Discussion of 2021-1757

IMPROVING OUTCOMES AFTER ALLOGRAFT NEPHRECTOMY THROUGH
USE OF PREOPERATIVE ANGIOGRAPHIC KIDNEY EMBOLIZATION

**DR CARL E HAISCH** (Greenville, NC): Transplant nephrectomy is considered on a regular basis in each transplant program in the country. Graft failure rates of 10% to 20% at 3 years and 60% at 10 years resulting in needing to remove the graft for hematuria or graft intolerance syndrome, which was well outlined in the paper. Historically, the complication rate for this procedure can be up to 82% for morbidity and a mortality rate, as was mentioned, up to 16%. The authors have reviewed their experience.

 Was consideration given to perform these two operations or these procedures on the same day as has been discussed in the literature? It must be noted that the authors' results were impressive with marked decrease in morbidity and mortality compared to what they show here but also compared to those cited in the literature.

 This paper also shows that they are now using the embolization technique much more commonly than they did in the past. You do have some patients more recently who have had only allograft nephrectomy alone, and there were 12% of those patients recently. Do have comments on why that is the case?

 Is there a time that you believe that all these patients will have dual procedure done and that this will be the standard of care? Have the authors developed a cost analysis, and with the two major procedures being done in the hospital, how does the hospital administration receive that?

 I would also like to know if they have any comments, as they pointed out in the paper, with the differences in the length of time prior to removal in the embolization group versus the allograft only group. It is five times longer.

 The authors, in their abstract, as well as in the paper, show a picture of a very large allograft, and I am sure this approach is very useful in this type of patient. They still report some vascular injuries in a small percent of patients needing a transplant nephrectomy. This did not totally remove vascular complications, and I want to know if they have any comments on that. Are the surgeons in the Radiology suite when the coils are placed, and do they talk about where the coils and embolization needs to be done?

**DR KENNETH L BRAYMAN** (Charlottesville, VA): The development of organ transplantation is one of modern medicine's greatest achievements. The first successful kidney transplant in the US was performed in 1954, and with the development and availability of newer, more effective immunosuppressive agents and the development of governmental and non‑governmental funding streams, an increased number of transplants has occurred. Since 1988, more than 800,000 transplants have been carried out in the US, and more than half of those have been renal transplants. The success of renal transplantation has never been higher. Unfortunately, there are some allografts that do fail, and when they do fail, it can occur early or late after transplantation. The late failures in particular are challenging for controlling allograft intolerant syndrome, but also trying to manage the complex surgery which may require to remove the allograft.

 So, the value of this paper that has been nicely presented is substantial. The technique for allograft nephrectomy was first described by Sutherland and colleagues in 1978 and then again in a larger series by Nancy Asher in 1984. The use of intracapsular dissection is effective for allograft mobilization, but essentially results in an uncontrolled mobilization of a vascularized allograft which is often difficult to control.

 The allograft nephrectomy procedure is often associated with high levels of acute blood loss. Due to the overall success of renal transplantation, the incidence of allograft nephrectomy has actually decreased, and the experience of younger transplant surgeons with this particular procedure is often less than their older colleagues.

 The paper by Dr Jay and Dr Stratta is a particularly important contribution, because it describes a technique that allows for control of essentially an uncontrolled operation, where you do not really have control of the vessels prior to mobilization of the allograft. Intraarterial embolization is an important alternative, especially for individuals that may not be as experienced with carrying out this procedure in an expedited manner.

 The authors wrote a great paper. I appreciate the opportunity to look at this ahead of time. The paper engendered a few questions, and I would like to describe them now.

 Can the authors comment on the large standard deviation seen for blood loss in both groups? To me, this implies that the estimated blood loss has a significant degree of variability between patients. I was curious if an analysis had been done that would allow them to look at the individuals who experienced very high levels of blood loss, both in the allograft nephrectomy in the PAKE group. Does this imply some specific characteristics in those patients, such as platelet abnormality or other types of predisposing factors?

 As you know, there are many pharmacologic approaches to try to control allograft intolerant syndrome including the use of high dose steroids. In patients who receive high dose steroids, the amount of edema is often decreased, allowing for a more effective allograft nephrectomy with considerably less blood loss.

 So, in the group that had both the PAKE and the allograft nephrectomy procedure, what was the percentage of individuals who received pre‑nephrectomy high dose steroids in an effort to quell inflammation and edema?

 Finally, and similar to Dr. Haisch's question, what are the cost considerations for using preoperative angiographic embolization, and is this additional cost burden outweighed by the decreased length of stay, shorter OR times, and so forth?

**DR DANIEL DENT** (San Antonio, TX): The transfusion requirements data looks to simply reflect a change in transfusion practice over time and likely does not reflect an actual difference in blood loss. Early in the series, the nephrectomy patients were transfused to a hemoglobin of 10. Later in the series, the PAKE patients were transfused to the hemoglobin of 9. The difference in transfusions between the groups is about 1 unit per patient. So, does the blood loss data or the transfusion data reflect anything more than a change in transfusion practices over time?

**DR OMAIDA VELAZQUEZ** (Miami, FL): Thank you for this great contribution. I am not from the transplant field, but from the vascular perspective I have just one simple question. When we embolize other end organs, such as the spleen, sometimes they involute obviating the need for removing the organ. Have the authors entertained the idea of just doing the PAKE and not doing the post embolization nephrectomy, and is that a feasible approach?

**DR DEBRA SUDAN** (Durham, NC): First, when we have necrotic tissue in an immunosuppressed patient, there is a high risk for infection, and there is no mention of infection rates between the two different approaches, and I would like that to be addressed. Also, there is one patient death in the PAKE group. I was wondering what the cause of death for that patient was.

 And, finally, was there a difference in the amount of blood loss from the PAKE group depending on what type of embolization was performed, whether it was the gel foam or whether it was coils? In our previous publications of coiling for intestine transplant antrectomies, we found that the gel foam was less efficient at decreasing the blood flow to the graft. And so I wondered if that was the same with the kidney.

**DR GAZI B ZIBARI** (Shreveport, LA): I would like to congratulate the authors for their important paper and for their excellent presentation. If I may, I would like to ask a couple of questions. First, do you think shorter hospitalization is purely related to embolization technique, and or it may be in part related to the new accelerated surgery discharge protocols? As you know, we used to keep the patient in the hospital much longer than necessary, but nowadays we discharge them much faster. Second question, can you tell us about the type of vascular injuries in both groups and how did you manage these vascular complications?

**DR VIKAS DUDEJA** (Birmingham, AL): I am not a transplant surgeon, so pardon my naivety, but the difference in the length of stay is very striking. I would love to know the cause of increased length of stay in these patients without the embolization and what leads to the reduction.

**DR ROBERT J STRATTA** (Winston‑Salem, NC): I thank everyone for their insightful comments and questions. I would like to acknowledge Drs Jesse and Wayne Meredith, both of whom are longstanding members of the Southern Surgical Association. Dr Jesse initiated the transplant program at Wake Forest in December of 1970 and was a mentor and inspiration to all of us. The transplant program celebrated its 50‑year anniversary this past December and we mourned the passing of Jesse at the age of 98 this past April.

 I would also like to pay tribute to his son, Wayne, who recruited me to Wake Forest. He is a Former President of the Southern Surgical Association and Immediate Past President of the American College of Surgeons. More importantly, Wayne is a close friend, colleague, mentor and leader for many of us. Wayne continues to personify perseverance and resilience in his ongoing struggle with a number of health issues. This meeting just does not feel the same without the presence of Gail and Wayne amongst us.

 Pursuant to Dr Haisch, although the two procedures can be performed on the same day, it presents logistical and scheduling challenges with both interventional radiology and the operating room. Moreover, the typical scenario is that the patient has graft failure and has resumed dialysis, so admitting the patient the day before scheduled surgery for embolization allows us to dialyze the patient after embolization and prior to nephrectomy. This permits us to avoid dialysis in the first 24 to 48 hours after nephrectomy, which may further reduce the risk of bleeding or hypotension postoperatively. Moreover, we do believe that performing the procedure sequentially on different days does permit more time for the venous outflow and possible collateral circulation to more effectively thrombose, although we cannot prove this point.

 The dual procedure has essentially become our standard of care since 2010, but indications for not performing preoperative embolization include allograft nephrectomy early following transplant in which case a more anatomic extracapsular dissection can be performed with complete extirpation of the kidney; or the presence of preexisting auto thrombosis, which would render the embolization procedure unwarranted.

 Pursuant to cost, the additional total cost associated with embolization are in the range of $2,000 to $4,000 depending on whether anesthesiology is required for the IR procedure. However, given that complications, transfusions, operating time and length of hospital stay are significantly decreased with the dual procedure, the total cost for the hospitalization is comparable for the two approaches. Consequently, there have not been any concerns raised by hospital administration with the addition of the preoperative embolization.

 The differences in time interval between transplant and allograft nephrectomy in the two groups represents selection bias because more cases of allograft thrombosis leading to nephrectomy occurred early as compared to late after transplantation.

 Vascular injuries are mitigated but not eliminated with embolization because the kidney can largely be excised with minimal blood loss so that the pertinent underlying vascular anatomy can then be better visualized with or without application of a large hilar vascular clamp. However, vascular injuries can still occur in a number of ways, including traction injury or too much tension on the vascular pedicle while mobilizing the kidney through a subcapsular technique that could lead to an avulsion injury, of either the renal vessels or underlying iliac vessels. There also can be a direct iliac vascular injury while dissecting out the ureter down to the bladder or accidental direct injury to the iliac vessels while achieving hemostasis in the remaining capsular bed of the kidney.

 Regarding placement of coils, the embolization procedure is performed by IR in the absence of any direct in‑person surgeon input or interference, although we frequently discuss the cases ahead of time. When excising the kidney, we still prefer to place a hilar vascular clamp whenever possible, mainly to control venous bleeding, as venous thrombosis is not always present.

 The clamp may or may not be below the coils or even at the level of the coils. I have always been taught to excise the kidney very high and proximal in the hilum initially, even to the point of leaving behind some residual renal parenchyma in order to remove the bulk of the kidney so that we can actually visualize the pertinent vascular anatomy. The dual approach is not perfect, and complications may still occur, but performing a nephrectomy in a relatively bloodless field provides a greater sense of security and reduces the stress level not only for the patient but also for the surgeon. In the absence of PAKE, this can be a challenging procedure in which proximal and distal vascular control is usually not achieved until after the kidney has been removed.

 Pursuant to Dr Brayman, we agree that blood loss can be highly variable. Although we did not specifically review this factor by individual surgeon, we did perform a sensitivity analysis in patients undergoing allograft nephrectomy for graft intolerance syndrome.

 When we excluded the two cases of active hemorrhage, the variation of estimated blood loss was reduced but transfusion requirements, operating time, complications and length of stay all remain significantly decreased in embolization group. We did not perform a specific analysis of risk factors for excessive blood loss although I suspect that patients with large swollen kidneys, uremia, or difficult anatomy (narrow deep pelvis) may pose additional risks. In response to the management of graft intolerance syndrome, first line therapy at our center is bolus IV steroids with resumption of some immunosuppression. Many of these patients respond to medical management alone and avoid the need for nephrectomy. Patients in this study who ultimately required nephrectomy were failures of medical management. We believe that steroids are an important part of the management algorithm, but may not be sufficient for all patients.

 However, since virtually all patients received preoperative steroids, we cannot discern whether this treatment influenced overall outcomes.

 With respect to Dr Dent, I agree that there is a time bias in this study and that transfusion thresholds have changed over time, although in doing these cases, the indication for transfusion usually is not waiting for a hemoglobin level to be checked. It is because there is massive acute bleeding in front of you in the absence of vascular control and the patient becomes hemodynamically unstable.

 With regard to Dr Velazquez' comment about embolization alone, there are some small series in the literature looking at embolization alone. This seems to work best with very small atrophic chronically rejected kidneys. We have performed two cases of embolization alone. One was successful and in the other case, we eventually had to take out the kidney because of persistent pain. The indication for embolization alone would be in a patient who has multiple co‑morbidities in which you do not want to subject them to general anesthesia or a major vascular procedure with potential blood loss.

 With respect to Dr Sudan, one of the major differences in complication rates was a higher incidence of wound infections in the nephrectomy group vs embolization group; this data is included in the paper. The cause of death in the PAKE group was cardiovascular. We really did not look at differences according to technique, whether IR used coils or gel foam. I really do not believe that this made a significant difference in terms of the success of having an adequate infarction of the kidney although coils are preferred.

With respect to Dr Zibari, similar to the time bias with transfusions, clearly there is a time bias with length of hospital stay as we get people out of the hospital a lot quicker now than we did in the past. But part of the reason for the longer length of stay with the nephrectomy alone group was because they were experiencing more complications, some of which were operative complications.

The vascular injuries I recall include a repair with a bovine patch on the iliac artery and another was a direct suture repair of the iliac artery for a localized area of injury.