



Original Article

One-year follow-up for type II odontoid process fractures in octogenarians: Is there a place for surgical management?

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ABSTRACT

Background: Type II odontoid fractures are becoming one of the most common injuries among elderly patients and are associated with increased morbidity rates. Here, we compared the safety/efficacy of conservative versus surgical treatment for type II C2 fractures and, in particular, evaluated the complications, hospital lengths of stay, and mortality rates for patients over 80 years of age.

Methods: We retrospectively reviewed the records of 63 nonsurgically versus 18 surgically treated C2 fractures in patients over 80 years of age (2003–2018). Cervical computed tomography images, X-rays, and magnetic resonance images were reviewed by both a neurosurgeon and a neuroradiologist. The following patient data were included in the analysis; Glasgow Coma Scale score, injury severity score, the abbreviated injury scale scores, their comorbidities (e.g., utilizing the Charlson comorbidity index), their primary outcomes, and mortality rates (e.g., at 6 weeks and 1 year after treatment).

Results: Eighty-one patients were included in the study; 63 were treated conservatively and 18 underwent surgical management of type II C2 fractures. Patients averaged 87.0 ± 5.0 years of age, and their combined mortality rates were 13.6% at 6 weeks and 25.9% at 1 year. Notably, at 1 year, the mortality rates were not statistically different between the two groups: 18 (30.0%) patients from the conservatively treated group versus 3 (16.7%) patients from the surgically managed patients died indicating (e.g., using the Kaplan–Meier analysis) no survival advantage for either treatment strategy.

Conclusion: Surgical versus conservative management of type II odontoid fractures were associated with comparable high mortality rates at 1 year.

Keywords: Complications, Mortality, Nonoperative management, Octogenarians, Odontoid fractures, Surgical management

INTRODUCTION

Odontoid fractures are the most common fracture of the axis, the most common cervical spine fracture in the elderly and represent approximately 20% of all cervical fractures. Further, type II fractures (according to the classification of Anderson et D'Alonzo) represent more than 60% of all C2 fractures.^[1]

Nonsurgical treatment using a rigid collar carries a significant risk of nonunion, fibrous union (pseudarthrosis),^[6] and increased morbidity, while surgical management has its own significant

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morbidity/mortality rates.^[8] We have compared the clinical outcomes and mortality rates for utilizing conservative versus surgical treatment of type II fractures in octogenarians and compared our data with the 30-day mortality rate in the literature of that goes up to 25% and the 1-year mortality rate that approaches 50%.

MATERIALS AND METHODS

Data acquisition

We retrospectively collected demographic data and assessed clinical scores e.g., the Glasgow Coma Scale, the abbreviated injury scale, the injury severity score (ISS), and the Charlson comorbidity index for 63 nonsurgically versus 18 surgically treated C2 fractures in patients over 80 years of age (2003–2018) [Table 1].

Mortality rates were recorded at 6 weeks and 1 year in both groups and correlated with clinical scores, the type of treatment received, the length of hospital stay (LOS), and complication rates [Table 2].

Patient population

We retrospectively reviewed a cohort of 81 consecutive patients older than 80 years old with type II C2 fractures (2003 and 2018); complete data were available for 96.3% of the patients [Table 1]. Cervical computed tomography images, X- gists and a neurosurgeon, who confirmed the presence of type II cervical fracture (Anderson and D'Alonzo classification).^[1]

Sixty-three patients (77.8%) were managed with a rigid cervical collar; of these, three patients, x-rays, and magnetic resonance imaging (MRI) were reviewed by both a neuroradiologist and a neurosurgeon, who confirmed the presence of type II cervical fracture (Anderson and D'Alonzo classification).^[1]

Eighteen (22.2%) patients had surgery; 14 patients underwent posterior C1-C2 fusion (Harms technique), while 4 had anterior odontoid screw fixation [Figure 1].

The mean age was 87 years old in both groups (range 80-99 years), but patients were significantly older in the conservative group [Table 1; 87.8 vs. 84.2 $P = 0.005$]. An associated spinal cord injury was found in only 6.2% of all

Table 1: Demographic and clinical characteristics in nonoperative and surgical populations.

	Surgical treatment (n=18)	Conservative treatment (n=63)	Total (n=81)	P-value
Mean age (year)	84.2±3.5	87.8±5.0	87.0±5.0	0.005
Gender (male)	9.0 (50.0)	23.0 (36.5)	32.0 (39.5)	0.3
Mechanism of the trauma				
Fall	17.0 (94.4)	56.0 (88.9)	73.0 (90.1)	
Motor vehicle accident	1.0 (5.6)	3.0 (4.8)	4.0 (4.9)	0.9
Other	0	4.0 (6.3)	4.0 (4.9)	
Additional cervical fracture	5.0 (27.8)	12.0 (19.0)	17.0 (21.0)	0.4
Spinal cord injury	1.0 (5.6)	4.0 (6.3)	5.0 (6.2)	0.9
Mean GCS at admission	14.9±0.2	14.5±2.1	14.6±1.9	0.4
Mean Charlson comorbidity index	5.3±1.7	5.6±1.7	5.6±1.7	0.5
Mean abbreviated injury scale	3±0	3.1±0.4	3.1±0.4	0.4
Mean injury severity score	10.0±2.9	10.7±4.5	10.6±4.2	0.5

GCS: Glasgow coma scale. Continuous variables are displayed as mean±standard deviation; categorical variables are displayed as numbers (percentages); statistically significant P-values are in bold (comparison between both groups)

Table 2: Outcomes in nonoperative and surgery populations.

	Surgical treatment (n=18)	Conservative treatment (n=63)	P-value
Hospital stay (day)	14.2±9.2	9.3±7.0	0.02
Conversion to surgical treatment	0	3.0 (4.8)	
Overall mortality	3.0 (16.7)	18.0 (30.0) [†]	0.3
In-hospital mortality	1.0 (5.6)	6.0 (9.5)	
Six-week mortality	1.0 (5.6)	10.0 (15.9)	
One-year mortality	3.0 (16.7)	18.0 (30.0) [†]	

[†]Missing data (n=3)

Continuous variables are displayed as mean±SD; categorical variables are displayed as numbers (percentages); statistically significant P-values are in bold (comparison between both groups)

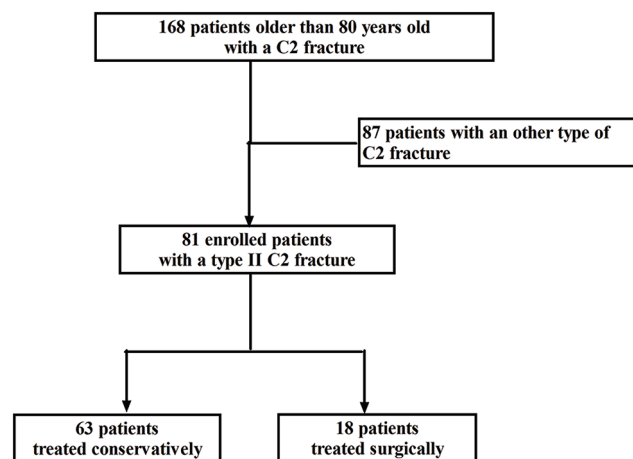


Figure 1: Workflow of the study.

patients from both groups (5.6% and 6.3% for surgical and nonsurgical groups, respectively, $P = 0.9$) [Table 1].

Statistical analysis

Categorical variables were expressed as n (%), and continuous variables were expressed using the mean \pm standard deviation. Statistical analysis included Student's t -test and Fisher's exact test. Long-term survival analysis was performed using the Kaplan–Meier method.

RESULTS

Data of both groups showed a longer LOS for surgical patients 14.2 ± 9.2 days versus the nonoperative group LOS of 9.3 ± 7.0 days ($P = 0.02$) [Table 2]. The 6-month and 1-year mortality rates for the surgical versus nonsurgical patients were comparable. The overall mortality rate at 6 months was 5.6% for the surgical group versus 9.5% for the conservatively treated group; at 1 year, the mortality rate was 16.7% with surgery versus 30.0% without surgery. Although the Kaplan–Meier analysis did not show any significant survival advantage for either treatment population, this analysis must take into account the extremely small number of just 18 patients in the surgical group [Figure 2].

Major general complication rates were comparable for both groups; eight surgical patients (44.0%) versus 22 patients (35.0%) in the conservative group; rates were comparable for both groups: ($P = 0.6$) [Table 3].

DISCUSSION

Odontoid type II fracture in octogenarians is associated with high mortality rates, with an overall 1-year mortality of up to 26%.^[2,5,7] In 1993, Hanigan *et al.* found a 1-year

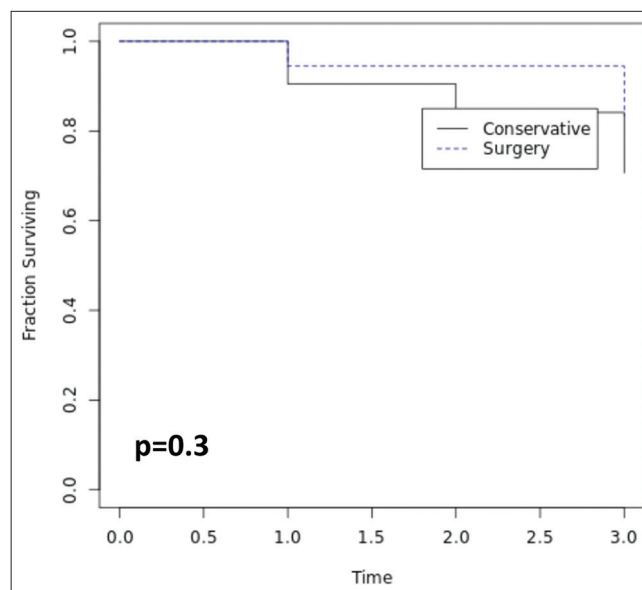


Figure 2: Kaplan–Meier survival analysis comparing nonoperative and operative groups. Times 1.0, 2.0, and 3.0 represent in-hospital mortality, 6-week mortality, and 1-year mortality, respectively.

Table 3: Complications in nonoperative and surgery populations.

	Surgery (18)	Conservative (63)	P-value
All complications	8 (44.4)	22 (35.0)	0.6
Hematological			
Postoperative transfusion	3 (16.7)	-	
Neurological			0.3
Confusion	1 (5.6)	2 (3.2)	
Drug intoxication	0	1 (1.6)	
Stroke	1 (5.6)	0	
Pulmonary			0.5
Pneumonia	1 (5.6)	6 (9.5)	
Respiratory failure	0	2 (3.2)	
Pulmonary Edema	0	1 (1.6)	
Cutaneous			1
Bedsore	1 (5.6)	5 (7.9)	
Cardiologic			1
Myocardial infarction	1 (5.6)	4 (6.3)	
Gastro-intestinal			1
Paralytic ileus	0	1 (1.6)	

Categorical variables are displayed as numbers (percentages); statistically significant P -values are in bold (comparison between both groups)

mortality rate of 56% and a nonsignificant difference in mortality between surgical versus nonsurgical groups; they concluded that dens displacement of > 5 mm was a clear

surgical indication.^[5] Schoenfeld *et al.* compared mortality rates for the surgery versus no surgery in patients 75–84 years of age versus >85 years old; the overall mortality rate was 31% at 1 year, and mortality rates were comparable for both operatively and conservatively treated groups (21% vs. 36%, $P = 0.06$).^[7] Chapman *et al.* also suggested that the surgical treatment of type II odontoid fracture did not impact overall survival even when adjusted for age, sex, and comorbidities.^[2] Gembruch *et al.* found comparable outcomes and mortality rates for managing type II fractures at 3 postoperative months; the mortality rate was 27.8% for surgical versus 20.0% for those treated conservatively.^[3] Finally, Graffeo *et al.* mortality rate at 1 year were 41%, with no differences between the two groups (41 vs. 41, $P = 1.0$ [operative vs. nonoperative, respectively]).^[4]

CONCLUSION

Surgical versus conservative management of type II odontoid fractures were associated with comparable high mortality rates at 1 year. Based on our very small sample size of just 18 patients undergoing surgery for type II odontoid fractures versus 63 treated nonoperatively, we cannot offer a definitive recommendation for the optimal management of type II odontoid fractures in patients over 80 years of age.

Declaration of patient consent

Patient's consent is not required as patients identity is not disclosed or compromised.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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