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Title: SECONDs Administration Guidelines: A Fast Tool for Assessing Consciousness in Brain-Injured Patients

Authors and Affiliations: Leandro R. D. Sanz[1,2]*, Charlène Aubinet[1,2]*, Helena Cassol[1,2], Olivier Bodart[1,2], Sarah Wannez[1,2], Estelle A. C. Bonin[1,2], Alice Barra[1,2], Nicolas Lejeune[1,2,3,4], Charlotte Martial[1,2], Camille Chatelle[1,2], Didier Ledoux[5,6], Steven Laureys[1,2], Aurore Thibaut[1,2], and Olivia Gosseries[1,2]

[1]Coma Science Group, GIGA-Consciousness, GIGA research center, University of Liège
[2]Centre du Cerveau[2], University Hospital of Liège
[3]CHN William Lennox, Groupe Hospitalier Saint-Luc
[4]Institute of NeuroScience, UCLouvain
[5]Department of Intensive Care, University Hospital of Liège
[6]Anesthesia & Intensive Care Laboratory, GIGA-Consciousness, GIGA Research Center, University of Liège

Corresponding Author:
Leandro R. D. Sanz
leandro.sanz@uliege.be

Co-Authors:
caubinet@uliege.be
hcassol@uliege.be
olivier.bodart@chuliege.be
sarah.wannez@gmail.com
estelle.bonin@uliege.be
a.barra@uliege.be
nicolas.lejeune@chnwl.be
cmartial@uliege.be
camillechatelle@gmail.com
dledoux@chuliege.be
steven.laureys@uliege.be
athibaut@uliege.be
ogosseries@uliege.be

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Author Questionnaire

1. **Microscopy**: Does your protocol require the use of a dissecting or stereomicroscope for performing a complex dissection, microinjection technique, or similar? **N**

2. **Software:** Does the part of your protocol being filmed demonstrate software usage? **N**

3. **Interview statements:** Considering the Covid-19-imposed mask-wearing and social distancing recommendations, which interview statement filming option is the most appropriate for your group? **Please select one**.

   ☒ Interviewees wear masks until the videographer steps away (≥6 ft/2 m) and begins filming. The interviewee then removes the mask for line delivery only. When the shot is acquired, the interviewee puts the mask back on. Statements can be filmed outside if weather permits.

4. **Filming location:** Will the filming need to take place in multiple locations (greater than walking distance)? **N**

Protocol Length
Number of Shots: **48**

Introduction

1. Introductory Interview Statements

REQUIRED:

1.1. **Leandro Sanz**: The accurate diagnosis of patients with disorders of consciousness is essential to their management but can be time-consuming. The SECONDs is a validated diagnostic scale designed for time-constrained clinical settings **[1]**.

1.1.1. INTERVIEW: Named talent says the statement above in an interview-style shot, looking slightly off-camera

REQUIRED:

1.2. **Charlène Aubinet**: The SECONDs provides a reliable diagnosis of consciousness within 10 minutes, whereas the current gold-standard scale takes nearly 3 times longer, limiting its use in clinical practice **[1]**.

1.2.1. INTERVIEW: Named talent says the statement above in an interview-style shot, looking slightly off-camera

OPTIONAL:

1.3. **Olivia Gosseries**: When learning the SECONDs, it is essential to follow the administration guidelines closely to obtain reproducible results, for example, by respecting the prescribed time between trials and using the suggested wording **[1]**.

1.3.1. INTERVIEW: Named talent says the statement above in an interview-style shot, looking slightly off-camera

Ethics Title Card

1.4. Procedures involving human subjects have been approved by the Ethics Committee of the University of Liège and the University Hospital of Liège.

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Protocol

2. Simplified Evaluation of CONsciousness Disorders (SECONDs) Administration Preparation

2.1. Before starting a behavioral examination, adjust the lighting of the room to a level that is adequate for performing the exam **[1]** and ensure that the Patient is positioned comfortably with the four limbs exposed and the head oriented as straight as possible **[2]**.

2.1.1A Added Introduction shot?

2.1.1. WIDE: Talent adjusting lighting

2.1.2. Talent removing the bedsheet from over the legs and/or repositioning Patient's head

2.2. Turn off any TV, radio, or other potentially distracting stimuli **[1]**.

2.2.1. Talent turning off stimulus NOTE: Split into 2 shots: A) TV off B) radio off

2.3. Note any recent changes in medication in the Patient's current treatment regimen **[1]** with particular attention to sedative and psychoactive drugs **[2]**.

2.3.1. Talent checking patient chart

2.3.2. Shot of chart with sedative or psychoactive drugs listed *Videographer: Can skip if shot not possible; Video Editor: can skip if not shot; if shot, please emphasize drug(s)*

2.4. Then select a mirror of a minimum recommended 10- x 10-centimeter size for a square-shaped mirror or a 10-centimeter diameter for a round-shaped one **[1]**.

2.4.1. Talent selecting mirror

3. Observation

3.1. To assess spontaneous movement, observe the Patient for one minute, recording any spontaneous behaviors **[1]**.

3.1.1. Talent observing Patient/recording behavior(s)

3.2. At any time during the assessment, if no sustained eye-opening is observed or if the Patient stops following commands for at least one minute, administer auditory **[1]** …

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tactile **[2]** … or noxious stimulation to arouse the Patient **[3]** and observe the Patient again, recording any spontaneous behaviors **[4-TXT]**.

3.2.1. Talent clapping hands NOTE: 3.2.1 – 3.2.4 filmed together
3.2.2. Talent applying tactile stimulus
3.2.3. Talent pressing Patient nail bed
3.2.4. Talent observing Patient/recording behavior(s) **TEXT: See text for spontaneous behavior details**

4. Command-Following

4.1. To assess command-following, test three simple movements three times, with a 10-second interval between trials, that are within the physical capabilities of the Patient and that were not observed as spontaneously repetitive during the observation period **[1-TXT]**.

4.1.1. WIDE: Talent giving command/Patient following command *Videographer: Important/difficult step* **TEXT: See text for suggested commands** NOTE: Squeeze hand and stick tongue out

4.2. In cases of suspected locked-in syndrome, relate at least one command to eye movements **[1]**.

4.2.1. Talent giving command/Patient blinking eye(s) NOTE: Command is "look down".

4.3. In cases of known or suspected deafness, administer written commands. If the Patient does not react to any of the oral commands, test at least one written command **[1]**.

4.3.1. Talent holding up written command/Patient responding

4.4. Report the commands used on the scoring sheet along with the number of successful trials **[1-TXT]**.

4.4.1. Shot of scoring sheet with reported commands and number of successful trials **TEXT: See text for score assignment details** NOTE: zoom available

5. Communication (Conditional)

5.1. If at least two distinct responses to command have been successfully performed, or if the Patient can express a "yes" and "no", clearly explain the communication code to the Patient **[1-TXT]** and ask the 5 binary autobiographical questions **[2-TXT]**.

5.1.1. WIDE: Talent explaining yes and no code *Videographer: Important step* **TEXT:**

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Can repeat code before each question NOTE: Use 5.1.1.2

5.1.2. Talent asking question and Patient responding *Videographer: Important step* **TEXT: See text for standardized autobiographical questions**

5.2. If the Patient fails to correctly answer the autobiographical questions, the situational question set should be asked **[1-TXT]**.

5.2.1. Talent asking questions and Patient responding **TEXT: See text for standardized situational questions**

5.3. Report the nature of the "yes-no" code, the modality and the type of the questions used, the number of responses, and the number of correct responses **[1]**.

5.3.1. Shot of recorded information

6. Visual Pursuit

6.1. To assess visual pursuit, move silently around the bed while observing whether the Patient's gaze spontaneously and clearly follows this movement during at least two seconds in two different directions **[1]**.

6.1.1. WIDE: Talent moving around Patient bed

6.2. If a clear pursuit is not spontaneously observed, position the mirror about 30 centimeters in front of the Patient's face **[1]**.

6.2.1. Talent holding mirror in front of Patient face NOTE: This and next shot together

6.3. After confirming that the Patient can see their reflection, move the mirror slowly from left to right, right to the left, top to bottom, and bottom to top for at least four seconds per movement **[1]**.

6.3.1. Talent moving mirror *Videographer: Important/difficult step*

6.4. Report the number of observed pursuits on each axis, the type of stimulus used, and whether manual eye-opening was employed **[1]**.

6.4.1. Shot of recorded information NOTE: zoom available

7. Visual Fixation

7.1. To score visual fixation, enter the Patient's field of view and observe whether the Patient's gaze spontaneously fixates on the Examiner for at least two seconds in two

different visual quadrants by turning toward the Examiner **[1]**.

7.1.1. WIDE: Talent entering field of view while checking Patient's gaze NOTE: Use take 2

7.2. If no clear and spontaneous visual fixations are observed, present the mirror about 30 centimeters away from the Patient's face in all four quadrants of the Patient's visual field outside of the axis of their gaze for at least four seconds per quadrant **[1]**.

7.2.1. Mirror being positioned then moved *Videographer: Important step* NOTE: Use take 2

7.3. Report the quadrants in which the Patient showed the fixations, as well as the type of the stimulus used, and whether manual eye-opening was employed **[1]**.

7.3.1. Shot of recorded information

8. Localization to Pain (Conditional)

8.1. If the Patient did not demonstrate command-following, place a pen or pencil on the Patient's fingernail bed for five seconds without applying pressure **[1]** and instruct the Patient to remove their hand to avoid the pain **[2]**.

8.1.1. WIDE: Talent placing pencil and instructing
8.1.2. Patient removing hand in anticipation

8.2. If the Patient does not remove the hand within five seconds, administer pressure to the nail bed for five seconds **[1]**.

8.2.1. Talent applying pressure, patient reaching the stimulation site with other hand *Videographer: Important step* NOTE: Use take 2

8.3. One trial should be performed on each hand. If the Patient removed their hand after the warning, do not apply pressure and directly proceed to the other hand, repeating the warning **[1]**.

8.3.1. Talent switching hands/instructing warning

8.4. If the Patient removed the hand before applying pressure, report this response as an anticipation. If the Patient reached to the stimulation site with the contralateral hand, report this action as a localization. Report the side of each observed localization and anticipation response **[1]**.

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8.4.1. Shot of recorded information/information being recorded

9. Oriented Behaviors

9.1. To assess oriented behaviors, perform continuous observation throughout the examination and score any Patient motor behavior clearly oriented toward themselves, another person, or an object **[1]**, such as scratching their nose, holding the bed, pulling on a feeding tube, grabbing the bedsheets, or smiling to a joke or nodding **[2-TXT]**.

9.1.1. WIDE: Talent observing and recording *Videographer: Important step*
9.1.2. Patient performing any of the described motor behaviors *Videographer: Important step* **TEXT: Do not include grasping, yawning, or chewing reflexes**

9.2. Report the type and the number of times each behavior is observed **[1]**.

9.2.1. Shot of recorded information NOTE: Use take 2

10. Arousal

10.1. To assess arousal, perform continuous observation throughout the examination and score "0" for no arousal if, during the entire evaluation, the Patient never opened their eyes, with or without stimulation **[1]**.

10.1.1. WIDE: Talent observing while Patient keeps eyes closed

10.2. Score "1" for arousal if the Patient opened their eyes at least once during the assessment, either spontaneously or following stimulation **[1]**.

10.2.1. Talent observing and Patient opening eyes

10.3. Report the approximate percentage of time that the Patient's eyes were open throughout the examination **[1]** and specify if the eye-opening happened spontaneously or following a noxious, tactile, or auditory stimulation as well as the number of stimulations of each type that were administered **[2]**.

10.3.1. Shot of recorded information *Video Editor: please emphasize percentage of time with eyes open*
10.3.2. Use 10.3.1. *Video Editor: please emphasize eye-opening and number of stimulations*
10.3.3. Added shot: Final score and diagnosis

11. Potential Pitfalls and Solutions

11.1. Pitfalls may be encountered while administering this scale **[1]**.

11.1.1. WIDE: Talent approaching Patient/looking at Patient chat NOTE: Use 2.3.1

11.2. For example, in Patients demonstrating spontaneous vertical eye movements, administering the "Look up" command could result in a score of 6 **[1]** and a consequent erroneous diagnosis of MCS-plus, as spontaneous repeated movements must not be used to test command-following **[2-TXT]**.

11.2.1. Patient demonstrating spontaneous vertical eye movements, while Talent issues "Look up" command

11.2.2. Shot of MCS+ diagnosis *Video Editor: please add circle with slash over MCS+ diagnosis* **TEXT: MCS: minimally conscious state** NOTE: Clip 50, Maybe slated as 11.2.1

11.3. As another example, in a Patient with Korsakoff syndrome, testing communication using only autobiographical questions **[1]** could result in a score of 7 and a diagnosis of MCS-plus, due to memory deficits and not altered consciousness **[2]**.

11.3.1. Talent asking Patient autobiographical question, while Patient looks confused/fails to answer question

11.3.2. Shot of 7 score and MCS+ diagnosis *Video Editor: please add circle with slash over MCS+ diagnosis and 7 score* NOTE: Clip 50

11.4. Correct administration of the SECONDs testing communication with both autobiographical and situational question sets **[1]** would result in a correct score of 8 and a diagnosis of emergence from the minimally conscious state **[2]**.

11.4.1. Talent asking situational question, Patient responding appropriately NOTE: Use take 2

11.4.2. Shot of 8 score and EMCS diagnosis NOTE: Clip 50

11.5. The importance of manual eye opening is especially important in Patients suffering from motor impairments preventing eye opening, such as neurotoxic ptosis, as the administration of the SECONDs without manual eye-opening **[1]** would result in a score of 0, corresponding to a diagnosis of coma **[2]**.

11.5.1. Talent attempting visual pursuit without eye opening

11.5.2. Shot of score 0 and coma diagnosis *Video Editor: please add circle with slash over coma diagnosis and 0 score* NOTE: Clip 50

11.6. A correct administration, in which manual eye opening is employed **[1]**, would result in a score of 8 and a diagnosis of emergence from the minimally conscious state **[2]**.

11.6.1. Talent manually opening Patient eye(s)/ instructing to look up/Patient responding appropriately
11.6.2. Shot of score 8 and EMCS diagnosis NOTE: Clip 50

Protocol Script Questions

A. Which steps from the protocol are the most important for viewers to see? Please list 4 to 6 individual steps.
4.1., 5.1., 6.3., 7.2., 8.2., 9.1.

B. What is the single most difficult aspect of this procedure and what do you do to ensure success? Please list 1 or 2 individual steps from the script above.
4.1. it is crucial to select adequate commands within the motor abilities of the patient, but not spontaneously and repeatedly observed, and the Patient should be left sufficient time to perform the movement after the instruction, as cognitive and motor deficits can considerably delay reactivity
6.3. the mirror should be moved very slowly, at a sufficient distance from the Patient's face (30 centimeters), and movements should always start when the patient has open eyes, facing the mirror. Manual eye-opening should be used if optimal eye-opening conditions are not spontaneously met.

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Results

12. Results: Representative Consciousness Assessment in Brain-Injured Patients

12.1. In a French validation study performed on 57 patients with disorders of consciousness **[1]**, three SECONDs (seconds) **[2]** and one CRS-R (C-R-S-R) assessments were performed on two consecutive days by three different examiners blinded for diagnosis **[3]**.

12.1.1. LAB MEDIA: Table 2
12.1.2. LAB MEDIA: Table 2 *Video Editor: please emphasize SECONDs data columns*
12.1.3. LAB MEDIA: Table 2 *Video Editor: please emphasize CRS-R data column* **TEXT: CRS-R: Coma Recovery Scale-Revised**

12.2. The administration duration of the SECONDs was significantly shorter **[1]** compared to the CRS-R duration **[2]**.

12.2.1. LAB MEDIA: Table 2 *Video Editor: please emphasize SECONDS Administration duration data cell*
12.2.2. LAB MEDIA: Table 2 *Video Editor: please emphasize CRS-R Administration duration cell*

12.3. The concurrent validity was excellent between the CRS-R and the best SECONDs' diagnosis **[1]**. The intra- and inter-rater reliability were also excellent **[2]**. The CRS-R total score strongly correlated with the score of the best SECONDs **[3]**.

12.3.1. LAB MEDIA: Table 2 *Video Editor: please emphasize Best SECONDs Concurrent validity data cell*
12.3.2. LAB MEDIA: Table 2 *Video Editor: please emphasize Intra-rater and Inter-rater reliability rows*
12.3.3. LAB MEDIA: Table 2 *Video Editor: please emphasize Best Seconds Correlation data cell*

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Conclusion

13. Conclusion Interview Statements

13.1. **Leandro Sanz**: For reliable results, the SECONDs must be performed under the best possible conditions. The examiner should promote arousal and motivation, but only clear and non-ambiguous responses must be scored **[1]**.

13.1.1. INTERVIEW: Named talent says the statement above in an interview-style shot, looking slightly off-camera (3.2.)

13.2. **Olivia Gosseries**: The SECONDs is fast diagnostic test designed for clinical settings with limited time. Complementary assessments such as the CRS-R, NCS-R, FOUR, Glasgow-Liège, DRS, BERA, or SWADOC scales can provide useful information on targeted deficits **[1]**.

13.2.1. INTERVIEW: Named talent says the statement above in an interview-style shot, looking slightly off-camera

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