

New 3-D technology improving patient care for complex kidney surgeries

March 9 2017



In the operating room, 3-D reconstructed image of patient Wes Nance's abdomen was paired with a 40-inch autostereoscopic display, otherwise known as glasses-free 3-D television, which allowed surgeons to see Nance's anatomy, layer by layer, throughout the surgery in a truly 3-D view. This is the first time this type of glasses-free 3-D technology has been used in a surgery. Credit: Intermountain Medical Center

If you were asked to describe the shape of a kidney, you may visualize a kidney bean. But Wes Nance's kidneys had a different shape, plus they were positioned atypically inside his body—plus, he had roughly a dozen painful kidney stones.

Since the abnormal [anatomy](#) of Nance's kidneys made removing his stones more complicated, Jay Bishoff, MD, medical director of the Intermountain Medical Center Urological Institute in Salt Lake City, came up with a unique solution. He collaborated with a team from Intermountain Healthcare's Innovation Lab to create 3-D reconstructions of Nance's anatomy.

"In working with Dr. Bishoff, we were able to produce multiple advanced 3-D images and models that not only helped him plan the best approach for Wes' surgery, but he used our images in the [operating room](#) to find and remove the kidney stones, despite Wes' complex anatomy," said Billy Prows, manager of Intermountain Healthcare's Innovation Lab.

Moments before Nance was wheeled into the operating room at Intermountain Medical Center, Dr. Bishoff and the team shared some of the 3-D reconstructions with he and his wife.

- A 3-D printed model of Nance's kidneys and the placement of each kidney stone allowed them to examine his anatomy from multiple angles. The clear kidney wall, yellow urinary ducts, and blue kidney stones showed up clearly in the customized model, which Wes, his wife, and the care providers could hold and examine together to see exactly what they'd be doing during the surgery.
- Using a laptop, Nance was shown a colorful 3-D rendering of his kidneys in relation to his spine, pelvis, and other organs. The rendering could be digitally rotated and the organs could be removed from the screen to isolate the kidneys and show the

location of his kidney stones.

- The team walked Nance through a 3-D rendering of his anatomy on an iPad, which showed the layers Dr. Bishoff would have to go through to get to the kidney stones - skin, intestines, and the ducts in the kidneys. The team navigated through the layers with the swipe of a finger across the screen.

In the operating room, that third 3-D reconstructed image of Nance's abdomen was paired with a 40-inch autostereoscopic display, otherwise known as glasses-free 3-D television, which allowed Dr. Bishoff to see Nance's anatomy, layer by layer, throughout the surgery in a truly 3-D view.

This is the first time this type of glasses-free 3-D technology has been used in a surgery.

"Imagine looking deep in a 40-inch hologram of a patient created from their standard MRI or CT images," said Prows. "Without special glasses or a headset, it's possible to use hand gestures to rotate and peel through the patient's anatomy and see images that have the brightness and opacity of a standard flat-panel display."

Before the complex surgery to remove Nance's [kidney stones](#), Dr. Bishoff and members of the Innovation Lab evaluated the various 3-D reconstructed images and model to find which ones were most useful.

"We were able to use these cutting-edge technologies to find and remove stones we otherwise wouldn't have been able to find," said Dr. Bishoff. "This allowed us to provide better care to Wes in a procedure that was simpler and less invasive than it would have been without these revolutionary new innovations."

The team is exploring other uses of the technologies to see if there are

ways to create 3-D images that can allow surgeons to practice surgery long before they actually step into the operating room.

Provided by Intermountain Medical Center

Citation: New 3-D technology improving patient care for complex kidney surgeries (2017, March 9) retrieved 2 May 2024 from

<https://medicalxpress.com/news/2017-03-d-technology-patient-complex-kidney.html>

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