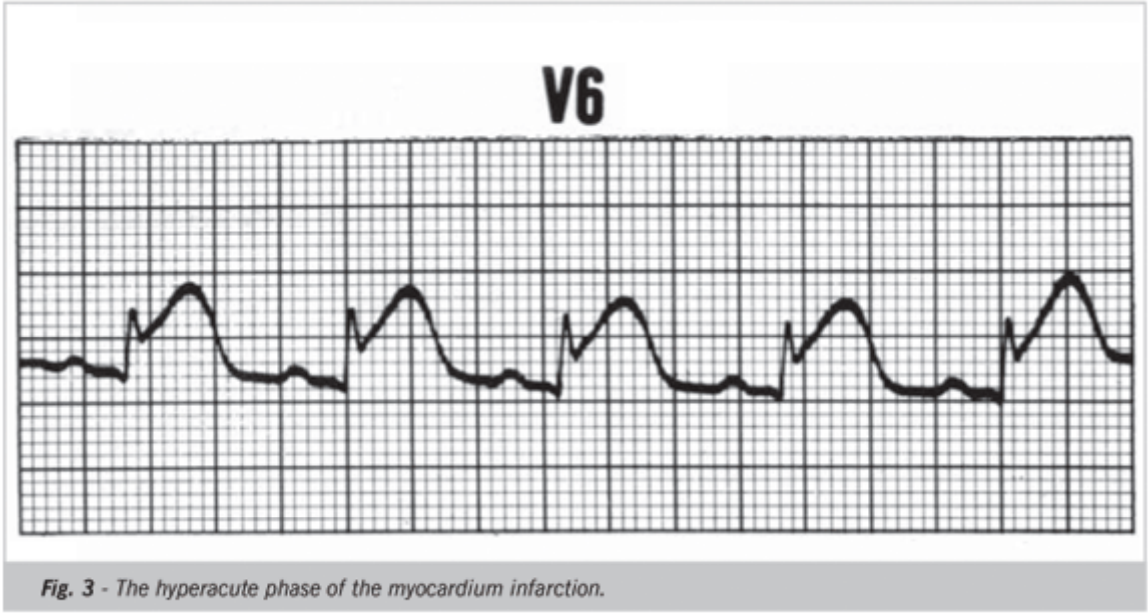
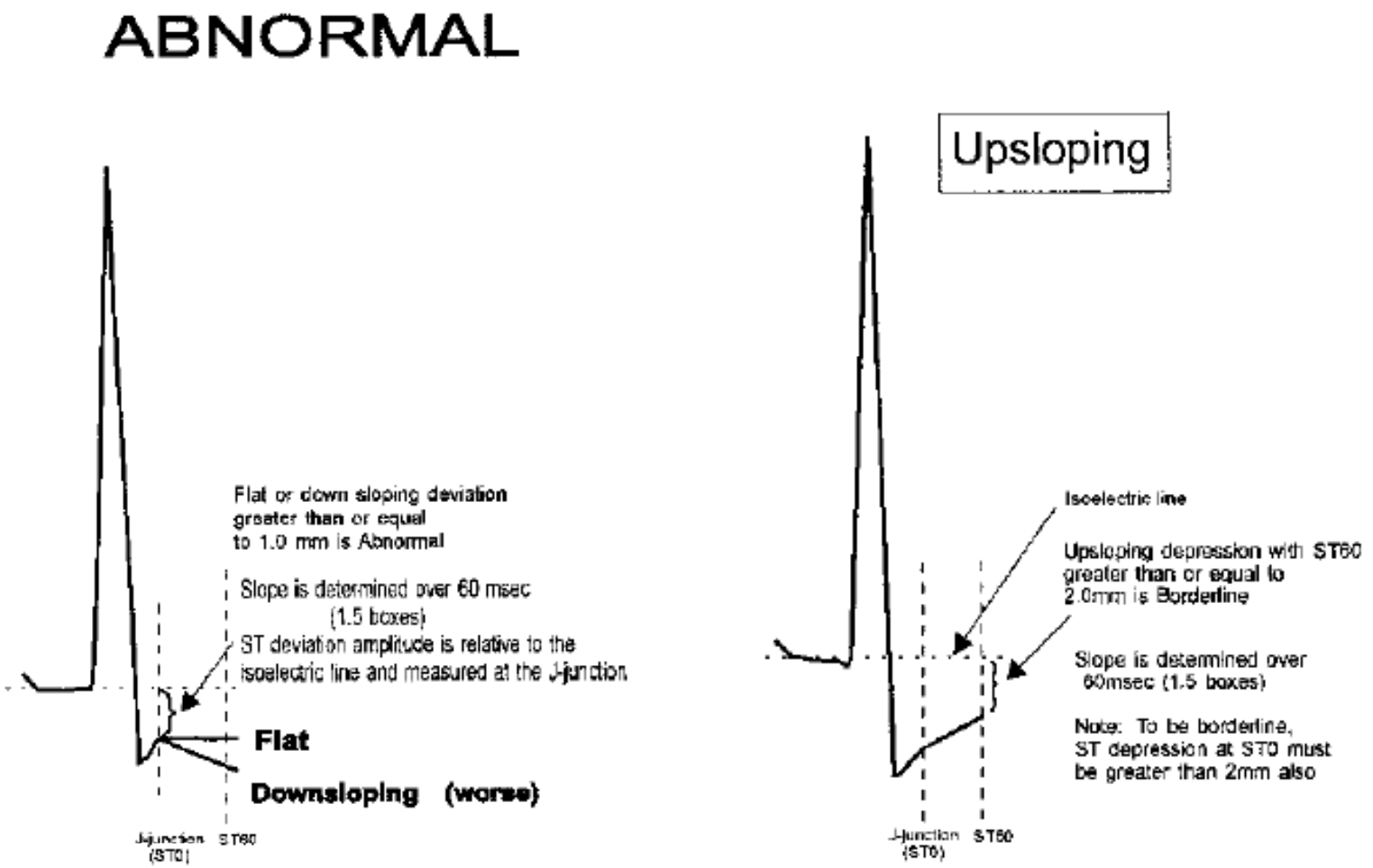


Fig. 3 *- The hyperacute phase of the myocardium infarction.*

ST deviation assessment



FUNCTIONAL CLASS	CLINICAL STATUS	O_2 COST ml/kg/min	METS	BICYCLE ERGOMETER	TREADMILL PROTOCOLS						METS
				1 WATT = 6.1 Kpm/min FOR 70 KG BODY WEIGHT Kpm/min	BRUCE MODIFIED 3 min Stages MPH %GR		BRUCE 3 min Stages MPH %GR		NAUGHTON 2 min Stages MPH %GR		
					6.0	22	6.0	22			
					5.5	20	5.5	20			
NORMAL AND I	HEALTHY, DEPENDENT ON AGE, ACTIVITY				5.0	18	5.0	18			
		56.0	16								16
		52.5	15								15
		49.0	14								14
		45.5	13	1500	4.2	16	4.2	16			13
		42.0	12	1350							12
		38.5	11	1200							11
		35.0	10	1050	3.4	14	3.4	14			10
		31.5	9	900					2	17.5	9
		28.0	8	750					2	14.0	8
		24.5	7		2.5	12	2.5	12			7
II	SEDENTARY HEALTHY	21.0	6	600					2	10.5	6
		17.5	5	450	1.7	10	1.7	10	2	7.0	5
III	LIMITED	14.0	4	300	1.7	5			2	3.5	4
		10.5	3	150					2	0	3
		7.0	2		1.7	0			1	0	2
IV	SYMPTOMATIC	3.5	1								1

BRUCE protocol

stage	Speed mph	Speed Km/hr	Grade %	time	METs
1	1.7	2.7	10	3	4.5
2	2.5	4.0	12	6	7
3	3.4	5.4	14	9	10
4	4.2	6.7	16	12	13

✓ Bruce protocol:

$$METS = (mph \times 26.8) \times \frac{[0.1+(grade \times 0.018) + 3.5]}{3.5}$$

The most frequently used protocol

EST

- Age
- Reason for exercise test
- Protocol : BRUCE, modified BRUCE
- Total time, % MPHR, Max workload (METs)
- Max HR, resting HR, Max BP
- RPP (DP) = HR x SBP
- Hemodynamic response, arrhythmia
- Reason for termination : positive ischemia?

EXERCISE STRESS TEST REPORT

PRAMONGKUTKLAO HOSPITAL

[redacted]

DOB: 25.06.1947
Age: 65yrs
Gender: Male
Race: Asian

Height: 167 cm
Weight: 65 kg

Study Date: 10.07.2012
Test Type: Exercise Stress Test
Protocol: BRUCE
Medications: --
Medical History: Case SVD S/P PCI on 21/04/2012, HT and Dyslipidemia

Ordering Physician: --
Attending Physician: Dr Possawee/ Dr Kitcha

Reason for Exercise Test: Evaluation of functional and exercise capacity

Exercise Test Summary

Phase Name	Stage Name	Time In Stage	Speed (mph)	Grade (%)	HR (bpm)	BP (mmHg)	Comment
PRETEST	SUPINE	03:52	1.40	0.00	80	126/107	
EXERCISE	STAGE 1	03:00	1.70	10.00	85	167/102	
	STAGE 2	03:00	2.50	12.00	105	183/99	
	STAGE 3	02:24	3.40	14.00	122		
RECOVERY	RECOVERY	02:00	1.20	0.00	90	195/95	
		02:00	0.00	0.00	78	186/96	
		00:46	0.00	0.00	77	157/97	

The patient exercised according to the BRUCE for 8:24 min:s, achieving a work level of Max. M The resting heart rate of 71 bpm rose to a maximal heart rate of 125 bpm. This value represents 80 % maximal, age-predicted heart rate. The resting blood pressure of 126/107 mmHg , rose to a maximum pressure of 195/95 mmHg. The exercise test was stopped due to Target heart rate achieved.

Interpretation

Summary: Resting ECG: anterior Q waves. Functional Capacity: normal. HR Response to Exerc appropriate. BP Response to Exercise: normal resting BP - appropriate response. Chest Pain: Exerc none, Recovery phase-none. Arrhythmias: none. ST Changes: Exercise phase- none, Recovery pha Overall impression: Negative stress test.

Conclusions

The EST was performed with good quality.
The stress test was stopped due to acheived target HR (Double product = SBP x HR >20,000).
The exercise to 8.24 minutes into stage 3 of BRUCE protocol with 80 % of MPHR and 10.1 METS.
There was no significant ST change or arrhythmia or angina during exercise and recovery phase.
Appropriated hemodynamic response.
He left from EST unit with stable condition.

Impression: Negative test at high workload, with good excercise capacity.

Physician _____
Dr Possawee/ Dr Kitcha

Tabular Summary

PRAMONGKUTKLAO HOSPI

10.07.2012 12:06:18

Male 167 cm 65 kg
65yrs Asian
Meds:

Test Reason: Evaluation of functional and exercise capacity
Medical History: Case SVD S/P PCI on 21/04/2012, HT and Dyslipidemia
Ref. MD: Ordering MD:
Technician: Test Type: Exercise Stress Test
Comment:

BRUCE Total Exercise Time 08:24
Max HR: 125 bpm 80% of max predicted 155 bpm
Max BP: 195/95 Maximum Workload: 10.10 METS
Reasons for Termination: Target heart rate achieved
Summary: Resting ECG: anterior Q waves. Functional Capacity: normal. HR Response to Exercise: appropriate. BP Response to Exercise: normal resting BP - appropriate response. Chest Pain: Exercise phase-none, Recovery phase-none. Arrhythmias: none. ST Changes: Exercise phase- none, Recovery phase-none. Overall impression: Negative stress test.
Conclusion: The EST was performed with good quality.
The stress test was stopped due to acheived target HR (Double product = SBP x HR >20,000).
The exercise to 8.24 minutes into stage 3 of BRUCE protocol with 80 % of MPHR and 10.1 METS.
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He left from EST unit with stable condition.

Impression: Negative test at high workload, with good excercise capacity.
Location Number: * 0 *

Phase Name	Stage Name	Time in Stage	Speed (mph)	Grade (%)	Workload (METS)	HR (bpm)	BP (mmHg)	RPP (*100)	VE (/min)	Comment
PRETEST	SUPINE	03:52	1.40	0.00	2.0	80	126/107	100	0	
EXERCISE	STAGE 1	03:00	1.70	10.00	4.6	85	167/102	141	0	
	STAGE 2	03:00	2.50	12.00	7.0	105	183/99	192	0	
	STAGE 3	02:24	3.40	14.00	10.1	122			0	
RECOVERY	RECOVERY	02:00	1.20	0.00	2.0	90	195/95	175	0	
		02:00	0.00	0.00	1.1	78	186/96	145	0	
		00:46	0.00	0.00	1.1	77	157/97	120	0	

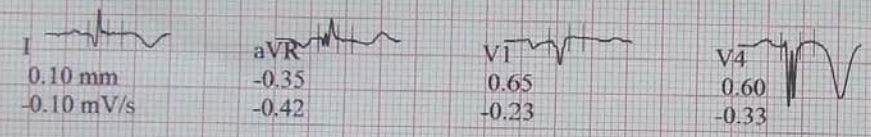
Graded Exercise Summary Report

10.07.2012
12:06:18

PRAMONGKUTKLAO HOSPIT

BASELINE

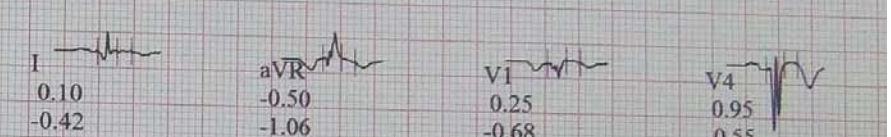
EXERCISE 0:01 | STAGE 1 2.0 METS | 80 bpm | ST @ 10mm/mV 80ms post J



I	aVR	V1	V4
0.10 mm	-0.35	0.65	0.60
-0.10 mV/s	-0.42	-0.23	-0.33
II	aVL	V2	V5
0.50	-0.15	1.95	0.20
0.12	-0.49	0.35	-0.37
III	aVF	V3	V6
0.40	0.45	2.20	0.15
0.16	0.17	0.56	-0.04

PEAK EXERCISE

EXERCISE 8:24 | STAGE 3 10.1 METS | 122 bpm | ST @ 10mm/mV 80ms post J



I	aVR	V1	V4
0.10	-0.50	0.25	0.95
-0.42	-1.06	-0.68	-0.55
II	aVL	V2	V5
0.90	-0.30	0.90	0.75
1.21	-1.01	-0.14	0.31
III	aVF	V3	V6
0.75	0.85	1.85	0.30
1.59	1.45	0.52	0.94

GE CASE V6.51 (0)
25mm/s 10mm/mV 50Hz 0.05Hz ERE+

Unconfirmed

Attending MD: Dr Possawee/ Dr Kitcha

Page

12:06:18

BASELINE EXERCISE	PEAK EXERCISE EXERCISE	TEST END RECOVERY
0:01	8:24	4:36
80 bpm	122 bpm	77 bpm
I	I	I
0.10 mm	0.10	0.20
-0.10 mV/s	-0.42	-0.12
II	II	II
0.50	0.90	0.25
0.12	1.21	-0.16
III	III	III
0.40	0.75	0.05
0.16	1.59	-0.14
aVR	aVR	aVR
-0.35	-0.50	-0.25
-0.42	-1.06	-0.14
aVL	aVL	aVL
-0.15	-0.30	0.10
-0.49	-1.01	-0.28
aVF	aVF	aVF
0.45	0.85	0.15
0.17	1.45	-0.14

BASELINE EXERCISE	PEAK EXERCISE EXERCISE	TEST END RECOVERY
0:01	8:24	4:36
80 bpm	122 bpm	77 bpm
V1	V1	V1
0.65	0.25	0.50
-0.23	-0.68	-0.03
V2	V2	V2
1.95	0.90	1.45
0.35	-0.14	0.12
V3	V3	V3
2.20	1.85	1.90
0.56	0.52	0.14
V4	V4	V4
0.60	0.95	0.75
-0.33	-0.55	-0.58
V5	V5	V5
0.20	0.75	0.30
-0.37	0.31	-0.71
V6	V6	V6
0.15	0.30	-0.05
-0.04	0.94	-0.17

GE CASE V6.51 (0)
25mm/s 10mm/mV 50Hz 0.05Hz FRF+

Unconfirmed

Exercise prescription

HR method

- % of maximum HR
  - Moderate = 64-76% MHR (ACSM 8th ed)
    55-70% MHR (ACSM 7th ed)
- Karvonen ’s method (HR reserve)
  - THR = resting HR + %Intensity (max HR-resting HR)
  - Moderate = 40-60% HRR

ผู้ป่วย CR ควรเริ่มจาก light intensity ก่อนเสมอ
40-60% MHR, 20-40% HRR

Exercise Intensity

Intensity	Talk test	RPE	%HRR VO2R	%max HR	METs
Light	talk and sing	10-11	20-40	<64	<3
Moderate	Talk but not sing	12-13	40-60	64-76	3-6
Hard (Vigorous)	Difficulty talking	14-16	60-84	>76	>6

ACSM 8th ed

Exercise prescription

METs method

- % VO2 max (max METs from EST)
- %VO2R
  - Moderate = 40-60% VO2max(VO2R)

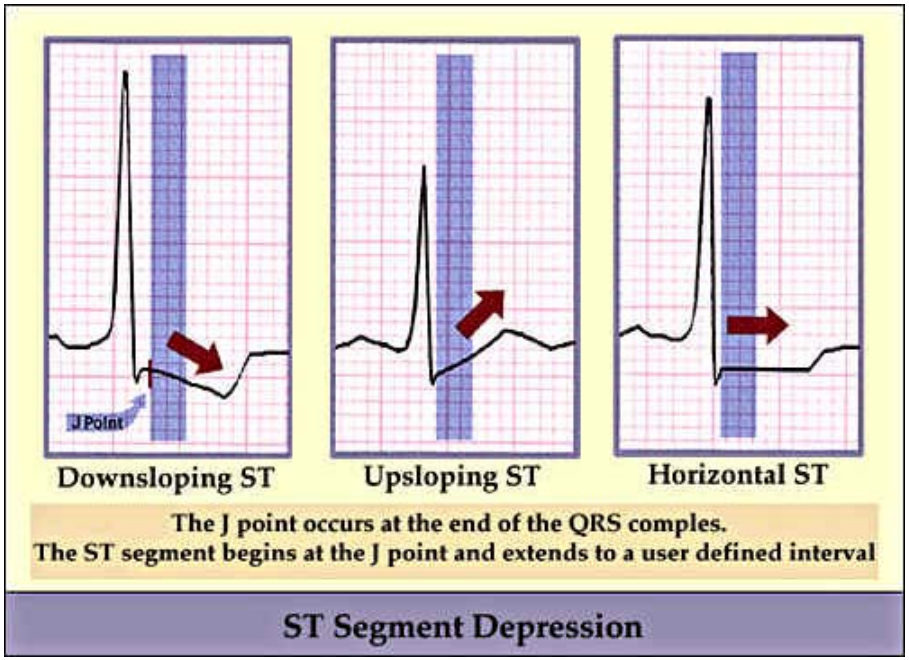
O2 consumption method

- % VO2 max (VO2 max (ml/kg/min) from gas analysis during EST)
  - Moderate = 40-60% VO2max

Exercise prescription

If termination EST due to positive ischemia

- exercise not exceed
  - Max HR - 10 bpm
  - RPP - 10%



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		02:00	0.00	0.00	78	186/96	
		00:46	0.00	0.00	77	157/97	

The patient exercised according to the BRUCE for 8:24 min:s, achieving a work level of Max. METS: 10.10. The resting heart rate of 71 bpm rose to a maximal heart rate of 125 bpm. This value represents 80 % of the maximal, age-predicted heart rate. The resting blood pressure of 126/107 mmHg , rose to a maximum blood pressure of 195/95 mmHg. The exercise test was stopped due to Target heart rate achieved.

Interpretation

Summary: Resting ECG: anterior Q waves. Functional Capacity: normal. HR Response to Exercise: appropriate. BP Response to Exercise: normal resting BP - appropriate response. Chest Pain: Exercise phase-none, Recovery phase-none. Arrhythmias: none. ST Changes: Exercise phase- none, Recovery phase-none. Overall impression: Negative stress test.

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The EST was performed with good quality.
The stress test was stopped due to acheived target HR (Double product = SBP x HR >20,000).
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He left from EST unit with stable condition.

Impression: Negative test at high workload, with good excercise capacity.

Physician_____
Dr Possawee/ Dr Kitcha

Case

- Resting HR = 71 bpm
- Maximal HR = 125 bpm
- Maximal METs = 10.1
- Negative for ischemia

- จงหา THR ที่ moderate intensity
  - 40-60% HRR
  - 64-76% MHR

Case

- Resting HR = 71 bpm
- Maximal HR = 125 bpm
- Maximal METs = 10.1
- Negative for ischemia

- จงหา THR ที่ moderate intensity
  - 40-60% HRR = 92-103
  - 64-76% MHR = 80-95

Exercise prescription

- Exercise intensity
  - high risk 40-55% HRR 65-75% HR max
  - moderate risk 55-70% HRR
  - low risk 70-85% HRR

  (Threshold : 40% VO2max, 60% HR max → training effect)
- Degree of supervision (Telemetry monitoring)
  - high risk : 18-24 sessions (6-8wk)
  - moderate risk : 12-18 sessions (4-6wk)
  - low risk : 6-12 sessions (2-4wk)

ACSM 8thed

Exercise prescription

- 10 min callisthenic warm-up
- 20-60 min conditioning : continuous or intermittent
- 10 min cool-down that includes stretching
- Training advance : Duration → Intensity
- Initial 2-4METs = 1.7-2.0mph (2.7-3.2kph)
- Progression 1-2 METs = 1-1.5 mph (1.6-2.4kph)
- ใน 3 เดือนแรก train ไม่เกิน moderate intensity (brisk walk)
- Avoid valsalva, heavy resistance, anaerobic

Aerobic exercise

Treadmill

Elliptical

HR monitoring

Exercise prescription

- The risk for arrhythmias and ischemia can be highest during recovery after exercise training
- Warm-up → prevent arrhythmia
- Cool-down → prevent postexercise hypotension subsequent myocardial ischemia and arrhythmia
- Gentle muscle and joint stretching before and after exercise → prevent postexercise soreness

Resistive Exercise

Resistive Exercise

- Start at Phase 2 : ควรเริ่มเมื่อได้ทำ aerobic exercise ไปแล้ว
  - PCI : 4 wk (CARES-THAI)
  - Post MI, CABG : 6 wk (CARES-THAI) / CABG : 8wk (AACVPR)
- C/I : Resting BP >160/100 mmHg, ตอบสนองต่อการออกกำลังกายที่ผิดปกติ, EST → Ischemia, Capacity < 5 METs, LVEF < 0.35
- เริ่มต้นควร monitor BP, HR, EKG Telemetry อย่างน้อย2ครั้ง, RPE ≤ 13
- เริ่มจากน้ำหนักน้อยสุด x 12-15 ครั้ง 2ชุด, 8-10ท่า, 2-3ครั้ง/wk
- เพิ่มน้ำหนักครั้งละ 0.5-2 kg เมื่อสามารถยกน้ำหนักเท่าเดิมได้อย่างสบาย
- ต้องไม่กลั้นหายใจหรือเบ่ง (Valsalva) ไม่กำแน่น สอนให้หายใจออกขณะยกน้ำหนัก (concentric)และหายใจเข้าขณะวางน้ำหนักลง (eccentric)

ข้อบ่งชี้ของการสิ้นสุด Phase 2

- Functional capacity 5 METs
- Normal hemodynamic response to exercise
- Absent or stable angina pectoris
- Stable, controlled resting HR, BP
- Adequate level of physical fitness for daily activity and occupational tasks

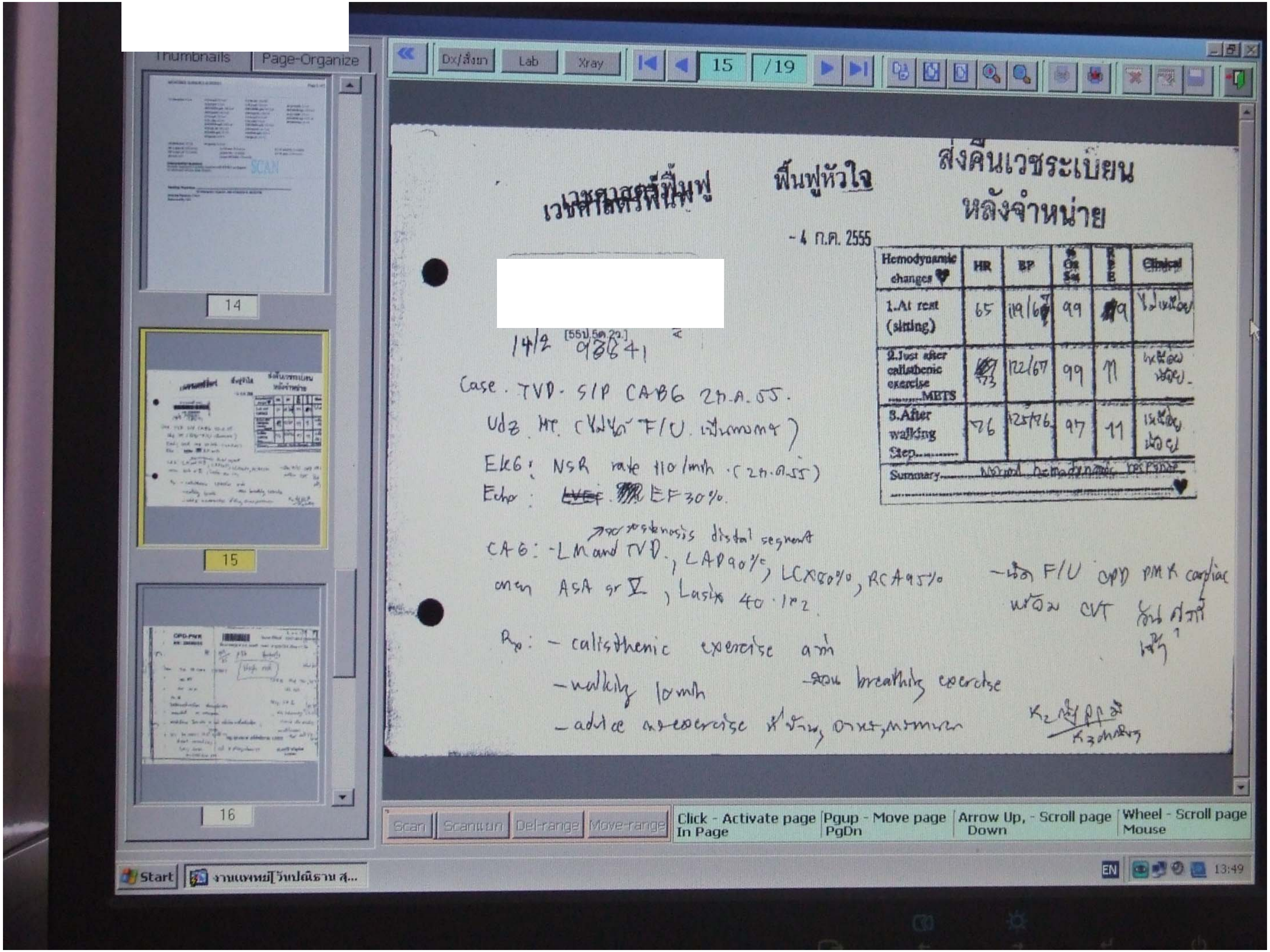
การออกกำลังกาย Phase 3

- ผ่านการเข้าโปรแกรม Phase 2 แล้ว
- การควบคุมอย่างใกล้ชิดลดลง
- ไม่ต้อง monitor EKG อย่างต่อเนื่อง
- มีความเข้าใจและสามารถออกกำลังกายตามโปรแกรมได้ด้วยความเหมาะสมและปลอดภัย (self monitor)

Exercise undersupervision with telemetry monitoring


MARATHON
TS7302I
MARATHON
TS7302I

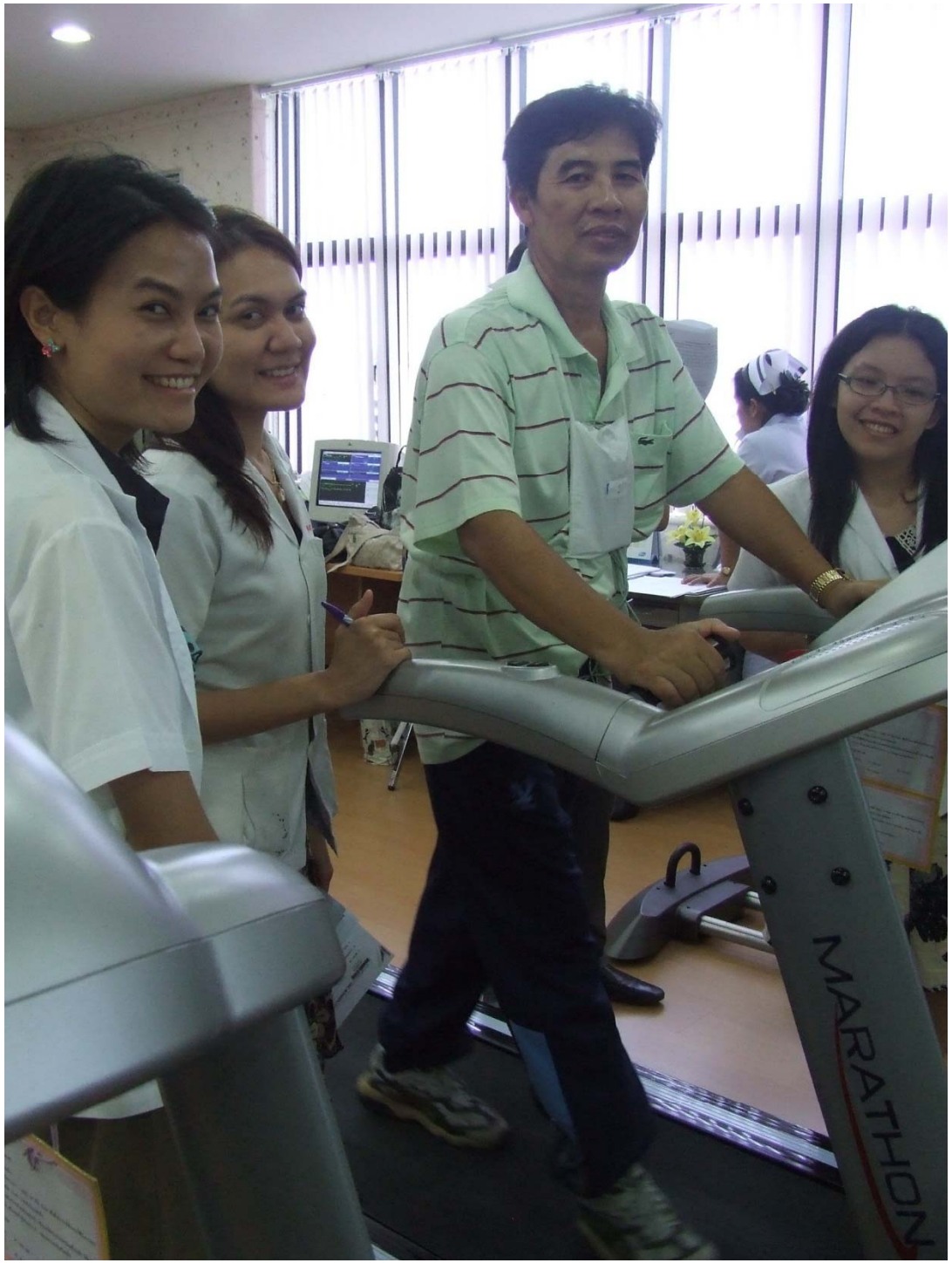

DIAMONDBACK
DIAMONDBACK
DIAMONDBACK



Thumbnails
Page-Organize
Dx/สั่งยา
Lab
Xray
15
/19
14
15
16
เวชศาสตร์ฟื้นฟู
ฟื้นฟูหัวใจ
ส่งคืนเวชระเบียน
หลังจำหน่าย
- 4 ก.ค. 2555
Hemodynamic changes
HR
BP
RPE
Clinical
1.At rest (sitting)
65
99
2.Just after calisthenic exercise ......MRTS
122/67
99
3.After walking Step.........
76
97
11
Summary
normal hemodynamic response
Case. TVD - S/P CABG
EKG: NSR rate 110/min
Echo: EF 30%.
CAG: - LM and TVD, LAD 90%, LCX 80%, RCA 95%
ASA gr V, Lasix 40
Rx: - calisthenic exercise
- walking
breathing exercise
- advice
Scan
Scanแยก
Del-range
Move-range
Click - Activate page In Page
Pgup - Move page PgDn
Arrow Up, - Scroll page Down
Wheel - Scroll page Mouse
Start
EN
13:49


Systolic
122
MAP/Cuff
87
Diastolic
66
Pulse Rate
V100


TEL
Move mouse over blue sector to silence alarm
8/1/2012 14:23
PHILIPS
Bed1
Montree Kongka
HR
93
PVC
0
Bed4
Chukiet Sriwajanapong
NO SIGNAL
Bed2
Tem Sukjam
Bed5
No patient admitted
Bed3
No patient admitted
Bed6
Praisong Chaipratheep
Patient Window
Help
Bed1: Montree Kongka TELE1
94
1 mV
Continuous Recording...
Alarms
Suspend
Unsuspend
View
Arrhythmia Analysis
Multilead ECG
More Waves
Main Screen
Discharge
Sector Setup
Standby
Wave Review
Patient Window
Arrhyth Alarms
Trend Review
Alarm Review
Admit
All Controls
hp p720


MARATHON


TREADMILL
SPEED
4.2
DISTANCE/LEVELS
0.77
15:16
TIME
PROGRAM/PULSE
CALORIES/INCLINE


TEL
Move mouse over blue sector to silence alarm
8/1/2012 14:23
PHILIPS
Bed1
Montree Kongka
HR
93
PVC
0
Bed4
Chukiet Sriwajanapong
NO SIGNAL
Bed2
Tem Sukjam
Bed5
No patient admitted
Bed3
No patient admitted
Bed6
Praisong Chaipratheep
Patient Window
Help
Bed1: Montree Kongka TELE1
94
1 mV
Continuous Recording...
Alarms
Suspend
Unsuspend
View
Arrhythmia Analysis
Multilead ECG
More Waves
Main Screen
Discharge
Sector Setup
Standby
Wave Review
Patient Window
Arrhyth Alarms
Trend Review
Alarm Review
Admit
All Controls
hp p720