ERABI EVIDENCE-BASED REVIEW of moderate to severe ACQUIRED BRAIN INJURY

Clinical Handbook

12. Older Age and Traumatic Brain Injury

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Older Age and Traumatic Brain Injury

By the end of this chapter you should be able to:

- Know the common mechanisms of injury in older populations
- Understand the different psychological and functional outcomes which are affected by TBI
- Differentiate between the models of care for older individuals with TBI
- Know the supported guideline recommendations regarding the triage and care of older individuals with a traumatic brain injury

12.1 Introduction to Older Age and Traumatic Brain Injury

The term "aging" is often used in the literature to describe how adults progress developmentally to an older state of being. However, the meaning of aging in the current context is used to describe individuals that have already reached the age of 65 years and are living out their remaining years according to Canada's life expectancy estimate. Although the differences are subtle, the point is to highlight the aging process as a normal physical, cognitive and psychosocial decline in later years, beyond the age of 65, and not simply a chronological progression. This decline (in multiple areas) presents a unique challenge in the management of ABI for older individuals as pre-existing conditions can be fairly common complicating the diagnosis and management of ABI.

Traumatic brain injury (TBI) is a leading cause of death in the elderly and often has devastating long-term effects (Frankel et al., 2006). Not only does TBI have consequences for the older individual, but also for the public health system and caregivers. Clinical research has demonstrated that TBI can seriously hinder physical, cognitive, and psychosocial functioning, regardless of whether the head injury is mild, moderate, or severe (US Department of Health and Human Services, 1998).

- 29% of all head injury hospitalizations in Canada are for elderly individuals (Canadian Institute for Health Information, 2006).
- Elderly population only makes up approximately 12% of Canadian population.
- In Canada, 59% of patients who died as a result of their head injury were seniors.

It should be noted that in this chapter only considerations relating to the diagnosis and management of ABI in older populations will be discussed. For general information on areas of ABI rehabilitation please see our other chapters.

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12.1.1 Injury Mechanisms, Incidence, and Mortality

Q1. How does older age effect mortality post-TBI?

1. Individuals over the age of 65 have an increased risk of mortality post-TBI, with this risk increasing with age and worse GCS.

In 2004 the predominant mode of injury for older Canadian adults was unintentional falls and these represented 76% of all head injury admissions. Further, 82% of all injury related admissions of Canadian older adults were the result of a fall (Canadian Institute for Health Information, 2006). Individuals who have fallen previously are at a high risk of subsequent falls (Teno et al., 1990). In 2004, the second and third leading causes of head injury in older Canadian adults were motor vehicle collisions and assaults at 17% and 1.1%, respectively (Canadian Institute for Health Information, 2006). The rates due to motor vehicle collisions are particularly worrisome given that older adults drive considerably less than younger adults. The rate of death resulting from motor vehicle collisions in those 65 years and older was 13.2 per 100,000, yet for those aged 45 to 64 years, the rate was only 8.2 per 100,000 (Ramage-Morin, 2008). Head injuries caused by falls produce a greater number of focal brain lesions than those produced by other mechanisms such as motor vehicle accidents (Alberico et al., 1987).

Table 12.1 Summary of Select Studies Evaluating Mortality in Seniors Post TBI.

Author/ Year/ Country/ Study Design/ N	Time Point	Study Findings	
Mortality at Discharge			
Lilley et al. (2016) United States Case Series, N=90	Mortality rate at discharge	Mortality >65 yr GCS ≤8=79% GCS>8=6.2%	
Utomo et al. (2009) The Netherlands Case Series, N=428	Mortality rate at discharge	Mortality >65 yr GCS 3-8=83.3% GCS 9-12=47.8% GCS 13-15=14%	
Mortality at 1-6 Months Post Injury			
Patel et al. (2010) United Kingdom Case Series, N=669	Mortality rate 3 mo post injury	Mortality GCS 3-5 65-70 yr=79.6% 70-75 yr=85.9% 75-80 yr=92.0% >80 yr=92.6%	Mortality GCS 6-8 65-70 yr=47.1% 70-75 yr=56.4% 75-80 yr=73.3% >80 yr=78.8%
Mohindra et al. (2008) India Case Series, N=1071	Mortality rate 6 mo post surgery	Mortality 20-40 yr GCS 3-8= 39.2% GCS 9-12=19.0% GCS 13-15=5.7%	Mortality >70 yr GCS 3-8=72.7% GCS 9-12=71.4% GCS 13-15=0.0%
Mortality 1-5 Years Post Injury			
Lilley et al. (2016) United States Case Series, N=90	Mortality rate at 1 yr post injury	Mortality GCS≤8=87.9% GCS>8=40.6%	
Colantonio et al. (2008) Canada Case Series, N=2,721	Mortality rate 1-9 yr post injury	Mortality 15-34 yr=3.2% 35-64 yr=16.3% >65 yr=55.0%	
Mortality >5 Years Post Injury			
Ratcliff et al. (2005) USA Case Series, N=640	Mortality rate 8-24 yr post-injury	Mortality 14-24 yr=7% 25-39 yr=9% 40-59yr=31% >60 yr=74%	

Several studies have demonstrated that that older individuals (>56 years) have up to 62% higher mortality rates at discharge (Bouras et al., 2007; Kuhne et al., 2005; Mosenthal et al., 2002; Spaniolas et al., 2010; Susman et al., 2002). In general, studies have also shown that older seniors fare worse than younger ones, in terms of outcomes as well as mortality (65 compared to 75 years of age; Bouras et al., 2007; Kuhne et al., 2005). However, the Practice Management Guidelines for Geriatric Trauma from the Eastern Association for the Surgery of Trauma provide Level III evidence which found that advanced age alone is not a sufficient cause to deny or limit care to this patient population.

Click HERE to see the full ERABI evidence examining the relationship between older age and mortality post-TBI

12.2 Clinical Presentation and Diagnosis of ABI in Older Adults

In this section, only specific considerations for older adults related to ABI will be discussed. For an in-depth assessment of the clinical presentation of common sequelae following an ABI please see the appropriate corresponding chapter (e.g. Cognition and Cognitive-Communication, Motor and Sensory, etc.).

One of the consistently identified challenges in the treatment and management of ABI in older populations is the high likelihood of pre-existing or comorbid conditions. Given that older adults are more likely to have pre-existing or comorbid conditions, it may be difficult to distinguish signs and symptoms related to an ABI compared to a pre-existing condition (Jacobs et al., 2003). In these circumstances, two strategies have been recommended to identify and diagnose complications exclusively as a result of an ABI. First, in circumstances where the presence of an existing ABI is ambiguous, evidence of acute cranial trauma may be relied upon to confirm a diagnosis of ABI (Peters & Gardner, 2018). In cases where ABI is suspected but no evidence of physical neurotrauma is indicated, diagnosis remains particularly challenging and further research should evaluate methods of diagnosis in these specific circumstances (Peters & Gardner, 2018). The second strategy to facilitate diagnosis under challenging conditions is to systematically evaluate pre-existing conditions and disabilities to determine their contribution to the present condition (Peters & Gardner, 2018). By quantifying the extent of pre-existing conditions, it may be easier to fully determine the independent effects of an ABI. It is worth noting that older adults (specifically with those with multiple injuries or conditions) may have difficulty completing outcome assessments, and in these circumstances family, care giver, or proxy testimony may be particularly helpful in determining pre-ABI status and abilities (Peters & Gardner, 2018).

12.3 Outcome Measures and Assessments

As noted in the section above, older adults are more likely to have pre-existing or comorbid conditions which can limit their ability to complete assessments and impact their outcome. If individuals are still relatively unimpeded by pre-existing conditions, it is appropriate for them to complete standardized assessments outlined in other chapters of this Guidebook related to the specific area of injury. Should individuals have pre-existing conditions which significantly impact their ability to complete assessment measures, the strategies outlined above (utilization of imagining and an attempt to quantify pre-existing conditions; Peters & Gardner, 2018) should be considered to help in the interpretation of current status and future outcomes. It is commonly recognized that the assessment of older adults with an ABI requires a different approach than younger cohorts, although some strategies exist to support this unique challenge, the ability to systematically evaluate and assess ABI in older adults is ongoing.

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12.4 Outcomes Post-TBI

Q2. What percentage of older adults with a TBI experience a good recovery? (GOS 4-5)

Only 4% with those with an initial GCS <8 make a good recovery.

Q3. What considerations regarding outcome in older adults are recommended by the Practice Management Guidelines for Geriatric Trauma? (Jacobs et al., 2003)

1. Direct transport to a trauma center is indicated given advanced age in patients.
2. If a patient is over the age of 65 with an initial GCS≤8, and a substantial GCS improvement is not observed within 72 hours of injury, limiting further aggressive interventions may be considered.
3. Complications following ABI lead to longer lengths of stay and poorer outcomes in the elderly, as a result specific therapies should be strongly considered to prevent poorer long-term outcomes.

Individuals who have sustained a TBI in late adulthood or are of an older age have unique challenges. Older age is already accompanied by some level of normal physical and cognitive decline. However, individuals who have sustained a TBI and live to older adult years, or who sustain a TBI during late adulthood, experience unique and often accelerated declines in physical and mental health (Born et al., 1985; Kakarieka et al., 1994; Katz & Alexander, 1994; Ritchie et al., 2000).

Only 4% of the older adults with an incoming GCS of less than 8 have been seen to experience a good outcome (GOS 4-5), while 91% experience a poor outcome (GOS 1-3; Kotwica & Jakubowski, 1992). Further, only 5-20% experienced a moderate-to-good recovery one year later (Alberico et al., 1987; Brazinova et al., 2010; Dikmen et al., 1995). Kilaru et al. (1996) reported that lower GCS is a strong independent predictor of poor long-term functional outcomes in older adults. Ultimately, the research literature has shown that older adults have poorer outcomes at all time points, regardless of the severity of injury (Frankel et al., 2006; Hukkelhoven et al., 2003; Katz & Alexander, 1994; LeBlanc et al., 2006; Mosenthal et al., 2002; Rothweiler et al., 1998; Susman et al., 2002; Vollmer et al., 1991).

12.4.1 Functional Outcomes

Q4. Do older adults, compared to younger matched individuals, have poorer functional outcomes at discharge?

1. Yes. Older adults (>65) have poorer functional outcomes at discharge compared to matched younger individuals. This effect is still seen even when younger individuals have poorer initial GCS scores (Graham et al., 2010).

When examining functional outcomes specifically, older aged individuals exhibit similar trends with functional outcomes being poorer as older age increases. A side-by-side comparison of admission GCS to discharge FIM revealed that despite the same injury severity in both young and old groups, the older patients with a TBI were discharged with a poorer FIM score for each moderate and severe brain injury

sustained (LeBlanc et al., 2006). At one-year post discharge, younger adults recovered significantly better than the older group, even after accounting for pre-morbid conditions (Livingston et al., 2005).

Click here for the complete ERABI evidence on functional outcomes in older age

12.4.2 Cognitive Outcomes

Q5. How do neurodegenerative diseases impact recovery in older populations post-TBI?

1. Older individuals that have experienced a TBI and have a comorbid neurodegenerative disease experience a progressive decline in cognitive outcome post-TBI: those without neurodegenerative diseases recover to a small degree.

Short-term and long-term cognitive decline has been shown to be a risk factor for older adults who have sustained a TBI; however, many older individuals experience a decline in cognitive functioning as a result of normal aging or pathology. Such pathology may include dementia, a progressive neurodegenerative disease whereby memory and thinking become impaired. Quite often dementia (unrelated to a TBI) and TBI-related cognitive decline exist as co-morbid conditions. Typically individuals post TBI recover to some degree over time or plateau, whereas patients with dementia experience a progressive decline (Kersel et al., 2001). For example, compared to individuals with Alzheimer's disease, individuals with TBI were able to learn new information and retain it over time with practice (Bigler et al., 1989) and perform better on both verbal and visual memory tests (Bigler et al., 1989; Goldstein et al., 1996). Determining whether dementia is the underlying problem as opposed to TBI sequela is made even more challenging by the fact that a brain injury is a risk factor for developing Alzheimer's disease and other dementias (Fleminger et al., 2003; Guo et al., 2000; Mayeux et al., 1995; Mortimer et al., 1991; Plassman et al., 2000; Roberts et al., 1991; van Duijn et al., 1992). Starkstein & Jorge (2005) claimed that the changes in the brain following a TBI may lower the threshold for the manifestation of Alzheimer's disease in predisposed individuals.

12.4.3 Psychological Outcomes

Q6. What are the two avenues that psychological care should target for older individuals post-TBI?

1. Psychological care and treatment should focus on the patient themselves as one approach, but a strategy should also be put in place to support family and caregivers of those with TBI.

Very little is currently known about how older adults fare psychologically after a TBI. One study has shown that older adults with brain injuries suffered from significantly more psychosocial dysfunction, psychological distress, and post-concussive symptoms than non-TBI controls (Goldstein & Levin, 1995). Psychological outcomes in older adults post-TBI focuses on two streams. The first, focuses on the individual and their specific needs, while the second guides the family and/or caregiver. Caregivers should be a part of the planning process for future treatments and services (Dikmen et al., 1995). Family and caregiving assistance is crucial for all individuals during rehabilitation, but perhaps more so for older adults. As individuals age their social network diminishes and family members or friends must endure a greater burden. Thus, rehabilitation efforts and support services should be available to both the TBI patient and their support network (Uomoto, 2008).

12.5 Models of Care for Seniors

Older adults who experience a head injury also experience a greater number of medical complications compared to younger individuals (Thompson et al., 2006) and typically have poorer long-term prognoses (Mosenthal et al., 2002). According to the Center for Disease Control and Prevention (2007), 79.1% of all individuals over the age of 65 years, who had sustained a severe head injury, had at least one co-morbid disease. As mentioned previously, physicians should be wary of the overlap in symptoms between cognitive impairment and TBI to eliminate the potential for misdiagnosis (Flanagan et al., 2006). Seniors are also at further risk for complications because of comorbidities, frailty, previous head traumas, and medication interactions. As a result, models of care may need to be adapted to suit the unique circumstances of ABI at an advanced age. These considerations are discussed below in the appropriate sections. When indicated, the following clinical algorithm may serve as an example of a possible approach to the management and rehabilitation of an ABI in an older adult (Figure 12.1).

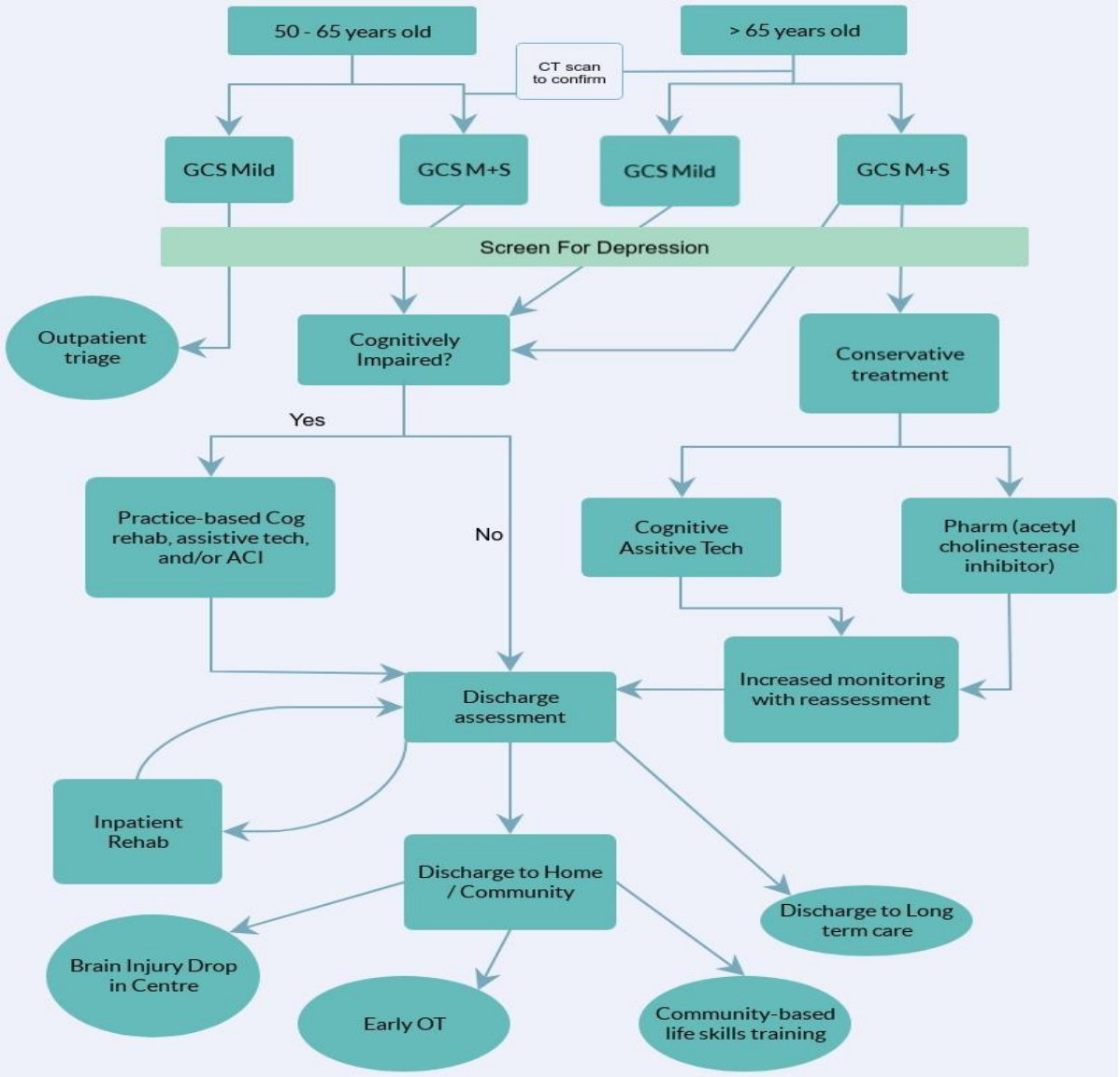

Figure 12.1 A potential care continuum for older adults with an ABI. GCS M+S indicates a moderate to severe GCS score, OT indicated occupational therapy.

12.5.1 Triage

When evaluating the appropriate intensity of care for older individuals, a general consideration is the survivability of their injuries, and their quality of life should they recover from those injuries (Jacobs et al., 2003). Individuals who have injuries which are assessed as "survivable" have been shown to benefit from immediate aggressive treatment, with a specific focus on the prevention of secondary injury (Jacobs et al., 2003). For those individuals who are unlikely to survive their initial injury, a potential shift away from aggressive treatment should be considered. Additional considerations during triage are presented in Table 15.2. Recent trends in the literature have shifted towards compassion-based care (Lilley et al., 2016), meaning that the quality of life and end-of-life experience is taken into consideration when choosing what level of care to provide. As more research is demonstrating age itself to be a predictor of poorer outcomes (Kuhne et al., 2005; Ritchie et al., 2000), end of life decisions are being increasingly approached by a team of individuals (e.g., social worker, family members, and physicians) with the intent of prioritizing the minimization of suffering and not necessarily achieving a functional outcome (Lilley et al., 2016; Schumacher et al., 2017).

Considerations for the triage of older adults with an ABI from the Practice Management Guidelines for Geriatric Trauma (Jacobs et al., 2003).

- Survivability based on injury severity
- Long-term outcome
- Side-effects and invasiveness of procedures and interventions
- End-of-life experience
- Patient/proxy's wishes
- Non-aggressive interventions

12.5.2 Acute Care

Q7. Improvement at what time point post-treatment is critical to predicting the likelihood of a favorable outcome in older individuals with a TBI?

1. 72 hours.

In acute care, older patients should be monitored closely (Selassie et al., 2005), and referred to senior medical staff (Zietlow et al., 1994). Mitra et al. (2008) emphasize that transitioning to intensive care units optimizes good outcomes. The Practice Management Guidelines for Geriatric Trauma provide Level III evidence that up to 85% of older adults with an ABI can return to independent living given an aggressive approach (Jacobs et al., 2003).

One retrospective study by Lilley et al. (2016) has shown that approximately half of all older adults admitted with a TBI and GCS<8 die in hospital. Of those who survived the initial stages of treatment, 72 hours of significant neurological impairment, and no response to treatment, predicted in-hospital mortality (Lilley et al., 2016). Other factors can also contribute to the likelihood of recovery. Another retrospective study of 1165 seniors with severe TBIs found that intensive treatment, *"defined as surgical or critical care provided to control intracranial hypertension"*, lengthened the total number of days spent in the hospital, but did result in significantly more favorable outcomes (Yokobori et al., 2016). There was

some evidence to demonstrate that only those who were previously living independently would respond to intensive treatment. However, in contrast to this, several studies have shown that performing decompressive craniotomies on the elderly is not ideal for a variety of reasons. When CPP increases to dangerous levels, decompressive craniotomy is a procedure used to relieve pressure in the brain and results in significantly better management of uncontrollable intracranial hypertension (Aarabi et al., 2006; Jiang et al., 2005; Meier et al., 2005; Ucar et al., 2005). While good outcomes can be achieved in young trauma patients, whether the same outcomes can be obtained for older adults is controversial. A suggested age limit for performing decompressive craniotomy has been said to be 40-50 years of age (Aarabi et al., 2006; Meier et al., 2006; Skoglund & Nellgard, 2005). However, surgery should still be recommended for patients with mild injuries who are only recently identified as elderly (Bouras et al., 2007; Jamjoom, 1992). Mohindra et al. (2008) examined 45 older (70+ years) and 1,026 younger (20-40 years) individuals with TBI for outcomes after advanced trauma care, including surgery. The elderly consistently showed greater rates of disability and mortality post-surgery (Kinoshita et al., 2016). Taken together, decompressive craniotomies are not typically performed on patients older than 50 years, as the usual risks of surgery combined with the risks of older age typically result in poorer outcomes compared to those under the age of 50.

These are important factors when considering the intensity of care that is reasonable to apply to an older individual. Many regions are now switching to models of compassionate care, which focus on the wishes of the individual, the family, and support system, regardless of medical intervention. Having control and autonomy over one's end of life stage has been shown to be important for psychological wellbeing (Lilley et al., 2016).

12.5.3 Rehabilitation

Long term recovery in older populations is often complicated by poor discharge status, and high rates of comorbidities. Goldstein (2005) has noted that, unlike the significant focus on rehabilitative efforts in children and young adults, very little has been researched regarding the rehabilitative needs of older adults. A concern is whether a "good" outcome is even possible in older adults with more severe injuries. As indicated previously, overall there is a linear relationship between severity of injury and outcome (Mosenthal et al., 2002).

In 2011, the Netherlands implemented a targeted Geriatric Rehabilitation Program, which proposed a framework to improve the rehabilitative care of seniors (Holstege et al., 2015). The program focused on four areas of care; the alignment of care with the patient's needs, quality of care, coordination of care, and coordination of care with care team members. A study examining the effects of this Geriatric Rehabilitation Program (Holstege et al., 2015) determined that seniors with a TBI were more likely to experience successful rehabilitation outcomes compared to seniors who have suffered a stroke. Compared to a retrospective control group, TBI individuals who participated in the rehabilitation program had significantly greater independence in activities of daily living, decreased length of hospital stay, and improved functional improvement. However, the majority of rehabilitation efforts that are being used with elderly individuals have resulted from studies solely investigating a younger population.

Older adults stay significantly longer in rehabilitation compared to younger patients; studies have reported length of stays ranging from 27 to 56 days among older adults (40+ years), and 22 to 33 days among young patients (<40 years; Cifu et al., 1996; Frankel et al., 2006; Marquez de la Plata et al., 2008).

However, despite longer stays, and therefore greater total costs, there was no notable difference between age groups in terms of daily rehabilitation costs.

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12.6 Conclusions

Rehabilitation in older adults is challenging for two primary reasons. First, there is a lack of literature specifically on senior populations themselves, and without data on how older populations uniquely respond to specific interventions it is challenging to make conclusions as to their efficacy in this population. The second challenge, are the high rates of comorbidities that exist within senior populations which can make rehabilitation challenging. These range from diabetes, obesity, stroke, to neurodegenerative diseases such as Alzheimer's. Given these challenges, two strategies can be used to facilitate the diagnosis and management of ABI in older individuals; the use of fine imaging techniques to examine neuro-physical injury, and a comprehensive assessment of pre-existing conditions. Ultimately, in recent years models of care have focused less on high intensity interventions, and more on compassionate care.

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