<TITLE>**What's Hot, What's New in Clinical Organ Transplantation: Report From the American Transplant Congress 2015**

ATC 2015: What's Hot, What's New

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Abstract

Innovative and exciting advances in the clinical sciences in organ transplantation were presented at the American Transplant Congress 2015. The full spectrum of transplantation was covered, with important developments in many topics. Key areas covered by presentations included living donor outcomes, optimal utilization and allocation of deceased donors, new immunosuppression regimens, antibody-mediated rejection and tolerance induction. This review highlights some of the most interesting and noteworthy clinical presentations from the meeting.

Abbreviations: AKI, acute kidney injury; AMR, antibody-mediated rejection; BOS, bronchiolitis obliterans syndrome; DCD, donation after cardiac death; DRI, Donor Risk Index; DSA, donor-specific antibody; HCV, hepatitis C virus; KDPI, Kidney Donor Profile Index; LKDPI, living donor Kidney Donor Profile Index; MELD, Model for End-Stage Liver Disease; miRNA, microRNA; OPO, organ procurement organization; TNF, tumor necrosis factor; Tregs, regulatory T cells; UNOS, United Network for Organ Sharing; VCA, vascularized composite allograft

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The American Transplant Congress, one of the premiere meetings in solid organ transplantation, was held May 2–6, 2015, in Philadelphia, Pennsylvania. Attended by >3800 delegates from throughout the world, it featured >2000 presentations in the form of oral abstracts, posters, minisymposia, lectures and state-of-the-art lectures. This review highlights some of the most innovative and impactful abstract presentations in the clinical sciences. Topics covered include individual organ types and living and deceased donation. Within each topic, a variety of more general topics are represented that are relevant to all different organ types including areas such as allocation, immunosuppression, rejection, tolerance and complications.

Kidney Transplantation

The most prominent presentations in kidney transplantation were focused on rejection, immunosuppression and tolerance. Orandi et al (1) reported results from a 22-center cohort of incompatible live donor kidney recipients compared with waitlist controls or deceased donor recipients. In all categories of incompatibility-positive donor-specific antibody (DSA), positive flow crossmatch–incompatible transplant—even positive cytotoxic crossmatch–incompatible transplant—resulted in better survival, thus patients with DSA still benefit from incompatible living donor kidney transplant. Schinstock studied DSA in the first year in crossmatch-positive

recipients maintained on eculizimab. Anti–class I DSA usually decreases or disappears in the first year after transplant, with more variability in class II DSA responses. Persistent DSA was associated with transplant glomerulopathy at 1 year.

Tsuji et al (2) presented a retrospective review of protocol biopsies for patients with chronic antibody-mediated rejection (AMR), and those with class II DSA without AMR. Compared with DSA-negative controls, there was more microvascular inflammation in patients who were diagnosed with chronic AMR later (at 3 months) and in both chronic AMR and class II DSA–positive patients at 1, 3, and 5 years. These results suggest that patients exhibiting microvascular inflammation in the early posttransplant period may develop chronic AMR.

Venner et al (3) studied the effect of time after transplant on atrophy–fibrosis in 703 kidney transplant–indication biopsies. Atrophy was strongly correlated with fibrosis, and both were strongly correlated with time after transplant. Transcripts most strongly associated with fibrosis were immunoglobulins, CXCL6 and mast cell transcripts but not acute kidney injury (AKI)–associated or fibrillar collagen transcripts. Correction for time resulted in a massive reduction in association strength for the immunoglobulins and mast cell transcripts with atrophy–fibrosis; however, AKI-associated transcripts were more strongly associated with fibrosis. CXCL6 remained the top fibrosis-associated molecule. The authors concluded that CXCL6 is one of the most robust single molecules associated with fibrosis (independent of time), and its relationship to long-term wound repair processes deserves closer examination.

The Northwestern trial of tolerance induction using living donor stem and facilitating cells was updated by Leventhal et al (4). Overall, 12 of 19 patients with >18 months of follow-up achieved stable donor chimerism and have been successfully taken off immunosuppression. In addition, eight of nine subjects have achieved durable chimerism, and thus far three have been taken off immunosuppression. Return of CD4+ and CD8+ T central and effector memory cell populations was rapid and stable after 1 year. Nearly 97% of the clones in the TCR repertoire were unique after transplant. In the nonchimeric patients, the overlap in clones was larger with the recipient before transplant, whereas in chimeric patients, there was more overlap with the donors' pretransplant repertoire. Chimeric patients retained immunologic memory and generated normal response to new vaccination. BK viremia and cytomegalovirus activation were absent after cessation of immunosuppression. These findings suggest that immunological recovery is robust in these chimeric patients.

Leventhal et al (5) also presented 6-year follow-up data from their study of immunosuppression withdrawal in HLA-identical living donor transplant recipients receiving donor stem cells that was not designed to induce chimerism. Tolerant subjects were found to have higher numbers of circulating regulatory T cells (Tregs) and demonstrated signatures for tolerance by global gene expression profiling. The 357-gene signature for immunoquiescence could predict tolerance after drug withdrawal as early as 1 year postoperatively, prior to actual withdrawal of immunosuppression.

Using data from the Scientific Registry of Transplant Recipients and Medicare on 710 HIV-positive kidney transplant recipients, Kucirka et al (6) found that infection rates were similar between categories of induction immunosuppression, and recipients who received anti–thymocyte globulin actually had lower rates of many important infectious complications. Those who received induction had a lower risk of adverse events such as hospitalization, acute rejection, graft loss and death. These results suggest that induction therapy improves transplant outcomes and should be strongly considered for HIV-positive kidney transplant recipients.

Heo et al (7) using United Network for Organ Sharing (UNOS) data to look at long-term survival in hepatitis C virus (HCV)–positive kidney recipients and found that inferior patient survival and death censored graft survival in HCV recipients. Notably, HCV recipients were more likely to die from infection, malignancy or liver failure and to have graft failure from chronic rejection and recurrent disease. This demonstrates the need for improved patient management using the more effective agents available.

Using UNOS data, Jay et al (8) showed that preemptive deceased donor transplant in patients aged >60 years with kidneys having Kidney Donor Profile Index (KDPI) >85% was associated with higher patient survival compared with waiting for a KDPI 0%–85% kidney. Consideration should be given to using high-KDPI grafts in older patients to avoid or limit dialysis. Luo et al (9) showed a survival benefit with donation after cardiac death (DCD) expanded criteria donor kidneys compared with waiting for either a brain-dead donor or a DCD standard criteria donor. Stratified by KDPI, there was still benefit at 5 years for all KDPI >90% DCD kidneys, suggesting that they represent an underutilized resource.

The RADIANT study (10,11) linked Medicare and US Renal Data Systems data on >15 000 adult dialysis patients referred for kidney transplant from 308 Georgia dialysis facilities, with 1-year referral data from all three Georgia transplant centers. Only 28% of patients were referred, although referrals increased by year, and variation among facilities ranged from 0% to 75%. A higher patient:social worker ratio was associated with lower odds of 1-year referral, whereas treatment in a for-profit dialysis unit was actually associated with increased referral likelihood. Older age, female sex, heart disease, cancer and smoking were associated with lower odds of 1-year referral, whereas black race, private insurance, and pre–end-stage renal disease nephrology care were associated with increased likelihood of referral.

Pancreas Transplantation

Optimizing immunosuppression was a major focus in pancreas transplantation. The International Pancreas Transplant Registry (12) analyzed five different induction immunosuppression regimens in nearly 4000 kidney–pancreas recipients, based on immunologic risk as defined by PRA, race, and age. In low-risk groups, type of induction did not affect outcomes; however, in high-risk patients, survival was better with Campath or a longer course of thymoglobulin compared with nondepleting agents or short-term thymoglobulin, suggesting that stratification of induction by risk may permit improved survival outcomes.

Fridell et al (13) described outcomes of >500 pancreas transplants using antibody induction and early steroid withdrawal at a single center. Due to a high incidence of chronic immunologic pancreas graft loss, rituximab was added midway for this cohort. Pancreas survival and frequency of rejections and infections were similar with and without rituximab. The authors concluded that use of rituximab is safe, but longer follow-up will determine its impact on DSA and chronic rejection.

A cohort of 90 patients who received islet autotransplantation after total pancreatectomy using a regimen targeting both tumor necrosis factor α (TNF-α) and IL-1β was reported by Takita et al (14). The dual regimen resulted in significantly better hemoglobin A1c levels compared with those receiving no treatment, higher basal c-peptide levels compared with TNF-α blockade alone, and dramatic effects on the islet injury marker miR-375, demonstrating that control of inflammation enhances outcomes by minimizing peritransplant islet damage.

Liver Transplantation

The most prominent presentation on liver transplantation focused on allocation, tolerance and liver–kidney transplantation. Edwards et al (15) compared liver transplantation in the year following Share 35 implementation with the year prior. As designed, the percentage of recipients with Model for End-Stage Liver Disease (MELD) ≥35 increased by 7.5%, and regional sharing increased from 20% to 32%. Median cold ischemic time and discards were unchanged. Ninety-day transplant rates for those >35 were significantly higher, and wait list mortality was lower. Six-month posttransplant survival was similar. Washburn et al (16) reported data showing that under Share 35, there were more offers to candidates with MELD ≥35, with a decrease in acceptance rates. Mean Donor Risk Index (DRI) was unchanged for this group, and acceptance rates and DRIs of accepted livers were mostly unchanged in other candidates. This suggests that that the policy appears to be working as intended and as predicted.

Ekser et al (17) presented their experience with delayed deceased donor kidney transplant of up to 77 hours following liver transplant. Patient and graft survival were better after 3 years for the delayed kidney transplant cohort. Interestingly, recipients of kidneys that were delayed >48 hours on a pump had better GFR, patient survival and kidney graft survival than those delayed <48 hours. The demonstration that kidney transplant can be delayed until recipient stability or survival is established is attractive and could lead to better outcomes and more effective kidney utilization in this patient population. In another interesting study, Wadei et al (18) reported on 127 liver transplant recipients with suspicion of chronic kidney disease who underwent biopsy and found that systolic blood pressure transplant evaluation was higher in patients with renal pathology. Although differentiation of acute tubular necrosis and chronic kidney disease may be difficult, this simple method may assist in the assessment of renal recovery in centers that do not perform pretransplant biopsies.

The iWITH prospective multicenter cohort study investigates immunosuppression withdrawal in stable, long-term, pediatric, liver transplant recipients. Feng et al (19) described the results of protocol biopsies in participants with normal liver function tests. They defined two pathologic clusters, one with predominantly interface activity and the other with fibrosis. Deceased donor transplant and class II DSA were associated with interface activity, and patient age at biopsy was associated with fibrosis. This study demonstrated that long-term pediatric liver transplant recipients with normal liver function tests can harbor fibrosis with or without inflammation.

Danger et al (20) reported on immunosuppression withdrawal in stable liver recipients, of which 40% were successfully declared tolerant. Using microRNAs (miRNAs) obtained from prewithdrawal biopsy specimens, they identified a nine-miRNA signature associated with tolerance. Several of these genes were involved in iron metabolism. The most informative miRNA, miR-193a-3p, targeted to the transferrin receptor, was significantly overexpressed in tolerant subjects and exhibited a high predictive value with an area under the curve of 0.76, thus the use of a sole miRNA could be useful in the prediction of immunosuppression withdrawal outcome. They also found that miR-193a-3p is highly expressed in enriched hepatocytes and hypothesized that overexpression in tolerant patients protects hepatocytes during immunosuppression withdrawal.

Deceased Donation

Much attention has been focused on donors at increased risk for disease transmission, and Kucirka et al (21) described the impact of the new US Public Health Service guidelines implemented in 2012. The percentage of donors labeled CDC high risk increased from 8% in 2009 to 12% in 2013. After the new guidelines were implemented, the percentage rose from 12% to 20% in 1 year, 45% higher than predicted by the existing trend. The increase was consistent across organ procurement organizations (OPOs), and OPOs that labeled >25% of their donors as increased risk increased from 5% to 14% under the new guidelines. Theodoropolous et al (22) conducted a retrospective multicenter cohort study to evaluate the posttransplant screening algorithms for liver and kidney recipients of increased risk donors at 3 large midwestern centers from 2008 to 2012. The use of serology without nucleic acid testing was documented in 16%–22% of screening episodes. Posttransplant screening was reported at 1 month in 44% of recipients, at 3 months in 30% and at 1 year in 8%. Adherence to posttransplant screening was poor, which highlights an opportunity to improve detection of possible transmission events.

Boffa et al (23) studied transplant outcomes related to brain death duration, which has increased over the past decade. Duration of brain death was associated with increased odds of delayed graft function but not kidney graft survival, which in fact was better. In addition, there was no difference in liver or pancreas outcomes, which should provide reassurance about organs from donors with prolonged brain death due to placement efforts or organ-specific donor resuscitation.

Living Donation

Optimizing the living donation process for both the donor and the recipient has been debated on many fronts recently. Massie and Segev (24) described the living donor KDPI (LKDPI). Elements include age >50 years, male sex, black race, no family relation, and HLA-B and -DR mismatch. In this model, the risk from a live donor kidney with a given LKDPI score equals that of a deceased donor kidney with the same KDPI score so that living and deceased donor organs can be compared. This model could be useful in counseling recipients with more than one viable living donor and has application in paired donation, particularly compatible paired donation.

Wiseman et al (25) reported that about one-quarter of living donors paid for medical expenses, with 6% of them paying more than $500. Overall, 75% of donors pay for nonmedical expenses, primarily related to travel costs. More than 30% reported a meaningful financial burden, and in roughly 10%, this burden could be considered severe. In addition, 40% dipped into savings, borrowed money from family, held a fundraiser or obtained a bank loan. This underscores the need for greater efforts to eliminate financial disincentives to donation.

A method for unbiased high-throughput screening of a large panel of renal disease genes to identify genetic variants in transplant candidates and their related donors was described by Thomas et al (26). In three transplant candidates, testing confirmed pathogenic mutations and excluded disease in at-risk children and sibling donor candidates. In one transplant candidate with a family history of end-stage renal disease, no mutation was identified, increasing the likelihood of sporadic nongenetic renal disease and informing risk in the related donor. This technology facilitates the evaluation of living donor candidates for presymptomatic inherited kidney diseases that may put them at risk from donor nephrectomy.

Heart and Lung Transplantation

Significant advances have been made in the immunology of heart transplant rejection. Wong et al (27) reviewed outcomes of 22 heart–liver transplants and found lower incidence and severity of acute heart rejection in heart–liver patients compared with heart transplant alone. There was a similar incidence of AMR, even though the combined recipients had a higher frequency of pretransplant DSA. In addition, cardiac allograft vasculopathy was less frequent and less severe in the heart–liver patients. This suggests that, similar to combined liver–kidney transplants, the liver may confer a degree of immunoprotection to the heart.

Patel et al (28) presented a cohort of 30 heart candidates who underwent desensitization with plasmapheresis and bortezomib. Desensitization was well tolerated and was effective at reducing class I and II HLA antibody levels in a majority of patients, including those with high levels of antibodies. The majority of patients were able to undergo transplant with excellent 1-year survival and low rejection rates. Desensitization may increase access and improve outcomes for the sensitized heart candidate.

As reported by Grskovic et al (29), cell-free DNA is higher in patients with rejection in heart recipients, and preliminary data indicate similar findings in kidney transplant recipients. Furthermore, cell-free DNA levels decline in conjunction with successful antirejection treatment and suggests that this biomarker may help reduce the need for follow-up biopsies after rejection treatment.

In lung transplantation, Xu et al (30) studied the expression of miRNA miR-144, which targets TGF-β–induced factor homeobox 1, in biopsies of lung transplant recipients with and without bronchiolitis obliterans syndrome (BOS). MiR-144 was highly expressed in BOS recipients in both tissue and lavage specimens. In vitro miR-144 transfection of lung fibroblasts resulted in increased SMAD expression, downregulation of TGIF1 and increased α-smooth muscle actin and fibronectin. In addition, knockdown of miR-144 diminished fibrogenesis. Consequently, miR-144 is an important regulator of the TGF-β signaling cascade and fibrogenesis and is a potential target for prevention and intervention in BOS.

Intestinal and Vascularized Composite Allograft Transplantation

Advances in the characterization and diagnosis of rejection were reported in both intestinal and vascularized composite allograft (VCA) transplantation. Kroemer et al (31) reported that, in 10 intestinal transplant recipients, increased graft expression of markers for cellular activation and costimulation, TH17 transcription factors and effector cytokines, and proinflammatory Th17-inducing cytokines were all noted during rejection. Flow cytometry confirmed a significant fraction of Th17 cells in the rejecting grafts. The authors concluded that the proinflammatory milieu of the intestinal graft induces Th17-mediated alloimmune responses via IL-6/TGF-β and IL-23/IL-1β pathways

An interesting report by Vrakas et al (32) described the use of an abdominal wall VCA in conjunction with the intestinal graft in 15 recipients compared with 15 historic controls. The rationale was that diagnosis of intestinal rejection is easy and timely with VCA and that, because intestinal dysfunction is nonspecific, the skin component adds specificity to the diagnosis. There were four rejections in the intestine-alone group and one in the intestine/VCA group. An additional five patients in the intestine-alone group were treated for rejection that was later labeled as infection. Interestingly, there were five rejections in the group with VCA graft alone, suggesting either that the VCA may have diverted the rejection response or that treatment of the VCA rejection may have prevented clinical rejection of the intestinal graft.

Finally, Borges et al (33) described clinical and histological characteristics of face transplant rejection in five recipients followed for a mean duration of 3.2 years. All patients had at least one acute cellular rejection. Rejection was characterized histologically by graft infiltrates in cellular rejection and C4d staining in humoral rejection. Rejections were characterized by increases in CD4 and CD8 effector cells, and TH17 and TH1 cells in blood and graft. Interestingly, no de novo DSA was observed. Circulating Tregs were twofold higher at 1 year after transplant compared with a cohort of kidney recipients at 1 year. Tregs decreased in blood and increased in the graft during rejection. These data suggest that acute rejection of face transplants broadly resembles that of other organs.

Disclosure

The authors of this manuscript have no conflicts of interest to disclose as described by the *American Journal of Transplantation*.

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