

Living Donor Kidney Transplant Surgery
Sentara Norfolk General Hospital,
Norfolk, Virginia
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Welcome to this “OR-Live” webcast presentation presented by Sentara Healthcare. Sentara Healthcare is a not-for-profit integrated delivery system serving more than two-million residents in southeastern Virginia and northeastern North Carolina. Nationally recognized for quality and innovation, Sentara employs over 15,000 people and operates more than 100 caregiving sites, including seven acute care hospitals, four advanced imaging centers, seven nursing homes, and three assisted-living centers. During the program, it’s easy for you to make referrals, make appointments, or request more information. Just click on the buttons on your screen and open the door to informed medical care. “OR-Live,” the vision of improving health.

Good evening, I’m Dr. John Colonna, the surgical director of the kidney transplant program here at Sentara Norfolk General Hospital. I would like to thank the audience for joining us tonight for our live webcast on living donor kidney transplant surgery. Please feel free to e-mail questions as we go on. We’ll try to get to as many of them as we can. We make group some together if they’re similar. I’d like to tell you a little bit about Sentara.

This hospital is a wonderful hospital. It was designated as a magnet hospital for its outstanding nursing care. For the past two years, “U.S. News” and “World Report” has recognized Norfolk general as one of the 50 best hospitals in the America for patients with kidney disease, and only one other hospital in the State of Virginia received that designation in 2008.

With me today is Dr. Edwin Robey who is the transplant urologist who does the living donor surgeries, and Dr. Harland Rust, who is one of our transplant nephrologists. Also with us today, one of a group of sisters, Anna and Sarah, who have been a living donor and living donor recipient, Anna donating to Sarah.

The program, kidney transplantation at Norfolk General was started in 1972. Since that time, over 1,800 kidneys have been transplanted, and 441 of these have been living donor transplants, and that will be the focus of our presentation today. Dr. Robey will now introduce the laparoscopic donor nephrectomy.

We started the laparoscopic approach to donor nephrectomies in 1999. My partner, Dr. Fabrizio, brought this technique to us from John Hopkins, and we have done hundreds of these since then. The procedure is beneficial to patients because the incisions are less painful, we have really excellent visualization of the anatomy of the kidney and organs around the kidney. Patients have a shorter recovery after they’re discharged from the hospital, and the scars are less obvious than with an open incision.

There is a screening process for potential donors. It’s important to emphasize that donating a kidney is safe. It has an excellent safety record both here and nationwide. To ensure that, we take every step possible to make sure that the potential donor is medically and surgically an acceptable candidate. This shows our screening process, first the potential donor meets with a social worker and a psychologist, and there are also some basic medical tests done to, first and foremost, find out if the potential donor is compatible with the recipient. Then further medical tests such as EKG and basic X-rays and blood work and urine tests are done.

And then after all that is done, the potential donor meets with myself or another nephrologist for a final and detailed medical visit to make sure that there's no reason that this person can't get there through the surgery okay and then most importantly, there's no reason to expect that they couldn't do just fine with one kidney, which most of us can. Finally, after that is done, the patient sees Dr. Robey for a surgical clearance.

There are some absolute disqualifiers for a potential donor; serious medical condition, such as HIV positive status or diabetes or cancer or mental illness or severe obesity are some of these conditions. And once we've taken a good look at the potential donor and we don't see any reasons why they can't safely donate, then they go forward with the surgery.

Let's take a look at a video of a donor recipient pair from here at Sentara. In the '80s, I worked in a dialysis unit in Arkansas. I was a dialysis tech, and I got to know the people that came in. They would come in three times a week, so basically you become their family. They become a part of your family and you become a part of their family. And it just touched me what they have to go through. And I always thought, when I'm in a position that I could be off of work for a little while and my child is grown and I don't have to take care of her so much, I would donate my kidney to help somebody get off of a machine, have a better quality of life. It ended up not happening until 2001. It was 20 years later then after I decided.

Since I've become a kidney donor, my life really hasn't changed. My health is just as good now as it ever was. I don't have any side effects or any problems as a result of donating my kidney. I'm fine. I'm doing great. I haven't had any problems. I would do it again. If I had another kidney, I would donate.

If I were to give advice to anybody as far as donating their kidney, I would say if that's where your heart is at, because it's a wonderful feeling to know when you've helped somebody to live and get off of a machine and have the same quality of life that we enjoy, my advice would just be make sure that that's what you really want to do. Make sure that it's in your heart to do that, and then just do it.

After a donor has been cleared medically, we proceed with a CT scan angiogram, which gives us an excellent view of the anatomy of the kidneys, including the blood vessels. And we have a slide that shows the kidney. Here you can see the left kidney here and right kidney here. And we generally use the left kidney because the vein for the left kidney is longer than the vein to the kidney of the right kidney. Here is another CT angiogram image, and you can see how clear these are. This shows a kidney, again, the left kidney to your right, and the artery -- main artery here, and a smaller artery right here going to the kidney to be donated.

When patients are cleared for a nephrectomy or removal of the kidney, they are admitted the same day as the surgery, and the recipient's admitted that day as well. It takes about four to five hours to remove the kidney in terms of total operative time. Patients are generally in the hospital about three days. Occasionally they're ready to go home in two days, but usually it's three days. And they have intravenous fluids for two to three days until they can eat solid foods.

A few images of the procedure show this initially is looking from outside the patient's abdomen and you can see what we call "trochars." These are instruments placed into the abdominal cavity. There's generally three of those. And through those, we can pass instruments that allow us to free up the kidney.

Here's a view from inside the abdomen, and you can see the kidney artery here and the kidney vein over here going up towards the kidney, which is at the top of the screen. This patient had three arteries going to the kidney. The kidney has been flipped over, so the kidney is now at the bottom of the screen. This is the aorta here. Here there's one artery here, one artery here, and one artery here, and this makes Dr. Colonna's work of hooking all this back up more tedious but still works out quite nicely.

The incision to remove the kidney after the blood vessels have been divided and the kidney is ready to be retrieved is made in the lower part of the abdomen. Here is the patient's belly button right here, so the incision is made down in the lower abdomen or sometimes off to the side depending upon the patient's anatomy.

Looking inside the abdomen, this is the spleen. The pancreas is going to be over in this area here. Here is the kidney back here. It's behind the spleen and pancreas. We're using this instrument to free up the kidney. And now we've gotten the kidney partially freed. You can see it beginning to show up behind the fat here, and now it's more exposed, you can see here. Now we're beginning to see the blood vessels to the kidney. This is the kidney vein here and some branches of the kidney vein. This vein actually goes up to the -- or drains the adrenal gland, which is right here. And, again, this is the renal vein or vein to the kidney. And again, the kidney is at the top of the field.

Now we're looking down towards the pelvis of the patient. This is the tube going down to the bladder, the ureter, and that will have to be divided as well to free up this kidney. In this image we've got a patient who has actually two arteries to the kidney, one here and one here, and then here's the vein to the kidney right here.

This shows the stapling device we have right in the bottom of the field that's going to lay down a row of staples on the aorta, which is running right here, and lay down another set of staples towards the kidney and then cuts between the two rows of staples. So there's an artery here, and artery back here, and then a vein here that all have to be divided.

And then after the incisions are completed this gives a representative example of the incisions the patient has. There's typically three punctures for our trochar-site incisions, and then one larger incision that's either if the lower abdomen or off to the side. Sometimes it's over on this side here.

We now have a video of the procedure that gives you an idea about the intraoperative work. So, again, looking from outside the patient, we have several instruments passed inside that allow us to free up the kidney. That device is called the "ligature device" and actually heats the tissue and then cuts tissue, and we'll see that again in just a moment.

At the bottom of the screen we have what's called a "GelPort" that can allow placement of a hand into the abdominal cavity for retraction. And you can see at this point we're cutting the attachments of the colon to the abdominal wall. The kidney is behind the colon. Here is another example of the procedure, looking, again, from the outside, the lower incision with make, placing this GelPort or hand port into the abdominal cavity to allow us to retrieve the kidney at the end of the procedure and actually allows us to expose tissue more easily, depending upon the patient's anatomy.

So once we have everything set, then we cut the attachments of the colon, which you can see at the bottom of the screen. We're dividing what's call the "peritoneum," which is the lining of the abdominal cavity. We're cutting that down into the pelvis, and you can see the iliac artery pulsating at the bottom of the screen here. So we're going to free the colon up all the way down to the pelvis.

This shows this ligature device heating the tissue and then cutting the tissue and exposing the kidney, which is at the bottom of the field. The spleens up towards the top. It takes a fair amount of work to get all this tissue freed up to get down to the main blood vessels of the kidney. So we're dissecting all this fatty tissue off from the kidney now. We're looking into the pelvis at the ureter, which goes down to the bladder and some veins that run alongside the ureter.

Now we've moved back up to the kidney itself, freeing this fatty tissue, which will then allow us to visualize the artery and vein to the kidney to be donated. So we'll work our way up along the medial aspect of the tissue, which is the side towards the pancreas and towards the bowel. We're freeing up branches of the renal vein. You can see a large branch coming down from the renal vein. We're using this ligature device to heat and then cut tissue. And we're going to pass that device behind the branch of the kidney vein to get more exposure, because we really need to get a long length of this kidney or renal vein to allow Dr. Colonna a more easy hookup for the blood vessels into the recipient.

So here is this branch. This is called the lumbar vein coming off the back of the renal vein. We're going to use this ligature device, again, to basically heat this tissue. The heat from this instrument doesn't

spread much at all, so it has little risk of damaging other tissues. But it does a good job of securing the vessel and then cutting it for us. You can see it heating there. And then we have a trigger to put to cut the tissue.

Now we're working on the top of the kidney vein, and there's a small vein you can see right here. This is called the "adrenal vein." And it drains the blood supply from the adrenal glands, so we're going to use the ligature device to heat that and divide it as well. That's our landmark for how much exposure we need of the kidney vein, because that gives us plenty of length for Dr. Colonna if we can get to that vein and divide that branch, then he's got plenty to work with.

Now we're working on the back of the kidney, taking off all the fatty tissue. And we're going to flip the kidney over in just a moment, once we get this tissue freed off. And now we're looking at the back of the kidney and blood vessels. You can see the kidney artery pulsating there in the middle of the field, and we're going to use this ligature device again to heat the tissue and divide it, because we really have to get these blood vessels cleaned up clearly to divide them safely. So this instrument is a hook to divide tissue around the artery.

Here is the main renal artery in the back of the renal vein, which is being pushed up. Now we're going to use this stapling device to come in and secure the blood vessels and divide them, first the kidney artery and then the kidney vein. You can see we're behind that adrenal branch of the vein, again, assuring plenty of length of the blood vessels. After this, the kidney is retrieved.

Here is another patient with two arteries. Here is one artery at the top of the kidney. We're dissecting a branch of that upper artery, which we're going to secure with the ligature device again. And once that's completed, then we'll further dissect and free up to the two arteries. There's a small artery at the top, you can see, being exposed there, and a larger artery at the bottom. So in this instance we have to divide both of those arteries. It takes another stapling or another load of the staple to complete that. Here is the other ureter going down to the bladder, the kidney tube that as been clipped, it's going to be cut, and that's what we'll sew to the patients -- the recipient's bladder.

We're putting a bit of vasodilator or a tissue -- or a fluid that increases blood flow through the arteries to keep them open. Here we're stapling the upper smaller artery, and then the larger lower artery, and then, again, stapling the vein. After this, the kidney is brought out through that port that we showed you being placed earlier and passed to Dr. Colonna.

Hi. We have several questions that we wanted to address. One is from Nancy. The question is, "Is there a weight restriction on potential donors?"

The answer to that is, "Yes." We look closely not at the weight but the body mass index, which is a formula derived from the weight and height of the person. We generally try and avoid the very obese donor, particularly because they're at long-term risks for health problems such as diabetes, which in turn can cause kidney disease, but also because of risks perioperatively such as wound infections. People with a body mass index over 40 certainly should probably not donate a kidney. We encourage those people to lose weight, and then we reevaluate them and try and give them every chance to donate.

We have another question on -- we talked earlier about the compatibility between the donor and recipient. There's a question, "Can you, and if you can, do you perform non-compatible kidney transplants." There are ways to make it so that a person who has antibodies against another person, that recipient can be treated with treatments that will bind up their antibodies and allow them to accept a kidney from a person that previously they were non-compatible, so technically they would then be compatible.

There are also other options in terms of identifying another donor perhaps for a different patient who they incompatible but would be compatible with your intended recipient. That's where you see some of these eight-way transplants where this kidney goes to the first patient then to the second and third and people get transplanted that way. So, yes, there are ways to make it so a person who started incompatible can be made compatible with their recipient.

And we had one question which maybe will come a little bit later, "But do patients who receive a transplant need dialysis after the operation?" One of the advantages of living donation is that these kidneys essentially always work immediately. So it is extremely uncommon that a person would receive a living donor transplant and have to have dialysis early after surgery. It does occasionally happen, but it is less than five percent of the time, whereas with the deceased donor, as much as a third of people may need a little time on dialysis until the kidney fully recovers. But when a person has had a successful kidney transplant, they are not on dialysis, not three times a week, not two times a week, not one time a week. They're off dialysis as long as the kidney is working.

Now at this point we'll talk about the recipient operation. Excuse me, Dr. Robey, talk about some of the recovery for the person who is going to donate.

So after discharge, kidney donors generally take about ten days to get to the point where they can be mobile enough to drive. We ask that they do no heavy lifting that makes them strain for about four weeks, walking, lifting, climbing stairs, really they can do that any time. Depending upon the patient's exertion at work, generally they can get back to work within two to four weeks, sometimes six weeks.

Long-term, really the only issue is just taking care of their bodies. We do suggest that they not overdue the use of non-steroidal medications like ibuprofen, which can affect kidney function.

And then about four weeks after surgery, I'll see them back in the office. And we'll see them again about six months after the surgery, and then about 18 months after just to be sure that the donor is doing well after giving away one of their kidneys.

Part of talking about the recipient operation, there was one question about how we as surgeons can distinguish between different organs at the time of surgery, and it's really just a matter of experience as you -- in medical school and you do gross anatomy and you learn what the organs look like and where they are. And then as you do your surgery training you get more and more experience. And really, with laparoscopic surgery you actually have better visualization of the organs and the structures. The scope can get up within millimeters or even touching the vessel, which, obviously, you can't get that close to it with your own face. So you really actually have better visualization with the laparoscopic approach.

When we do the kidney transplant, one of the things that's a little different about kidney transplants compared to, say, heart transplants or liver transplants is it's not necessary to remove the patient's own kidneys. There is plenty of room for the new kidney. We actually put it down in part of the lower abdomen. And the diseased kidneys really don't tend to cause any problem. They actually get smaller and smaller over time, and it would be a much bigger operation to both remove their kidneys and put a new one in, so that's not necessary.

We now have some video of the operation once the kidney has been passed off from Dr. Robey to myself. There you see the kidney coming out of patient. It's put in a vase and a vice. Right now it still has some blood in it from where the staples are in. That's now taken over to the back table. I've divided the stable lines, and I'm now flushing the kidney to remove any of the blood that's still in the kidney so it doesn't clot while it's in there. And we flush all the blood out of the kidney through the artery. We then package the kidney sterilely in ice, and it's double bagged and then put in a sterile container, and then we'll actually wheel it right over to the operating room, which is right across.

Once in the room, we do some preparation on the kidney to make it easier to work with the blood vessels. That's the renal artery or the artery to the kidney. That was the smaller second artery. I typically do a little line on the kidneys just to help me maintain the orientation when I put them in the recipient so they don't get accidentally twisted.

The kidney, we're now back in the recipient room and I put the kidney in a stockinet there and put ice on top of it to keep the kidney cold so that it doesn't have problems. The first hookup is the renal vein or the kidney vein anastomosis. The kidney is at the top of the screen in the stockinet, and the iliac vein or

actually the external iliac vein of the recipient actually has the big clamp on it, and you can see the sutures being put in between the donor vein and the recipient vein.

This is fine monofilament suture like fishing line. We wear magnifying lenses while we sew it in, and here you can see the vein is done, and we're now starting the artery. The smaller artery in this donor is already done up at the top there. And we're now making a hole in the recipient's artery that will allow us to sew the new kidney to that. And this is just preparing that hole. I'm just trimming some extra tissue away from the artery to make it a little easier to sew.

This is the donor renal artery, there's the stitch going in the donor artery and then down in the recipient artery to get the anastomosis started. And now the arteries have been sewn and we're now removing the clamps, and you can see very rapidly the kidney gets nice and pink. That's always kind an exciting part of the surgery to see the kidney get nice and pink. You can see the arteries pulsating nicely.

This is -- now that the kidney's reperfused, we're preparing to do the renal anastomosis, and you can see the ureter, which the tube that drains the urine down from the kidney into the bladder. And this kidney is already making urine really literally within a few minutes of being hooked up. And that's really one of the exciting parts of the operation. The green tube you see there is a stent that we put between the ureter and the bladder to allow this hookup a little time to heal. This is typically removed a few weeks after the transplant by Dr. Robey. Really it's just a little office procedure for a cystoscopy. And now everything is hooked up, the kidney looks great, and we're actually preparing to close. This usually happens fairly quickly once the kidney has been handed to us. Usually within an hour we're ready to close.

And we have another question here. This would be for you, Dr. Colonna. How long does a kidney survive out of the body in

Well there have been kidney transplants done as long as 72 hours after a kidney was removed from the donor. This would typically be the deceased donor where a kidney was transported perhaps across country or even from one country to another. Typically, we try to get a kidney from a deceased donor in within 24 hours after it has come out. The kidneys are kept in ice to slow down their metabolism, and they tolerate this fairly well.

Although the longer the kidney is out, the more risk you have where the kidney taking a while to get going. You obviously can extend that time some if it's a younger donor where we would expect the kidney to tolerate that better than a kidney from an older donor. But our routine is to try to get them in under 24 hours, but there have been many done over 24 and some even as much as 72 hours after they were removed from the donor. One of the advantages of living donor is that time is from within an hour to when it came out to when it's hooked up.

Here's another question. "How long does the procedure take?" We typically advise the patients this is going to take about five hours for each of the procedures, the donor and the recipient. So for the donor, if the surgery starts at 7:30, they're usually in the in the recovery room by noon or 12:30. And for the recipient the surgery generally starts about 10:00 o'clock because we have to get a bit of lead time to get the kidney freed up to give to Dr. Colonna. So he'll start that about 10:00 o'clock for the recipient, and they're usually done by 3:00. So it's about five hours for each of the parts of the operation.

Another question is here versus open cavity surgery, "If there is hemorrhage or a vein is ruptured is there a greater difficulty stopping the bleeding when you're doing it laparoscopically?" It's a more tedious procedure for that very reason that we don't want to cause any bleeding we can't deal with laparoscopically, but with the aided visualization from the laparoscope, which magnifies the tissue, it's much easier to see blood vessels, and with the instruments we have, both the instrument you saw that heats up tissue and divides it and the other stapling device that secures blood vessels, it's pretty unusual to have bleeding that is difficult to control laparoscopically.

But we tell patients ahead of time to plan for having an open incision to do the surgery if we ran into something like that, which has happened on two occasions over the last ten years. So it's really unusual,

but it can happen that there's bleeding that's difficult to control with the laparoscopic technique, in which case we convert to an open incision.

I think next we were going to --

I think at this point I think what we'd like to do is have the audience have an opportunity to hear from a couple of our patients. This is two sisters, Anna and Sarah, who underwent a transplant last November where Anna donated her kidney to her sister, Sarah.

We knew we were going to do a transplant, so we were looking towards that, working towards that process. So it was a quick process for me. I think most people it takes longer, anyway, from the time, you know, they find to have a transplant. But because my sister was a match right away, they were able to speed things up, and because I'm so young they were pushing for it for us so.

They decided to go with me because since we are blood related, then it's just a better chance that she would not reject it, that it would be accepted well. And we actually were an exact match in a lot of -- in the things they test. We're not doctors, so I don't know exactly, like, what to say. But I think from our understanding, there are certain antigens that they look for. And so since it was such a good match, then, they went with me.

Our whole process was such a whirlwind. It's been six months since I even knew I had the disease. Then I was on dialysis. And now the transplant. So it was like, what just happened, you know? But it was like, okay. Life's back to normal for me, which is amazing. I sort of lucked out. Dialysis in some ways you just sort of grit your teeth and get through it, but it was hard, and you know, the quality of life is so much better now.

After about a month, I mean it's like it never happened to me, you know. I don't have any side effects, I don't have any other things. There's kind of just no change in life really.

The transplant's the way to go. You don't want to be on dialysis, and so I mean I have just my life back, and I think it's definitely, definitely better of the two.

I'd like to celebrate here the two real stars of our webcast today, Anna and Sarah, who went through this procedure last November. Anna, it's now been several months since your surgery. Just tell us how you're doing now, and do you feel like you're back to normal?

I do feel like I'm back to normal. It has been, yeah, about three months, and I would say really after the first month, I felt back to normal and have had no problems since.

And, Sarah, you mentioned just how you feel, and I've always thought that was one of the neat things about transplant is you're not just transplanting an organ, you're really kind of transforming a life. And if you could talk just a little bit about how different life is for a dialysis patient versus a patient with a functioning kidney transplant.

Yeah. Life on dialysis was very draining for me. Not only with my time, I spent at least 12 hours a week literally hooked up to a machine that cleaned my blood. But then afterwards, I was done for the night. I was so tired, so just my energy level is the other thing. I mean really I feel brand new. I feel back to normal now.

We have a lot of e-mail questions. We have a lot of e-mail questions that we can try to go through some of those. So one of the questions is, "Do other organs fill in the place where the kidney was removed from the donor?" And the answer to that is, "Yes." On the left side, the spleen and the colon fall into that space, and the patient doesn't really notice that. On the right side it would be the liver and the colon would fill the space where the kidney was located.

And this question I'll give you to you, Dr. Colonna. "Why do you not remove the old kidney from most recipients?"

For the vast majority of recipients, there isn't a particular advantage to the recipient to having them out. They will get smaller and smaller over time. They do get an ultrasound every year to look at their native kidneys to make sure nothing is developed in them. But, again, since we put the kidney in through an incision in the lower part of the belly on the right side, you really wouldn't be able to reach the left kidney, and it would really be a lot of work to reach the right kidney. And it would put the patient through a much bigger operation really for what is no benefit.

Now in the very early years of transplant, that was part of the routine to remove their native kidneys, but it was very quickly learned that there really was no benefit to that, and at a finite risk to the patient. There are some patients who do have to have one or both of their kidneys removed if they were, let's say, to develop a cancer in one of their kidneys, and certainly that would be removed. A patient who had chronic infections in one of their kidneys, we would want to have that kidney removed prior to putting the patient on the immunosuppressive medicines to take care of their new kidney. But that said, out of a hundred kidney transplants, it's rare that even one of them we had to remove their native kidneys.

Here is a question for our recipient. Sarah, How long did it take for you to begin to feel like your kidney was working normally?

Well, it's funny, even right after the surgery, I was still -- I mean I was still in pain and recovering, but it's funny, I already could start to feel better than I did when I was on dialysis and then before I started dialysis when I had all the toxins, so pretty immediately. And then more and more, I mean every day, I feel better. I mean it's been a while now that I feel like I'm doing good. I feel -- I can tell through the energy. So, you know, for a while I felt back to normal.

Good. And, Dr. Colonna, do the staples remain on the -- actually this would be -- I'll answer this one. "Do the staples remain on the donor's arteries after surgery or are they replaced with sutures of some sort?" No. The staples are -- it's a row of three staple lines that stay on the donor's side of the artery, and they're quite secure. They have been tested in animal models and have shown to have high, what we call "burst pressure," so they secure the vessels well, and we don't have to remove them to replace them with anything else.

There's a question here, "Is there any risk that you can lose the patient during this surgery? If so, what is the risk?" There have been deaths from donor kidney removal. They're very rare. Much less than one percent, so, yes, there is a risk of that, but it is extremely low.

The donors that it has been a problem with had been with out that artery was controlled on the aorta. If a clip or a locking device as opposed to the staples that we use or also a suture where the control thing goes through and through the blood vessel, and so it really eliminates the risk of bleeding from that line. That's where in the past if there had been a problem with the donor that really was the main source. Otherwise these patients are screened very carefully medically before the transplant to make sure they wouldn't have -- a reason they wouldn't make it through the surgery. If there's any thought that this person would be unable to tolerate the donor operation, then they certainly would have been turned down as a donor. So, again, the stapling device that we use and other centers use has really eliminated that risk of bleeding of the donor.

And, Dr. Rust, here is a question for you? "How does having only one kidney affect a patient's life? Is kidney function still normal?"

That's a good question. As soon as two weeks after you have one kidney taken out, you have about 60 to 65 percent of your original kidney function even though half of your kidney mass was taken out. And by just a few weeks later, you'll have maybe 70 percent of the kidney function you had before you had a kidney removed, and that's about where it stays. We're given an enormous amount of reserve function in our kidneys. So having 70 percent, for example, of your kidney function is more than enough to make

you perfectly healthy. And most donors have no problem long-term. They have ample kidney function and they do very well.

And for our donor, Anna, a question that pertains to having children. "What was your understanding about being able to have children after donating your kidney?"

As far as I understand, there is no relation at all. There is no complications. It should be no problem. I hadn't really thought about it, and I actually had a lot of people ask me when I was saying that I was going to be through this. And they're like, "oh, are you going to be able to have kids?" And I was like, "I think." I asked the doctors, and, yeah, no, it doesn't complicate that at all.

That's right. Another question for Dr. Rust. "Can someone receive a transplant before going into kidney failure?"

Absolutely. That's call a "preemptive transplant." There are many advantages to that; namely, the patient doesn't go through having to be on dialysis and having to have the surgical procedures that have to take place before dialysis, and that is an ideal situation. Unfortunately it's often difficult to do, to get the patient cleared to get the donor cleared, and to get everybody together before kidney failure actually occurs. But we do do preemptive transplants here. And there is quite a bit of information now coming out in studies that preemptive living transplants actually do even better than regular living transplants, so it's really an excellent thing. It's just difficult to arrange in term of logistics, but, yes, we definitely do those.

And another question for Dr. Colonna. "Do you do paired donations at Sentara?"

Paired donations, this would be another similar question about incompatible donors. An example of a paired donation would be, let's say there's a donor whose blood-type A is their intended recipient donor is blood-type B, so they're not compatible. But if there is another pair of our patients who have exactly the opposite problem, then if all four parties are in agreement, you can do a paired donation; a paired donation exchange, living donor exchange, where the A donor would donate to the A recipient and the B donor to the B recipient. And those are very commonplace. They're the first of the matched exchanges.

Here is an interesting question, and I'll give this to Dr. Rust. "Can a recipient ever be a donor?"

No. The recipient, by definition, had end-stage kidney disease and certainly can't ever be a donor, living or deceased for anyone else. Certainly as a living donor, they have one kidney, the transplanted kidney, and they need that themselves.

And there probably have been times where, let's say, a recipient received a kidney, and for some reason early postoperatively passed away or down the road passed away, where maybe they received a kidney but their liver was fine and donated their liver. But in general, it would be very unusual that that would take place. But it has been done, but it's certainly the exception, not by any means the rule.

And, Dr. Colonna, another question for you. "Do you have to transplant right kidney on the right side and left to left, or are they interchangeable?"

They're very much interchangeable. We do most of the kidney transplants preferably on the right side. Dr. Robey mentioned that we prefer to take the kidney on the left because the vein on the kidney is longer on the left. Similarly in the recipient, the vein that it we hook it up to is deeper in the pelvis on the left side. So typically most living donors or left donor kidney are placed on the right side of the abdomen. And really, the two blood vessels are very close together, so there's no issues with that at all. It's really a matter of preference. There are some surgeons who prefer to put them on the left, but there really isn't any reason you can't put one on one side and one on the other. If a person had had a transplant in the past that, for whatever reason, had eventually failed and they're coming for a second transplant, then we always would go to the opposite side where their blood vessels had not been operated on before.

And a question for our donor, Anna. “Anna, thinking back over the course after surgery, how long did it take until you felt that you were totally over the operation?”

I think it took about a month all in all. When I had the surgery done, it was on a Tuesday, and it only took until, I guess, Friday before I was out of the hospital. The first two weeks felt like you were in recovery. It was just -- you still had some pain, but that was being helped with medication, and it was difficult to get up and move around. But by the, you know, ten days or so I'd say, just pretty much like you guys had said, I was driving at that point and pretty mobile, didn't really hurt, felt good.

It took about another two weeks where I would just get tired, easily tired. I think there was just so much healing going on that it was taking a lot of my energy. But we did it by the week of Thanksgiving, and by Christmas, literally a month later, I was fine. I felt good. I had the rest of my stamina back up. I was back to life as normal.

Did you feel like after going through the process leading up to the surgery that you pretty much expected what happened, or were there any surprises for you? No. I felt like I was very well prepared for what it was going to be like. And I think it was a little bit interesting to see just how much it did line up with what I had been told. When you're going into and you feel like you hear everything it is being said, and feel like you explain it but you're not really sure you have it, and then you go through it, and you're like, “Oh, it's exactly like what they said. It's not too bad at all.” It was, I think, in my opinion, a pretty easy recovery.

That's where our team is really helpful with the transplant coordinators, Amy Sokolowski and her team, to help the donor get ready for all this. And it is a lot to go through. We tend to tell the donors that they're going to feel pretty bad the day after surgery, because we can't make them feel any better, whereas the recipient, like Sarah said, is going to feel really good the next day, because all of a sudden, all the toxins in their bloodstream are being cleared by this new kidney.

Dr. Rust, here is a question for you. “Does the patient have to take medication after receiving a transplanted kidney?”

Absolutely. All of our patients take three immunosuppressive drugs to keep them from rejecting the kidney. Even if the kidney is well matched from, for example, a close family member, the recipient has to take anti-rejection medications for the rest of their life. The risk of rejection goes down quite a bit as time goes on, particularly after the first year, but even after that first year they have to continue to take medications or they will reject that kidney.

We have another question for Dr. Colonna. “How do you manage pediatric patients, given the fact that the space is smaller? Is it possible to transplant an adult kidney to a child?”

Certainly. Our team here works with children's hospital the King's Daughters with their nephrologists, and we do the transplants there as well. Once a child is, you know, kind of adolescent age, it's really the same as doing a transplant on a smaller adult. But in babies, and we do them as low as about 20 pounds for the recipient, the vast majority of time they will be receiving an adult kidney from either typically their mother or father. And we just basically have to go -- we put it inside the main part of the abdomen, in the mid part of the belly where the artery and the vein that we're hooking it up to are much bigger.

We do wait until they're, what we would say ten kilos in size, just so that they're big enough to accommodate the kidney. I know there's -- I've heard of places that do them as small as seven kilograms for the recipient. But it does give them time to grow and accommodate the size of the kidney. And it certainly I mean it really kind of goes from the bottom of their waist all the way up to where the liver is, so it fills up that side of the abdomen pretty well, but they really work quite well, and it's as that kidney will stay the same size and the child will grow. That's one of the main reasons we like to do kidneys in children is children grow much better after a transplant. And by the time they're a fully grown adult, they'll have that kidney that's adult size. So except for very, very small children, they're done routinely with adult kidneys.

Dr. Rust, what is the average life span of a transplanted kidney?

That's one of the key differences between deceased donor kidneys and a living kidney. Deceased donor kidneys at about five years. We talk about five year survival and one year survival of the kidney. At five years, something like 55 or 60 percent, depending on what type of deceased donor kidney you're talking about, will still be working. In the a living kidney, it would be closer to 70 percent at five years. The first year is essential -- is very important. If the person gets through the first year without any rejection or other problems, particularly those living kidneys, if they get through the first year with no problems, those can go many years. And we have many people who have gone over 10 years, 15 years. The other day I saw somebody who has had their kidney for 20 years. So the living kidneys clearly have a longer survival.

I talked about the changing trends in living donations. Some of the advancements, certainly in the laparoscopic donor nephrectomy, has been a huge advance, made it much easier for people to donate and really for the recipients, a little easier to let for someone to donate to them. We don't restrict it just to sisters as was the case here, and that has opened it up a lot. At least a third of our donors are not immediate family members or blood relatives of donors. We saw earlier the video of the lady who was an altruistic donor.

We've had a number of very good questions about the incompatible donors and the options that are available for them, such as the multiple-list paired exchange. There are now several national registries of donors and they're incompatible, so they can be matched. Really there's kidneys, living donor kidneys being removed in Los Angeles and flown to New York and other places for their recipients, which spares the recipient the risk of sitting on dialysis for five years while they're waiting to get their deceased donor kidney. That's certainly been a huge advance.

For some of these people who, due to their antibody problems, might have waited on the list even more than five years and maybe even more receive their living donor. We had the good question about making people who have a lot of antibodies. There are ways to try to reduce it so they can be compatible with the donor kidney.

We have one more question, and we'll give this to Anna, our donor. This person is going to be donating a kidney to her mother, and her concern is about the pain afterwards. Could you tell her how your pain was managed and what she can expect in terms of discomfort.

Sure. It is -- excuse me. When I first woke up, I definitely felt a little bit of pain. But quickly they give you medication for that, and it helps a lot. The first day in the hospital you're medicated, but I think one of the hardest things is when they ask you to stand up and they want to get you out of the bed the first day, and that was really kind of difficult. Everything's been a little bit, you know, cut and torn, but they help you and just help you sit up. And really, after that first time, even by the second day, it was so much better, and the third day so much better.

And I think when I got home that first week when there still was pain, I felt it more just in normal things where you would use your stomach muscles. I had help when I wanted to sit up and, like, get out of a chair. But it was really not bad. It was really when you were in the physical motion of doing it. So that was it, and then after that it was really, really, really mild. I mean I think almost no pain, I'd say, probably by a week. Maybe if people made me laugh really hard it started to hurt a little bit. That was not good. But that's about it.

And you had that PCA pump for pain control to where you push the button to help out with pain control? Is that what you used?

I did. They had -- there was a little pain pump for the first two days, I think. And then they gave you medicine through the IV after that.

Right. So the pain was fairly well controlled?

Oh, very well controlled.

And, Dr. Rust, is there an age limit for recipient patients?

That varies from program to program. Every program sets its own limit. Ours has been roughly 73 or 74 years old for recipients. We base that on data showing that the benefit of staying on dialysis versus getting a kidney transplant in terms of life expectancy may be similar around that point, and so when people get to 73, we will -- if they are still interested in a transplant, we explain what our position is. A few programs in the country will transplant older recipients.

We did have a historian out there in our audience today who asked, "When was the first kidney transplant surgery performed and how successful was it?" There was one, what we would consider a real transplant, the first successful transplant was performed almost 54 years ago now at the Peter Bent Brigham Hospital in Boston. Dr. Joseph Murray was awarded the Nobel Prize for that pioneering work. And we've had a lot of talk about the safety for the living donors. The donor for that operation turned 80 last year, which is really quite an accomplishment.

On the 50th anniversary of that transplant the National Transplant meetings they had a celebration of the event and that donor it was there to accept the accolades of the office. It was really, really quite moving. Over 50 years now of being a donor, he's still alive and well.

Here is a couple of the questions that I'll answer. "Does the living donor experience weight loss?" Just from being in the hospital and not eating for a couple of days, maybe some weight loss from that. The kidney doesn't weigh enough to really perceive that on the scales.

And another question. "Why do you cut off the extra tissue on the kidney, and is the adrenal gland removed with the kidney or is it left behind?" We do leave the adrenal gland behind. There's no reason to remove that with the donated kidney. And we take off the extra tissue around the kidney just to make it easier for the exposure of the artery and the vein for Dr. Colonna. And it's just fatty tissue basically that surrounds the kidneys, so there's no reason to remove that with the kidney.

Dr. Rust, why do you choose a younger donor for a recipient rather than an older donor, say, choosing between a parent over a sibling, or how would you choose one donor over another?

There are several factors go into that. If somebody's fortunate enough to have more than one person who is willing to donate them a kidney, first we will do compatibility testing, see who is the best match in terms of their antigens and who has a negative cross match and can be a donor for sure. If there is a large age difference, we would usually go with a younger donor simply because they're less likely to have any problems around the time of the surgery. But there have been instances where it's been a close call.

We meet in a committee once a week to discuss these issues, and a healthy donor who is, say, 50 versus another donor who might be 30, there might not be much besides the matching that would make the difference for us. Very young donors such as -- we would never take anyone who is less than 18. But say a person who is in their early 20s, we may be concerned that -- down -- we don't know what health problems that person might develop down the road, and so we actually might be a little less eager to take one of their kidneys versus somebody who maybe had reached, say, age 30 or so. But it's a complex decision.

We have another question. We're getting close to our time. "Are doctors using manmade kidneys for transplant?" That has not been accomplished yet. Certainly, we've all heard about artificial heart and ventricular assist device that have been successful. But for the complicated function of the kidney, its filtering and all those kinds of things, really wouldn't be able to create that artificially, even dialysis, which is basically that, which is done three times a week typically. Still, those people don't have anywhere near normal kidney function. Really nothing matches a real kidney. Creatinine, which is a level that reflects kidney function would run in the six to ten range in a person on dialysis depending on whether they had

just been dialyzed or were coming to dialysis. But after a kidney transplant, it's really less than two, frequently one, which is normal.

Dr. Rust, is it possible that the closer the match of the donor to the recipient that the recipient could have fewer drugs to take to keep from rejecting the kidney. That's a good question. The answer to that is -- the short answer to that is, yes. The closer the match does not make much of a difference in the first year. The rejection rate in the first year after kidney transplant is pretty low no matter what the match is. The close match really pays off over the next several years when, yes, lower doses of medications can be used. In what we call a zero antigen mismatch, which is a perfect match kidney, the medications can be really minimal. And that has real long-term benefits for the recipient. And those kidneys do have a lower -- they do have a longer survival. So the better matching is important for the long term.

And a question for Sarah, our recipient. Sarah, could you contrast how your life has been impacted comparing before you had the transplant to after the transplant" because you were on dialysis, I think you said, for a period of time, so how has this improved your quality of life?

Well I was on dialysis for about four-and-a-half months, and you know, I just had to go for about -- I think I ran three-and-a-half hours, three times a week on the machine. They cleaned my blood, and like I said before, it was so exhausting for me, and I know everyone's experience is different. But I would just go home and sleep or lay on the couch because I was so tired. I was tired all the time. I had a hard time exercising, a hard time even just going out or having people over. So since then, I have all that time back, and, you know, I take medication. That's really it right now. That's the only difference between I think me and a normal person that I experience and I feel so much better. Without all the toxins in my body I just have a lot more energy and I'm enjoying life now.

It's hard for us who haven't dealt with that to imagine how, I guess, limiting that would be to have to be tied to a machine that many hours a day and that many days a week, so I'm glad you're doing much better?

We just have received a couple of very wonderful e-mails in from some of our former patients. I do want to thank you for your kind words for us. It's really our privilege to work with you all. It's really one of the really neat things about transplant is really just patients wants -- the people you get to work with who are so grateful for what we're really allowed to do for them.

I think we're about ready to wrap it up. I do want to thank our audience. We really had a tremendous response in terms of our e-mail questions I really didn't know what to expect on this, and they have just been one another. They're very thoughtful questions. I hope we have answered many of your concerns.

We certainly want to thank Anna and Sarah for their time, and we want to thank all of the members of the team. We have a great team here at Norfolk General, particularly Amy who works so hard with the living donors, but really everyone. We have a wonderful team in the operating room, the histocompatibility lab, in the intensive care unit, on the floor. Really it's very obvious to me why this hospital was named one of the top 50 hospitals in the United States for taking care of patients with kidneys, not only for transplants but our dialysis patients and others. So thank you very much once again. It has really been a pleasure to appear today. And, again, thank you very much to Anna and Sarah for their participation.

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