The recent strategy for the upper cervical spine injury in the elderly

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Upper cervical spine injury in the elderly is caused by low-energy trauma.

It may gradually increase as the population ages!

Purpose

This study investigated clinical findings of the upper cervical spine injury in recent years, and demonstrated the strategy for these injuries in the elderly.

Patients and Methods

Upper cervical spine injury: 56 consecutive patients treated between April 2006 and July 2011

Gender: 19 females, 37 males

Using medical records and CT scans of all patients, we reviewed the patient’s age, causes and pattern of injury, methods and outcomes of treatment.
Results

The average age of 56 patients: 62.7 years (range 3-93 years)

1. Age

31 patients (55.4%) were over 65 years
21 patients (37.5%) were over 75 years

2. Causes of injury

- Traffic injury: 26
- Fall from height: 17
- Fall from standing: 10
- The other: 3

Fall from standing: 90% (9/10) were over 65 years. The average age of them was 79.0 years with a range from 63 to 93 years.
### 3. Pattern of injury

<table>
<thead>
<tr>
<th>Pattern of injury</th>
<th>Total</th>
<th>&lt;65yrs</th>
<th>65yrs≤</th>
</tr>
</thead>
<tbody>
<tr>
<td>C0 Occipital condylar</td>
<td>1</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>C0-1 dislocation</td>
<td>1</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>C1 Jefferson’s</td>
<td>2</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>C1-2 fracture dislocation</td>
<td>3</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>C2 Odontoid-2</td>
<td>6</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>C2 Odontoid-3</td>
<td>15</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>C2 Hangman’s-2</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>C2 Hangman’s-2a</td>
<td>1</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>C2 Vertebral body-1</td>
<td>13</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>C2 Vertebral body-2</td>
<td>3</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>C2 Others</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

**Odontoid fracture; Anderson-d’Alonzo**
Type 1: Avulsion fracture of the apex
Type 2: Fracture at the junction of the body and the neck
Type 3: Fracture extends into the body of C2 and may involve the lateral facets.

**Hangman’s fracture; Levine-Edwards**
Type 1: non displaced fracture (<3mm)
Type 2: significant angulation and translation
Type 2a: very severe angulation without translation
Type 3: severe angulation and displacement with facet dislocation

**C2 body fracture; Benzel**
Type 1: coronally oriented vertical
Type 2: sagittaly oriented vertical
Type 3: horizontal rostral
4. Treatment method

46 patients except early death and transfer

Surgical treatment: 35 patients (76%)

- Halo vest: 20 patients
  - Jefferson: 1
  - C1/2 fracture dislocation: 1
  - Odontoid-3: 10
  - Hangman’s-2: 2
  - C2 Vertebral body-1: 5
  - C2 fracture other: 1

Conservative treatment: 11 patients (24%)

- Philadelphia collar: 8 patients
- Soft cervical collar: 7 patients
- Posterior fixation: 11 patients
  - C1-2 fusion: 8 patients
  - Odontoid-2: 6
  - Odontoid-3: 2
  - C1-3 fusion: 2 patients
  - Hangman’s-2A: 1
  - C2 Vertebral body-1: 1
  - C2 screw fixation: 1 patient
  - C2 Vertebral body-1: 1
## 5. Treatment outcomes

<table>
<thead>
<tr>
<th></th>
<th>Surgical group</th>
<th>Conservative group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>total</td>
<td>early surgery</td>
</tr>
<tr>
<td>No. of patients</td>
<td>11</td>
<td>7</td>
</tr>
<tr>
<td>Non-union</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Age (years)</td>
<td>74.3</td>
<td>69.0 (60-81)</td>
</tr>
<tr>
<td>Hospitalization period</td>
<td>45.9</td>
<td>25.4 (17-50)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Soft collar</td>
<td>Hard collar</td>
</tr>
<tr>
<td>No. of patients</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td>Non-union</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Age (years)</td>
<td>52.6</td>
<td>56.8</td>
</tr>
<tr>
<td>Hospitalization period</td>
<td>16</td>
<td>31</td>
</tr>
</tbody>
</table>

* Stable fibrous union (Hangman’s-2: 72 M)

- The average duration of Halo vest immobilization was **7.5 weeks** (range 5-8 weeks).
- The **postoperative patients** were initially immobilized with Philadelphia collar and since 2010 with soft collar, and in principle started **ambulation training on postoperative days 2**.
## Complications of halo vest (HV) immobilization

<table>
<thead>
<tr>
<th>Age Group</th>
<th>No. of patients</th>
<th>Pneumonia</th>
<th>Delirium</th>
<th>Pin loosening</th>
<th>Decubitus under HV</th>
<th>Incidence of complications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Under 65 years</td>
<td>6</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>65-75 years</td>
<td>7</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>2 (28%)</td>
</tr>
<tr>
<td>Over 75 years</td>
<td>12</td>
<td>3</td>
<td>9</td>
<td>2</td>
<td>1</td>
<td>10 (83%)*</td>
</tr>
<tr>
<td>Total No.</td>
<td>25</td>
<td>4</td>
<td>8</td>
<td>3</td>
<td>1</td>
<td>12 (48%)</td>
</tr>
</tbody>
</table>

- *5 patients gave up HV ahead of schedule for complications.
- *2 patients were treated with ventilators.
- **All of them were over 75 years.**

- **5 patients underwent surgical treatment.**
  - Odontoid-2 71M, 68F; Instability with HV
  - Odontoid-2 81M, 84F; Instability and delirium with HV
  - Odontoid-3 85M; Delirium with HV and following instability with Philadelphia collar

5. Treatment outcomes

- 5 patients underwent surgical treatment.
- 5 patients gave up HV ahead of schedule for complications.
- 2 patients were treated with ventilators.
- All of them were over 75 years.
## 5. Treatment outcomes

### Complications of surgical fixation

<table>
<thead>
<tr>
<th></th>
<th>Complications</th>
<th>Neurovascular injury with surgery</th>
<th>Incidence of complications</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. of patients</td>
<td>Pneumonia</td>
<td>Delirium</td>
</tr>
<tr>
<td>Under 65 years</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>65-75 years</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Over 75 years</td>
<td>6</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Total No.</td>
<td>11</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

* In 5 of 7 patients, these complications occurred during preoperative bed rest, and some of them temporally became worse after surgery.
* In 2 other patients, these occurred after surgery; one was pneumonia and the other was delirium.
* In all patients, these complications were mild and resolved in a few days.
Discussion

The first and second cervical vertebra fractures occur more frequently in the elderly than in younger people.

Spivak JM et al. Spine 1994

Odontoid fracture is the most frequent individual fracture of the cervical spine.

Malik SA et al. Eur Spine J 2008

Upper cervical spine injuries; 56 cases

31 cases (55.4%) were over 65 years.
21 cases (37.5%) were odontoid fractures, and 16 cases (76.1%) of those were over 65 years.

In elderly patients

With degenerative change, C4-C7 segments become stiffer; and C1/2 segment becomes the most mobile portion.

Osteopenia by osteoporosis

Upper cervical injuries in elderly are caused by low energy trauma.

Watanabe M et al. J Orthop Sci 2010

Fall from standing: The average age of them was 79.0 years with a range from 63 to 93 years.
The problems with halo vest in the elderly have been increasingly highlighted by several authors with complication rates of up to 51%. In our institution, morbidity rate was similar between the surgical and HV managed patients. However, the complications with HV were potentially severe compared with those of surgery, because Immobilization in halo vest was maintained for a long period.

Finally, all of type II odontoid fractures underwent surgical treatment at our institution.

Complication rates over 65 years

Halo vest: 63%
Surgery: 55%

Halo vest immobilization: 25 cases

5 patients gave up HV ahead of schedule for complications.
2 patients were treated with ventilators.
All of them were over 75 years.

Our management options

Soft collar
Surgical fixation
Halo vest
Hard collar

Stable
Unstable

Management options

When considering the treatment for upper cervical spine injuries in the elderly, several factors need to be taken into consideration including other injuries, co-morbidities, healing potential of fracture, anticipated tolerance of the halo vest (HV) or surgery and patients wishes.

D. Pal et al. Eur Spine J 2011

The problems with halo vest (HV)

In our institution, morbidity rate was similar between the surgical and HV managed patients. However, the complications with HV were potentially severe compared with those of surgery, because Immobilization in halo vest was maintained for a long period.
In 56 patients of upper cervical spine injuries, 31 patients (55.4%) were over 65 years, 21 patients (37.5%) were odontoid fractures, and 16 patients (76.1%) of those were over 65 years.

10 patients (17.8%) were injured by fall from standing, and the average age of them was 79.0 years.

The old elderly patients (over 75 years) were at high risk for complications irrespective of the treatment method. In particular, halo vest was associated with severe complications.

**Conclusion**

- The surgery for the upper cervical spine injury in the elderly might be more reasonable than ever before.

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**Surgical treatment**

- **Merit**
  - Avoidance of complications due to halo vest
  - Shortening of treatment period

- **Demerit**
  - The risk of neurovascular injury
  - General anesthesia and associated problems

**Cervical collar treatment for unstable type**

- Bony union is not always necessary in the elderly, and that stable fibrous union may be an acceptable result. Lieberman IH et al. J Bone Joint Surg 1994

Recently, several authors have showed the usefulness of collar treatment in elderly patients, that accept fibrous union.