Korean Journal of Pediatrics Vol. 52, No. 3, 2009
DOI : 10.3345/kjp.2009.52.3.380
Case report

A case of acute transverse myelitis following chickenpox

Min Young Kim, M.D. and Eun Sook Suh, M.D.

Department of Pediatrics, College of Medicine, Soonchunhyang University, Seoul, Korea

= Abstract =

Acute transverse myelitis (ATM) in most patients is characterized by an abrupt onset of progressive weakness and sensory disturbance in the lower extremities with a preceding viral infection such as Epstein-Barr, herpes simplex, influenza, mumps and Varicella-zoster viruses (VZV). Although less frequent, some residual deficits including bladder dysfunction or weakness in the lower extremities may follow ATM, from which recovery usually begins within the first week of the onset of symptoms. In this report, we describe the case of a 9-year-old girl who experienced ATM following chickenpox and had bladder dysfunction as a sequela. (Korean J Pediatr 2009;52:380-384)

Key Words : Myelitis, Transverse; Varicella-zoster; Chickenpox

Introduction

Acute transverse myelitis (ATM) refers to inflammation across the width of the spinal cord. Although ATM is a recognized entity, little is known about its etiology[1]. Many cases of ATM are linked to a previous viral infection including Epstein-Barr, herpes simplex, coxsackie, mumps, influenza, rubella, hepatitis A and B, cytomegalovirus and varicella zoster viruses, responsible for the etiology of 20-40% of cases[2-4]. Varicella zoster virus (VZV) is a rare cause of ATM, the frequency of which during or following the VZV infection is 0.3%[5]. VZV can cause neurological defects by invading the central nervous system. It typically causes bilateral sensory deficit at a certain level, paraparesis, quadriparesis, paralysis, and abnormal rectal and bladder function[6]. The diagnosis is triggered by clinical features with a medical record of chickenpox, laboratory examinations including serologic VZV antibody test and cerebrospinal fluid (CSF) analysis with VZV PCR, and spinal magnetic resonance imaging (MRI) findings[4, 7]. Sphincter dysfunctions and weakness in the lower extremities are considered as important and common sequelae of ATM[8, 9]. The bladder dysfunction improves more slowly than the other deficits do. The prognosis is related to whether the duration of the plateau is within one week, supraspinal symptoms are present, and it takes shorter than one month to walk independently[6, 10].

We report a girl with a recent disease history of chickenpox who showed a rapid and marked improvement in all clinical manifestations except for minimal bladder dysfunction, although she had no mobility of her lower extremities on admission.

Case report

A 9-year-old girl was admitted to our hospital after three-day-care in another university hospital with complaints of paralysis in the lower extremities occurring abruptly in the morning three days ago. She had recently been in good health except that she had suffered from chickenpox 18 days before the onset of paralysis, which was her only disease on record.

Initially, she had been presumably diagnosed with meningitis based on the analysis of CSF revealing elevated white blood cell count of 140/μL and protein level of 222 mg/dL, and treated with antibiotics. However, the paralysis in her lower extremities had seldom improved. Accordingly, spinal MRI was required to be preformed for identifying the cause of her paralysis as further evaluations, and it showed the longitudinal view of high signal intensity and fusiform swelling extending from C1 to T6 levels on T2-weighted images (Fig. 1A). T1-weighted axial images showed an edematous lesion of the cord compressing extramedullary space (Fig. 1B). On admission to our hospital, her vital signs were stable

Received : 11 August 2008, Revised : 9 September 2008,
Accepted : 6 November 2008
Address for correspondence : Eun Sook Suh, M.D., Ph.D.
Department of Pediatrics, Soonchunhyang University Hospital,
#22 Daesakwangil, Yongsan-Gu, 140-743 Seoul, Korea
Tel : +82.2-709-9487, Fax : +82.2-794-5471
E-mail : essuh@hosp.sch.ac.kr

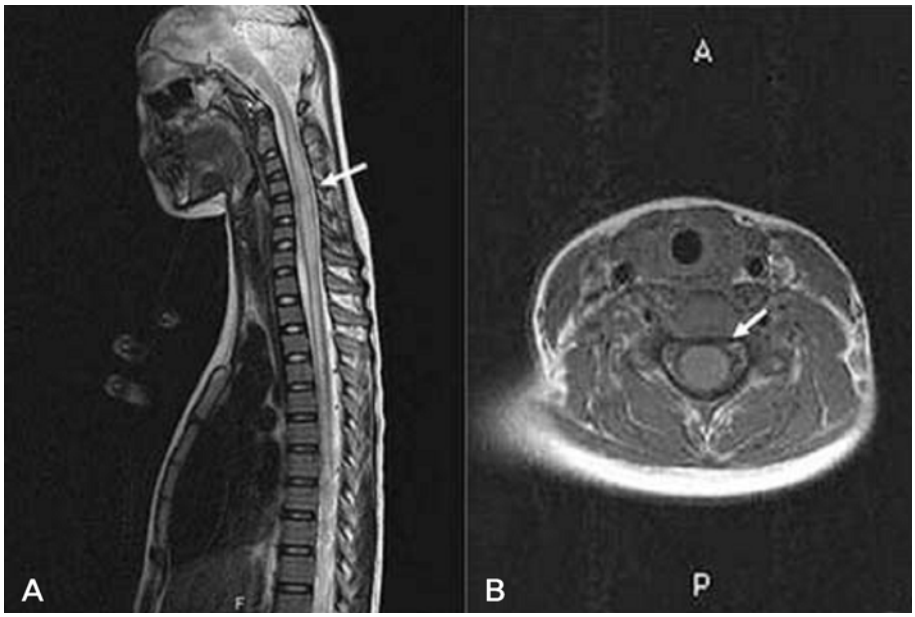

Fig. 1. On initial MRI, T2-weighted sagittal image (A) shows a longitudinal view of the intramedullary high signal intensity and fusiform swelling (arrow) extending to the C1-T6 levels. T1-weighted axial image (B) shows an edematous lesion (arrow) of the cord compressing the extramedullary space.

with alert mental status. Neurologic examination showed normal consciousness, cooperation, orientation, intact cranial nerves, and normal cerebellar functions. Her motor power was grade IV/V in both upper extremities, while it showed the decrease in the lower extremities as grade II/V, bilaterally. There was hypotonic muscle tone and diminished sensation to temperature, pain, light touch and vibration. Babinski signs were negative. Right ankle clonus was checked positively. There was no neck stiffness.

Laboratory examinations disclosed white blood cell count of 6,600/μL, hemoglobin level of 12.7 g/dL, hematocrit of 37.1 %, and platelet count of 440,000/μL. Albumin, glucose, aspartate aminotransferase (AST) and alanine aminotransferase (ALT), urea, creatinine level, and electrolytes were all within normal limits. Also, C-reactive protein was 0.5 mg/dL (normal range, 0-0.8 mg/dL). ELISA for IgM antibodies to VZV in serum was positive, but VZV PCR in CSF negative. Although VZV was not found in CSF, we made a confirmed diagnosis of ATM following chickenpox based on her important medical disease history, positive VZV IgM antibody in serum and the findings of the spinal MRI.

The patient was treated with a high dose of intravenous methylprednisolone (1 g/1.73m^2) for five consecutive days followed by oral prednisolone (1 mg/kg/day) for a total treatment duration of fourteen days. Antiviral acyclovir (30 mg/kg/day q 8 hours) was additionally administered. She also received physical therapy by help of the department of rehabilitation medicine. On the 10th day after the outbreak of the disease, her paralytic symptoms began to improve, and she could eventually walk for herself even though she was unsteady on her feet. Follow-up spinal MRI performed on the 11th day showed a remarkable improvement of the edematous lesions (Fig. 2). The paralysis completely disappeared within two weeks. In spite of her favorable recovery from paralysis in the lower extremities, she had to keep urinary catheterization because of urinary incontinence and voiding difficulty. She started to take voiding training through clean intermittent catheterization on the 13th day. Uroflowmetry performed on the 21st day showed the maximum flow rate was 2.1 mL/sec while acceptable minimal urine flow rate in the females between 8 and 13 years is 15 mL/sec, and postvoid residual volume was 110 mL (normal range, below 50 mL). As her voiding dysfunction, we performed her nelatone urination training 4 times every day, and started to administer cholinergic agent, bethanechol to her on the 22nd day. Her postvoid residual volume was checked 39 mL.

As her urinary symptoms showed improvement, she was discharged on the 25th day. About one month after discharge, we could see her fully recovered for the minimal urinary retention. Thereafter, throughout periodic follow-up observa-

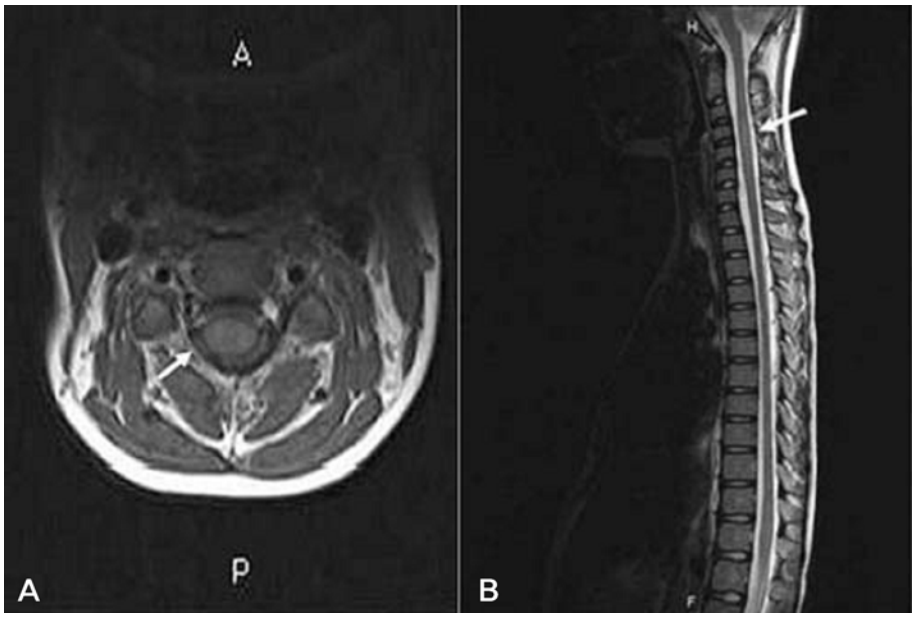

Fig. 2. On a follow-up MRI performed on the 11th day, T1-weighted axial image (A) shows a marked improvement (arrow) of the edematous swelling of the cord. T2-weighted sagittal image (B) shows normal findings (arrow) of the spinal cord without an edematous lesion.

tion, we identified her complete recovery from ATM without any sequelae including urinary dysfunction.

Discussion

ATM is characterized by an abrupt onset of progressive weakness and sensory disturbance in the lower extremities. A neurologic disorder is caused by inflammation across both sides of one level or segment of the spinal cord[1, 5].

The incidence has been estimated at 1.34 per million population according to study of Berman et al. in Israel[2, 6, 8]. The annual incidence is between 1 to 8 new cases per million people[9, 11]. In the United States, 1,400 new cases of ATM are diagnosed each year[10]. The age at onset clustered between ages 0 to 2 and 5 to 17[7].

The preexisting etiology is difficult to be well understood. It has been reported that most cases experienced a infectious disease prior to ATM. Viral disease is responsible for the etiology of 20-40% of cases of ATM, such as Epstein-Barr, herpes simplex, influenza, rubella, mumps and VZV[2-4]. VZV is not a common cause of ATM, but there have been several studies about infection of the central nervous system caused by VZV including ATM[4, 12]. Not only can bacterial infectious agents including *Mycoplasma pneumoniae, Staphyloccocus aureus* and group B *Streptococcus* cause ATM, but autoimmune disorders such as systemic lupus erythematosus are also associated with the etiology. In addition, vaccination is known as a causing factor according to cases reports[12, 13].

The pathophysiology of ATM is in hypothetical stages. Vidwan[14] reported three hypotheses of pathophysiology of ATM. One hypothesis being discussed is that cell-mediated autoimmune response evoking abnormal immune reaction results in ATM. Another is that direct viral invasion of the spinal cord does extensive injury to nerve fibers. The other is referring to ATM as autoimmune vasculitis. Accordingly, ischemia is caused by decrease of oxygen supply in spinal cord tissue, spinal arteriovenous malformation, or vascular decreases. Nervous cells and fibers are subsequently damaged, which finally causes inflammation[11, 14].

ATM is divided into 2 phases according to onset time[4]. ATM develops over a few hours to several days. Four classic features represents clinical manifestations of ATM. The first, weakness of the legs occurs which often progresses to their paralysis. The second symptom is pain, which was usually symmetric and located in one or more spinal segments[4]. Pain is usually the primary presenting symptom which one third to a half of patients complain of. The third feature is sensory alternation such as numbness, tingling, coldness, or burning. The forth, sphincter dysfunction - bladder and bowel dysfunction - may last even after other symptoms are

completely resolved. Frequency of the urge to urinate or have bowel movements increases. Patients may suffer from incontinence, difficulty in voiding, the sensation of incomplete evacuation, or constipation. Recovery of sphincter function is usually associated with motor recovery and early management of bladder dysfunction[8, 9]. An interval between the onset of chickenpox and ATM is likely various. According to a report of LaRovere et al.[7], ATM caused by chickenpox can either occur simultaneously with VZV infection, or manifest 1-2 weeks after the appearance of a papulovesicular rash. Our patient complained of paralysis, her first symptom of ATM, 18 days after the onset of chickenpox.

The evidence for diagnosis of ATM can be obtained from results of immunological and viral tests and CSF examination, and findings from MRI as well as analysis of the clinical manifestations. The efficacy of MRI is unclear. However, a distinctive finding in ATM can be the size of the lesions, which extends along three or four vertebral levels[8, 15]. The most frequent MRI findings observed in the patients were cord swelling in affected regions, longitudinal fusiform- like diffuse hyperintensities on T2-weighted images, and presence of patchy or heterogeneous enhancement, if enhanced. Furthermore, the cord gradually tapers to normal size at the end of the lesions [5, 10, 17, 18]. Laboratory findings in CSF describe pleocytosis with dominant lymphocytes, slightly increased or normal level of protein, and normal glucose level. Likewise, the CSF analysis in our case revealed increased white blood cell count of 140/μL and protein level of 222 mg/dL, and normal glucose of 50 mg/dL. ATM is difficult to differentiate from clinically similar conditions, especially the first attack of multiple sclerosis[9]. However, strong evidence can be obtained from an analysis of the clinical manifestations, results of viral test and CSF examination, and spinal MRI.

As far as treatment for ATM, aggressive corticosteroid therapy may be beneficial during the first few weeks of illness to decrease inflammation and reduce immune system activity. According to a study of Guillaume et al.[19], intravenous methylprednisolone was revealed effective in children with severe forms of ATM[14]. They were prompted to evaluate the effect of intravenous methylprednilone based on the presumed immune mediated physiopathological mechanism for ATM[4, 8, 19]. In our case, we also used intravenous methylprednisolone followed by oral prednisolone. We recognized the treatment had an great influence on her rapid recovery. It was not proven whether antiviral agents are effective in the treatment. It is difficult to determine how differently administration of antiviral agents and spontaneous resolution affect clinical courses. However, some studies revealed a high dose of acyclovir in ATM after VZV infection is useful[4, 10]. We treated our patient with antiviral agent, acyclovir, in addition to methylprednisolone. Long-term rehabilitative therapy is available. Physical therapy can diminish permanent neurological deficits such as severe weakness, spasticity or paralysis, incontinence, and chronic pain.

Prognosis of ATM is various, depending on the degree of progressive improvement of all deficits[9, 20]. The mean duration of peak period of the disease is one week, but more commonly, it may take several weeks or months to begin to show improvement. Patients who have not recovered at 2 to 3 weeks may have symptoms lasting more than 2 years. More than one-third of the patients with ATM achieve a full recovery[8]. They regain the ability to walk normally and experience minimal urinary or bowel dysfunction. About one-fourth to one-third make only a fair recovery left with significant deficits, such as spastic gait, sensory dysfunction, prominent urinary urgency or incontinence. There are also some patients who unfortunately experience worse outcomes remaining wheelchair-bound or bedridden. One of the most important and common sequelae as residual deficits are bladder or bowel dysfunction and weakness in the lower extremities[9]. In particular, bladder dysfunction remains untreated, only showing slow improvement[8]. The study of Tanaka et al.[9] revealed 86% of patients at mean follow-up 7.1 years had persistent bladder dysfunctions. Clean intermittent catheterization and cholinergic agents can be recommended as the treatment for bladder dysfunction[9]. Our case suffered from bladder dysfunction including dysuria and urinary retention in spite of a rapid recovery from paralysis. Her uroflowmetry showed a decreased maximal flow rate and elevated urine residuals. We performed clean intermittent catheterization, and subsequently treated her with anticholinergic agent, bethanecol. Eventually, she was released from voiding difficulty.

Through this case, we recognized ATM following by VZV and its clinical courses including prognosis.

한 글 요 약

수두 감염 후 발생한 급성 횡단성 척수염 1예

순천향대학교 의과대학 소아과학교실

김 민 영 · 서 은 숙

급성 횡단성 척수염은 갑자기 발생하는 하지의 진행성 쇠약과

감각 장애가 특징이며, 대부분의 환자가 선행하는 바이러스 감염 증상의 병력을 가진다. 원인이 되는 선행 바이러스는 Epstein-Barr 바이러스, 헤르페스, 인플루엔자, 풍진, 볼거리, 수두 바이러스 등이 있다. 대개 발병 1주 내에 회복을 보이기 시작하지만 수 주 또는 수 개월 동안 지속되는 경우도 있으며, 방광 기능 장애와 하지 쇠약감 등의 후유증이 남을 수 있는 소아에서 비교적 발병이 드문 질환이다. 저자들은 수두를 앓고 난 뒤 전신 마비를 주소로 내원하여 척수 자기공명영상에서 횡단성 척수염을 진단받고, 치료 후 경미한 방광 기능 장애만 남고 거의 완전한 회복을 보인 1예를 경험하였기에 보고하는 바이다.

References

1) Krishnan C, Kaplin AZ, Deshpande DM, Pardo C, Kerr DA. Transverse myelitis: pathogenesis, diagnosis and treatment. Front Biosci 2004;9:1483-99.
2) Syed AM, Shahnaz I. Acute transverse myelitis in children. J Ayub Med Coll Abbottabad 2006;18:90-2.
3) Al Deeb SM, Yaqub BA, Bruyn GW, Biary NM. A localized form of postinfectious encephalomyelitis. Brain 1997;120:1115-22.
4) Celik Y. Transverse myelitis caused by varicella. Clin Neurol Neurosurg 2001;103:260-1.
5) Vesna VB, Mario H, Marko B, Branko M, Marina B. The differential diagnosis of acute transverse myelitis. Clin Neruol Neurosurg 2006;108:278-83.
6) Berman M, Feldman S, Alter M, Ziber N, Kahana E. Acute transverse myelitis: incidence and etiologic considerations. Neurology 1981;31:966-71.
7) LaRovere KL, Raju GP, Gorman MP. Postvaricella acute transverse myelitis in a previously vaccinated child. Pediatr Neurol 2008;38:370-2.
8) Pierre D, Henri H, Beatrice H, Brahim T, Pierre L, Gilbert H, et al. Acute transverse myelitis in children: clinical course and prognostic factors. Child Neurol 2003;18:401-6.
9) Tanaka ST, Stone AR, Kurzrock EA. Transverse myelitis in children: long-term urological outcomes. J Urol 2006;175:1865-8.
10) Banwell BL. The long (-itudinally extensive) and the short of it: transverse myelitis in children. Neurology 2007;68:1447-9.
11) Kerr DA, Avetev H. Immunopathogenesis of acute transverse myelitis. Curr Opin Neurol 2002;15:339-47.
12) McCarthy JT, Amer J. Postvaricella acute transverse myelitis: A case presentation and review of the literature. Pediatrics 1978;62:202-4.
13) Pidcock FS, Krishnan C, Crawfor TO, Salorio CF, Trovato M, Kerr DA. Acute transverse myelitis in childhood: center-based analysis of 47 cases. Neurology 2007;368:1447-9.
14) Vidwan P. Acute transverse myelitis. AM report 2008 Mar 7; Available from: URL://www.med.unc.edu/medicine/web/3.7.08%20TM%20Vidwan.ppt
15) Kalita J, Shah S, Kapoor R, Misra UK. Bladder dysfunction in acute transverse myelitis: magnetic resonance imaging and neurophysiological and urodynamic correlations. J Neurol Neurosurge Psychiatry 2002;73:154-9.
16) Tartaglino LM, Croul SE, Flanders AE, Sweeney JD, Schwartzman RJ, Liem M, et al. Idiopathic acute transverse myelitis: MR imaging findings. Radiology 1996;201:661-9.
17) De Seze J, Lanctin C, Lebrun C, Malikova I, Papeix C, Wiertlewski S, et al. Idiopathic acute transverse myelitis: Application of the recent diagnostic criteria. Neurology 2005;65:1950-3.
18) Choi KH, Lee KS, Chung SO, Park JM, Kim YJ, Kim HS, Idiopathic transverse myelitis: MR characteristics. AJNR Am Neuroradiol 1996;17:1151-60.
19) Sebire G, Hollenberg H, Meyer L, Huault G, Landrieu P, Tardieu M. High dose methylprednisolone in severe acute transverse myelopathy. Arch Dis Child 1997;76:167-8.
20) Kopyta I, Wojaczska-Stanek K, Marszal I. Chickenpox-neurological complications in children. Wiad Lek 2007;60:470-4.