The elderly: Major trauma and Severe traumatic brain injury

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Overview

- Background
- Victorian State Trauma Registry
- The elderly and major trauma
- Severe traumatic brain injury
Background

- Ageing population
- Increased health at older age
  - Greater participation in activities with the potential for injury

What has this meant for health care utilisation?

Proportion of the world population aged 60 years or more

Source: UN report World Population Ageing 1950-2050
Background

- Ambulance service utilisation

Lowthian et al. (2011)
Background

- ED presentations
  - 32% rise in rate of presentation from 1999-00 to 2008-09
  - Elderly disproportionately represented

**Demand at the emergency department front door: 10-year trends in presentations**

Major trauma
VSTR

- Victorian State Trauma Registry (VSTR)
  - Population-based
  - Patient, clinical and outcomes
  - Patients followed up at 6, 12 and 24 months post injury

- Inclusion – any of:
  - Death after injury
  - Injury severity score (ISS) > 12
  - Admission to ICU for >24 hours, requiring mechanical ventilation
  - Urgent surgery
VSTR in the context of all hospitalisations

- Major trauma
  - 10% of injury hospital presentations > 1 day
  - 16% of all injury-related bed days
Major trauma increased 2.4% per year
Major trauma in Victoria

![Graph showing the incidence of major trauma per 100,000 population (95% CI) from 2006 to 2015, with different categories such as MVC, Motorcycle, Low falls, and High falls.]

Incidence per 100,000 population (95% CI)

- MVC: +6.6%
- Motorcycle: 0%
- Low falls: 0%
- High falls: 0%
Major trauma in Victoria

- **Trauma Audit Research Network (TARN)**
  - Low falls most common cause of major trauma in UK (39%)
  - Increasing age of major trauma patients
    - 1990: mean age = 36 years
    - 2013: mean age = 54 years

![Graph showing hospital episode statistics data of patients eligible for Trauma Audit Research Network inclusion.](image)

*Figure 1* Hospital episode statistics data of patients eligible for Trauma Audit Research Network inclusion.

Major trauma in Victoria

- Major trauma in the elderly (65 plus)

- 66% Low fall
- 24% High fall
- 10% Transport
Major trauma in Victoria

- Incidence of low falls in the elderly

![Graph showing the incidence of low falls in the elderly from 2006 to 2015 for different age groups (35 to 64, 65 to 74, 75 to 84, 85 plus). The graph displays an increase in incidence with 95% CI.]

- 35 to 64: +5.9%
- 65 to 74: +7.2%
- 75 to 84: +5.5%

[Graph data and analysis]
### Major trauma in Victoria

- Low falls in the elderly – place of event

<table>
<thead>
<tr>
<th>Location</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Home</td>
<td>59%</td>
</tr>
<tr>
<td>Residential Care Facility</td>
<td>20%</td>
</tr>
<tr>
<td>Road/street</td>
<td>7%</td>
</tr>
</tbody>
</table>
Major trauma in Victoria

- Low falls in the elderly – discharge direction

<table>
<thead>
<tr>
<th>Discharge direction</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>In-hospital death</td>
<td>32%</td>
</tr>
<tr>
<td>Rehabilitation</td>
<td>33%</td>
</tr>
<tr>
<td>Hospital for convalescence</td>
<td>8%</td>
</tr>
<tr>
<td>Nursing home</td>
<td>4%</td>
</tr>
<tr>
<td>Home</td>
<td>20%</td>
</tr>
</tbody>
</table>

- In-hospital mortality
  - 65-74 years: 19%
  - 75-84 years: 29%
  - 85 plus: 41%
Major trauma in Victoria

- **Summary**
  - Low falls account for 2/3 of major trauma in the elderly
  - Incidence of low falls is on the rise
  - Poor outcomes
    - 1/3 in-hospital mortality
    - Only 20% discharged home
Severe traumatic brain injury
Severe TBI

- Severe traumatic brain injury (TBI)


Traumatic brain injury (TBI) is the most significant cause of death and severe disability resulting from major trauma. The economic burden of TBI is significant, with estimated annual hospital costs of $184 million in Australia. Although severe TBI constitutes a small proportion of all TBI, these injuries are a significant public health problem, associated with high mortality, profound long-term disability, and significant long-term healthcare costs.

While there is evidence that mortality associated with severe TBI has not changed since 1980, data on temporal trends in the incidence and causes of severe TBI are limited. Understanding the epidemiological patterns of severe TBI is necessary for developing targeted interventions and evaluating injury prevention strategies. This is particularly important given the worldwide focus on the prevention of falls and road trauma, the major causes of severe TBI.

The aim of this study was therefore to examine trends in the incidence and causes of hospitalisations for severe TBI across a statewide population (Victoria) over a 9-year period (2006–2014).

Abstract

Objective: To describe the incidence and causes of hospitalisation for severe traumatic brain injury (TBI) in Victoria over a 9-year period.

Design, setting, and participants: A retrospective review of data from the population-based Victorian State Trauma Registry for hospitalised cases of severe TBI, 2006–2014.

Main outcome measures: Temporal trends in the incidence of severe TBI and in causes of injury.

Results: There were 2022 patients hospitalised with severe TBI in Victoria during the 9-year study period. The incidence of severe TBI declined significantly over this period, from 5.0 to 3.2 cases per 100 000 population per year, mainly because of reductions in severe TBI resulting from motor vehicle crashes (incidence rate ratio [IRR], 0.89; 95% CI, 0.85–0.92; P < 0.001), which largely involved people in the 15–34-year-old age group (41%). A decline was also observed in severe TBI in motorcyclists, but this was not statistically significant (IRR, 0.94; 95% CI, 0.89–1.00; P = 0.06). The incidence of severe TBI resulting from falls, which occurred mostly in people aged 65 years or more (18%), increased (IRR, 1.04; 95% CI, 1.00–1.08; P = 0.03). The overall incidence of severe TBI resulting from intentional events was 0.60 cases per 100 000 population, and declined over the study period (IRR, 0.95; 95% CI, 0.91–1.00; P = 0.03).

Conclusions: The decline in the incidence of motor-vehicle–related severe TBI suggests that road injury prevention measures have been effective. Additional targeted measures for reducing the incidence of major head injuries from falls should be explored.

- The patient is admitted to an intensive care unit for more than 24 hours and mechanical venting is not caused by a head injury, but by alcohol or drug intoxication, for example. Injury diagnoses coded before the introduction of the AIS 2008 were mapped from the AIS 1990, 1996 version to the AIS 2008 using a validated map. When recorded.
Severe TBI

- Severe TBI
  - Represent 8.5% of the major trauma population

- Victorian State Trauma Registry: 2006-2015

- Inclusion criteria
  - Head AIS ≥ 3
  - GCS < 9

- n = 2280
Severe TBI declined 5% per year
Severe TBI

Incidence per 100,000 population (95% CI)

- MVC
- Motorcycle
- Low falls
- High falls


+3%
-9%
0%
-6%
Severe TBI

- Low falls
  - 68% of low falls occurred in those aged 65 years and greater

- Low falls in the elderly - where are they happening?
  - Home: 56%
  - Residential care facilities: 24%
Severe TBI

- Low falls in the elderly – injury types

<table>
<thead>
<tr>
<th>Injury Type</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brainstem injury</td>
<td>20%</td>
</tr>
<tr>
<td>Subdural haematoma</td>
<td>80%</td>
</tr>
<tr>
<td>Subarachnoid haemorrhage</td>
<td>10%</td>
</tr>
</tbody>
</table>
Severe TBI

- Low falls in the elderly – injury types

Fig. 2. Age standardised TBI admission rates by type of injury and year, persons aged 65 years and older, NSW 1998/99 to 2010/11.

Harvey & Close (2012)
Severe TBI

- Low falls in the elderly
  - What is the role of anticoagulants and antiplatelets in falls?
    - Clear benefits in multiple conditions
    - However, increased complexity of managing trauma patients

The effect of preinjury warfarin use on mortality rates in trauma patients: a European multicentre study

Fiona E Lecky,1 Mahad Omar,2 Omar Bouamra,1 Tom Jenks,1 Antoinette Edwards,1 Ceri E Battle,3 Phillip A Evans1

- Warfarin associated with increased mortality (AOR = 2.14)

### Low falls in the elderly – discharge direction

<table>
<thead>
<tr>
<th>Discharge direction</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Home</td>
<td>3%</td>
</tr>
<tr>
<td>Rehabilitation</td>
<td>10%</td>
</tr>
<tr>
<td>Hospital for convalescence</td>
<td>4%</td>
</tr>
<tr>
<td>Nursing home</td>
<td>3%</td>
</tr>
</tbody>
</table>

**In-hospital death** 80%
Severe TBI

- Low falls in the elderly – outcomes (GOS-E)
  - 70 patients discharged alive

6 months

- Dead: 32%
- Vegetative state: 29%
- Lower severe disability: 9%
- Upper severe disability: 3%
- Lower moderate disability: 7%
- Upper moderate disability: 12%
- Lower good recovery: 7%
- Upper good recovery: 0%

12 months

- Dead: 40%
- Vegetative state: 2%
- Lower severe disability: 22%
- Upper severe disability: 3%
- Lower moderate disability: 6%
- Upper moderate disability: 19%
- Lower good recovery: 6%
- Upper good recovery: 0%
Severe TBI

- **Summary**
  - Incidence of severe TBI resulting from low falls on the rise
    - Now the leading cause of unintentional severe TBI
  - Elderly severe TBI
    - Most commonly intracranial haemorrhages
      - Role of anticoagulants?
    - 80% in-hospital mortality
  - Poor long-term outcomes
    - 40% of those discharged alive have died at 12 months
    - 35% are left with moderate/severe disability
Summary
Conclusion

- Low falls
  - Largest cause of major trauma
  - Incidence of major trauma and severe TBI resulting from falls increasing at alarming rates
  - High mortality and poor long-term outcomes
Call to arms
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