



Management of upper cervical spine fractures in elderly patients: current trends and outcomes

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KEYWORDS

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ABSTRACT

Upper cervical spine fractures in the elderly represent serious injuries. Their frequency is on the rise. Their early accurate diagnosis might be compromised by the existence of extensive degenerative changes and deformities. Adequate stabilisation allowing fracture healing is of paramount importance. However, the debate is ongoing as to the best protocol that can be applied taking into consideration the presence of comorbidities and the increase risk of mortality in this frail patient population. A literature review, based on PubMed, related to protocols reporting on fracture fixation of the upper cervical spine, fractures (C1–C2) was carried out. Papers including information about type of fracture, treatment carried out, complication rates, mortality and morbidities were eligible to be included in this study.

Fourteen papers met the inclusion criteria. Six reported on all types of injuries of the upper cervical spine, and eight only odontoid fractures (C2). Overall mortality rate ranged between 0 to 31.4%. Overall morbidity rate was from 10.3 to 90.9%. No significant difference was identified between three types of treatment (rigid collar cuff without fracture reduction, halo cast with reduction of fracture displacement, and surgical treatment). Halo-cast got the highest rate of complications. Surgical treatment got a mortality rate from 0 to 40.0%, and a morbidity rate from 10.3 to 62.5%. Non-union rate ranged between 8.9 to 62.5%.

Elderly patients with upper cervical spine fractures must be notified that these injuries are associated with high incidence of non-union, morbidity and mortality.

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Introduction

Fractures of the upper cervical spine in elderly patients are rising globally mainly due to the increased life expectancy noted in this patient population. These injuries are secondary to low energy trauma and the underlying bone is characterised by osteopenia and degenerative changes [1]. The risk of neurological deficit is high including the likelihood of fatality in a very fragile patient. Involvement of the upper cervical spine has been reported to be around 69% of all fractures of the cervical spine in elderly, in contrast to 36% in young adults [2]. Among these injuries, odontoid fractures are the most common ones. They represent over 50% of the injuries listed in patients over 80 years old [3]. Unfortunately, it is a commonly missed injury because most patients are asymptomatic. Furthermore,

radiologic diagnosis is also difficult as the upper cervical spine in the elderly is always modified due to degenerative arthritis involving the anterior and posterior segment of the vertebra. In addition, fixed deformities are not uncommon. Consequently, radiologic landmarks used for screening are missing and positive diagnosis of trauma of the upper cervical spine in the elderly may lead to misdiagnosis. To avoid under diagnosis, upper cervical spine fracture must be systematically excluded in every elderly patient suffering from head injury, and for this reason some authors recommend the acquisition of routine CT-scan of the C1 and C2 vertebra [1,3].

Once diagnosis is made, therapeutic options in the elderly are still controversial [3–5]. Three main types of treatment are used in daily orthopaedic practice: rigid cervical collar immobilisation (CC) without fracture reduction, Halo-vest (HV) and equivalent management with progressive fracture reduction, and surgical treatment (ST) which includes aggressive approach based on the fracture type [6]. The aim of the study was to review the literature in order to evaluate the morbidity and mortality rates of each treatment protocol in elderly patients suffering from upper cervical spine fracture.

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Table 1
Upper cervical spine trauma management in elderly patients

			N	Age	Level	Non-operative treatment						Surgical treatment		
						Cervical collar			Halo-vest			N	Mortality	Complications
						N	Mortality	Complications	N	Mortality	Complications			
Tashjian et al. [12]	2006	Series	78	80.7 ± 0.9	O	27	7 (26%)		38	16 (42%)	25 (66%)	13	0 (0%)	
Smtih et al. [19]	2008	Series	72	85.5 ± 3.5	O (II)	40	6 (15%)	14 (35%)	0			32	4 (12.5%)	20 (62%)
Jackson et al. [7]	2005	Series	9	> 65	UCS	0						9	0 (0%)	
White et al. [21]	2010	MA	366	> 65	O	0			0			366	37 (10.1%)	127 (37.5%)
Sokolowski et al. [8]	2007	Series	75	> 65	UCS	66	6 (9.1%)					9	0 (0%)	
Daentzer et al. [9]	2009	Series	11	75 (67–82)	UCS	0			11	0 (0%)	10 (90.9%)	0		
Kuntz et al. [14]	2000	Series	20	80 (66–92)	O (II)	2	0 (0%)	0 (0%)	10	1 (10%)	2 (20%)	11	1 (9.1%)	2 (18.2%)
Frangen et al. [15]	2007	Series	27	86 (63–98)	O	0			0			27	6 (22.2%)	8 (29.6%)
Omeis et al. [10]	2009	Series	29	> 70	UCS	0			0			29	1 (3.4%)	3 (10.3%)
Schoenfeld et al.* [17]	2011	Series	156	82 (65–101)	O (II)	84	22 (26.2%)		28	6 (21.4%)		44	5 (11.4%)	
							31 (36.9%)			9 (32.4%)			9 (20.5)	
Muller et al. [18]	1999	Series	23		O	15	4 (26.7%)	4 (26.7%)	3	1 (33.3%)	1 (33.3%)	5	2 (40.0%)	3 (60.0%)
Koeh et al. [20]	2008	Series	42	80 (67–91)	O (II)	10	0 (0%)	1 (10%)	32	0 (0%)	5 (15.6%)	0		
Weller et al. [6]	1997	Series	10	(70–85)	UCS	3	0 (0%)		7	2 (28.6%)		0		
Olerud et al. [11]	1999	Series	35	(66–99)	UCS	9		0 (0%)	0			26		7 (26.9%)

*Follow-up at 3 months and 1 year.

MA, meta-analysis; O, odontoid; UCS, upper cervical spine.

Materials and methods

A systematic review of the international literature was conducted using PubMed. Inclusion criteria were articles published either in French or in English between 1995 and 2011 and evaluating the morbidity-mortality rates of the three treatment protocols in elderly patients over 65 years of age. Only papers where complete clinical data were available were included. The PubMed research was made using the keywords: 'fracture, cervical spine, elderly'. Studies were pre-selected depending on their title and abstract. Case series were included as well as original papers, as long as they met the inclusion criteria. Using the pre-selection criteria, each study that would not allow collection of precise data concerning elderly patients over 65 years of age was excluded. We included articles evaluating the treatment of upper cervical spine fractures but also those evaluating only fractures of the Atlas (C1) or the Axis (C2) especially the fracture of the odontoid. On the contrary, articles evaluating the management of cervical spine (C1–C7) fracture were excluded if it was not possible to collect precise data on the modalities and results for the upper cervical spine injuries.

In order to be able to compare each treatment protocol, we have analyzed different items for outcome: type of fracture, patient's age, number of patients, choice of treatment, morbidity and mortality rates according to the treatment. Results were expressed in percentage of patients treated in each group in each study (Table 1).

Results

Fourteen [2–4,6–16] articles were selected in total, according to the criteria described. Six of them [6–11] focused their content on the type of fracture and management of the upper cervical spine, and eight articles [2–4,12–16] evaluated specifically the odontoid fracture out of which four [2,5,11,16] reported only on fractures Type II according to the Anderson-Alonzo classification [16].

Only four articles [5,14,17,18] compared the three treatment options amongst to each other. Three articles [8,11,19] compared the surgical treatment to the non-operative treatments options, one article [5] compared the treatment of halo-vest to the other

two treatment options and two articles [6,20] compared the treatment by rigid cervical collar to the halo-vest immobilization. Four studies [7,10,15,21] analyzed the morbidity and mortality rates after surgical treatment and one study [9] analyzed the morbidity and mortality rates of the halo-vest immobilization. All the articles were retrospective studies. One article was written in the form of meta-analysis whereas the other thirteen were case series.

Global mortality rate for upper cervical spine fractures, whatever was the treatment, varied from 0% to 31.4%. Global morbidity rate varied from 10.3% to 90.9%, without any significant difference between treatments. For the non-operative treatment options (CC or HV), complication rate varied from 0.0% to 90.9%, with a mortality rate ranging from 0.0% to 42.1%. In studies where specific analysis of each treatment was available, cervical collar (CC) complication rate varied from 0.0 to 44.4%, and Halo-Vest (HV) complication rate from 15.6% to 90.9%. There was also a difference in the mortality rate between the two treatments, with a trend to a lower rate for CC, which varied from 0.0% to 35.0%, compared to HV mortality rate, which varied from 0.0% to 42.1%. Only 2 studies [9,12] reported on HV complications in elderly patients. Morbidity rate was 66% and 90.9%, and mortality rate 42% and 0.0% respectively.

The surgical treatment was responsible for a global morbidity between 10.3% and 62.5% and a global mortality between 0.0% and 40.0%. In the four articles [6,7,10,15] analyzing specifically the morbid-mortality of the surgical treatment, the morbidity varied between 10.3% and 37.5% and the mortality between 0.0% and 22.4%.

Four articles [6,11,12,20] have defined the fracture's non-union rate. The rate ranged from 8.9% to 62.5% without any significant differences between each treatment modality. In detail, the non-union rates were 8.9%, 15.4% and 65.5% for the surgical treatment, 33.3%, 44.4% and 50% for the cervical collar (CC) and 62.5% for the halo-vest (HV).

Discussion

The occurrence of an upper cervical spine fracture in an elderly patient is associated with a high rate of morbidity and mortality.

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