

However, rather than suggesting that a single case report “contradicts” the anterior horn cell hypothesis, we suggest that WNV-associated flaccid paralysis be viewed as having a spectrum of causes, one of which certainly is poliomyelitis like illness.

The neuropathologic findings in poliomyelitis (due to poliovirus, WNV, or other viruses) are not restricted focally to the anterior horn cells (5). Demonstrating pathologic changes as well as focal anterior horn cell loss in the patient referenced by Holman is in keeping with neuropathologic findings in poliomyelitis. Additionally, the presence of a diffuse axonal polyneuropathy cannot be concluded from Holman’s data. Reduced compound motor axon potentials and slowing of conduction velocity could certainly be seen in pathologic conditions affecting anterior horn cells or spinal nerve roots. In addition, reduced sensory nerve action potentials in the median and ulnar nerves alone, without documentation of neuropathy in additional nerves, cannot be used as evidence of a diffuse axonal polyneuropathy, since both of these nerves are commonly prone to entrapment neuropathies. Finally, the context in which the preservation of this patient’s reflexes is observed remains unclear. Preserved “normal” deep-tendon reflexes, in the setting of disease that interrupts the reflex arc at any point, are incongruous with established physiologic and clinical concepts.

The seven patients observed by our group clearly had a distinct clinical syndrome with similar clinical findings and electrodiagnostic results. However, as demonstrated by prior reports (3,5–7), multiple mechanisms may lead to WNV-associated flaccid paralysis. In fact, we acknowledge a spectrum of cord, root, and nerve involvement with WNV flaccid paralysis.

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Typhus Group Rickettsiae Antibodies in Rural Mexico

To the Editor: In 2002, the risk of transmission of epidemic typhus in the

state of Mexico was assessed by analyzing serum specimens from 393 residents of previous typhogenic areas for immunoglobulin (Ig) G antibodies against *Rickettsia prowazekii*. Louse-borne typhus has been a historic scourge in Mexico. In 1576, in a population of 9 million, 2 million deaths were attributed to epidemic typhus (1). These illnesses primarily affected indigenous peoples, who called the illness *cocolixtle* and *matlazahuatl* (2).

In 1951 a national campaign against louseborne typhus was begun by using newly developed technological approaches, antibiotics, and insecticides, resulting in decreases in the incidence and case-fatality rate. In 1951 >1,000 cases and 737 deaths caused by epidemic typhus were reported in 18 states, and 6,781 localities were identified as at risk (3). By 1965, only 36 cases and no deaths were reported from 12 states with 4,841 localities at risk. Most cases occurred during the cold months of November–April. One third of cases occurred in persons 19–29 years of age with nearly 40% of the deaths in patients aged 15–44 years. In 1979, 10 years had passed without any cases of epidemic typhus reported in Mexico. In the 1980s, three outbreaks of typhus occurred in rural communities, two in Chiapas and one in the state of Mexico (4).

In the state of Mexico, during the period 1893–1907, 7,353 epidemic typhus deaths were reported (annual mortality rate, 52.4/100,000 population); from 1939 to 1943, 1,220 cases were reported with 707 deaths (annual mortality rate, 12.1/100,000 population); and from 1959 to 1963, 64 cases were reported with 14 deaths (annual mortality rate, 0.1/100,000 population) (3). In 1967, Atlacomulco, a county in the state of Mexico that had been free of typhus for 5 years, experienced an outbreak of louseborne typhus associated with a case of Brill-Zinsser disease in a 76-year-old man who had a history of

epidemic typhus. Forty cases were diagnosed and one death occurred (3). The last outbreak in the state of Mexico occurred in 1983 in San Juan Cote in San Felipe del Progreso County, with 22 ill persons and one death (4). Since then, a public health program against *Pediculus humanus corporis* has been conducted in five counties with epidemiologic surveillance for cases of reactivation of latent infection. At the beginning of the 1980s, the rate of infestation with *P. humanus corporis* (*mazahua*) in the indigenous population of the state of Mexico was 100%; in 1988, 58%; and in 1990, 15%. In 1999, indices of infestation between 5% and 12% were detected in this population (5).

In 2002, personnel from the office of the Secretary of Health of the State of Mexico evaluated the risk to the population who lived in previously typhogenic areas to measure the impact of their programs (5). In a cross-sectional study, 393 human serum specimens were analyzed by immunofluorescence assay (IFA) for IgG antibodies against *R. prowazekii*, and a titer of 64 or higher was considered positive (6). Antibodies against *R. prowazekii* were detected in 74 serum samples (seropositivity, 18.8%; 26% for males and 18% for females). The prevalence of antibodies to *R. prowazekii* increased with age; 1–14 years of age (seropositivity 0%), 15–24 years (14%), 25–44 years (17%), 45–64 years (24%), and ≥ 65 years (48%). Thirty-three (45%) of the serum specimens had a titer of 64, 25 (34%) had a titer of 128, and 16 (22%) had a higher titer. All eight serum specimens with a titer of ≥ 512 were from persons ≥ 45 years of age.

The high seroprevalence suggests that this population had extensive exposure to the agent of typhus and its louse vector in the past. The finding of two subjects aged ≥ 65 years with a titer of 1,024 and four subjects aged ≥ 45 years with a titer of 512 suggests reactivation of latent *R. prowazekii*

with a resulting boost in their antibody titers. These possible cases of Brill-Zinsser disease were likely not severely ill and recovered either with antimicrobial treatment that was effective against *R. prowazekii* or by immune control of the infection without a specific diagnosis.

That IgG antibodies against *R. prowazekii* are absent in young persons suggests that this rickettsia has not been circulating in this population during recent years. The high seroprevalence suggests a human reservoir of latent *R. prowazekii* in this population. The presence of human body lice in this population indicates that there is risk of spreading *R. prowazekii* from an index patient with Brill-Zinsser disease to persons in contact with the patient.

Although the general lack of attention to *R. prowazekii* by scientists, physicians, and public health agencies would lead one to believe that typhus has been eliminated as a public health concern, the recent occurrence of a large epidemic in Burundi (7), infected lice in Rwanda, an outbreak in Russia, a documented case originating in Algeria, and outbreaks every year in Andean Peru (8) indicate that global attention should be directed to surveillance, risk assessment, diagnostic capability, and planning for rapid epidemic control to avoid establishing a large reservoir of latent infection for future epidemics originating from recrudescing typhus in louse-infested populations. Typhus likely poses a similar threat in other parts of the world including the Himalayas, Andes, Afghanistan, and highlands of Africa. Even in industrialized countries, the diagnosis of typhus is likely to be delayed or missed. The potential threat of bioterrorist-disseminated, aerosol-transmitted typhus emphasizes that enhanced attention to and knowledge of typhus are needed throughout the world (9). The requirement concerns not only physician awareness but also wide availability

and application of the most appropriate diagnostic laboratory methods.

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Schistosoma haematobium Infection and Buruli Ulcer

To the Editor: Buruli ulcer caused by *Mycobacterium ulcerans* was recognized in 1997 as an emerging public health problem by the World Health Organization (WHO) (1). The disease is found in tropical Africa, the Americas, Australia, and Asia (2). In Benin, severe disease with serious complications is reported with increasing frequency. Buruli ulcer causes serious deformities and disability, particularly since amputating limbs is sometimes required in cases of severe disease such as osteomyelitis (3). Given the effect on the quality of life of those afflicted and the lack of adequate treatment, identifying host risk factors for Buruli ulcer is an important research imperative (2). We investigated one potential risk factor, concurrent infection with *Schistosoma haematobium*. Preliminary data indicate that although *S. haematobium* is not a risk factor for Buruli ulcer, it may be associated with osteomyelitis.

Although Buruli ulcer and schistosomiasis each exist in the absence of the other, close parallels exist between their epidemiology, suggesting that schistosomiasis could be one possible risk factor for Buruli ulcer. Both diseases are associated with the tropical wetlands of west and central Africa. Cases of both schistosomiasis and Buruli ulcer have increased rapidly in these areas since the 1980s, particularly after irrigation and dam construction. Buruli ulcer is most fre-

quent in children <15 years of age; this group typically also has the highest prevalence and intensity of schistosome infections. Schistosomiasis is transmitted through contact with infected water when the cercarial larvae penetrate skin, and increasing evidence exists that *M. ulcerans* proliferates in the bottom mud of stagnant waters and may be harbored by aquatic insects (4).

An immunologic rationale for linking the two diseases has been proposed (5). Briefly, protective immune responses to other mycobacterial diseases are known to depend on a type 1 cellular response, typified by interferon-gamma (IFN- γ). Helminth infections, on the other hand, are classically associated with type 2 responses, typified by interleukin (IL)-4 and IL-5 production. Therefore, a concurrent infection with a bloodborne helminth such as *S. haematobium* may skew the immune response away from a potentially protective type 1 response (5).

A total of 113 patients were recruited from Buruli ulcer treatment centers in Lalo (Couffo Department) and Zagnanado (Zou Department) in Benin. A team of experienced surgeons clinically confirmed all cases of Buruli ulcer. Controls (n = 429) were recruited at random from residents of eight current Buruli ulcer foci in the Couffo Department. Past or current Buruli ulcer patients were excluded from the lottery for controls.

Clinical records reported no case of intestinal schistosomiasis in this area. This finding was confirmed by a preliminary survey of 60 Buruli ulcer patients, which detected no concurrent *S. mansoni* by using the Kato Katz method (6). Diagnosis of *S. haematobium* (urinary schistosomiasis) was performed by filtering three urine samples given on different days. Neither cases nor controls were asked to exercise (as is usual) before giving urine samples because many Buruli ulcer cases were immobile. All patients positive for *S. haematobium*

were offered praziquantel treatment.

In the entire participating population, 11.5% (95% confidence interval [CI] 6% to 19%) of Buruli ulcer cases were positive for *S. haematobium*; 11.1% (95% CI 5% to 20%) of cases from Lalo and 12.2% (95% CI 4% to 26%) from Zagnanado were positive. The difference between the two centers was not statistically significant. Of the 429 non-Buruli ulcer controls, 9.5% (95% CI 7% to 13%) were positive for *S. haematobium*. No statistically significant difference between cases and controls was detected. The odds ratio for *S. haematobium* infection in a logistic regression model (which also included age and sex) was 1.3 (95% CI 0.63 to 2.4). Prevalence of *S. haematobium* infection did not significantly differ between controls' residence (data not shown). Power analysis indicates that about 4,000 cases and controls would be required to find a statistically significant difference at this prevalence of schistosomiasis.

Both schistosomiasis and Buruli ulcer are very local in nature; one village can have substantial numbers of cases whereas the next village could have none. *S. haematobium* foci with infection prevalence >50% do exist in Benin but in different settlements from the Buruli ulcer foci. Should a Buruli ulcer focus coincide with a schistosomiasis focus with a higher prevalence of infection, some association between the two diseases could appear.

Detailed clinical information was available for 36 patients tested for *S. haematobium*. In all cases, at least two of four laboratory tests were positive for *M. ulcerans*. These tests were: 1) acid-fast bacilli in a smear stained by the Ziehl-Neelsen technique, 2) positive culture of *M. ulcerans*, 3) histopathologic examination of a tissue specimen, and 4) positive polymerase chain reaction (PCR) for *M. ulcerans* DNA. Five patients had confirmed infection in bone samples, so they were classified as osteomyelitis