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Study identifies better blood glucose monitor for burn care

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Glucose monitoring systems with an autocorrect feature that can detect red blood cells (hematocrit), vitamin C and other common interferents in burn patients' blood are better for monitoring care, a pilot study conducted by UC Davis researchers at the School of Medicine and College of Engineering has found. The study was published in the *Journal of Burn Care Research*.

Burn patients are at risk for high blood glucose levels, or hyperglycemia, due to the body's stress response. Intensive insulin therapy, which is commonly used to keep glucose under tight control, significantly reduces mortality and morbidity. But not all glucose monitoring systems are created equal, according to Nam Tran, assistant adjunct professor of pathology and laboratory medicine at UC Davis and lead author of the study.

"Many glucose monitoring systems, including those used throughout the five University of California health systems, may not adequately correct for interferents in the blood of burn patients," Tran said. "As a result, an inaccurate reading increases the potential for an insulin overdose. Our study showed that using a device that autocorrects for interferents can produce more accurate blood glucose measurements, which can improve insulin dosing and glucose control."

A multidisciplinary team of faculty and student researchers from the Department of Pathology and Laboratory Medicine, Department of Biomedical Engineering, and the Department of Surgery conducted the

study by assessing two different commercially available glucose monitoring systems in UC Davis' Firefighters Burn Institute Regional Burn Center.

Based on the researchers' findings, UC Davis patients at risk of hematocrit and vitamin C interferences, especially burn patients receiving high dose vitamin C therapy, will now be tested for glucose levels with the hospital's clinical chemistry laboratory analyzer. Tran is working with the UC Davis Clinical Laboratory staff to install a flag notification in the electronic health record system to notify physicians about utilizing the hospital's laboratory analyzer for these high-risk patients.

Traditional hospital lab testing uses plasma (samples devoid of red blood cells), so it remains the most accurate method for measuring blood glucose levels. However, the newer autocorrecting devices use less blood, essentially one drop, and produce results in just five seconds, as opposed to approximately 10 to 20 minutes for lab testing.

"In a critical burn patient, glucose levels can change even within that small time frame," Tran said. "A glucose monitoring system that can autocorrect is a necessary requirement to improve the quality of patient care."

Future studies will evaluate the performance of the autocorrection features of newer glucose meters. and assess whether autocorrection provides the most accurate glucose monitoring for all patient populations.

Tina L. Palmieri, professor of surgery and director of the Firefighters Burn Institute Regional Burn Center at UC Davis, is enthusiastic about the findings.

"Hyperglycemia is an important issue for burn patients because it decreases the body's ability to respond to infection and can cause other metabolic perturbations," Palmieri said. "Our published research has shown that administering insulin and controlling hyperglycemia decreases infection rates and improves outcomes in patients with severe burn injuries. However, controlling hyperglycemia can be problematic, as there are issues with monitor accuracy, calculation of the proper insulin dose and practitioner administration of insulin. This study addresses all three of these areas and may very well improve morbidity and mortality in burn patients."

Anthony G. Passerini, a UC Davis associate professor of biomedical engineering, launched the study with Tran. Passerini is the faculty instructor of the senior design course which pairs teams of undergraduate students with clinicians to identify needs and to design devices for improving health-care delivery.

"By bringing these technologies to the bedside, there is a real opportunity to improve patient care, by saving time and reducing human error," Passerini said.

Lydia P. Howell, professor and chair of pathology and laboratory medicine, believes this type of translational research has the potential to improve lives and transform health care.

"We strive to ensure that our patients have the most accurate and up-to-date testing methods available to them, and we are constantly working to improve the quality of care. I am especially pleased with the involvement of the undergraduate students in this study, as their contributions were significant and the experience they gained is excellent training for emerging leaders among the next generation of health-care providers."

Julian Cheng, a recent biomedical engineering graduate and a co-author

of the paper, developed the software and algorithm used to automatically evaluate the glucose measurements between devices. The project was an extension of his senior design project to monitor glucose for intensive insulin therapy and adherence to glycemic control protocol at the point of care.

Provided by UC Davis