



Case Report

Thrombolysis for atlantoaxial dislocation mimicking acute ischemic stroke

Adam Tsou, MD^a, Yu-Hsiu Juan, MD^{b,c}, Tsu-Yi Chen, MD^d, Shinn-Kuang Lin, MD^{a,c,*}^a Stroke Center and Department of Neurology, Taipei Tzu Chi Hospital, Buddhist Tzu Chi Medical Foundation, Taiwan^b Department of Radiology, Hualien Tzu Chi Hospital, Buddhist Tzu Chi Medical Foundation, Taiwan^c School of Medicine, Tzu Chi University, Hualien, Taiwan^d Department of Emergency, Taipei Tzu Chi Hospital, Buddhist Tzu Chi Medical Foundation, Taiwan

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ABSTRACT

The frequency of stroke mimics among stroke patients has been reported to be up to 30%, and that in patients who receive thrombolytic therapy ranges between 1% and 16%. Atlantoaxial dislocation with myelopathy mimicking stroke is extremely rare. An 83-year-old man with a history of old cerebellar infarction presented to the emergency department with acute left hemiplegia after a chiropractic manipulation of the neck and back several hours before symptom onset. Mild hypoesthesia was observed on his left limbs. No speech disturbance, facial palsy, or neck or shoulder pain was observed. Intravenous thrombolytic treatment was given 238 min after symptom onset. Brown-Sequard syndrome subsequently developed 6 h after thrombolysis with a hypoesthetic sensory level below the right C5 dermatome. An emergent brain magnetic resonance angiography did not reveal an acute cerebral infarct but rather an atlantoaxial dislocation causing upper cervical spinal cord compression. Clinical symptoms did not deteriorate after thrombolysis. He received successful decompressive surgery 1 week later, and his muscle power gradually improved, with partial dependency when performing daily living activities 2 months later. A literature review revealed that only 15 patients (including the patient mentioned here) with spinal disorder mimicking acute stroke who received thrombolytic therapy have been reported. Atlantoaxial dislocation may present as acute hemiplegia mimicking acute stroke, followed by Brown-Sequard syndrome. Inadvertent thrombolytic therapy is likely not harmful for patients with atlantoaxial dislocation-induced cervical myelopathy. The neurological deficits of patients should be carefully and continuously evaluated to differentiate between stroke and myelopathy.

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1. Introduction

The frequency of stroke mimics in patients with stroke has been reported to be up to 30% [1,2], and that in patients who receive thrombolytic therapy ranges between 1% and 16% [3,4]. Causes of stroke mimics are widely distributed, with the most common diagnoses being seizure, complicated migraine, conversion disorder, and metabolic disorders [2,5]. Spinal cord lesion presenting as acute hemiparesis mimicking stroke is uncommon and accounts for <3% of stroke mimics [6,7]. The frequency of thrombolytic therapy in patients with myelopathy is even lower. Herein, we present an extremely rare case of atlantoaxial dislocation mimicking stroke received thrombolytic therapy.

2. Case presentation

An 83-year-old man with a history of hypertension and old left cerebellar infarction was found to have atlantoaxial dislocation owing to limited neck extension ability approximately 6 months prior. During the period of conservative observation, he had an acute onset of left limb weakness at 20:30 and was sent to the emergency department at 23:30. Code stroke protocol was initiated with a National Institute Health Stroke Scale (NIHSS) score of 9. The muscle power of his left arm and left leg was grade 0/5 (Medical Research Council of Great Britain). Mild hypoesthesia of the left limbs was observed. No dysarthria, dysphagia, or facial palsy was noted. The patient did not complain of neck or shoulder pain. An emergent brain computed tomography (CT) revealed an old left cerebellar infarct. Although the patient had received chiropractic manipulation of the neck and back several hours before the onset of limb weakness, ischemic stroke was first considered because of the presence of multiple vascular risk factors.

We gave the patient intravenous tPA (0.6 mg/kg) 238 min after symptom onset (door-to-needle time: 58 min). A follow-up

* Corresponding author at: Department of Neurology, Taipei Tzu Chi Hospital, Buddhist Tzu Chi Medical Foundation, No 289, Jian Guo Road, 231, Xindian district, New Taipei City, Taiwan.

E-mail addresses: stuartlin0428@gmail.com, sk2022@tzuchi.com.tw (S.-K. Lin).

neurological examination 6 h after tPA treatment revealed persistent left hemiplegia but a decreased pinprick sensation on the right limbs and body with a sensory level of hypoesthesia below the right C5 cervical dermatome. An emergent brain magnetic resonance angiography was performed, which revealed no abnormally increased signals on diffusion-weighted images. Instead, dislocation of the atlantoaxial joint causing upper cervical spinal cord compression with slightly increased signals of the spinal cord on T2-weighted images was observed (Fig. 1A). Measurement of the brain CT with bone window density revealed an atlantodental interval of 4.8 mm and the space available for the spinal cord was markedly reduced to 7.5 mm (Fig. 1B). Intravenous methylprednisolone (40 mg every 6 h) was administered to reduce inflammation and cord swelling, and a cervical collar was used to protect the neck. The patient received a delayed (owing to family members' hesitation) but successful decompressive surgery without complications 1 week later through atlantoaxial fixation with the fusion of the occiput. The muscle power of his left limbs gradually improved to grade 3/5 after rehabilitation 2 months later.

3. Discussion

An increasing rate of thrombolytic therapy with decreasing door-to-needle time has been reported in patients with stroke mimics, particularly in leading CT-based hospitals [8,9]. In our CT-based hospital, the patient in this case report was the only one who received intravenous tPA treatment turned out to be a stroke mimic. We conducted a literature review and discovered that only 15 patients (including the patient mentioned here) with spinal disorder mimicking acute stroke who received thrombolytic therapy have been reported (Table 1 [8,10–18]). Detailed clinical features of two patients were unavailable. This group of patients comprised seven men and six women with a mean age of 65.5 years. Left hemiparesis was observed in 10 patients. The most frequent cause of acute hemiparesis was cervical spinal epidural hematoma, which accounted for 53% of all patients. Initial neck, shoulder, or upper back pain was present in 8/13 (62%) patients and was present in almost all patients with epidural hematoma, except for one patient with tumor bleeding. Four patients with epidural hematoma and one patient with tumor bleeding experienced clinical deterioration after tPA treatment. Only one patient with tumor bleeding had an outcome of dependency when performing activities of daily living. Several studies have addressed the safety of using thrombolysis in stroke mimics [11,19]. However, serious complications from inadvertent intravenous tPA treatment might be underreported. More attention must be paid to patients with cervical epidural hematoma or tumor bleeding, in

whom clinical deterioration might be triggered by an extension of hemorrhage caused by thrombolytic therapy.

Speech disorders and facial paralysis are usually not present in patients with spinal lesions [20]. Coexistent neck, shoulder, or upper back pain is an important clue for the identification of cervical problems, particularly cervical epidural hematoma. Nevertheless, pain may not be present in spinal disorders [20]. Furthermore, contralateral hypoesthesia can be mild or nonexistent in the acute stage of Brown-Sequard syndrome, when neurological deficits have not fully formed. Ali et al. developed the TeleStroke Mimic (TM)-score to discriminate strokes from stroke mimics: (age $\times$ 0.2) + 6 (if history of atrial fibrillation) + 3 (if history of hypertension) + 9 (if facial weakness) + 5 (if NIHSS > 14) – 6 (if history of seizure) [21]. By applying the clinical features of our patient to this prediction rule, we obtained a TM-Score of 19.6 and a likelihood of stroke mimic of 24%. In other words, the likelihood of stroke was 76%, which is higher than the value of 72% reported on the Cincinnati Prehospital Stroke Scale when arm weakness is presented [22].

Atlantoaxial dislocation is defined radiologically as an atlantodental interval >3 mm in adults [23], and compression myelopathy occurs if the space available for the spinal cord is <13 mm [24]. Neurological symptoms of atlantoaxial dislocation include radiculopathy, myelopathy and vertebralbasilar insufficiency [25]. Serious neurological complications caused by cervical manipulation include ischemic stroke, subdural hematoma, radiculopathy, and myelopathy [26]. Given that atlantoaxial dislocation combined with cervical manipulation also increases the risk of stroke, the decision to administer thrombolytic therapy at the emergency department may not be erroneous.

In conclusion, atlantoaxial dislocation may present as acute hemiplegia mimicking acute stroke. Inadvertent thrombolytic therapy to cervical myelopathy is likely not harmful. The neurological deficits of the patient should be carefully and continuously evaluated to differentiate between stroke and myelopathy.

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Declarations of interest

None.



Fig. 1. (A) Sagittal spinal MRI on T2-weighted imaging reveals an atlantoaxial dislocation causing severe upper cervical spinal cord compression (arrow) with an intramedullary high-intensity lesion. (B) Measurements on the sagittal spinal CT with bone window density revealed a widened atlantodental interval (ADI) of 4.8 mm and a markedly reduced space of 7.5 mm available for the spinal cord (SAC).

Table 1

Reported cases of cervical myelopathy mimicking acute ischemic stroke treated with thrombolytic therapy.

Reference	Age/gender	Symptoms/signs	Pain	Location of lesion	Deterioration after tPA	Outcome
Chernyshev et al. [11]	NA	NA	NA	Cervical spinal epidural mass with hemorrhage	No	NA
Knaissi et al. [12]	65/M	Left hemiparesis	Neck and left shoulder pain	C5–C6 spinal epidural hematoma	Yes	Independent
Son et al. [13]	63/M	Disturbed consciousness, left arm weakness and flaccid paraplegia	Severe neck and left shoulder pain	C4–T2 spinal epidural hematoma	No	Partially dependent
Okada et al. [14]	49/F	Left hemiparesis	No	C1–T2 epidural hematoma	Yes	Independent
Yurter et al. [15]	69/F	Left hemiparesis	Left neck and upper back pain	C1–T1 spinal epidural hematoma	Yes	Partially dependent
Liberman et al. [8]	NA	NA	NA	Cervical spine injury	NA	NA
Nunes et al. [16]	71/M	Right sensory-motor hemiparesis, facial asymmetry	Interscapular pain	C4–C7 spinal epidural hematoma	No	Partially dependent
Siddiqui et al. [17]	69/F	Right hemiplegia	Right neck pain	C2–C6 extradural tumor bleeding	Yes	Dependent
Kim et al. [10]	71/M	Left hemiparesis with Brown-Sequard syndrome	No	Cervical herniated disc	No	Partially dependent
	73/F	Left hemiparesis	Left neck pain	Spinal epidural hematoma	No	Partially dependent
	58/F	Left hemiparesis with Brown-Sequard syndrome	No	Cervical herniated disc	No	Partially dependent
	65/F	Left hemiparesis	Left neck pain	Spinal epidural hematoma	No	Partially dependent
Patel et al. [18]	65/M	Left hemiparesis	No	Cervical epidural abscess	No	Independent
	51/M	Right hemiparesis, T12 sensory level	Right neck pain	C3–C5 spinal epidural hematoma	Yes	Independent
Present case	83/M	Left hemiplegia followed by Brown-Sequard syndrome	No	C1–C2 subluxation	No	Partially dependent

NA: not available; tPA: tissue plasminogen activator.

References

- [1] Hand PJ, Kwan J, Lindley RI, et al. Distinguishing between stroke and mimic at the bedside: the brain attack study. *Stroke* 2006;37:769–75. <https://doi.org/10.1161/01.STR.0000204041.13466.4c>.
- [2] Moulin S, Leys D. Stroke mimics and chameleons. *Curr Opin Neurol* 2019;32:54–9. <https://doi.org/10.1097/WCO.0000000000000620>.
- [3] Zinkstok SM, Engelter ST, et al. Safety of thrombolysis in stroke mimics: results from a multicenter cohort study. *Stroke* 2013;44:1080–4. <https://doi.org/10.1161/STROKEAHA.111.000126>.
- [4] Tsivgoulis G, Zand R, Katsanos AH, et al. Safety of intravenous thrombolysis in stroke mimics: prospective 5-year study and comprehensive meta-analysis. *Stroke* 2015;46:1281–7. <https://doi.org/10.1161/STROKEAHA.115.009012>.
- [5] Huff JS. Stroke mimics and chameleons. *Emerg Med Clin N Am* 2002;20:583–95.
- [6] Bailey KC, Sochor MR, Wintermark M, et al. Spontaneous cervical epidural hematoma mimicking stroke. *J Neuroradiol* 2012;39(2):132–4. <https://doi.org/10.1016/j.neurad.2011.03.001>.
- [7] Gibson LM, Whiteley W. The differential diagnosis of suspected stroke: a systematic review. *J R Coll Physicians Edinb* 2013;43:114–8. <https://doi.org/10.4997/JRCPE.2013.205>.
- [8] Liberman AL, Liotta EM, Caprio FZ, et al. Do efforts to decrease door-to-needle time risk increasing stroke mimic treatment rates? *Neurol Clin Pract* 2015;5:247–52. <https://doi.org/10.1212/CJP.0000000000000122>.
- [9] Burton TM, Luby M, Nadareishvili N, et al. Effects of increasing IV tPA-treated stroke mimic rates at CT-based centers on clinical outcomes. *Neurology* 2017;89:343–8. <https://doi.org/10.1212/WNL.0000000000004149>.
- [10] Kim MC, Kim SW. Improper use of thrombolytic agents in acute hemiparesis following misdiagnosis of acute ischemic stroke. *Korean J Neurotrauma* 2018;14(1):20–3. <https://doi.org/10.13004/kjnt.2018.14.1.20>.
- [11] Chernyshev OY, Martin-Schild S, Albright KC, et al. Safety of tPA in stroke mimics and neuroimaging-negative cerebral ischemia. *Neurology* 2010;74:1340–5. <https://doi.org/10.1212/WNL.0b013e3181dad5a6>.
- [12] Knaissi N, Derex L, Cho TH, et al. The risk of thrombolysis in “stroke mimics”: a case report. *Neurol Sci* 2011;32:973–5. <https://doi.org/10.1007/s10072-010-0462-7>.
- [13] Son S, Kang DH, Choi DS, et al. A case of spontaneous spinal epidural hematoma mimicking a stroke. *Neurologist* 2012;18:41–3. <https://doi.org/10.1097/NRL.0b013e31823d7ade>.
- [14] Okada E, Matsumoto M, Watanabe K, et al. A case of spontaneous spinal epidural hematoma that mimicked acute cerebral ischemic stroke and was treated by a recombinant tissue-type plasminogen activator. *Neurosurg Q* 2012;22:99–101. <https://doi.org/10.1097/WNQ.0b013e3182345176>.
- [15] Yurter A, Kaloustian PE. Spontaneous cervical epidural hematoma mimicking stroke: a new perspective on diagnosis and treatment. *Open J Modern Neurosurg* 2013;3:59–62. <https://doi.org/10.4236/ojmn.2013.34013>.
- [16] Nunes RM, João RB, Motta ACBS, et al. An atypical presentation of spinal epidural hematoma: case report and literature review. *J Neurol Stroke* 2017;7(1):00227. <https://doi.org/10.15406/jnsk.2017.07.00227>.
- [17] Siddiqui KA, Radhakrishnan R, Dehdashtian AR, et al. Unusual stroke mimic. *J Neurol Stroke* 2017;7(7):00262. <https://doi.org/10.15406/jnsk.2017.07.00262>.
- [18] Patel R, Kumar A, Nishizawa K, et al. Hemiparesis in spontaneous spinal epidural haematoma: a potential stroke imitator. *BMJ case report* 2018. <https://doi.org/10.1136/bcr-2017-222686>.
- [19] Winkler DT, Fluri F, Fuhr P, et al. Thrombolysis in stroke mimics: frequency, clinical characteristics, and outcome. *Stroke* 2009;40:1522–5. <https://doi.org/10.1161/STROKEAHA.108.530352>.
- [20] Koksal V, Yavasi O. Controversies in the differential diagnosis of Brown-Sequard syndrome due to cervical spinal disease from stroke: a case series. *Turk J Emerg Med* 2017;17:115–20. <https://doi.org/10.1016/j.tjem.2017.05.002>.
- [21] Ali SF, Viswanathan A, Singhal AB, et al. The TeleStroke Mimic (TM)-Score: a prediction rule for identifying stroke mimics evaluated in a telestroke network. *J Am Heart Assoc* 2014;3:e000838. <https://doi.org/10.1161/JAHA.114.000838>.
- [22] Kothari R, Hall K, Brott T, et al. Early stroke recognition: developing an out-of-hospital NIH Stroke Scale. *Acad Emerg Med* 1997;4:986–90.
- [23] Wang S, Wang C, Yan M, et al. Novel surgical classification and treatment strategy for atlantoaxial dislocations. *SPINE* 2013;38(21):E1348–56. <https://doi.org/10.1097/BRS.0b013e3182a1e5e4>.
- [24] Yurube T, Sumi M, Nishida K, et al. Kobe Spine Conference. Incidence and aggravation of cervical spine instabilities in rheumatoid arthritis: a prospective minimum 5-year follow-up study of patients initially without cervical involvement. *Spine* 2012;37(26):2136–44. <https://doi.org/10.1097/BRS.0b013e31826def1c>.
- [25] Jones MW, Kaufmann JCE. Vertebrobasilar artery insufficiency in rheumatoid atlantoaxial subluxation. *J Neurol Neurosurg Ps* 1976;39:122–8.
- [26] Stevincen C, Honan W, Cooke B, et al. Neurological complications of cervical spine manipulation. *J R Soc Med* 2001;94:107–10.