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SURGICAL NEUROLOGY INTERNATIONAL
SNI: Spine, a supplement to Surgical Neurology International
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Editor: Nancy E. Epstein, MD Winthrop University Hospital, Mineola, NY, USA

Commentary

Commentary on the management of type II odontoid process fractures in octogenarians: Article by Graffeo *et al*. and Editorial by Falavigna (J Neurosurgery Spine August 19, 2016)

Nancy E. Epstein

Department of Neuroscience, Winthrop Neuroscience, Winthrop University Hospital, Mineola, New York, USA

E-mail: *Nancy E. Epstein - nancy.epsteinmd@gmail.com
*Corresponding author

Received: 02 September 16 Accepted: 16 September 16 Published: 21 November 16

Abstract

Background: Establishing a clear treatment paradigm for octogenarians with type II odontoid fractures in hampered by a literature replete with level III articles.

Methods: In the study by Graffeo *et al*., the authors evaluated 111 patients over the age of 79 (average age: 87) with type II odontoid fractures undergoing nonoperative (94 patients) vs. operative intervention (17 total; 15 posterior and 2 anterior). They studied multiple variables and utilized several scales [abbreviated injury scale (AIS), injury severity score (ISS), and the Glasgow coma scale (GCS)] to determine the outcomes of nonoperative vs. operative management.

Results: Graffeo *et al*. concluded that there were no significant differences between nonoperative and operative management for type II odontoid fractures in octogenarians. They found similar frequencies of additional cervical fractures, mechanisms of injury, GCS of 8 or under, AIS/ISS scores, and disposition to "nonhome" facilities. Furthermore, both appeared to have increased mortality rates at 1-year post injury; 13% during hospitalization, 26% within the first post-injury month, and 41% at 1 year.

Conclusions: In the editorial by Falavigna, his major criticism of Graffeo's article was the marked disparity in the number of patients in the operative (17 patients) vs. the nonoperative group (94 patients), making it difficult to accept any conclusions as "significant." He further noted that few prior studies provided level I evidence, and that most, like this one, were level III analyses that did not "significantly" advance our knowledge as to whether to treat octogenarians with type II odontoid fractures operatively vs. nonoperatively.

Key Words: Cons, conservative management, pros, octogenarians, odontoid fractures, surery, type II

Access this article online
Website: www.surgicalneurologyint.com
DOI: 10.4103/2152-7806.194515
Quick Response Code:

INTRODUCTION

Falavigna's critique of the radiographic diagnosis of type II fractures in the Graffeo *et al*. study

In "Deadly falls: Operative versus nonoperative management of Type II odontoid process fracture in octogenarians" (J Neurosurgery Spine, 2016; August 19), Graffeo *et al*. retrospectively evaluated the management of type II odontoid fractures in 111

How to cite this article: Epstein NE. Commentary on the management of type II odontoid process fractures in octogenarians: Article by Graffeo *et al*. and Editorial by Falavigna (J Neurosurgery Spine August 19, 2016). Surg Neurol Int 2016;7:S901-4.
http://surgicalneurologyint.com/Commentary-on-the-management-of-type-II-odontoid-process-fractures-in-octogenarians:-Article-by-Graffeo-*et-al*.-and-Editorial-by-Falavigna-(J-Neurosurgery-Spine-August-19,-2016)/

octogenarians (e.g., patients over the age of 79, average age of 87) between 1998 and 2014; 94 patients were treated nonoperatively whereas 17 underwent surgery.[5] Confirmation of type II fractures was provided by two independent neurosurgical residents blinded to the study design; disparate opinions regarding the radiographic diagnosis were resolved by an attending neurosurgeon. In Falavigna's editorial, "Management of Type II Odontoid Process Fracture in Octogenarians" (J Neurosurgery Spine, 2016; August 19), he criticized the study's lack of specific criteria for documenting type II fractures; Graffeo *et al.* just referenced the article by Anderson and D'Alonzo.[1,3]

Similar clinical/other data for Graffeo *et al.* nonoperative vs. operative management of type II odontoid fractures

There were no significant differences in some of the basic clinical data in Graffeo *et al.*, i.e., nonoperative vs. operative populations. Although patients averaged 87 years of age (range: 80–104), there was a "small but significant

Table 1: Summary of nonsurgical vs. surgical results for treatment of type II odontoid fractures in octogenarians

Study	Number of Patients	Nonoperative management	Operative Management	Outcomes Mortality
Hanigan *et al.*[6] 1993	11 Type II Retrospective Followed 28.8 months	1 Halo 5 Hard Collars	5 Posterior Fusions	5 in-hospital deaths (26.3%: prolonged bed rest. medial illnesses) 1 year; 9 died. Mortality comparable for both groups
Smith *et al.*[12] 2008	72 Type II Neurologically intact Retrospective Cohort study	40 nonsurgical treatment 35% Significantly <at least one complication Significantly <LOS 11.2 days	10 Anterior 22 Posterior 62% Significantly >at least one complication Significant >>LOS 22.8 days	Comparable mortality both groups 15% nonoperative 12% operative Substantial morbidity mortality with or without surgery
Henaux[8] 2012	11 Type II B Anterior screw fixation	None	11 Anterior screw fixation No operative morbidity or mortality	1-year mortality 18% Bony union 4 patients Stable fibrous union 5 patients Outcomes; 5 Excellent; 2 Good 1 Fair; 3 Poor 2 Deaths: unrelated causes 2 months
Boakye *et al.*[2] 2012	3758 Type II All ages Nationwide Inpatient sample No cord injury Retrospective	Halo bracing Overall complication rate 10.1% Shorter LOS 6.4 days >nonhome discharge 62.2%	Surgery Complication rates 20.2% >LOS 8.9 days <nonhome discharge 52.6%	Same hospital mortality for both groups; no difference in mortality Fusion 2.75% vs. Halo 3.33% Complications 3.5 Times Greater in Patients over 80 with/without surgery vs. patients under 60
Schoenfeld *et al.*[11] 2011	156 over 65 years of age Average age 82 Retrospective Ages 65-74 Older 75-84 Over 85	112 Nonoperative (72%) 25% mortality 3 months 36% mortality one year	44 Surgical 11% mortality at 3 months 21% mortality one year	Overall decreased mortality in surgery groups at 1 year (25% vs. 36%) Overall mortality 39% at 3 years Protective effect surgery age 65-74 High mortality regardless of intervention technique
Fehlings *et al.*[4] 2013	159>65 old Type II 6-12 month follow up	58 (36.5%)	101 (63.5%)	44 Successful outcomes (27.7%) 86 (54.1%) Treatment failures Correlated with older age, initial non operative management and male sex 29 patients; no determined 29 (18.2%) mortality before 12 months Failure older age (odds ratio: 1.08 for each year of age)
Pal *et al.*[9] 2011	Review: >65 Type II Followed 12 months 124/126 Class III studies	> Morbidity long duration bracing Satisfactory Type I and Type III fractures	Optimal management Type II fractures; Not resolved	Favored surgery Type II Adequacy fibrous vs. bony union Risks delayed myelopathy outweighs risk of surgery Insufficient evidence for standard of care for odontoid fractures/elderly

increase in age" for those treated nonsurgically.[5] There were more females in the nonoperative group; however, this difference was not significant ($P = 0.1$). Multiple other surgical/outcome variables for the two populations were also similar. These included the three mechanisms of injury, the frequency of additional cervical fractures, the incidence of Glasgow scores of 8 or under, the extent of injury assessed by the abbreviated injury scale (AIS) or injury severity score (ISS), and the dispositions to "nonhome facilities."

Falavigna's criticism of Graffeo *et al.* study; disparate number of patients in nonoperative vs. operative groups

Of the original 111 patients in Graffeo *et al.* series, 94 were treated nonoperatively (e.g., hard cervical collars used in 85% of patients), whereas 17 had surgery (15 performed posteriorly, and 2 anteriorly). The 15 posterior fusions of C1-C2 utilized Harms and Melchier's segmental polyaxial screw fixation/rods technique.[7] Notably, the 2 patients who initially underwent anterior odontoid screw fixation both exhibited postoperative pseudoarthroses warranting secondary posterior fusions.[10]

Falavigna criticized the study for the large disparity in the number of patients in the nonoperative vs. operative groups, noting that the study design severely limited "statistical analysis." He also commented that the authors failed to utilize uniform "guidelines" as to which treatment modalities were chosen (e.g., surgeon's experience/preference appeared to largely determine the management strategy). Furthermore, adequate information regarding other critical variables was lacking; e.g. the ultimate fusion status of patients in the two groups, the time elapsed since type II fractures occurred, patients' attendant comorbidities/medical risk factors, and the initial and final neurological status of patients.

Similar mortality rates in Graffeo *et al.* series with/without surgery

The average survival for both groups in Graffeo *et al.* series was 22 months (range: 0–129 months).[5] Despite a "trend toward shorter median survival in the nonoperative population," there were no significant differences in survival rates for the nonoperative vs. operative groups.[4] In fact, for both the groups, the overall mortality rate was 13% during the hospitalization, 26% within the first post-injury month, and 41% at the end of the first post-injury year. Notably, these mortality rates were significantly higher than for patients without type II odontoid fractures in their 80s and successive two decades.

Falavigna also criticized Graffeo *et al.* for summarily concluding outcomes and mortality rates for octogenarians with type II fractures were comparable with/without surgery based on retrospective data collected at just one institution.[3,5] Falavigna did cite comparable mortality rates for octogenarians treated nonoperatively 11–38% vs. operatively (15–51%) collected from multiple studies, the majority of which were level III analyses like this one [Table 1].[2,4,6,8,9,11,12]

Recommendation for future analyses

At the end of his analysis, Falavigna cited the potential future advantages of a prospective randomized study (e.g., level I) to better determine optimal treatment for type II fractures in octogenarians. Reviewing the article by Graffeo *et al.* and editorial by Falavigna reminds us that many level III studies have fundamentally flawed study designs. In this case, the study by Graffeo *et al.* was a retrospective level III analysis that included an extremely small number of patients in the operative vs. nonoperative group, and spuriously came to the conclusion, without an adequate study design, that nonoperative and operative outcomes of Type II odontoid fracutres were comparable. In fact, this article would have been improved had the editor originally recommended the authors exclude the small operative group entirely, and only focus on improving their presentation of the clinical, radiographic, and nonoperative management of type II odontoid fractures in octogenarians.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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