showed that pregnant women were 7.2 times more likely to be hospitalized and 4.3 times more likely to be admitted to an ICU than nonpregnant women.[6] Immunologic changes, increased ventilatory demand, and decreased functional residual capacity and oncotic pressure all are postulated to predispose pregnant and postpartum women to severe respiratory complications from influenza virus infection.[5,6]

The case series in this report highlights some delays in pregnant women seeking care and obtaining appropriate diagnosis and treatment of 2009 H1N1 virus infection in New York City, despite extensive outreach to the public and health-care providers by public health officials. The illustrative cases highlight some factors contributing to the delays, including false-negative rapid diagnostic test results and not taking oseltamivir as prescribed. In addition, only one of the 17 women was reported to have received 2009 H1N1 vaccine. Although no vaccine is 100% effective, vaccination remains the most important and effective means of preventing influenza among pregnant women.

The findings in this report are subject to at least three limitations. First, this report represents a case series rather than a population-based study, and methods of case ascertainment and influenza activity in New York City differed among the April–June, July–September, and October–December periods. The number of severe illnesses from 2009 H1N1 infection in pregnant women identified during these different periods might not be comparable for various reasons. For example, the threshold for admission to an ICU might have been lower in the fall than in the spring, given increased awareness of the potential severity of 2009 H1N1 infection in pregnant women. Second, underascertainment of cases might have occurred during all three periods because of limitations in active case-finding. Finally, 2009 H1N1 vaccine was not available until October, and the vaccination status for most of the 17 women was unknown; therefore, no conclusions can be drawn regarding the prevalence of vaccination in this group.

All clinicians, including obstetricians and health-care providers, should maintain a high index of suspicion for influenza when surveillance data suggest that influenza is circulating in a community. Pregnant and postpartum patients should be educated to recognize influenza-like symptoms and counseled to seek care immediately and to take antiviral therapy as prescribed.[9] Health-care providers should ensure prompt evaluation and early empiric treatment with oseltamivir, irrespective of negative rapid influenza diagnostic test results; treatment with antipyretics and antibiotics also should be considered when indicated.[5,8,10]

For pregnant or postpartum women and for those women considering becoming pregnant, clinicians and health departments should emphasize the importance of vaccination against seasonal influenza and 2009 H1N1 to prevent life-threatening complications. Although 2009 H1N1 activity has declined in the United States, the virus is still circulating and causing illness, and increases in influenza activity remain possible. Clinicians caring for pregnant and postpartum women should continue to encourage influenza vaccination during this and subsequent years and remember the importance of prompt empiric antiviral therapy for pregnant or postpartum patients with possible 2009 H1N1 influenza.

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*In 15 of the cases, 2009 H1N1 was confirmed by real-time reverse transcription—polymerase chain reaction. Two cases with laboratory evidence of influenza A that were not subtyped were considered probable 2009 H1N1 because surveillance data indicated >90% of circulating influenza A in New York City at the time was 2009 H1N1.

Presumptive Abortive Human Rabies—Texas, 2009

MMWR. 2010;59:185-190

1 figure, 2 tables omitted

RABIES IS A SERIOUS ZOONOTIC DISEASE. Recovery has been well documented in only six human patients worldwide.[1,2] Five of those patients had received rabies vaccinations before illness; one had not received rabies vaccination but survived infection after prolonged intensive care. In most of these survivors, moderate to profound neurologic sequelae occurred.[2,3] In all six survivors, rabies was diagnosed based on exposure history, compatible clinical symptoms, and detection

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of rabies virus-neutralizing antibodies (VNA). This report describes the clinical course and laboratory findings of an adolescent girl with encephalitis who had not had rabies vaccination and who had been exposed to bats 2 months before illness. Antibodies to rabies virus were detected in specimens of the girl's serum and cerebrospinal fluid (CSF) by indirect fluorescent antibody test (IFA). However, the presence of rabies VNA was not detected until after she had received single doses of rabies vaccine and human rabies immune globulin (HRIG). Although the patient required multiple hospitalizations and follow-up visits for recurrent neurologic symptoms, she survived without intensive care. No alternate etiology was determined, and abortive human rabies (defined in this report as recovery from rabies without intensive care) was diagnosed. Public education should emphasize avoiding exposure to bats and other potentially rabid wildlife and seeking prompt medical attention after exposure to such animals. Rabies is preventable if rabies immune globulin and vaccine are administered soon after an exposure; however, this case also suggests the rare possibility that abortive rabies can occur in humans and might go unrecognized.

Case Report

On February 25, 2009, an adolescent girl aged 17 years went to a community hospital emergency department with severe frontal headache, photophobia, emesis, neck pain, dizziness, and paresthesia of face and forearms. The headaches had begun approximately 2 weeks before she went to the hospital. Her examination was significant for intermittent disorientation, with a Glasgow Coma Score of 14, nuchal rigidity, and fever to 102.0°F (38.9°C). Computed tomography of her head was normal. A lumbar puncture (LP) was performed and revealed a white blood cell (WBC) count of 163/mm^3, no red blood cells (RBC), 97% lymphocytes, 3% monocytes, and glucose of 61 mg/dL. The patient was treated with intravenous ceftriaxone and dexamethasone, but when CSF bacterial cultures produced no growth, these medications were discontinued. After 3 days in the hospital, the girl's symptoms resolved, and she was discharged home.

Subsequently, her headaches recurred and intensified; on March 6, she went to another local hospital with photophobia, emesis, and myalgias, particularly of the neck and back. Magnetic resonance imaging (MRI) of her head demonstrated enlarged lateral ventricles for her age; another LP was performed and revealed a protein level of 160 mg/dL, WBC count of 185/mm^3, and RBC count of 1/mm^3 with 95% lymphocytes and 5% macrophages. She was transferred to a tertiary-care children's hospital that same day.

On admission to the hospital, she was afebrile, alert, and oriented. Fundoscopic examination demonstrated a blurring of disk margins bilaterally. She was photophobic with transient limitation of vision in the left visual field. Initially, she had decreased strength of the left lower and upper extremities, but it resolved during subsequent examinations. She also had a new papular pruritic rash on her arms and back. She received a diagnosis of suspected infectious encephalitis and was treated during the hospitalization with intravenous acyclovir, ceftriaxone, ethambutol, isoniazid, pyrazinadmide, and rifapmin. On March 10, the girl reported loss of sensation and strength of the right extremities, and weakness was confirmed on examination. Emesis increased, and she became agitated and combative. But these symptoms resolved the next day. Repeat LP demonstrated increased intracranial pressure.

An extensive workup for potential etiologies of encephalitis/aseptic meningitis was performed, but no definitive etiology was determined. On March 10, the medical team elicited a history of bat exposure, and rabies was considered in the differential diagnosis. The patient recalled that approximately 2 months before her headaches began she had entered a cave while on a camping trip in Texas and came into contact with flying bats. Although several bats hit her body, she did not notice any bites or scratches. The patient also reported owning pet ferrets and a dog; all were in good health and under routine veterinary care.

The patient reportedly had never received rabies prophylaxis. On March 11, serologic tests of serum and CSF for antirabies virus antibodies, polymerase chain reaction (PCR) tests of saliva and nuchal skin biopsy for the presence of rabies virus RNA, and direct fluorescent antibody tests of the nuchal biopsy for rabies virus antigen were performed at CDC. No rabies virus antigens or RNA were detected. However, four serum and CSF samples tested positive for rabies virus antibodies by IFA. Serum immunoglobulin G (IgG) reactivity increased to a peak dilution of 1:8192 and immunoglobulin M (IgM) to 1:32. The CSF IgG was positive up to dilution 1:32 through March 19 and by April 3 had decreased to 1:8. The CSF IgM remained negative. The positive IFA results were corroborated by a Western blot assay performed in blinded fashion by an independent investigator. Although rabies virus can crossreact serologically with other members of the *Lyssavirus* genus, Kern Canyon virus (KCV) is the only other rhabdovirus associated with bats in North America that potentially could demonstrate a limited serologic crossreactivity with rabies virus. KCV RNA was not detected in the patient's skin biopsy, saliva, and CSF by nested PCR.

On March 14, after notification of positive rabies serology results, the girl received 1 dose of rabies vaccine and 1,500 IU of HRIG. Additional doses of vaccine were not administered because of concern over possible adverse effects from potentiating the immune response. On March 19 and March 29, the patient's serum tested

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What is already known on this topic?

Only six human rabies survivors have been well documented after clinical onset, and none of the survivors had abortive rabies (i.e., recovery without intensive care).

What is added by this report?

This is the first reported case in which certain clinical and serologic findings indicate abortive human rabies and in which, despite an extensive medical investigation, no alternate etiology for the illness was determined.

What are the implications for public health practice?

Clinicians treating possible human rabies, indicated by acute, progressive infectious encephalitis, a compatible exposure history, and serologic evidence of a specific lyssavirus response, should contact their state health department for engagement with CDC; public education should continue to stress the importance of avoiding exposure to bats and seeking prompt medical attention after exposure to any potentially rabid animals.

positive for rabies VNA by the rapid fluorescent focus inhibition test (RFFIT), whereas her CSF remained negative for rabies VNA.

The patient was managed supportively and never required intensive care. She was discharged on March 22 with clinical symptom resolution but returned to the emergency department on March 29 with recurring headache. She left before an LP could be performed, but returned to the emergency department again on April 3 with headache and emesis. At that time, an LP was performed, and her CSF opening pressure was still elevated. After the LP, her headache resolved. She was not rehospitalized and did not return for follow up in the outpatient clinic.

Questionnaires were administered to close friends and family members of the girl and to health-care workers to assess indications for postexposure prophylaxis (PEP). Only the girl's boyfriend met the criteria and received PEP.[4] The current clinical status of the patient or her boyfriend is unknown.

Reported by: G Holzmann-Pazgal, MD, A Wanger, PhD, G Degaffe, MD, C Rose, MD, G Heresi, MD, R Amaya MD, Univ of Texas School of Medicine Dept of Pediatrics; A Eshofonie, MD, H Lee-Han, PhD, A Awosika-Olumo, MD, Bur of Epidemiology, Office of Surveillance and Public Health Preparedness, Houston Dept of Health and Human Svcs, Houston, Texas. I Kuzmin, MD, PhD, CE Rupprecht, VMD, PhD, Div of Viral and Rickettsial Diseases, National Center for Zoonotic, Vector-Borne, and Enteric Diseases, CDC.

CDC Editorial Note: This is the first reported case in which certain clinical and serologic findings indicate abortive human rabies and in which, despite an extensive medical investigation, no alternate etiology for the illness was determined. The patient's positive serologic results offer evidence of rabies virus infection; IFA and Western blot assays indicated the presence of antibodies capable of binding to rabies virus antigens before the patient received rabies PEP. Rabies virus can crossreact serologically with other members of the *Lyssavirus* genus, distributed in Australia, Eurasia, and Africa[5] or, theoretically, with as yet uncharacterized rhabdoviruses. However, this patient had no history of foreign travel and no evidence of infection with KCV, the only other rhabdovirus associated with bats in North America.

Laboratory diagnosis of rabies antemortem is based typically on routine detection of viral antigen in a full-thickness skin biopsy, viral RNA in the skin biopsy or saliva, or antibodies in serum and CSF. Only antibodies were found in this patient. However, viral antigen and RNA often are not detected in infected humans antemortem because of limited virus replication and intermittent viral excretion in saliva.[1,4,6] Notably, the diagnosis of rabies in all human survivors has been based solely on serologic findings, including the presence of VNA, but without virus isolation or detection of viral antigens or RNA.[2,6]

Certain other clinical and laboratory findings also support a diagnosis of abortive rabies in the patient described in this report. First, the onset of acute encephalopathy approximately 2 months after exposure to bats is compatible with documented incubation periods after rabies virus exposure. Second, central nervous system (CNS) findings (e.g., fever, photophobia, emesis, neck pain, dizziness, paresthesia, limitation of visual field, and altered behavior with agitation and combativeness) are compatible with clinical aspects of rabies. Although this patient did not have classic symptoms such as laryngeal spasms (manifested as hydrophobia) or autonomic instability, the lack of such symptoms has been documented in other rabies patients.[1,2,6] Finally, despite an extensive medical workup, no alternate infectious etiology was identified for the patient's neurologic symptoms, increased intracranial pressure, and CSF pleocytosis.

In animal models, both cellular and humoral immune responses are important indicators in survivorship after rabies virus infection.[7-9] In this report, the patient's serologic profile suggests that her immune system cleared the rabies virus before production of VNA. This might help explain the patient's atypical (i.e., waxing and waning) neurologic course. In more typical rabies cases, infected persons who have not received rabies PEP experience a rapid neurologic decline, resulting in death. Human survivors of rabies have demonstrated a vigorous immune response to the virus, as measured by serum and CSF antibody levels.[2,4] However, CSF IgG in the patient in this report never exceeded a dilution of 1:32, with serum IgG reaching 1:8192, not nearly as high as values reported in previous survivors.[1] Another patient, given experimental treatment, showed evidence for neurologic recovery, with high serum but low CSF VNA, but died shortly after therapy.[10]

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Detection of viral antibodies in serum can be indicative of previous vaccination or exposure to a lyssavirus, but does not necessarily indicate the development of disease. Contact with virus does not ultimately constitute a productive infection (e.g., the virus can be inactivated by the host innate response or by other means before replication in host cells). Similarly, a productive infection does not necessarily result in transportation of virus to the CNS. An abortive infection can occur outside the CNS, with limited replication of the virus at the exposure site and further clearance by the host immune system.[7,8]

Rabies virus is a highly neurotropic pathogen, transported from the exposure site to the CNS by peripheral nerves without significant local replication and avoiding or impairing the host immune response during the incubation period. Thereafter, when the virus reaches higher concentrations in the CNS and spreads peripherally, specific antibodies can be detected as the clinical course evolves. Typically, the detection of specific virus antibodies in the CSF indicates a CNS infection. Based on evidence to date with U.S. rabies patients, antibodies to the abundant viral nucleocapsid antigens detected by IFA are registered first, whereas VNA, directed to the outer viral glycoprotein, are only detected later by RFFIT, if VNA are detected at all. The patient described in this report did not have detectable rabies VNA in the serum until after receiving rabies vaccine and HRIG.

In all previous human survivors, rabies was diagnosed based on exposure histories, compatible clinical symptoms, and detection of rabies virus antibodies. However, in all of those patients, the clinical courses were substantially longer, with more severe neurologic compromise and more prominent stimulation of the immune system, including the induction of VNA. In the case presented here, the clinical manifestation was relatively mild, which might imply variables associated with viral dose, route, and type, with a more limited virus replication and less apparent stimulation of the immune system. Clinicians treating possible cases of human rabies, indicated by acute, progressive infectious encephalitis, a compatible exposure history, and serologic evidence of a specific lyssavirus response, even in the absence of detectable VNA or fulminant neurologic decline, should contact their state health department for engagement with CDC.

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Launch of TB Genotyping Information Management System (TB GIMS)

MMWR. 2010;59:300

CDC HAS LAUNCHED THE TB GENOTYPing Information Management System (TB GIMS) to improve dissemination of data to state and local health officers, including TB controllers.[1] TB GIMS is the first major improvement in genotyping data management since inception of The National Tuberculosis Genotyping Service (NTGS) in 2004, when state laboratories from all TB programs in the United States began voluntary submission of isolates from culture-confirmed patients for molecular characterization.[2] TB GIMS builds upon the established infrastructure of CDC's National Tuberculosis Surveillance System (NTSS) and incorporates genotype data to create a centralized database and reporting system of patient-level results to generate local and national TB cluster—level reports, tables, and maps.

TB GIMS can host up to 3,000 registered users, who will be designated by state TB controllers. By generating alerts when local TB clusters exceed an expected geographic concentration, TB GIMS can help detect suspected tuberculosis outbreaks and thereby direct public health action and response more efficiently. The centralized design also encourages interjurisdictional collaboration and exchange of information regarding outbreaks that cross state lines, providing a new tool for interrupting tuberculosis transmission.

Additional information regarding user registration and a schedule of upcoming instructional training sessions is available at http://www.cdc.gov/tb/programs/genotyping/tbgims/default.htm. Comments and questions can be sent to e-mail, tbgims@cdc.gov.

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