Clinical Case Report

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Traumatic C1–2 rotatory subluxation with dens and bilateral articular facet fractures of C2

A case report

Dong-Gune Chang, MD, PhD[a], Jong-Beom Park, MD, PhD[b,*], Hyuk-Jin Jang, MD[b]

Abstract

Rationale: To the best of our knowledge, this is an extremely rare case of traumatic C1–2 rotatory subluxation associated with multiple C2 fractures.

Patient concerns: We report the case of a 63-year-old man with type 2 traumatic C1–2 rotatory subluxation (Fielding and Hawkins classification) associated with type III dens (Anderson and D'Alonzo classification) and bilateral articular facet fractures of C2. This injury occurred as a result of falling down in a drunken state. The patient complained of neck pain and mild degree of torticollis but did not show any neurologic abnormalities.

Diagnoses: Plain radiographs of cervical spine showed extensive soft tissue swelling, a fracture fragment, disruption of spinolaminar line at C1–2 level, and bony overlapping of right side lateral joint of C1–2. Two- and three-dimensional reconstructed computed tomography scans clearly demonstrated complicated C1–2 combined injury. The atlantodental interval was normal.

Intervention: By skull traction and derotation, closed reduction of C1–2 rotatory subluxation with a type III dens and bilateral articular facet fractures of C2 was successfully achieved. He was managed with halovest fixation for 3 months.

Outcomes: At the 1-year follow-up visit solid fusion and improvement of clinical symptoms were achieved without C1–2 instability.

Lessons: Despite traumatic C1–2 rotatory subluxation associated with multiple C2 fractures, trial of closed reduction should be considered as the first choice of treatment so as to preserve C1–2 motion.

Abbreviations: ADI = atlantodental interval, CT = computed tomography, MRI = magnetic resonance imaging, TAL = transverse atlantal ligament.

Keywords: bilateral articular facet fracture, dens fracture, traumatic C1–2 rotatory subluxation

1. Introduction

Traumatic C1–2 dislocation or subluxation associated with a C2 fracture is a rare injury and to date, few cases have been reported in the English literature.[1–5] Moreover, there has been only 1 report describing traumatic C1–2 dislocation with multiple C2 fractures.[1] In the current study, we therefore reported the second case of type 2 traumatic C1–2 rotatory subluxation (Fielding and Hawkins classification)[6] associated with type III dens (Anderson and D'Alonzo classification)[7] and bilateral articular facet fractures of C2 that was successfully managed by closed reduction and halovest fixation.

2. Case report

A 63-year-old man who complained of neck pain and mild degree of torticollis was admitted to the emergency room. His symptoms developed following a fall in a drunken state. Physical examination revealed no specific neurological abnormalities. Plain radiographs of cervical spine showed extensive soft tissue swelling, a fracture fragment, disruption of spinolaminar line at C1–2 level, and bony overlapping of right side lateral joint of C1–2 (Fig. 1A and B). Two-dimensional reconstructed computed tomography (CT) scans demonstrated traumatic C1–2 rotatory subluxation associated with type III dens fracture that was established based on the Anderson and D'Alonzo classification and bilateral articular facet fractures (Fig. 2A–E). However, the atlantodental interval (ADI) was normal. Three-dimensional reconstructed CT scans confirmed type 2 traumatic C1–2 rotatory subluxation that was established based on Fielding and Hawkins classification and revealed type III dens (Anderson and D'Alonzo classification) and bilateral articular facet fractures of C2 (Fig. 3A–F).

Skeletal traction was gently performed with halo traction. The traction weight was initially 7 pounds and was gradually increased to 12 pounds under fluoroscopy over 30 minutes.

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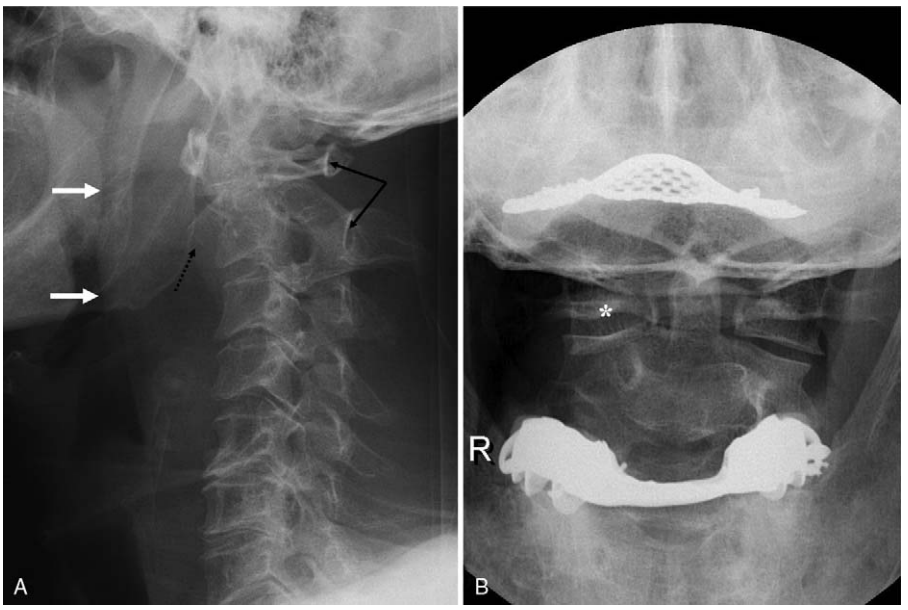

Figure 1. Plain radiographs of cervical spine showed extensive soft tissue swelling (white arrows), a fracture fragment (dark dotted arrow), disruption of spinolaminar line at C1–2 level (dark arrows) (A), and bony overlapping of right side lateral joint of C1–2 (asterisk) (B).

During the skeletal traction, a derotation maneuver was applied. Closed reduction of traumatic C1–2 rotatory subluxation with type III dens fracture was successfully achieved (Fig. 4A and B). The patient was managed with halovest fixation for 3 months. At the 6-month follow-up, neck pain was almost completely alleviated and two-dimensional reconstructed CT scans showed a well-reduced state of C1–2 and union processing of dens and bilateral articular facet fractures of C2 (Fig. 5A and B). At the 1-year follow-up, solid union was achieved without C1–2 instability on plain radiographs (Fig. 6A–D). This case report has been approved by institutional review board of Uijeongbu St. Mary's Hospital, The Catholic University of Korea with waived informed consent (UC17ZESI0137).

3. Discussion

Traumatic C1–2 combined injuries are rare; usually, C1 atlas fracture occurs in conjunction with C2 dens or traumatic spondylolisthesis.[8] Therefore, there have been few reports to describe traumatic C1–2 dislocation or subluxation associated with C2 fracture.[1–5] Moreover, only 1 case of traumatic C1–2 dislocation with multiple C2 fractures has been reported. Spoor

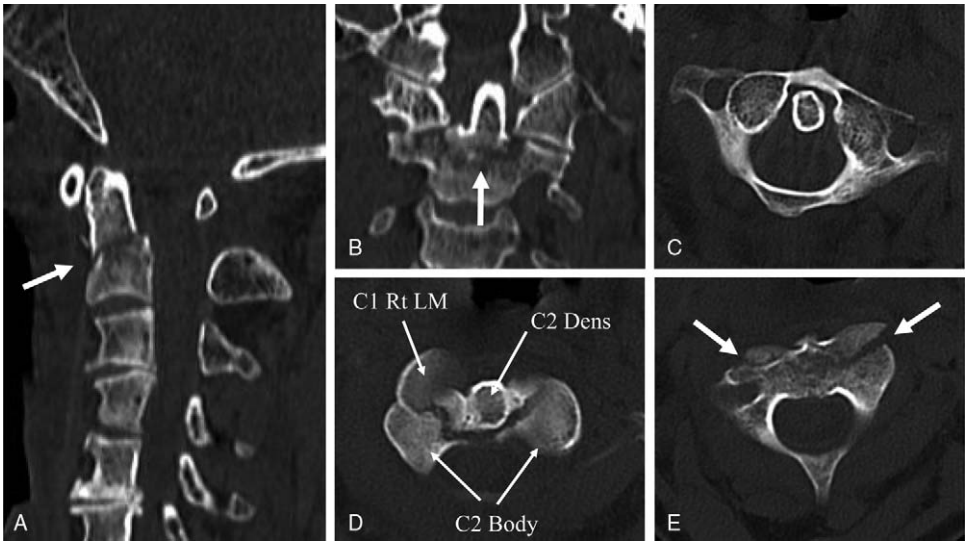

Figure 2. Two-dimensional reconstructed CT scans demonstrated a type III dens fracture that was established based on the Anderson and D'Alonzo classification (white arrow) (A and B), type 2 traumatic C1–2 rotatory subluxation that was established based on the Fielding and Hawkins classification (C and D), and bilateral articular facet fractures of C2 (white arrows) (E). However, the atlantodental interval (ADI) was normal. CT = computed tomography.

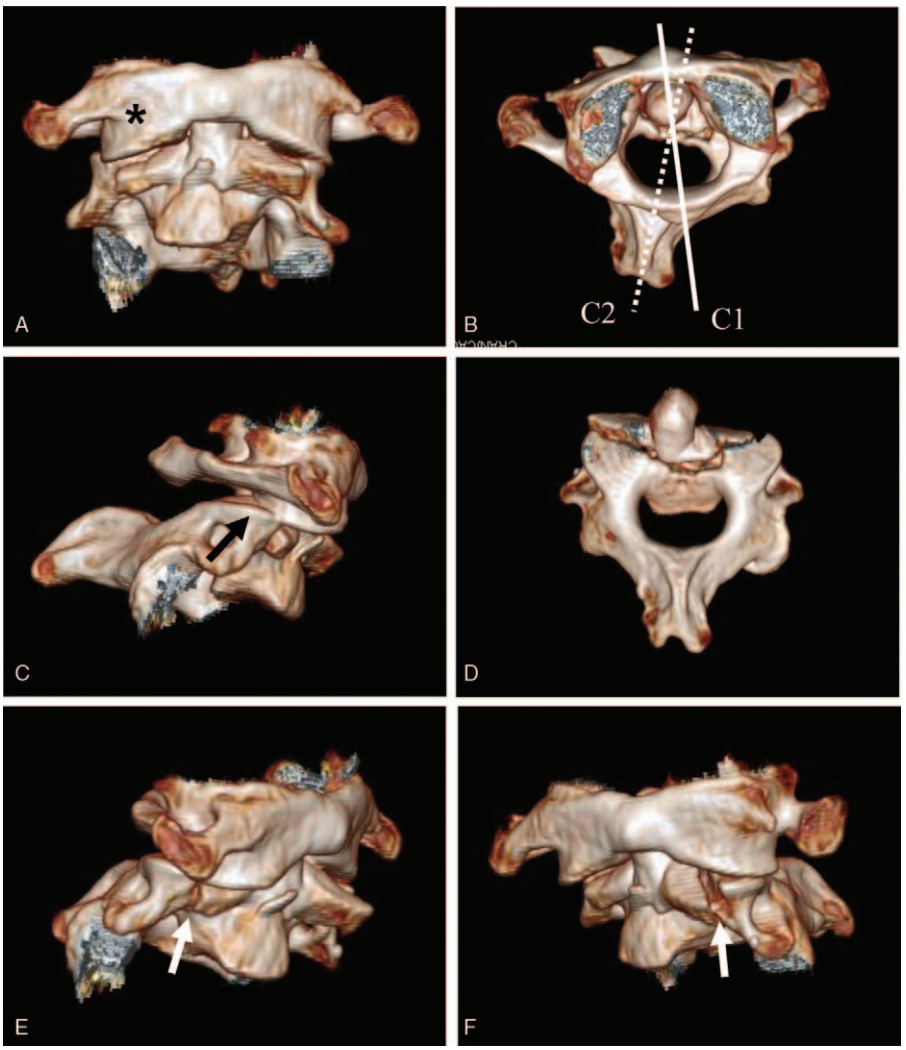

Figure 3. Three-dimensional reconstructed CT scans confirmed type 2 traumatic C1–2 rotatory subluxation that was established based on Fielding and Hawkins classification (asterisk and dark arrow) (A, B, and C) and revealed a type 3 dens fracture (Anderson and D'Alonzo classification) (D) and bilateral articular facet fractures of C2 (white arrows) (E and F). CT = computed tomography.

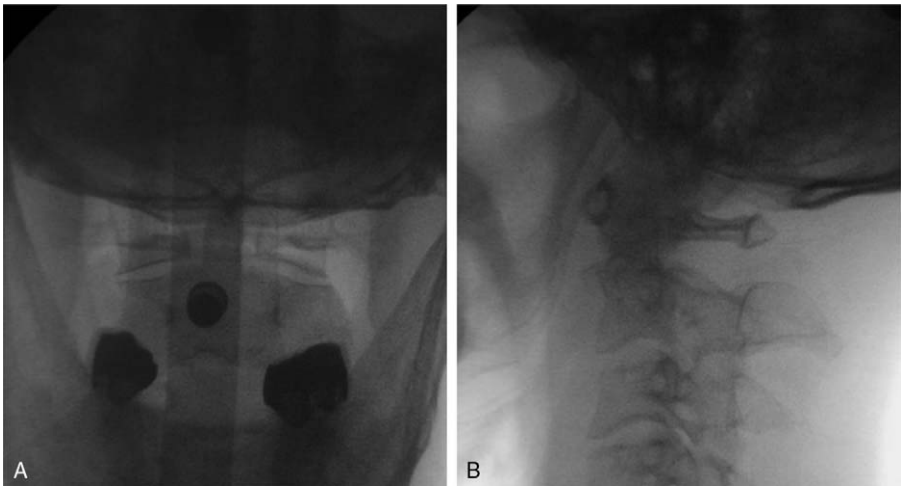

Figure 4. Open mouth and lateral views of intraoperative fluoroscopy (A and B) demonstrated successful reduction of C1–2 and dens fracture.

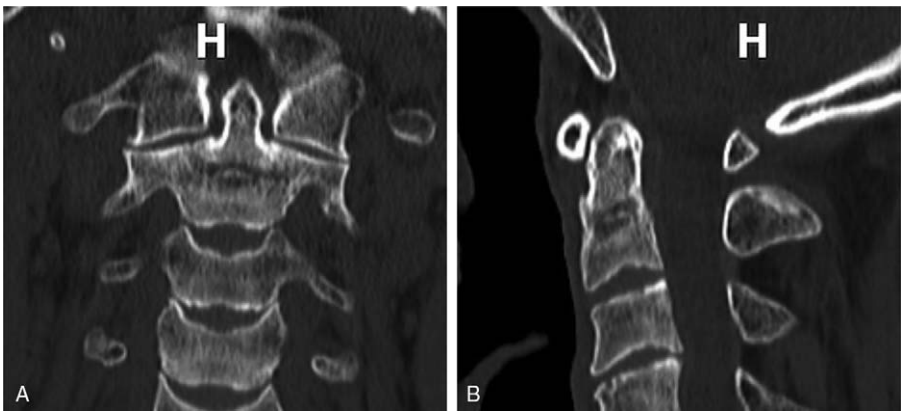

Figure 5. At the 6-month follow-up, two-dimensional reconstructed CT scans (A and B) showed a well reduced state of C1–2 and union processing of type III dens fracture and bilateral articular facet fractures of C2. CT = computed tomography.

et al[1] described a case of traumatic complex dislocation of the atlanto-axial joint with odontoid and C2 superior articular facet fracture. Therefore, our case report is the second to describe traumatic C1–2 dislocation with multiple C2 fractures but has several features that distinguish it from the first case. First, our C1–2 injury is type 2 traumatic rotatory subluxation (Fielding and Hawkins classification) but the exact type of C1–2 dislocation in the first case was not described. Second, the associated dens fracture was a type III dens fracture (Anderson and D'Alonzo classification), but the exact type of Dens fracture was also not described in the first case. Third, associated C2 articular facet fracture of our case was bilateral compared with unilateral superior articular facet fracture in the first case. Fourth, our case was neurologically intact whereas the first case was

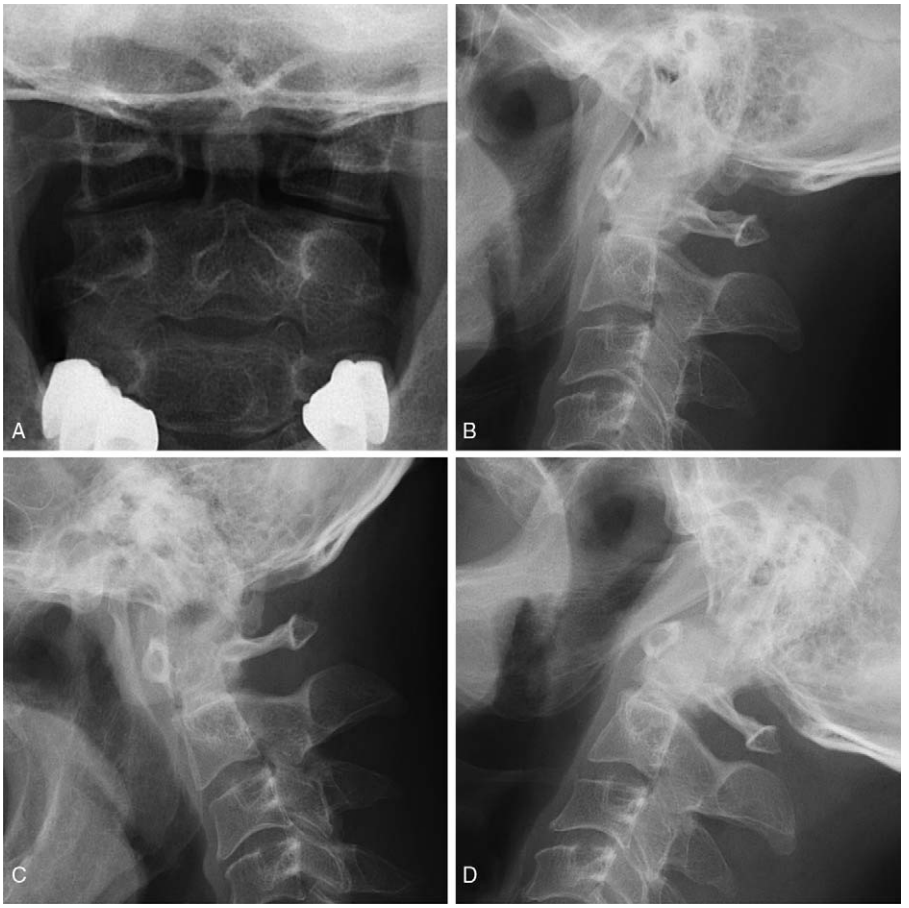

Figure 6. At the 1-year follow-up, solid union was achieved without abnormal motion of C1–2 on plain radiographs including flexion and extension lateral radiographs (A–D).

complete hemiplegia. Finally, our case report provided two- and three-dimensional reconstructed CT scans to clearly diagnose this combined C1–2 complex injury.

The definite treatment strategy of traumatic C1–2 rotatory dislocation or subluxation with C2 fracture, especially dens fracture, has not been established because this combined C1–2 complex injury is rare.[4,5,9–15] However, most previous studies reported that they tried to reduce the C1–2 dislocation or subluxation with dens fracture by skeletal traction and/or derotation maneuver.[9–11] If traumatic C1–2 rotatory dislocation or subluxation cannot be reduced by closed reduction, open reduction and fusion must be performed.[12,13] After successful closed reduction, comprehensive consideration including stability of C1–2 and features of dens fracture should be made to decide the need for surgery.[8] If C1–2 is stable without transverse atlantal ligament (TAL) injury, conservative treatment, such as halovest or rigid cervical brace, is sufficient. However, if complete injury of TAL or significant residual C1–2 instability is identified, posterior C1–2 fusion must be performed. The appropriate treatment option for dens fracture should be determined by fracture type and the degree of angulation or displacement.[7,14]

Our case was type 2 traumatic C1–2 rotatory subluxation (Fielding and Hawkins classification) associated with type III dens (Anderson and D'Alonzo classification) and bilateral articular facet fractures of C2. Closed reduction was successfully achieved with skeletal traction and derotation maneuver. Intraoperative fluoroscopy showed complete stable reduction of C1–2 and dens fracture; therefore, we performed halovest fixation for 3 months and achieved solid union of dens and bilateral articular facet fractures of C2 without C1–2 instability. Previous studies reported a successful outcome of conservative treatment, such as cervical brace or halovest, for C1–2 rotatory dislocation or subluxation after closed reduction.[9–11] In addition, type III dens fracture has been reported to be successfully managed with conservative treatment because the location of type III dens fracture is cancellous portion of dens.[7,14] The results of our study are consistent with those of previous studies. Traumatic C1–2 rotatory subluxation associated with dens and articular facet fractures of C2 is a complicated C1–2 injury. Once C1–2 rotatory subluxation is resolved by closed reduction, it can be successfully managed by conservative treatment without significant complications.

In conclusion, despite traumatic C1–2 rotatory subluxation associated with multiple C2 fractures, trial of closed reduction should be considered as the first choice of treatment so as to preserve C1–2 motion. To the best of our knowledge, this is an extremely rare case of traumatic C1–2 rotatory subluxation associated with multiple C2 fractures that was successfully managed with conservative treatment.

Author contributions

Conceptualization: D.-G. Chang, J.B. Park.
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Investigation: D.-G. Chang.
Methodology: H.-J. Jang.
Project administration: J.B. Park.
Resources: J.B. Park.
Validation: J.B. Park.
Visualization: J.B. Park.
Writing – original draft: D.-G. Chang.
Writing – review & editing: J.B. Park.

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