Surgeons perform first robotic liver transplant in US

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Transplant surgeon Adeel Khan, MD, controls a surgical robot. A surgical team from Washington University School of Medicine in St. Louis led by Khan recently performed the first robotic liver transplant in the U.S. in May at Barnes-Jewish Hospital. Credit: Katie Gertler/Washington University

A surgical team from Washington University School of Medicine in St.

Louis recently performed the first robotic liver transplant in the U.S. The successful transplant, accomplished in May at Barnes-Jewish Hospital, extends to liver transplants the advantages of minimally invasive robotic surgery: a smaller incision resulting in less pain and faster recoveries, plus the precision needed to perform one of the most challenging abdominal procedures.

The patient, a man in his 60s who needed a transplant because of liver cancer and cirrhosis caused by hepatitis C virus, is doing well and has resumed normal, daily activities. Typically, liver transplant recipients require at least six weeks before they can walk without any discomfort. The patient was not only walking easily one month after surgery, but was also cleared to resume golfing and swimming.

"The transplant was a success: The operation went smoothly, the new liver started working right away, and the patient recovered without any surgical complications," said transplant surgeon Adeel Khan, MD, the leader of the team that conducted the trailblazing surgery. Khan is an associate professor of surgery at the School of Medicine.

"Liver transplantation is one of the most complex abdominal operations and heavily relies on a specialized team for good outcomes. Here at Washington University and Barnes-Jewish Hospital, we are very fortunate to have the support needed to develop a world-class robotic-transplant team that allows us to safely perform complex operations. This team is a big part of our success."

A liver transplant traditionally is performed as an "open" procedure, with a surgeon making a 3- to 4-inch vertical and 12- to 16-inch horizontal incision just below the rib cage to remove a patient's diseased liver and place the healthy donated liver. There has been a push by transplant surgeons to shift the procedure to one that is minimally invasive—with smaller incisions that typically result in less pain and faster recoveries.

Yet, most transplant surgeries have been thought to be too complicated for a minimally invasive approach—whether performed laparoscopically or robotically—and liver transplants are particularly challenging. Diseased livers are prone to excessive bleeding during surgery to remove them, and attaching the new liver to the patient's circulatory system requires delicately sewing several tiny blood vessels together.

Robotic surgeries are a kind of minimally invasive surgery. Surgeons maintain complete control of the robot's tools and perform the operations remotely—usually just a few feet away from the patient—using joystick-like controls. High-resolution cameras provide a magnified, 3D view of the surgical site viewable via a large monitor. The high-tech instrumentation allows for very precise, fine manipulations that would be impossible using traditional techniques.

For this robotic liver transplant, the surgeons operated through several half-inch keyhole incisions and made a single 6-inch vertical incision between the abdominal muscles for removing the diseased organ and placing the new liver, which is about the size of a football, inside the abdomen. This incision is considerably smaller than the one used traditionally and does not require cutting through abdominal muscles, enabling a faster recovery.

While the patient's physical recovery has been on schedule, he did require extra time in the hospital due to cognitive symptoms that are not unusual in older patients after major surgery.

The robotic liver transplant took just over eight hours—on the high end but within the expected time frame for traditional open liver transplants, which usually take six to eight hours. Future robotic liver transplants likely will be completed faster as the OR team gains experience and gets more used to the subtleties of the new surgical technique, Khan said.

A South Korean team reported the first robotic liver transplant in the world in 2021. That surgery involved transplanting half a liver from a living donor instead of the whole organ, and the surgery was partially robotic; the diseased liver was removed laparoscopically and the new liver implanted robotically. Khan said his team is the first to perform a robotic liver transplant in which a whole liver was transplanted.

"Liver transplantation is the most difficult of the abdominal organs to consider for a minimally invasive approach—given the difficulty of removing a failing liver and successfully implanting the new organ—but Dr. Khan has shown that this is possible," said William Chapman, MD, the Eugene M. Bricker Professor of Surgery, director of Washington University's Division of General Surgery and chief of the transplant surgery section. "Further experience with this technique will be needed to establish the extent of the benefits of performing liver transplant as a minimally invasive approach."

Washington University and Barnes-Jewish Hospital have focused heavily on robotic surgery as part of a concerted effort to advance minimally invasive surgeries and improve patient outcomes. The robotic transplant team was formed five years ago, with an initial focus on kidney transplants. To date, the team has performed more than 30 robotic kidney transplants, all with good outcomes. The team also performs living-donor kidney removal surgery, and other robotic surgeries involving the liver, bile ducts, pancreas and stomach.

"Over the span of several years, we have built a dedicated robotic transplant team that is second to none and has been instrumental to our success," Khan said. "Once we had this team in place, it allowed us to grow in both number and complexity of the cases while maintaining very good patient outcomes. We have five surgeons on the transplant service doing robotic surgery, and this number will increase to seven by the end of the summer. Since starting our program, we have mentored over 30 transplant centers around the country in building successful robotic programs of their own. Transplant teams from other centers come to observe our process, and we also visit their sites and mentor them as they develop their skills. We are probably one of the very few places in the country that has the support, expertise and team to take robotic transplant surgery to this level."

Provided by Washington University School of Medicine

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