Clinical identification of cognitive impairment in ICU survivors: insights for intensivists

Abstract Background: A growing body of research has demonstrated the presence of ongoing cognitive impairment in large numbers of ICU survivors. Objective: This review offers a practical framework for practicing intensivists and those following patients after their ICU stay for the identification of cognitive impairment in ICU survivors. Conclusions: Early detection of cognitive impairment in critically ill patients is an important and achievable goal, but overt cognitive impairment remains unrecognized in most cases. However, it can be identified by objective (test scores) or subjective evidence (clinical judgment, patient observation, family interaction).

Keywords Cognitive impairment · Neuropsychological assessment · Encephalopathy · Geriatrics · Critical illness · Intensive care unit

Recent communication from an ICU survivor

The following are selected comments from a 40-year-old college-educated ICU survivor (acute respiratory distress syndrome) writing to her internist (E.W.E.) 2 years after her discharge:

I hate to be a bother, but I have some questions about the problems that I am having. Since you cared for me in the ICU, I have been out of the hospital and trying to get on with my life for the past 2 years. Primarily, how long my memory will be effected? I am having daily problems with many different things. I have trouble with people’s names that I have worked with for years. I can’t remember where I put things at home. I can’t help my children with their homework because I don’t remember how to do simple multiplication problems. It is so embarrassing that I cant balance my check book...
Introduction

Approximately 55,000 patients are hospitalized in intensive care units (ICUs) each day in the United States [1]. While research is limited regarding cognitive outcomes in patients who survive critical illness, these patients are at risk for physical, emotional, and neurocognitive morbidity [2, 3, 4, 5, 6]. Although additional research is necessary to address crucial questions regarding cognitive impairment in ICU survivors, early reports are worrying, and in some respects parallel early reports of cognitive impairment following coronary artery bypass grafting (CABG). Two decades ago studies on CABG and cognitive outcome were in their infancy and received relatively little attention [7]. Since that time over 50 investigations [8] have studied the effects of CABG on cognition and have documented the existence of pervasive and frequently severe cognitive deficits in 20–80% of patients following surgery [9]. The cognitive impairment reported in ICU survivors is similar to that observed following elective CABG surgery [10] and following carbon monoxide poisoning [11].

Current data suggest that approximately one-third or more of ICU survivors develop ongoing and persistent cognitive impairment [6]. Among specific populations of ICU survivors such as patients with acute respiratory distress syndrome (ARDS) the prevalence of persistent cognitive impairment is even greater and may be as high as 78% at 1 year [12] and 25% at 6 years [13] (Table 1). While cross-study comparisons are difficult due to differences in study design (e.g., prospective vs. retrospective), definition of sequelae, neurocognitive tests administered, time to follow-up, patient population, and disease severity, the potential ramifications of these findings are significant, particularly if cognitive impairment goes unidentified. The purpose of this report is to highlight the problem of cognitive impairment following ICU survival, to assist clinicians in identifying probable cognitive impairment in ICU patients through objective as well as clinically oriented strategies, and to provide guidelines for referral of cognitively impaired patients to specialists in cognitive evaluation and rehabilitation. For a discussion of research issues with ICU survivors, please refer to our companion article in this issue.

Importance of cognitive impairment

Defining cognitive impairment

This review uses key terms that are widely understood in psychiatric, neurology, and neuropsychological settings but may be less familiar to intensivists. The term cognitive impairment, as defined here, refers to clinically significant abnormalities in one or more brain functions including memory, attention, mental processing speed, executive function, visual spatial abilities, and intellectual function. Cognitive impairment can be mild, moderate, or severe and can limit an individual’s ability to think, reason, and/or perform everyday tasks. The term cognitive decline refers to deterioration in cognitive abilities from baseline and is not necessarily synonymous with cognitive impairment as it does not imply an absolute level of functioning. For example, a person with an intelligence quotient in the superior range might experience significant cognitive decline and still function within the normal range, therefore not being characterized as cognitively impaired. However, this type of decline can cause significant disruption in the everyday life of a person who is used to performing at high levels in occupational and vocational areas. Such was the case of the person quoted in the opening paragraph. Alternatively, slight decline in a person with below average intelligence could result in the diagnosis of cognitive impairment but have a minor impact on everyday function.

The impairment experienced by patients following ICU hospitalization should not be equated with common dementias, such as Alzheimer’s disease and vascular dementia, which are typically age related, largely irreversible, progressive in nature, and characterized by significant impairments in memory and at least one other sphere of mental activity [14, 15]. In contrast to common dementias, there is only limited information regarding the clinical course of ICU-related cognitive impairment. For example, cognitive functioning appears to improve in many ICU survivors from hospital discharge to 1 year; however, significant numbers (46%) of ICU survivors remain impaired at 1 year [12], with little improvement during the 2nd [16].

Severity of acquired deficits

The cognitive impairment experienced by many ICU survivors varies widely with regard to severity and should be thought of as acquired disease or an exacerbation of a preexisting disease (depending upon the individual patient’s situation). Acquired cognitive impairment can range from mild to severe. For example, Jackson et al. [6] reported that after excluding those with detectable pre-ICU baseline cognitive impairment 34% of patients suffered from persistent cognitive impairment of a severity...
| Reference         | Population                          | Age (years) | Test Interval                          | No. of tests | Comments                                                                                                                                   |
|-------------------|-------------------------------------|-------------|----------------------------------------|--------------|------------------------------------------------------------------------------------------------------------------------------------------|
| Jackson et al. [6] | 34 ICU survivors                    | 53.2±15.3   | 6 months after hospital discharge      | 9            | 30% of patients experienced generalized cognitive decline at 1 year on at least one of the following: memory, attention/concentration, processing speed |
| Rothenhausler et al. [13] | 46 ARDS survivors                 | 41.5±14.7   | Median 6 years after ICU discharge     | 1 with 9 subtests | 24% of patients displayed moderate/severe cognitive impairment in attention and memory, 100% of whom were disabled (unable to work) |
| Hopkins et al. [12] | 55 ARDS survivors                   | 45.5±16.0   | 12 months after hospital discharge     | 6 with multiple subtests | 32% of patients were cognitively impaired to a degree consistent with at least mild dementia |
| Abstracts         |                                     |             |                                        |              |                                                                                                                                          |
| Al-Saidi et al. [61] | 87 ARDS survivors                  | Median 44   | 12 months after hospital discharge     | 1            | 20% rated memory as poor, 38% reported severe depression
Impaired in general intelligence, memory, attention/concentration, processing speed or executive function at 1 and 2 years; significant improvement in cognitive function in 1 year; little additional improvement from 1 to 2 years
Cognitive impairments in attention, visual processing, psychomotor speed, and cognitive flexibility (more prevalent in ARDS survivors than controls) |
| Hopkins et al. [85] | 67 ARDS survivors                   | 45.9±16.4   | Hospital discharge, 12 and 24 months after hospital discharge | 6 (3 with multiple subtests) |                                                                                                                                          |
| Marquis et al. [86] | 33 ARDS survivors and 23 critically ill controls | NA          | At least 1 year after ARDS            | NA           |                                                                                                                                          |
| Case reports      |                                     |             |                                        |              |                                                                                                                                          |
| Jackson et al. [87] | 1 ARDS survivor                     | 49          | 7 months after hospital discharge      | 9            | Impairment in attention, executive dysfunction, and visual memory; decline of +2 SD from baseline on measures of verbal, performance, and full-scale IQ |
| Hopkins et al. [88] | 2 Hanta virus survivors             | 56/67       | 12 months after hospital discharge     | 7 (3 with multiple subtests) | Impaired attention, memory, mental processing speed, and mild generalized cognitive decline |

**Table 1** Summary of studies on cognitive outcomes following critical illness
similar to the cognitive impairments observed in mild to moderate dementia. Although the nature of deficits differs across studies, it appears that impairment is particularly pervasive in areas of memory, visuoconstruction, processing speed, and executive functioning (Fig. 1). The cause and risk factors for the development of cognitive impairment following ICU hospitalization are largely unknown, although the risk factors for cognitive impairment following cardiac surgery are well documented and include advanced age, lower premorbid intelligence, cerebrovascular and peripheral-vascular disease, and hypoxia [17, 18]. Researchers have hypothesized that the presence of certain factors such as sepsis and ARDS and its associated hypoxemia [12], the development of delirium [19], and the use of sedative and narcotic medications are associated with the development of cognitive impairment after critical illness, although such mechanisms are in need of further exploration.

Functional and financial implications of cognitive impairment for ICU survivors

Although between one and three of every four patients experience cognitive impairment following ICU treatment [6, 12], little is known regarding the functional and financial impact of such impairment in these patients. Cognitive impairment is generally associated with inability to return to work, decreased quality of life and independence, and generalized functional decline; an important caveat to this observation, however, is that many investigations on the consequences of cognitive impairment have been carried out in populations with Alzheimer’s disease, and may not be directly applicable to ICU survivors [20, 21, 22, 23]. Cognitive impairment resulting from a host of illnesses and medical syndromes including human immunodeficiency virus, ARDS, traumatic brain injury, and bacterial meningitis are associated with decreased quality of life [13, 24, 25, 26]. Even mild forms of cognitive impairment can be extremely problematic and may lead to significant difficulties in activities of daily living such as impaired driving, money management, and performance of basic household functions (e.g., cleaning, cooking, organizing) [27, 28, 29].

The specific economic consequences of cognitive impairment following a stay in the ICU are not yet known. However, in the general population the economic consequences of cognitive impairment are substantial and depend on factors such as the severity and nature of impairment, rate of decline, and the setting in which care is provided (e.g., nursing home vs. private residence) [30]. For example, a 3-point decrease on the Mini Mental State Examination (MMSE) is associated with a $6,000 per year increase in overall healthcare expenditures [31]. The “per-patient societal cost burden” of even mild forms of cognitive impairment is estimated to be over $15,000 per year [32]. The costs associated with traumatic brain injury are less well known, but it appears that the wages of individuals returning to work after a brain injury decline by approximately 50% per year [33].

Should the ICU team strive towards early identification of cognitive impairment?

A consensus is emerging among neurologists, psychiatrists, and other specialists regarding the importance of early identification of cognitive impairment [34]. The failure to identify cognitive impairment can have serious implications for patients in a variety of functional domains. For example, a person may return to work based on the erroneous assumption that he or she is “perfectly fine,” only for the patient to encounter difficulties performing at the previous level due to problems with memory and disorganization. These difficulties may be wrongly attributed to “laziness” or lack of motivation and may result in the termination of employment. Situations such as this are not inevitable and can often be avoided if a patient’s cognitive impairment is identified as such. The identification of cognitive impairment is valuable not only to patients but also to their families and caregivers as it enables them to mobilize necessary resources before the onset of a crisis such as inability to care for self or children and to function independently.

The lack of early identification of cognitive impairment delays referral for cognitive rehabilitation, which has been shown to improve cognitive function [35]. Cognitive rehabilitation may be appropriate for individuals with cognitive impairment due to a wide variety of causes (e.g., traumatic brain injury, cerebrovascular accident, hypoxia) and is considered to be effective in improving neuropsychological abilities such as attention/concentration, memory, and executive function [36].
Despite the importance of early identification of cognitive impairment, studies consistently demonstrate that physicians fail to recognize (or assess) cognitive impairment in 35–90% of patients in non-ICU clinical practice settings [37, 38]. Recent data suggest that cognitive impairment is rarely evaluated in ICU patients [6] and may be overlooked in one of every two cases [39]. Reasons for limited recognition of cognitive impairment include time constraints, perception of limited treatment options, and limited knowledge regarding how to perform cognitive screening [40]. Intensivists and those caring for patients after the ICU stay should be aware that there are excellent brief screening tools that can be readily used in the midst of a busy day by themselves or other members of the ICU team (Table 2). These measures are simple to use and do not require specialized training to administer. While the early identification of cognitive impairment is very important, the approaches to identification vary widely depending on the setting.

Clinical issues in the identification of cognitive impairment

Assessing patients in various hospital and outpatient settings presents various challenges and may require the use of different tools. Patients can be assessed at various stages of their illness as they move from the ICU to acute care and then to the outpatient setting. Cognitive impairment in these different settings can be identified in a variety of ways and can be based on objective data (e.g., test scores) or more subjective evidence (e.g., clinical judgment, patient observation, family interaction). The following section suggests a logical approach at each stage and consider advantages and limitations of tools that can be used in each setting.

How do you identify cognitive impairment in critically ill ICU patients?

In many instances intensivists are the providers best positioned to identify possible acute cognitive impairment in critically ill patients. Although it is unlikely that they have the time to assess these patients individually, evaluations can be performed by nurses and other allied healthcare professionals such as psychologists, social workers, and speech therapists [41, 42]. However, due to multiple factors in ICU settings such as mechanical ventilation, related communication difficulties, the high prevalence of delirium, and patient fatigue, formal in-depth assessment of critically ill patients is often not possible. Sometimes the only assessment possible in such populations is related to detection of delirium, which can be rapidly and reliably assessed with the Intensive Care Delirium Screening Checklist [43, 44] or the Confusion Assessment Method for the Intensive Care Unit (CAM-ICU) [45, 46]. For free downloads of material used to monitor delirium in the ICU (including translations into multiple languages) the reader is referred to the educational website: http://www.icudelirium.org. If patients are not delirious, their cognitive function can be quickly evaluated using the MMSE or another brief cognitive screening tool. The detection of delirium may be important in light of evidence suggesting an association between delirium and an increased risk of cognitive impairment and other adverse outcomes (although much remains to be discovered about this association) [19].

How do you identify cognitive impairment following ICU stay in hospitalized patients?

When patients are discharged from the ICU to rehabilitation or general hospital units, their cognitive status may improve, and they may be more able to interact with an evaluator or clinician. At this point neuropsychological assessment may be appropriate and the completion of such testing more realistic. In cases where cognitive screening is possible numerous suitable instruments are available [47]. The MMSE is widely considered the “gold standard” among screening tools and consists of 17 items (30 possible points) that assess a range of global abilities including orientation, memory, and attention [48]. A score of 23 or below on the MMSE indicates the presence of moderate to severe cognitive impairment, but it should be noted that the test is susceptible to the effects of age and education and can be more reliably scored using age and education adjusted norms [49]. Other screening tools that are equally “user friendly” and, in some cases require even less time to administer are available (Table 2). In general, cognitive screening instruments require little if any specialized training to administer and score, and depending on the instrument the administration time varies from 1 to 10 min. While the sensitivity and specificity of these instruments vary, they generally have acceptable reliability and validity and are effective at identifying moderate to severe cognitive impairment. They are less sensitive in the detection of mild forms of cognitive impairment [47]. While more comprehensive and sophisticated instruments exist, using them with hospitalized patients may be impractical as they can be quite lengthy and may require specialized training to administer. Moderate or severe forms of cognitive impairment can frequently be identified without the use of psychometric instruments or questionnaires and through reliance on more subjective methods [50, 51, 52]. These methods include the use of clinical judgment, the direct observation of patients, and interaction with families. The perceptions of family members can be very helpful as parents, spouses, or children are often aware of even minor changes in a patient’s functional abilities or personality.
| Test                                | Admin. time | Description                                                                 | Cutoff score                                                                 | Comment (pro/con)                                                                                   |
|------------------------------------|-------------|------------------------------------------------------------------------------|------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|
| Clock Drawing Test [89]            | 1 min       | A test requiring subjects to draw a clock face that reads a specific time    | Varies widely depending on scoring system                                     | Pro: assesses broad range of cognitive abilities and can be used by individuals with little       |
|                                    |             | suggested by the examiner                                                    |                                                                              | experience in assessment Con: can be difficult to score and is adversely affected by advanced age |                                                                                  |
|                                    |             |                                                                              |                                                                              | and low education Con: measures only two cognitive domains                                      |                                                                                  |
|                                    |             |                                                                              |                                                                              | Pro: not affected by language or education and can detect mild cognitive impairment               |                                                                                  |
|                                    |             |                                                                              |                                                                              | Con: measures only two cognitive domains                                                          |                                                                                  |
|                                    |             |                                                                              |                                                                              | Pro: very brief and simple to administer                                                          |                                                                                  |
|                                    |             |                                                                              |                                                                              | Con: poor sensitivity and specificity                                                              |                                                                                  |
| Mini-Cog [90]                      | 3 min       | A recall test of three unrelated words and includes a Clock Drawing Test     | Impairment defined as inability to recall 3/3 words or abnormal clock         | Pro: not affected by language or education and can detect mild cognitive impairment               |                                                                                  |
|                                    |             |                                                                              | An incorrect response on either/or both tasks suggests probable dementia      | Con: measures only two cognitive domains                                                          |                                                                                  |
| Time and Change Test [91]          | 3 min       | A timed test requiring subjects to tell time from a clock and to assemble a | An incorrect response on either/or both tasks suggests probable dementia      | Pro: very brief and simple to administer                                                          |                                                                                  |
|                                    |             | dollar in change (from a group of coins placed in front of them)             |                                                                              | Con: poor sensitivity and specificity                                                              |                                                                                  |
|                                    |             |                                                                              |                                                                              | Pro: not affected by language or education and can detect mild cognitive impairment               |                                                                                  |
|                                    |             |                                                                              |                                                                              | Con: measures only two cognitive domains                                                          |                                                                                  |
|                                    |             |                                                                              |                                                                              | Pro: very brief and simple to administer                                                          |                                                                                  |
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|                                    |             |                                                                              |                                                                              | Con: poor sensitivity and specificity                                                              |                                                                                  |
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|                                    |             |                                                                              |                                                                              | Con: measures only two cognitive domains                                                          |                                                                                  |
|                                    |             |                                                                              |                                                                              | Pro: very brief and simple to administer                                                          |                                                                                  |
|                                    |             |                                                                              |                                                                              | Con: poor sensitivity and specificity                                                              |                                                                                  |
|                                    |             |                                                                              |                                                                              | Pro: not affected by language or education and can detect mild cognitive impairment               |                                                                                  |
|                                    |             |                                                                              |                                                                              | Con: measures only two cognitive domains                                                          |                                                                                  |
|                                    |             |                                                                              |                                                                              | Pro: very brief and simple to administer                                                          |                                                                                  |
|                                    |             |                                                                              |                                                                              | Con: poor sensitivity and specificity                                                              |                                                                                  |
|                                    |             |                                                                              |                                                                              | Pro: not affected by language or education and can detect mild cognitive impairment               |                                                                                  |
|                                    |             |                                                                              |                                                                              | Con: measures only two cognitive domains                                                          |                                                                                  |
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|                                    |             |                                                                              |                                                                              | Con: measures only two cognitive domains                                                          |                                                                                  |
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|                                    |             |                                                                              |                                                                              | Con: poor sensitivity and specificity                                                              |                                                                                  |
|                                    |             |                                                                              |                                                                              | Pro: not affected by language or education and can detect mild cognitive impairment               |                                                                                  |
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|                                    |             |                                                                              |                                                                              | Pro: not affected by language or education and can detect mild cognitive impairment               |                                                                                  |
|                                    |             |                                                                              |                                                                              | Con: measures only two cognitive domains                                                          |                                                                                  |
|                                    |             |                                                                              |                                                                              | Pro: very brief and simple to administer                                                          |                                                                                  |
|                                    |             |                                                                              |                                                                              | Con: poor sensitivity and specificity                                                              |                                                                                  |
The following is a list of warning signals, or “red flags,” that can suggest possible cognitive impairment in hospitalized or ICU patients:

- Personality changes
  - Increased apathy
  - Loss of social inhibitions, display of socially inappropriate behavior with staff
  - Increased irritability or suspiciousness toward family, visitors, or medical team
  - Outbursts of inappropriate or unprovoked anger

- Memory complaints
  - Difficulty learning new facts and information about one’s medical condition
  - Persistent word finding problems
  - Inability to recall conversations with medical staff and recent events in the hospital such as visits by staff, family, or friends
  - Inability to remember having eaten or what was eaten at meal time

- Executive dysfunction
  - Difficulty following nurses’, physicians’, or therapists’ directions
  - Problems with planning and decision making related to such things as discharge planning
  - Confusion when trying to perform multiple tasks

- Functional deficits
  - Difficulty looking up telephone numbers or using the telephone or other equipment such as the television and hospital bed
  - Decline in self-care not attributable to physical problems or limitations
  - Inability to find one’s room
  - Inability to follow a conversation
  - Difficulty following through with tasks

Caution should be exercised when drawing conclusions about cognitive functioning based on in-hospital assessments as performance may be adversely affected by factors such as fatigue and residual effects of sedative and narcotic medications.

How do you identify cognitive impairment following ICU stay in the outpatient clinic?

Patients typically return to outpatient clinics approx. 1–2 months after hospital discharge for routine follow-up. By then patients have recovered from any transient cognitive dysfunction (e.g., delirium, effects of medications) and may be functioning at levels that reflect their new baseline. Generally, individuals have begun to resume their normal activities and may experience previously nonexistent functional limitations due to acquired cognitive impairment. It may be beneficial to repeat the MMSE and compare the current score with those obtained during the patient’s hospitalization. Improvement in cognitive function is expected and a decline of more than 3 points (or a score below the standard cutoff of 23), as well as the presence of persistently abnormal scores, suggests the need for further evaluation, as the MMSE is a relatively stable, reliable measure and resistant to large fluctuations in scoring in the absence of actual neuropsychological change [53].

It is also appropriate to assess activities of daily living such as bathing and dressing or, more importantly, instrumental activities of daily living (IADLs) such as cooking, following a recipe, and balancing a checkbook (which can be significantly affected by even minor neuropsychological changes) [27, 54]. Formal assessments of functional abilities can be carried out with instruments such as the Pfeffer et al. [55] Functional Activities Questionnaire (FAQ) and the Lawton and Brody [56] Instrumental Activities of Daily Living (Table 3) or by asking simple, targeted questions. For example, clinicians can inquire about a patient’s ability to perform complex tasks...
tasks such as using a telephone or a remote control, following a complex recipe, making a grocery list, or managing money or medications [57]. An important factor to evaluate is the presence of change and the degree to which the current level of function is different from prehospital levels. Poor performance on measures of functional ability are not proof of cognitive impairment but can assist a practitioner in determining whether a patient should be referred for a more comprehensive neuropsychological assessment [58].

Depression and other psychological problems

Many ICU survivors experience significant affective symptoms such as depression and anxiety [59]. The prevalence and severity of affective disorders including symptoms of depression and anxiety in ICU survivors range from less than 10% to 58% [6, 12, 60, 61, 62]. Depression has been reported to occur in up to 30% of ICU survivors [6], and it is estimated that 47% have clinically significant anxiety [59]. Indeed, it may be that the high rates of depression among ICU survivors are related to the cognitive impairment they experience, although this has not been evaluated in ICU cohorts. Affective disorders such as depression as well as posttraumatic stress disorder and anxiety may adversely affect test performance, especially if severe [63, 64]. Moderate to severe depression may result in decreased effort and low motivation that may decrease neuropsychological test scores in cognitive domains such as psychomotor speed or attention [65, 66], whereas moderate to severe anxiety may result in increased distractibility and blocked thoughts or words [67, 68]. In some cases severe depression may mimic symptoms of cognitive impairment, although important differences exist between these conditions. In general, individuals with depression retain the ability to learn and do not forget as rapidly, do not display significant decrements in language, are inconsistent with regard to orientation to time and date and are typically more self-aware than their cognitively impaired counterparts [69, 70, 71].

A variety of instruments are available for use in the assessment of affective function (Table 4). Those for assessing depression include the Geriatric Depression Scale–Short Form (GDS-SF) [72], the Beck Depression Inventory (BDI) [73], the Center for Epidemiologic Studies Depression Scale (CES-D) [74], and the Hospital Anxiety-Depression Scale (HADS) [75]. Anxiety can be assessed using the HADS [75] or the Beck Anxiety Inventory (BAI) [76].

### Proposed guidelines for cognitive impairment screening and referral

Recent guidelines (2003) for dementia screening developed by the United States Preventative Services Task Force recommend that clinicians assess cognitive function whenever cognitive impairment or deterioration is suspected [77]. In keeping with this recommendation (given the high rates of cognitive impairment in ICU survivors), it would be ideal yet impractical to screen all ICU survivors at hospital discharge and subsequent follow-up visits. Therefore this is not recommended. An alternative approach is to screen only those individuals with an increased likelihood of developing cognitive impairment, although, as discussed above, only limited research has assessed causal mechanisms and risk factors of cognitive impairment following critical illness. More general evi-

### Table 4 Common screening tools for psychological disorders

| Test                              | Reference                      | Admin. time | No. of items | Cutoff score                          | Comment                                                                 |
|-----------------------------------|--------------------------------|-------------|--------------|---------------------------------------|-------------------------------------------------------------------------|
| Anxiety                           |                                |             |              |                                       |                                                                         |
| Beck Anxiety Inventory            | Beck et al. [76]               | 5–10 min    | 21           | 0–7 minimal anxiety; 8–15 mild anxiety; 16–25 moderate anxiety; 26–63 severe anxiety | Four-point rating scale of anxiety symptoms                             |
| Hospital Anxiety and Depression   | Zigmond et al. [75]            | 7           |              | 8–10 borderline anxiety; ≥11 definite anxiety | Widely used with medical patients                                      |
| Beck Depression Inventory         | Beck [73]                      | 5–10 min    | 21           | 0–9 minimal depression; 10–16 mild depression; 17–29 moderate depression; ≥30 severe depression | Multiple choice format makes it more difficult for elderly patients to respond |
| Geriatric Depression Scale-SF     | Sheik and Yesavage [72]        | 5 min       | 15           | >5 Depression                         | Assesses cognitive dimensions of depression while minimizing the somatic components of depression |
| Center for Epidemiologic Studies Depression Scale | Radloff [74] | 5–10 min | 20           | >16 Clinical depression               | Primarily assesses cognitive and affective dimensions of depression    |
dence from investigations of neuropsychological dysfunction following medical illness suggests that risk factors include advanced age, the presence of disease states with central nervous system involvement (ARDS, sepsis, bacterial meningitis, chronic obstructive pulmonary disease, diabetes, cardiovascular disease), and hypoxemia [12, 25, 78, 79, 80, 81, 82, 83, 84].

Cognitive screening using a tool such as the MMSE or Mini-cog should be performed on any individuals who answer affirmatively to questions about memory difficulties, display impaired IADLs, or have signs of cognitive impairment including ongoing delirium or memory/orientation problems (e.g., confusion, repeating the same question, losing things such as glasses, forgetting familiar names, getting lost), social problems (e.g., neglect of appearance, nutrition, hygiene, loss of interest in hobbies, social withdrawal), and/or behavioral problems (e.g., wandering, irritability, agitation, apathy) should undergo cognitive screening using a tool such as the MMSE.

Although screening at hospital discharge may result in a high false-positive rate because of the transient effects of medication and acute illness, it is important to track the patient’s cognitive status during the weeks to months following ICU and hospital discharge. When patients are thought to have cognitive impairment, they should be referred to a clinical neuropsychologist for consultation and further neuropsychological evaluation. Although few neuropsychologists are actively involved in the assessment and management of survivors of critical illness at the present time, they are the appropriate professionals to assess cognitive function in these patients. It should be noted that neuropsychologists might be unavailable in small hospitals or rural areas. Neuropsychologists are typically employed in neurology, rehabilitation medicine, or psychiatry departments in most moderately sized or large medical centers. In cases where neuropsychologists are unavailable, it is appropriate to refer patients to a clinical psychologist, as they are trained in performing basic cognitive evaluations.

Conclusions

The adverse effects of critical illness on cognitive functioning are being increasingly studied and recognized by both clinicians and investigators. Although much remains unknown, it appears that a significant percentage of critically ill patients and survivors experience cognitive impairment affecting quality of life and overall daily functioning. Intensivists, particularly those that follow patients after ICU discharge, are uniquely positioned to initiate cognitive screening and subsequent referral of critically ill patients and survivors. Cognitive screening is simple, quick, and of great potential benefit, particularly in the early detection of cognitive impairment and should be widely incorporated in relevant clinical settings.

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