Odontoid fractures in elderly patients

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This retrospective analysis describes the clinical characteristics, treatment, and outcome of 19 patients aged 80 years or older with odontoid fractures. The fractures were due to falls in 15 patients (78.9%) and were associated with motor-vehicle accidents in four. Type III fractures were seen in three patients and type II fractures in 16. No patient suffered a neurological injury associated with the fracture. Five patients (26.3%) died during hospitalization; factors contributing to their death included prolonged bed rest, associated injuries, and concomitant medical illnesses. The mean follow-up period in the remaining 14 patients was 28.8 months (range 5 to 72 months). Eight patients with a posterior displacement of 5 mm or less were treated with cervical immobilization; three of whom showed a stable non-union of the fracture site at follow-up review. One patient with 10-mm displacement refused operative treatment. Three of the patients without surgical treatment subsequently died from unrelated causes; all remaining patients resumed their routine activity. Five patients with displacement of 5 mm or greater and instability at the fracture site were treated with posterior cervical fusion of C1-2 using wire and autologous iliac bone grafts. In this group, no operative morbidity or mortality occurred and stable constructs developed in all patients; one patient died from an unrelated cause during the follow-up period and the other patients resumed their normal activity. Prolonged bed rest caused respiratory complications in two of six patients who survived initial hospitalization; two of three patients treated with rigid immobilization developed complications that required alternative treatments.

Key Words: odontoid process fracture · cervical spine · spine immobilization · posterior cervical fusion · geriatrics

As the population of mobile elderly individuals increases over the next decade, their risk for fractures of the spinal column rises proportionately. Although data are incomplete, previous reports describing several large series of patients with odontoid fractures have shown a greater incidence of radiological non-union or morbidity in older patients. As a distinct group within the older population, the elderly patient with an odontoid fracture presents a difficult clinical problem. This review describes the clinical characteristics, treatment, long-term outcome, and principles of management in a consecutive series of patients aged 80 years or older.

Clinical Material and Methods

Patient Population

A retrospective review was performed of 19 patients aged 80 years or older who sustained fractures of the odontoid process between 1980 and 1989. These patients represented approximately 12% of all elderly patients admitted to our hospital for management of fractures of the cervical spinal column during the years of the study. Two patients with fractures associated with a neoplasm were excluded from the series. Nine patients were men with a mean age of 85 years (oldest 93 years) while 10 patients were women with a mean age of 87.2 years (oldest 99 years). Fifteen patients sustained fractures from falls and four were involved in motor-vehicle accidents.

Data Analysis

Data were recorded from hospital charts, and each patient was characterized as to age, sex, etiology of injury, degree of neurological impairment, associated injuries or illnesses, treatment, complications, and outcome. Available radiographs of the cervical spine, radiographic tomograms, or computerized tomography scans were categorized according to the classification of Anderson and D'Alonzo. The criteria for diagnosis of non-union at the site of fracture were outlined by Apuzzo, et al. Clinical and radiological outcomes were assessed by consecutive outpatient visits, telephone interviews, and written responses.
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**TABLE 1**

<table>
<thead>
<tr>
<th>Case No.</th>
<th>Type of Fracture</th>
<th>Displacement</th>
<th>Associated Injuries</th>
<th>Treatment</th>
<th>Survival (days)</th>
<th>Cause of Death</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>II</td>
<td>4–6 mm anterior</td>
<td>none</td>
<td>bed rest, collar</td>
<td>4</td>
<td>cardiopulmonary arrest</td>
</tr>
<tr>
<td>2</td>
<td>II</td>
<td>2 mm anterior</td>
<td>none</td>
<td>bed rest, collar</td>
<td>10</td>
<td>respiratory failure</td>
</tr>
<tr>
<td>3</td>
<td>II</td>
<td>10 mm anterior</td>
<td>closed head injury</td>
<td>bed rest, collar</td>
<td>23</td>
<td>aspiration pneumonía</td>
</tr>
<tr>
<td>4</td>
<td>II &amp; Jefferson</td>
<td>5 mm posterior</td>
<td>scalp laceration</td>
<td>bed rest, skeletal traction</td>
<td>4</td>
<td>aspiration pneumonía</td>
</tr>
<tr>
<td>5</td>
<td>II</td>
<td>4 mm posterior</td>
<td>forearm abrasion</td>
<td>bed rest, collar</td>
<td>8</td>
<td>myocardial infarction, pulmonary embolism</td>
</tr>
</tbody>
</table>

*Graded according to Anderson and D’Alonzo.*

**TABLE 2**

<table>
<thead>
<tr>
<th>Case No.</th>
<th>Type of Fracture</th>
<th>Displacement</th>
<th>Associated Injuries</th>
<th>Hospitalization (days)</th>
<th>Treatment</th>
<th>Follow-Up Period (mos)</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>II</td>
<td>none</td>
<td>forehead abrasion</td>
<td>24</td>
<td>collar</td>
<td>12</td>
<td>union</td>
</tr>
<tr>
<td>7</td>
<td>II</td>
<td>5 mm posterior</td>
<td>forehead laceration</td>
<td>6</td>
<td>collar</td>
<td>7</td>
<td>non-union, routine activity</td>
</tr>
<tr>
<td>8</td>
<td>II</td>
<td>none</td>
<td>none</td>
<td>7</td>
<td>collar</td>
<td>5</td>
<td>union, stable, died, CVA</td>
</tr>
<tr>
<td>9</td>
<td>II &amp; Jefferson</td>
<td>5 mm posterior</td>
<td>none</td>
<td>29</td>
<td>bed rest, halo</td>
<td>51</td>
<td>non-union, stable, routine activity</td>
</tr>
<tr>
<td>10</td>
<td>II</td>
<td>10 mm posterior</td>
<td>scalp laceration</td>
<td>4</td>
<td>collar</td>
<td>24</td>
<td>union</td>
</tr>
<tr>
<td>11</td>
<td>II</td>
<td>3–4 mm posterior</td>
<td>multiple rib fractures</td>
<td>18</td>
<td>bed rest, collar</td>
<td>25</td>
<td>died, died, cancer</td>
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<tr>
<td>12</td>
<td>III</td>
<td>2 mm posterior</td>
<td>none</td>
<td>18</td>
<td>collar</td>
<td>37</td>
<td>non-union, stable, routine activity</td>
</tr>
<tr>
<td>13</td>
<td>III</td>
<td>none</td>
<td>none</td>
<td>33</td>
<td>bed rest, halo (not tolerated), collar</td>
<td>7</td>
<td>union</td>
</tr>
<tr>
<td>14</td>
<td>III</td>
<td>none</td>
<td>none</td>
<td>15</td>
<td>collar</td>
<td>11</td>
<td>union</td>
</tr>
</tbody>
</table>

*Type of fracture graded according to Anderson and D’Alonzo.* CVA = cerebrovascular accident.

**Management Protocol**

Rigid immobilization consisted of skeletal traction or halo device fixation. Philadelphia collars were used for alternative treatment. Posterior cervical fusion was performed using a modification of the technique of Alexander, et al.,1 or Brooks and Jenkins,4 and involved wiring of C1–2 and fusion with autologous iliac bone grafts. A new illness or death directly attributable to surgery appearing during the initial hospitalization or within 30 days of discharge was identified as a surgical complication.

**Results**

**Patient Mortality**

Five patients (26.3%) died during their initial hospitalization. Their relevant clinical, radiological, and follow-up findings are presented in Table 1. All five patients were treated with flat bed rest; one (Case 4) was placed in skeletal traction without reduction of the subluxation and the other four were managed with Philadelphia collars. In two patients (Cases 3 and 4), death was attributed to flat bed rest; in a third patient, with severe, chronic obstructive pulmonary disease (Case 2), the cause of death was respiratory failure. One patient (Case 5) died from an acute myocardial infarction associated with a pulmonary embolism, and one

(Case 1) suffered cardiopulmonary arrest. No patient sustained a spinal cord injury during hospitalization.

**Nonoperative Treatment**

Five patients with Type II fractures displaced 5 mm or less and all three patients with Type III fractures were treated with cervical immobilization (Table 2). One patient (Case 10) with a displacement of 10 mm refused operative treatment and was included in this group. The mean length of hospitalization was 17.1 days (range 4 to 33 days), with a follow-up period of 19.9 months (range 5 to 51 months). Seven patients were placed in a Philadelphia collar initially; an additional patient (Case 13), who had halo immobilization, developed respiratory compromise and was ultimately treated with a Philadelphia collar. At follow-up review, radiological examinations demonstrated stable non-union in three patients and showed 4-mm motion at the fracture site in one patient. The other five patients demonstrated bone healing. Three patients died of unrelated causes; no patient sustained neurological injury.

**Operative Treatment**

Five patients with unstable Type II fractures and a posterior displacement of 5 mm or greater were treated with posterior cervical fusion (Table 3). The mean length of hospitalization was 24.6 days (range 15 to 32
days), with a follow-up period of 44.8 months (range 24 to 72 months). One patient treated with skeletal traction (Case 17) developed an infection at the pin site and a Philadelphia collar was used for immobilization. No operative complications occurred. At follow-up review, stable constructs were demonstrated in all five patients; three demonstrated stable non-union at the fracture site. One patient died of an unrelated cause; no patient sustained a neurological injury.

**Discussion**

**Odontoid Fractures in the Elderly**

The treatment of fractures of the odontoid process remains a popular and contentious topic. While many reports have described large series of patients,2,12,18,10,27,29 or smaller series,5,6,7,8,10,11,13,17,21,24,28,32 very few have addressed specific problems associated with this age group.5,6,31 Investigators have agreed that the incidence of morbidity, mortality, and non-union at the fracture site is greater in older patients, especially those over 65 years of age.5,6,22,30,31 In this series, a mortality rate of 26.3% and a 30% incidence of non-union in treated cases is in concert with those observations. The majority of our patients sustained their fractures from falls rather than motor-vehicle accidents, which is consistent with findings in previous reports.5,30

Analysis of the clinical characteristics of the patients who died indicated that only one patient (Case 3) sustained additional injury of any severity. Five patients underwent prolonged bed rest; the vulnerability of elderly patients to this position has been described2,20 and was related directly to death in two patients and indirectly in two additional patients. Since none of these patients sustained spinal cord injury at the time of their accident and the cause of death was not related to cord compression, it was concluded that factors such as prolonged bed rest leading to respiratory complications and associated injuries or illnesses, rather than the type or severity of subluxation, contributed to the deaths. This conclusion was reinforced by analysis of the surviving patients. One-third of those patients who underwent prolonged bed rest suffered respiratory complications, while none of the patients who walked early in treatment developed this problem.

In addition to bed rest, surgical techniques for rigid immobilization may not be tolerated in the elderly patient.16,30,31 Two of the three patients in our series developed complications associated with skeletal fixation. Consequently, Philadelphia collars were used successfully for cervical immobilization. Strict skin care was observed during treatment and the collar was re-fashioned or padded as needed.

**Fracture Type, Subluxation, and Treatment**

In our series, all three patients with Type III fractures were treated ultimately with collars; two of these showed healing of their fractures. Although Clark and White9 have suggested that Type III fractures may not be benign, our study confirmed the findings of several others that these fractures may be treated safely and effectively with conservative management.15,16,18,30

Cervical immobilization was used in five patients with Type II fractures and subluxation of 5 mm or less. Although fibrous union only was demonstrated in two patients in this group, radiographic stability provided long-term protection against neurological injury. Since large series of patients have shown increased surgical mortality in the elderly, posterior cervical fusions were limited to patients with displacements of 5 mm or greater who represented acceptable medical risks.3,4,7,5,11,15,17,18,24 Stable constructs developed without morbidity in all five patients so treated. For patients with unacceptable surgical risks, the example of one patient (Case 10) who refused surgery suggests that immobilization with a Philadelphia collar may be an acceptable alternative treatment. However, the high incidence of non-union in patients with subluxation of the dens greater than 5 mm12,19 and the small number of elderly patients in this series with similar radiological findings preclude a recommendation for this conservative regimen as primary treatment.

**Conclusions**

This study demonstrated that fibrous union with stability may be a sufficient goal of treatment in elderly patients with odontoid fractures. For patients with fractures displaced less than 6 mm, rapid mobilization with a Philadelphia collar offered long-term protection.
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against neurological injury. For elderly patients with greater subluxation, posterior cervical fusion achieved similar results. The use of prolonged bed rest and rigid immobilization was associated with significant morbidity. Additional injuries sustained at the time of fracture, respiratory complications during treatment, or concomitant medical illnesses contributed to the mortality in these elderly patients.

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References


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