was similar to infectious mononucleosis. Sennetsu ehrlichiosis thus far has only been reported from southern Japan and Malaysia.[3,6] The first case of human ehrlichiosis in the United States was reported in 1987; this illness resembled Rocky Mountain spotted fever but was without an exanthem.[1] The disease was attributed to *Ehrlichia canis*, the canine *Ehrlichia* agent. This and subsequent reports have shown that in the US human cases, serologic rises occur to *E canis* and not to *E sennetsu*.[4,6] Since the original US report, there has been increasing speculation that the US human agent is indeed not *E canis* but a distinctly new species.[2-4,6] The first organism of *Ehrlichia* isolated from a person in the United States has been recently identified by a team at the CDC and has been named *Ehrlichia chaffeensis;* it is genetically distinct from *E canis* and *E sennetsu*.[7,8]

Human ehrlichiosis, as described in the United States, is a multisystemic illness with many similarities to Rocky Mountain spotted fever. Prostration, severe headache, fever, malaise, myalgias, nausea, and vomiting occur in more than half of the cases; interstitial pneumonia, abdominal pain, jaundice, diarrhea, arthralgias, encephalopathy, and lymphadenopathy also may occur.[2] Rash has been described in 10% to 50% of patients, but in contrast to Rocky Mountain spotted fever, the rash is usually not petechial and can be subtle and transient.[2,3,9] Cerebrospinal fluid pleocytosis and meningeal signs may occur in ehrlichiosis, as they do in Rocky Mountain spotted fever.[2,10] Laboratory manifestations may also include hyponatremia, leukopenia (especially lymphopenia), anemia, thrombocytopenia, elevated aminotransferase levels, hyperbilirubinemia, azotemia, and evidence of disseminated intravascular coagulation.[2,3] Deaths do occur but probably less commonly than with Rocky Mountain spotted fever.[2,3] Although there is strong circumstantial evidence that the disease is transmitted to humans by ticks, the specific tick vector has not been proved, nor has a nonhuman vertebrate host been identified.[2-4] The human disease occurs mainly in the area of distribution of the Lone Star tick, *Amblyomma americanum*, and human illness occurs April through October (with the peak occurrence being May through July), times that correlate with the activity of this tick.[2,3] The treatment choice is one of the tetracyclines, although chloramphenicol is also effective. Penicillins, cephalosporins, aminoglycosides, and erythromycin are not effective; the efficacy of sulfonamides and quinalones, if any, is yet to be determined.[1-4,11]

This case illustrates the importance of obtaining an accurate travel history in all patients with unexplained, unusual illnesses, even when the travel is within the United States, and the need to know about illnesses that may be acquired in specific areas.

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Blood-Saturated Operating-Room Shoe Covers

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THE IMPLEMENTATION of "universal precautions" in hospitals to prevent the spread of infectious disease has recently received much attention.[1(pp129-130)] Yet, blood contamination of surgeons' footwear through blood-permeable, paper operating-room shoe covers remains an unresolved issue. A special risk of shoe and stocking contamination with blood and amniotic fluid may exist for obstetricians during vaginal delivery and cesarean section. This study was carried out to assess the possible risk for shoe contamination with blood in operating rooms if standard blood-permeable shoe covers are used.

Materials and Methods

Disposable paper shoe covers were collected from the waste containers in the men's and women's operating-room dressing areas at the Tulane University Hospital, New Orleans, Louisiana. Each shoe cover was put into a biohazard bag. Shoe covers were collected within a two-day period at the end of each workday before trash collection and were then checked for blood. Because of the anonymous nature of this review, surgeons were not classified by surgical specialty or type of surgical case. The Tulane University Hospital is a general teaching hospital with essentially all standard surgical specialties represented. The covers were classified visually into three categories: covers with no blood, covers that blood had not soaked through, and covers that blood had soaked through. Shoe covers discarded in the nurses' lounge or the operating room were not examined. This may have introduced an underreporting of grossly contaminated shoe covers because the tendency may have been to dispose of such covers in the operating room.

A strip measuring 2 cm by 3 cm was cut out of one blood-soaked area on each shoe cover. This strip was then soaked for 30 minutes in a 0.9% saline solution to extract the pre-

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sumed blood spot. Negative and positive control specimens were included. Final confirmations of blood were accomplished with a phenolphthalein test (Kastle-Meyer test).[2(p610)] Initially 2 ml of extract was placed in a plastic conical centrifuge tube. Next, 2 ml of phenolphthalein reagent and 2 ml of 5% hydrogen peroxide solution were added to the tube. A color change to pink supported the presumption that the extract was indeed blood.

During five busy daytime periods, all surgeons were observed while taking off their shoe covers. The intent was to determine whether a sterile technique—that is, an effort to avoid blood exposure—was generally used. Observation was carried out without the knowledge of the operating room staff.

Results

Over a two-day period, 102 surgical shoe covers were collected from the dressing area for the operating room at Tulane University Hospital. Of those, 43 shoe covers showed no visible evidence of blood. Blood that appeared not to have soaked through to the inside of the shoe cover was detected on the outside of 27 shoe covers. A total of 32 shoe covers had visual evidence of blood soaked through to the inside. All cases of visibly identified blood were confirmed with a positive Kastle-Meyer test.

Many of the staff who were observed in the locker rooms did not wear gloves when removing the shoe coverings. Yet gloves worn by the investigators inspecting the shoe covers uniformly became contaminated with blood from the shoe covers, suggesting a risk of blood contamination to the surgeon with the removal of the shoe cover. Also, it was noted that some staff members walked in bare feet in the dressing area where shoe covers were removed, which may also present a risk of infectious exposure to the surgical staff. Of the 103 physicians observed, 84 wore contaminated shoe covers into the lounge-dressing area. Of the 84 physicians, 35 removed shoe covers with their bare hands and 35 removed shoe covers in the dressing area rather than immediately on entering. Only 7 washed their hands in the dressing area after removing the covers.

Discussion

The importance of infection control in the surgical area is obvious. Practical rules regarding surgical attire and mucous membrane protection have been well publicized, but the risk of blood contamination by operating-room shoe covers appears to be an unresolved matter of concern, at least at the Tulane University Hospital. This finding is probably typical for most general hospitals. Shoe covers not only carry possibly contaminated blood from the operating room to the dressing room area but also allow blood to soak through and saturate the surgeons' footwear. Further risk of blood exposure is evident when removing the contaminated shoe cover. Admittedly there was some potential in this study that shoe covers could have become contaminated after disposal. The potential for this was limited by the finding that shoe covers were generally inside out and crumpled up by the process of removal, protecting many of the contamination sites from contact with other shoe covers. Also, in some cases blood could have soaked through the shoe covers after disposal. The fact that blood could soak through the material was considered the more significant issue.

It is our opinion that the ideal shoe cover would minimize the risk of blood contamination for the surgical staff. Traditionally shoe covers were designed to prevent a transfer of contaminated material from surgeons' shoes to the operating environment. At one time, surgical shoe covers were also important to provide a ground contact when explosive anesthetic agents were in use. The role of shoe covers in the operating room should be modified to afford surgeons protection against blood exposure. The ideal characteristics of such a shoe cover would include the following:

- The shoe cover should be nonpermeable to blood,
- The shoe cover should have a nonwettable surface so that blood will tend not to adhere,
- The shoe cover should have some mechanism for easy removal that would minimize the risk of blood exposure at this point.

Shoe covers contaminated with blood probably should be removed with a gloved hand, and measures should be implemented to allow for the removal of shoe covers before entering dressing areas.

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