CERVICAL SPINE INJURIES IN THE ELDERLY

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We reviewed 41 patients over the age of 65 years (mean 76.5) who had suffered cervical spine injuries, 12 of them with neurological deficit. Eleven patients died during treatment, mostly from respiratory disease. Seven patients were treated by surgical stabilisation, five by halo traction, and the rest by rigid collars or halo-vests. The cervical injury was missed at the first examination in four patients.

We conclude that most injuries can be treated by a rigid collar, and that the use of a halo-vest or surgical stabilisation are effective alternatives. Bed rest and traction are poorly tolerated by old people. There should be a high index of suspicion that any elderly patient who presents with a history of a fall or minor trauma may have a cervical spine injury.

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Very little information has been published regarding the treatment and outcome of cervical spine injuries in the elderly. There are a few articles which deal specifically with odontoid fractures (Pepin, Bourne and Hawkins 1985; Hanigan et al 1993), but to obtain information about subaxial injuries one must extrapolate from articles on patients from a wide age spectrum, and which include only a few elderly patients.

Our aim was to determine the mortality and morbidity of cervical spine injuries in the elderly and to ascertain the best methods for their treatment.

PATIENTS AND METHODS

We found that 234 patients with cervical spine injuries had been admitted to the Queen's Medical Centre, Nottingham between January 1982 and January 1993; 46 of these were more than 65 years old. We retrieved their hospital charts, post-mortem reports and radiographs and

when these notes were incomplete we contacted the general practitioners and nursing homes for further information. We were able to obtain complete data on 41 patients, which we attempted to review. Most, however, had either died from causes related or unrelated to their cervical spine injury or were too ill to return to hospital for review. In these cases we relied upon the orthopaedic surgeon's last clinical assessment and the general practitioner's evaluation to determine the clinical outcome.

We recorded the patient's age at the time of injury, the mechanism, pattern and level of injury, any neurological deficit and associated systemic injuries. We noted the previous medical and surgical history, the initial and subsequent treatment of the cervical injury, and the complications and duration of treatment. Outcome was recorded in terms of return to preinjury status, the resolution of neurological deficit and the healing of the bone and soft-tissue injuries.

We reviewed the post-mortem reports of the patients who had died during treatment to determine the extent to which the cervical spine injury had contributed to death. We examined the radiographs to verify the diagnosis and pattern of injury recorded in the notes and to assess the final outcome.

There were 23 men and 18 women and their ages ranged from 65 to 91 years (mean 76.5).

RESULTS

A fall in the home was the cause of injury in 32 of the 41 patients. Eight were pedestrians involved in a vehicle accident and one was injured while a passenger in a motor vehicle (Table I). Two patients had two fractures.

There were 16 odontoid injuries, 11 type 2 and five type 3 as classified by Anderson and D'Alonzo (1974). There were three Jefferson's fractures (Jefferson 1927), one isolated, one in combination with a C2-C3 bilateral facet-dislocation, and one in combination with an odontoid type-3 fracture. There were three 'hangman's' fractures. In the subaxial spine there were four compression-type injuries, three extension injuries, 12 bilateral facet-dislocations, and two unilateral facet-dislocations (Table I). Two patients had two fractures.

Twenty-six patients had no neurological deficit. Of the 12 patients with nerve injury, eight had no recovery. These included three complete quadriplegics two of whom died, one progressive quadriparetic who also died, two other quadriparetics, one patient with a Brown-Sequard

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Table I. Details of 41 patients with cervical spine injuries

Case	Age (yr)	Date of admission	Sex	Mechanism of injury	Injury	Neurology	Treatment	Outcome/neurology
1	80	1/82	F	Fall	C4 compression	—	Collar	Stable
2	86	4/83	F	Fall	Odontoid 2	—	Collar	Died
3	73	12/83	F	RTA*	Odontoid 2	—	Collar	Stable
4	74	2/84	F	Fall	C6–C7 bilat facet-disloc	Complete quadriplegia	Collar	Died
5	74	2/84	F	PVA†	Odontoid 3	—	Collar	Stable
6	79	3/84	M	PVA	C6–C7 bilat facet-disloc	—	Collar	Died
7	72	1/85	F	Fall	C6–C7 bilat facet-disloc	—	Collar	Stable
8	74	3/85	M	Fall	C4–C5 compression	Not known	Collar	Died
9	67	6/85	M	Fall	Odontoid 2	Quadriplegia	Surgery	Stable Resolved
10	75	8/85	F	Fall	Odontoid 2	—	Collar	Stable
11	82	11/85	F	PVA	Odontoid 2‡	—	Surgery	Stable¶
12	68	12/85	M	Fall	C6–C7 bilat facet-disloc‡	Quadriplegia	Surgery	Stable Resolved
13	69	2/86	F	Fall	C5–C6 extension	—	Collar	Stable
14	86	5/86	F	Fall	C7–T1 bilat facet-disloc‡	—	Collar	Stable
15	69	3/87	M	Fall	Odontoid 2	—	Surgery	Died¶
16	66	6/87	M	Fall	Jefferson's	—	Collar	Stable
17	68	7/87	M	Fall	C6–C7 bilat facet-disloc	Quadriplegia	Traction	Stable Persistent
18	65	8/87	M	Fall	Hangman's	—	Traction	Died
19	81	9/87	M	Fall	Hangman's	—	Collar	Stable
20	68	3/88	M	PVA	C4–C5 extension	Not known	Collar	Died
21	70	6/88	M	Fall	C6–C7 unilat facet-disloc	Quadriplegia	Collar	Stable Persistent
22	91	7/88	F	Fall	Odontoid 2	—	Collar	Stable
23	78	7/88	F	Fall	Odontoid 2	—	Halo-vest	Stable
24	79	12/88	M	PVA	C6–C7 unilat facet-disloc	—	Traction	Stable
25	86	1/89	M	Fall	Odontoid 2	—	Collar	Died
26	78	1/89	F	Fall	Hangman's	—	Collar	Stable
27	65	3/89	F	Fall	C4–C5 bilat facet-disloc	Complete quadriplegia	Surgery	Stable Persistent
28	78	7/89	M	Fall	C4–C5 bilat facet-disloc	—	Halo-vest	Stable
29	74	9/89	M	Fall	Odontoid 3	Quadriplegia	Collar	Stable Resolved
30	76	3/90	M	PVA	C4–C5–C6 bilat facet-disloc	Complete quadriplegia	Collar	Died
31	68	9/90	M	Fall	C6 compression‡	—	Collar	Stable
32	75	12/90	F	Fall	Jefferson/odontoid 3	Radiculopathy	Collar	Stable Persistent
33	75	11/91	M	Fall	C7 compression§	Brown-Sequard	Surgery	Stable Persistent
34	82	11/91	M	Fall	Odontoid 3	—	Collar	Stable
35	85	1/92	F	Fall	Odontoid 2	—	Halo-vest	Stable
36	91	2/92	F	Fall	Odontoid 3	—	Halo-vest	Stable
37	84	4/92	M	Fall	C5–C6 extension	Quadriplegia	Trac/sur	Stable Resolved
38	75	8/92	M	PVA	C6–C7 bilat facet-disloc	Not known	Collar	Died
39	79	8/92	F	Fall	Jefferson/C2–C3 bilat facet-disloc	—	Collar	Stable
40	81	1/93	M	PVA	C5–C6 bilat facet-disloc‡	Quadriplegia	Traction	Died Progressive
41	88	1/93	M	Fall	Odontoid 2	—	Halo-vest	Stable

* road-traffic accident

† pedestrian vehicle accident

‡ missed injury

§ also had ankylosing spondylitis

¶ surgical complication

lesion, and one with radiculopathy. Of the last five of these patients (cases 17, 21, 27, 32 and 33), two had been treated surgically, two by a rigid collar and one by traction; they all finally had stable spines. Four patients were quadriparetic on presentation and completely recovered. Three patients had severe head injuries and it was impossible to assess their spinal-cord function (Table I).

Twenty-five patients were treated initially by a rigid collar, five by a halo-vest, and five by halo traction. One of these subsequently had an operation having been unable to tolerate the halo-traction. The remaining six patients were treated by immediate operation.

Twenty-four patients made a full recovery from the injury, returned to their preinjury status, and had full stability of the cervical spine. Twenty of these had been treated by a halo-vest or a rigid collar, two had been treated by primary surgery, one by halo-traction and one by halo-traction followed by surgery. Among the patients treated by a halo-vest there were two cases of pin-site infections; in those treated by a rigid collar there were no recorded complications. No patient treated by a rigid collar or a halo-vest lost reduction of the spine or developed neurological symptoms.

Of the five patients who had been treated primarily by halo-traction, two (cases 17 and 24) tolerated it for six and eight weeks respectively, two (cases 18 and 40) died at two and three days respectively, and the fifth (case 37) had respiratory problems and subsequently underwent surgery.

Eleven patients died during treatment at a mean of 5.4 days after admission (Table II). Five had been injured in falls and six in pedestrian vehicle accidents. Seven of the ten had other injuries which contributed to their deaths. Head injury (seen in nine patients) and respiratory

failure were the typical final common pathway. One patient (case 15) had unrecognised metastatic disease of the spine and died 18 weeks after admission from systemic metastases.

Twenty-four patients had associated injuries which included fracture of the long bones (12), head injuries (10), chest injuries (2) and splenic rupture (1). Four patients had lacerations and contusions.

In four patients the cervical injury was missed (Table I). One of these (case 11) had an odontoid type-2 fracture, diagnosed because of persistent pain four weeks after the injury. She was at first treated by anterior screw fixation of the odontoid but this failed and a posterior C1-C2 fusion was performed. Another (case 12) had C6-C7 bilateral facet-dislocations and presented with progressive quadriplegia four weeks after injury. He was treated by halo-traction reduction followed by anterior fusion and had an uneventful recovery. A third patient (case 31) who had a C6 compression fracture, returned to the emergency department two days after his first visit complaining of persistent pain. He was treated by a collar and made a full recovery. The fourth (case 40) who had C5-C6 bilateral facet-dislocations was admitted to hospital for traction treatment of an acetabular fracture; 48 hours after admission he was quadriparetic. Radiographs then revealed C5-C6 bilateral facet-dislocations which had not been evident on the admission films. He died on the third day as a result of respiratory failure.

Of the seven surgically treated patients (Table III), three underwent operation for neurological indications, three for instability, and one because he could not tolerate halo-traction. The patients with neurological deficit were not improved by surgery. Two of the other four patients achieved solid fusions, but the two with odontoid fractures

Table II. Details of patient deaths

Case	Age (yr)	Injury	Associated injuries	Time from injury to death (days)	Cause of death
2	86	Odontoid 2	—	15	Medical condition
4	74	C6-C7 bilateral facet-dislocation	—	2	Respiratory failure
6	79	C6-C7 bilateral facet-dislocation	Head, chest, spleen, ankle	9	Multiple injuries and respiratory failure
8	74	C4-C5 compression	Head	1	Head injury
15	69	Odontoid 2	—	135	Metastatic lung disease
18	65	Hangman's	—	2	Respiratory failure
20	68	C4-C5 extension	Head, extremity	14	Head injury and respiratory failure
25	86	Odontoid 2	Head	6	Head injury and respiratory failure
30	76	C4-C5-C6 bilateral facet-dislocation	Head, chest	1	Spinal injury and respiratory failure
38	75	C6-C7 bilateral facet-dislocation	Head	1	Head injury
40	81	C5-C6 bilateral facet-dislocation	Extremity	3	Spinal and extremity injury and respiratory failure

Table III. Details of surgically treated patients

Case	Injury	Indication	Procedure	Fusion	Neurology
9	Odontoid 2	Instability/neurology	Posterior C1–C2 fusion	Solid	Resolved
11	Odontoid 2	Instability, surgical failure	Anterior dens screw Posterior C1–C2 fusion	Cut out Solid	
12	C6–C7 bilateral facet-dislocation	Neurology/instability	Posterior fusion	Solid	Resolved
15	Odontoid 2	Instability	Anterior dens screw	Cut out	
27	C4–C5 bilateral facet-dislocation	Neurology/instability	Posterior fusion	Solid	No recovery
33	C7 compression	Neurology	Laminectomy and fusion	Solid	No recovery
37	C5–C6 extension	Traction failure	Anterior fusion	Solid	

which had been treated initially by anterior screw fixation were failures (cases 11 and 15).

DISCUSSION

The earliest reference to the high mortality of cervical spine injuries in the elderly is in Samuel 1, 4:18 and describes the death of Eli, the 94-year-old high priest of Israel, as follows:

“and it came to pass, when he made mention of the ark of God (to the Philistines), that he (Eli) fell from off the seat backward by the side of the gate, and his neck brake, and he died; for he was an old man and heavy.”

Anderson and D'Alonzo (1974) in their series of 49 patients with odontoid fractures whose ages ranged from 3 to 86 years reported two deaths one of which was an 86-year-old patient who had been treated in traction.

Pepin et al (1985) described 19 elderly patients with odontoid fractures and reported that three had died during treatment by halo-vests. They cited two patients treated surgically who had good outcomes and concluded that halo-vest treatment is poorly tolerated by the elderly and that early fusion or a rigid collar are the treatments of choice.

Bucholz and Cheung (1989) reported on the outcome of halo-vest treatment as against spinal fusion for cervical injuries. Their series of 124 patients included 30 who were over the age of 65 years and they concluded that age did not influence outcome after halo-vest treatment.

Rockswold, Bergman and Ford (1990) described 41 patients who had been treated surgically. Of the three who died, one was a 73-year-old who had a cerebrovascular accident and the other was a 76-year-old who developed renal failure.

Anderson and Bohlman (1992) and Bohlman and Anderson (1992) in their articles on anterior decompression and arthrodesis included five patients over the age of 65 years. They reported that of the three with incomplete cord injuries who had had anterior decompression and fusion two had a poor outcome and one did well. The other two elderly patients presented with complete cord

injuries and died after surgery. They concluded that surgery is contraindicated in old people with complete cord injury.

Hanigan et al (1993) described 19 elderly patients with odontoid fractures. Five treated surgically with posterior cervical fusions had good results but of the 14 treated non-operatively five died, and five recovered, three had stable nonunion and one had an unstable nonunion. They concluded that in the elderly, fibrous union of the odontoid is an adequate goal, and that a rigid collar provides sufficient immobilisation.

In our series there were 11 deaths over a ten-year period, seven from respiratory failure directly attributable to the spinal injury. These deaths prove the vulnerability and limited physiological reserve of injured elderly patients.

Twelve of our patients had spinal cord injuries, of whom only four recovered neurologically. In the elderly minor trauma can cause serious cord damage, and our experience confirms the opinion of Anderson and Bohlman (1992) that the potential for recovery is limited.

In four of our patients the spinal injury was missed at the first examination. One died and one had a compromised recovery. Any elderly patient who presents with a history even of minor trauma or a fall and is suspected of having a head or neck injury must be examined and re-examined to rule out cervical spine damage.

Of the 30 patients in this study who were treated by a rigid collar or a halo-vest, 22 recovered uneventfully. Only two pin-site infections occurred and no patient had late instability or neurological progression. The other eight patients initially treated in this way all died, for reasons which were unrelated to the method of treatment (see Table II). It appears that in the elderly a rigid collar or a halo-vest provides adequate stability until healing has occurred.

Six of our seven patients treated surgically achieved sound fusion, one after reoperation because the screw cut out. It is our experience that surgery is well tolerated in the elderly and that bony fusion is achievable. These

results support the conclusions of Pepin et al (1985) and Hanigan et al (1993).

The aims of treatment of cervical spine injuries are very different in the elderly and the young. In old people the first goal is to keep the patient mobile in order to promote maximum respiratory function and maintain mental health. This can be achieved in most cases by a rigid collar. If the spine is very unstable or there are multiple injuries then the use of a halo-vest or surgical stabilisation are effective alternatives. Traction and bedrest are inappropriate for the elderly.

Our study suffers from the limitations of any retrospective review. We were unable to determine with certainty how many of the injured spines did in fact achieve solid stable healing although we do know that no patient had progressive instability or late neurological deterioration. Bony union is not always necessary in the elderly; in odontoid fractures particularly, a stable fibrous union may be an acceptable result.

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