ScientificScholar®
Knowledge is power
Publisher of Scientific Journals

www.surgicalneurologyint.com

Surgical Neurology International

Editor-in-Chief: Nancy E. Epstein, MD, Clinical Professor of Neurological Surgery, School of Medicine, State U. of NY at Stony Brook.

SNI: Spine

Editor
Nancy E. Epstein, MD
Clinical Professor of Neurological Surgery, School of Medicine, State U. of NY at Stony Brook

SNI
Open Access

Case Report

A case of anterior arch fracture of the atlas associated with C1 laminectomy

Toshinari Kawasaki[1], Motohiro Takayama[1], Yoshinori Maki[2], Kota Nakajima[3], Tamaki Kobayashi[1], Masaaki Saiki[1], Yoshihiko Ioroi[1]

[1]Department of Neurosurgery, Japanese Red Cross Otsu Hospital, Otsu, [2]Department of Neurosurgery, Hikone Chuo Hospital, Hikone, [3]Department of Neurosurgery, Kobe City Medical Center General Hospital, Kobe, Japan.

E-mail: *Toshinari Kawasaki - toshi821@kuhp.kyoto-u.ac.jp; Motohiro Takayama - m-takayama.rx@otsu.jrc.or.jp; Yoshinori Maki - passatempo19840816@gmail.com; Kota Nakajima - koh.nakaji@gmail.com; Tamaki Kobayashi - ktamaki@kuhp.kyoto-u.ac.jp; Masaaki Saiki - seijinbyo@hotmail.com; Yoshihiko Ioroi - yioroi@kuhp.kyoto-u.ac.jp

***Corresponding author:**
Toshinari Kawasaki,
Department of Neurosurgery,
Japanese Red Cross Otsu
Hospital, Otsu, Japan.

toshi821@kuhp.kyoto-u.ac.jp

Received : 23 March 2023
Accepted : 30 March 2023
Published : 14 April 2023

DOI
10.25259/SNI_254_2023

Quick Response Code:

ABSTRACT

Background: Spontaneous anterior arch fracture of the atlas after a C1 laminectomy (CIL) is an extremely rare complication.

Case Description: A 72-year-old male presented with the sudden onset of neck pain. His prior history included; a CIL for atlantoaxial subluxation, shunt closure for a spinal dural arteriovenous fistula at C3, a cervical laminoplasty from C3 to C6 for stenosis, and a prior anterior C4/5 and C5/6 fusion 14 years ago. Once the computed tomography documented a right C1 anterior arch fracture, and occipital-cervical fusion was performed utilizing C2 laminar screws and C4 pedicle screws with halo-vest placement. Postoperatively, the neck pain resolved and he remained stable.

Conclusion: Neurosurgeons should be aware of the risk of anterior arch fractures following a CIL and may alternatively consider a C1 laminoplasty in the future.

Keywords: Anterior arch, Atlas, Cervical laminectomy, Fracture, Spine

INTRODUCTION

The atlas (C1) is a simple ring structure composed of an anterior and a posterior arch with two lateral masses that play a crucial role in stabilizing the craniocervical junction. Atlas fractures account for 3–13% of cervical spine injuries, most of which are attributed to traffic accidents and falls.[2] Here, we report a case of a spontaneous anterior C1 atlas arch fracture following a cervical laminectomy in the absence of trauma.

CASE DESCRIPTION

A 72-year-old male presented with the sudden, spontaneous onset of neck pain. He had a history of two cervical operations; a ½ years ago, he had a C1 laminectomy (CIL) for atlantoaxial subluxation, shunt closure for a spinal dural arteriovenous fistula at the C3

level, and, a cervical laminoplasty from C3 to C6 for stenosis. Fourteen years before that, he had undergone a C4/5–C5/6 anterior cervical. An old cervical computed tomography (CT) 3 months after the operation had documented the prior surgical procedures without a C1 arch fracture [Figure 1]. On this admission, however, he newly showed a right C1 anterior arch fracture on the CT study, while dynamic films confirmed C1-C2 instability

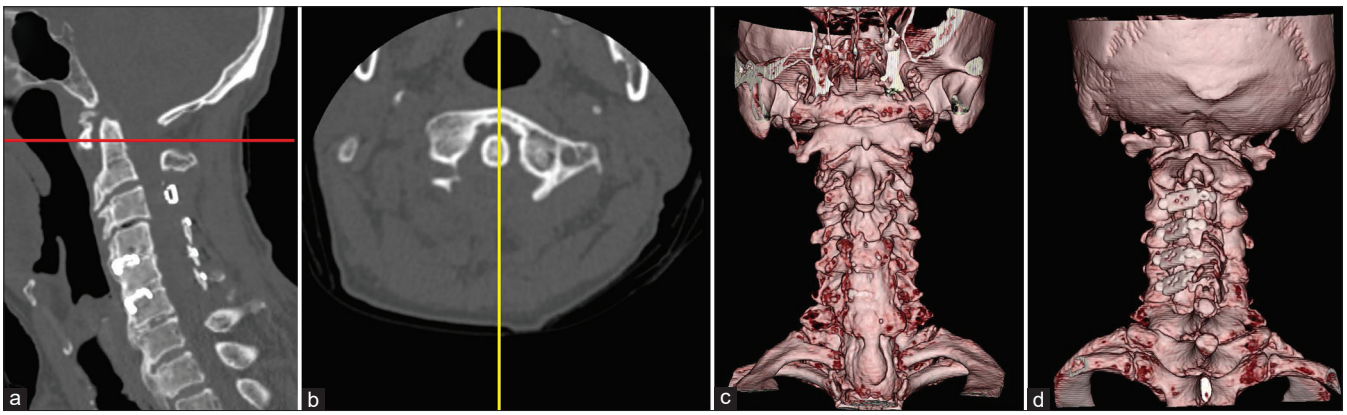

Figure 1: Latest postoperative computed tomography (CT) of sagittal-view (a) and axial-view (b) showed C1 laminectomy, cervical laminoplasty, anterior cervical fusion, and no anterior arch fracture of C1. (b) was at the level of the red line in (a). (a) was at the level of the yellow line in (b). Anterior view (c) and posterior view (d) three-dimensional CT scans.

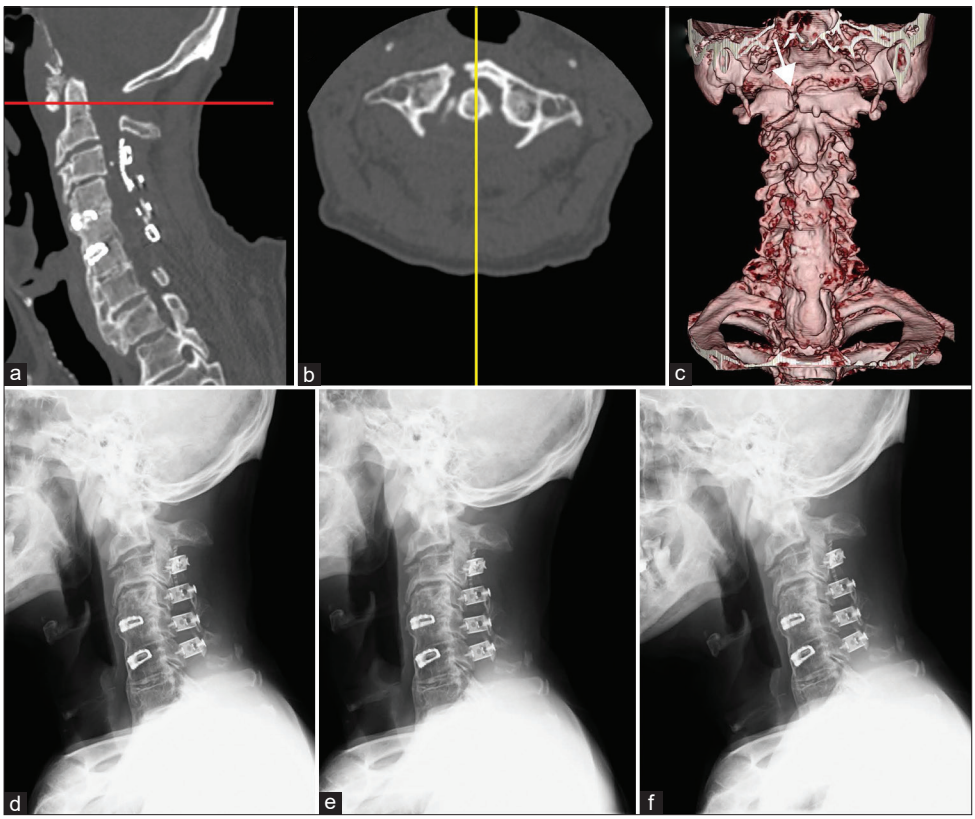

Figure 2: Sagittal-view (a) and axial-view (b) after onset of neck pain showed right C1 anterior arch fracture. (b) was at the level of the red line in the sagittal-view image (a). (a) was at the level of the yellow line in (b). Anterior view (c) three-dimensional computed tomography scan. White arrow indicates right C1 anterior arch fracture. Cervical radiographs indicated instability between C1 and C2 (d: lateral neutral view, (e: extension view, (f: flexion view).

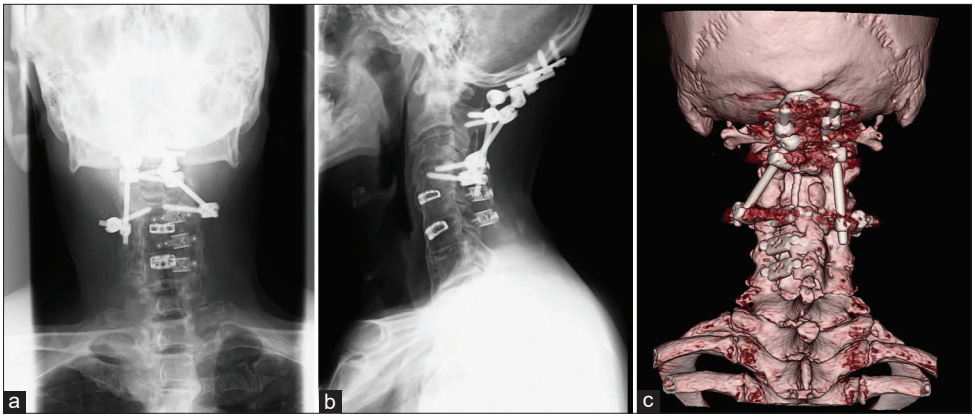

Figure 3: Postoperative cervical radiographs (a: anteroposterior view and b: lateral neutral view) showed the adequate placement of the implants with good cervical alignment. Posterior view (c) three-dimensional computed tomography scans.

[Figure 2]. He underwent an occipitial-cervical fusion with the application of a halo-vest under neuronavigation. A plate was applied to the occipital bone and, with bilateral rods, was connected to bilateral C2 lateral mass (4.0 mm × 30 mm) and C4 bilateral pedicle screws (4.5 mm × 30 mm). Screw locations were all confirmed with C-arm navigation. The fusion included placement of the left iliac bone graft. Postoperative cervical radiographs showed adequate implant placement/alignment [Figure 3]. The patient was discharged from the hospital, with marked abatement of his prior neck pain. The patient has been well for 16 months after the procedure.

DISCUSSION

The mechanism of spontaneous C1 anterior arch fractures associated with C1L may be attributed to excessive, repeated axial loading forces on the C1 anterior arch caused by a lack of sufficient posterior support.[1] Shimizu *et al*. described the concentration of stress distribution in the anterior arch of C1 after C1L, leading to anterior-arch fracture in the absence of trauma (i.e., using atlas models).[4]

Hypothesis: Use of C1 laminoplasty to prevent anterior C1 arch fractures

C1 laminoplasty would help prevent such anterior arch fractures following C1L. Tarukado *et al*. described how C1 laminoplasty performed for spinal cord compression at the C1/2 level resulted in favorable outcomes, and, therefore suggested this might be an effective alternative to CIL for patients without C1–C2 instability.[5] Shimizu *et al*. described a 14.2% (10 patients) incidence of C1 anterior atlas arch fractures in 70 patients who had undergone C1L without fusion.[3] They noted the following independent risk factors; a large inferior facet angle and subaxial ankylosis.

CONCLUSION

Anterior arch fractures of the atlas after a C1L are extremely rare. Neurosurgeons should be aware of the risk of anterior arch fractures following C1L and may alternatively consider laminoplasty rather than C1L in the future.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. Hirano Y, Mizuno J, Watanabe K, Sugawara A, Takeda M, Ogasawara K. Spontaneous C1 anterior arch fracture as a postoperative complication of foramen magnum decompression for Chiari malformation Type 1. Surg Neurol Int 2011;2:138.
2. Kakarla UK, Chang SW, Theodore N, Sonntag VK. Atlas fractures. Neurosurgery 2010;66:60-7.
3. Shimizu T, Otsuki B, Fujibayashi S, Kumamoto S, Hijikata Y, Shimizu Y, *et al*. Incidence and risk factors of anterior arch fracture of the atlas following C1 laminectomy without fusion. Spine (Phila Pa 1976) 2018;43:667-74.

4. Shimizu T, Otsuki B, Fujibayashi S, Takemoto M, Ito H, Sakamoto T, *et al*. Spontaneous anterior arch fracture of the atlas following C1 laminectomy without fusion: A report of three cases and finite element analysis. J Orthop Sci 2016;21:306-15.
5. Tarukado K, Ikuta K, Iida K, Tono O, Doi T, Harimaya K. Radiographic and clinical results of C1 laminoplasty for the treatment of compressive myelopathy. Asian Spine J 2020;14:459-65.

How to cite this article: Kawasaki T, Takayama M, Maki Y, Nakajima K, Kobayashi T, Saiki M, *et al*. A case of anterior arch fracture of the atlas associated with C1 laminectomy. Surg Neurol Int 2023;14: 136.