

Mortality following Surgical and Nonsurgical Treatment of Odontoid Fracture among Medicare Beneficiaries and the Influence of Dementia: A Matched Cohort Analysis

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INTRODUCTION:

Type-II odontoid fractures are common among elderly patients due to the increased fragility of the upper cervical spine coupled with the greater incidence of low energy trauma. These fractures increase morbidity and limit physiologic reserve, leading to greater mortality. Current literature suggests lower mortality rates following surgical fixation of odontoid fractures within this population. However, it is unclear whether this reduction in mortality is confounded by the selection of healthier patients for surgery. Dementia represents age-related cognitive impairment that crosses a threshold of deterioration greater than what would be expected for a patient's functional status. Preoperative dementia has been shown to increase the complication profile following elective spine surgery. However, no previous studies have evaluated the association of dementia on outcomes following surgical versus nonsurgical management of type-II odontoid fracture.

METHODS:

The number of days from fracture to date of death was derived by linking claims to the Master Beneficiary Summary File. Comorbidity, including dementia, was calculated with a 90-day lookback prior to Type II odontoid fracture. The Average Treatment Effect among surgically treated patients was reported in comparison to nonsurgically treated patients using a 1:2 nearest-neighbor Mahalanobis matching by age, sex, race, and comorbidity. Robust logistic regressions were used to report the association of dementia on mortality, controlling for age, sex, race, and comorbidity.

RESULTS:

Unadjusted mortality was significantly lower among surgical patients compared to nonsurgical patients: 10.8% vs. 19.0% within 90 days, 17.9% vs. 30.9% at 1 year, 25.9 vs. 41.7 at 2 years, and 35.5% vs. 50.3% at 3 years ($p < 0.001$ at all timepoints). From the matched analysis, mortality remained significantly lower among surgical patients with an average treatment effect of 5.9 percentage points lower than nonsurgical patients at 90 days (95%CI -7.5; -4.3), 8.5 percentage points lower at 1 year (95%CI -10.5; -6.4), 8.9 percentage points lower at 2 years (95%CI -11.7; -6.2), and 9.4 percentage points lower at 3 years (95%CI -13.6; -5.3). Dementia was strongly associated with mortality (OR 1.96; 95%CI 1.69 - 2.27; $p < 0.001$).

DISCUSSION AND CONCLUSION: While the risk of mortality is greater in patients with dementia, surgically treated Medicare beneficiaries with Type II odontoid fractures still have a lower mortality rate through four years compared to nonsurgical patients in a matched analysis.

Table 2: Mortality of operative and non-operative treatment of Medicare beneficiaries with odontoid fractures.

	Mortality
90 days	
Crude rate nonoperative, %	19.0
Crude rate operative, %	10.8
Operative vs. non-operative, ppt (95%CI) p-value	-9 (-7.5, -4.3) p<0.001
1 year	
Crude rate nonoperative, %	30.9
Crude rate operative, %	17.9
Operative vs. non-operative, ppt (95%CI) p-value	-8.5 (-10.5, -6.4) p<0.001
2 years	
Crude rate nonoperative, %	41.7
Crude rate operative, %	25.9
Operative vs. non-operative, ppt (95%CI) p-value	-8.9 (-11.7, -6.2) p<0.001

ppt = percentage point difference.

Relative effect based on average treatment effect among the surgically treatment patients from propensity matched analysis of surgical cohort matched 1:2 to non-surgical cohort on age, sex, race, comorbidity, and dementia.

Table 1: Demographic characteristics of operative and non-operative treatment of Medicare beneficiaries with odontoid fractures.

Characteristic	Nonoperatively treated (n = 18,979)	Operatively treated (n=3,166)	p-value
Age, mean (sd)	84.0 (8.2)	79.2 (7.2)	<0.001
Female, %	59.7	57.0	<0.001
Race, %			0.078
	White	96.2	95.4
	Black	1.7	2.6
	Other	1.1	2.6
Charlson Comorbidity Index, %			<0.001
	None	26.6	23.0
	1	22.8	23.1
	2+	50.6	53.9
Osteoporosis, %	9.8%	10.8%	0.016
Dementia, %	21.8%	22.3%	0.528
Cardiovascular disease, %	14.2%	14.5%	0.125