

รายงานผู้ป่วย

เทคนิคการดึงกระดูกเข้าที่ในการเคลื่อนหลุดของกระดูกคอปล้องที่ 1 ไปด้านหลังปล้องที่ 2 จากอุบัติเหตุโดยไม่มีการหักร่วมของกระดูก โอตตอนตอยด์หรือการบาดเจ็บของระบบประสาท:

รายงานผู้ป่วย 1 รายและการทบทวนวรรณกรรม

สายันต์ สุเมรวนิชย์ พ.บ., บุติพงษ์ สุขพักตร์ พ.บ., แพดล วังจิระพันธ์ พ.บ.
กลุ่มงานศัลยกรรมออร์โธปิดิกส์ โรงพยาบาลลำปาง

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การเคลื่อนหลุดของกระดูกคอปล้องที่ 1 ไปด้านหลังปล้องที่ 2 จากอุบัติเหตุโดยไม่มีการหักร่วมของกระดูกโอตตอนตอยด์เป็นการบาดเจ็บที่พบได้น้อยมากและมีวิธีการรักษาที่หลากหลาย รายงานนี้นำเสนอบรรผู้ป่วยหญิงอายุ 40 ปีที่มีการเคลื่อนหลุดของข้อต่อกระดูกคอดังกล่าว ผู้ป่วยได้รับการดึงกระดูกคอให้เข้าที่โดยไม่ดมยาสลบและไม่เปิดแผลผ่าตัด แต่กระดูกอย่างไม่มั่นคงจึงได้รับการผ่าตัดเขื่อมปล้องกระดูกและยึดตึงด้วยโลหะจากทางด้านหลัง หลังผ่าตัด 1 ปีกระดูกคอเขื่อมติดดีโดยไม่มีความเจ็บปวดหรือระบบประสาทผิดปกติ บทความนี้ยังอธิบายเทคนิคการดึงกระดูกให้เข้าที่และบททบทวนวรรณกรรมเกี่ยวกับผลการรักษาการบาดเจ็บนี้

คำสำคัญ:

การเคลื่อนหลุดของกระดูกคอปล้องที่ 1
กระดูกคอปล้องที่ 2
ไปด้านหลังปล้องที่ 2,
การดึงกระดูกให้เข้าที่,
การผ่าตัดยึดตึงกระดูก
จากทางด้านหลัง



Case Report

Pure Traumatic Posterior Dislocation of the Atlantoaxial Joint without Associated Odontoid Fracture and Neurological Deficit: a Case Report, Reduction Technique and Literature Review

Sayun Sumethvanich M.D., Chutipong Sookpattee M.D., Noppadol Wangjiraphan M.D.

Department of Orthopaedic Surgery, Lampang Hospital, Lampang, Thailand

Abstract

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Pure traumatic posterior atlantoaxial dislocation without fracture of the odontoid process is an extremely rare condition. The treatments vary and remain controversial. We reported a 40-year-old woman who sustained this kind of dislocation. Closed reduction in awakening was achieved using intravenous analgesia and fluoroscopy. Atlantoaxial instability was demonstrated after anatomical reduction and then managed by posterior screw-rod instrumentation and fusion. One-year postoperatively, the patient had painless stable spine without neurological deficit or evidence of implant failure. This article aimed to describe reduction technique and review the literatures about treatment outcomes of this injury.

Keywords:

posterior atlantoaxial dislocation,
closed reduction,
posterior cervical fixation

Corresponding author:

Dr.Sayun Sumethvanich.

Department of Orthopaedic Surgery,
Lampang Hospital, 280 Phaholyothin
Road, Hua Wiang Subdistrict,
Mueang District, Lampang 52000,
Thailand. Tel. 66-5423-7400 ext 8264
Email: sysumathv@ymail.com

Introduction

Pure traumatic posterior atlantoaxial dislocation without fracture of the odontoid process is a very rare injury. Fewer than twenty cases of this condition have been reported since 1969 and most of patients had normal neurological status or mild neurological deficit⁽¹⁻¹¹⁾. The treatments vary and remain controversial. The dislocations were managed either with closed reduction or open reduction, followed by posterior fixation or anterior fixation and some of them were treated by closed reduction and halo vest immobilization. We presented a case of this injury treated successfully by conscious closed reduction and operative posterior fusion with instrumentation.

Case report

A 40-year-old female sustained a traffic accident in March 2018. She was a front-seat passenger in a pickup truck when it crashed into a trailer. She had transient unconsciousness, severe neck pain without weakness or numbness, and a deformity of left thigh. She was immobilized with a Philadelphia collar and a wooden splint before transferring from a nearby hospital to Lampang Hospital.

The physical examination revealed marked tenderness at the upper part of the neck with a small contusion and marked deformity without external wound of the left thigh. Her neurological assessment demonstrated normal of all extremities except the left leg because of the suspected fracture.

The x-rays of left thigh revealed a minimally comminuted fracture of the distal shaft of the femur. A computed tomography (CT) scan of her brain and cervical spine showed posterior dislocation of the atlas to the axis without any fracture of the odontoid process (Figure 1).



A



B

**C****D**

Figure 1. The CT scan in axial (A), lateral (B) and 3D reconstruction view (C-D) demonstrated posterior dislocation of the C1–C2 vertebrae without fracture of the odontoid process

After a traction pin had been inserted to the proximal tibia, she was carried directly to the operating room to obtain conscious reduction of the C1–C2 dislocation under fluoroscopy. She was positioned in supine, on a radiolucent operating theatre. The vital signs were monitored as usual. Intravenous morphine 5 mg was administered for analgesic purpose.

The reduction method was divided into 3 phases (Figure 2). Firstly, we applied the Gardner-Wells tongs and skull traction was started with 3 kg of weight. Then, it was gradually increased by 1–2 kg at a time for distraction until the atlas was close to the tip of odontoid process. The total weight used was 10 kg and her neurological status

remained normal. In the second phase, we manually lifted her head to manipulate the neck into a flexed position until the anterior arch of the atlas slipped forward over the tip of the odontoid process. Finally, we gradually decreased the traction, pending the fluoroscopic confirmation of a complete reduction. The stability of the atlantoaxial joint was tested by passive flexion-extension movement of neck under image intensifier and we found that the joint was totally unstable although the neurological status and consciousness were unchanged. Thereafter, skull traction was continued with 3 kg of weight in neutral position of the neck.

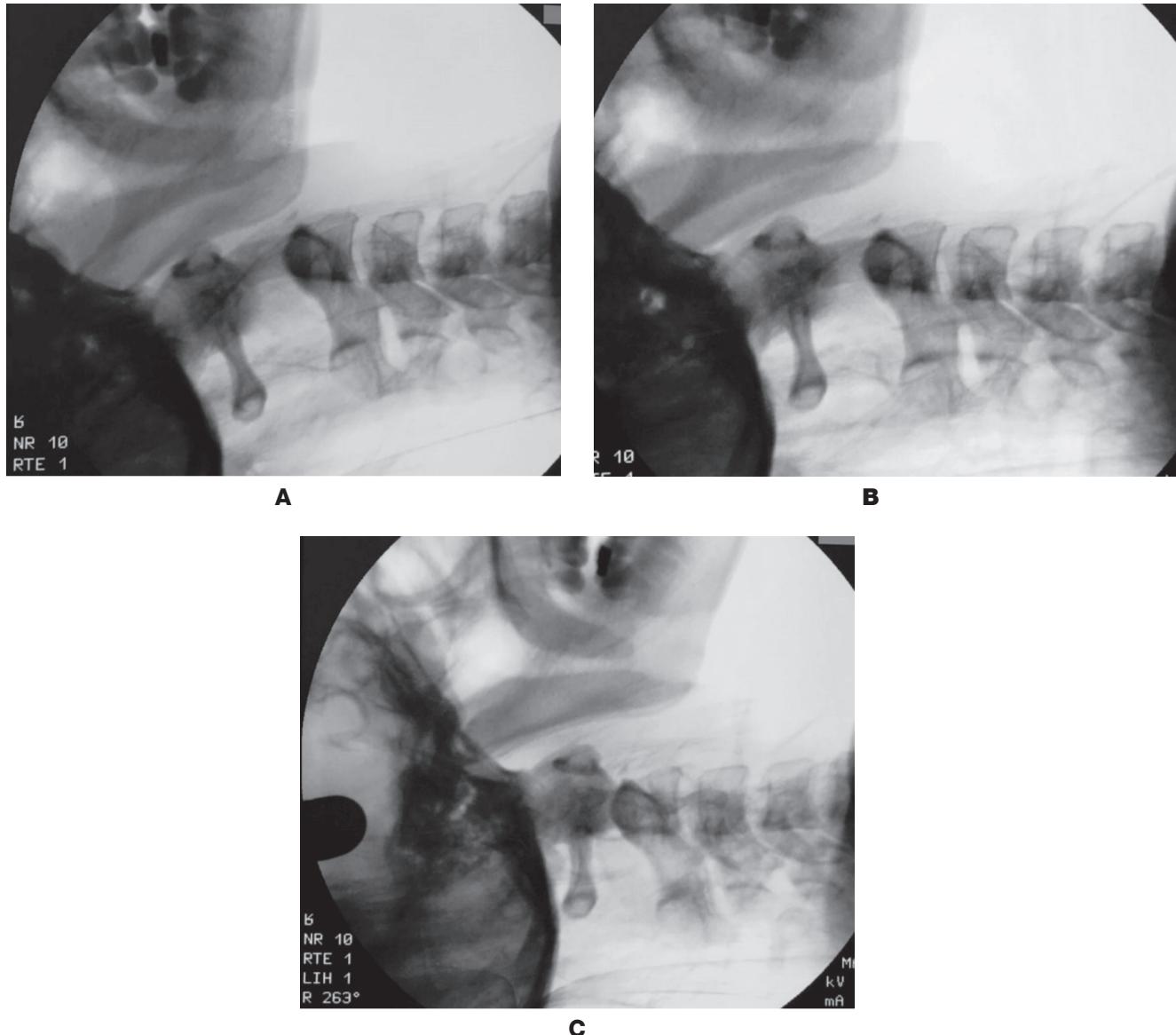


Figure 2. Closed reduction was divided to 3 phases. *Phase 1*: gradually increased the weight until the atlas was just above the tip of odontoid process (A); *Phase 2*: gentle neck flexion to bring the atlas slipped forward onto odontoid process (B) and *Phase 3*: decreased the weight until reduction was achieved (C).

Two days later, we operated on the femur by open reduction and internal fixation with broad dynamic compression plate. She underwent a preoperative CT angiography of the neck since the magnetic resonance imaging (MRI) was not available in our hospital and her neurology had not deteriorated. The CT angiogram confirmed successful reduction without the evidences of cervical vascular injury or anomaly. The measured atlanto-dens interval (ADI) was 4.3 mm that indicated the instability of atlantoaxial joint.

She underwent posterior cervical instrumentation with Harms-Goel screw-rod system via C1 lateral mass screw and C2 pedicle screw on the eighth

day after admission. Posterior fusion was achieved using autologous iliac bone grafts (IBG). Minimal cerebrospinal fluid leakage was noted, but no tear of the dura was identified.

Postoperatively, the endotracheal tube was retained to the spinal unit and removed on the next day. Her neurological status was normal and no complications were observed. Postoperative plain radiograph demonstrated a good cervical alignment and secured fixation (Figure 3). She could ambulate with protected weight bearing using axillary crutches in the third day after surgery. She was instructed to wear a SOMI brace for 3 months.

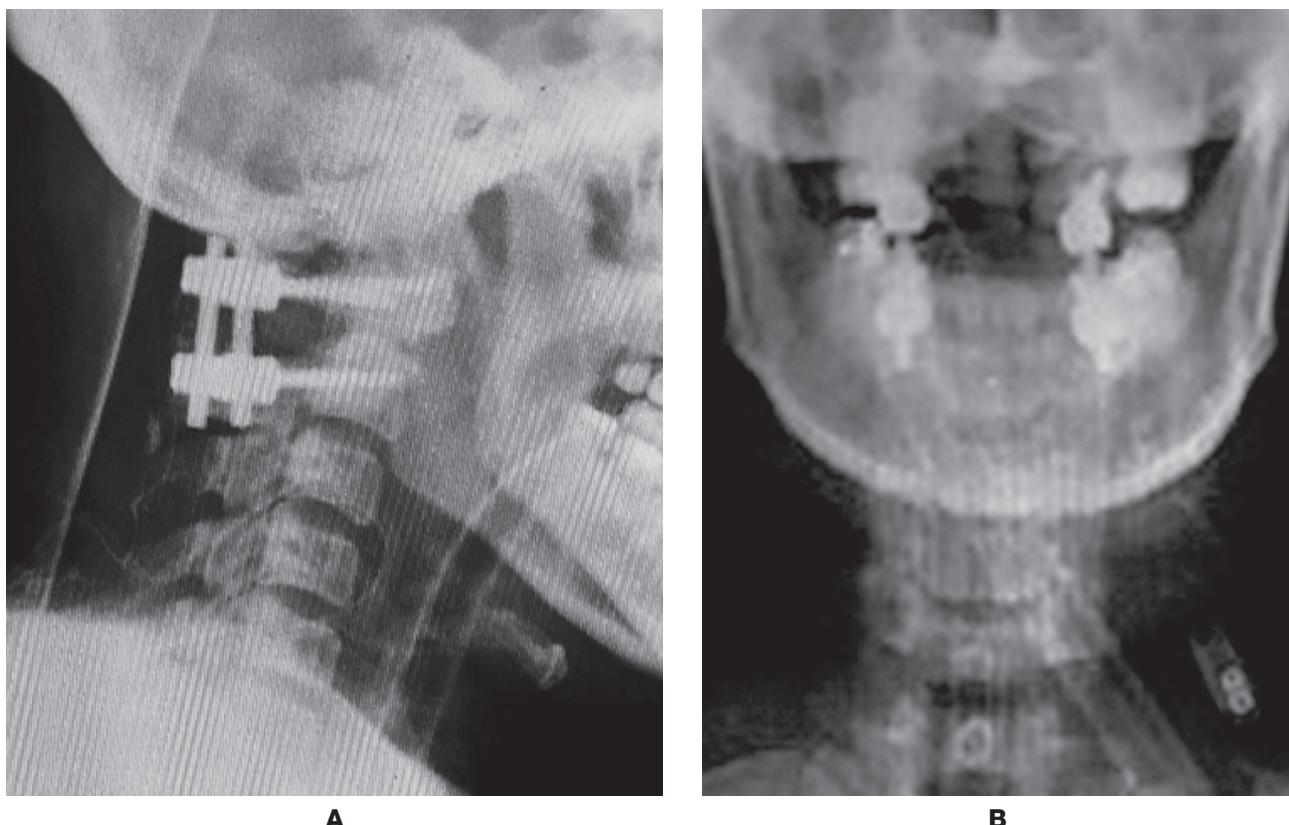


Figure 3. Postoperative radiographs in lateral view (A), and anteroposterior view (B)

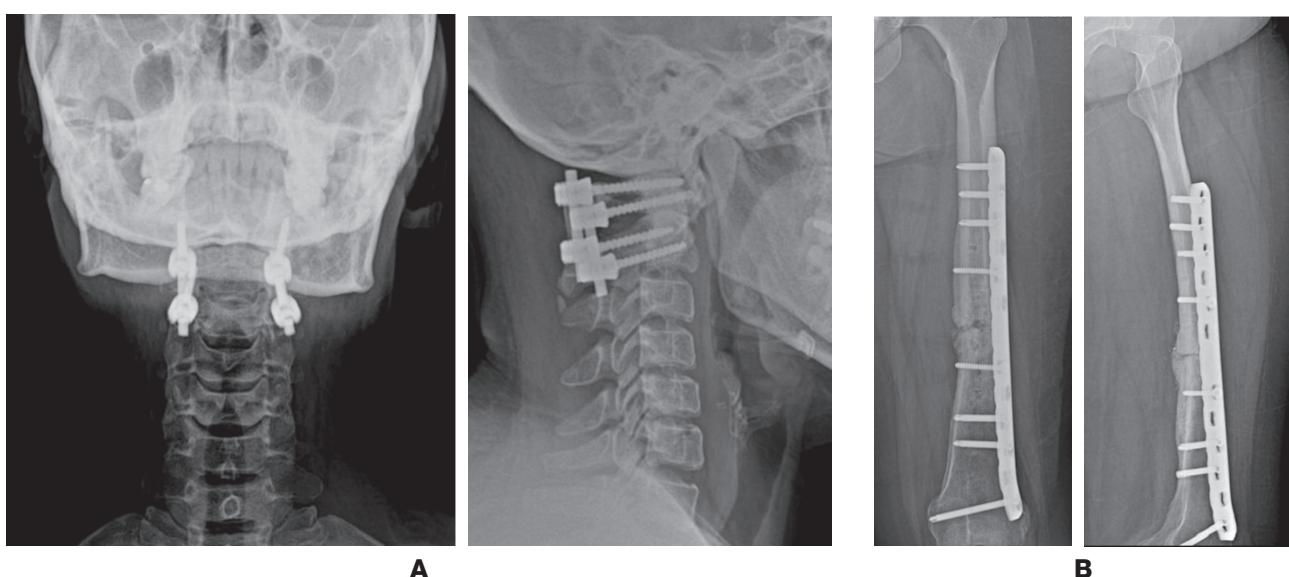


Figure 4. Plain radiographs of cervical spine at 6 months (A), and left femur (B) at 1 year of the follow-up.

At 6-months follow-up, she had no the clinical neck pain or late deterioration of neurological status. The radiographs presented normal alignment of atlantoaxial complex with secured instrument. However, she underwent revision surgery of left

femur with a locking compression plate and iliac bone grafting because of nonunion. At 1-year follow-up, the x-rays showed the complete bone healing (Figure 4).

Discussion

The stability of the atlantoaxial complex is provided by the odontoid process interlocking in the osseo-ligamentous ring formed ventrally by the anterior arch of the atlas and dorsally by the transverse ligament. This ring allows dislocation to occur anteriorly more frequently than posteriorly because of the weaker transverse ligament. Thus, most of posterior dislocation occurs when the odontoid process is broken or all atlantoaxial ligaments are disrupted⁽¹²⁾.

Hyperextension with variable amounts of distraction has been acknowledged to be the cause of the posterior C1–C2 dislocation without fracture of odontoid process. These injuries tend to cause severe spinal cord damage or immediate death. However, many patients reported in the literatures had normal neurological status, mild or transient neurological deficit (Table 1). This can be explained by the rule of third described by Steel et al⁽¹³⁾. These three one-thirds comprised of odontoid process, spinal cord and spinal fluid. The one-third with spinal fluid is the large free space available for the spinal cord to escape from the compression after dislocation.

The best treatment for these rare conditions cannot be decided upon. The treatment options include closed reduction, open reduction and difference cervical fixation techniques (Table 1). Hu et al⁽¹¹⁾ reported that 58% of dislocations were reduced successfully with closed reduction. It can be performed through manual traction or skull traction with or without general anesthesia⁽¹⁴⁾. Wong et al⁽⁷⁾ advocated closed reduction techniques in three phases. In distraction phase, traction applied in slight flexion to keep the C1 ring opposed to the posterior odontoid. In realignment phase, the C1 ring slipped back over the odontoid, but it was displaced too far forward because of the excessive flexion angle of the traction

force. For the release phase, traction was changed to slight extension, allowing the C1 ring to come closer to the anterior odontoid. Care must be taken for an over-distraction of the C1–C2 complex and improper rotation or flexion-extension maneuver that could damage the spinal cord. Therefore, closed reduction should be performed under fluoroscopic control and continuous assessment of the neurological status.

The stability of the atlantoaxial complex should be confirmed after reduction. Many authors reported successful conservative treatment without any operation in the cases whose stability was restored after closed reduction^(1–4). The transverse ligament plays an important role for this stability and its integrity should be confirmed by MRI^(8,9). Alternatively, this integrity could be determined indirectly on radiographs by measuring an atlanto-dental interval of 3 mm or less in adult⁽¹⁵⁾. Patients with instability or residual subluxation needed the operative atlantoaxial fixation and fusion posteriorly^(5–8). In case of closed reduction failure, open reduction by transoral approach with partial odontoidectomy was recommended, supplemented with posterior fixation and fusion^(16–18).

In our case, the C1–C2 dislocation was initially managed by closed reduction with skull traction under C-arm fluoroscopic guidance. Intravenous morphine was used to relieve the pain. Awakening the patient was easily done to evaluate the neurological status clinically during traction or manual manipulation and there was no need for neurological monitoring. Intraoperative cervical stability testing and 4.3 mm of ADI in postoperative radiograph confirmed the instability after successful closed reduction. We chose the posterior C1–C2 screws fixation and fusion with IBG due to the strongest implant system, high success rate of fusion without rigid postoperative immobilization and low incidence of complications as reported by many studies⁽¹⁹⁾.

Table 1. Summary of previously published case reports.

Authors, year	Age	Gender	Neurological deficit	Reduction technique	Cervical xation
Sassard et al 1974 ⁽¹⁾	20	Female	Mild	Closed	No
Patzakis et al 1974 ⁽²⁾	37	Male	No	Closed	No
Neumann et al 2003 ⁽³⁾	22	Male	No	Closed	No
Chaudhary et al 2008 ⁽⁴⁾	35	Female	Weakness of elbow extensor and hand grip	Closed	No
Haralson and Boyd 1969 ⁽⁵⁾	30	Male	No	Closed	Posterior cervical wiring
Jamshidi et al 1983 ⁽⁶⁾	22	Male	No	Closed	Posterior cervical wiring
Wong et al 1991 ⁽⁷⁾	23	Male	No	Closed	Posterior cervical wiring
Kambali et al 2013 ⁽⁸⁾	32	Male	No	Closed	Posterior screws and rods system
Song et al 2017 ⁽¹⁴⁾	58	Male	Transient quadriplegia	Closed	Posterior screws and rods system
Jiang et al 2010 ⁽⁹⁾	48	Male	No	Open	Partial odontoidectomy with posterior screws and rods system
Zhen et al 2011 ⁽¹⁰⁾	44	Male	No	Open	Partial odontoidectomy with posterior screws and rods system
Hu et al 2015 ⁽¹¹⁾	50	Male	No	Open	Partial odontoidectomy with posterior screws and rods system
Fox and Jerez 1977 ⁽¹⁶⁾	65	Male	Transient quadriplegia	Open	Odontoidectomy with posterior cervical wiring
Sud et al 2002 ⁽¹⁷⁾	38	Male	Upper limb weakness	Open	Partial odontoidectomy with posterior screws fixation
Yoon et al 2003 ⁽¹⁸⁾	64	Male	Quadripareisis	Open	Posterior transarticular screw fixation

Conclusion

The pure posterior atlantoaxial dislocation without odontoid process fracture is extremely rare injury. Most of previous studies favored conscious closed reduction for the initial management and should be done immediately and carefully under fluoroscopic guidance. The definite spinal fixation and fusion should be considered if the instability of cervical spine or rupture of the transverse ligament is presented after anatomical reduction.

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