[MUSIC PLAYING]

ARMANDO GANOZA: We're going to review most of the common indication for kidney transplant, the difference between management, between adults and kids, and try to summarize the perioperative management of infant renal transplant recipient, which are tiny kids less than 20 kilos. The indication for a transplant is the same as in adults end stage renal disease. And it has changed significantly over the past 30 years or 40 years.

We don't wait anymore for transplant. Probably the only limitation that we have is vascular access, psychosocial aspects. But technically, we don't have a real cutoff for age. We try to say more than 8 or 10 kilos, or 16 or 20 pounds because of the size of the donor. But things have changed over the past three decades. I will say 30%, or roughly 30% or 40% of all the pediatric transplant that we perform are done in kids less than five years old. Improvement in surgical technique, perioperative care, immunosuppressive regimen-- again, the indication end stage renal disease, we still follow a GFR as a primary indication.

The end stage renal disease in children is not that common. 14 cases per million children in the US, that's what we deal with. Overall, children's hospital since the early '90s where the programs started performing transplant initially in livers and intestine and then kidneys, we have done almost close to 600 kidneys at Children's

You can see there are more livers and intestine performed or liver kidneys performed in kidneys alone because of the-- it's not a frequent pathology. But there are certain differences that we have to know and address when we deal with kids, immunologic factors. The cause of kidney failure is different. They're more related to urological issues. And again, if you are dealing with a young man that is under 30s and you have a previous kidney transplant because of a bad bladder, that is not going to be fixed. So that's something that we have to understand.

Donor allocation policies are different. The kids have priority on the list. And the immunization, the immunizations here are really important. We wait for the patients that are evaluated for the immunizations to be completed. Like vaccines are not done, but the other ones, we have to wait. There's a huge media propaganda about immunization. So you guys understand how difficult it for us to try to get those patients vaccinated nowadays.

As Dr. [INAUDIBLE] was mentioned in the primary viral infection after transplantation, he said it's really important. It's a really important problem in adults. But is more important in pediatrics. More than 80% of our kids are EBV negative, EBV naive. And a high percentage of pediatric patients are CMV negative. So if the donor come from adults, which more than 90% are positive, it will be high risk CMV or EBV infection.

Something that we measure-- and it's something that we don't do in adults, is the height growth and the neurocognitive development of the pediatric patient. Even though the patient is not yet on dialysis-- it seems be doing OK-- if the linear height growth is stuck and is flat, or is not doing well at school, that's a real indication for transplant. And that makes a big difference, because we're talking about a kid that probably is not even with a EFR, maybe a EFR around 20, but it's not growing, or even if it's doing really well in dialysis, why do you want to transplant it? Because it's not growing and not developing.

So if I have a kid that probably was meant to be an A plus in school, but if you keep him on dialysis for five years, or for three, or for two, whatever, and he's going to be a B plus-- B plus is fine. I was a b minus, I think. But I'm a surgeon, so that's OK. But if a kid deserved to be A plus that's why we tried to push for the transplant earlier.

And then something really important is the transition to the adult care. We're trying to develop this transition program It started with the liver program. The kidney program is also trying to put things together. The transition to the adult care, it's super different. And again, as I said, a kid that is 21, 25, is still a kid. And if they lost the first organ for noncompliance or nonadherence, why we're going to give them a new transplant if they're a kid still, right? So that's really important.

Then going by points, the immunological factors, the immune system in the pediatric population is basically naive. T cells, B cells, the dendritic cells, everything that we talk about, they are all immature, that's why the infants, when we transplant infants, they do better and the kidney lasts longer. You will ask why this living donor that we did in an adult lasted just five, six years, and this pediatric patient had the kidney for 20 years? It's because the immune system was different when we did the transplant.

But most importantly, the primary decease that led this patient to kidney failure is what we're going to review here. We don't have-- we don't deal with hypertension and diabetes as cause of primary kidney failure. But in tiny babies, most of them, I'll say 30% to 40% have kidney failure related to congenital problems, renal dysplasia, obstructive issues, reflect nephropathy. That is more common in young kids. However, in teenagers, and in 10 years and older kids, the common nephritis, the FFGS, glomerulonephritis, they are more common in this population.

Even though 40% of all the pediatric transplant performed in the US are from unknown reasons, the congenital problems are still close to 40%. And that, as I said, that changes with age. Kids that are less than six-year-old, the congenital anomalies are more frequent than in teenagers.

The donor source, basically the same as in the adult. We have living donors, and we have deceased donors. The main difference here to me is the fact that we barely use DCDs. DCDs are mainly used in older kids for two reasons. In infants and young kids that are not on dialysis, the risk of having DGF just because of low perfusion of the organ is really high.

So on DCD's organs that already have a lot of issues with warm ischemia and warm ischemia at the time of recovery and cold ischemia at the time of the transplant, we try to avoid those kind of donors in young kids. I think since I came here, 2011, I have seen our children's just two DCDs, and both of them teenagers. The youngest patient I've seen was a 13-year-old. And because we did a DCD at press [INAUDIBLE] it was just like a living donor.

The allocation system is different. The kids have priority on the list. They get offer from donors that are less than 35 years old. And that was changed. [INAUDIBLE] share 35 allocation system. So it is a good thing or a bad thing. We can now [INAUDIBLE] if you're a family member, it said, yeah, it's a good thing. If you're a patient-- an older patient on the wait list, you will say no. You're taking an organ that could have come to me. So we can discuss about that also.

One thing to have happen-- and the trend is evident on the SRTR data is that the family that's bringing the kid that is on n stage renal disease, or being evaluated for a kidney transplant, they know already about this. And they know that the wait time for a kid is no more than six months. So why you want to do a living donor? Why [INAUDIBLE] my kid is probably going to have a kidney in three months, three or six months?

So the SRTR data-- and I'll show you some numbers-- it's unfortunately, the living donor have decreased significantly. Just to give you an example, around 2000, 2004, 50% of all the pediatric kidney transplant were from living donor. Nowadays, not even 30%. Yeah. I'd try to-- it's hard to-- unless they're super young, that we recommend not to do a cadaveric donor, and we strongly recommend a living donor, the patient that I have, all their kids, they don't feel strong about living donation, which is something that we are trying to change in our evaluation. Sorry.

Again, now you can see on the-- you can see these are related. Family members, they don't want to-- living donors, they don't want to donate anymore. And this is by age, which has become a little bit stable, even though it's decreased also. It's living donation and pediatric patients of less than six years old. I mean a living donor that we have altruistics, they always want to donate to a cute baby, right? You don't want to donate to a teenager. That's unfortunate, but that's what we are dealing with.

The workup is pretty much the same, a medical evaluation, laboratory studies, cardiopulmonary cardiovascular evaluation-- 20% to 30% of a patient to have congenital urological mental issues. They will have cardiac or vascular problems. My rotations, I say this inverses-- so that's part of our evaluation also. But the most important thing is our screening for viruses. And we have to be prepared for this. EBV, CMV, and all the viruses that [INAUDIBLE] already talk about.

Again, really important immunization how we-- we have patients on the list waiting as in the status 7 just waiting for the immunization, which is what we have to do. The social and psychosocial evaluation are really important for us. We have-- one of our psychologists, she got a grant in trying to prevent known adherence in our kids.

And she has found, established a really nice evaluation process, a questionnaire where she intervene really early in patients that are high risk. And we have decreased more than 20% the amount of known adherence. However, we're seeing known adherence known adherence on the patient that we didn't think were high risk. So what we have to do is just-- it's easy right-- just keep a close eye on everybody.

They're nice while they are five, or six, or 10. But who listens when you're 13, 13 or 14, right? So you just stop taking the medication. [INAUDIBLE] considerations before transplant, as I said, urologic. 40% of our kids, vascular-- 20% of the patient that have urologic issues, and the size match also is important. How are going to be our approach, intra-abdominal or extraperitoneal as we do in adults.

And it's really important. If we go in the abdomen with a midline incision, we will have to mobilize the entire intestine medially to access the grade vessels, meaning aorta and vena cava. And that will prolonged the hospital stay for 10 days. You have a kid with an NG2, probably not going to be eating. We remove the appendix at the time. We haven't seen any complication related to that, but that's part of our protocol. So those are things that we have to consider on a pediatric kidney transplant.

So in terms of a urological evaluation, we work closely with our urologist, and we recommend that even though if the patient needs the transplant, we have to fix the urological issues before. Either the patient needs a urinary diversion, meaning a conduit, a piece of intestine that will drain all the urine from the bladder, drainage procedure-- if a patient needs a cystosomy, rather do it before transplant.

No, but he's not having issues. Yeah, he's not having issues. He probably is not-- he's not making 200 CC's of urine every hour he's going to make after a transplant. So that's really important. An augmented bladder, they put a piece of intestine on top of the bladder and extend the volume capacity of the bladder. That has to be done before the transplant. We cannot do it at the time of transplant.

The immunosuppression, the amount of urine that we'll produce will prevent that. So I think it's really important to get it done before. Vascular-- if we have a patient that is not on dialysis, even if they're not on dialysis, we do an extensive vascular evaluation starting with Dopplers, ultrasounds, and if there is any question, if you have any lines in the past we do a CT angio if it's possible, or an MRI if it is possible.

We have surprised patients who were scheduled for surgery, evaluated a year before, or whatever. And then you do a duplex at the time of emission, and then you see that there are no flow on the legs. And you get a CT scan. And you see the entire-- this is cava. The entire cava is occluded. But you have the right renal vein and left renal vein, left renal vein and the entire cava occluded.

So we change our approach. We made a midline, look for the kidney, mobilize everything, and use the renal vein as an approach. This, I didn't have the picture. But this renal vein was draining to a huge lumbar that drained to the [INAUDIBLE]. So we were able to manage that. But that's something that we need to know beforehand.

This is how previous multi visceral transplant patient have a liver intestine transplant. I was able to participate on him, so I knew him. He had no iliac vein. He was a 14-year-old kid. So we had to do an intra-abdominal approach. If you see, this is not the native cava. This is the SMV coming to the intestine from the entire grafts. And we mobilized liver, intestines, everything medial. And we found, finally, the cava. And we were able to put it here, like an eight hours operation.

Something that we don't do in adults-- but in kids, we have to ask before going to the OR. I always ask our colleague from nephrology. You do want the kidney's out or not? You have to decide. Because once we're there, we're out, it's going to be really hard. Chronic renal infections, urolithiasis, heavy proteinuria, kids who have severe FSGS, we don't do that in adults. When they're on dialysis, anuric.

But kids, we go preemptively. They lose a lot of proteins. And then the last case that we did three weeks ago, early recurring FSGS and possibly three, we did a nephronectomy at the time of the transplant. And he was loosing proteins severely. So he's doing better now, but so it's something that we have to know. You don't want to be questioning yourself and possibly three or four. Is this protein coming from the native kidneys or from the new one?

If they have bad hypertension, polycystic kidney disease, it's always good to take them out. You will get some room to place the kidney. Infected reflux for bad bladder or ureters, or infected hydronephrosis. That's the time to-- is the time to fix that issue because you don't want to have the native kidneys remain in place. And with the amount of urine that they're going to make after a transplant, all the urine will reflex on the native kidneys. And you will come with recurring UTIs.

Again, this is more so-- this is a summary of what we do when we list this patient. After we evaluate them, OK, we list them. But as you can see, this doesn't happen in the adult ward. Almost 40% of the kids that we list are inactive for vaccines, urological issues. So that's the main difference. 47%, 50% of the patients that are synactive status are because of the [INAUDIBLE] was incomplete.

That's in general for the pediatric population. But lately, it's been really hard. Most of the centers that do adults, they can do teenagers more than 14 or 12-year-old kids. And they do. So most of the referrals that we're getting, 30% to 40% now, and it's changing in time, are small kids, that they're not transplanting in older centers, they don't deal with pediatrics.

The last kid that we transplanted, he was small. He was on dialysis because the other center was waiting for the kid to gain weight. And he's never going to gain weight if he's on dialysis. So the procedure, as I said, is completely different. If the kid is less than 20 kilos, we avoid going into retroperitoneal space. We do an intra-abdominal approach, meaning a midline incision, and mobilize the entire intestine, and connect the new kidney to the main vessels, aorta and cava.

And the kids are more than 20 or 30 kilos, 40 or 60 pounds, we tried to do the retroperotoneal approach if the kidneys, designated kidneys don't need to be removed. This is how you connect the kidneys. This is the intra-abdominal approach. You mobilize the colon, you take out the appendix, and then put the colon on top of it. We take out the appendix because you can see here in this graphic, the appendix will sit on top of the kidney. And if you ever in life, you have a right lower quadrant abdominal pain, you don't want to deal with this appendix stuck to the kidney, or injure the ureter or whatever.

In this case, it's like the regular approach that we know. This is how it looks. It looks like an alien, but it's actually an aorta and a cava, which on a baby is no more than a-- in a 20 kilos is no more than 1, 1.5 centimeter diameter. And our picture, it's not clear this one. But this is the kidney occupying the entire right abdomen. And this is the colon all retracted all the way medially.

And there's a picture of the kid that I mentioned without any cava. Everything is mobilized. It looks red, but probably it was not that bloody. It's just a bad image. But this is the stump of a cava. This is the edge of the liver. And this is our new anastomosis.

Anyways, renal transplantation in infants, as I said, is really uncommon. In kids that are less than two-year-old it's less than 5% of pediatric recipients. However, we in our center, we do at least 30% to 40% of those. As I mentioned before, the congenital urinary tract anomalies are more frequent. We can have congenital nephrotic syndrome.

And interestingly, we just signed an agreement with a center in Lancaster that have this metabolic kits that are Lancaster from the Amish and Mennonite population. We're going to start working with them, to try to get them to transplant earlier because they were referring to center that are not doing small kids.

Neonatal cortical necrosis, due to thrombosis, and cerebral palsy, we have a couple of those. Polycystic kidney disease-- most of the kids, if the kids are end stage renal disease, and in need of dialysis, we strongly recommend peritoneal dialysis instead of hemodialysis. Hemodialysis, in small kids, they don't tolerate hemodialysis very well. The blood pressure-- the blood pressure fluctuation in hemodialysis is really erratic, and it doesn't help the kid.

Peritoneal dialysis, they tolerate it really well. They help us with abdominal wall distinctions. So when we put the new kidney, we have more room. The belly is really, really compliant for that. So we strongly recommend if we need dialysis, to do peritoneal dialysis, of course, if it's feasible. The issue that I have seen with peritoneal dialysis, I would say roughly 50% of the kids that are in peritoneal dialysis, they don't tolerate well the diet. So they have to get a g tube at the time that they get that peritoneal dialysis because they have severe reflux with the belly fully distended with fluid.

And maintain the p.o. intake after the transplant is really challenging because a kidney will occupy half of the belly. So they won't eat, and you have to secure that. So instead of-- it's either we put a G tube at the time of the transplant, or they come before the transplant. We mentioned about the comorbidities, most of them vascular, if they have urologic issues.

In the nation, in the US, as I said 50%, 50% of the renal transplant in the low-- all the data that we have seen the early '90s, are from living donor. However, the trend is until two years ago is coming down, is less than 40%, 35% of living donors. Again, for the policies that you just mentioned, however, 74% of the renal transplant in pediatric, in the pediatric population was directed to infant kids.

Advantages of living donor you all know. The advantages, however, in kids is more important. Doing it preemptively, if we can avoid dialysis, it's a better immunological matching. Good donor age, the cold ischemic time is really short. And the risk of DGF is minimal.

So but the perioperative managing-- OK, if we do a good surgery, why it didn't work? We work directly with the anesthesiologist. It's really important. If you think about a kid that is less than 20 kilos, the volume of the adult kidney, it will be around 30% to 40% of this kid's volemia. So when you re-perfuse the kidney basically steal all that blood. And then you can have really, really bad blood pressures after that. So we work close with them. We said in the OR, we just tank them with fluids before we improve the central venous pressure, and the mean arterial pressure, and tried to release clamps really slow.

Things that we have seen in the past, if you do a really fast re-perfusion of a new kidney, again, is like leading 30% of your volemia at once. And you will go in severe shock. And then your kidney will go in shock, and we'll [INAUDIBLE] both the kidney. Luckily, I haven't seen ones recently.

So the use of anticoagulation, we anticoagulation at a time of the clamps and maybe the vessels. But we routinely don't use it in the postoperative period. However, if a patient have a coagulopity as a baseline, a coagulation disorder as a baseline, like, for example, in kids with nephrotic syndrome, that they are already anticoagulated, we use them. As you know, with nephrotic syndrome, one of the complications is being hypercoaguable, and they can develop clots really easy.

In terms of the immunosuppression, you ever get a kid transferred to you guys, it's not going to be major changes. We as a center over Childrens, we still use a [INAUDIBLE] since the early 2000s. And we haven't changed that. We just-- we have roughly 10% of our recipient that under [INAUDIBLE] thymo for induction, those are cases that we have done after liver or after a small bowel with good result. We haven't explored the need of changing to thymo on a regular basis.

No changes in the immunosuppression based on the PRA. It is a national-- so in terms of maintenance, if you want to receive a kid that is being transitioned to you guys or to any adult center, most of our kids are on tacrolimus. They are on MNF. And in the country, at one year post transplant, roughly 50% or 60% of the center still use a little bit of steroids with kids.

Most common postoperative issues, there are some things similar than the adult transplant is the late [INAUDIBLE] function is less common in small kids. Acute rejection is still present, but since the majority of our kids are from living donor, still, the majority of them, it is not that common. And that have improved significantly in recent era.

Complications, surgical complications, as I said, 40% of our kids have urological issues. So the most frequent complications are urethral stricture, urinary leaks. Thrombosis, dealing with the small vessels, the smaller the kid, the more frequent, it's more frequent. But and again, something that we are improving, urologic complications in the general pediatric population is just 3%. But if you look into the small kids, or into kids that have congenital neurologic issues, they can be up to 15%, 20% depending on the series on the center.

Vascular thrombosis, it's around 7% in the US. And you can go higher depending on the size and the age. There's some picture of the most common complication. There's a kid that, even though it's not that common, Dr. Harry might remember this kid. I asked him about him, how if he has seen urethral issues with severe BK virus. And he did have-- thank you for your help with this kid-- I've never seen it. And he had developed a severe urethral restricture secondary to BK.

We ended doing a urethroplasty first. And then we have to reoperate on him. Vascular issues are frequent in terms of thrombosis compared to adults. However, we are really careful. This is how a clamp, a clamp injury looks like, is when you are not careful, kids the arteries are really sensitive to that. So more-- I always tell the fellows what they told me not long time ago. Just one click is what you need. More than two or three clicks, that's what you're going to have in your artery. And your kidney is going to look like that, black.

Pseudoaneurysms are also present, are not that frequent as in adults, given the fact that the blood pressure is not that common in kids. Subcapsullar hematomas in cases that we have anticoagulator, lymphoceles or hydroceled. It can be a big issue on a pediatric [INAUDIBLE] that whole body CT scan of a kid that had a kidney transplant, we were able to extrapolate [INAUDIBLE]. However, lymphocele massively lymphocele mobilize the entire intestine, as you can see, an entire kidney medially compromising the profusion of the kidney.

I'm just-- I'm almost done, I promise. Malignancies are not that frequent, not even 3% in all the entire pediatric kidney population. However, 50% of the malignancies are related to PTLDHS because they are EBV naive. A nice paper published for one of our ID fellows at Children show that we have 10% of our kidney patients are EBV carriers, high load carriers. So from those, 1% to 2% have developed PTLD. So ti's really important that we keep track of those kids, so when they become adults it's going to be an issue in our center later.

And infections, more frequently in the first month is, as we know, urinary tract infections, if they have congenital urinary issues or problems, when infections are less common, pneumonias, if they have reflux due to the to the high volume of the kidney in half of the abdomen of the patient. And after six months, all the viruses that we have talked is not different.

Graft survival are really good, are are more than 90% in all of the series, cannot get better. Unfortunately, the older the pediatric patient that works as a survival of the graph, and that's something that we have to get better. You see, the kids are more than 12 years old, the graph survival is really poor. So that's something that we have to deal with. Compliance is an issue. Adherence is an issue.

We're seeing this. As you know, we send labs monthly, weekly, whatever. But they learn to take the medication before the lab. So you find labs look good, but nothing different. Anyway, this is-- all our series and all the organs that we do at Childrens-- liver, intestine, kidney and cardiopulmonary-- we follow all our kids until they transition to the adult side. We currently have more than 200 kids being followed by us with good results.

Yes, to finish, to summarize the ideal treatment for end stage renal diseases in the younger population is the kidney transplantation even though the CRT or the replacement therapies have improved significantly. The transplantation from living donor is strongly recommended. And it's what we do in pediatrics, we try to do in pediatrics. And it's mandatory, I think in infants and kids that are less than 20 kilos.

Noncompliance, as in any other population, or non-adherence is the main cause of rejection issue and deserve special attention. Again, our psychosocial evaluation is way-- extends, more extensive compared to what we probably do. And we're saying that we don't do it well in the adults. But it's different. We evaluate mom, dad, everything, everybody. And the long term outcomes are excellent. That's what I have. That's my old house. Just kidding. Thank you. Any questions?

[APPLAUSE]