[HELICOPTER WHIRRING]

VIVIEN WILLIAMS: Disaster zones and battlefields can be difficult, confusing places. Medics make quick decisions about triaging the wounded. Some life-threatening injuries are obvious. But if a soldier is bleeding internally, there's no easy way to tell.

MICHAEL JOYNER: So there's a kind of a gradual response where your body compensates, followed by a sudden decompensation.

VIVIEN WILLIAMS: Dr. Michael Joyner and his research team at Mayo Clinic are studying how the body responds to blood loss.

MICHAEL JOYNER: The purpose of this experiment is to help the Army develop better monitors to determine who needs a transfusion and who doesn't need a transfusion in battlefield or trauma situations.

VIVIEN WILLIAMS: Triaging the wounded can be difficult, because when someone loses blood, vital signs such as blood pressure and heart rate don't change much until the victim suddenly collapses.

MICHAEL JOYNER: So what we're trying to do is determine if we can predict when the vital signs are becoming unstable.

VIVIEN WILLIAMS: So they can intervene in time and save lives. The study, funded by the Department of Defense, includes two phases. First, the research team slowly, and in a very controlled manner, removes blood from a test subject.

MICHAEL JOYNER: We're going to take about a liter of blood.

VIVIEN WILLIAMS: That's about 20% of total blood volume.

MICHAEL JOYNER: And that is typically about where some people start to decompensate.

VIVIEN WILLIAMS: Then they put the blood back in and start phase two. This involves putting the test subject into a negative pressure box. The negative pressure makes it difficult for blood to flow back to the heart. So it pools in the legs. The amount of blood that reaches the brain and heart decreases, mimicking blood loss.

The researchers say if the body responds to the negative pressure the same way it responds to actual blood loss, they can do more experiments without having to take blood from patients' bodies. The information they gather will be used to develop monitoring devices that will hopefully help determine who needs immediate medical attention on and off of the battlefield.

MICHAEL JOYNER: So that when we're working with trauma victims, or people in the operating room, we can figure out who needs blood when. And the goal is to make sure the patients do well during surgery and to make sure that we give blood to the right patient when and don't give too much blood or too little.

VIVIEN WILLIAMS: For the Mayo Clinic News Network, I'm Vivien Williams.