Upper Extremity Motor Score (UEMS)

Assessment Overview

Assessment Area

ICF Domain:
Body Function
Subcategory:
Neuromusculoskeletal & Movement-related Functions and Structures

You Will Need

Length:
10 locations (myotomes) (5 each side of the body):
- C5 - elbow flexors
- C6 - wrist extensors
- C7 - elbow extensors
- C8 - long finger flexors
- T1 - small finger abductor

Scoring:
The score is rated from 0 to 5:
- Grade 0 = Total paralysis
- Grade 1 = Palpable or visible contraction
- Grade 2 = Active movement, full range of motion (ROM) with gravity eliminated
- Grade 3 = Active movement, full ROM against gravity
- Grade 4 = Active movement, full ROM against gravity and moderate resistance in a muscle specific position
- Grade 5 = (Normal) active movement, full ROM against gravity and full resistance in a functional muscle position expected from a otherwise unimpaired person

The maximum score is 50.

Training:
Training is mandatory. The International Standards Training e-Learning Program (InSTeP) is a five-module course (including basic anatomy, sensory examination, motor examination, anorectal examination, and

Summary

The upper extremity motor score (UEMS) is a subscale of the International Standards for Neurological Classification of Spinal Cord Injury (ISNCSCI) that assesses upper extremity muscle strength.

Previous research suggests that individual UEMS or LEMS scores alone (rather than total ISNCSCI scores) better predicts upper limb or lower limb function (Marino & Graves, 2004; Graves, 2006).

The score range is 0–5 for each of 5 key muscles (elbow flexors, wrist extensors, elbow extensors, long finger flexors, and small finger abductor) of each arm, with maximum score of 50.

The UEMS, along with the ISNCSCI exam should be performed in the supine position (except for the rectal examination that can be performed side-lying) to ensure scores collected are standard and comparable.

During each myotome / muscle group testing, the assessor should start the assessment in “grade 3” by default. Depending on the performance of the patient in each test, then the assessor will move forward to Grade 4-5 or Grade 0-2. Please, refer to the worksheet to see the patient positions and testing procedures for each muscle group and grade.

Availability

Motor Exam Guide from: http://asia-spinalinjury.org/wp-content/uploads/2016/02/Motor_Exam_Guide.pdf

Scoring Diagram and Worksheet: https://asia-spinalinjury.org/wp-content/uploads/2023/12/ASIA-ISCOS-Worksheet-Sides-12_12_4_2023.pdf

Online ISNCSCI calculator: www.isncscialgorithm.com

Video: https://www.youtube.com/watch?v=PpgGzIhCpuI

Languages: ISNCSCI Worksheet is available in many languages: https://asia-spinalinjury.org/isncsci-worksheet-now-available-in-other-languages/

scoring, scaling, and the AIS classification) designed to enable clinicians to perform accurate and consistent SCI neurological examinations of individuals with SCI.
The test may pose a significant clinician/patient burden and results may be inaccurate unless the clinician is experienced and well-practiced in the test.
Equipment:
N/A

Assessment Interpretability

Minimal Clinically Important Difference

MID by Injury Level and Severity:
Cervical A = 2.91
Cervical B = 2.1
Cervical C = 2.42
Cervical D = 1.9

Effect size-based estimate for small/large changes in UEMS scores:
Cervical A = 2.94/7.35
Cervical B/C = 2.32/5.8
Cervical D = 2.18/5.45

(Scivoletto et al. 2013; n=661; 440 males; mean age: 50.35 years; 192 people with Cervical SCI; 233 ASIA A, 67 ASIA B, 158 ASIA C, 142 ASIA D; mean (SD) time since injury = 51.6(36.8) days)

Statistical Error

Minimal Detectable Change:
2.0
(Marino et al. 2008; n=16; 16 examiners; 10 males; 5 complete tetraplegia, 5 motor incomplete tetraplegia, 5 complete paraplegia, 1 motor incomplete paraplegia)

Smallest Real Difference:
1.3
(Tester et al. 2016; n=72, 57 males, 15 females; mean age: 36 years; median time since injury: 0.7 years; ASIA A-D)

Typical Values

Mean (SD) UEMS scores Admission to Discharge:
Cervical A = 19.3(14.7) to 23.6(14.4)
Cervical B = 19.05(11.6) to 28(9.3)
Cervical C = 23.8(11.6) to 37(12.6)
Cervical D = 35.4(10.9) to 41.2(7.9)

(Scivoletto et al. 2013; n=661; 440 males; mean age: 50.35 years; 192 people with Cervical SCI; 233 ASIA A, 67 ASIA B, 158 ASIA C, 142 ASIA D; mean (SD) time since injury = 51.6(36.8) days)

Measurement Properties

Validity – Moderate to High

Moderate correlation with SCIM self-care subscore:
r = 0.407, p<0.001
(Lena et al. 2021; n=140, 92 males, 48 females; mean (SD) age: 60 (16) years; 30 cervical, 78 thoracic, 32 lumbar; ASIA A-D)

High correlation with the Duruöz Hand Index (DHI):
r = -0.80, p = 0.001
(Misirlioglu et al. 2016; n=40; mean age: 35.6 years; duration of injury: 116.7 years)

High correlation with the Capabilities of Upper Extremity Test (CUE-T):
r = 0.83-0.91
(Marino et al. 2015; n=50, 36 males, 14 females; mean age: 48.1 years; ASIA A-D)
(Marino et al. 2012; n=30, 23 males, 7 females; mean age: 44.8 years; chronic SCI; complete and incomplete SCI)

High correlation with the Revised CUE-Q total (at admission and at discharge):
r = 0.70-0.89
(Oleson & Marino 2014; n=46, 42 males, 4 females; median age: 44 years; ASIA A-D)

High correlations with the GRASSP Strength subscale (at 1-, 3-, 6-, and 12-months post-injury):
r = 0.89-0.96
(Kalsi-Ryan et al. 2016; N =53 (48M, 5F); Mean (SD) age 49.6 (15.6); All acute SCI, 0-10 days post-injury; AIS-A/B/C/D: 11/5/16/21; Level of injury: 51 cervical, 2 thoracic)

High correlation with the short-form QIF:
r = 0.824
(Marino & Goin 1999; n=95, 85 males, 10 females; mean (SD) age: 31.2 (13.2) years; tetraplegia)

Moderate correlation with the Neuromuscular Recovery Scale (NRS) Overall Phase and Summary Score:
r = 0.41-0.49
(Harkema et al. 2016; n=152; 123 male; mean age: 36 years; 43 ASIA A, 21 ASIA B, 39 ASIA C, 49 ASIA D; median (range) time post-SCI: 0.9 (0.1-45.2) years)

High correlation with the FIM:
r = 0.741
(Marino et al. 2008; n=154; mean age: 37 years; chronic SCI; ASIA A-D)

Number of studies reporting validity data: 22

Reliability – High

High Inter-rater Reliability:
r = 0.931 (0.855-0.980)
(Lena et al. 2021; n=140, 92 males, 48 females; mean (SD) age: 60 (16) years; 30 cervical, 78 thoracic, 32 lumbar; ASIA A-D)

High Intra-rater Reliability:
ICC = 0.98
(Marino et al. 2008; n=16; 16 examiners; 10 males; 5 complete tetraplegia, 5 motor incomplete tetraplegia, 5 complete paraplegia, 1 motor incomplete paraplegia)

High Internal Consistency:
Cronbach's α = 0.995 (0.993-0.996)
(Lena et al. 2021; n=140, 92 males, 48 females; mean (SD) age: 60 (16) years; 30 cervical, 78 thoracic, 32 lumbar; ASIA A-D)

Number of studies reporting reliability data: 2

Responsiveness

Floor/Ceiling Effect:

42% of participants at ceiling (score 50)

(Marino & Graves 2004; n=4338, 3443 males; 854 complete tetraplegia, 1464 incomplete tetraplegia, 1195 complete paraplegia, 825 incomplete paraplegia, 2049 ASIA A, 511 ASIA B, 655 ASIA C, 1123 ASIA D; median (IQR) time since injury = 15 (9-28) days)

Effect Size:

0.69-1.29

(Velstra et al. 2015; n=74; 51 males; mean age: 49 years; at one month: 18 ASIA A, 12 ASIA B, 10 ASIA C, 34 ASIA D; acute SCI at study enrollment, measured 1,3,6,12 months post-SCI)

0.87

(Oleson & Marino 2014; n=46, 42 males, 4 females; median age: 44 years; ASIA A-D)

Standardized Response Mean:

0.38

(Post locomotor training; breakdown by AIS levels available in research summary; Harkema et al. 2016; n=152; 123 male; mean age: 36 years; 43 ASIA A, 21 ASIA B, 39 ASIA C, 49 ASIA D; median (range) time post-SCI: 0.9 (0.1-45.2) years)

Number of studies reporting responsiveness data: 4