PROGRAMME BOOK

The 12th Bali Cardiology Update

"Improving Knowledge on Latest Cardiovascular Disease: Translating Guideline into Real-world Experience"

23-26 August 2023 | The Westin Nusa Dua, Bali
CHAIRMAN FOREWORD

As the COVID-19 pandemic has been resolved, we are glad to welcome our colleagues to visit the paradise island, Bali, while joining our annual meeting, the 12th Bali Cardiology update that will be held offline. We organise workshops, symposiums, plenary talks, lectures with international and national keynote speakers, and interactive gatherings from throughout regions to discuss cutting-edge discoveries to advance the profession and medications specializing in cardiovascular disease management, providing an absolutely superb framework for professionals in cardiovascular health, researchers, scientists, healthcare specialists, academicians, and individuals with interest in cardiology. This is your best opportunity to network with the most individuals from hospitals, academic institutions, heart associations, and research facilities because there are people from all over the world interested in finding a few solutions in the field of cardiology. The opportunity to network with colleagues and hear from renowned cardiologists and cardiovascular researchers at this cardiology summit is unmatched.

Agung Pradnyana Suwirya
**Workshop I: Physical Examination in Clinical Settings: Tips and Tricks for General Practitioners**  
Venue: Jakarta Room A  
PIC: dr. I Made Agus Dharma, SpP, FHKI

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<td>General approach to vital signs, murmur, and heart sounds by Dr. Tjak Adji, SpP, FHKI</td>
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<td>General approach to cardiac defect murmur by Dr. I Ketut Rinaldy Surya, SpP, FHKI</td>
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<td>Management and post-procedural issues: Interventionist point of view by Dr. I Made Gunama, SpP, FHKI</td>
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<td>Solving the Problems in ASD with Pulmonary Hypertension: Which deductive should we use? by Dr. Anna Urban Raharjo, SpP, FHKI</td>
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| 15.45 - 15.50 | 1. Pembukaan peserta terbuka (2 orang)
2. Pembukaan video berup dan sponsor (bila ada) |

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**Workshop II: Exercise Stress Test: How to Session**  
Venue: Jakarta Room B  
PIC: dr. A.A.A. Deni Adelia Yosristi, Sp.(P)KAI

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<td>07.50 - 08.00</td>
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<td>08.00 - 08.05</td>
<td>General approach to vital signs, murmur, and heart sounds by Dr. I Made Agus Dharma, SpP, FHKI</td>
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<td>08.05 - 08.15</td>
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<td>Lecture 1</td>
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<td>Overview of Exercise Physiology, Recognizing the Modalities and Protocols of Exercise Stress Test by Dr. I Nyoman Wiranata, SpP, FHKI, FAPSC</td>
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<tr>
<td>08.45 - 08.55</td>
<td>The Role of Exercise Stress Test in Diagnostic of CAD by Prof. Dr. I Wayan Widi, SpP, FHKI, FAPSC</td>
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<td>Lecture 2</td>
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<tr>
<td>09.05 - 09.20</td>
<td>The Role of Exercise Stress Test in Assessing Fitness Classification and Exercise Prescription by Dr. AA Ani Deni Adelia Yosristi, Sp.PKAI, FHKI</td>
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<tr>
<td>09.20 - 09.40</td>
<td>Discussion with all instructors</td>
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**Workshop III: All About Atrial Septal Defect: From Diagnosis to Intervention**  
Venue: Jakarta Room C  

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<tr>
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<td>Opening by MC</td>
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<tr>
<td>13.30 - 13.45</td>
<td>Physical Examination of ASD: What should not be missed? by Dr. dr. I Made Vinu Kastika Yanti, Sp.PAI</td>
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<tr>
<td>13.45 - 13.55</td>
<td>Imaging of ASD: Focus on Transesophageal and Transesophageal Echocardiography by Dr. Ni Made Ayu Willyati, SpP, FHKI</td>
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<td>13.55 - 14.15</td>
<td>Discussion</td>
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<td>Table quiz</td>
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<td>15.30 - 15.45</td>
<td>Closing workshop</td>
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| 15.45 - 15.50 | 1. Pembukaan peserta terbuka (2 orang)
2. Pembukaan video berup dan sponsor (bila ada) |

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**Workshop IV: ACS**  
Venue: Jakarta Room D  
PIC: dr. I Made Junior Rina Artha, Sp.(P)KI, FHKI, FAPSC, FESC, FSCAI

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<tr>
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<td>Opening by MC</td>
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<td>13.20 - 13.35</td>
<td>Chest Pain in Emergency: Should we consider ACS by Dr. I Putu Gede Brasana, SpP, FHKI</td>
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<td>14.10 - 14.25</td>
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<td>14.25 - 14.40</td>
<td>East Asian Paradigm: From Evidence into Clinical Practice by Dr. I Kadek Sudia Surya Darmo, SpP, FHKI, FAPSC</td>
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<td>14.45 - 14.55</td>
<td>Discussion</td>
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<td>14.55 - 15.20</td>
<td>Evidence Based Original Devices (scientific): Long Journey for Efficacy and Safety by Dr. dr. I Made Junior Rina Artha, Sp.(P)KI, FHKI, FAPSC, FESC, FSCAI</td>
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<td>15.20 - 15.35</td>
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<td>15.35 - 15.50</td>
<td>Lecture 2 (Hands-on)</td>
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<td>15.50 - 16.05</td>
<td>Primary PCI management on ACS patients by Speaker</td>
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Workshop V: Hands-on Session  
Venue: Jakarta Room E  
PIC: dr. I Made Junior Rina Artha, Sp.(P)KI, FHKI, FAPSC, FESC, FSCAI  
Time: 13.00 - 15.00  
Location: Hands-on area

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Workshop VI: Primary PCI on ACS Patients  
Venue: Jakarta Room F  
PIC: dr. I Made Junior Rina Artha, Sp.(P)KI, FHKI, FAPSC, FESC, FSCAI  
Time: 13.00 - 15.00  
Location: Hands-on area
### Workshop VIII: Acute Heart Failure

**Venue:** Jakarta Room A  
**PIC:** dr. Hendy Wirawan, Sp.JP

**TIME:** Thursday, 24 August 2023

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<td>Symptomatic Relief and Acute Treatment in AHF: dr. Hendy Wirawan, SpJP, FHIA</td>
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<td>Lecture 4: Role of ultrasound in guiding acute heart failure with cardiogenic shock: dr. Hendy Wirawan, SpJP, FHIA</td>
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### Workshop VIII: Echocardiography

**Venue:** Jakarta Room B  
**PIC:** dr. I Made Bagus Renaga Wibhukti, Sp.JP

**TIME:** Thursday, 24 August 2023

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<td>08.20 - 08.40</td>
<td>Lecture 1: Anatomy and Physiology of Artery and Vein Structure: dr. Ni Wayan Leta Agustini, SpJP, FHIA</td>
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<td>08.40 - 08.50</td>
<td>Discussion</td>
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### Workshop VIII: Arhythmia

**Venue:** Jakarta Room A  
**PIC:** dr. I Made Putra Suwara Pratama, Sp.PC, FHIA

**TIME:** Thursday, 24 August 2023

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<td>Opening by Chairman: dr. Putu Sukma Parasita, Sp.PC, FHIA</td>
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<td>Lecture 2: Approach to palpitation as a frequent symptom in daily practice: dr. I Dewa Gde Madu, Sp.PC, FHIA</td>
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<td>11.10 - 11.15</td>
<td>Post-test</td>
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### Workshop VIII: Peripheral Arterial & Venous Disease

**Venue:** Jakarta Room B  
**PIC:** dr. Agung Pradnyana Suwings, Sp.JP

**TIME:** Thursday, 24 August 2023

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<td>08.45 - 08.55</td>
<td>Discussion</td>
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14.25 - 14.55
#Fields of Diagnosing and Managing Disorders of The Liver and how to manage comprehensive in Primary Health Care Services
Speaker: dr. Angga Pradhyana Suryawar, SpP, FHKI

Lecture 3
14.55 - 15.25
CLT I and AUL: the difference and treatment
Speaker: dr. Bagas Am Pradhyana DS, SpKAI, FHKI, FICA, FAKC

Lecture 4
15.25 - 15.55
Basic Doppler ultrasound for arterial/venous disorder
Speaker: dr. Taufan, Sp.P(K), FHKI, FICA, FAKC

15.55 - 16.30
Discussion

16.30 - 16.40
Real Case Discussion

16.40 - 17.00
Hands on

17.00 - 17.20
PROBANDUS SPONSORS

17.20 - 17.30
Post-test

17.30 - selesai
Closing workshop:
1. Pembacaan peserta terbaik (2 orang)
2. Pembaharuan ilmu buat up dan sponsor (biaya sendiri)

PROBANDUS: ALIP, ROEP, DEMA
Overview of Exercise Physiology, Recognizing the Modalities and Protocols of Exercise Stress Test

I Nyoman Wiryawan$^{1,2}$

$^1$Department of Cardiology and Vascular Medicine, Prof. I.G.N.G. Ngorah Hospital, Faculty of Medicine, University of Udayana, Bali
$^2$Working Group of Cardiovascular Prevention and Rehabilitation Indonesian Heart Association

Email: dr_wiryawan@yahoo.com

Abstract

Exercise physiology is the study of the physiologic responses and adaptations that occur because of acute or chronic exercise. Exercise is the body's most common physiologic stress, and it places major demands on the cardiopulmonary system. Exercise stress testing is a noninvasive clinical procedure used by health providers to evaluate the cardiovascular system's response to exercise under carefully controlled conditions and is used to measure functional capacity, assess the patient's prognosis in coronary artery disease, and evaluate the patient's treatment for hypertension, certain arrhythmias, angina, and heart failure. It can be beneficial for patients who will be involved in exercise rehabilitative programs. It may be useful for predicting mortality risk among patients who plan to start an exercise program, whose job affects public safety (airline pilot), or who have specific medical conditions (diabetes or chronic renal insufficiency).

Before performing exercise stress testing, health providers should choose the right modalities such as using a treadmill, an ergo cycle (arm or leg), or a stepping device, and the right protocols to get a valid result from the test. There are two format protocols of exercise stress testing, graded or intermittent and ramp or continuous. When considering the selection of the protocol, several factors should be considered, including the person's cardiac risk factors and how they affect the person's daily activities, the patient's cognitive status, age, weight, nutritional status, mobility, and the patient's preference.

Keywords: Exercise physiology, Exercise stress testing, the right modalities and protocols
Overview of Exercise Physiology, Recognizing the Modalities and Protocols of Exercise Stress Test

**Introduction**
- Exercise Physiology: the study of the physiological responses and adaptations that occur as a result of acute or chronic exercise.
- Exercise testing as a non-invasive tool to evaluate the cardiovascular system's response to exercise under carefully controlled conditions.
- Basic principles of exercise physiology for understanding of exercise testing.
  1. **Phylogenetic principles**: The phylogenetic relationship between the amount of exercise a species conducts and the amount of exercise a person conducts.
  2. **Ontogenetic principles**: The ontogenetic relationship between the exercise test conditions and the exercise prescription for the individual.

**Skeletal Muscle Physiology**

**Muscle Fiber Types**
- **Type I (slow twitch)**
  - Lower force production, power, speed
  - Greater endurance
  - Lower glycogen stores
  - More mitochondria
- **Type II (fast twitch)**
  - Recruited during high-intensity exercise
  - Higher rates of cross-bridge turnover
  - Require more ATP and readily fatigue

**Energy Metabolism**
- As indicated earlier, the process that facilitates muscular contraction is entirely dependent on the body's ability to provide and rapidly replenish ATP.
- Minimal amounts of ATP are stored for muscle contraction, but ATP can be derived from three specific energy systems:
  - the immediate or creatine phosphate system
  - the short-term or glycolytic system
  - the long-term or oxidative/oxidative system.
Acute Exercise and the Cardiopulmonary Response

Cardiovascular Physiology
- The principal function of the cardiovascular system during exercise is to sustain delivery of oxygen (O2) and vital nutrients to the target organ, skeletal muscle.
- The cardiovascular system consists of a pump, a high-pressure distribution circuit, exchange vessels, and a low-pressure collection and return circuit.
- This system moves approximately 5 liters (L) of blood each minute at rest, to the heart pumps nearly 7,200 L (1,900 gallons) per day.

• Maximal Oxygen uptake (VO2max) is considered the “gold standard” of cardiopulmonary health and represents the body’s ability to deliver and utilize oxygen.
• VO2 max is a product of cardiac output and extraction of oxygen from the circulation by the peripheral skeletal muscles.

Cardiovascular Effects of Exercise

Criteria for Maximal Aerobic Power
- A plateau in oxygen uptake
- Blood lactate levels
- Respiratory exchange ratio
- Age-predicted maximal heart rate
- Borg scale or rating of perceived exertion

A Plateau Oxygen Uptake
- A plateau in oxygen intake, despite an increase in workload, is considered the primary criterion for VO2max.
- If a plateau in VO2 is observed, VO2max has been achieved. However, this criterion is not always achieved.
- Various factors influence quantification of VO2max, to include between-subject variability and absolute increases in grade and speed.
Blood Lactate Levels

- In the absence of a true plateau in VO2, a rise in blood lactate has been used to demonstrate a maximal effort.
- As the workload continues to rise and the person nears a maximal effort, blood lactate levels increase due to:
  - anaerobic glycolysis
  - an increase in the recruitment of fast twitch muscle fibers
  - a reduction in liver blood flow and/or
  - an elevation in plasma epinephrine concentration

Respiratory Exchange Ratio

- Because RER reproducibly increases during exercise, it is considered a parameter that can document maximal effort.
- Studies have noted values of 1.00, 1.05, 1.10, and 1.13 as criterion for maximal performance, but at present no clear consensus has been reached

Borg Scale or Rating of Perceived Exertion

- The Borg scale is the most widely used method for quantifying perceived exertion.
- It was designed to increase in a linear fashion as exercise intensity increased and parallel the apparent linearity of VO2 and heart rate with work load.
- The original Borg scale ranges from 6 to 20, with each number anchored by a simple and understandable verbal expression.

Recommended Criteria for Testing

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<tr>
<th>Table 1.3</th>
<th>The Body of Knowledge for Physical Education and Sport Science</th>
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<tbody>
<tr>
<td>VO2max</td>
<td>(liters/min)</td>
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<tr>
<td>HR</td>
<td>(beats/min)</td>
</tr>
<tr>
<td>Rating</td>
<td>(on Borg scale)</td>
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<tr>
<td>Power</td>
<td>(watts)</td>
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Factors Affecting Maximal Exercise Performance

- Intrinsic Factor
- Age
- Gender
- Genetic

Extrinsic factor
- Type of exercise
- Environment
- Postural position

Physiology of Ischemia

Myocardial oxygen uptake

- In order to meet the increasing O2 demands of external work, the heart must correspondingly increase its own O2 requirements.
- The increase in the internal work of the heart is identified as myocardial oxygen uptake (MO2).
- MO2 can be estimated by multiplying systolic blood pressure by heart rate to yield the “double product” or “rate pressure product”.

References

[Insert references for each section if applicable]
Physiology of Ischemia

- The principal indicator of myocardial ischemia during a graded exercise test is the presence of ST-segment depression.

Arm vs Leg Exercise

ARM EXERCISE
- HR, SBP, DBP, RPP, VE, VO2, respiratory exchange ratio, blood lactate concentration are higher
- SV and AT are lower
- Elevated BP during arm exercise is believed to reflect increased peripheral vascular resistance \( \uparrow \) sympathetic tone mediated by reduced SV with compensatory tachycardia

Maximal Oxygen Consumption (VO2 Max)

<table>
<thead>
<tr>
<th>VO2 Max (ml/kg/min)</th>
<th>Heart Rate (bpm)</th>
<th>Stroke Volume (ml)</th>
<th>Heart Rate x Stroke Volume (ml/min)</th>
<th>Stroke Volume x HR (ml/min)</th>
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<tbody>
<tr>
<td>210</td>
<td>90</td>
<td>90</td>
<td>1890</td>
<td>1800</td>
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<td>180</td>
<td>80</td>
<td>70</td>
<td>1260</td>
<td>1200</td>
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</table>

Myocardial Oxygen Consumption (MVO2 Max)

- Determinant
  - HR
  - contractility
  - Wall tension
- During exercise, \( \uparrow \) HR is the major contributor
- \( MVO2 = 0.28 \times HR - 14 \)
- \( MVO2 = (0.14 \times HR \times SBP/100) - 6.3 \)
Introduction to Exercise Testing

Clinical exercise testing has been part of the differential diagnosis of patients with suspected ischemic heart disease (IHD) for more than 50 yr.

During this time additional purposes for testing have evolved. Exercise testing now is used widely for the following:
1. Detection of coronary artery disease (CAD) in patients with chest pain (chest discomfort) syndrome or potential coronary equivalents.
2. Evaluation of the anatomic and functional severity of CAD.
3. Prediction of cardiac events and all-cause death.
4. Evaluation of physical capacity and effort tolerance.
5. Evaluation of exercise-related symptoms.
6. Assessment of chronic lung disease, arrhythmias, and response to implanted device therapy.
7. Assessment of the response to medical interventions.

Functional Capacity

- Exercise capacity are usually expressed in METS (Metabolic Equivalent of Task). Based on metabolic equivalents (MET) achieved.
- One MET is defined as 3.5 ml O2 uptake/kg per min, which is the resting oxygen uptake in a sitting position.
- Energy cost: multiples of resting/basal metabolic rate.
- FC I: capable of achieving 7-8 METs.
- FC II: limited by symptoms at workloads 5-6 METs.
- FC III: symptomatic at workloads 3-4 METs.

Estimated Functional Capacity

Indication

Diagnostic Purposes:
- Assessment of chest pain
- Diagnosis of coronary artery disease
- Diagnosis of cardiac induced syncope

Evaluation purposes:
- Exercise capacity and functional evaluation
- Efficacy of medical therapy for CAD (e.g., drug therapy, coronary bypass grafting, percutaneous coronary intervention)
- Efficacy of rehabilitation therapy for CAD
- Evaluation of other diseases affecting functional capacity
- Evaluation of degree

Rehabilitation purposes:
- Cardio and exercise rehabilitation

2019 ESC Guidelines for the diagnosis and management of chronic coronary syndromes

2019 ESC Guidelines for the diagnosis and management of chronic coronary syndromes (version 1.1). The Task Force for the Diagnosis and Management of Chronic Coronary Syndromes of the European Society of Cardiology (ESC).
Pre-test Probability of CAD

Contraindications

Selection of Exercise Stress Test Modes

Exercise Testing

Exercise Protocols
"Ramp" vs "Staged/Graded" Protocols

The exercise protocol should be targeted for the patient rather than the reverse. Treadmill speed should be targeted to the individual's capabilities. Work increments should be even, and total time should be 8 to 12 minutes. METs, not minutes, should be reported.

Exercise Protocols: Ramp Protocol

- An alternative approach - work rate increases in a constant and ventilated manner
- Target MET workload is selected in a set of target workload in grade and speed can be programmed to increase in alternating fashion
- A more physiologic experiment and an uncalculated change with each stage by the participant

Treadmill Test

- The treadmill should have front slope, side walls, or some other subject stability.
- Subjects should be instructed not to alter the plane of slope
- Ensure the exercise supports body weight and that the subject is comfortable at any given angle leading to the potential for a significant contribution of oxygen uptake
- Must always be performed at the angle ergometer
- Subjects must have a stable of running
- Risk of falling

Treadmill Protocols

- Bruce protocols
- Treadmill Protocols

Estimated Treadmill Capacity

| Less than 5 METS | Poor |
| 5-10 METS | Fair |
| 10-15 METS | Good |
| 15 METS or more | Excellent |

- An inability to exercise 10 minutes on the Bruce protocol, or an inability to increase heart rate (HR) 100% of maximum predicted heart rate (MPHR) are significant indicators of increased risk of coronary events with a greater survival ranging from 80% to 15%.

Modified Bruce Protocol

- The free stages similar to those of 2-3 METS. Stage 4 equal to the final stage of Bruce protocol
- Often use in older individuals or those whose exercise capacity is limited by coronary disease
Cycle Ergometer

- Used extensively, especially for asthma, and it has many more than a treadmill.
- Cycle ergometers are calibrated in kilowatts or watts (W). 1 W is equivalent to 0.746 kilowatts.
- The highest levels of fatigue and muscle are achieved with cadence intervals of 70 to 80 rpm.
- Leg fatigue is an underestimated fact and could cause early termination before reaching a true VT.
- Thus, 90% is 20% to 25% faster in cycle versus treadmill testing in those not accustomed to cycling.

Cycle Ergometry Protocols

- Cycle Ergometry (left panel)
  - Field assessment: Test assessment protocols reaching an initial work rate of 100 W after 15 minutes of exercise, followed by maximal protocols reaching an initial work rate of 100 W after 15 minutes of exercise.
  - Exercise assessment (right panel)
  - Protocols for cycle ergometry. The work rate assessment is added at the start of each 3-minute stage for the conventional incremental test, whereas the incremental is equal to 1 W every 30 seconds and 1 W every 60 seconds for the 20 minutes and 20 minutes using protocols, respectively, beginning from stage 0 of the exercise period.

Ergocycle Exercise Protocols

<table>
<thead>
<tr>
<th>Exercise Intensity</th>
<th>Stage 1</th>
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</table>

Cycle Ergometry as a Choice of Exercise Test Modality

- Mechanically braked
- Electrically braked

Advantages and Disadvantages of Leg Cycle Ergometers

- 6 Mo between the magnitude of VT ergometer changes in the two tests. If one observes changes over time, the exercise is still valid.
- VT ergometer changes were assessed immediately before exercise.
- The exercise is valid for the test, but the test is not suitable for the assessment of ventricular contractile failure.
**Exercise Protocols**

**Protocols of Exercise Stress Testing**
- Initial warm-up period → successive (graded) increase in workload → recovery period.
- Workloads should be increased gradually & maintained for a sufficient length of time.

**6 Minutes Walking Test**
- This test measures the distance that a patient can quickly walk on a flat, hard surface in a period of 6 minutes (the 6MWT).
- The self-paced 6MWT assesses the submaximal level of functional capacity. Most patients do not achieve maximal exercise capacity during the 6MWT.

**Indications and Limitations**
- Strongest indication 6MWT: measuring the response to medical interventions in patients with moderate to severe heart or lung disease.
- The 6MWT does not determine peak oxygen uptake, diagnose the cause of dyspnea on exertion, or evaluate the causes or mechanisms of exercise limitation.
- The information provided by a 6MWT should be considered complementary to cardiopulmonary exercise testing, not a replacement for it.

**Conclusion**
- Exercise physiology is the study of the physiologic responses and adaptations that occur as a result of acute or chronic exercise.
- Exercise is the body's most common physiologic stress, and it places major demands on the cardiopulmonary system and can be considered the most practical test of cardiac perfusion and function.
- Exercise testing is a non-invasive tool to evaluate the cardiovascular system's response to exercise under carefully controlled conditions.
- Choosing appropriate protocol, good preparation, and observing precautions are essential to ensuring patient safety during exercise stress testing performed.

**Thank You**
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CERTIFICATE

This certificate is proudly presented to

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as

SPEAKER

in the 12th Bali Cardiology Update 2023 Workshop Of Exercise Stress Test: How to Session

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