

Assessment protocol of limb muscle strength in critically ill patients admitted to the ICU: the Medical Research Council Scale

To proceed to voluntary muscle strength assessment, the neurologic and hemodynamic stability of the patient should be guaranteed by a medical doctor.

- **Evaluation of the level of cooperation**

Two options:

A. Five standardized questions¹

Open and close your eyes
Look at me
Open your mouth and put out your tongue
Nod your head
Raise your eyebrows after I have counted to five

Each correct answer is worth 1 point. The commands may be repeated twice. It is allowed to slightly pinch the patient once to increase the attention of the patient. A patient that is fully awake and cooperative achieves a score of 5 on 5. A score of 5 on 5 is required to assess volition muscle strength.

B. Confusion Assessment method for the intensive care unit (CAM-ICU)²

Delirium has four features: (1) acute onset of changes or fluctuations in the course of mental status, (2) inattention, (3) disorganized thinking and (4) altered level of

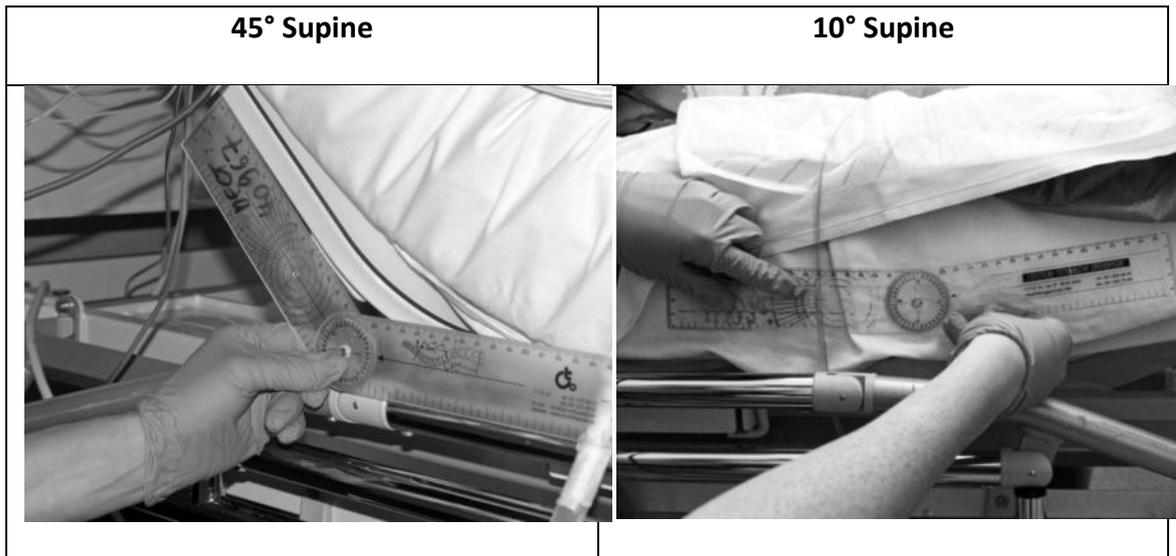
consciousness (other than alert)³. The patient is determined to be delirious according to the CAM-ICU if he/she manifests both features 1 and 2, plus either feature 3 or 4².

- **Assessment of muscle strength with the MRC-scale⁴.**

Grade 0	No contraction visible or palpable
Grade 1	Flicker of contraction visible or palpable, although no limb movement
Grade 2	Movement with gravity eliminated over almost full range of motion
Grade 3	Movement against gravity over almost full range of motion
Grade 4	Movement against moderate resistance over full range of motion
Grade 5	Normal power

- Standardized test positions

- To perform movements against gravity (MRC \geq 3), the head end of the bed is placed in 45°. For movements with elimination of gravity (MRC < 3), the head end of the bed is placed in 10°
- The head of the patient is supported by a pillow, to enable the patient to see the limb to be tested.
- Fixation and positioning materials must be removed. Side rails are removed. Make sure that catheters do not interfere with the movements that have to be performed.
- If necessary, bronchial toilet is performed prior to testing, followed by a short recuperation period for the patient.
- First test muscle strength for an MRC-score of 3. Then continue the test for an MRC-score 4 or 2 depending on the result.



- Learning attempts, repetitions and rest in between repetitions
 - First, the physiotherapist will perform the movement passively so the patient knows which movement he/she is expected to do. Next, ask the patient to perform the movement actively.
 - Begin the test at the right hand side. Finish muscle strength examination for 1 muscle group bilateral before continuing to the next muscle group. The muscle test must always be carried out in the same order
 - Three attempts for each muscle group may be performed. When the first attempt is correctly performed, continue to the next muscle group.
 - Resting periods in between measurements may be short (less 30 seconds) unless the patient needs more time to recover.

- Contraction time

- Since contraction time is delayed in critically ill patient, encourage the patients to maintain the effort for at least 5-6 seconds⁵.
- Verbal encouragement
 - Encourage the patient during the testing.

Muscle test 1: shoulder abduction	
Commands: - move your elbow upwards	
	
Grade 1	Grade 2
	
Grade 3	Grade 4/5

Muscle test 2: Elbow flexion

Commands: - Move your hand towards your shoulder



Grade 1



Grade 2



Grade 3



Grade 4/5

Muscle test 3: Wrist extension

Commands: - Move your hand to the side (grade 2)
 - lift your hand of the matras (grade 3)



Grade 1

Grade 2



Grade 3

Grade 4/5 (fingers in extension)



Grade 4/5 (fingers in flexion)

Muscle test 4: Hip flexion

Commands: - Move your knee towards your chest



Grade 1

Grade 2



Grade 3

Grade 4/5

Muscle test 5: Knee extension

Commands: - Lift your foot of the matras



Grade 1

Grade 2



Grade 3

Grade 4/5

Muscle test 6: Ankle dorsiflexion	
Commands: - Pull up your toes	
	
Grade 1	Grade 2
	
Grade 3	Grade 4/5

- Calculation of MRC-sum score
 - For global muscle strength, calculate the MRC-sum score by summing all the obtained strength values of upper limbs and lower limbs⁶ (see table 1)
- Handling of missing data
 - When muscle strength cannot be evaluated due to orthopedic, neurologic or other reasons, results of the contralateral muscle group will be substituted to calculate the MRC-sum score. The only exception is

paraplegia. The values of the arm are then extrapolated to the leg (ipsilateral limb here). When there are more than two extrapolations the MRC sum score cannot be used! The reason of extrapolation must be reported at the time of the measurement⁴.

Table 1 Scoring table MRC sum score

MRC-SUMSCORE¹

Name: _____ Date: ___/___/___ Hour: ___:___

Pre-Existing NMD: No Yes: _____

SCORE 5 QUESTIONS²

A. Open and close your eyes

B. Look at me

C. Open your mouth and put out your tongue

D. Nod your head

E. Raise your eyebrows when I have counted up to five

S5Q Correct Answer: /5	Right	Reason	EP	Left	Reason	EP
MS: Abduction of the arm						
MS: Flexion of the forearm						
MS: Extension of the wrist						
MS: Flexion of the leg						
MS: Extension of the knee						
MS: Dorsal flexion of the foot						
STRENGTH SUBTOTAL VALUE						STRENGTH TOTAL =
EP SUBTOTAL VALUE						EP TOTAL =
MRC TOTAL SUMSCORE						

MRC: Medical Research Council; **NMD:** Neuromuscular disease; **S5Q:** Score 5 Questions; **EP:** Extrapolation; **MS:** Muscle Test.

EP CLASSIFICATION

A	Hemiplegia After Stroke:
B	Paraplegia Spinal Cord Injury:
C	Prohibited Orthopaedics Reason:
D	Peripheral Nerve Injury:
E	Amputation:
F	Others:

MRC-SCALE¹

0 = No visible contraction

1 = Visible contraction without movements of the limbs

2 = Movements of the limbs but not against the gravity

3 = Movement against gravity over (almost) the full range

4 = Movement against gravity and resistance

5 = Normal

Name prospector:

Day:

REFERENCES

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2. Ely EW, Inouye SK, Bernard GR, et al: Delirium in mechanically ventilated patients: validity and reliability of the confusion assessment method for the intensive care unit (CAM-ICU). *JAMA* 2001; 286: 2703-2710
3. Inouye SK, van Dyck CH, Alessi CA, et al: Clarifying confusion: the confusion assessment method. A new method for detection of delirium. *Ann Intern Med* 1990; 113: 941-948
4. Hermans G, Clerckx B, Vanhullebusch T, et al: Interobserver agreement of Medical Research Council sum-score and handgrip strength in the intensive care unit. *Muscle Nerve* 2012; 45: 18-25
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6. Kleyweg RP, van der Meche FG, Schmitz PI: Interobserver agreement in the assessment of muscle strength and functional abilities in Guillain-Barre syndrome. *Muscle Nerve* 1991; 14: 1103-1109