

# Influenza A (H1N1) Encephalitis with Right Axillary Nerve Lesion

## Sağ Aksiller Sinir Lezyonu İle birlikte Influenza A (H1N1) Ensefaliti

Sevgi GÜMÜŞ ATALAY<sup>a</sup>, Sumru ÖZEL<sup>a</sup>

<sup>a</sup>Department of Physical Medicine and Rehabilitation, University of Health Sciences Ankara City Hospital, Ankara, Türkiye

**ABSTRACT** The influenza virus (H1N1) infection can be causative of the encephalitis, as with other influenza virus infections. In a six-year-old female patient, fever, and neurological symptoms developed three days after influenza-like symptoms appeared. Multifocal lesions, including bilateral thalamus, brain stem, and cerebral hemisphere, compatible with viral encephalitis were monitored on cranial magnetic resonance imaging of the patient. A result of physical therapy and rehabilitation program, her neurological symptoms except for abduction and external rotation of the right shoulder improved. Right axillary nerve lesion was detected on electromyoneurographic. The patient was considered to have axillary nerve involvement due to the same infection in addition to H1N1 encephalitis. Influenza A H1N1 virus can appear with various neurological medical courses. It should be kept in mind with the help of this case report that central and peripheral nervous system can be involved together such as deterioration of general condition and change in consciousness.

**Keywords:** Axillary nerve injury; encephalitis; H1N1; influenza A virus

**ÖZET** Grip virüsü (H1N1) enfeksiyonu, diğer grip virüsü enfeksiyonlarında olduğu gibi ensefalite neden olabilir. Altı yaşındaki kız hastada grip benzeri semptomların ortaya çıkmasından 3 gün sonra ateş ve nörolojik semptomlar gelişmiştir. Hastanın kraniyal manyetik rezonans görüntülemesinde viral ensefalit ile uyumlu olarak, bilateral talamus, beyin sapı ve serebral hemisfer gibi multifokal lezyonlar izlendi. Fizik tedavi ve rehabilitasyon programının sonucunda, hastanın sağ omuz abduksiyon ve dış rotasyonu dışındaki nörolojik semptomları düzeldi. Elektromiyografide sağ aksiller sinir lezyonu tespit edildi. Hastada H1N1 ensefalite ek olarak aynı enfeksiyon nedeniyle aksiller sinir tutulumu düşünüldü. İnfluenza A H1N1 virüsü, çeşitli nörolojik medikal durumlara ortaya çıkabilir. Genel durum bozukluğu, bilinç değişikliği gibi merkezi ve periferik sinir sisteminin birlikte tutulabileceği bu olgu sunumu yardımıyla akılda tutulmalıdır.

**Anahtar Kelimeler:** Aksiller sinir hasarı; ensefalit; H1N1; influenza A virüsü

Novel type influenza A (H1N1) virus first emerged in 2009 and caused a pandemic. Clinical course of H1N1 can range from a mild upper respiratory tract infection to a life-threatening severe condition.<sup>1</sup> While classic influenza symptoms are seen in mild influenza without complications, pneumonia, central nervous system symptoms, severe dehydration, renal failure, multiorgan failure, myocarditis, rhabdomyolysis, invasive secondary bacterial infection, or septic shock can be seen in severe influenza or influenza with complications.<sup>2</sup> Influenza infections

can cause several neurological complications including polyneuritis, meningitis, encephalomyelitis, encephalopathy, and Guillain-Barré syndrome (GBS).<sup>3</sup> Although pneumonia is the most common complication of H1N1 infection, it is important to consider encephalitis, which is a rare complication of H1N1 in the differential diagnosis, when acute respiratory distress, loss of consciousness and worsening of general condition develop following the signs of influenza infection, and to obtain cultures for viral infections in the early period.

**Correspondence:** Sevgi GÜMÜŞ ATALAY

Department of Physical Medicine and Rehabilitation, University of Health Sciences Ankara City Hospital, Ankara, Türkiye

**E-mail:** sevgigumusatalay@hotmail.com

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## CASE REPORT

A six-year-old female patient was admitted to the family physician with the complaints of cough and sore throat and she was given symptomatic treatment. Three days later, she applied to the pediatric emergency service because of his general condition worsening, somnolence and changes in consciousness. On physical examination, she was unconscious and had a Glasgow Coma Scale of 9 and was admitted to the intensive care unit.

She had no feature in her medical history. Her family history gave the information that her 4-year-old brother deceased a week ago when he was followed up in the intensive care unit with the diagnosis of encephalitis after similar complaints. On December 21 2019, novel influenza A (H1N1) viral RNA was detected in nasopharyngeal specimens but not in cerebrospinal fluid (CSF) of the patient who was followed up in the intensive care unit. Influenza virus is only occasionally determined in CSF. Hemogram, serum electrolyte and immunoglobulin levels were normal. There was no white blood cell on lumbar puncture and Gram stain result was negative. Epileptic activity was not monitored on electroencephalogram. On December 21 2019, Subcortical white matter lesions and diffusion restriction in bilateral frontal, right parieto-occipital and right cerebral hemisphere were monitored on cranial magnetic resonance imaging (MRI) and the image was reported as encephalitis after viral infection. Antiviral therapy included oseltamivir, ceftriaxone, vancomycin, and acyclovir. Although drugs were added to the patient's treatment, adequate response could not be obtained. When clinically sufficient response was not obtained in the treatment, the patient received intravenous immunoglobulin, pulse steroid and plasmapheresis treatments, respectively. In January 2020, the patient whose treatment was completed in the intensive care unit was transferred to the pediatric neurology service.

In February 2020, the patient was admitted to our clinic for rehabilitation after her medical treatment was completed and her general condition was stable. On neurological examination, the patient was conscious, oriented, and cooperative. She could hold

her head but had no sitting balance and passive range of motion was full in four extremities and she had no active motion. Sensory examination was performed but superficial, deep, and cortical sensory examinations could not be fully evaluated. There was no control on bladder, rectum or feeling. Deep tendon reflexes were brisk, plantar reflex was indifferent and tonus was normotonic. The patient had poor functional status.

A program including range of motion, balance, posture and neurophysiological rehabilitation exercises, functional electrical stimulation and robotic rehabilitation was arranged for the patient. Rehabilitation robots include training devices used to retrain and regulate lost body functions caused by neurological or traumatic events. Armeospring, one of the robotic rehabilitation devices, (Hocoma AG, Zurich, Switzerland) was used to increase pediatric and upper extremity functions, and the Andago gait system, C-mill and Locomat robotic rehabilitation devices were used for gait training. The C-Mill rehabilitation system was used for both gait analysis and gait training. It is a system used for balance and gait training in patients with balance insufficiency. As a result of the rehabilitation program, except for muscle weakness in abduction and external rotation of the right shoulder, her muscle strength improved, and she became ambulatory without support under supervision. The last functional status of the patient's was shown in [Figure 1](#) and [Figure 2](#).

On electromyoneurographic (EMG) examination performed due to the present muscle weakness, compound muscle action potential amplitude of the right axillary nerve with stimulation at Erb's point and recording from deltoid muscle was significantly low compared to the left on nerve conduction studies. On needle EMG, apart from deltoid and teres minor muscles, other C5/C6 anterior root/anterior horn-innervated muscles were normal in terms of bioelectrical activity, which revealed that there was isolated axillary nerve involvement. Needle EMG also showed long-term, polyphasic, normal/high amplitude motor unit potentials, reinnervation potentials and abundant denervation potentials in the deltoid muscle, showing advanced thinning in the right deltoid and teres minor muscles. Other muscles exam-



**FIGURE 1:** As a result of the rehabilitation program on 12 weeks, except for muscle weakness in abduction and external rotation of the right shoulder, her muscle strength improved, and she became ambulatory without support under supervision.



**FIGURE 2:** As the result of rehabilitation program, she became ambulatory without support under supervision.

ined (teres major, biceps, brachioradialis, supraspinatus, infraspinatus, rhomboideus major, serratus anterior, triceps, flexor carpi radialis, extensor digitorum communis, first dorsal interosseus) were evaluated as normal.

An additional program for axillary nerve lesion was added to the present rehabilitation program of the patient. In May 2020, the patient was discharged at the request of her family. She was called for control to the physical therapy and rehabilitation outpatient clinic. A written informed consent was obtained from the patient's family.

## DISCUSSION

Influenza infections can cause several neurological complications such as polyneuritis, meningitis, encephalomyelitis, encephalopathy, GBS, and cranial nerve involvement (oculomotor nerve involvement).<sup>3,4</sup> They can also cause different muscle involvements. Bilateral upper extremity weakness, and bilateral hand weakness due to myositis, and bilateral femoral nerve compression due to rhabdomyolysis have been reported.<sup>5-7</sup>

Although incidence of neurological complications is not definitely known it is predicted to be 4 per 100,000 children in a year.<sup>1</sup> There is no marker to predict the development of neurological complications in patients with influenza-like symptoms. It has been reported that early age is the most important risk factor for neurological complications associated with influenza and neurological complications are more common in children under the age of six.<sup>2</sup> As our case was under the age of six and her 4-year-old brother deceased with the same diagnosis, she was in the risk group.

The duration between fever and the first neurological symptoms is generally shorter than 48-72 hours. The first neurological symptoms can be seizure, loss of consciousness, personality changes, speech disturbances, hallucinations, cranial nerve abnormalities, motor deficits, and gait disorder.<sup>2</sup> In our case, neurological symptoms appeared 72 hours after influenza symptoms appeared and the first neurological symptoms were somnolence and clouding of consciousness.

Neurological studies can help confirmation of the diagnosis, assessment of the severity of clinical condition and treatment selection. The most common neuroradiological abnormalities reported in patients with neurological complications due to influenza are localized or generalized edema, cortical and subcortical white matter signal changes, and bilateral symmetric multifocal lesions on thalamus and cerebral medulla.<sup>8</sup> In our case, the most affected regions of central nervous system were cerebellum, brain stem, mesencephalon, thalamus, basal ganglions, and periventricular white matter.

Severity of acute encephalitis and encephalopathy is very changeable. There may be patients characterized with high morbidity and mortality and with malignant clinical course. Pathophysiology of influenza-associated encephalopathy cannot be fully understood. Direct viral invasion of central nervous system, proinflammatory cytokines, metabolic disorders, autoimmune mechanisms, or genetic predisposition can cause it. Since a virus was not detected on CSF polymerase chain reaction (PCR) and culture of our patient and her brother deceased due to the same diagnosis, we think the virus in our case was caused by immune-mediated or autoimmune mechanism of influenza-associated encephalopathy rather than by direct viral invasion of central nervous system.

Neurological complications developing were divided into two groups as neurological complications due to H1N1 influenza virus infection and neurological complications due to influenza vaccine and assessed in a review published in 2014.<sup>3</sup> The rate of pediatric patients was significantly higher than the rate of adult patients in the group of neurological complications due to H1N1 influenza virus infection. While the incidence of clinical symptoms such as seizures and status epilepticus, and encephalitis-encephalopathy was high in the group of neurological complications due to H1N1 influenza virus infection the incidence of GBS or cranial neuropathy and acute disseminated encephalomyelitis was significantly high in the group of neurological complications due to influenza vaccine. According to clinical results, the

rate of improvement was higher in the group of neurological complications due to H1N1 influenza virus infection.<sup>3</sup> Improvement of encephalitis symptoms in our patient was consistent with these results.

Different neurological complications such as brachial plexopathy and Bell's paralysis after vaccination for H1N1 virus infection have also been reported in the literature.<sup>9</sup> Muscles strengthened in four extremities but weakness continued in abduction and external rotation of the right shoulder in our case who was hospitalized for rehabilitation in our clinic, which made us consider axillary nerve involvement. Findings on EMG were consistent with our diagnosis. Axillary nerve injury can develop depending on trauma, humerus fractures, traction, crutch use, carbon monoxide poisoning, malaria infection, and viral infections. Our case had no trauma, traction, or fracture in her medical history. Axillary nerve involvement in our patient can be associated with H1N1 viral infection as she was diagnosed with influenza A H1N1.

Influenza A H1N1 virus can appear with various neurological courses. It should be kept in mind with the help of this case report that central and peripheral nervous system may be involved together. In addition, we can say that early rehabilitation is very effective in reducing the sequelae of the disease.

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#### **Conflict of Interest**

*No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.*



## REFERENCES

1. Jain R, Goldman RD. Novel influenza A(H1N1): clinical presentation, diagnosis, and management. *Pediatr Emerg Care*. 2009;25:791-6. [[Crossref](#)] [[PubMed](#)] [[PubMed](#)]
2. Treanor JJ. Influenza (Including Avian Influenza and Swine). In: Bennett JE, Dolin R, Blaser MJ, eds. *Mandell, Douglas, and Bennett's Principles and Practice of Infectious Diseases*. 8th ed. Philadelphia, PA: Churchill Livingstone Elsevier, 2015: 2000-24. [[Crossref](#)]
3. Cárdenas G, Soto-Hernández JL, Díaz-Alba A, et al. Neurological events related to influenza A (H1N1) pdm09. *Influenza Other Respir Viruses*. 2014;8:339-46. [[Crossref](#)] [[PubMed](#)] [[PMC](#)]
4. Senda J, Araki K, Tachi Y, et al. Acute unilateral isolated oculomotor nerve palsy in an adult patient with influenza A. *Intern Med*. 2019;58:433-6. [[Crossref](#)] [[PubMed](#)] [[PMC](#)]
5. Scaber J, Molyneux AJ, Buckley C, et al. Two case reports of distal upper limb weakness following influenza-like illness: an emerging pattern of parainfectious myositis in adults. *BMC Neurol*. 2020;20:237. [[Crossref](#)] [[PubMed](#)] [[PMC](#)]
6. Datta S, Cosgrove J, Alam T, et al. Unusual case of bilateral hand weakness. *Pract Neurol*. 2017;17:479-81. [[Crossref](#)] [[PubMed](#)]
7. Ng YS, Li HS, Chan CW. Bilateral femoral nerve compression and compartment syndrome resulting from influenza A-induced rhabdomyolysis: a case report. *J Orthop Surg (Hong Kong)*. 2008;16:117-21. [[Crossref](#)] [[PubMed](#)]
8. Dadak M, Pul R, Lanfermann H, et al. Varying patterns of CNS imaging in influenza a encephalopathy in childhood. *Clin Neuroradiol*. 2020;30:243-9. [[Crossref](#)] [[PubMed](#)]
9. Bardage C, Persson I, Orqvist A, et al. Neurological and autoimmune disorders after vaccination against pandemic influenza A (H1N1) with a monovalent adjuvanted vaccine: population based cohort study in Stockholm, Sweden. *BMJ*. 2011;343:d5956. [[Crossref](#)] [[PubMed](#)] [[PMC](#)]