

Introduction

Odontoid fracture is a common injury, particularly in elderly, fall-prone patients. Previous studies comparing surgical and non-operative management have classified elderly patients as all individuals over 65 years, or those 65-80 years. We compare surgical and non-operative management in octogenarians (>79 years), a medically-distinct population.

Methods

A prospectively maintained trauma database was reviewed for all C2 fractures between 1998-2014. Blinded radiographic review confirmed Anderson/D'Alonzo type II fracture pattern. Outcomes included surgical intervention, cord injury, additional cervical fracture, Glasgow Coma Score (GCS), Abbreviated Injury Scale (AIS), Injury Severity Score (ISS), and 30-day and 1-year mortality. Statistical tests included student's t, Chi-square, Fisher's exact, Kaplan-Meier, Cox proportional hazards.

Results

111 patients with type II fractures were identified. Mortality or 1-year follow-up was available for 100%. Seventeen underwent surgery (20%). Mean age at injury was 87 (range 80-104, 55% female). Mean time to mortality or last follow-up was 22 months (range 0-129). Overall mortality was 26% at 30 days and 41% at 1 year. There was a trend toward longer median survival after surgery (69 vs. 40 months, $p=0.66$), though there was no mortality difference at one year (41% vs 41%, $p=0.98$). Cord injury was associated with 30-day and 1-year mortality (OR=8.3 $p=0.0093$; OR=9.6 $p=0.0122$). GCS, AIS, and ISS were associated with 30-day mortality ($p<0.0001$; $p=0.0015$; $p=0.0029$); GCS and AIS were significantly associated with 1-year mortality ($p=0.0027$; $p=0.0113$). Halo placement and additional cervical fracture were not associated with increased mortality. Surgery was not associated with any outcomes. Kaplan-Meier analysis did not show an association between any variable and survival.

Conclusions

Type II odontoid fracture is highly morbid among octogenarians, with 1-year mortality approaching one-in-two. Neither surgical nor non-operative management is associated with a survival benefit. Cord injury, GCS, AIS, and ISS are significant predictors of poor prognosis.

Learning Objectives

By the conclusion of this session, participants should be able to: 1) Describe the mortality associated with type II odontoid fractures in the elderly, 2) Discuss the evidence regarding operative and non-operative management of type II odontoid fractures, with respect to survival, 3) Highlight statistically significant clinical variables associated with increased mortality in type II odontoid fracture.

Table 1 – Baseline Characteristics of Nonoperative and Surgery Populations

| | Nonoperative (n=94) | Surgery (n=17) | p-value |
|--|---------------------|--------------------|------------|
| Age | 87 (± 5)* | 84 (± 3)* | $p=0.0003$ |
| Percentage female | 54 (57%) \ddagger | 6 (35%) \ddagger | $p=0.1$ |
| Additional cervical fracture | 37 (39%) \ddagger | 6 (35%) \ddagger | $p=0.8$ |
| Cord injury | 3 (3%) \ddagger | 0 (0%) \ddagger | $p=0.5$ |
| Glasgow Coma Scale ≤ 8 | 6 (7%) \ddagger | 1 (6%) \ddagger | $p=0.8$ |
| Glasgow Coma Scale (continuous variable) | 14 (± 3)* | 14 (± 2)* | $p=0.5$ |
| Abbreviated Injury Scale | 3 (± 0.5)* | 3 (± 0.4)* | $p=0.1$ |
| Injury Severity Score | 12 (± 6)* | 13 (± 4)* | $p=0.6$ |
| Halo placement | 5 (5%) \ddagger | 2 (12%) \ddagger | $p=0.3$ |

*Outcome reported as mean (\pm standard deviation)

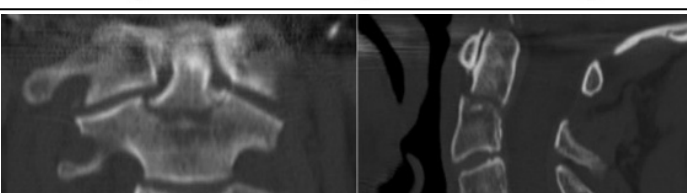
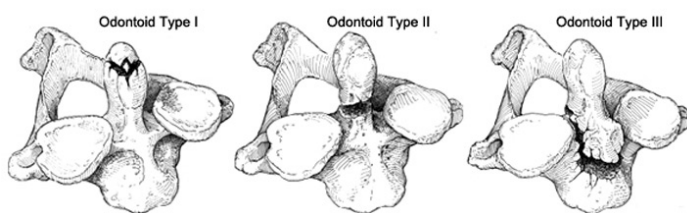
\ddagger Outcome reported as n (%)

Table 2 – Outcomes in Nonoperative and Surgery Populations

| | Nonoperative (n=94) | Surgery (n=17) | p-value |
|--|---------------------|--------------------|---------|
| Mean time to mortality / last follow-up (months) | 21 (± 24)* | 28 (± 32)* | $p=0.3$ |
| Median survival | 40 | 69 | $p=0.7$ |
| 30-day mortality | 25 (27%) \ddagger | 4 (24%) \ddagger | $p=0.8$ |
| 1-year mortality | 39 (41%) \ddagger | 7 (41%) \ddagger | $p=1.0$ |

*Outcome reported as mean (\pm standard deviation)

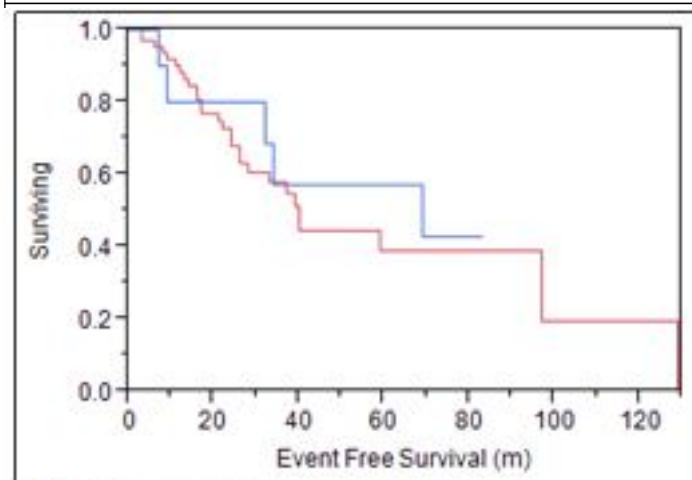
\ddagger Outcome reported as n (%)



Type II odontoid fracture, coronal and sagittal CT

Table 3 – Associations between Patient Characteristics and Outcomes (all patients)

| | 30-Day Mortality | 1-Year Mortality | Cox Proportional Hazards |
|--|------------------------|-----------------------|--------------------------|
| Cord injury | $p=0.005$ (OR=8.3) | $p=0.01$ (OR=9.6) | $p=0.2$ |
| Halo placement | $p=0.1$ | $p=0.4$ | $p=0.3$ |
| Additional cervical fracture | $p=0.7$ | $p=0.9$ | $p=0.9$ |
| Glasgow Coma Scale ≤ 8 | $p=0.005$ (OR=21.9) | $p=0.01$ (OR=10.9) | $p=0.31$ |
| Glasgow Coma Scale (continuous variable) | $p=0.004$ | $p=0.01$ | $p=0.2$ |
| Abbreviated Injury Scale | $p=0.02$ | $p=0.2$ | $p=0.07$ |
| Injury Severity Score | $p=0.04$ | $p=0.07$ | $p=0.7$ |



Red = Nonoperative
Blue = Surgery
 $p=0.7$

References

Fehlings, Michael G., et al. "Predictors of treatment outcomes in geriatric patients with odontoid fractures: AOSpine North America multi-centre prospective GOF study." *Spine* 38.11 (2013): 881.
Smith, Justin S., et al. "Effect of type II odontoid fracture nonunion on outcome among elderly patients treated without surgery: based on the AOSpine North America geriatric odontoid fracture study." *Spine* 38.26 (2013): 2240-2246.