Keeping stress at a distance

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Beep-beep, tick, shoosh, beep-beep, tick, shoosh. Four tiny incisions are made in the patient's abdomen … thin metal tools are inserted into the incisions.

These will help the surgeon—who now sits by the console of a robot—navigate his way to the source of the problem: a tumor in the prostate gland of a 65-year-old patient diagnosed with localized prostate cancer.

Nurses, residents, anesthesiologists check vital signs, give fluids, swab, replace tools. As the dance of the operating room goes on around him, the surgeon's inner monologue is complex: "Avoid the vascular bundle, identify tissue margins, don't nick the blood vessel … blink your eyes, avoid the rectum…"

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Mental stress? Sure, the operating room is full of it, particularly in modern medicine where surgeons are required to not only perform procedures effectively and safely but do so with tools that require dexterity, advanced hand-eye coordination and a certain level of physical disconnection from the patient.

In minimally invasive surgery, surgeons hold thin metal tools to act as their hands inside the patient's body. With the addition of the robot, those metal arms are maneuvered from about 15 feet away behind the

computer console, where the surgeon looks at a 3-D real-time picture of the patient's internal anatomy and "feels" with metal arms, not his own hands.

Mental stress is not a topic commonly addressed in research, but for UC College of Medicine associate professor of urology Krishnanath Gaitonde, MD, it is an important area that he is studying with the help of a uniquely trained psychologist—UC alumna Martina Klein, PhD.

Their collaboration began in 2008 when Klein was a graduate student in UC's psychology department studying experimental/human factors psychology.

The team of psychologists and urologists began conducting tests to pinpoint what triggers stress for surgeons in the operating room during minimally invasive surgery and develop strategies for combating it through training and stress management strategies.

The pilot project, funded by UC's University Research Council, examined perceived stress surgeons felt while performing training exercises on an inanimate training module as well as a da Vinci surgical robot.

The results indicated that the da Vinci system induces lower levels of mental stress. At the crux of this research is a practical challenge: Laparoscopic and robotic surgery is being established as the standard of care for many surgeries performed in the United States. More procedures are being adapted for minimally invasive techniques, which gives academic surgeons like Gaitonde the challenge of teaching minimally invasive surgery to residents while also teaching the fundamentals of traditional surgery.

"The training tools for surgery are very generic, so giving trainees

valuable experience on specific procedures is difficult," says Gaitonde, who specializes in robot-assisted surgery as a urologist with UC Health.

"New surgeons must manage the inherent stress of the operating room and gain the hand-eye coordination necessary to operate by cameras, monitors and surgical 'arms'—all while looking at a monitor away from the area where they are operating."

Now several years into the work, the research project has grown beyond a pilot study into a Intuitive Surgical Inc.-funded multi-institutional effort at UC, Stanford University and Texas Tech—the latter where Klein now serves as an assistant professor of psychology.

The project is aimed at evaluating the stress profiles of minimally invasive surgeons across varying levels of experience in the laparoscopic and robotic surgical environments. Previously, testing had been limited to inanimate models: trainer boxes, virtual reality simulators and other generic tools.

Gaitonde and Klein are designing the next stage of research, which will be conducted in live operating rooms using task analysis. Five cameras will be set up to capture simultaneous recordings of the surgeon's movements during robotic surgery, the operative field and the surrounding environment.

A psychologist will then sit down with the surgeon and analyze the video to help splice out the specific elements—body position and posture, environmental noises, etc.—that contribute most to perceived mental stress in an effort to identify clues on how experienced surgeons make decisions during stressful situations.

"This step-by-step analysis entails asking lot of very specific questions," says Klein. "This approach helps us pull out those key things that

experienced surgeons do—often out of ingrained habit—that help them stay more relaxed and focused in the OR. We want to take those key learnings and work them into strategies that help new surgeons deal with mental stress and become better surgeons."

The team is also in the process of extending their research by incorporating Doppler ultrasound technology to evaluate carotid blood flow as a real time measure of mental workload during a surgical procedure.

"This is an offbeat area of research for sure," adds Gaitonde, "but it could have a huge impact on the way we train surgeons. And that is the goal—giving our surgeons-in-training the skills and mental fortitude to handle the mental stress of a high-stakes environment before they ever enter an OR."

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