Let's Be Objective: Using Objective Measures and Vital Signs in Acute PT

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Disclosures

- No relevant financial relationship exists for the content being presented today.

Learning Objectives

- Describe various rehabilitation objective measures used in acute care settings and their clinical usefulness
- Apply objective measures to clinical cases and synthesize test results
- Demonstrate knowledge of hemodynamic principles when mobilizing patients through interactive, case-based discussions
- Describe normal vs. abnormal hemodynamic responses to mobility and explain implications for rehabilitation

Course Outline

- Part 1
  - The case for objective measures
  - Objective measures useful in acute care
  - Case studies
- Part 2
  - Hemodynamic concepts
  - Relevance of Hemodynamics in acute care PT
  - Case studies

The Case for Objective Tests and Measures

- Objective Measures –
  - Establish a measureable baseline
  - Outcomes measurement to determine response to interventions
  - Meaningful goal setting (eg. reduction in fall risk, improved endurance, improved gait speed to safely access the community)

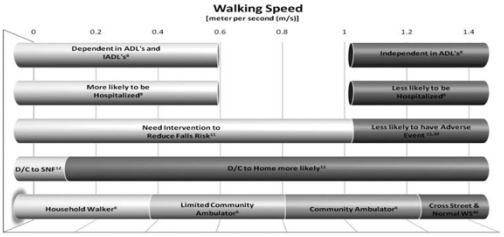
The Case (cont)

- Support discharge recommendations (“AMPAC is indicative of probable discharge to home”)
- Provide a repeatable process to measure performance (“slow gait speed” vs. “patient ambulated .30 meters/sec”)
- Some help predict rehabilitation prognosis (eg. ICUAW vs. deconditioning weakness)
- May allow for rehabilitation research

Gait Speed

- Psychometric Properties
- Valid and reliable as a measure of walking ability, and is strongly related to balance.[1,2]
- Predictive of health outcomes, SNF placement, mortality, poor QOL, falls[1,3]
- Meaningful change – in general, ~.10 m/s for older adults[4]

Gait Speed



Fritz and Lusardi 2009

What About Acute Care?

- [3]Peel et al - Meta-analysis older adults mean age ≥ 70 yrs; acute care CGS = .46 m/s, FGS = .75 m/s
- [5]Braden et al – 66 ill elderly (acute care setting) with broad range of dx, majority using a wh walker at discharge, mean gait speed was .31 meters/sec at eval and .38 meters/sec at discharge (either 10 meter walk test or 3 meter walk test used depending on ability)

Implications of Gait Speed

- Gait speed change of .10 m/s considered substantial in patients with abnormal gait speed[4]
- < 0.4 m/s – household ambulation
- 0.4 – 0.8 – "limited" community ambulation
- >0.8 m/s – unlimited community ambulation[6]
- Patients in the Braden et al[5] study that did return home walking < 0.4 m/s were only household ambulators who had caregiver assistance and few or no steps

AMPAC 6 Clicks

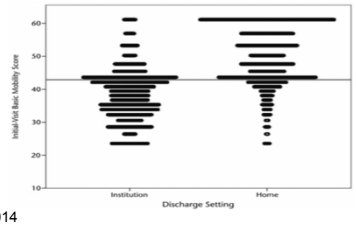
- Psychometric Properties
- Valid and reliable as a measure of basic mobility function in the acute care setting.[8,9]
- Predictive of discharge setting after acute care (raw "cut-off" score of 17 or less predicts institutional discharge)[7]

How Its Done

Please check the box that reflects your (the patient's) best answer to each question.	Unable	A Lot	A Little	None
How much difficulty does the patient currently have . . .				
1. Turning over in bed (including adjusting bedclothes, sheets, and blankets)?	☐1	☐2	☐3	☐4
2. Sitting down on and standing up from a chair with arms (eg, wheelchair, bedside commode)?	☐1	☐2	☐3	☐4
3. Moving from lying on back to sitting on the side of the bed?	☐1	☐2	☐3	☐4
How much help from another person does the patient currently need . . .				
4. Moving to and from a bed to a chair (including a wheelchair)?	☐1	☐2	☐3	☐4
5. To walk in hospital room?	☐1	☐2	☐3	☐4
6. Climbing 3–5 steps with a railing?	☐1	☐2	☐3	☐4

Jette 2014

Predicting Discharge Location



Jette 2014

Berg Balance Scale

- Psychometric Properties
- Valid and reliable as a measure of balance (most studied in elderly, stroke and other neurological conditions). Normative values in community elderly have been established (above 50 for all age ranges)[10].
- Predictive of falls ("cut-off" score of 45 or less predicts risk of falls [90% specificity, but only 64% sensitivity])[10,11]

Berg (cont)

- One study of 44 community-dwelling elderly combined Berg score with falls history - found that those who have more than 1 fall in the past 6 months and score ≤ 51 or who do not fall but score ≤ 42, correctly categorized fallers (Sensitivity) 91% of the time, and non-fallers (Specificity) 82% of the time.[12]
- Meaningful change – MDC_{95} = between 3 and 7 points[11,13]

Dynamic Gait Index (DGI)

- Psychometric Properties[14]:
  - Populations studied: older adults, CVA, PD, MS and vestibular deficits
  - Test-Retest reliability (ICC between .84 - .96) and inter-rater reliability are high
  - Concurrent validity moderate to high with TUG and 10 meter walk test
  - Sensitivity and specificity have been reported as 59% and 64%
  - Cut-off score for fallers vs. non-fallers varies by population, ranging from 19 to 23
  - $MDC_{95\%}$ - 3 points (community elderly with falls or near falls)[11]

4-item DGI

- Marchetti and Whitney[15] proposed a 4 item DGI to improve time efficiency
  - 4 items selected – horizontal/vertical head turns, gait on level surfaces, changes in gait speed
  - Cut off to identify fallers was reported at 9 or less (out of 12 total points)[15,16]
  - Psychometric properties – less studied than original DGI, reliability and validity established in outpatient stroke population with a proposed MDC of 3 points[17]

Functional Status Score ICU (FSS ICU)

- Psychometric properties:
- Validated against other established measures of strength and function in critical care[19]
- Responsiveness – established and correlates to muscle strength improvements[19]
- Reliable - .99 ICC[20]
- MID estimated to be between 3-5 points[19]
- Predictive of discharge location when measured at time of ICU discharge ([median scores] 28 = home, 20 = IP Rehab, 9 = SNF)[20]

FSS ICU

- Therapeutic Activities:

Functional Status Score in the Intensive Care Unit (FSS-ICU)		
Activity	**Score**	**Scoring**
Preambulation Categories		0 = unable to perform
• Rolling	3	1 = Total assistance
• Supine to Sit Transfer	3	2 = Maximal assistance
• Unsupported sitting	5	3 = Moderate assistance
Ambulation categories		4 = Minimal assistance
• Sit to stand transfer	3	5 = supervision
• Ambulation	0 (0 feet)	6 = Modified Independence
		7 = Complete Independence
Cumulative FSS-ICU Score	14	

MRC

- Psychometric properties –
  - Valid and reliable [ICC of .96 for inter-tester reliability[21]] in patients with central/peripheral nerve dysfunction and those with critical[22]
  - Cut-off score of 48 (persists with serial measurement) identifies ICUAW[23]
  - Cut-off of greater than or equal to 41.5 required to stand and complete the PFIT[22]

MRC Scale

Medical Research Council Scoring System[13]

Strength of Muscle Groups for the Following Motions:	Strength Grades
Shoulder abduction	5=normal muscle strength/power
Elbow flexion	4=active movement against gravity with resistance
Wrist extension	3=active movement against gravity
Hip flexion	2=active movement with gravity eliminated
Knee extension	1=flicker/trace muscle contraction
Ankle dorsiflexion	0=no active muscle contraction

Nordon-Craft 2012

Handheld Dynamometer

- What it can tell you – weak grip accompanies decreased muscle mass and physical function, weak grip predicts mortality and longer hospitalization.[24]
- Correlates to MRC score to detect ICUAW[25]
  - <11 kg for men, and <7 kg for women identifies ICUAW
  - These cut-off scores yielded 81% sensitivity and 83% specificity
- Valid and reliable (inter-rater and test-retest) as a measure of grip force[26]

Hemodynamic Terms

- **Hemodynamics** is primarily about tissue perfusion (with oxygen)
- **Cardiac Output** – amount of blood pumped/min (Normal Value = 4 to 8 lpm at rest)
- **Heart Rate** and **Rhythm**
- **Stroke Volume** (SV)
- **Cardiac Output** (CO) - a function of HR and SV
- **Peripheral Vascular Resistance** (PVR)
- **Blood pressure** (BP) – a function of CO and PVR
- **Preload, Contractility** and **Afterload**[27]

Formula That Changes Lives

BP = CO x PVR

HR SV

Factors Lowering HR

- Key point: the actual HR is less important than it's impact on systemic perfusion

Heart Rhythm

- How would this heart rhythm affect hemodynamics?

Stroke Volume

- Amount of blood ejected from each ventricle with each heartbeat (normally 50 – 100 ml/beat)
- Ejection Fraction (normal is usually over 60%) = percentage of blood volume ejected from the ventricles with each heartbeat
- Preload - amount of stretch on the LV reflecting EDV
- Afterload - amount of resistance to ejection of blood from LV
- Contractility and venous return[27]

Determinants of Preload

- Factors that increase preload:
- Factors that decrease preload:

Changing Position Impacts Hemodynamics

- How does a transfer to sitting (from supine) or standing (from sitting) affect preload?
- What should happen to BP when your patient transfers from supine to sitting? Sitting to standing?
- Why?

Physiology of the Reflex

- Baroreceptors are stretch receptors that send electrical impulses to the brain at a certain rate directly related to BP
- Increased or decreased BP results in changes to rate of baroreceptor signal firing
- Brainstem reacts with either a sympathetic (norepinephrine) or parasympathetic (increased vagal tone) effect on HR, contractility (SV), and vascular tone. [28,29]

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