ACUTE GERIATRICS

Major trauma in the older patient: Evolving trauma care beyond management of bumps and bruises

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Two-thirds of female and one-third of male injury-related deaths occur in those over age 65 years. Falls account for 73% of cases of major trauma in patients over age 65 with road trauma constituting the majority of the remainder.2 As injurious standing level falls and fall prevention will be reviewed later in this series, this article focuses on major trauma and geriatric management.

Hospitalisations for injury-related issues continue to increase among ageing baby-boomers prompting increasing focus on these scenarios.3–5 After adjusting for Injury Severity Score, geriatric trauma victims have twice the mortality of younger patients and significantly longer intensive care unit (ICU) and hospital stays.6,7 Unfortunately, even minor geriatric trauma that does not require hospital admission can be associated with functional decline and preventable re-presentation to the ED.8 Increasing age has been recognised as one determinant of survival and post-trauma functional recovery for decades, but age alone is an insufficient marker for futility because some ageing trauma victims will benefit from aggressive trauma resuscitation.1,9,10

Scenario 1: Pedestrian struck by motor vehicle – highlighting team-based trauma care, geriatric imaging, analgesia and prognostication

Ruth, an 85-year-old widow who lives independently, is struck by a car whilst crossing the road. After a short pre-hospital time, she arrives in the ED with complaints of left chest pain and left groin discomfort. Your primary survey reveals a patent airway; a respiratory rate of 24/min with oxygen saturations of 94% on room air, equal air entry and bruising to her left chest; an initial pulse rate of 98/min and blood pressure of 110/50. There is bruising to her left groin and a non-tender abdomen; she is conscious and alert and the secondary survey is otherwise unremarkable. She has a history of hypertension and ischaemic heart disease.

Triage and initial clinical assessment

Although trauma mortality appears to increase from age 70, older age is associated with under-triage in the pre-hospital setting and lower rates of ambulance transfer to advanced trauma care centres.11–13 Then, once in the ED, elderly patients are again more likely to be under-triaged than severity matched younger patients and less likely to receive trauma team activation despite higher mortality.14,15 This may be contributed to by over-reliance on physiologic criteria. In adults ≥70 years, 63% with severe injuries and 25% with an injury severity score over 30 do not meet standard hemodynamic criteria for trauma team activation.16 Early trauma team activation and a low threshold for ICU admission with tissue perfusion monitoring decreased geriatric trauma mortality by almost 20% in one study.17

Trauma assessment and management in the older person is more complex than in younger persons. Geriatric trauma assessment and management is dependent on an awareness of (Table 1):
1. Age-related anatomic and physiologic changes, including reduced cardiac and respiratory reserve, skin and bone fragility and immunosenescence, which predispose older adults to more severe injuries for a given trauma mechanism. These changes also significantly impact sensitivity and specificity of clinical findings in trauma.

2. Increased potential for medical events inciting or complicating trauma related to comorbidities.

3. Functional frailty that may impact trauma assessment (through presence of baseline deficits including cognitive impairment), management and outcome.

**Resuscitation and investigation**

Resuscitation of the geriatric trauma patient requires modification of...
commonly used values for identifica-
tion of hemodynamic or neurologi-
cal compromise.\textsuperscript{18,19} Venous lactate
(≥2.5 mmol/L) or base deficit (≤−6)
may better predict hemodynamic
compromise than traditional vital
signs.\textsuperscript{20,21} In conjunction with early
engagement of trauma surgery, lac-
tate monitoring for occult hyperper-
fusion could reduce mortality.\textsuperscript{22}

Age has not been identified as an
independent predictor of outcome in
patients undergoing massive transfu-
sion, and massive transfusion proto-
cols should be activated equivalently
for an older person.\textsuperscript{23} Use of a per-
missive hypotension with a systolic
target of <90 mmHg, as a compo-
ment of damage control resuscita-
tion in older persons, is controversial.
Although mortality rises with lower
admission systolic blood pressure,
there was no synergistic effect of age
and blood pressure on mortality in
one retrospective study.\textsuperscript{24}

The increased incidence of severe
injury and mortality and the reduced
sensitivity of clinical findings, sup-
port a liberal approach to pan-CT
scanning in geriatric trauma. ED
physicians adopting this approach
need to be aware of and prepared to
manage the high rates of incidental
findings.\textsuperscript{25} Though the risk of
contrast-induced nephropathy is
often raised, a retrospective study of
non-ionic iso-osmolar intravenous
contrast in older trauma patients
demonstrated no association between
intravenous contrast media
administration and acute kidney
injury.\textsuperscript{26}

\section*{Injury management}

Post-trauma pain management in
older trauma victims is often sub-
optimal.\textsuperscript{27} Rib fractures are a com-
mon cause of morbidity and mortal-
ity in the older trauma patient, with
one study identifying that mortality
increased (odds ratio for death of
1.19) for each additional rib frac-
ture.\textsuperscript{28} Appropriate analgesia for rib
fractures is critical to reduce splint-
ing of the chest wall and optimise
vital capacity.\textsuperscript{29} Although intrave-
nous opioid analgesia (in cognitively
intact persons ideally via patient-
controlled analgesia) is generally
utilised as an initial approach in the
ED setting, we prefer opioid sparing,
multimodal shared decision-making
approaches to analgesia including
regular paracetamol and regional
anaesthesia.\textsuperscript{30,31}

Pelvic fractures in geriatric trauma
are common, with lateral compres-
sion fractures the most common.\textsuperscript{32}
Rates of clinically significant hae-
morrhage associated with pelvic
fractures are significantly higher in
elderly.\textsuperscript{33} Sensitivity of plain trauma
series pelvic films for posterior pelvic
ring fractures is unacceptably low
with up to 97\% of posterior pelvic
ring fractures missed when pubic
rami fractures are present.\textsuperscript{34,35}

Central to management of the ger-
iatric trauma patient is the evolving
concept of shared decision-making,
with the cognitively intact patient or
with alternate health decision-makers
in those patients lacking decision-
making capacity.\textsuperscript{36} Informed deci-
sion-making in this setting requires
an understanding of likely prognosis
with respect to survival and func-
tional outcomes. Trauma-related
mortality for geriatric victims with
severe injuries has been declining in
Australia for the last decade.\textsuperscript{37} A
study of 38 707 older trauma
patients showed that 90\% of seri-
ously injured older adults survived to
hospital discharge, with 52\% dis-
charged directly home, 20\% dis-
charged to rehabilitation and 25\%
discharged to a residential aged care
facility.\textsuperscript{38} The presence of pre-existing
comorbidities increased the odds of
complications three fold. Frailty also
increases risk, but objective measures
of frailty are not widely accepted
across surgical or medical
specialties.\textsuperscript{39,40}

\section*{Scenario 2: Motor vehicle
accidents – assessing beyond
the acute injuries}

Alfred is a 92-year-old Veteran of
World War II who arrives at the ED
via ambulance, after the vehicle he
was driving accidentally struck one
of his neighbours while he was
crossing the street. When he
slammed on his brakes, his forehead
struck the steering wheel and he was
knocked unconscious. Upon his arri-
val in the ED he is awake and com-
communicative with a Glasgow Coma
Scale (GCS) score of 13, but very
concerned about the woman that he
struck and emotionally distraught.
You note a golf ball size hematoma
over his forehead. Your primary and
secondary trauma surveys are other-
wise unremarkable, but you note
that he takes apixaban for atrial
fibrillation. He is otherwise robust
and well.

By virtue of their common cortical
atrophy and high use of antiplatelet/
anticogulant medications, older per-
sons are at higher risk of intracranial
injury despite normal GCS.\textsuperscript{41} While
the incidence of traumatic intracra-
nial bleeds is extensively researched
for warfarin,\textsuperscript{42–44} new oral anticoa-
gulation (NOAC) therapies include
direct thrombin (dabigatran) or Fac-

tor Xa (rivaroxaban and apixaban)
inhibitors.\textsuperscript{45} Traditional measures of
anticoagulation (PT, PTT) do not
provide information about the
degree of anticoagulation with
NOACs. Furthermore, their effective
reversal requires a shift away from
fresh frozen plasma with vitamin K
and towards prothrombin concen-
trate complex or activated Factor
VII.\textsuperscript{46} Researchers and pharmaceuti-
cal manufacturers continue to
explore safe, effective and costly
reversal agents for NOACs, such as
andexanet alpha (factor Xa inhibitor
reversal agent).\textsuperscript{47} Idarucizumab, a
monoclonal antibody to reverse
dabigatran, is currently the only
NOAC reversal agent registered in
Australia.\textsuperscript{48}

The Canadian Head CT Rule iden-
tifies age 65 or older as an independ-
ent risk factor for ‘high-risk’ head
injuries that require CT imaging.\textsuperscript{49} A
normal brain CT does not eliminate
the risk of a delayed intracranial
bleed, but from that point manage-
ment and the decision to admit or dis-
charge is mired in controversy. The
incidence of delayed intracranial hae-
morrhage among traumatic brain
injury (TBI) victims taking warfarin
and/or antiplatelet agents ranges from
0.6\% to 6\%, and most delayed bleeds
are clinically inconsequential and
require no surgical intervention.\textsuperscript{50–53}
Bleeding presentations can be delayed
weeks, especially subdural bleeding. Routine admission for every warfarin-anticoagulated victim with a normal brain CT would cost over $1 million per life saved, which is neither practical nor cost-effective.\(^{55}\)

Our approach is again based on shared decision-making and a risk-benefit analysis. With the patient’s agreement, families and carers are educated about the risks and signs of delayed brain bleeding. We do not recommend routine repeat CT scanning. It is prudent for the patient to see their General Practitioner in the days after discharge for clinical review and re-evaluation of the indication for anticoagulation. Admission is offered where safe home observation or certainty of follow up cannot be established AND it is felt the risks of discharge exceed those risks of hospitalisation we have discussed elsewhere in this series.\(^{55}\)

Operative management of TBI in patients over age 75 is associated with higher mortality. A GCS of 8 or less implies a 70% overall mortality in geriatric TBI victims and survival over the age of 85 with this severity of brain injury is extremely rare.\(^{56,57}\) The dismal outcomes in very old TBI victims led to the Eastern Association for the Surgery of Trauma (EAST) Guideline recommendation of ‘discussions regarding the goals of care if no improvement in GCS is seen after the initial phase of care and after withdrawal of sedatives’ following 72 h of aggressive trauma management.\(^{58}\) Early engagement of palliative care and/or geriatrics for critically injured trauma and TBI victims can improve symptom management and reduce intensive care unit and hospital lengths of stay without increasing mortality.\(^{59-61}\) The EAST Guidelines may require revisions because more recent research indicates that half of TBI patients with persistent GCS ≤ 8 after 72 h are ultimately discharged from the hospital alive and over half of those discharged are still alive 12 months later, albeit with universal functional impairment.\(^{62}\)

Blunt head or neck trauma in ageing adults is associated with cervical spine fractures. Since geriatric-specific C-spine decision aids have not been validated, we support a low threshold to image the cervical spine.\(^{63-65}\) CT is more sensitive than plain films for detecting spine fractures at the cost of preventable over-diagnosis and over-treatment of insignificant fractures or incidental findings unrelated to the trauma.\(^{66,67}\)

**Conclusions**

Managing major trauma in geriatric adults requires a low clinical threshold for advanced imaging and multidisciplinary assessment, recognising that mechanism and physical examination can be deceiving. Physiological and anatomical changes of ageing increase trauma-related mortality. Efficient laboratory, imaging and disposition decisions require an understanding of typical injuries and common resuscitation pitfalls, as well as recovery trajectories and preventative strategies to reduce short-term functional decline or further injury.

**Competing interests**

None declared.

**References**

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