

Clinical Assessment

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Disorders of consciousness

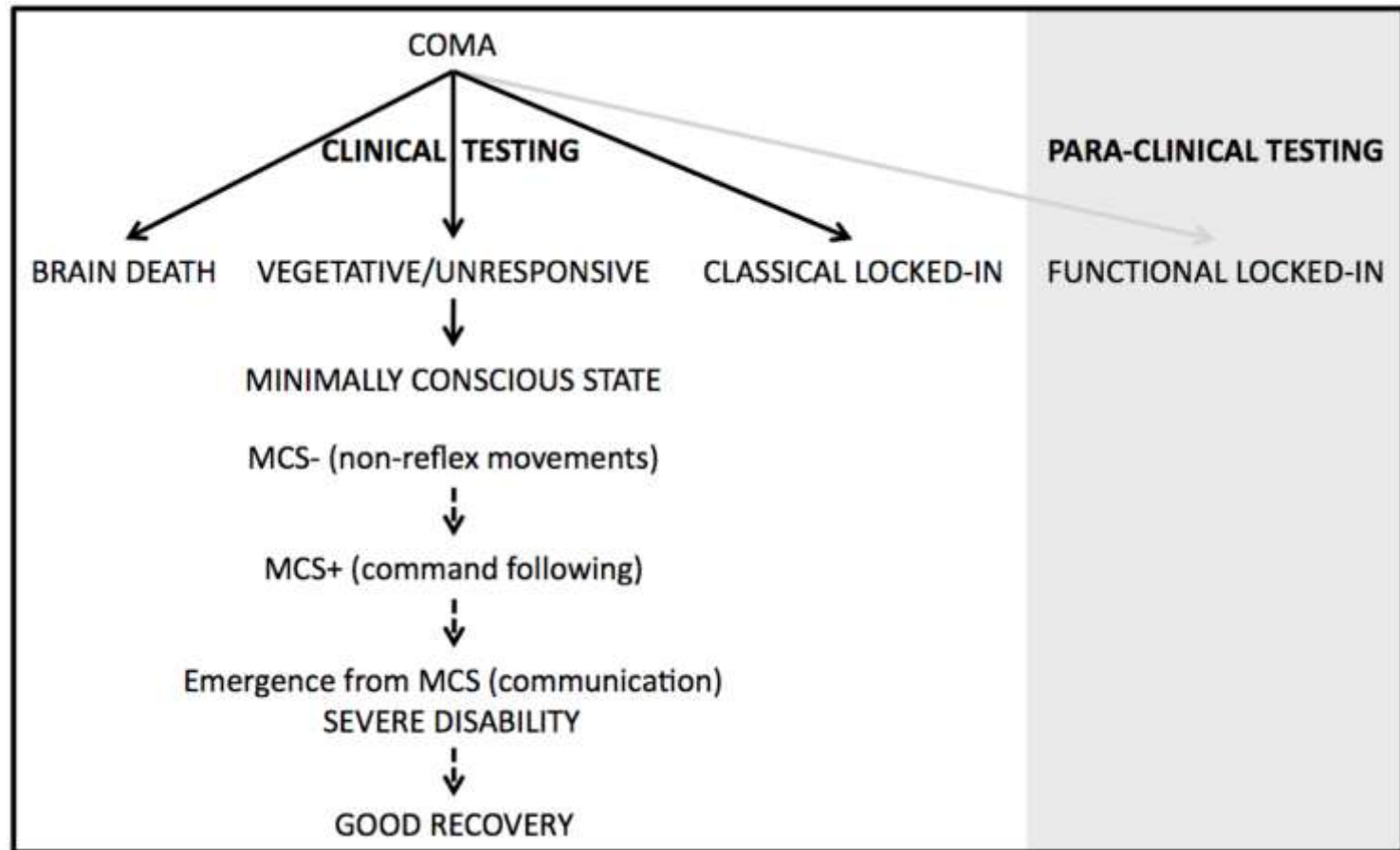




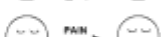







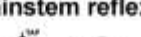



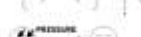


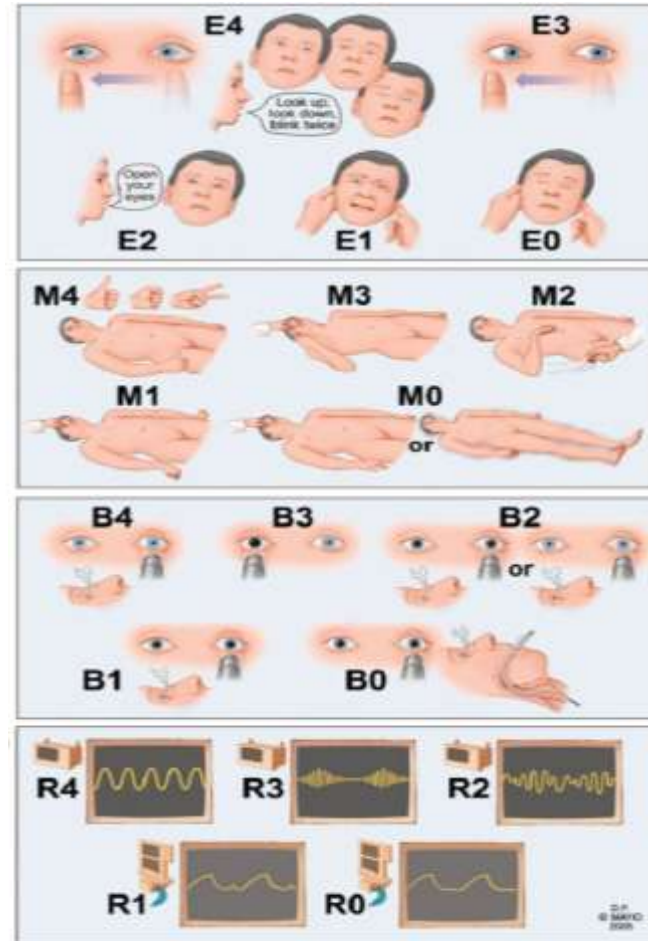
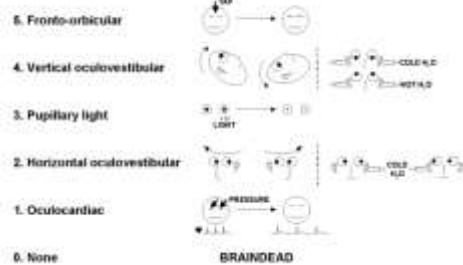
Table 1 Summary of the American Congress of Rehabilitation Medicine evidence-based review of behavioural assessment scales for disorders of consciousness [39]

Scale	Free access	Guidelines of administration & scoring procedures	Content validity (i.e., enclosing diagnostic criteria)	Internal consistency	Inter-rater reliability	Test-retest reliability	Diagnostic validity	Outcome prediction
Coma Recovery Scale-Revised (CRS-R, [45])	Yes	Present	Excellent	Good	Good	Excellent	Unproven	Unproven
Sensory Stimulation Assessment Measure (SSAM, [46])	Yes	Present	Good	Unproven	Unproven	Unproven	Unproven	Unproven
Wessex Head Injury Matrix (WHIM, [47])	No	Present	Good	Unproven	Unproven	Unproven	Unproven	Unproven
Western Neuro Sensory Stimulation Profile (WNSSP, [48])	Yes	Present	Good	Excellent	Unproven	Unproven	Unproven	Unproven
Sensory Modality Assessment and Rehabilitation Technique (SMART, [49])	No	Present	Good	NA	Excellent	Excellent	Unproven	Unproven
Disorders of Consciousness (DOC, [50])	Yes	Present	Acceptable	Good	Unproven	Unproven	Unproven	Unproven
Coma Near Coma (CNC, [51])	Yes	Present	Acceptable	Unacceptable	Unproven	Unproven	Unproven	Unproven
Full Outline of Unresponsiveness scale (FOUR, [52])	Yes	Absent	Poor	Excellent	Good	Unproven	Unproven	Yes
Comprehensive Level of Consciousness Scale (CLOCS, [53])	Yes	Absent	Acceptable	Good	Unproven	Unproven	Unproven	Unproven
Innsbruck Coma Scale (INNS, [54])	Yes	Absent	Poor	Acceptable	Unproven	Unproven	Unproven	No
Glasgow Liège Scale (GLS, [55])	Yes	Absent	Poor	Unproven	Unacceptable	Unproven	Unproven	Yes
Loewenstein Communication Scale (LOEW, [56])	Yes	Absent	Acceptable	Unproven	Excellent	Unproven	Unproven	Unproven
Reaction Level Scale (RLS85, [57])	Yes	Absent	Acceptable	Unproven	Unproven	Unproven	Unproven	Unproven

GCS/GLS/FOUR

E – eye opening	C. Not assessable	
	4. Spontaneous	
	3. To speech	
	2. To pain	
	1. None	
V – verbal response	T. Not assessable	
	5. Oriented conversation	
	4. Confused speech	
	3. Inappropriate words	
	2. Incomprehensible sounds	
	1. None	
M – motor response	6. Obeys simple commands	
	5. Localizes pain	
	4. Withdraws (no)	
	3. Stereotyped fle	
	2. Stereotyped ex	
	1. None	

R – brainstem reflexes



Wijdicks et al., Ann Neurol (2005)
Teasdale G, Jennett B, Lancet (1974)
Born, Acta Neurochir (1988)

GCS, GLS or FOUR?

n=60

GCS : 29 diagnosed
"vegetative"/unresponsive

FOUR : 24 PVS/UWS

Schnakers et al, Annals of Neurology, 2006

n=146

131 intubated (74%)

Inter-rater reliability

- GCS (κ 0.65), GLS (κ 0.66),
FOUR (κ 0.75)

Outcome prediction

- GCS \approx GLS \approx FOUR

GCS: 71 diagnosed
"vegetative"/unresponsive

FOUR: identified 8 MCS-
(eye tracking - 11%)

Bruno et al, Neurocritical Care, 2011

Diagnostic error

n=103 post-comatose patients

- 45 clinical consensus diagnosis 'vegetative state'
- 18 signs of awareness (Coma Recovery Scale-Revised)

 **40% potential misdiagnosis**

JFK COMA RECOVERY SCALE - REVISED ©2004

Record Form

This form should only be used in association with the "CRS-R ADMINISTRATION AND SCORING GUIDELINES" which provide instructions for standardized administration of the scale.

Patient:		Diagnosis:		Etiology:																
Date of Onset:		Date of Admission:																		
	Date																			
	Week	ADM	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16			
AUDITORY FUNCTION SCALE																				
4 - Consistent Movement to Command *																				
3 - Reproducible Movement to Command *																				
2 - Localization to Sound																				
1 - Auditory Startle																				
0 - None																				
VISUAL FUNCTION SCALE																				
5 - Object Recognition *																				
4 - Object Localization: Reaching *																				
3 - Visual Pursuit *																				
2 - Fixation *																				
1 - Visual Startle																				
0 - None																				
MOTOR FUNCTION SCALE																				
6 - Functional Object Use †																				
5 - Automatic Motor Response *																				
4 - Object Manipulation *																				
3 - Localization to Noxious Stimulation *																				
2 - Flexion Withdrawal																				
1 - Abnormal Posturing																				
0 - None/Flaccid																				
OROMOTOR/VERBAL FUNCTION SCALE																				
3 - Intelligible Verbalization *																				
2 - Vocalization/Oral Movement																				
1 - Oral Reflexive Movement																				
0 - None																				
COMMUNICATION SCALE																				
2 - Functional: Accurate †																				
1 - Non-Functional: Intentional *																				
0 - None																				
AROUSAL SCALE																				
3 - Attention																				
2 - Eye Opening w/o Stimulation																				
1 - Eye Opening with Stimulation																				
0 - Unarousable																				
TOTAL SCORE																				

Denotes emergence from MCS†

Denotes MCS*



• simple
command-following

*Minimally
Conscious State*

SELF-STUDY DVD OFFER

**COMA RECOVERY SCALE - REVISED:
GUIDELINES FOR ADMINISTRATION AND
SCORING**



coma@chu.ulg.ac.be



Auditory function

JFK COMA RECOVERY SCALE - REVISED 0004

Revised Form

This form should only be used in association with the "COMA ADMINISTRATION AND SCORING GUIDELINES" which provide instructions for standardized administration of the scale.

Patient:		Diagnosis:	
Date of Onset:		Date of Admission:	
Etiology:			
Date:			
Week:			
Day:			
Hour:			
Minute:			
Second:			
Tenth:			
Hundredth:			
Thousandth:			
Total Score:			

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4- Consistent mvt to command

Choose at least 1 object-related and 1 non-object related command from the Command Following Protocol. The type of command chosen (eye, limb, oral) should be based on patient's physical capacity and should be of low spontaneous frequency. If time permits, more than one type of command from each category may be used. The command should be repeated once during the 10 second response interval.

This item is credited only when **all 4 trials of 2 different commands** are passed.

3- Reproducible mvt to command

3 clearly discernible responses occur over the 4 trials on any one of the object **or** non-object related commands.

2- Localization to sound

Standing behind the patient and out of view, present an auditory stimulus (eg. voice, noise) from the right side for 5 seconds. Perform a second trial presenting the auditory stimulus from the left side. Repeat above procedure for a total of 4 trials, 2 on each side.

Head and/or eyes orient toward the location of the stimulus on **both** trials in at least one direction. This item is scored when there is clear evidence of head and/or eye movement. It is not dependent on the degree or duration of movement.

1- Auditory startle

Present a loud noise directly above the patient's head and out of view. Administer 4 trials.

Eyelid flutter or blink occurs immediately following the stimulus on at least 2 trials.

Visual function

JFK COMA RECOVERY SCALE - REVISED 2008											
Revised Form											
This form should only be used in association with the "COMA ADMINISTRATION AND SCORING GUIDELINES" which provide instructions for standardized administration of the scale.											
Patient		Diagnosis					Etiology				
Date of Onset	Date	Date of Admission									
Week											
1	2	3	4	5	6	7	8	9	10	11	12
AUDITORY FUNCTION SCALE											
1- Comprehension Movement to Command *											
2- Reproductive Movement to Command *											
3- Localization to Sound											
4- Auditory Startle											
5- Startle											
VISUAL FUNCTION SCALE											
1- Object Recognition *											
2- Object Localization - Reaching *											
3- Visual Pursuit *											
4- Fixation *											
5- Visual Startle											
6- Startle											
MOTOR FUNCTION SCALE											
1- Functional Object Use											
2- Automatic Motor Response *											
3- Object Manipulation *											
4- Localization to Tactile Stimulation *											
5- Flexor Withdrawal											
6- Abnormal Posturing											
7- Startle/Startle											
OCULOMOTOR/OVERALL FUNCTION SCALE											
1- Intergaze Volition *											
2- Volitional Gaze Movement											
3- Gaze Refixation Movement											
4- Startle											
COMMUNICATION SCALE											
1- Functional - Accurate *											
2- Non-Functional - Intentional *											
3- Startle											
AROUSAL SCALE											
1- Attention *											
2- Eye Opening w/o Stimulation											
3- Eye Opening with Stimulation											
4- Spontaneous											
TOTAL SCORE											
Denotes emergence from ICD7											
Denotes ICD7 *											

5—Object recognition^a

Object-related eye or limbs movement commands

3/4 clearly discernible responses

4—Object localization: reaching^a

The patient is asked to touch an object with his/her arm or leg, 4 trials (2 left, 2 right presentations).

Movement must occur in the correct direction on 3/4 trials.

3—Pursuit eye movements^a

Move mirror 45° to the right, left, upper and lower directions. 2 trials in every direction (manually open eyes if necessary).

Eyes must follow the mirror for 45° without loss of fixation on 2 occasions in any direction.

2—Fixation^b

Present a brightly coloured object in front of the patient's face and then rapidly move to upper, lower, right and left visual fields for a total of 4 trials (manually open eyes if necessary).

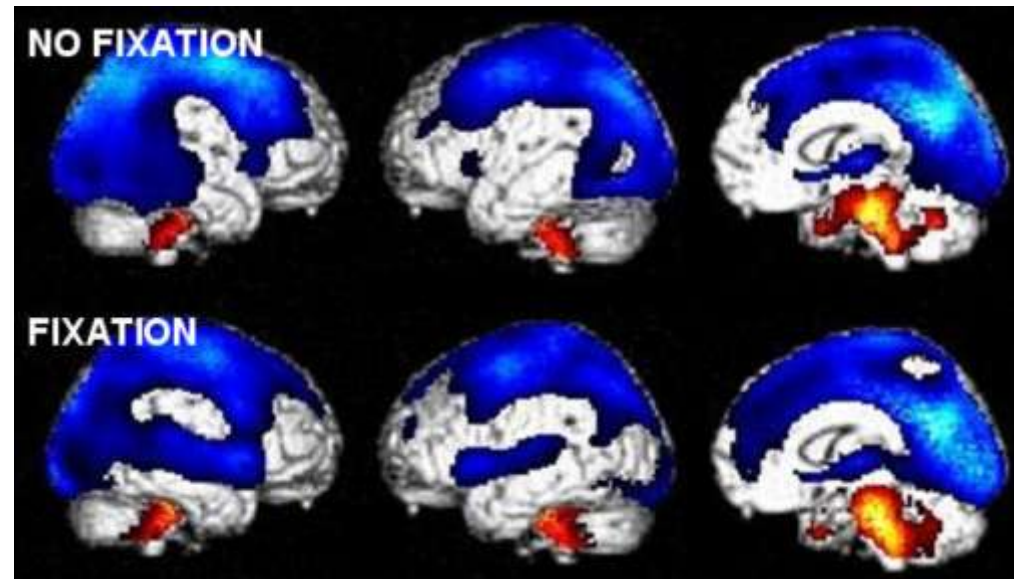
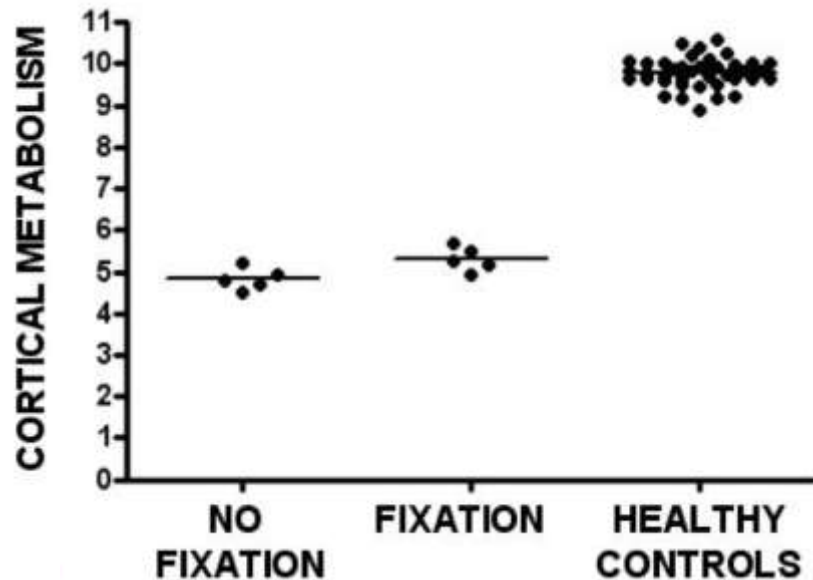
Eyes change from initial fixation point and then fixate on the new target location for more than 2 s. At least 2 fixations.

1—Visual startle

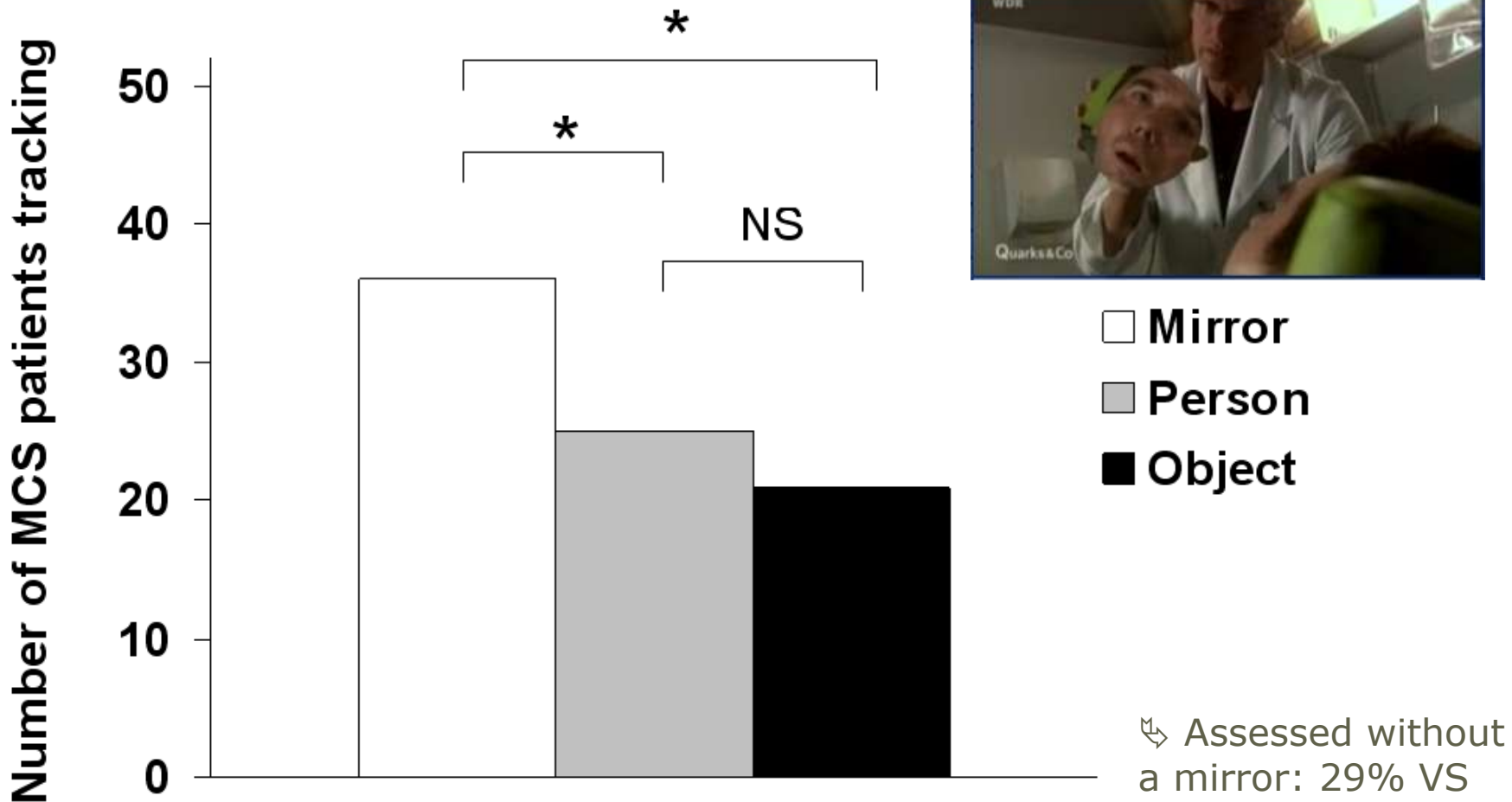
Quickly move a finger 1 inch in front of the patient's eye, while avoiding contact with the eyelashes or inadvertent production of a breeze (manually open eyes if necessary). 4 trials per eye.

Blink promptly following presentation of visual threat on at least 2 trials with either eye.

Visual fixation = reflex



Eye tracking: use a mirror!



Motor function

JFK COMA RECOVERY SCALE - REVISED 0304

Revised Form

This form should only be used in association with the "COMA ADMINISTRATION AND SCORING GUIDELINES" which provide instructions for standardized administration of the scale.

Patient	Diagnosis	Etiology
Date of Onset	Date of Admission	
Date		Week
1	2	3
4	5	6
7	8	9
10	11	12
13	14	15
16	17	18
AUDITORY FUNCTION SCALE		
1- Responds to Sound		
2- Localization to Sound		
3- Auditory Startle		
4- Startle		
VISUAL FUNCTION SCALE		
1- Object Recognition		
2- Object Localization		
3- Object Manipulation		
4- Object Manipulation		
5- Visual Startle		
6- Startle		
MOTOR FUNCTION SCALE		
1- Functional Object Use		
2- Abnormal Motor Response		
3- Abnormal Posturing		
4- Object Manipulation		
5- Localization to Noxious Stimulation		
6- Flexion Withdrawal		
7- Abnormal Posturing		
8- Startle/Startle		
DIAGNOSTIC OVERALL FUNCTION SCALE		
1- Integumentary		
2- Vocalization/Oral Movement		
3- Oral Reflexive Movement		
4- Startle		
COMMUNICATION SCALE		
1- Vocalization/Oral Movement		
2- Functional, Accurate		
3- Non-Functional, Inaccurate		
AROUSAL SCALE		
1- Attention		
2- Eye Opening w/o Stimulation		
3- Eye Opening with Stimulation		
4- Spontaneous		
TOTAL SCORE		

Source: emergency nurses society
© 1994 JCS

6- Functional object use

Select 2 common objects (e.g. comb, cup). Place one of the objects in the patient's hand and instruct the patient to "Show me how to use a [name object]." Next, place the second object in the patient's hand and restate the same instruction.

Movements executed are generally compatible with both object's specific function (e.g. comb is placed on or near the head) on all 4 trials administered.

5- Automatic motor response

Observe for automatic motor behaviors such as nose scratching, grasping bedrail that occur spontaneously during the examination.

At least 2 episodes of automatic motor behavior are observed within the session and each episode can be clearly differentiated from a reflexive response.

4- Object manipulation

Place a baseball size ball on the **dorsal** surface of one of the patient's hands. Roll the ball across the index finger and thumb without touching the undersurface of the hand or fingers. While moving the ball, instruct the patient to, "Take the ball."

The following criteria must be met on 3 of the 4 trials administered:

1. The wrist must rotate and the fingers should extend as the object is moved along the dorsal surface of the hand;
- and
2. The object must be grasped and held for a minimum of 5 seconds. The object cannot be held by means of a grasp reflex or increased finger flexor tone.

3- Localization to Noxious stimulation

Extend all four extremities. Apply pressure to the finger or toe of an extremity (use best extremity on each side of the body) for a minimum of 5 seconds (ie. squeeze the finger or toe between your thumb and index finger). Administer 2 trials on each side for a total of 4 trials.

The non-stimulated limb must locate and make contact with the stimulated body part at the point of stimulation on at least 2 of the four trials.

2- Flexion withdrawal

There is **isolated** flexion withdrawal of at least one limb. The limb must move **away** from the point of stimulation. If quality of response is uncertain, the trial may be repeated.

1- Abnormal posturing

Slow, stereotyped flexion **or** extension of the upper and/or lower extremities occurs immediately after the stimulus is applied.

Oromotor/Verbal function

JFK COMA RECOVERY SCALE - REVISED 0308

This form should only be used in association with the "CPRS ADMINISTRATION AND SCORING GUIDELINES" which provide instructions for standardized administration of the scale.

Patient: _____ Diagnosis: _____ Etiology: _____

Date of Onset: _____ Date of Admission: _____

Date	Day	Week													
		1	2	3	4	5	6	7	8	9	10	11	12	13	14
AUDITORY FUNCTION SCALE															
1- Consistent Movement to Command *															
2- Reproductive Movement to Command *															
3- Localization to Sound															
4- Auditory Startle															
5- Name															
VISUAL FUNCTION SCALE															
1- Object Recognition *															
2- Object Localization - Reaching *															
3- Visual Pursuit *															
4- Fixation *															
5- Visual Startle															
6- Name															
MOTOR FUNCTION SCALE															
1- Functional Object Use															
2- Automatic Motor Response *															
3- Object Manipulation *															
4- Localization to Tactile Stimulation *															
5- Flexor Withdrawal															
6- Abnormal Posturing															
7- Jaw Thrust															
OROMOTOR/OBSERVATIONAL FUNCTION SCALE															
1- Involuntary Vocalization															
2- Oral Movement															
SCALE															
1- Severe *															
2- Moderate *															
3- Mild *															
4- No Stimulation															
5- No Stimulation															

3- Intelligible verbalisation

1. Tell patient "I would like to hear your voice." This should be followed by an attempt to directly elicit speech using the verbal prompts shown below. At least one prompt should be selected from the Aural Set and at least one from the Visual Set.
2. A maximum of 3 trials should be administered for each prompt chosen from the Aural and Visual Sets. Prompts should be administered at 15 second intervals.

1. Each verbalization must consist of at least 1 consonant-vowel-consonant (C-V-C) triad. For example, "ma" would not be acceptable, but "mom" would. Make sure objects chosen have a C-V-C sequence;
- and
2. Two different words must be documented by the examiner to ensure that a repetitive word-like sound is not mistaken for a word. Words need not be appropriate or accurate for the context, but must be fully intelligible;
- and
3. Words produced by writing or alphabet board are acceptable.

2- Vocalisation/oral movement

Observe for non-reflexive oral movements, spontaneous vocalizations or vocalizations that occur during administration of vocalization commands (see page 5).

At least one episode of non-reflexive oral movement and/or vocalization occurs spontaneously or in response to application of sensory stimulation.

1- Oral reflexive movement

Present tongue blade between patient's lips and/or teeth

There is clamping of jaws, tongue pumping, or chewing movement following introduction of tongue blade into mouth.

Communication

JFK COMA RECOVERY SCALE - REVISED 0308

Revised Form

This form should only be used in association with the "COMA ADMINISTRATION AND SCORING GUIDELINES" which provide instructions for standardized administration of the scale.

Patient	Diagnosis	Etiology
Date of Onset	Date of Admission	
Date		Week
1	2	3
4	5	6
7	8	9
10	11	12
13	14	15
16	17	18
AUDITORY FUNCTION SCALE		
1- Comprehension of Verbal Commands *		
2- Reproductive Movement to Commands *		
3- Localization to Sound		
4- Auditory Startle		
5- Startle		
VISUAL FUNCTION SCALE		
1- Object Recognition *		
2- Object Localization - Reaching *		
3- Visual Pursuit *		
4- Fixation *		
5- Visual Startle		
6- Startle		
MOVILE FUNCTION SCALE		
1- Functional Object Use		
2- Automatic Motor Response *		
3- Object Manipulation *		
4- Localization to Tactile Stimulation *		
5- Flexion Withdrawal		
6- Abnormal Posturing		
7- Startle/Startle		
DIAGNOSTIC OBSERVATION FUNCTION SCALE		
1- Intentional Volitional		
2- Vocalization/Oral Movement		
3- Oral Reflexive Movement		
4- Startle		
COMMUNICATION SCALE		
1- Functional - Accurate *		
2- Non-Functional - Intentional *		
3- Startle		
AROUSAL SCALE		
1- Eye Opening with Stimulation		
2- Eye Opening with Stimulation		
3- Unarousable		
TOTAL SCORE		

Source: American Neurological Association
Revised: 03/08

2-Functional accurate

Administer the 6 Situational Orientation questions from the Communication Assessment Protocol (page 12). The examiner may use the Visual set, Auditory set or both sets, if appropriate.

Clearly discernible and accurate responses occur on all 6 of the Visual **or** Auditory Situational Orientation questions from the Communication Assessment Protocol (see page 12).

1- Non functional/intentional

A clearly discernible communicative response* (e.g. head nods/shakes, thumbs up) must occur within 10 seconds on at least 2 of the 6 Situational Orientation questions (irrespective of accuracy).



Arousal

JFK COMA RECOVERY SCALE - REVISED 03054

Revised Form

This form should only be used in association with the "COMA ADMINISTRATION AND SCORING GUIDELINES" which provide instructions for standardized administration of the scale.

Patient	Diagnosis	Etiology
Date of Onset	Date of Admission	
Date		Week
1	2	3
4	5	6
7	8	9
10	11	12
13	14	15
16	17	18
AUDITORY FUNCTION SCALE		
1- Consistent Movement to Command *		
2- Reproductive Movement to Command *		
3- Localization to Sound		
4- Auditory Startle		
5- None		
VISUAL FUNCTION SCALE		
1- Object Recognition *		
2- Object Localization - Reaching *		
3- Visual Pursuit *		
4- Fixates *		
5- Visual Startle		
6- None		
MOVILE FUNCTION SCALE		
1- Functional Object Use		
2- Automatic Motor Response *		
3- Object Manipulation *		
4- Localization to Noxious Stimulation *		
5- Flexor Withdrawal		
6- Abnormal Posturing		
7- None/Flaccid		
OROPHARYNGEAL FUNCTION SCALE		
1- Intelligible Verbalization		
2- Vocalization/Oral Movement		
3- Oral Reflexive Movement		
4- None		
COMMUNICATION SCALE		
1- Functional - Accurate *		
2- Non-Functional - Intentional *		
3- None		
AROUSAL SCALE		
1- Eye Opening w/o Stimulation		
2- Eye Opening with Stimulation		
3- Unresponsive		
TOTAL SCORE		

Source: American Neurological Association, 1980

3-Attention

Observe consistency of behavioral responses following verbal or gestural prompts.

There are no more than 3 occasions across the length of the evaluation in which the patient fails to respond to a verbal prompt.

2- Eye opening w/o stimulation

Observe status of the eyelids across length of assessment.

Eyes remain open across the length of the examination without the need for tactile, pressure or noxious stimulation.

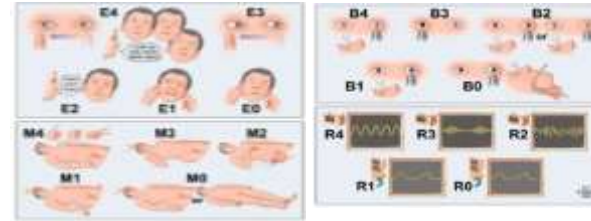
2- Eye opening with stimulation

Tactile, pressure or noxious stimulation must be applied at least once during the examination in order for the patient to sustain eye opening (the length of time the eyes remain open may vary and is not considered in the scoring).

New knowledge, new scales

- FOUR

↳ Visual subscale → LIS detection



- CRS-R

↳ MCS criteria

↳ Better diagnosis sensitivity

The image shows a screenshot of the 'JFM COMA RECOVERY SCALE - REVISED' form. It is a structured table with multiple columns for recording scores and observations. The form includes sections for 'GENERAL INFORMATION', 'EYE TRACKING', 'MOTOR RESPONSE', 'VERBAL RESPONSE', and 'COMA RECOVERY SCALE'. Each section contains specific criteria and a grid for recording scores.

- Eye tracking → use a mirror!



- Ambiguous signs of consciousness : e.g. visual fixation