To comply with professional boards/associations standards:

• I declare that I (or my family) do not have a financial relationship in any amount, occurring in the last 12 months with a commercial interest whose products or services are discussed in my presentation. Additionally, all planners involved do not have any financial relationship.
• Requirements for successful completion are attendance for the full session along with a completed session evaluation.
• Vyne Education and all current accreditation statuses does not imply endorsement of any commercial products displayed in conjunction with this activity.

Session 404: Utilizing Vital Sign Information in Acute Care Rehab
Andrew Mills, PT, DPT, CCS

Objectives

• Describe the importance of vital sign monitoring in rehabilitation
• Recognize normal vital signs for individual patients
• Interpret safety of therapeutic interventions and modifications to the plan of care based on vital signs
• Differentiate potential vital sign abnormalities in certain patient populations and how to properly handle them
• Explain the potential physiological changes occurring within patients based on the presence of a vital signs being abnormal
Background

• Worked in acute care, rehab, outpatient, work conditioning
• Not currently involved in full time patient care
• Physical therapist

Outpatient Scenario

• Wynn is a 25 year old semi professional soccer player coming to therapy after a grade 2 ankle sprain
• Would you take vital signs on these patients?
  • Poll Question
    Would you take vital signs on this patient?
    A. Yes
    B. No
Outpatient Scenario

- Luxor is a 55 year old referred for balance training after falling at the Linq. PMHx: Smoker (1 pack times 32 years), HTN
- Medications beta blocker
- Coming to therapy for balance training

Poll Question
Would you take vital signs on this patient?  
A. Yes  
B. No

What are Vital Signs

- Merriam Webster definition  
  - Important body functions that are measured to see if someone is alive or healthy  
- Blood Pressure  
- Heart Rate  
- Breathing Rate  
- SpO₂  
- Body Temperature

https://www.merriam-webster.com/dictionary/vital%20signs

Other Vital Signs

- Gait speed (Fritz and Lusardi 2009)  
- Level of Pain  
- Weight  
- Height  
- RPE  
- Therapist observation  
- Various invasive monitoring  
- Lab Values  
  - Academy of Acute Care Physical Therapy Laboratory Values Interpretation Resource  
Why monitor vital signs

- Luxor is coming to an outpatient therapy after a total knee replacement. Upon arrival of his 5th visit he is stating he got the new apple watch the therapist looks at it and sees that his resting heart 115 BPM.
- Are they ok to participate in therapy today?

Why monitor vital signs

- We can get a lot of information
  - Screen for red flags
    - Establish baseline
    - Can have normal vital signs at rest and an abnormal response to activity
    - Vital sign responses can be abnormal but asymptomatic
  - Responding to exercise
    - They may need to go to the ED
    - Well-they may be able to advance quicker
    - May not affect your care at all
    - However you could send patient for referral
    - Hypertension is silent killer—progresses to advanced stages before clinically, increases risk of stroke kidney damage, RA
    - See how hard somebody is working
      - Increased energy expenditure in
        - Arthritis, deconditioned, overweight
        - Irregular pulse—Monitor more closely
        - Clinical due diligence-avoid a lawsuit
    - Inexpensive
    - Safe

Why monitor BP

Using the old blood pressure criteria!

An estimated 103 million U.S. adults have high blood pressure

- US Pop 325,000,00
- Adult population 249,000,000 (40%)

https://news.heart.org/more‐than‐100‐million‐americans‐have‐high‐blood‐pressure‐aha‐says/
After organizing the available history information, the physical therapist begins the hands-on component of the examination. The physical therapist begins organizing and organizing the available information about the patient’s functional ability, affect, cognition, learning style, and expectations. This examination includes the patient’s physical examination which focuses on the systems review.

The systems review is a brief or limited examination of (1) the anatomical and physiological status of the cardiovascular, pulmonary, integumentary, musculoskeletal, and neuromuscular systems and (2) the communication ability, affect, cognition, language, and learning style of the individual. The physical therapist especially notes how each of these last 5 components affects the ability to initiate, sustain, and modify purposeful movement for performance of an action, task, or activity that is pertinent to function.

The systems review includes the following:

- **For the cardiovascular/pulmonary system:** the assessment of heart rate, respiratory rate, blood pressure, and edema
- **For the integumentary system:** the assessment of pliability (texture), presence of scar formation, skin color, and skin integrity
- **For the musculoskeletal system:** the assessment of gross symmetry, gross range of motion, gross strength, height, and weight
- **For the neuromuscular system:** a general assessment of gross coordinated movement (eg, balance, gait, locomotion, transfers, and transitions) and motor function (motor control and motor learning)
- **For communication ability, affect, cognition, language, and learning style:** the assessment of the ability to make needs known, consciousness, orientation (person, place, and time), expected emotional/behavioral responses, and learning preferences (eg, learning barriers, education needs)

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“Vital sign measurement and assessment is ignored far too often by rehabilitation professionals”

- Andrew Mills 7/27/2018

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Is vital sign monitoring happening?

[Image of vital sign monitoring]
Is vital sign monitoring happening?

- Included 15 PT's
- Observed 74 visits outpatient PT (15 initial visits)
- Although 26% of the patients had hypertension as a comorbidity
- Initial HR and BP were only taken in 2 sessions
- Only once taken after exercise

**Conclusions:** Within our limited sample, PT's in outpatient settings were not following HR and BP screening or exercise monitoring practice guidelines. This could put patients at risk for cardiovascular incidents during therapy sessions.

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**Table:**

<table>
<thead>
<tr>
<th>Patient</th>
<th>Age</th>
<th>Height</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient 1</td>
<td>35</td>
<td>180 cm</td>
<td>80 kg</td>
</tr>
<tr>
<td>Patient 2</td>
<td>45</td>
<td>175 cm</td>
<td>90 kg</td>
</tr>
<tr>
<td>Patient 3</td>
<td>55</td>
<td>185 cm</td>
<td>95 kg</td>
</tr>
</tbody>
</table>

---

**Yeah! but that was outpatient**
Reasons given for not taking vital signs

<table>
<thead>
<tr>
<th>Reason</th>
<th>Percentage of Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not important for patient population</td>
<td>56.3%</td>
</tr>
<tr>
<td>Information obtained from patient’s chart</td>
<td>20.3%</td>
</tr>
<tr>
<td>Measured in emergency setting</td>
<td>16.3%</td>
</tr>
<tr>
<td>Lack of time</td>
<td>6.7%</td>
</tr>
<tr>
<td>Equipment available</td>
<td>5.1%</td>
</tr>
<tr>
<td>Lack of self-defining requirements</td>
<td>5.2%</td>
</tr>
<tr>
<td>Other</td>
<td>1.8%</td>
</tr>
</tbody>
</table>

Poll Question
Would you take vital signs on this patient?
A. Yes
B. No

• Tropicana is a 43 year old female who wants to get back into shape after having 3 kids. She is a former collegiate level swimmer and still enjoys it, so she started a swimming fitness program 2 weeks ago. She arrives in an outpatient clinic for therapy.
• She complains of right shoulder pain while swimming and came to therapy for help.
• Poll Question
  Would you take vital signs on this patient?
  A. Yes
  B. No

• Tropicana is a 43 year old female who wants to get back into shape after having 3 kids. She is a former collegiate level swimmer and still enjoys it, so she started a swimming fitness program 2 weeks ago. She arrives in an outpatient clinic for therapy.
• She complains of right shoulder pain while swimming and came to therapy for help.
• Her mother is 65 years old with heart disease and father died at age 43 of a heart attack.
• Tropicana gets the pain sometimes when climbing the stairs or jogging.
• She also states she may be coming down with something because she has been experiencing more fatigue than usual over the past week or so with her Morning And sometimes with shortness of breath
• Poll Question
  Would you take vital signs on this patient?
  A. Yes
  B. No
Physical Therapists’ Ability to Predict Hypertensive Status Based on Visual Observation With and Without Past Medical History

• Methods: Two examiners measured participants’ blood pressure (BP). Four panel members then visually examined and classified each participant as normotensive or prehypertensive/hypertensive before and after review of the participant’s PMH. For each participant, panelists also recorded if they would measure the participant’s BP in the clinical setting. The measured BPs were used as the reference standard to analyze panelists’ sensitivity and specificity.

• Results: Sixty-eight percent of participants (n = 132) had BP measurements within the prehypertensive/hypertensive category. Each panelist’s classifications had poor sensitivity when based on visual observation alone and with review of medical history. Of those participants in the prehypertensive/hypertensive category, the panel members would have performed BP assessment clinically 9% of the time.

• Conclusions: Our data suggest that clinicians are unable to predict patients’ hypertensive status using visual inspection alone or in conjunction with review of the patient’s PMH. To adequately screen for hypertension, clinicians should measure BP for each patient rather than relying on clinical judgment to predict patients who need BP screening.

Normal vital sign ranges for the average healthy adult at rest

• Blood pressure: 90/60 mm Hg to 120/80 mm Hg
• Breathing: 12 to 18 breaths per minute
• Pulse: 60 to 100 beats per minute
• Temperature: 97.8°F to 99.1°F (36.5°C to 37.3°C)/average 98.6°F (37°C)

http://medlineplus.gov/ency/article/002341.htm

<table>
<thead>
<tr>
<th>BP Category</th>
<th>SBP</th>
<th>DBP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>&lt;120 mm Hg</td>
<td>&lt;80 mm Hg</td>
</tr>
<tr>
<td>Elevated</td>
<td>120–129 mm Hg</td>
<td>&lt;80 mm Hg</td>
</tr>
<tr>
<td>Hypertension</td>
<td>Stage 1 130–139 mm Hg or 80–89 mm Hg</td>
<td>Stage 2 ≥140 mm Hg or ≥90 mm Hg</td>
</tr>
</tbody>
</table>

Individuals with SBP and DBP in 2 categories should be designated to the higher BP category.

BP indicates blood pressure (based on an average of ≥2 careful readings obtained on ≥2 occasions, as detailed in Section 4); DBP, diastolic blood pressure; and SBP, systolic blood pressure.

http://www.onlinejacc.org/content/early/2017/11/04/j.jacc.2017.11.006
NORMAL AND ABNORMAL RESPONSES TO EXERCISE

Metabolic Equivalent
- Measurement of O2 consumption
- 1 MET = 3.5 ml/kg/min
- 1 MET = Sitting at rest
- Based on 70 kg male

- MET Guide
  - https://sites.google.com/site/compendiumofphysicalactivities/Activity-Categories

Considerations for Therapy
- Kozey et al. found that the standard MET misclassifies the intensity category in individuals that are overweight, older, low fit, or women

Extrinsic-Cardiac Innervation

Cortical control
Cardiovascular center

- Help Regulate HR and SV, blood vessel diameter
- Signals originate in the CV center in the medulla and travel via the ANS
- Sympathetic - Epi and norepinephrine
  - Heart ↑ HR, ↑ SV, ↑ conduction velocity
  - Vasomotor tone (peripherally)- Vasoconstrict (causes what to BP?)
- Parasympathetic - Acetylcholine
  - ↓ HR, ↓ SV, ↓ conduction velocity

Table 10.1 The Autonomic Nervous System and Cardiovascular Function

<table>
<thead>
<tr>
<th>SYMPATHETIC INFLUENCE</th>
<th>PARASYMPATHETIC INFLUENCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increase heart rate</td>
<td>Decrease heart rate</td>
</tr>
<tr>
<td>Increase myocardial contraction force</td>
<td>Decrease myocardial contraction force</td>
</tr>
<tr>
<td>Dilate coronary blood vessels</td>
<td>Constrict coronary blood vessels</td>
</tr>
<tr>
<td>Constrict pulmonary blood vessels</td>
<td>Dilate pulmonary blood vessels</td>
</tr>
<tr>
<td>Constrict blood vessels in abdomen, muscle, skin, and kidneys</td>
<td>Dilate blood vessels in abdomen, muscle, skin, and kidneys</td>
</tr>
</tbody>
</table>

McArdle W, Katch, F, Katch, 2016
Anticipatory HR control

- Cortical input also causes the heart rate to increase rapidly in anticipation of exercise
  - By sympathetic discharge
  - Reduction of vagal tone

Peripheral Input to cardiovascular center

- Mechanoreceptors monitor vessels, joints, muscles –
  - Exercise begins & sympathetic → Cause HR ↑, BP ↑, CO?
- Chemoreceptors monitor chemicals in blood–
  - Peripheral – located in carotid bodies and aortic arch
    - Central – in medulla monitor CSF
      - If high CO₂ ↑ or O₂ ↓: Increase symp to Vasoconstrict the periphery, vasodilate coronary art
- Baroreceptors – monitor stretch (pressure)
  - If low BP: ↑ sympathetic and ↓ para ↑ and CO

Pulse rate

- Stretch and recoil of arterial wall during cardiac cycle
- Things to Monitor
  - Rate - BPM
  - Rhythm – Pausos between beats
  - Strength –
    - Increase in systolic pressure (bounding/full) will cause ↑ pulse strength
    - Decrease in systolic pressure (weak/thready) will cause ↓ decrease in pulse strength
- (0) no palpable pulse
- (1 +) faint, but detectable pulse, obliterated with very little pressure
- (2 +) slightly diminished pulse than normal obliterated with light pressure
- (3 +) is a normal pulse, Moderate pressure to obliterate
- (4 +) indicating a bounding pulse heavy pressure to obliterate

Hill and smith 1990
What is the Normal HR Response to activity?

- Bally is a 45 year old female with no significant PMHX and is on no medicines.
- Poll question
  - If Bally was sitting in a chair and got up to walk across the room. What would we expect heart rate to do?
  
  A. Stay the same
  B. Increase by 2-3 BPM
  C. Increase by 8-12 BPM
  D. Increase by 18-26 BPM

What is the Normal HR Response to activity?

- Bally is a 45 year old female with no significant PMHX and is on no medicines.
- If Bally was sitting in a chair and got up to walk across the room. What would we expect her heart rate to do?
- Increase 8-12 BPM per MET (ACSM Guidelines for exercise testing and prescription 10th ed)
- EG. RHR 60 BPM
  2.0 walking, household

What is the Normal HR Response to activity?

- Bally is a 45 year old female with no significant PMHX and is on no medicines.
- If Bally was sitting in a chair and got up and starting leisurely climbing stairs.
  
  Poll Question
  - What would we expect her heart rate to do?
  
  A. Stay the same
  B. Increase by 8-12 BPM
  C. Increase by 16-24 BPM
  D. Increase by 24-36 BPM

- 4.0 METS stair climbing, slow pace
- EG. RHR 60 – What would new expected HR be?

https://sites.google.com/site/compendiumofphysicalactivities/ActivityCategories/walking

Bally is a 45 year old with female no significant PMHX and is on no medicines?

- What would we expect her heart rate to do for arm exercises?
  - Given an equal workload HR rise is greater during U/E vs. L/E work

- What about isometric exercising?
  - Compared to dynamic exercise, isometric contractions rise in heart rate is less pronounced (Lind et al. 1966)

Normal HR Response to Activity

Increases with increasing work load
- Rise is nearly linear at submax. effort
- Increases ~ 8-12 bpm/met (ACSM, 2018)
- Given an equal workload Rise is greater during U/E vs. L/E work
- Compared to dynamic exercise, isometric contractions rise in heart rate is less pronounced (Lind et al. 1966)

Heart rate recovery response

- HR should drop >12 BPM in the first minute
- Decrease of 22 BPM by second minute
- If not it has a high correlation with increased mortality
- (ACSM 10th edition)
Heart Rate is Linearly Related to Oxygen Consumption

Figure 4.2 ACSM 10th edition

Heart Rate Affected By:

- Pain
- Age-Blunted as we age
- Disease
- Inactivity
- Medications
  - Beta Blockers in particular
    - Propranolol (Inderal)
    - Carvedilol (Coreg)
    - Nadolol (Corgard)
    - Tenolol (Visken)
    - Timolol (Tenormin)
  - Beta Adrenergics: asthma, etc.
  - Fever
  - Low blood volume

Abnormal HR Responses

- Rapid rate of rise (seen in deconditioned individuals) Convertino 1997
- Very slow rate of rise in untrained individual: blunted
  - Inability to achieve near predicted max (85%) heart rate on max test: chronotropic incompetence
- Decrease with increased work
- Irregular rhythm
Blood Pressure

- Blood Pressure = CO X Total peripheral resistance
- Systolic - force of blood against the arterial walls during systole
- Diastolic - force of blood against the arterial walls during diastole

Regulation of BP

Blood Pressure Control

- HR can speed up or slow down
- Veins dilate or constrict
- Arteries dilate or constrict
- Kidneys hold on to or release fluid

- What happens with low BP?
What is the Normal BP Response to aerobic activity?

- Bally is a 45 year old female with no significant PMHX and is on no medicines?
- Poll question
- If Bally was sitting in a chair and got up to walk across the room, what would we expect systolic blood pressure to do?
  A. Stay the same
  B. Systolic increase by 2-3 mmHg
  C. Systolic Increase by 8-12 mmHg
  D. Systolic Increase by 18-26 mmHg
- What about Diastolic BP?

What is the Normal BP Response to aerobic activity?

- Bally is a 45 year old female with no significant PMHX and is on no medicines?
- If Bally was sitting in a chair and got up to walk across the room. What would we expect her BP to do?
- Increase 8-12 BPM per MET (ACSM Guidelines for exercise testing and prescription 10th ed)
- EG. RHR 60 mmHg

J.0 MET's walking, household
http://www.researchbedford.com/HP/helena-social-menu\ActivityCategories/walking

What is the Normal BP Response to aerobic activity?

- Bally is a 45 year old female with no significant PMHX and is on no medicines?
- If Bally was sitting in a chair and got up and starting leisurely climbing stairs.
- Poll Question
- What would we expect her blood pressure to do?
  A. Stay the same
  B. Systolic increase by 8-12 mmHg
  C. Systolic increase by 16-24 mmHg
  D. Systolic increase by 24-36 mmHg
  E. Systolic and diastolic increase by 16-24 mmHg

4.0 MET's stair climbing, slow pace
EG. Resting BP is 120/80 – What would new expected BP be?
Bally is a 45 year old with female no significant PMHX and is on no medicines.

- What is the normal blood pressure response to isometric exercise?
- Compared to dynamic exercise, isometric contractions elicit marked increases in both systolic and diastolic blood pressures, (Lind et al. 1966)

Blood Pressure During Cardiovascular Exercise

Blood Pressure response during Resistance Exercise

- Sustained muscle contraction compress Arterioles → resistance to blood flow → ↑ BP

https://www.pinterest.co.kr/pin/52481905331391940/
Normal BP Response to Activity

**Normal Systolic BP Response to Activity**
- Systolic BP ↑’s with ↑’ing workload
  - Rises ~ 8-12 mm Hg/met (ACSM, 2018)
  - Response is greater during U/E vs. L/E work (Crivino et al 2009)
  - Greater during static vs. dynamic work (Weppert et al 2013)
  - Isometric exercise - compared to dynamic exercise, isometric contractions elicit marked increases in both systolic and diastolic blood pressures, (Lind et al. 1966).

**Normal Diastolic BP Response to Activity**
- Diastolic BP remains unchanged or decreases during aerobic activity (ACSM, 2018)
- DBP increases during heavy resistance activity (Akdur et al., 2002)

BP affected by
- Pain - we may be able to work with nursing to give meds to bring down pain
- Volume of blood
  - ↓ Volume = ↓ BP (dehydration, excessive bleeding, vomiting diarrhea)
- Viscosity
  - More viscosity = ↑ pressure
- Cardiac Output
  - Increased cardiac output = ↑ BP
  - Decreased cardiac output = ↓ BP

**Pulse pressure**
- Pulse pressure = Systolic BP - DBP
- At rest normal value around 40 mm/hg
- High pulse pressure above 60 mm/hg is an indication of heart disease
  - Indicates aortic atherosclerosis
- Low (less than 25 % of SBP)
  - Indicates Low stroke volume (CHF, valve dysfunction, blood loss)
- Normal exercise response –widening pulse pressure
BP response post exercise

- Normal response is for SBP to return to pre-exercise levels or lower within 6 minutes
- A failure to see this decrease is highly correlated with ischemic conditions and increased mortality
- May remain below pre-exercise BP for up to 12 hours

(ACSM 10th edition)

Abnormal BP responses

- Systolic BP
  - Rapid rate of rise
  - Blunted
  - Exertional hypotension (> 10 mm Hg decrease) while exercise increasing (ACSM, 2018)
- Diastolic BP
  - Progressive rise (> 10 mm Hg)
  - Decrease (> 10 mm Hg)

What is Normal SpO₂ Response?

- Bally is a 45 year old female with no significant PMHX and is on no medicines?
  - If Bally was sitting in a chair and got up to walk across the room. What would we expect SpO₂ to do?
    A. Stay the same
    B. Increase by 4-6%
    C. Increase by 8-12% percent
    D. Decrease by 2-6%
### Pulse pressure

- Pulse pressure = Systolic BP - DBP
- At rest normal value around 40 mm/hg
- High pulse pressure above 60 mm/hg is an indication of heart disease
  - Indicates aortic atherosclerosis
- Low (less than 25 % of SBP)
  - Indicates Low stroke volume (CHF, valve dysfunction, blood loss)
- Normal exercise response – widening pulse pressure

### Rate pressure product

- RPP = HR x SBP
- Indirect measure of Myocardial Oxygen Demand
- Factors that affect work on heart, and therefore amount of O2 heart needs to perform work
  - HR
  - Systolic BP
  - Wall tension
  - Ventricular volume

### Determinants of Myocardial Oxygen Demand

- Factors that affect work on heart, and therefore amount of O2 heart needs to perform work
  - HR
  - Systolic BP
  - HR X Syst B/P = Rate Pressure Product
  - Wall tension
  - Ventricular volume
Case?

- A physical therapist is treating a 68 year old male s/p TKR. Upon sit to stand the BP goes from 120/80 to 98/80 and pt complains of dizziness. What should therapist do? And Why?
- A physical therapist is treating a 68 year old male s/p TKR. Upon sit to stand to walking the BP goes from 130/80 to 90/82 and pt complains of dizziness. What should therapist do? And Why?

Other Responses to Assess

- Oxygen Saturation (SpO2)
  - Normal response: no change or minimal decrease
  - Abnormal response – decrease with increasing activity (decrease of 4 percentage points, particularly if < 90%, is clinically significant) [ACSM, 2018]
  - Severely abnormal: SpO2 drops below 88%

- Respiratory Rate
  - Normal = 12-20
  - Should correspond with HR changes
  - Will severely change with drop in SpO2

Utilizing vital signs considerations to help form your decision to work with patient or adjust treatment
### Considerations

- Not RCTs
- Guidelines –
  - Put together by a consensus opinion of experts
  - Weight risk versus reward

### Parameters indicating lack of readiness for mobility

**Pulmonary Measures**
- SpO2 < 88% or 10% desat below rest
- RR > 35 breaths/min
- PEEP > 10 cm H2O
- FiO2 > 0.59

**Cardiovascular Measures**
- MAP <65 or >120 mmHg or > 10 lower than NL
- RHR <50 or >140 bpm
- Systolic BP <90 or >200 mm Hg
- New arrhythmia developed
- New onset angina like chest pain

### Parameters indicating lack of readiness for mobility

**Laboratory Values**
- HCT <25% NO Exercise
- Hb < 8 g/dL NO exercise
- Platelets < 20,000/mm³ NO exercise
- Anticoagulation INR >2.5-3.0 discuss with physician

**Metabolic Measures**
- Glucose levels < 70 or > 200 mg/dL
Contraindications to Initiating Early Mobility

- Significant change in resting ECG
- Unstable angina
- Uncontrolled cardiac arrhythmias
- Uncontrolled symptomatic heart failure
- Suspected or known dissecting aneurysm
- Uncontrolled active bleeding
- Acute respiratory failure
- Acute pulmonary embolus: NOT on anticoagulants
- Acute neurological changes
- Severe combatively
- Acute, unstable fracture
- Acute untreated compartment syndrome

Criteria for Terminating a PT/OT Mobilization Session as Summarized from the Literature

- Heart Rate:
  - Heart rate
  - New onset dysrhythmia
  - New anti-arrhythmia medication
  - New MI by ECG or cardiac enzymes
- Mechanical Ventilation
  - FIO2 ≥ 0.60
  - PEEP ≥ 10
  - Patient-ventilator asynchrony
  - MV mode change to assist-control
  - Tenuous airway
- Blood Pressure:
  - SBP >180 mmHg
  - MAP < 65 mmHg; > 110 mmHg
- Respiratory Rate:
  - < 5 breaths/minute; > 40 breaths/minute
- Alertness/Agitation and Patient symptoms:
  - Patient sedation or coma – (Richmond agitation sedation scale) RASS ≤ −3
  - Patient agitation requiring addition or escalation of sedative medication; RASS >2
  - Patient refusal
Relative contraindications to exercise

• PaO2 60 mm/Hg or O2 < 90%
• Resting ST displacement of >3 mm/Hg
• Respiratory rate >45 BPM
• Orthostatic hypotension
  - SBP drop 20 mm/Hg DBP
  - HR 10-20 BPM with symptoms

Absolute Indications for Terminating Exercise Testing

• Drop in SBP 10 ≥ with increase work rate or decrease below the resting SBP in the same position
• Moderately severe Angina like symptoms (3 on angina scale)
• Increasing nervous system symptoms (eg ataxia, dizziness, near syncope)
• Signs of poor perfusion (cyanosis, pallor)
• Technical difficulties monitoring ECG or SBP
• Subjects desire to stop
• Sustained ventricular tachycardia
• ST elevation (+1.0 mm) in leads without diagnostic Q waves (other than V1 or aVR)

Angina scale
- 1 Mild barely noticeable
- 2 Moderate bothersome
- 3 Moderately severe uncomfortable
- 4 Most severe pain

You are at a party and Bellagio is your co-worker and is a 65 year old with type 1 diabetes (Diagnosed at age 15). She comes up and starts chatting with you and says she recently joined a gym and is working out with a trainer. She is bragging to you about how her trainer is impressed with how in shape she is because she does not seem to have an increase in heart rate when he increases treadmill speed and grade.

Poll Question

• Given the choices below what is the best course of action?
  - A. Grab another IPA
  - B. Nothing based on her HR response she is obviously in great shape
  - C. Tell her she should make an appointment with a physician soon to have that looked into further
  - D. Call the Ambulance and grab another IPA
Vignette

- Planet Hollywood is an 80 year old patient with no significant PMH and no medications that comes to therapy and wants to start and aerobic conditioning program. He has a RHR of 100 BPM
- Cromwell is a 25 year old patient with no significant PMH and no medications that comes to therapy and wants to start and aerobic conditioning program. He has a RHR of 100 BPM

Poll Question
Which of the above patients is most likely going to be able to exercise at a higher MET level?
A. They will be the same, age should not matter
B. Planet Hollywood
C. Cromwell
D. 

Heart rate reserve

- Predicted Heart rate max = Resting Heart rate
- To increase this one must decrease Rest HR
- Gives us a good idea of patients tolerance to activity
- Planet Hollywood is an 80 year old patient with no significant PMH and no medications that comes to therapy and wants to start and aerobic conditioning program. He has a RHR of 100 BPM
  - Using age predicted Max hr (220-80)=140
  - HRR=40
- Cromwell is a 25 year old patient with no significant PMH and no medications that comes to therapy and wants to start and aerobic conditioning program. He has a RHR of 100 BPM
  - Using age predicted Max hr (220-25)=195
  - HRR=95

Vignette

- Paris is a 72 year old male states “I am healthy as a horse and so I don’t go to the doctor in fact I have not been to see a physician in 20 years” I am not able to do what I used to but I am doing just fine”
- Smokes 2 packs a day
- Does not participate in regular exercise
- Resting vitals
  - BP 210/100
  - HR 19
- Spo2 94%

Poll Question
The therapist wants to walk and do some strengthening exercises with this individual. What is the best course of action?
A. Postpone treatment
B. Proceed with plan
C. Adjust plan to eliminate walking but keep strengthening
D. Adjust plan to eliminate walking but keep strengthening

No exercise testing data is available
Vignette

* Mirage is a 65 year old woman no cardiac risk factors and no significant medical history.
* Patient underwent a stress test with the following results

<table>
<thead>
<tr>
<th>Min</th>
<th>HR</th>
<th>BP</th>
<th>SpO2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rest</td>
<td>72</td>
<td>130/88</td>
<td>97</td>
</tr>
<tr>
<td>3</td>
<td>94</td>
<td>135/85</td>
<td>98</td>
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<tr>
<td>6</td>
<td>136</td>
<td>155/70</td>
<td>98</td>
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<tr>
<td>9</td>
<td>170</td>
<td>165/72</td>
<td>98</td>
</tr>
<tr>
<td>Recovery min 1</td>
<td>155</td>
<td>135/74</td>
<td>98</td>
</tr>
<tr>
<td>Recovery min 2</td>
<td>125</td>
<td>114/70</td>
<td>98</td>
</tr>
</tbody>
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Poll Question
A. Normal
B. Abnormal

Vignette

* Harrah is a 55 year old male father died at age 40 of heart attack, works as a cashier at Albertsons drinks 1-2 beers a day
* Patient vitals at rest are
* HR 77
* Patient underwent a stress test with the following results

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<tr>
<td>Rest</td>
<td>77</td>
<td>114/72</td>
<td>97</td>
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<td>3</td>
<td>96</td>
<td>135/84</td>
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<td>178</td>
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<tr>
<td>Recovery min 1</td>
<td>155</td>
<td>168/70</td>
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<tr>
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</tbody>
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Poll Question
A. Normal
B. Abnormal

Vignette

* Arizona Charley is a 35 year old male who is seeing an outpatient therapist for left ankle sprain. He is coming in for his second visit and the therapist wants him to warm up on the treadmill. Arizona does well for the first 3 minutes and so the therapist increases the treadmill grade and speed.
* Arizona states “I can feel my heart is beating strong every once in a while”
* Poll question
  * Select from the choices below which would be the therapists best course of action?
    a. Increase the TM grade and speed more to see if it goes away
    b. Put a polar heart rate monitor on him to check his heart rate
    c. Stick a pulse oximeter on him to check his heart rate
    d. Call the ambulance Arizona may be having a heart attack
    e. Manually palpate the pulse
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<th>COPD Vignette</th>
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<th>BP Vignette</th>
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Conclusion

- Take basic vital signs and interpret them more frequently
- Encouraging you colleagues Take basic vital signs and interpret them more frequently
- Put yourself in the situation of the patient
  - Would you want more information about your health status if it could be provided to you?
- Clinical decision making is imperative
- Balance risk with reward for patient

Thank you

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References

References


• https://medlineplus.gov/ency/article/002341.htm
