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INSIDE

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Hold Your Breath? Legionellosis and Tuberculosis During Travel

ABSTRACTS & COMMENTARY

Synopsis: *Two papers published just this year present the findings of investigations into the transmission of respiratory infections: Cruise ship-associated Legionella pneumophila and exposure to tuberculosis while riding a train. Both of these papers were accompanied by interesting editorials that help to put the issue of travel-associated respiratory infections in perspective.*

Sources: Pastoris MC, et al. Legionnaires' disease on a cruise ship linked to the water supply system: Clinical and public health implications. *Clin Infect Dis* 1999;28:33-38; Moore M, et al. A train passenger with pulmonary tuberculosis: Evidence of limited transmission during travel. *Clin Infect Dis* 1999;28:52-56; Edelstein PH, Cetron MS. Sea, wind, and pneumonia (editorial response). *Clin Infect Dis* 1999;28:39-41; Witt MD. Trains, travel, and the tubercle (editorial response). *Clin Infect Dis* 1999;28:57-58.

Pastoris and associates describe a 67-year-old british man who presented with pneumonia in September 1995, eight days into a Mediterranean cruise on a large Italian ship. He was hospitalized but, despite treatment, died 20 days following the development of symptoms. The patient was a cigarette smoker and had coronary artery disease. The case was reported to the Italian representative for the European Working Group on *Legionella* Infection (EWGLI) by the British Communicable Disease Surveillance Centre. An investigation was made to detect other cases among crew or passengers and to determine the source of *Legionella* infection.

None of the 116 crew members reported symptoms, and only three (2.6%) had low-titer serologic evidence of infection. Among passengers, there were no other cases reported during the cruise with the index case and no cases prior to this cruise from 1986 through 1995. One clinically compatible case was subsequently reported in November 1995 and another documented case in October 1996. Environmental sampling of multiple water sources cultured *Legionella pneumophila* from the ship's freshwater system that was identical to the patient's isolate. In fact, 80% of the fresh water samples yielded *L. pneumophila*.

The second report was from the United States and the Centers for Disease Control. In January 1996, a 22-year-old male was diagnosed with highly smear-positive, culture-confirmed pulmonary tuberculosis, following hospitalization after requesting medical help while he was traveling on a train. The patient was coughing throughout his trip and frequently experienced hemoptysis. Despite antituberculous therapy in the hospital, he died from a pulmonary hemorrhage two weeks

into hospitalization. Because he had used public transportation (train and bus) over a two-day period, an investigation was launched into the possible transmission of tuberculosis to other passengers and crew members. All passengers and crew were contacted within two weeks of the exposure and were asked to undergo a two-step tuberculin skin test (TST) and, if negative, a third TST after three months. Those with positive tests were evaluated for their exposure to the index patient, for symptoms, for other possible exposures to tuberculosis, and whether they had received bacille Calmette-Guérin vaccine. A positive skin test was considered to be 10 mm or more.

The patient had traveled from Chicago to Florida. His first plane trip was 12.3 hours. Because of flooded train tracks, there was an intervening bus trip of 5.5 hours, and the final train trip was 16.8 hours. Of 479 passengers, 368 (77%) were able to be contacted; there were 44 crew members. Final TST was obtained from 228 passengers and 29 of the crew. Seventeen patients were excluded from analysis. For the 240 passengers and crew, there were four TST conversions and 11 positive TSTs. Four of these 15 positive TSTs had exposure to the index patient. All of these exposures occurred in the dining car, three passengers were seated at tables near him, and one had a direct conversation. For two of these four persons, which included the person who had the conversation, there were no other risk factors for a positive TST and, thus, they were presumed to have acquired new infection from the index case. The patient had "briefly" traveled to the dining car but spent most of the time in the passenger cars with his head under a hooded sweatshirt. The train was fitted with high-efficiency particulate air filters, with about 10-15 air exchanges per hour.

COMMENT BY DAVID R. HILL, MD, DTM&H

The reports of legionellosis during a vacation cruise in the Mediterranean and tuberculosis exposure while riding public transport in the United States could be cause for concern and alarm. However, there is a silver lining to both reports. In the first instance, the establishment of EWGLI created the structure to identify the case in England and adequately investigate it in Italy.[1] This working group can be credited with raising awareness of the problem of legionellosis during tourist travel throughout many European sites, with developing methods for both detection and surveillance, and in helping to define standards for water purification to help prevent future cases. The Internet web site for information on *Legionella* outbreaks as well as other infectious disease outbreaks throughout Europe can be accessed at www.outbreak.org.uk/secure/index.html.

In the second case, despite a highly positive case of tuberculosis, transmission was limited (2 TST conversions/240 persons investigated). In the cases that acquired new infection, the risk factor was a brief, proximal contact, either face-to-face, or when seated near the patient, rather than sharing air space over a prolonged period. That the latter was not a risk could be because the patient coughed into his sweatshirt hood or because of the efficiency of air exchanges within the train ventilation system. Nevertheless, transmission did occur and there could have been other, unrecognized cases since only 49% of all passengers and crew were studied. The investigation was hampered by the inability to locate all passengers (77% identified) and the difficulty in having these persons complete a three-stage skin testing procedure over three months.

Travel-associated legionellosis has been well described in both cruise ship passengers and other tourists.[2-4] In cruise ships, the source has usually not been determined or has been from the whirlpool spas, as opposed to potable, fresh water.[4] The implications of the *Legionella* case for travel medicine physicians is threefold. First, they should be aware that elderly or other travelers with health risk factors, such as smoking and chronic illness, may be exposed to *Legionella* and, thus, at risk for infection. The elderly traveler with chronic illness is just the person who may choose to travel internationally by ship rather than overland. At the International Traveler's Medical Service at the University of Connecticut, cruise ship travelers had a mean age of 61 years compared to 41 years for all other travelers ($P < 0.001$), and 55% of them had chronic medical conditions. Second, these travelers should be assessed for their immunization status against other respiratory infections, such as influenza and pneumococcal pneumonia.

Third, the travel medicine provider should be aware that a pulmonary infection in a returned traveler could be *Legionella*. The travel history should be taken and specialized tests ordered to isolate the organism. If a case of legionellosis is documented, it should be promptly reported to the appropriate health authorities so that other cases may be identified and a potential outbreak explored and contained. It was through the recognition of only a few cases in a community hospital[5] that the largest ship-associated outbreak was discovered.[4] Prompt recognition and reporting may also be useful in containing other pulmonary infections occurring on ships. The most recent example of this was the outbreak of influenza A among passengers touring Alaska and the Yukon Territory last summer.[6]

The risk of tuberculosis during public transport has received recent publicity surrounding airline-associated cases. The risk in these situations has been determined to be extremely low. Indeed, out of seven investigations of separate flight exposures to a highly infectious index case, in only two situations was there evidence for transmission to other passengers or crew members,[7-9] and, in one of these, the transmission probably occurred with repeated exposures over several flights since the index case was a

crew member.[7] Active tuberculosis has not occurred as a result of airline transmission in any situation.

The WHO recently convened a consensus committee on airline-associated tuberculosis and, from analysis of these investigations, has recommended that passengers and crew be notified of a potential exposure only if the exposure occurred within three months, if the flight was eight or more hours duration (including ground and waiting time), and if passengers were in close proximity to the index case.[10] Because of the low risk of transmission and the difficulty and cost of performing adequate epidemiologic studies, they also state that further epidemiologic studies of airline-associated tuberculosis did not appear warranted.

Exposure to tuberculosis is unlikely during travel, although there could certainly be instances of unknown exposure both during public transport and from face-to-face contact. The data from the train and airline studies indicate that transmission is extremely low, and the writers from the CDC even suggest that expanded contact investigations in situations of a low likelihood of transmission may not be worth the resources. If a traveler is concerned about potential contact with tuberculosis, then the most prudent action is to check pre- and post-travel TSTs, with the post-travel TST performed approximately two months following exposure.

Thus, it seems that travelers can breath easily; however, they should keep in mind the potential for exposure to unusual pathogens, particularly if they have concomitant health conditions. In addition, the travel health professional should be prepared to recognize and respond to these situations if the traveler returns ill. ❖

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Traveler's Diarrhea in Jamaica

ABSTRACT & COMMENTARY

Synopsis: *The overall attack rate for diarrhea in travelers to Jamaica was 23.6%. Less than 3% of travelers avoided all potentially high-risk food and beverages. The most frequently detected pathogens were enterotoxigenic Escherichia coli, Rotavirus, and Salmonella species.*

Source: Steffen R, et al. Epidemiology, etiology, and impact of traveler's diarrhea in Jamaica. *JAMA* 1999;281:811-817.

A two-armed, cross-sectional survey was conducted between March 1996 and May 1997 to determine the epidemiology, etiology, and impact of traveler's diarrhea (TD) in Jamaica. The first part of the study was a survey of travelers leaving from Montego Bay's Sangster International Airport, analyzing the epidemiology, economic features, and impact of TD on the travelers' well-being. Data were collected from travelers who filled in the questionnaires while waiting in the departure area. The second part of the study consisted of stool collections from patients with diarrhea who volunteered for evaluation of the etiology of TD. Ten large hotels participated by encouraging their guests with TD to visit the nurse's station.

A total of 30,532 questionnaires were collected. The questionnaires elicited information on pretravel health advice and economic features (such as expenses for prophylaxis, TD therapy, and cost of stay) as well as food/beverage consumption and quality of life.

Stool samples were analyzed for bacterial pathogens including *Escherichia coli*, *Salmonella* spp., *Shigella*

spp., *Campylobacter jejuni*, *Yersinia enterocolitica*, *Vibrio* spp., *Aeromonas* spp., and *Plesiomonas shigelloides*. Detection of protozoa was done using enzyme-linked immunosorbent assay (*Giardia lamblia*, *Entamoeba histolytica*, and *Cryptosporidium parvum*) as well as stains for *Microsporidia* and *Cyclospora*. Virology studies were performed specifically for rotavirus and adenovirus.

In this study, classic TD was defined as passage of three or more unformed stools per 24 hours, with at least one accompanying symptom (nausea, vomiting, abdominal cramps or pain, fever, blood in stools). Moderate TD was passage of 1-2 unformed stools, with at least one additional symptom or more unformed stools without additional symptoms. Mild TD was passage of 1-2 unformed stools without additional symptoms.

The attack rate for diarrhea was 23.6% overall, with 11.7% having classically defined TD, 8.3% moderate TD, and 3.6% mild TD. TD attack rates significantly decreased with age but did not differ between the sexes. All TD attack rates increased with duration of stay until day 14 but then decreased. Residents of northern countries and honeymooners showed higher classic and moderate TD attack rates. A recent stay in another developing country was associated with a lower attack rate. Patients with underlying medical conditions had no increased severity of disease. The visitors who stayed with friends and/or family had a lower total TD rate, whereas tourists with full board had a higher probability of diarrhea. There was a seasonal variation where TD rate dropped to 15% in the winter months. The onset of TD occurred around day 4. Almost half the patients with classic TD were incapacitated, and the mean duration of incapacitation for all TD patients was 11.6 hours. A total of 6.6% of the travelers experiencing TD consulted medical professionals. Travel health advice had no effect on the incidence of TD.

Details of the airport survey showed that less than 3% reported to have avoided all potentially contaminated food and drinks. Ninety-five percent of travelers had ice cubes in their drinks and 90% ate salads, 80% consumed dairy products and tap water, and more than 55% ate ice cream, hamburgers, and incompletely cooked chicken, lobster, or shrimp. Travelers aged 36-55 were slightly negligent with respect to potentially contaminated food and beverage items compared with other age groups. There was no significant risk associated with eating from street vendors. Two percent of all travelers used prophylactic medication against TD; most often, these were Americans using bismuth subsalicylate.

A total of 322 volunteers participated in the hotel survey. The pathogen detection rate was 31.7%. Enterotoxigenic *E. coli* (ETEC) was the most frequently diagnosed pathogen. *C. jejuni* was only detected during the winter. Viruses were also predominant in the winter.

The analyses of economics revealed that per stay (mean duration, 7.7 days), the estimated cost for medication, medical treatment, and missed activities was US $116.50/patient or US $27.50/traveler to Jamaica.

COMMENT BY LIN H. CHEN, MD

Diarrhea is the most common health problem encountered by travelers visiting developing countries. Prior reports have shown the incidence to be 20-60%, and destination is a significant determinant of diarrhea risk.[1] The diarrhea rate of 23.6% from the current survey puts Jamaica in the range of intermediate-to-moderate risk.

The study made several important observations, confirming some prior findings:[2-4] 1) There was no significant difference in diarrhea attack rates between the sexes; 2) Diarrhea risk decreased with age; 3) Residency in areas with high attack rates or recent travel to those areas was associated with lower TD attack rates; 4) Travelers on full board plans appeared to have an increased risk for diarrhea, possibly associated with buffets; and 5) ETEC was the most frequently identified pathogen.

Some interesting differences emerged in comparison with other studies. First, incapacitation lasted about 12 hours, which was shorter than other reports of 3.6 days.[1,3-5] Second, the pathogen detection rate of 31.7% was lower than other studies.[2-4] There was a higher than usual rate for rotavirus (9.2%) in the current study. Also, there was a marked seasonal variation for the diarrhea attack rate in Jamaica.

The lack of dietary discipline was notable, even in people who had received pretravel advice. Clearly, there is need for additional ways to prevent TD. Improved hygienic conditions at the destination would be desirable. A killed oral ETEC vaccine is undergoing clinical evaluations and appears safe and immunogenic.[6] When this vaccine becomes available, it should contribute greatly to reducing TD. A rotavirus vaccine has been licensed by the FDA to prevent gastroenteritis among infants and children,[7] and this may also help to reduce TD rate. ❖

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The Diabetic Traveler

ABSTRACTS & COMMENTARY

Synopsis: *It is clear that considerable information is now available regarding issues for diabetic travelers, including their compliance with medications, control of glycemia, and new technical products that enhance our ability to advise such patients. Driessen and colleagues have recently brought this group of patients to our attention in a small study from The Netherlands. We must also familiarize ourselves with newer methods for insulin administration and rapidly acting insulin preparations that, when combined with developing technology for glucose monitoring, will surely change the landscape for diabetic travelers in the future.*

Sources: Driessen SL, et al. Travel-related morbidity in travelers with insulin-dependent diabetes mellitus. *J Travel Med* 1999;6:12-15; Dewey CM, Riley WJ. Have diabetes, will travel. *Postgrad Med* 1999;105:111-126.

Driessen and colleagues performed what they referred to as a small, exploratory, retrospective cohort study using telephone interviews of all insulin-dependent diabetic (IDDM) patients advised in their travel clinic over a 12-month period. The data they collected related to hypoglycemic and hyperglycemic dysregulation, infections (such as diarrhea), general health issues, physical exertion, and practical problems for their diabetic travelers. During the study period, 9385 travelers attended their travel medicine service of whom only 22 (0.2%) were known to have IDDM. They had 19 respondents (11 type-1 diabetics, 8 type-2) who could be reached—13 of whom (68%) reported metabolic dysregulation. These 13 included all but one patient with type 1 diabetes. Critical dysregulation of glycemic control requiring third-party assistance occurred in two patients. All respondents except four did *not* increase their frequency of blood glucose monitoring during travel; only 36% of type 1 diabetics increased their frequency of blood glucose monitoring. Three reported febrile illnesses with consequences for control of glycemia and five experienced difficulty with insulin dosage adjustments in the tropics.

More than 50% of respondents reported more dysregulation of glycemic control than in the preceding time period at home. Other problems reported by patients in this study included gastroenteritis, diarrhea, upper respiratory infection, one case of documented Q-fever, and skin infections (without foot involvement). As might be expected, travel through several time zones was associated with metabolic dysregulation for two patients, and one experienced difficulty at customs for carrying injection materials.

In their discussion, Driessen et al maintain that two travelers experienced critical dysregulation while using insulin lispro (Humalog), a rapidly acting insulin with shorter duration of action than regular insulin, and they suggest that insulin lispro *not* be substituted for conventional human insulin before travel. Their concerns about insulin lispro centered around a potential for post-prandial hypoglycemia. However, I do not share that view, and the use of short-acting insulins, discussed below, will likely be a critical issue in the future for improving glycemic control in such patients.

Dewey and Riley have recently published a useful article that can serve as an informative reference for health-care providers dealing with traveling diabetic patients. They list a considerable amount of information available on the Internet from both national and international resources, including check lists for travelers with diabetes and the oft quoted Benson and Metz strategy for adjusting insulin doses in patients who are taking insulin and traveling across several time zones.

COMMENT BY FRANK J. BIA, MD, MPH

The problems encountered by patients traveling with diabetes have not been given the attention their numbers warrant, and much of what is happening to influence their lives is not yet appearing under the rubric of travel medicine literature.[1] Some of what is currently appearing in the literature is either less than accurate or rapidly becoming outdated. For those advising travelers with diabetes, there are at least two major developments their patients should be familiar with, because in each instance they truly encourage compliance. If there is one clear point in the article by Driessen et al, it is that compliance with increased blood glucose monitoring and insulin administration would do much to enhance control of glycemia in traveling diabetics.

Both manufacturers of insulin in the United States, Eli Lilly and Co. and Novo Nordisk, manufacture regular insulin and mixtures of 70/30 (NPH/regular) insulin, which are available in various cartridge pen systems.

Either the entire pen can be disposed of when the insulin has been used up, or a new cartridge can be inserted in the nondisposable unit. The insulin is stable, and unrefrigerated for at least a week (70/30 mixtures) and up to a month (regular insulin). With a traveler able to carry these devices as simply as he or she would a pen, the administration of insulin is much easier and compliance increases. However, one issue for control of glycemia, whether individuals are traveling, relates to the mistimed usage of regular insulin prior to meals. This is a difficult area for compliance since regular insulin must be given 30-45 minutes prior to a meal. Usually it is not. Compliance has been made much easier with the availability of insulin lispro. Any diabetic who is planning an extensive travel experience and is not yet familiar with this rapidly acting form of insulin has been short-changed some important information.

There are several advantages for travelers who gain familiarity with this rapidly-acting insulin.[3-5] Because there is a strong tendency for travelers with diabetes to take their insulin immediately prior to a meal, rather than the 30-45 minutes before a meal required for regular insulin to become absorbed, the inconvenience of timed administration leads to poor control of glycemia. There is a mismatch between post-prandial carbohydrate absorption and the two- to four-hour post-injection peaking of regular insulin. In addition, there will still be circulating insulin present as the peripheral blood glucose is falling. This predisposes such patients, particularly those who exercise, to late post-prandial hypoglycemia. Driessen et al incorrectly state that "with insulin lispro a post-prandial hypoglycemia will arise more easily compared to conventional insulin, especially if the food contained few carbohydrates or physical exercise is performed immediately after the meal." The pharmacology of insulin lispro actually works against such a problem occurring.

Regular human insulin is absorbed slowly since it consists of hexamers of insulin that are crystallized around zinc molecules. To be absorbed from its subcutaneous injection site, it must first dissociate into monomers and dimers. Insulin lispro derives its name from the switching of two amino acids, proline and lysine, within the beta-chain of insulin. After subcutaneous injection, this insulin dissociates more rapidly into dimers and monomers. The peak serum concentrations of insulin lispro occur within 30-90 minutes following administration, and regardless of the site of administration, there is a better match between carbohydrate absorption and insulin availability with less chance for late-peaking regular insulin to cause post-prandial hypoglycemia.

With the general availability of small, portable glucometers for monitoring blood glucose, convenient insulin delivery devices, and rapidly acting insulin lispro, older guidelines for management of insulin administration could be altered to include more frequent monitoring and less rigid formulae for insulin administration. I prefer the method outlined by Sane and colleagues that calls for a 2-4% adjustment in insulin dosing for each time zone crossed.[2] For instance, a traveler going west over 10 time zones would have his or her day lengthened and require about a 30% increase in his or her long-acting insulin. Adjustments to that regimen can be more finely tuned using insulin lispro as needed, based upon more frequent blood glucose monitoring.

This is certainly the beginning of a new story for traveling diabetics. A personal laser lancing device for obtaining a capillary blood sample weighing approximately 10 oz will be available from Chronimed (800/848-0614) in mid-1999. Since a beam of light, rather than a lancet, penetrates the skin, sharps disposal is eliminated and pain is reduced. Cell Robotics International (800/866-1533) has developed a skin patch for glucose monitoring on the forearm. Monitors that read the patch test results and can store months worth of data, by time and date, are being paired with such patch monitoring systems. Recently, Eli Lilly and Co. received approval to market a new formulation of glucagon, based upon recombinant DNA technology, in their Glucagon Emergency Kits, which eliminates dependency on animal pancreas glands for manufacture. Generalized allergic reactions and nausea/vomiting have occurred using previous animal glucagon formulations but can also occur with the new product formulation. For information or questions regarding recombinant glucagon, call 1-800-88LILLY.

This is a time of rapid change in the technology available to encourage and enhance the compliance of diabetics with glucose monitoring and insulin administration. The challenge for travel medicine specialists remains one of providing the most current useful information about such technology for our traveling population of diabetics. The end results will be fewer episodes of glycemic dysregulation and will ultimately decrease any opportunity for travel, per se, to result in further end organ damage from poorly regulated diabetes. ❖

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The Emergence of Gnathostomiasis in Mexico

ABSTRACT & COMMENTARY

Synopsis: *Alter the environment near a well-established resort center by the construction of new dams, then seed rivers with parasite-infected fish, and you have an emerging infectious disease in the most unlikely of places. Then again, it may not be so unlikely once the pieces fall into place.*

Source: Gnathostomiasis, an emerging foodborne zoonotic disease in Acapulco, Mexico. Rohas-Molina N, et al. *Emerg Infect Dis* 1999;5:264.

Between 1993 and 1997, 98 cases of gnathostomiasis were clinically identified at an outpatient dermatology referral hospital in Acapulco, Mexico. Intermittent cutaneous migratory swellings were the most common clinical manifestations and were described as edema of variable size accompanied by a burning sensation and pruritus. Recurring edema developed mainly in the upper and lower extremities (gluteus, thorax, and face). The duration of edema varied from one day to two weeks. The median value of percent blood eosinophils was 12% and serum IgE levels elevated. Larvae were identified in 26 cases, while, in 72 cases, final diagnoses were made on the basis of epidemiologic data, food habits, and positive ELISA/Western blot serological results.

COMMENT BY MICHELE BARRY, MD

Gnathostomiasis is a food-borne zoonotic disease caused by several species of *Gnathostoma nematodes*. The life cycle of this parasite involves the feces of dogs and cats; feces-containing ova reach water and free-swimming first-stage larvae are ingested by the copepod of the species, *Cyclops*, and then become second-stage larvae. Freshwater fish then eat copepods and third-stage larvae develop in the fish muscle. Consumption of this fish by cats, dogs, and other mammals completes the cycle. Humans acquire the infection by eating undercooked, infected fish. When larvae are ingested by a human host, no further development occurs, but the larva migrates through subcutaneous tissue causing the subcutaneous edema described in this article. What is not described in patients from this dermatology referral clinic are the painful radiculomyelopathies that can occur or the fatal eosinophilic meningoencephalitis caused by aberrant migrating larvae.

With its highest prevalence in southeast Asia, gnathostomiasis has now become an emerging public health problem in Peru, Ecuador, and, since 1970, Mexico—the latter emergence thought to be due to new dams built on rivers leading to the Pacific Ocean coast and the introduction of infected fish. Travelers to Acapulco should be warned against eating sushi or ceviche, the popular raw lime-marinated fish salad. Treatment with albendazole will cause outward migration of the worms to the dermis, permitting surgical removal and identification of larvae. Serological testing by the ELISA method and Western blot are described in this report, but larvae identification and characteristic clinical manifestations usually clinch the diagnosis. ❖

Rattlesnake Bite—Tourniquet or Not?

ABSTRACT & COMMENTARY

Synopsis: *Tourniquets are not beneficial and should not be used in the initial management of rattlesnake bites.*

Source: Amaral CF, et al. Tourniquet ineffectiveness to reduce the severity of envenoming after *Crotalus durissus* snake bite in Belo Horizonte, Minas Gerais, Brazil. *Toxicon* 1998;36:805-806.

The effect of tourniquet placement on the clinical outcome after a rattlesnake bite on the extremities was assessed by Amaral and associates in 97 patients who had been bitten by the neotropical rattlesnake, *Crotalus durissus*, whose venom has both neurotoxic as well as local tissue effects. In 45 of these patients, a proximal tourniquet was applied as part of acute management; 52 patients did not have tourniquets. Both groups were similar with regard to age, sex, time since bite, and early neurologic findings. On follow-up, there were no differences in the rate of coagulopathy, rhabdomyolysis, and fatality between the tourniquet and nontourniquet groups.

COMMENT BY ROBERT HOFFMAN, MD

Despite common perception, fatalities following bites with envenomation by North American pit vipers (rattlesnakes, cottonmouths, and copperhead snakes) are rare. This probably results from several factors, including the predominant local tissue toxicity of the venom of these snakes, the availability of medical care, and the proven benefits of antivenom. Although fatalities are rare, life-threatening systemic symptoms such as coagulopathies and shock can occur. The snake-bitten person and immediate attendants have no way of knowing

whether these symptoms may develop prior to obtaining definitive medical care. Thus, the search for simple, safe, and effective immediate first-aid management continues.

Arterial or venous tourniquets or lymphatic constrictors seem reasonable, in that the venom will remain concentrated in that extremity, preventing systemic distribution and systemic toxicity. In fact, when dealing with primarily neurotoxic snakes such as cobras, constricting bandages and tourniquets have been shown to reduce weakness and respiratory arrest.[1] However, when ultimately released, systemic toxicity may often develop rapidly.

When envenomation is a result of a bite from a snake such as the rattlesnake, whose toxicity is predominantly local, a clinical dilemma may arise as to the risk of damaging a limb or exacerbating the local toxicity vs. the risk of systemic toxicity. In these circumstances, the ischemic damage produced by a tourniquet may be worse than that expected from the original snake bite.[2]

In this study of a large number of snakebites, there may be selection bias (why some patients had tourniquets applied and others did not) and this prevents any firm conclusions. However, the findings appear to indicate that tourniquets offer little advantage concerning clinical outcome. For the present time, and especially with North American rattlesnakes and other pit vipers, it seems unlikely that application of a tourniquet will significantly improve outcome and may potentially exacerbate local toxicity. If traveling abroad or if bitten a great distance from definitive health care, a loose-fitting lymphatic constriction bandage may be reasonable. Venous and arterial occlusion are not advisable. If you receive a patient who has had a tourniquet applied, it is essential to have antivenom and resuscitation equipment ready prior to release of the tourniquet. (*Dr. Hoffman is Associate Director of the New York City Poison Control Center, Bellevue and New York University Medical Centers, NY.*) ❖

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CME Questions

8. Traveler's diarrhea:

a. affects men and women equally.
b. occurs less frequently in visitors from a developing country.
c. attack rates decrease with age.
d. is caused by ETEC more frequently than other identifiable pathogens.
e. All of the above

9. Diabetic travelers are at risk for several complications of their disease related to travel. Which of the following is *not* such a complication?

a. Enteric infections related to unreliable water sources
b. Frequent hypoglycemic episodes from use of rapidly acting insulin preparations
c. Poor control of glycemia due to travel across several time zones
d. Increased blood levels of glycosylated hemoglobin over long-term travel assignments or vacations

Disclaimer

The content of the *Travel Medicine Advisor* country-specific handout sheets is in no way intended to replace the medical advice of a trained travel medicine practitioner. Various medical conditions, medications, previous immunization status, itinerary, duration of stay, and proposed activities must be considered before specific recommendations can be made. These handouts are designed to provide supplementary written information and general guidelines regarding health risks, and the potential need for immunizations, medications, and precautions for international travelers. Information contained in these handouts is updated regularly but may not reflect very recent changes in requirements and recommendations for international travel. ❖