

# Fungal Wound Infection

[Announcer] This program is presented by the Centers for Disease Control and Prevention.

[Sarah Gregory] During the recent war in Afghanistan, invasive fungal wound infections, or IFIs, among U.S. combat casualties were associated with risk factors related to the mechanism and pattern of injury. Although previous studies recognize that IFI patients primarily sustained injuries in Southern Afghanistan, environmental data were not examined. The authors compared the environmental conditions of this region with those of an area in Eastern Afghanistan that was not associated with observed IFIs after injury.

Today I'm talking with Dr. David Tribble about his article on fungal wounds after combat trauma in Afghanistan. Dr. Tribble is the acting director of the infectious disease clinical research program at Uniform Services University of the Health Sciences. The IDCRP is a Department of Defense and the National Institute of Allergy and Infectious Diseases collaborative research program. Welcome Dr. Tribble.

[David Tribble] Thank you for having me on.

[Sarah Gregory] Dr. Tribble, what are trauma related invasive fungal infections?

[David Tribble] Trauma related invasive fungal infections, or what we've termed IFIs, are soil contaminated traumatic wound infections that are most commonly caused by the tissue invasive molds in the order *Mucorales* or *Aspergillus* species. These infections develop after a traumatic penetrating injury and, in this case, with combat casualties, this is usually an explosive blast injury. The IFIs may result in further loss of limb, leading to amputations in order to remove the necrotic tissue that develops around the infection. If the infection disseminates through out the body, it may result in death, so these can be fatal infections. These types of infections have also been reported in civilians after agricultural accidents and natural disasters, such as, there was a tornado that happened a few years ago in Joplin, Missouri. In the military, the IFIs have been primarily reported due to combat related blast trauma, where a soldier on foot patrol or a marine is—and we've seen this commonly in Southern Afghanistan, which is as you reported. This type of injury commonly results in a traumatic amputation of at least one lower extremity between the period of June 2009 and August of 2011 there were 77 combat-related IFI cases and this ended up representing a very substantial amount—6.8 percent of trauma admissions to the regional military hospital in Germany.

[Sarah Gregory] What were you looking for when you did your study?

[David Tribble] Well, what we were looking for, after the combat-related IFI outbreak was recognized, we began doing a series of investigations to try to look at individual and injury factors that could be related to the risk of developing an infection. This particular study examined regional and environmental factors that might be useful in risk stratification.

[Sarah Gregory] So what did you find?

[David Tribble] Well, the regional risk of mold contamination of wounds was observed in injuries that occurred primarily in Southern Afghanistan, so we were comparing this region to the eastern part of Afghanistan where there were also several serious blast injuries, and in the

southern region we were seeing that this area was primarily characterized in comparison to the east as being lower elevation, warmer temperatures, and less precipitation. Interestingly though, even though less precipitation, we were seeing the cases clustering along waterways.

[Sarah Gregory] Why are these geographical areas more likely to produce these infections?

[David Tribble] Well, as probably most people know, molds commonly grow in warm and wet climates. So, mold is frequently found on decaying organic matter, crop debris, or compost heaps. So, Southern Afghanistan is notably warmer and it became termed, during the period of the war, as the “green zone” and this area is notable for large agricultural areas, several rivers and waterways, which many of those may be irrigation areas in these agricultural sites, and so this provided a very favorable environment for the mold growth.

[Sarah Gregory] And why is this significant?

[David Tribble] Well, while we were not able to identify the specific environmental factors. When you look at it on an individual injury site level, so the grid coordinates for that—where that injury occurred in order to directly associate that with mold wound contamination. We were able, however, to describe environmental conditions and regional data that was useful for risk stratification. When you take this information and combine this with injury circumstances, such as being on foot patrol, having a mechanism of injury like a blast as well as the severity like above the knee amputation, traumatic above the knee amputation, then it really assists in risk assessment. There is a potential that this environmental data—we did this in the article—can be further extrapolated and used in ecological niche modeling to predict the likelihood that an IFI would develop if this was happening in another geographic area. So, overall, I would say the results of the study help describe certain clinical scenarios and settings with a high risk of mold contamination with specific injury patterns and that leads to contamination of the wounds.

[Sarah Gregory] What kind of wounds create an environment for IFIs?

[David Tribble] So, in general, these are very serious penetrating wounds that get inoculated with fungal spores. Within our combat casualty cohort, these patients have massive tissue loss, they have extensive traumatic injury, typically manifest by above the knee amputations or even more proximal into the thigh, perineal, and pelvic injuries and these are all due to these improvised explosive device blasts injuries.

[Sarah Gregory] Are there ways to prevent these kind of infections?

[David Tribble] Yeah, the best prevention, and actually it’s also the primary therapy, is aggressive surgical debridement and wound irrigation, so these are grossly contaminated wounds and they are, as I said, with quite a large amount of tissue loss, so they really need a very aggressive debridement. They can be very challenging because of the extent of the injuries. The other thing that’s important in prevention is an increased awareness of these risk factors that if you couple that with an early tissue-based diagnostics, you can get more timely diagnosis and directed antifungal chemotherapy.

[Sarah Gregory] So, does awareness help prevent morbidity and mortality?

[David Tribble] Absolutely. The best defense against IFI-related morbidity and mortality is an increased awareness of who is at risk and couple that with early diagnosis and aggressive therapy. After the outbreak of the combat-related IFIs, another major endeavor that we undertook with collaborators at the military hospital in Landstuhl, Germany was to assess a local clinical practice guideline where high risk patients, based on some of the factors we had identified, 4 out of 5 had aggressive wound cultures and tissue-based histopathology. So, by doing this, focusing on dismounted blast injuries, above-the-knee amputations, and patients receiving large volume blood transfusions within the first 24 hours of injury. We had a very significant decrease in the time to the IFI diagnosis and allowed for more aggressive surgical and antifungal therapy and topical antifungal treatment.

[Sarah Gregory] Are IFIs, in general, a public health threat?

[David Tribble] Yes they are. The IFIs are not common infections and these traumatic IFIs, you know, generally happen at a relatively low frequency. However, there has been an increased incidence of invasive mucormycosis, which is one of the predominant mycology groups that actually cause this in the general public and when we see this it's with agricultural accidents and natural disasters. As I mentioned earlier, the incident in the United States in 2011 where in Joplin, Missouri, there were post-traumatic IFI cases. In that case, there were 13 people diagnosed and they had a very high case fatality rate of 38 percent.

[Sarah Gregory] Thank you, Dr. Tribble.

You can read the entire October 2015 article, "Environmental Factors Related to Fungal Wound Contamination After Combat Trauma in Afghanistan 2009 – 2011" online at [cdc.gov/eid](http://cdc.gov/eid).

I'm Sarah Gregory for Emerging Infectious Diseases.

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