

# Study identifies factors predicting infection risk in patients with serious burns

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A team led by Massachusetts General Hospital (MGH) investigators has identified a set of characteristics - including differences in gene expression - that may indicate which patients recovering from severe burns are at greatest risk for repeat infections. The ability to predict the risk of infection before it occurs would indicate which patients should receive preventive treatment and should reduce the unnecessary use of antibiotics in those at low risk.

"Our approach is the first to enable the prediction of repeat infections days or even weeks before they occur," says Laurence Rahme, MS, PhD, director of the Molecular Surgical Laboratory in the MGH Department of Surgery and senior author of the report that has been published online in *Annals of Surgery*. "All current approaches that use biomarkers identify infections after they have occurred. The ability to predict [infection](#) would allow more effective prevention and treatment, help stem the emergence of antibiotic-resistant microorganisms, and reduce the costs of care."

Infection remains the leading cause of death in patients with serious burns, and multiple infections stress patients' ability to heal, delaying their recovery. Current practice calls for the initiation of antibiotic treatment when symptoms of infection develop, and the inability to quickly identify the infecting organism can result in patients' receiving powerful medications that target all likely infecting agents. Antibiotics also may be given prior to surgeries or other procedures that could introduce infection, and Rahme notes that the ability to select [antibiotic](#)

[treatment](#) based on a patient's individual susceptibility to infection would open a new pathway to improved treatment.

In their effort to identify factors associated with increased infection risk, her research team analyzed data from patients enrolled in the Inflammation and the Host Response to Injury program, a multi-institutional NIH-sponsored collaboration investigating the body's response to serious traumatic injury, led by Ronald Tompkins, MD, ScD - director of the MGH Center for Surgery, Innovation & Bioengineering and a co-author of the current study. Out of the more than 570 patients studied in the overall project, all of whom had burns over 20 percent or more of their bodies, the current study's investigators focused on 113 adults for whom gene expression data was collected within a week of their injury. They searched for factors - both clinical characteristics such as age and extent of burns, and gene expression patterns - that differed between the 66 patients with two or more infection episodes and the 47 with one or none.

In addition to finding that factors currently used to estimate infection risk - patients' age, the extent of burn injury and lung injury from smoke inhalation - could help predict multiple infections, the study showed that a biomarker model based on observed differences in [gene expression](#) correctly predicted the infection susceptibility of over 80 percent of patients. Analysis of risk-associated differences suggested that the expression of genes involved with the immune response, overall metabolism, and epigenetic functions - such as regulating the expression of other genes - was significantly different in patients who experienced multiple infection episodes, implying that impairment of those functions could be behind increased susceptibility to infection.

Shuangchun Yan, PhD, of the MGH Department of Surgery, lead author of the *Annals of Surgery* report, explains, "Using genomic signatures to understanding why some patients are more susceptible to infection may

allow the design of novel, personalized therapies that would support our fight against the antibiotic resistance crisis."

Rahme adds, "Our findings also may have very broad applicability to causes of infection other than burns, particularly in the care of military personnel, among whom multidrug-resistant infection of blast and other combat injuries has become a major cause of illness and death. These infections cause grave suffering, severe pain, emotional and physical stress, and considerable financial burdens to [patients](#), their families and to health care systems. With our focus on innovative ways to counter these infections through the development of biomarker panels and our pioneering work on anti-virulence therapies that block pathogenesis but not cell viability, we hope to open new avenues to treat and prevent infection that do not contribute to antibiotic resistance." Rahme is an associate professor of Surgery, Microbiology and Immunobiology at Harvard Medical School.

Provided by Massachusetts General Hospital

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