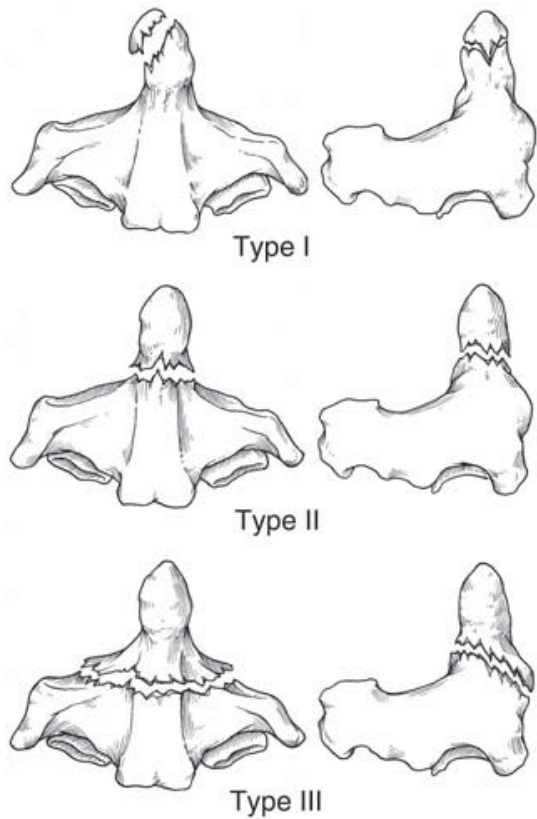


Odontoid #.

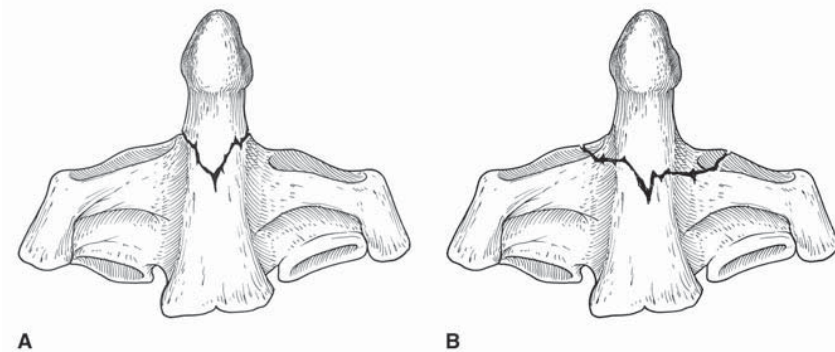
July 2010, Vol 18, No 7

- Recognition of the incidence of odontoid fractures as well as the associated morbidity and unexpectedly high mortality rates
- Nonsurgical management of type II odontoid fracture has historically been associated with a high nonunion rate.
- Thus, new classification systems have been devised to identify patients who might benefit from early surgical treatment.
- Increased familiarity with anterior and posterior surgical techniques has led to more aggressive treatment of odontoid fracture, with the intent of hastening functional rehabilitation.
- However, these clinical decisions have been associated with a significant rate of complications. The treatment algorithm for odontoid fractures continues to evolve based on the improved understanding of, and evidence-based literature on, anterior screw fixation, posterior spinal fusion, and halo-vest

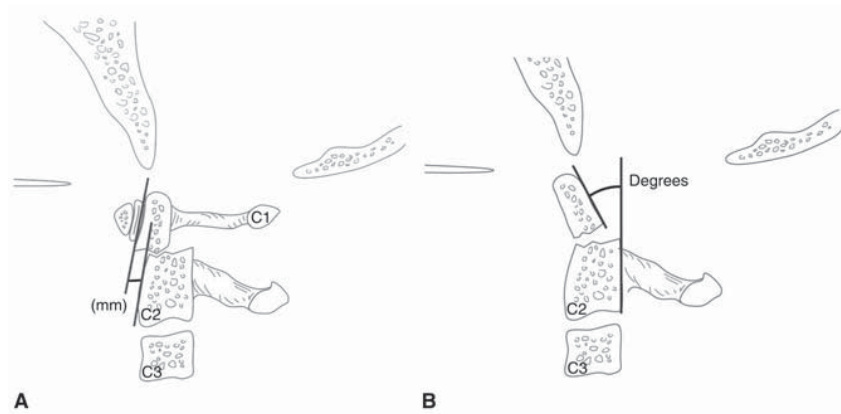
The Anderson and D'Alonzo



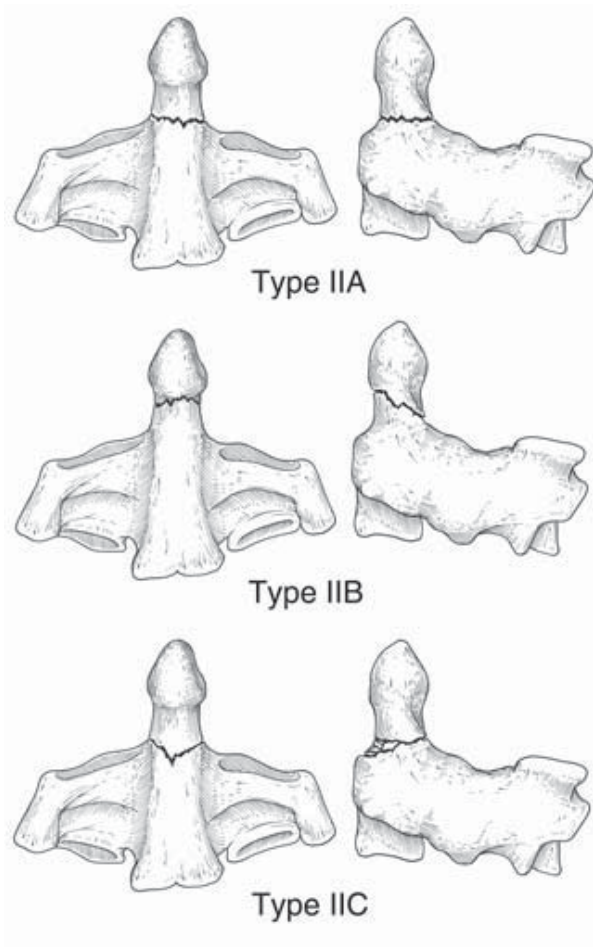
Grauer et al¹¹ proposed a modification



The Grauer modification of the odontoid fracture classification further delineated the difference between type II and type III fractures. Those without involvement of the C2 superior articular facet were classified as type II **(A)**, and those with facet involvement were classified as type III **(B)**.



- At the level of the fracture, a line is drawn connecting these two lines; this measurement indicates the amount of sagittal fracture displacement.
- **B, Standard** measurement technique for odontoid fracture angulation.
- The degree of fracture angulation is represented by the angle subtended by a tangent line along the posterior aspect of the odontoid and along the posterior aspect of the body of C2.



- The Grauer subclassification of
- type II odontoid fractures. Type IIA
- injuries demonstrate a transverse
- fracture pattern and displacement
- of <1 mm. Type IIB injuries have
- an oblique fracture pattern
- extending from the anterosuperior
- to the posteroinferior portion of the
- dens. Type IIC fractures begin
- anteroinferior and extend
- posterosuperior. These may be
- associated with significant anterior
- comminution.

Odontoid Fracture Classification, Subtypes, and Treatment Recommendations

Type	Subtype	Displacement	Transverse Ligament	Treatment Recommendation
I	Nondisplaced (occiput-C1)	None	Intact	Cervical collar ^a
	Displaced (occiput-C1)	±	±	Occiput-C2 fusion ^a
II	Low risk	<5 mm	Intact	Cervical collar, halo vest, ^a odontoid screw, posterior C1-2 fusion
	High risk	>5 mm	±	Cervical collar, halo vest, odontoid screw, ^a posterior C1-2 fusion ^a
	Elderly patient	±	Intact	Cervical collar, ^a halo vest, odontoid screw, posterior C1-2 fusion ^a
III	Body fracture	±	Intact	Cervical collar, ^a cervicothoracic brace, ^a halo vest

^a Authors' preferred treatment

± = with or without

- Müller et al¹⁸ reported the results of immobilization with a rigid cervical orthosis in 19 patients with type II odontoid fracture. Fracture gap was <2 mm, AP displacement was <5 mm, and angulation was <11°; 74% of fractures achieved radiographic union
- Ekong et al¹⁸ demonstrated that risk factors for nonunion are present in patients aged >40 years who present with odontoid fracture involving posterior displacement >5 mm, angulation >11°, and concomitant neurologic deficits, as well as in patients with significant comminution
- **Authors' Treatment Recommendations**
- It is important to use a shared decision-making protocol
Patients at low risk for nonunion (eg, nondisplaced and stable fracture after initial immobilization) can be treated with a halo-vest orthosis.
- The authors recommend surgery for patients at high risk for nonunion. Fractures with favorable patterns (ie, Grauer IIB) and body habitus are treated with an odontoid screw.
Other patients are treated using posterior atlantoaxial arthrodesis with screw fixation
- Posterior C1-2 fusion with screw fixation is also indicated in type II odontoid fractures that are not amenable to anterior fixation, that are associated with significant osteoporosis,

Type III

- Type III fractures make up less than one third of all odontoid fractures;
- In general, these fractures have a better prognosis than do type II injuries
- Historically, these injuries have been treated with a variety of surgical and nonsurgical approaches;6 however, much of the recent analysis has demonstrated acceptable healing with cervical collar immobilization.
- 8% demonstrated nonunion after treatment
- However, characteristics of certain type III patterns may lead to a poorer prognosis. For example, the incidence of nonunion may be greater in high type III fractures that
- involve the waist of the dens and in those that exhibit significant anterior or posterior displacement, such as in a type II odontoid fracture. In addition, in a certain subset of type III
- fractures that demonstrate vertical instability with >5 mm of distraction, surgical treatment should be considered

Odontoid in Elderly

- High rate of associated morbidity and mortality. : high as 40%.⁵⁰ >70 years.
- In elderly patients, halo-vest immobilization is associated with a high rate of morbidity and mortality; thus, its use should be avoided.
- In a retrospective analysis, Tashjian et al⁵² reported that patients aged >65 years with a type II or III odontoid fracture managed with a halo vest had a 42% mortality rate, compared with a 20% rate in the nonhalo group ($P = 0.03$). :attributed to a significant increase in cardiopulmonary complications.
- In an elderly person with poor pulmonary and rehabilitative reserve, rigid immobilization can lead to devastating complications. Conversely, however, nonrigid immobilization may not adequately stabilize the fracture to allow for healing.
- When surgery can be performed expeditiously with minimal trauma and postoperative complications, there is great potential to improve patients' ability to rehabilitate early and to decrease the need for postoperative halo vest immobilization.
- This has led many experts to recommend surgical stabilization for type II odontoid fractures in patients aged >50 years.¹⁵

- However, significant postoperative complications have been reported. In one study of odontoid fracture in patients aged >70 years, mortality rates were reported to be 40% with anterior screw fixation, 13% with hard collar immobilization, and 33% with a halo vest.
- Furthermore, a published case series has suggested that clinical outcomes involving chronic, unstable, dens nonunions are acceptable provided that the patient does not have myelopathic symptoms.⁵⁴ These studies suggest that type II odontoid fracture with a stable pattern can be treated with a cervical orthosis in the geriatric population.
- For all type I and type III as well as stable type II odontoid fractures in elderly persons, we recommend using a hard cervical collar or cervicothoracic brace. For unstable type II patterns, posterior C1-2 arthrodesis should be performed.

POST TRAUMATIC SYRINX

Post-traumatic syringomyelia J Neurol

Neurosurg Psychiatry. 1996 Jan;60(1):61-7.

- **study of 449 patients with spinal cord injury.**
- 1987 and 31 December 1993 were prospectively analysed.
clinically stable (3 years) Ten worsened--three refused operation, seven were operated on.
- Mean worsening time was 97 months.
- **Delay between appearance of the first symptoms of PTS and deterioration making surgery necessary may**
- be long (mean five years in the seven operated patients) underlining the need for regular tests. “
- mechanisms could explain cyst enlargement as surgical realignment of the spine resulted in a complete cyst collapse in two of the operated patients (normalisation of CSF flow?). Cord compression, tense syrinx at the fracture site, and kyphosis seemed to be closely linked to the enlargement of the cyst with subsequent further neurological deterioration.

Cervical radicular disease

- 1. Similar to rotator cuff disease, degenerative disk disease is age related. **Beginning in the third decade of life**, the hydration of the nucleus starts to diminish, accompanied by fissuring of the annulus.
- 2. a prevalence of cervical radiculopathy of **3.5 per 1,000** individuals.
- 4. Natural course: At long-term follow-up of 10 to 25 years, Gore et al²⁷ reported that nonoperative management was associated with complete symptom resolution in 43% of patients, partial resolution in 25%, and continued moderate to severe pain in the remaining 32%.
- In another long-term study, by Lees and Turner,³⁸ of 51 patients followed up for 2 to 19 years, 43% of the patients had only a single episode of radicular pain, 29% had mild symptoms, and the remaining 27% had more substantial symptoms.
- Surgical treatment: Rapid improvement of symptoms is typical, and prolonged relief of symptoms can be expected in approximately 70% to 90% of patients after either anterior or posterior surgery.
- ,

- Relief of arm pain and paresthesia were achieved in 96% of patients and resolution of the motor deficit in 98%.
- Arnasson et al⁴ found that axial neck pain persisted in roughly one-half of patients irrespective of conservative or surgical treatment, but radicular symptoms responded substantially better to surgery, with over 70% of patients having improved.
- After anterior surgery, Lundsford et al⁴⁰ found that 77% of patients had complete relief of symptoms initially, yet 38% had recurrent symptoms at some time during the 1 to 7 years of follow-up. At a mean follow-up of 6 years after anterior discectomy and fusion
- Bohlman et al.⁷ found that all patients had improvement or resolution of their preoperative motor deficit.
- Sensory deficits resolved in 71 of 77 patients.
- Only 6 of the 122 total patients had persistent radicular pain to any degree, but neck pain was present in 37.

POST TRAUMATIC SYRINX

Post-traumatic syringomyelia J Neurol

Neurosurg Psychiatry. 1996 Jan;60(1):61-7.

- **study of 449 patients with spinal cord injury.**
- 1987 and 31 December 1993 were prospectively analysed.
clinically stable (3 years) Ten worsened--three refused operation, seven were operated on.
- Mean worsening time was 97 months.
- **Delay between appearance of the first symptoms of PTS and deterioration making surgery necessary may**
- be long (mean five years in the seven operated patients) underlining the need for regular tests. “
- mechanisms could explain cyst enlargement as surgical realignment of the spine resulted in a complete cyst collapse in two of the operated patients (normalisation of CSF flow?). Cord compression, tense syrinx at the fracture site, and kyphosis seemed to be closely linked to the enlargement of the cyst with subsequent further neurological deterioration.