1. EVALUACIÓN DEL DONANTE FALLECIDO

1.1 ESCORES CLÍNICOS

1. A Comprehensive Risk Quantification Score for Deceased Donor Kidneys: The Kidney Donor Risk Index

Rao PS, Schaubel DE, Guidinger MK et al.
Transplantation. 2009 Jul 27;88(2):231-6.

ABSTRACT
BACKGROUND: We propose a continuous kidney donor risk index (KDRI) for deceased donor kidneys, combining donor and transplant variables to quantify graft failure risk.
METHODS: By using national data from 1995 to 2005, we analyzed 69,440 first-time, kidney-only, deceased donor adult transplants. Cox regression was used to model the risk of death or graft loss, based on donor and transplant factors, adjusting for recipient factors. The proposed KDRI includes 14 donor and transplant factors, each found to be independently associated with graft failure or death: donor age, race, history of hypertension, history of diabetes, serum creatinine, cerebrovascular cause of death, height, weight, donation after cardiac death, hepatitis C virus status, human leukocyte antigen-B and DR mismatch, cold ischemia time, and double or en bloc transplant. The KDRI reflects the rate of graft failure relative to that of a healthy 40-year-old donor.
RESULTS: Transplants of kidneys in the highest KDRI quintile (>1.45) had an adjusted 5-year graft survival of 63%, compared with 82% and 79% in the two lowest KDRI quintiles (<0.79 and 0.79-<0.96, respectively). There is a considerable overlap in the KDRI distribution by expanded and nonexpanded criteria donor classification.
CONCLUSIONS: The graded impact of KDRI on graft outcome makes it a useful decision-making tool at the time of the deceased donor kidney offer.

2. An Examination of the Application of the Kidney Donor Risk Index in British Columbia

Rose C, Sun Y, Ferre E et al.
Can J Kidney Health Dis. 2018 Mar 19;5:2054358118761052.

ABSTRACT
BACKGROUND: The Kidney Donor Risk Index (KDRI) is a continuous measure of deceased donor kidney transplant failure risk that was derived in US patients based on 10 donor characteristics. In the United States, the KDRI is utilized to guide organ allocation and to inform clinical decisions regarding organ acceptance.
OBJECTIVE: To examine the application of the US-derived KDRI in a large Canadian province.
PATIENTS: All deceased donor kidney-only transplant recipients in British Columbia (BC) between 2005 and 2014.
METHODS: We examined the predictive performance of KDRI in BC transplant recipients and compared the overall performance of KDRI with donor age alone in predicting transplant failure (from all causes including death).
RESULTS: Donors in BC (N = 785) were older but included no black donors and few Hepatitis C virus (HCV)-positive donors compared with the original derivation cohort of the KDRI in the United

States. The KDRI was moderately predictive of transplant failure (*c* statistic, 0.63) and had similar predictive performance to donor age alone (*c* statistic, 0.64).
CONCLUSION: Our findings suggest that the US-derived KDRI does not improve the prediction of kidney transplant failure compared with donor age alone in a Canadian cohort and highlight the need to determine the applicability of KDRI in different regions.

3. Is the Kidney Donor Risk Index a step forward in the assessment of deceased donor kidney quality?

Lee AP, Abramowicz D

Nephrol Dial Transplant. 2015 Aug;30(8):1285-90.

ABSTRACT

The allocation of deceased donor kidneys has become more complex because of the increasing spectrum of donors and recipients age and comorbidities. Several scoring systems have been proposed to evaluate the donor quality of deceased donor kidneys, based on clinical, pathological or combined parameters to predict the risk of renal allograft failure. Nonetheless, besides the dichotomous extended criteria donor (ECD) score, none of the others have been used in clinical practice because of numerous reasons, ranging from lack of robust validation to the technical challenges associated with the evaluation of donor biopsies. Recently, the Kidney Donor Risk Index (KDRI) and Profile Index (KDPI) were introduced in the USA as a refined version of the ECD score. This scoring system is based on 10 donor factors, therefore providing a finely granulated evaluation of donor quality without the need of a kidney biopsy. Here, we review the advantages and drawbacks of the main scoring systems, and we describe the components of the KDRI and KDPI. It is an easily accessible online tool, based solely on donor factors readily available at the moment of the donor offer. Importantly, the KDPI has also been made part of the 'longevity matching' allocation in the USA, where the best kidneys are allocated to the recipients with the longest predicted post-transplant survival. The KDRI should provide us with a robust qualitative evaluation of deceased donor quality, and therefore will probably play a role in deceased donor kidney allocation policies across Europe in the near future. Hopefully, the KDRI and the KDPI should help transplant programmes to better allocate the scarce resource of deceased donor kidneys.

4. Validation of the Prognostic Kidney Donor Risk Index Scoring System of Deceased Donors for Renal Transplantation in the Netherlands

Peters-Sengers H, Heemskerk MBA, Geskus RB et al.

Transplantation. 2018 Jan;102(1):162-170.

ABSTRACT

BACKGROUND: The prognostic Kidney Donor Risk Index (KDRI)—developed and internally validated in the United States—is a widely used tool to predict transplant outcome of a deceased donor kidney. The KDRI is currently used for longevity matching between donors and recipients in the United States.
METHODS: We aimed to externally validate the $KDRI_{donor\text{-}only}$ and $KDRI_{full}$ as proposed by Rao et al (2009). $KDRI_{donor\text{-}only}$ consist of 10 donor factors, and $KDRI_{full}$ with an additional 4 transplant factors.

We used the Dutch Organ Transplantation Registry to include 3201 adult recipients transplanted from 2002 to 2012.
RESULTS: The median Dutch KDRI was 1.21 and comparable with the year 2012 in the United States (median of 1.24). The calibrationslope was 0.98 and 0.96 for the $KDRI_{full}$ and $KDRI_{donor\text{-}only}$, respectively, indicating that predictions of graft failure were on average similar. The discriminative ability (Harrell C) of the $KDRI_{full}$ and the $KDRI_{donor\text{-}only}$ at 5 years was 0.63 (95% confidence interval [CI], 0.62-0.64), and 0.62 (95% CI, 0.61-0.63), respectively. We found misspecification of 3 KDRI factors: age (P = 0.002), weight (P = 0.017), and cold ischemia time (P < 0.001). Adding the use of inotropic drugs before donation (P = 0.040) and the interaction between circulatory-death donor kidneys and prolonged cold ischemic time (>24 hours vs 12 hours; P = 0.059) could improve predictive ability.
CONCLUSIONS: The KDRI performs equal in the Dutch population. Discriminative ability of the KDRI indicates limited clinical use for adequate individualized decisions. An updated KDRI may contribute to a standardized policy meeting the growing demand of donor kidneys in the Eurotransplant region.

DONOR RISK SCORES

5. Preoperative assessment of the deceased-donor kidney: from macroscopic appearance to molecular biomarkers
Dare AJ, Pettigrew GJ, Saeb-Parsy K
Transplantation. 2014 Apr 27;97(8):797-807.

ABSTRACT
Variation in deceased-donor kidney quality can significantly affect outcomes after kidney transplantation. Suboptimal organ selection for a given recipient can result in primary nonfunction, premature graft failure, or inappropriate discard of a suitable organ. Appraisal and appropriate selection of deceased-donor kidneys for use in transplantation is therefore critical. A number of predictive tools have been developed to assist the transplant team in evaluating the suitability of a deceased-donor kidney for transplantation to a given recipient. These include stratification of donors into "standard-" or "expanded-criteria" categories based on clinical parameters, pre-implantation biopsy scores, donor risk scores, machine perfusion characteristics, functional kidney weight, donor biomarkers and molecular diagnostic tools, ex vivo viability assessment using postmortem normothermic perfusion, and overall macroscopic appraisal by the surgical team. Consensus as to the role and predictive value of each of these tools is lacking and clinical practice regarding evaluation and selection of kidneys varies considerably. In this review, we seek to critically appraise the literature and evaluate the levels of evidence for tools used to assess deceased-donor kidneys. Although a plethora of appraisal tools exist, very few demonstrate desirable predictive power to be useful in clinical decision-making. Further research using large, well-designed prospective studies is urgently needed to advance this important field of transplantation science.

6. Does the Kidney Donor Index need non-donor factors?
Massie AB, Montgomery RA, Segev DL.
American Transplant Congress Abstracts 2011

Abstract not available

7. Survival benefit of primary deceased donor transplantation with high KDPI kidney
Massie AB, Luo X, Chow EK et al.
Am J Transplant 2014,14:2310-2316

ABSTRACT
The Kidney Donor Profile Index (KDPI) has been introduced as an aid to evaluating deceased donor kidney offers, but the relative benefit of high-KDPI kidney transplantation (KT) versus the clinical alternative (remaining on the waitlist until receipt of a lower KDPI kidney) remains unknown. Using time-dependent Cox regression, we evaluated the mortality risk associated with high-KDPI KT (KDPI 71-80, 81-90 or 91-100) versus a conservative, lower KDPI approach (remain on waitlist until receipt of KT with KDPI 0-70, 0-80 or 0-90) in first-time adult registrants, adjusting for candidate characteristics. High-KDPI KT was associated with increased short-term but decreased long-term mortality risk. Recipients of KDPI 71-80 KT, KDPI 81-90 KT and KDPI 91-100 KT reached a "break-even point" of cumulative survival at 7.7, 18.0 and 19.8 months post-KT, respectively, and had a survival benefit thereafter. Cumulative survival at 5 years was better in all three high-KDPI groups than the conservative approach ($p < 0.01$ for each comparison). Benefit of high-KDPI KT was greatest in patients age >50 years and patients at centers with median wait time ≥33 months. Recipients of high-KDPI KT can enjoy better long-term survival; a high-KDPI score does not automatically constitute a reason to reject a deceased donor kidney.

8. Utilization of kidneys with similar kidney donor risk index values from standard versus ex panded criteria donors
Woodside KJ, Merion RM, Leichtman AB et al.
Am J Transplant 2012; 12: 2106–2114

ABSTRACT
With the shortage of standard criteria donor (SCD) kidneys, efficient expanded criteria donor (ECD) kidney utilization has become more vital. We investigated the effects of the ECD label on kidney recovery, utilization and outcomes. Using data from the Scientific Registry of Transplant Recipients from November 2002 to May 2010, we determined recovery and transplant rates, and modeled discard risk, for kidneys within a range of kidney donor risk index (KDRI) 1.4-2.1 that included both SCD and ECD kidneys. To further compare similar quality kidneys, these kidneys were again divided into three KDRI intervals. Overall, ECD kidneys had higher recovery rates, but lower transplant rates. However, within each KDRI interval, SCD and ECD kidneys were transplanted at similar rates. Overall, there was increased risk for discard for biopsied kidneys. SCD kidneys in the lower two KDRI intervals had the highest risk of discard if biopsied. Pumped kidneys had a lower risk of discard, which was modulated by KDRI for SCD kidneys but not ECD kidneys. Although overall ECD graft survival was worse than SCD, there were no differences within individual KDRI intervals. Thus, ECD designation adversely affects neither utilization nor outcomes beyond that predicted by KDRI.

9. Validation of the kidney donor risk index (KDRI) score in a UK single centre DCD cohort
Pine JK, Goldsmith PJ, Ridgway DM et al.
TTS Inter-national Congress 2010

Abstract not available

10. The combined risk of donor quality and recipient age: higher-quality kidneys may not always improve patient and graft survival
Hernandez RA, Malek SK, Milford EL et al.
Transplantation 2014; 98: 1069–1076

ABSTRACT
BACKGROUND: The Kidney Donor Profile Index (KDPI) is a more precise donor organ quality metric replacing age-based characterization of donor risk. Little prior attention has been paid on the outcomes of lower-quality kidneys transplanted into elderly recipients. Although we have previously shown that immunological risks associated with older organs are attenuated by advanced recipient age, it remains unknown whether risks associated with lower-quality KDPI organs are similarly reduced in older recipients.
METHODS: Donor organ quality as measured by the KDPI was divided into quintiles (very high, high, medium, low, and very low quality), and Cox proportional hazards was used to assess graft and recipient survival in first-time adult deceased donor transplant recipients by recipient age.
RESULTS: In uncensored graft survival analysis, recipients older than 69 years had demonstrated comparable outcomes if they received low-quality kidneys compared to medium-quality kidneys. Death-censored analysis demonstrated no increased relative risk when low-quality kidneys were transplanted into recipients aged 70 to 79 years (hazard ratio [HR], 1.11; P=0.19) or older than 79 years (HR, 1.08; P=0.59). In overall survival analysis, elderly recipients gained no relative benefit from medium-quality kidneys over low-quality kidneys (70-79 years: HR, 1.03, P=0.51; >79 years: HR, 1.08; P=0.32).
CONCLUSION: Our analysis demonstrates that transplanting medium-quality kidneys into elderly recipients does not provide significant advantage over low-quality kidneys.

11. Kidney donor risk index is a good prognostic tool for graft outcomes in deceased donor kidney transplantation with short, cold ischemic time
Han M, Jeong JC, Koo TY et al.
Clin Transplant 2014; 28: 337–344

ABSTRACT
BACKGROUND: We performed a retrospective cohort study to determine the prognostic value of standard criteria donor/expanded criteria donor (SCD/ECD) designation, with regard to one-yr GFR and graft survival rate, in a region with short, cold ischemic time (CIT), and how this designation compares with the kidney donor risk index (KDRI) and zero-time kidney biopsies.
METHODS: We reviewed 362 cases of deceased donor kidney transplantation (DDKT). Donor kidneys were classified as SCD or ECD. They were also assessed by the KDRI. Zero-time kidney biopsy was performed in 196 patients, and histologic score was assessed.

RESULTS: Median follow-up duration was 46 months. Forty-two cases (11.6%) used ECD kidneys. The mean CIT was only 4.9 ± 2.7 h. Graft survival rates were not significantly different between ECD and SCD groups. The KDRI showed the best correlation with one-yr estimations of glomerular filtration rate (eGFR) ($R(2) = 0.230$, $p < 0.001$), and higher KDRI was associated with a higher risk of graft failure (hazard ratio 2.63, 95% confidence interval 1.01-6.87). However, higher histologic score was not associated with a higher risk of graft failure.
CONCLUSION: KDRI has greater predictive value for short-term outcomes in DDKT with short CIT than the SCD/ECD designation or pathology.

12. Kidneys at higher risk of discard: expanding the role of dual kidney transplantation
Tanriover B, Mohan S, Cohen DJ et al.
Am J Transplant 2014; 14: 404–415

ABSTRACT
Half of the recovered expanded criteria donor (ECD) kidneys are discarded in the United States. A new kidney allocation system offers kidneys at higher risk of discard, Kidney Donor Profile Index (KDPI)>85%, to a wider geographic area to promote broader sharing and expedite utilization. Dual kidney transplantation (DKT) based on the KDPI is a potential option to streamline allocation of kidneys which otherwise would have been discarded. To assess the clinical utility of the KDPI in kidneys at higher risk of discard, we analyzed the OPTN/UNOS Registry that included the deceased donor kidneys recovered between 2002 and 2012. The primary outcomes were allograft survival, patient survival and discard rate based on different KDPI categories (<80%, 80-90% and >90%). Kidneys with KDPI>90% were associated with increased odds of discard (OR=1.99, 95% CI 1.74-2.29) compared to ones with KDPI<80%. DKTs of KDPI>90% were associated with lower overall allograft failure (HR=0.74, 95% CI 0.62-0.89) and better patient survival (HR=0.79, 95% CI 0.64-0.98) compared to single ECD kidneys with KDPI>90%. Kidneys at higher risk of discard may be offered in the up-front allocation system as a DKT. Further modeling and simulation studies are required to determine a reasonable KDPI cutoff percentile.

13. The Impact of Kidney Donor Profile Index on Delayed Graft Function and Transplant Outcomes: A Single Center Analysis
Zens TJ, Danobeitia JS, Leverson G et al.
Clin Transplant. 2018 Mar;32(3):e13190.

ABSTRACT
INTRODUCTION: Renal transplant outcomes result from a combination of factors. Traditionally, donor factors were summarized by classifying kidneys as extended criteria or standard criteria. In 2014, the nomenclature changed to describe donor factors with the kidney donor profile index (KDPI). We aim to evaluate the relationship between KDPI and delayed graft function (DGF), and the impact KDPI on transplant outcomes for both donor after cardiac death (DCD) and donor after brain death (DBD).
METHODS: An IRB-approved single-center retrospective chart review was performed from January 1999 to July 2013. The patients were divided into six groups: DBD KDPI ≤60, DBD KPDI 61-84, DBD KDPI ≥85, DCD KDPI ≤60, DCD KPDI 61-84, and DCD KDPI ≥85. Rates of DGF, patient survival, and graft survival were examined among groups.

RESULTS: A total of 2161 kidney transplants were included. DGF rates increased, and graft and patient survival decreased with increasing KDPI (P < .001). DCD kidneys had higher DGF rates than their DBD counterparts (P < .001). In DCD kidneys, a higher KDPI score did not significantly affect the DGF rates (P > .302). There was no significant difference in graft or patient survival in all-comers when comparing DCD and DBD kidneys with equivalent KDPIs (P > .317). Patients with DGF across all categories demonstrated worse graft half-lives.
CONCLUSION: The KDPI system is an accurate predictor of donor contributions to transplant outcomes. Recipients of DBD kidneys experience an increase in the rate of DGF as their KDPI increases. DCD kidneys have higher DGF rates than their DBD counterparts with similar KDPIs. Patients with documented post-transplant DGF had between 3- and 5-year shorter graft half-lives when compared to recipients that did not experience DGF. Initiatives to reduce the rate of DGF could provide a significant impact on graft survival and result in a reduction in the number of patients requiring retransplant.

14. External Validation of Kidney Donor Risk Index (KDRI) Does not Mitigate its Basic Limitations
Budhiraja P, Kaplan B.
Transplantation. DOI: 10.1097/TP.0000000000001906

No abstract available

15. An Examination of the Application of the Kidney Donor Risk Index in British Columbia
Rose C, Sun Y, Ferre E et al.
Canadian Journal of Kidney Health and Disease 5: 1–10,2018

ABSTRACT
BACKGROUND: The Kidney Donor Risk Index (KDRI) is a continuous measure of deceased donor kidney transplant failure risk that was derived in US patients based on 10 donor characteristics. In the United States, the KDRI is utilized to guide organ allocation and to inform clinical decisions regarding organ acceptance.
OBJECTIVE: To examine the application of the US-derived KDRI in a large Canadian province.
PATIENTS: All deceased donor kidney-only transplant recipients in British Columbia (BC) between 2005 and 2014.
METHODS: We examined the predictive performance of KDRI in BC transplant recipients and compared the overall performance of KDRI with donor age alone in predicting transplant failure (from all causes including death).
RESULTS: Donors in BC (N = 785) were older but included no black donors and few Hepatitis C virus (HCV)-positive donors compared with the original derivation cohort of the KDRI in the United States. The KDRI was moderately predictive of transplant failure (c statistic, 0.63) and had similar predictive performance to donor age alone (c statistic, 0.64).
CONCLUSION: Our findings suggest that the US-derived KDRI does not improve the prediction of kidney transplant failure compared with donor age alone in a Canadian cohort and highlight the need to determine the applicability of KDRI in different regions.

16. Is the Kidney Donor Risk Index a step forward in the assessment of deceased donor kidney quality?

Lee AP, Abramowicz D.

Nephrol Dial Transplant. 2015 Aug;30(8):1285-90.

ABSTRACT

The allocation of deceased donor kidneys has become more complex because of the increasing spectrum of donors and recipients age and comorbidities. Several scoring systems have been proposed to evaluate the donor quality of deceased donor kidneys, based on clinical, pathological or combined parameters to predict the risk of renal allograft failure. Nonetheless, besides the dichotomous extended criteria donor (ECD) score, none of the others have been used in clinical practice because of numerous reasons, ranging from lack of robust validation to the technical challenges associated with the evaluation of donor biopsies. Recently, the Kidney Donor Risk Index (KDRI) and Profile Index (KDPI) were introduced in the USA as a refined version of the ECD score. This scoring system is based on 10 donor factors, therefore providing a finely granulated evaluation of donor quality without the need of a kidney biopsy. Here, we review the advantages and drawbacks of the main scoring systems, and we describe the components of the KDRI and KDPI. It is an easily accessible online tool, based solely on donor factors readily available at the moment of the donor offer. Importantly, the KDPI has also been made part of the 'longevity matching' allocation in the USA, where the best kidneys are allocated to the recipients with the longest predicted post-transplant survival. The KDRI should provide us with a robust qualitative evaluation of deceased donor quality, and therefore will probably play a role in deceased donor kidney allocation policies across Europe in the near future. Hopefully, the KDRI and the KDPI should help transplant programmes to better allocate the scarce resource of deceased donor kidneys.

17. Reevaluation of the Kidney Donor Risk Index (KDRI)

Zhong Y, Schaubel DE, Kalbfleisch JD, et al.

Transplantation 2018 Nov 16

ABSTRACT

BACKGROUND: The Kidney Donor Risk Index (KDRI) is a score applicable to deceased kidney donors which reflects relative graft failure risk associated with deceased donor characteristics. The KDRI is widely used in kidney transplant outcomes research. Moreover, an abbreviated version of KDRI is the basis, for allocation purposes, of the "top 20%" designation for deceased donor kidneys. Data upon which the KDRI model was based used kidney transplants performed between 1995 and 2005. Our purpose in this report was to evaluate the need to update the coefficients in the KDRI formula, with the objective of either (a) proposing new coefficients or (b) endorsing continued used of the existing formula.

METHODS: Using data obtained from the Scientific Registry of Transplant Recipients (SRTR), we analyzed n=156,069 deceased donor adult kidney transplants occurring from 2000 to 2016. Cox regression was used to model the risk of graft failure. We then tested for differences between the original and updated regression coefficients, and compared the performance of the original and updated KDRI formulas with respect to discrimination and predictive accuracy.

RESULTS: In testing for equality between the original and updated KDRIs, few coefficients were significantly different. Moreover, the original and updated KDRI yielded very similar risk discrimination and predictive accuracy.

CONCLUSIONS: Overall, our results indicate that the original KDRI is robust and is not meaningfully improved by an update derived through modeling analogous to that originally employed.

URINE BIOMARKERS

18. Utility of Applying Quality Assessment Tools for Kidneys With KDPI ≥80
Doshi MD, Reese PP, Hall IE et al.
Transplantation 2017, June 101(6):1125-113

ABSTRACT
BACKGROUND: Kidneys with "high" Kidney Donor Profile Index (KDPI) are often biopsied and pumped, yet frequently discarded.
METHODS: In this multicenter study, we describe the characteristics and outcomes of kidneys with KDPI of 80 or greater that were procured from 338 deceased donors. We excluded donors with anatomical kidney abnormalities.
RESULTS: Donors were categorized by the number of kidneys discarded: (1) none (n = 154, 46%), (2) 1 discarded and 1 transplanted (n = 48, 14%), (3) both discarded (n = 136, 40%). Donors in group 3 were older, more often white, and had higher terminal creatinine and KDPI than group 1 (all $P < 0.05$). Biopsy was performed in 92% of all kidneys, and 47% were pumped. Discard was associated with biopsy findings and first hour renal resistance. Kidney injury biomarker levels (neutrophil gelatinase-associated lipocalin, IL-18, and kidney injury molecule-1 measured from donor urine at procurement and from perfusate soon after pump perfusion) were not different between groups. There was no significant difference in 1-year estimated glomerular filtration rate or graft failure between groups 1 and 2 (41.5 ± 18 vs 41.4 ± 22 mL/min per 1.73 m; $P = 0.97$ and 9% vs 10%; $P = 0.76$).
CONCLUSIONS: Kidneys with KDPI of 80 or greater comprise the most resource consuming fraction of our donor kidney pool and have the highest rates of discard. Our data suggest that some discarded kidneys with KDPI of 80 or greater are viable; however, current tools and urine and perfusate biomarkers to identify these viable kidneys are not satisfactory. We need better methods to assess viability of kidneys with high KDPI.

19. A systematic review of kidney transplantation from expanded criteria donors
Pascual J, Zamora J, Pirsch JD.
Am J Kidney Dis 2008;52:553-86.

ABSTRACT
BACKGROUND: During the past few years, there has been renewed interest in the use of expanded criteria donors (ECD) for kidney transplantation to increase the numbers of deceased donor kidneys available. More kidney transplants would result in shorter waiting times and limit the morbidity and mortality associated with long-term dialysis therapy.
STUDY DESIGN: Systematic review of the literature.
SETTING & POPULATION: Kidney transplantation population.
SELECTION CRITERIA FOR STUDIES: Studies were identified by using a comprehensive search through MEDLINE and EMBASE databases. Inclusion criteria were case series, cohort studies, and randomized controlled trials assessing kidney transplantation in adult recipients using ECDs.

PREDICTOR: A special focus was given to studies comparing the evolution of kidney transplantation between standard criteria donors (defined as a donor who does not meet criteria for donation after cardiac death or ECD) and ECDs (defined as any brain-dead donor aged > 60 years or a donor aged > 50 years with 2 of the following conditions: history of hypertension, terminal serum creatinine level >or= 1.5 mg/dL, or death resulting from a cerebrovascular accident).
OUTCOMES: Criteria used to define and select ECDs, practice patterns, long-term outcomes, early complications, and some patient issues, such as selection criteria and immunosuppressive management.
RESULTS: ECD kidneys have worse long-term survival than standard criteria donor kidneys. The optimal ECD kidney for donation depends on adequate glomerular filtration rate and acceptable donor kidney histological characteristics, albeit the usefulness of biopsy is debated.
LIMITATIONS: This review is based mainly on data from observational studies, and varying amounts of bias could be present. We did not attempt to quantitatively analyze the effect of ECD kidneys on kidney transplantation because of the huge heterogeneity found in study designs and definitions of ECD.
CONCLUSIONS: Based on the available evidence, we conclude that patients younger than 40 years or scheduled for kidney retransplantation should not receive an ECD kidney. Patients 40 years or older, especially with diabetic nephropathy or nondiabetic disease, but a long expected waiting time for kidney transplantation, show better survival receiving an ECD kidney than remaining on dialysis therapy.

20. Effects of donor age and cell senescence on kidney allograft survival
Melk A, Schmidt BM, Braun H, et al.
Am J Transplant 2009;9:114-23.

ABSTRACT
The biological processes responsible for somatic cell senescence contribute to organ aging and progression of chronic diseases, and this may contribute to kidney transplant outcomes. We examined the effect of pre-existing donor aging on the performance of kidney transplants, comparing mouse kidney isografts and allografts from old versus young donors. Before transplantation, old kidneys were histologically normal, but displayed an increased expression of senescence marker p16(INK4a). Old allografts at day 7 showed a more rapid emergence of epithelial changes and a further increase in the expression of p16(INK4a). Similar but much milder changes occurred in old isografts. These changes were absent in young allografts at day 7, but emerged by day 21. The expression of p16(INK4a) remained low in young kidney allografts at day 7, but increased with severe rejection at day 21. Isografts from young donors showed no epithelial changes and no increase in p16(INK4a). The measurements of the alloimmune response-infiltrate, cytology, expression of perforin, granzyme B, IFN-gamma and MHC-were not increased in old allografts. Thus, old donor kidneys display abnormal parenchymal susceptibility to transplant stresses and enhanced induction of senescence marker p16(INK4a), but were not more immunogenic. These data are compatible with a key role of somatic cell senescence mechanisms in kidney transplant outcomes by contributing to donor aging, being accelerated by transplant stresses, and imposing limits on the capacity of the tissue to proliferate.

21. Kidney transplant outcomes from older deceased donors: a paired kidney analysis by the European Renal Association-European Dialysis and Transplant Association Registry
Pippias M, Jager KJ, Caskey F, et al.
Transpl Int 2018;31:708-19

ABSTRACT
As the median age of deceased kidney donors rises, updated knowledge of transplant outcomes from older deceased donors in differing donor-recipient age groups is required. Using ERA-EDTA Registry data we determined survival outcomes of kidney allografts donated from the same older deceased donor (55-70 years), and transplanted into one recipient younger and one recipient of similar age to the donor. The recipient pairs were divided into two groups: group 1; younger (median age: 52 years) and older (60 years) and group 2; younger (41 years) and older (60 years). A total of 1410 adults were transplanted during 2000-2007. Compared to the older recipients, the mean number of functioning graft years at 10 years was 6 months longer in the group 1 and group 2 younger recipients (P < 0.001). Ten-year graft survival was 54% and 40% for the group 1 younger and older recipients, and 60% and 49% for the group 2 younger and older recipients. Paired Cox regression analyses showed a lower risk of graft failure (group 1 younger; adjusted relative risk [RRa]:0.57, 95% CI:0.41-0.79, and group 2 younger; RRa:0.63, 95% CI:0.47-0.85) in younger recipients. Outcomes from older deceased donor allografts transplanted into differing donor-recipient age groups are better than previously reported. These allografts remain a valuable transplant resource, particularly for similar-aged recipients.

22. Spanish consensus document for acceptance and rejection of kidneys from expanded criteria donors
Lledó-García E, Riera L, Passas J, et al.
Clin Transplant. 2014 Oct;28:1155–66.

In the recent years, more than 60% of available deceased donors are either older than 50 yr or have significant vascular comorbidities. This makes the acceptance and rejection criteria of renal allografts very rigorous, especially in cases of younger recipients, and at the same time encourages live donations. In our country, there is a lack of homogeneity in the percentages of use of expanded criteria donor (ECD) allografts between the different autonomous communities. Furthermore, the criteria vary greatly, and in some cases, great importance is given to the biopsy while in others very little. In this study, we present a unified and homogenous criteria agreed upon by consensus of a 10-member Panel representing major scientific societies related to renal transplantation in Spain. The criteria are to be used in accepting and/or rejecting kidneys from the so-called ECDs. The goal was to standardize the use of these organs, to optimize the results, and most importantly to provide for the maximum well being of our patients. Finally, we believe that after taking into account the Panel's thorough review of specific scientific literature, this document will be adaptable to other national renal transplant programmes.

23. Is the Kidney Donor Risk Index a step forward the assessment of deceased donor kidney quality?
Lee AP, Abramovicz D.
Nephrol Dial Transplant. 2014:1–6.

ABSTRACT
The allocation of deceased donor kidneys has become more complex because of the increasing spectrum of donors and recipients age and comorbidities. Several scoring systems have been proposed to evaluate the donor quality of deceased donor kidneys, based on clinical, pathological or combined parameters to predict the risk of renal allograft failure. Nonetheless, besides the dichotomous extended criteria donor (ECD) score, none of the others have been used in clinical practice because of numerous reasons, ranging from lack of robust validation to the technical challenges associated with the evaluation of donor biopsies. Recently, the Kidney Donor Risk Index (KDRI) and Profile Index (KDPI) were introduced in the USA as a refined version of the ECD score. This scoring system is based on 10 donor factors, therefore providing a finely granulated evaluation of donor quality without the need of a kidney biopsy. Here, we review the advantages and drawbacks of the main scoring systems, and we describe the components of the KDRI and KDPI. It is an easily accessible online tool, based solely on donor factors readily available at the moment of the donor offer. Importantly, the KDPI has also been made part of the 'longevity matching' allocation in the USA, where the best kidneys are allocated to the recipients with the longest predicted post-transplant survival. The KDRI should provide us with a robust qualitative evaluation of deceased donor quality, and therefore will probably play a role in deceased donor kidney allocation policies across Europe in the near future. Hopefully, the KDRI and the KDPI should help transplant programmes to better allocate the scarce resource of deceased donor kidneys.

24. Strategies for expanded use of kidneys from elderly donors

Perez-Saez MJ, Montero N, Redondo-Pachón D et al.

Transplantation. 2017;101:727–45.

ABSTRACT
The old-for-old allocation policy used for kidney transplantation (KT) has confirmed the survival benefit compared to remaining listed on dialysis. Shortage of standard donors has stimulated the development of strategies aimed to expand acceptance criteria, particularly of kidneys from elderly donors. We have systematically reviewed the literature on those different strategies. In addition to the review of outcomes of expanded criteria donor or advanced age kidneys, we assessed the value of the Kidney Donor Profile Index policy, preimplantation biopsy, dual KT, machine perfusion and special immunosuppressive protocols. Survival and functional outcomes achieved with expanded criteria donor, high Kidney Donor Profile Index or advanced age kidneys are poorer than those with standard ones. Outcomes using advanced age brain-dead or cardiac-dead donor kidneys are similar. Preimplantation biopsies and related scores have been useful to predict function, but their applicability to transplant or refuse a kidney graft has probably been overestimated. Machine perfusion techniques have decreased delayed graft function and could improve graft survival. Investing 2 kidneys in 1 recipient does not make sense when a single KT would be enough, particularly in elderly recipients. Tailored immunosuppression when transplanting an old kidney may be useful, but no formal trials are available. Old donors constitute an enormous source of useful kidneys, but their retrieval in many countries is infrequent. The assumption of limited but precious functional expectancy for an old kidney and substantial reduction of discard rates should be generalized to mitigate these limitations.

25. The marginal kidney donor

Maggiore U, Cravedi P.

Curr Opin Organ Transplant. 2014;19:372–80.

ABSTRACT

PURPOSE OF REVIEW: The current era of organ shortage has necessitated a widening of criteria for donation, considering donors who would have been considered unsuitable before. This review summarizes the recent advances in strategies to maximize the use of marginal kidneys without compromising the outcomes.

RECENT FINDINGS: Various strategies have been studied and implemented to optimize procurement and allocation of marginal kidneys, and to preserve their function. In particular, a growing number of transplant centers are using donors after circulatory death. Whereas normothermic ex-vivo and postmortem perfusion are promising procedures to improve the outcomes of marginal grafts in the future, dual-kidney transplantation is a viable approach which is at present potentially underutilized. Despite active research on new strategies to evaluate organ quality, pretransplant biopsy assessment currently remains the most reliable method. The practice of using living donors with advanced age is supported by available evidence, whereas the use of young living donors with minor medical abnormalities needs further investigation.

SUMMARY: Progress has been made in the recent years, clarifying the best criteria for evaluating, recovering, and allocating marginal kidney donors. However, further research is needed, with special regards to the criteria for using marginal living-kidney donors.

26. Long-term outcome of renal transplantation from older donors

Remuzzi G, Cravedi P, Perna A, et al.

N Engl J Med 2006;354:343-52

ABSTRACT

BACKGROUND: Long-term survival of kidney grafts from older donors is inferior to that of grafts from younger donors. We sought to determine whether selecting older kidneys according to their histologic characteristics before implantation would positively influence long-term outcome.

METHODS: In a prospective cohort study, we assessed outcomes among 62 patients who received one or two histologically evaluated kidneys from donors older than 60 years of age. These outcomes were compared with outcomes among 248 matched recipients of single kidney grafts that had not been histologically evaluated and were either from donors 60 years of age or younger (124 positive-reference recipients who, according to available data, were expected to have an optimal outcome) or from those older than 60 years (124 negative-reference recipients, expected to have a worse outcome). The primary end point was graft survival.

RESULTS: During a median period of 23 months, 4 recipients (6 percent) of histologically evaluated kidneys progressed to dialysis, as compared with 7 positive-reference recipients (6 percent) and 29 negative-reference recipients (23 percent). Graft survival in recipients of histologically evaluated kidneys did not differ significantly from that of grafts in positive-reference recipients but was superior to that of grafts in negative-reference recipients (hazard ratio for graft failure in the negative-reference recipients relative to the recipients of histologically evaluated kidneys, 3.68; 95 percent confidence interval, 1.29 to 10.52; P=0.02). The performance of preimplantation histologic evaluation predicted better survival both in the whole study group (P=0.02) and among recipients of kidneys from older donors (P=0.01).

CONCLUSIONS: The long-term survival of single or dual kidney grafts from donors older than 60 years of age is excellent, provided that the grafts are evaluated histologically before implantation. This approach may help to expand the donor-organ pool for kidney transplantation.

27. Kidney donor risk index is a good prognostic tool for graft outcomes in deceased donor kidney transplantation with short, cold ischemic time

Han M, Jeong JC, Koo TY, et al.
Clin Transplant 2014;28:337-44.

ABSTRACT
BACKGROUND: We performed a retrospective cohort study to determine the prognostic value of standard criteria donor/expanded criteria donor (SCD/ECD) designation, with regard to one-yr GFR and graft survival rate, in a region with short, cold ischemic time (CIT), and how this designation compares with the kidney donor risk index (KDRI) and zero-time kidney biopsies.
METHODS: We reviewed 362 cases of deceased donor kidney transplantation (DDKT). Donor kidneys were classified as SCD or ECD. They were also assessed by the KDRI. Zero-time kidney biopsy was performed in 196 patients, and histologic score was assessed.
RESULTS: Median follow-up duration was 46 months. Forty-two cases (11.6%) used ECD kidneys. The mean CIT was only 4.9 ± 2.7 h. Graft survival rates were not significantly different between ECD and SCD groups. The KDRI showed the best correlation with one-yr estimations of glomerular filtration rate (eGFR) ($R(2) = 0.230$, $p < 0.001$), and higher KDRI was associated with a higher risk of graft failure (hazard ratio 2.63, 95% confidence interval 1.01-6.87). However, higher histologic score was not associated with a higher risk of graft failure.
CONCLUSION: KDRI has greater predictive value for short-term outcomes in DDKT with short CIT than the SCD/ECD designation or pathology.

28. New strategies for evaluating the quality of kidney grafts from elderly donors

Wohlfahrtova M, Viklicky O.
Transplant Rev (Orlando) 2015;29:212-8.

ABSTRACT
The increased demand for kidney transplantation and organ shortage resulted in the increased use of kidneys from suboptimal donors. Therefore, identification of kidneys that can be accepted without significantly compromising the outcome of allograft or recipient has become critical. A robust assessment of organ quality is of particular importance especially in kidneys from elderly donors in whom morphological and functional changes associated with aging and diseases are obvious. A number of predictive tools have been developed to help with evaluating the suitability of a deceased-donor kidney for transplantation. Among those, Kidney Donor Profile Index and zero hour graft biopsy in elderly donors have been already implemented in several transplant programs. This review captures the recent literature on this subject and discusses approaches for evaluating the quality of kidney grafts from elderly donors.

29. Increasing the Use of Kidneys From Unconventional and High-Risk Deceased Donors
Heilman RL, MathurA, Smith ML, et al.
American Journal of Transplantation 2016; 16: 3086–3092

ABSTRACT
In this paper, we have reviewed the literature and report on kidney donors that are currently used at relatively low rates. Kidneys from donors with acute kidney injury (AKI) seem to have outcomes equivalent to those from donors without AKI, provided one can rule out significant cortical necrosis. Kidneys from donors with preexisting diabetes or hypertension may have marginally lower aggregate survival but still provide patients with a significant benefit over remaining on the wait list. The Kidney Donor Profile Index derives only an aggregate association with survival with a very modest C statistic; therefore, the data indicated that this index should not be the sole reason to discard a kidney, except perhaps in patients with extremely low estimated posttransplant survival scores. It is important to note that the Scientific Registry of Transplant Recipients models of risk adjustment should allay concerns regarding regulatory issues for observed outcomes falling below expectations. The successful utilization of kidneys from donation after cardiac death over the past decade shows how expanding our thinking can translate into more patients benefiting from transplantation. Given the growing number of patients on the wait list, broadening our approach to kidney acceptance could have an important impact on the population with end-stage renal disease. Many lives could be prolonged by carefully considering use of kidneys that are often discarded.

30. Long-term outcomes following kidney transplantation from donors with acute kidney injury.
Heilman RL, Maxwell L. Smith, Byron H. Smith et al.
Transplantation. 2019 May 20. DOI: 10.1097/TP.0000000000002792

ABSTRACT
BACKGROUND: Kidneys from deceased donors with acute kidney injury (AKI) are more likely to be discarded because of concerns for poor outcomes after transplantation. The aim of this study was to determine the long-term outcomes of a large cohort of patients transplanted utilizing kidneys from deceased donors with acute kidney injury.
METHODS: All patients receiving a deceased donor kidney transplant during a recent 10-year period were included. Acute Kidney Injury Network (AKIN) criteria were used to classify the donors. Donor kidneys with more than 10% cortical necrosis or more than mild chronic changes were discarded. The primary outcome is the combined endpoint of death or graft loss.
RESULTS: The cohort included 1,313 kidneys from 974 donors, AKIN stage 0 (no AKI) in 319 (24.3%), stage 1 in 370 (28.2%), stage 2 in 177 (13.5) and stage 3 in 447 (34.0%). Estimated 5-year graft survival (95% CI) was 78.5% (72.5-84.5), 77.8% (72.8-82.1), 83.8% (76.8-88.9) and 84.6% (79.5-88.7) for AKIN donor stage 0 to 3, respectively (log-rank p=0.10). After adjusting for baseline differences, the HR (95% CI) for the combined endpoint for the AKIN stage 3 group (relative to AKIN 0 group) was 0.70 (0.45-1.10). DGF occurred in 44.6% and 75.4% of AKIN 2 and 3 groups, as compared to 33.9% and 33.5% in AKIN 0 and 1 (p<.001).
CONCLUSION: We conclude that transplanting selected kidneys from deceased donors with AKI with preimplantation biopsy showing less than 10% cortical necrosis and no more than mild chronic changes have excellent long-term graft survival.

31. Usefulness of the KDPI in Spain: A comparison with donor age and definition of standard/expanded criteria donor

Arias-Cabrales C, Pérez-Sáez MJ, Redondo-Pachón D, et al.

Nefrologia. 2018 Sep - Oct;38(5):503-513

ABSTRACT

INTRODUCTION: Kidney donor shortage requires expanding donor selection criteria, as well as use of objective tools to minimize the percentage of discarded organs. Some donor pre-transplant variables such as age, standard/expanded criteria donor (SCD/ECD) definition and calculation of the Kidney Donor Profile Index (KDPI), have demonstrated correlations with patient and graft outcomes. We aimed to establish the accuracy of the three models to determine the prognostic value of kidney transplantation (KT) major outcomes.

MATERIAL AND METHODS: We performed a retrospective study in deceased donor KTs at our institution. Unadjusted Cox and Kaplan-Meier survival, and multivariate Cox analyses were fitted to analyze the impact of donor age, SCD/ECD and KDPI on outcomes.

RESULTS: 389 KTs were included. Mean donor age was 53.6±15.2 years; 163 (41.9%) came from ECD; mean KDPI was 69.4±23.4%. Median follow-up was 51.9 months. The unadjusted Cox and Kaplan-Meier showed that the three prognostic variables of interest were related to increased risk of patient death, graft failure and death-censored graft failure. However, in the multivariate analysis only KDPI was related to a higher risk of graft failure (HR 1.03 [95% CI 1.01-1.05]; p=0.014).

CONCLUSIONS: SCD/ECD classification did not provide significant prognostic information about patient and graft outcomes. KDPI was linearly related to a higher risk of graft failure, providing a better assessment. More studies are needed before using KDPI as a tool to discard or accept kidneys for transplantation.

1.2 ESCORES HISTOLÓGICOS (BR PRE-IMPLANTE)

32. The Kidney Donor Profile Index (KDPI) of marginal donors allocated by standardized pretransplant donor biopsy assessment: Distribution and association with graft outcomes
Gandolfini I, Buzio C, Zanelli P, et al.
Am J Transplant. 2014 Nov;14:2515–25.

ABSTRACT

Pretransplant donor biopsy (PTDB)-based marginal donor allocation systems to single or dual renal transplantation could increase the use of organs with Kidney Donor Profile Index (KDPI) in the highest range (e.g. >80 or >90), whose discard rate approximates 50% in the United States. To test this hypothesis, we retrospectively calculated the KDPI and analyzed the outcomes of 442 marginal kidney transplants (340 single transplants: 278 with a PTDB Remuzzi score<4 [median KDPI: 87; interquartile range (IQR): 78-94] and 62 with a score=4 [median KDPI: 87; IQR: 76-93]; 102 dual transplants [median KDPI: 93; IQR: 86-96]) and 248 single standard transplant controls (median KDPI: 36; IQR: 18-51). PTDB-based allocation of marginal grafts led to a limited discard rate of 15% for kidneys with KDPI of 80-90 and of 37% for kidneys with a KDPI of 91-100. Although 1-year estimated GFRs were significantly lower in recipients of marginal kidneys (-9.3, -17.9 and -18.8 mL/min, for dual transplants, single kidneys with PTDB score<4 and =4, respectively; p<0.001), graft survival (median follow-up 3.3 years) was similar between marginal and standard kidney transplants (hazard ratio: 1.20 [95% confidence interval: 0.80-1.79; p=0.38]). In conclusion, PTDB-based allocation allows the safe transplantation of kidneys with KDPI in the highest range that may otherwise be discarded.

33. The reproducibility and predictive value on outcome of renal biopsies from expanded criteria donors
Azancot MA, Moreso F, Salcedo M et al.
Kidney Int. 2014 May;85(5):1161-8

ABSTRACT
Reproducibility and predictive value on outcome are the main criteria to evaluate the utility of histological scores. Here we analyze the reproducibility of donor biopsy assessment by different on-call pathologists and the retrospective evaluation by a single renal pathologist blinded to clinical outcomes. We also evaluate the predictive value on graft outcome of both evaluations. A biopsy was performed in donors with any of the following: age ≥55 years, hypertension, diabetes, creatinine>1.5 mg/dl, or stroke. Glomerulosclerosis, interstitial fibrosis, tubular atrophy, intimal thickening, and arteriolar hyalinosis evaluated according to the Banff criteria were added to obtain a chronic score. Biopsies were classified as mild (≥3), intermediate (4-5), or advanced (6-7) damage, and unacceptable (≥8) for transplantation of 127 kidneys biopsied. Weighted κ value between both readings was 0.41 (95% CI: 0.28-0.54). Evaluation of biopsies by the renal pathologist was significantly and independently associated with estimated 12-month glomerular filtration rate and a significant composite outcome variable, including death-censored graft survival and time to reach an estimated glomerular filtration rate<30 ml/min per 1.73 m2. Thus, there was no association between readings of on-call pathologists and outcome. The lack of association between histological scores obtained by the on-call pathologists and graft outcome

suggests that a specific training on renal pathology is recommended to optimize the use of kidneys retrieved from expanded criteria donors.

34. Renal Transplants from Older Deceased Donors: Use of Preimplantation Biopsy and Differential Allocation to Dual or Single Kidney Transplant according to Histological Score Has No Advantages over Allocation to Single Kidney Transplant by Simple Clinical Indication

Casati C, Colombo VG, Perrino M et al.

J Transplant. 2018 May 16;2018:4141756.

ABSTRACT

BACKGROUND: Grafts from elderly donors (ECD) are increasingly allocated to single (SKT) or dual (DKT) kidney transplantation according to biopsy score. Indications and benefits of either procedure lack universal agreement.

METHODS: A total of 302 ECD-transplants in period from Jan 1, 2000, to Dec 31, 2015, were allocated to SKT (SKT_{pre}) on clinical grounds alone (before Dec 2010, pre-DKT era, n = 170) or according to a clinical-histological protocol (after Dec 2010, DKT era, n = 132) to DKT (n = 48), SKT biopsy-based protocol ("high-risk", SKT_{hr}, n = 51), or SKT clinically based protocol ("low-risk", SKT_{lr}, n = 33). Graft and patient survival were compared between the two periods and between different transplant categories.

RESULTS: Graft and overall survival in recipients from ECD in pre-DKT and DKT era did not differ (5-year graft survival 87.7% and 84.2%, resp.); equal survival in the 2 ECD periods was shown in both donor age ranges of 60-69 and >70-years, and in low-risk or high-risk ECD categories. Within the DKT protocol SKT_{hr} showed worst graft and overall survival in the 60-69 donor age range; DKT did not result in significantly better outcome than SKT from ECD in either era. One-year posttransplant creatinine clearance in recipients did not differ between any ECD transplant category. At 3 and 5 years after transplantation there were significantly higher total dialysis-free recipient life years from an equal donor number in the pre-DKT era than in the DKT protocol.

CONCLUSIONS: Use of a biopsy-based protocol to allocate grafts from aged donors to SKT or DKT did not result in better short term graft survival than a clinically based protocol with allocation only to SKT and reduced overall recipient dialysis-free life years in time.

35. Pre-Implant Biopsy Predicts Outcome of Single-Kidney Transplantation Independent of Clinical Donor Variables

Hofer J, Regele H, Böhmig GA et al.

Transplantation 2014;97: 426-43

ABSTRACT

BACKGROUND: Pre-implant biopsy findings account for the discard of many donor kidneys although their clinical value is not fully understood. We retrospectively investigated the predictive value of pre-implant histology, which in our center was obtained for protocol purposes, not for transplant decisions, on long-term allograft and recipient outcome after single-kidney transplantation.

METHODS: This single-center study included 628 consecutive adult recipients of 174 Expanded Criteria Donor (ECD) and 454 Standard Criteria Donor kidneys. Chronic donor organ injury was assessed applying a chronic lesion score differentiating between mild, moderate, and severe

histologic organ injury based on the integration of glomerular, vascular, tubular, and interstitial lesions. Recipients were followed over a median time of 7.8 years.
RESULTS: Donor kidneys exhibiting mild or moderate chronic lesions yielded almost identical graft and recipient survival independent of ECD status or other clinical covariables (HR 1.20, 95% CI 0.83-1.74, P=0.326, and HR 1.27, 95% CI 0.83-1.95, P=0.274, respectively). However, if allograft injury was severe, occurring in 3% of transplanted kidneys, graft and recipient survival was significantly reduced (HR 3.13, 95% CI 1.61-6.07, PG0.001 and HR 2.42, 95% CI 1.16-5.04, P=0.005, respectively).
CONCLUSION: The results suggest that donor kidneys displaying moderate chronic injury can safely be transplanted as single kidneys, while organs displaying severe injury should be discarded. Thus, pre-implant biopsy might offer an effective approach to increase the utilization of renal donor organs, especially from ECD and donors with cerebrovascular accident as cause of death, and to improve overall graft outcome.

36. Banff Histopathological Consensus Criteria for Preimplantation Kidney Biopsies
Liapis H, Gaut JP, Klein C et al.
American Journal of Transplantation 2017; 17: 140–150

ABSTRACT
The Banff working group on preimplantation biopsy was established to develop consensus criteria (best practice guidelines) for the interpretation of preimplantation kidney biopsies. Digitally scanned slides were used (i) to evaluate interobserver variability of histopathologic findings, comparing frozen sections with formalin-fixed, paraffin-embedded tissue of wedge and needle core biopsies, and (ii) to correlate consensus histopathologic findings with graft outcome in a cohort of biopsies from international medical centers. Intraclass correlations (ICCs) and univariable and multivariable statistical analyses were performed. Good to fair reproducibility was observed in semiquantitative scores for percentage of glomerulosclerosis, arterial intimal fibrosis and interstitial fibrosis on frozen wedge biopsies. Evaluation of frozen wedge and core biopsies was comparable for number of glomeruli, but needle biopsies showed worse ICCs for glomerulosclerosis, interstitial fibrosis and tubular atrophy. A consensus evaluation form is provided to help standardize the reporting of histopathologic lesions in donor biopsies. It should be recognized that histologic parameters may not correlate with graft outcome in studies based on organs deemed to be acceptable after careful clinical assessment. Significant limitations remain in the assessment of implantation biopsies.

37. Successful Transplantation of Kidneys From Elderly Circulatory Death Donors by Using Microscopic and Macroscopic Characteristics to Guide Single or Dual Implantation
Mallon DH, Riddiough GE, Summers DM et al.
American Journal of Transplantation 2015; 15: 2931–2939

ABSTRACT
Most kidneys from potential elderly circulatory death (DCD) donors are declined. We report single center outcomes for kidneys transplanted from DCD donors over 70 years old, using preimplantation biopsy Remuzzi grading to inform implantation as single or dual transplants.

Between 2009 and 2012, 43 single transplants and 12 dual transplants were performed from elderly DCD donors. Remuzzi scores were higher for dual than single implants (4.4 vs. 3.4, p<0.001), indicating more severe baseline injury. Donor and recipient characteristics for both groups were otherwise similar. Early graft loss from renal vein thrombosis occurred in two singly implanted kidneys, and in one dual-implanted kidney; its pair continued to function satisfactorily. Death-censored graft survival at 3 years was comparable for the two groups (single 94%; dual 100%), as was 1 year eGFR. Delayed graft function occurred less frequently in the dual-implant group (25% vs. 65%, p=0.010). Using this approach, we performed proportionally more kidney transplants from elderly DCD donors (23.4%) than the rest of the United Kingdom (7.3%, p<0.001), with graft outcomes comparable to those achieved nationally for all deceased-donor kidney transplants. Preimplantation biopsy analysis is associated with acceptable transplant outcomes for elderly DCD kidneys and may increase transplant numbers from an underutilized donor pool.

38. Zero-Time Renal Transplant Biopsies: A Comprehensive Review
Naesens M.
Transplantation 2016;100: 1425–1439

ABSTRACT
Zero-time kidney biopsies, obtained at time of transplantation, are performed in many transplant centers worldwide. Decisions on kidney discard, kidney allocation, and choice of peritransplant and posttransplant treatment are sometimes based on the histological information obtained from these biopsies. This comprehensive review evaluates the practical considerations of performing zero-time biopsies, the predictive performance of zero-time histology and composite histological scores, and the clinical utility of these biopsies. The predictive performance of individual histological lesions and of composite scores for posttransplant outcome is at best moderate. No single histological lesion or composite score is sufficiently robust to be included in algorithms for kidney discard. Dual kidney transplantation has been based on histological assessment of zero-time biopsies and improves outcome in individual patients, but the waitlist effects of this strategy remain obscure. Zero-time biopsies are valuable for clinical and translational research purposes, providing insight in risk factors for posttransplant events, and as baseline for comparison with posttransplant histology. Themolecular phenotype of zero-time biopsies yields novel therapeutic targets for improvement of donor selection, peritransplant management and kidney preservation. It remains however highly unclear whether the molecular expression variation in zero-time biopsies could become a better predictor for posttransplant outcome than donor/recipient baseline demographic factors.

39. Significance of Preimplantation Analysis of Kidney Biopsies From Expanded Criteria Donors in Long-Term Outcome
Navarro MD, López-Andréu M, Rodríguez-Benot A et al.
Transplantation 2011;91: 432–439

ABSTRACT
Background. The shortage of organs has led to expanding the criteria for donors. Histologic evaluations before transplantation may enable the identification of organs unsuitable for single

implantation. The aim of this study was to evaluate the histologic findings as prognostic factors of allograft survival from expanded criteria donors (ECDs).
Methods. We included a cohort of 136 single transplantations with kidneys from ECD and correlated the preimplantation pathologic findings with graft failure. Renal structures from ECD older (n=104) or younger (n=32) than 60 years were evaluated histologically for renal senescence and rated with a total histologic score. A multivariate Cox analysis was performed to identify predictors of graft failure.
Results. Glomerulosclerosis was the most prevalent lesion in biopsies from donors older and younger than 60 years (*P*=0.002); interstitial fibrosis was more severe in biopsies from older donors (*P*=0.001); older donors showed a higher prevalence of tubular atrophy (*P*=0.022), and vascular compartment showed no significant differences. Kidney biopsy based scoring system ranged from 0 to 15 points, indicating the presence of changes in the renal parenchyma. Biopsies with total histologic scores less than or equal to 5 showed significantly better 5-year graft survival than those with scores more than 5 (*P*<0.001). A preimplantation score more than 5 points remained an independent predictor of graft failure (hazard ratio 6.95; 95% confidence interval 1.57–30).
Conclusions. Histologic analysis of kidney biopsies before transplantation is a valuable tool for facilitating the selection of viable grafts from ECD donors. When the total score is more than 5, single kidney transplantation from ECD should not be recommended for patients similar to this study population.

40. Pre-implantation analysis of kidney biopsies from expanded criteria donors: testing the accuracy of frozen section technique and the adequacy of their assessment by on-call pathologists

Sagasta A, Sánchez-Escudero A, Oppenheimer F et al.
ESOT 29 (2016) 234–240.

ABSTRACT
Pre-implantation renal biopsies of expanded criteria donors are one of the criteria used for allocation decisions, but there are concerns about the impact of the interobserver variability and the technique to be used. The aim was (i) to compare the original report performed by on-call pathologists using frozen sections (FS) to a retrospective analysis carried out by a trained pathologist using the same frozen section, and (ii) to compare the same FS to subsequently obtained paraffin sections (PS) by the same pathologist. A total of 92 biopsies, 78 from transplanted and 14 from nontransplanted cases, were analyzed. Agreement between observers using the same FS was weaker than the correlation between FS and PS in all the examined parameters (Kendall0s Tau b for the Remuzzi score 0.104 vs. 0.306). According to the Remuzzi score, the revised FS analysis would have resulted in a higher rate of organ discard (n = 19) than PS (n = 14) and the original report (n = 6). However, kidneys that would have been discarded according to the retrospective analysis showed adequate outcomes in terms of graft survival and function. Accordingly, the impact of interobserver and technique-related variability can be minimized by the use of a relatively low threshold (RS ≤ 4) for organ acceptance.

41. Histopathological evaluation of pretransplant donor biopsies in expanded criteria donors with high kidney donor profile index: a retrospective observational cohort study

Sánchez-Escudero A, Sagasta A, Revuelta I et al.

Transplant International 2017; 30: 975–986.

ABSTRACT

There is no consensus on the allocation of renal transplants from expanded criteria donors (ECD). The Kidney Donor Profile Index (KDPI) is used without the need for pretransplant donor biopsies (PTDB). We explored whether PTDB based on Remuzzi Score (RS) allows identification of those marginal kidneys in the highest calculated KDPI risk group (>91%) that appropriate for single transplantation. A retrospective study was conducted of 485 consecutive kidneys procured from a single center and transplanted if the RS was ≤4. We compared 5-year kidney and patients survival between KDPI groups and between RS <4 or =4 in the highest KDPI group. The median KDPI (interquartile range) was 71 (66–76) for KDPI <80% (n = 77), 86 (81–90) for KDPI 81–90% (n = 82), and 97 (94–100) for KDPI >91% (n = 205). Patient survival at 5 years was 85.7%, 85.3%, and 76.09% (P = 0.058) and death-censored graft survival was 84.4%, 86.5%, 73.6% (P = 0.015), respectively for each KDPI group. In >91% calculated KDPI group, there were no differences in graft survival depending on the RS (<4 vs. =4) (P = 0.714). The implementation of PTDB based on RS used for allocation of organs with the highest KDPI range could support to the acceptance of suitable organs for single transplantation with good patient and graft survival rate.

42. Pretransplant Biopsy of Marginal Kidneys: Is It Necessary?

Teixeira AC, Ferreira E, Marques MG et al.

Transplantation Proceedings, 51, 1585-1589 (2019).

ABSTRACT

INTRODUCTION: Pretransplant kidney biopsy from marginal donors is used to guide the decision of whether to accept or discard organs for transplantation; however, there is controversy about this procedure, and the need for a pretransplant biopsy is still a debate. We sought to determine if histologic evaluation before implantation of marginal kidneys would influence the outcome.

METHODS: A retrospective observational cohort study of marginal donor transplants at Centro Hospitalar e Universitário de Coimbra was done. From 2009 to 2016, 650 marginal kidney transplants were analyzed. We evaluated longterm graft survival in a cohort of patients who received marginal kidneys. The recipients were divided into 2 groups based on whether a pretransplant donor biopsy was performed. Continuous variables were summarized by mean and standard deviation or median and range, as applicable. Categorical variables were summarized by relative and absolute frequencies. The survival analysis was obtained and plotted using the Kaplan-Meier method and compared with the log-rank test.

RESULTS: The median age of recipients and donors were statistically different between both groups (P < .001), with the donors and the recipients being younger in the group without a pretransplant biopsy. The median cold ischemia time was higher in the biopsy group (P = .01). The survival analysis showed that graft survival didn't differ between the groups (P = .2).

CONCLUSIONS: Selection of kidneys based on histological findings may not influence the graft survival and implies a higher cold ischemia time. More data are necessary to provide insight into which clinical, histologic, and biochemical parameters are necessary for decision making on kidney acceptance.

43. The Predictive Value of Kidney Allograft Baseline Biopsies for Long-Term Graft Survival
De Vusser K, Lerut E, Kuypers E et al.
J Am Soc Nephrol 24: 1913–1923, 2013.

ABSTRACT
The effect of baseline histology and individual histologic lesions at the time of transplantation on longterm graft survival has been evaluated using different scoring systems, but the predictive capacity of these systems has not been adequately validated. All kidney recipients transplanted in a single institution between 1991 and 2009 who underwent a baseline kidney allograft biopsy at transplantation were included in this prospective study (N=548). All baseline biopsies were rescored according to the updated Banff classification, and the relationship between the individual histologic lesions and donor demographics was assessed using hierarchical clustering and principal component analysis. Survival analysis was performed using Cox proportional hazards analysis and log-rank testing. Mean follow-up time was 6.7 years after transplantation. Interstitial fibrosis, tubular atrophy, and glomerulosclerosis associated significantly with death-censored graft survival, whereas arteriolar hyalinosis and vascular intimal thickening did not. Notably, donor age correlated significantly with interstitial fibrosis, tubular atrophy, and glomerulosclerosis and associated independently with graft survival. On the basis of these findings, a novel scoring system for prediction of 5-year graft survival was constructed by logistic regression analysis. Although the predictive performance of previously published histologic scoring systems was insufficient to guide kidney allocation in our cohort (receiver operating characteristic area under the curve#0.62 for each system), the new system based on histologic data and donor age was satisfactory for prediction of allograft loss (receiver operating characteristic area under the curve = 0.81) and may be valuable in the assessment of kidney quality before transplantation.

44. The Donor Kidney Biopsy and Its Implications in Predicting Graft Outcomes: A Systematic Review
Wang CJ, Wetmore JB, Crary GS et al.
American Journal of Transplantation 2015; 15: 1903–1914.

ABSTRACT
Despite a growing organ shortage in the United States, many deceased donor kidneys removed for transplantation are discarded. Kidney biopsy findings often play a role in these discards, although it is not clear whether biopsies reliably inform acceptance decisions. Therefore, we carried out a systematic review of the medical literature on the utility of both procurement and implantation biopsies for predicting posttransplant outcomes. Between January 1, 1994 and July 1, 2014, 47 studies were published in the English language literature that examined the association between pretransplant donor biopsy findings from 50 or more donors (with more than half being from deceased donors) and either posttransplant graft failure, delayed graft function, or graft function. In general, study quality was poor. All were retrospective or did not indicate if they were prospective. Results were heterogeneous, with authors as often as not concluding that biopsy results did not predict posttransplant outcomes. The percent glomerular sclerosis was most often examined, and failed to predict graft failure in 7 of 14 studies. Of 15 semiquantitative scoring systems proposed, none consistently predicted posttransplant outcomes across studies. Routine use of biopsies to help determine whether or not to transplant a kidney should be reexamined.

45. The role of procurement biopsies in acceptance decisions for kidneys retrieved for transplant.

Kasiske BL, Stewart DE, Bista BR, et al.

Clin J Am Soc Nephrol. 2014; 9: 562-71

ABSTRACT

BACKGROUND AND OBJECTIVES: There is a shortage of kidneys for transplant, and many patients on the deceased donor kidney transplant waiting list would likely benefit from kidneys that are currently being discarded. In the United States, the most common reason given for discarding kidneys retrieved for transplant is procurement biopsy results. This study aimed to compare biopsy results from discarded kidneys with discard attributed to biopsy findings, with biopsy results from comparable kidneys that were successfully transplanted.

DESIGN, SETTING, PARTICIPANTS, & MEASUREMENTS: In this retrospective, observational, case-control study, biopsy reports were examined from 83 kidneys discarded in 2010 due to biopsy findings (cases), 83 contralateral transplanted kidneys from the same donor (contralateral controls), and 83 deceased donors randomly matched to cases by donor risk profile (randomly matched controls). A second procurement biopsy was obtained in 64 of 332 kidneys (19.3%).

RESULTS: The quality of biopsy reports was low, with amounts of tubular atrophy, interstitial inflammation, arteriolar hyalinosis, and acute tubular necrosis often not indicated; 69% were wedge biopsies and 94% used frozen tissue. The correlation between first and second procurement biopsies was poor; only 25% of the variability (R(2)) in glomerulosclerosis was explained by biopsies being from the same kidney. The percentages of glomerulosclerosis overlapped substantially between cases, contralateral controls, and randomly matched controls: 17.1%±15.3%, 9.0%±6.6%, and 5.0%±5.9%, respectively. Of all biopsy findings, only glomerulosclerosis>20% was independently correlated with discard (cases versus contralateral controls; odds ratio, 15.09; 95% confidence interval, 2.47 to 92.41; P=0.003), suggesting that only this biopsy result was used in acceptance decisions. One-year graft survival was 79.5% and 90.7% in contralateral and randomly matched controls, respectively, versus 91.6% among all deceased donor transplants in the Scientific Registry of Transplant Recipients.

46. A simple clinico-histopathological composite scoring system is highly predictive of graft outcomes in marginal donors.

Anglicheau D, Loupy A, Lefaucheur C, et al

Am J Transplant 2008;8(11):2325-34.

ABSTRACT

The predictive value of pre-implantation biopsies versus clinical scores has not been studied extensively in marginal donors. Pre-implantation biopsies were performed in 313 kidneys from donors that were > or = 50 years of age (training set, n = 191; validation set, n = 122). The value of the donor clinical parameters and histological results in predicting 1-year estimated glomerular filtration rate (eGFR) <25 mL/min/1.73 m(2) was retrospectively evaluated. In multivariate analysis, the only clinical parameters associated with low eGFR were donor hypertension and a serum creatinine level > or =150 micromol/L before organ recovery. Clinical scores (Nyberg and Pessione) were not significantly associated with graft function. Regarding histological parameters, univariate analysis showed that glomerulosclerosis (GS) (p = 0.02), arteriolar hyalinosis (p = 0.03) and the Pirani (p = 0.02) and chronic allograft damage index (CADI) (p = 0.04) histological scores

were associated with low eGFR. The highest performance in predicting low eGFR was achieved using a composite score that included donor serum creatinine (> or =150 micromol/L or <150 micromol/L), donor hypertension and GS (> or =10% or <10%). The validation set confirmed the critical importance of taking into account biopsy and clinical parameters during marginal donor evaluation. In conclusion, clinical scores are weak predictors of graft outcomes with marginal donors. Instead, a simple and convenient composite score strongly predicts graft function and survival and may facilitate optimal allocation of marginal donors.

47. The prognostic utility of deceased donor implantation biopsy in determining function and graft survival after kidney transplantation.
Cockfield SM, Moore RB, Todd G, Solez K, Gourishankar S.
Transplantation 2010;89(5):559-66.

ABSTRACT
BACKGROUND: Uncertainty remains in the prognostic utility of biopsies of deceased donor kidneys in predicting graft outcomes.
METHODS: We examined implantation biopsies for 730 kidney transplant recipients from 491 deceased donors from 1990 to 2004. The median follow-up time was 5.1 years. Of the 730 transplants, 633 (86.7%) had implantation biopsies (wedge 89.1%). Of these 633, 541 (85.5%) could be assessed for % glomerulosclerosis (GS), interstitial fibrosis, tubular atrophy, arteriolar hyalinosis, and fibrous intimal thickening. Independent risk factors for delayed graft function include regraft, longer cold ischemia time, and DR mismatch, but not donor age. Independent risk factors for worse function at 6 months include regraft, older donor and recipient, female donor and recipient, and rejection. Independent risk factors of graft failure include regraft, older donor age, male recipient, and rejection.
RESULTS: Of the histologic scores, arteriolar hyalinosis was independently associated with delayed graft function and graft loss, whereas fibrous intimal thickening was associated with decreased 6-month renal function. Importantly, the degree of GS was not independently associated with outcomes.
CONCLUSIONS: Therefore, although biopsy evidences of vascular pathologic condition, kidney may contribute meaningfully to the assessment of donor quality but the degree of GS does not.

48. Long-term results of biopsy-guided selection and allocation of kidneys from older donors in older recipients.
Fernandez-Lorente L, Riera L, Bestard O et al.
Am J Transplant 2012;12(10):2781-8.

ABSTRACT
In our old-for-old program, we discard or allocate older extended criteria donor kidneys to single (SKT) or dual kidney transplantation (DKT) depending on histological Remuzzi's score in recipients older than 60 years. Here, we analyze the long-term results of this program and try to identify independent predictors of patient and graft survival. Between December 1996 and January 2008, we performed 115 SKT and 88 DKT. Discard rate was 15%. Acute rejection incidence was higher in SKT than in DKT (22.6% vs. 11.4%, p = 0.04). Renal function was better in DKT than in SKT up to 5 years after transplantation.

Surgical complications were frequent in DKT. Ten-year cumulative graft survival was significantly lower in the SKT group (31% vs. 53%, p = 0.03). In SKT, histological score 4 provided similar graft survival than 3 or less, whereas in DKT score 4, 5 or 6 displayed similar outcome. Finally, independent predictors of graft survival were history of major adverse cardiac event and 1-year serum creatinine, rather than SKT or DKT. In conclusion, this biopsy-guided old-for-old strategy resulted in acceptable long-term graft survival. Our results suggest that DKT should be considered for scores of 5 or 6 only.

49. Improving the prediction of donor kidney quality: deceased donor score and resistive indices.

Nyberg SL, Baskin-Bey ES, Kremers W, et al.
Transplantation. 2005 Oct 15;80(7):925-9.

ABSTRACT

BACKGROUND: The deceased donor score (DDS), expanded criteria donor (ECD) definition, and resistive index (RI) were developed for pretransplant evaluation of donors. DDS and ECD are determined by a calculation of risk from donor variables, while RI is determined from flow characteristics of kidneys during machine preservation (MP). This study was designed to compare DDS, ECD status, and RI as predictors of outcome after deceased donor transplantation. We were also interested to see if DDS or ECD could identify kidneys most likely to benefit from MP.
METHODS: We retrospectively reviewed 48,952 deceased donor renal transplants reported to UNOS from 1997-2002. DDS (0-39 pts.), ECD status (+ or -), and preservation technique (MP vs. cold storage [CS]) were determined in all cases. RI during MP was studied in a single-center cohort of 425 transplants.
RESULTS: DDS was superior to ECD status and RI in its correlation with early and late renal function after transplantation. DDS identified a subgroup of ECD- kidneys, those with DDS > or = 20 pts, that functioned significantly below expectation and similar to ECD+ kidneys. Benefits of MP, which include improved early graft function and a trend towards longer graft survival, were greatest in the group of kidneys with DDS > or = 20 pts.
CONCLUSIONS: DDS was the best predictor of outcome after deceased donor renal transplantation and may be useful in identifying kidneys most likely to benefit from MP.

1.3 SISTEMAS DE PRESERACIÓN Y OTROS TRATAMIENTOS PERITRASPLANTE (NO FARMACOLÓGICOS Y FARMACOLÓGICOS)

50. Attenuating Ischemia-Reperfusion Injury in Kidney Transplantation by Perfusing Donor Organs With siRNA Cocktail Solution

Zheng X, Zang G, Jiang J, et al.
Transplantation 2016;100: 743–752.

ABSTRACT
BACKGROUND: Ischemia-reperfusion (I/R) injury is the major cause of delayed renal graft function in kidney transplantation. To date, there are no effective therapeutic approaches for preventing I/R injury. We previously reported that treatment of animals with small interference RNA (siRNA) would prevent warm I/R injury in nontransplant models and cold I/R injury in heart transplantation. In the present study, we further explore the feasibility of protecting grafts from extended cold I/R injury as applied to kidney transplantation by downregulating I/R-associated genes using siRNA.
METHODS: Donor kidneys were intra-arterially perfused with siRNA containing solution during donor excision and preserved in siRNA containing solution. The siRNA-treated donor organs were then implanted into syngeneic recipient mice, and the 2 original kidneys were removed from the recipient. The effect of siRNA solution on extended cold I/R injury was determined by assessing renal function, histopathological change, cell apoptosis, and inflammation.
RESULTS: The perfused siRNA solution knocked down the expression of complement 3, RelB, and Fas in the kidney at the mRNA and protein levels. Administration of siRNA solution reduced the levels of blood urea nitrogen and serum creatinine as compared with control groups. The siRNA cocktail decreased cell apoptosis and histopathological changes in the kidney and prolonged graft survival. The siRNA cocktail also reduced the expression of proinflammatory cytokines, IL-6, and TNFα.
CONCLUSIONS: In conclusion, this is the first demonstration that perfusing donor organs with an siRNA cocktail solution can induce gene silencing in the kidney and prevent kidneys from extended cold I/R injury in kidney transplantation, highlighting the promise of the clinical application of siRNA-based therapies in the preservation of donor organs.

51. Effects of Dopamine Donor Pretreatment on Graft Survival after Kidney Transplantation: A Randomized Trial

Kaths JM, Echeverri J, Chun YM, et al.
Clin J Am Soc Nephrol 12: 493–501, 2017.

ABSTRACT
BACKGROUND AND OBJECTIVES: Donor dopamine improves initial graft function after kidney transplantation due to antioxidant properties. We investigated if a 4mg/kg per minute continuous dopamine infusion administered after brain-death confirmation affects long-term graft survival and examined the exposure-response relationship with treatment duration.
DESIGN, SETTING, PARTICIPANTS, & MEASUREMENTS: Five-year follow-up of 487 renal transplant patients from 60 European centers who had participated in the randomized, multicenter trial of dopamine donor pretreatment between 2004 and 2007 (ClinicalTrials.gov identifier: NCT00115115).

RESULTS: Follow-up was complete in 99.2%.Graft survival was 72.6%versus 68.7% (*P*=0.34), and 83.3% versus 80.4% (*P*=0.42) after death-censoring in treatment and control arms according to trial assignment. Although infusion times varied substantially in the treatment arm (range 0–32.2 hours), duration of the dopamine infusion and all cause graft failure exhibited an exposure-response relationship (hazard ratio, 0.96; 95% confidence interval [95% CI], 0.92 to 1.00, per hour). Cumulative frequency curves of graft survival and exposure time of the dopamine infusion indicated a maximum response rate at 7.10 hours (95% CI, 6.99 to 7.21),which almost coincided with the optimum infusion time for improvement of early graft function (7.05 hours; 95%CI, 6.92 to 7.18). Taking infusion time of 7.1 hours as threshold in subsequent graft survival analyses indicated a relevant benefit: Overall, 81.5% versus 68.5%; P=0.03; and 90.3% versus 80.2%; *P*=0.04 after death-censoring.
CONCLUSIONS: We failed to show a significant graft survival advantage on intention-to-treat. Dopamine infusion time was very short in a considerable number of donors assigned to treatment. Our finding of a significant, nonlinear exposure-response relationship disclosed a threshold value of the dopamine infusion time that may improve long-term kidney graft survival.

52. Eight-Hour Continuous Normothermic Ex Vivo Kidney Perfusion Is a Safe Preservation Technique for Kidney Transplantation: A New Opportunity for the Storage, Assessment, and Repair of Kidney Grafts

Kaths JM, Echeverri J, Goldaracena N, et al.
Transplantation 2016;100: 1862–1870

ABSTRACT
BACKGROUND: Hypothermic kidney storage causes preservation injury and is poorly tolerated by renal grafts. We investigated whether static cold storage (SCS) can be safely replaced with a novel technique of pressure-controlled normothermic ex vivo kidney perfusion (NEVKP) in heart-beating donor kidney transplantation.
METHODS: Right kidneys were removed from30 kg Yorkshire pigs in a model of heart-beating donation and either preserved in cold histidine-tryptophan-ketoglutarate solution for 8 hours (n = 5), or subjected to 8 hours of pressure-controlled NEVKP (n = 5) followed by renal heterotopic autotransplantation.
RESULTS: During NEVKP, physiologic perfusion conditions were maintained with low intrarenal resistance and normal electrolyte and pH parameters. Aspartate aminotransferase and lactate dehydrogenase as injury markers were below the detectable analyzer range (<4 and <100 U/L, respectively). Perfusate lactate concentration decreased from baseline until the end of perfusion (10.38 ± 0.76 mmol/L vs 1.22 ± 0.26 mmol/L; P < 0.001). Posttransplantation, animals transplanted with NEVKP versus SCS grafts demonstrated similar serum creatinine peak levels (NEVKP, 2.0 ± 0.5 vs SCS 2.7 ± 0.7 mg/dL; *P* = 0.11) and creatinine clearance on day 10 (NEVKP, 65.9 ± 18.8 mL/min vs SCS 61.2 ± 15.6 mL/min; *P* = 0.74). After 10 days of follow-up, animals transplanted with NEVKP grafts had serum creatinine and blood urea nitrogen values comparable to their basal levels (*P* = 0.49 and *P* = 0.59), whereas animals transplanted with SCS grafts had persistently elevated serum creatinine and blood urea nitrogen when compared with basal levels (P = 0.01 and P = 0.03).
CONCLUSIONS: Continuous pressure-controlled NEVKP is feasible and safe in good quality heart beating donor kidney grafts. It maintains a physiologic environment and excellent graft function ex vivo during preservation without causing graft injury.

53. Ex-vivo machine perfusion for kidney preservation
Hamar M and Selzner M.
Curr Opin Organ Transplant 2018, 23:369–374

PURPOSE OF REVIEW: Machine perfusion is a novel strategy to decrease preservation injury, improve graft assessment, and increase organ acceptance for transplantation. This review summarizes the current advances in ex-vivo machine-based kidney preservation technologies over the last year.
RECENT FINDINGS: Ex-vivo perfusion technologies, such as hypothermic and normothermic machine perfusion and controlled oxygenated rewarming, have gained high interest in the field of organ preservation. Keeping kidney grafts functionally and metabolically active during the preservation period offers a unique chance for viability assessment, reconditioning, and organ repair. Normothermic ex-vivo kidney perfusion has been recently translated into clinical practice. Preclinical results suggest that prolonged warm perfusion appears superior than a brief end-ischemic reconditioning in terms of renal function and injury. An established standardized protocol for continuous warm perfusion is still not available for human grafts.
SUMMARY: Ex-vivo machine perfusion represents a superior organ preservation method over static cold storage. There is still an urgent need for the optimization of the perfusion fluid and machine technology and to identify the optimal indication in kidney transplantation. Recent research is focusing on graft assessment and therapeutic strategies.

54. Advances in organ preservation for transplantation
Hameed AM, Hawthorne WJ and Pleass HC.
ANZ J Surg 87 (2017) 976–980

ABSTRACT
Organ transplantation provides the best available therapy for a myriad of medical conditions, including end-stage renal disease, hepatic failure and type I diabetes mellitus. The current clinical reality is, however, that there is a significant shortage of organs available for transplantation with respect to the number of patients on organ waiting lists. As such, methods to increase organ supply have been instituted, including improved donor management, organ procurement and preservation strategies, living organ donation, transplantation education and the increased utilization of donation after circulatory death and expanded criteria donors. In particular, especially over the last decade, we have witnessed a significant change in the way donor organs are preserved, away from static cold storage methods to more dynamic techniques centred on machine perfusion (MP). This review highlights the current state and future of organ preservation for transplantation, focusing on both abdominal and thoracic organs. In particular, we focus on MP preservation of renal, hepatic, pancreatic, cardiac and lung allografts, also noting relevant advances in Australasia. MP of organs after procurement holds considerable promise, and has the potential to significantly improve graft viability and function post-transplantation, especially in donors in whom acceptance criteria have been expanded.

55. Ex vivo normothermic perfusion for quality assessment of marginal donor kidney transplants
Hosgood SA, Barlow AD, Hunter JP, et al.
Br J Surg 2015; 102(Suppl 5): 1–2

ABSTRACT
BACKGROUND: A significant proportion of kidneys procured for transplantation are discarded because of concerns about their suitability. In this study ex vivo normothermic perfusion (EVNP) was used as a quality assessment device before renal transplantation.
METHODS: Seventy-four human kidneys deemed unsuitable for transplantation following retrieval underwent 60 min of EVNP with an oxygenated red cell-based solution at 36°C. Receiver operating characteristic (ROC) curves were used to identify thresholds of renal blood flow and urine output. These thresholds and a grading of macroscopic appearance were incorporated into an EVNP assessment score (highest quality, 1; lowest, 5). This was applied to a series of 36 kidneys transplanted after EVNP.
RESULTS: In the discarded kidney series, 60 (81 per cent) scored 1-4 and 14 (19 per cent) scored 5. Although none of these kidneys was transplanted, those with a score from 1 to 4 were considered suitable for transplantation. In the 36 transplanted kidneys, the score ranged between 1 and 3 (score 1, 17; score 2, 11; score 3, 8). All of these kidneys were transplanted without any complications or primary non-function. The delayed graft function rate was 6 per cent (1 of 17) in kidneys scoring 1, 0 per cent (0 of 11) in those scoring 2 and 38 per cent (3 of 8) in those scoring 3 (P = 0·024). The mean(s.d.) estimated glomerular filtration rate at 12 months was 51(16), 63(15) and 38(21) ml in kidneys scoring 1, 2 and 3 respectively (P = 0·015).
CONCLUSION: EVNP combined with a simple scoring system is an innovative technology for pretransplant assessment of kidney quality and acceptability for transplantation. This study suggests that a high percentage of retrieved kidneys are being discarded unnecessarily.

56. Hypothermic machine perfusion of kidneys retrieved from standard and high-risk donors
Jochmans I, O'Callaghan JM, Pirenne J, et al.
Transpl Int. 2015 Jun;28(6):665-76.

ABSTRACT
Hypothermic machine perfusion (HMP) of kidneys is a long-established alternative to static cold storage and has been suggested to be a better preservation method. Today, as our deceased donor profile continues to change towards higher-risk kidneys of lower quality, we are confronted with the limits of cold storage. Interest in HMP as a preservation technique is on the rise. Furthermore, HMP also creates a window of opportunity during which to assess the viability and quality of the graft before transplantation. The technology might also provide a platform during which the graft could be actively repaired, making it particularly attractive for higher-risk kidneys. We review the current evidence on HMP in kidney transplantation and provide an outlook for the use of the technology in the years to come.

57. Normothermic Ex Vivo Kidney Perfusion for the Preservation of Kidney Grafts prior to Transplantation
Jochmans I, O'Callaghan JM, Pirenne J, et al.
J Vis Exp. 2015 Jul 15;(101)

ABSTRACT
Kidney transplantation has become a well-established treatment option for patients with end-stage renal failure. The persisting organ shortage remains a serious problem. Therefore, the acceptance criteria for organ donors have been extended leading to the usage of marginal kidney grafts. These marginal organs tolerate cold storage poorly resulting in increased preservation injury and higher rates of delayed graft function. To overcome the limitations of cold storage, extensive research is focused on alternative normothermic preservation methods.
Ex vivo normothermic organ perfusion is an innovative preservation technique. The first experimental and clinical trials for *ex vivo* lung, liver, and kidney perfusions demonstrated favorable outcomes.
In addition to the reduction of cold ischemic injury, the method of normothermic kidney storage offers the opportunity for organ assessment and repair. This manuscript provides information about kidney retrieval, organ preservation techniques, and isolated *ex vivo* normothermic kidney perfusion (NEVKP) in a porcine model. Surgical techniques, set up for the perfusion solution and the circuit, potential assessment options, and representative results are demonstrated.

58. The Benefits of Hypothermic Machine Preservation and Short Cold Ischemia Times in Deceased Donor Kidneys

Kox J, Moers C, Monbaliu D et al.

Transplantation. 2018 Aug;102(8):1344-1350

ABSTRACT
BACKGROUND: Hypothermic machine perfusion (HMP) of deceased donor kidneys is associated with better outcome when compared to static cold storage (CS). Nevertheless, there is little evidence whether kidneys with short cold ischemia time (CIT) also benefit from HMP and whether HMP can safely extend CIT.
METHODS: We analyzed prospectively collected data from the Machine Preservation Trial, an international randomized controlled trial. Seven hundred fifty-two consecutive renal transplants were included: 1 kidney of each of the 376 donors was preserved by HMP, the contralateral organ was preserved by CS.
RESULTS: The mean CIT was 3:05 PM (SD, 4:58 AM). A subgroup analysis was performed, groups were based on CIT duration: 0 to 10 hours, 10 to 15 hours, 15 to 20 hours, or 20 hours or longer. Delayed graft function (DGF) incidence in the subgroup with up to 10 hours CIT was 6.0% (N = 3/50) in the HMP arm and 28.1% (N = 18/64) in the CS arm (univariable P = 0.002; multivariable odds ratio [OR], 0.02; P = 0.007). Cold ischemia time remained an independent risk factor for DGF for machine perfused kidneys recovered from donation after brain death donors (OR, 1.06; 95% confidence interval [CI], 1.017-1.117; P = 0.008), donation after circulatory death donors (OR, 1.13; 95% CI, 1.035-1.233; P = 0.006) and expanded criteria donors (OR, 1.14; 95% CI, 1.057-1.236; P = 0.001).
CONCLUSIONS: In conclusion, HMP resulted in remarkably lower rates of DGF in renal grafts that were transplanted after a short CIT. Also, CIT remained an independent risk factor for DGF in HMP-preserved kidneys.

59. Machine perfusion versus cold storage for the preservation of kidneys from donors ≥65 years allocated in the Eurotransplant Senior Programme

Gallinat A, Moers C, Treckmann J, et al.

Nephrol Dial Transplant (2012) 27: 4458–4463

ABSTRACT

BACKGROUND: In the Eurotransplant Senior Programme (ESP), kidneys from donors aged ≥65 years are preferentially allocated locally and transplanted into patients aged ≥65 years on dialysis. The purpose of this study was to analyse whether the results of transplantation in the ESP can be improved by preservation of organs by hypothermic machine perfusion (MP) compared with simple cold storage (CS).

METHODS: Overall, 85 deceased heart-beating donors ≥65 years of age were included in this analysis with follow-up until 1 year post-transplant. For each donor, one kidney was randomly assigned to preservation by CS and the contralateral kidney to MP from organ procurement until transplantation. Delayed graft function (DGF), primary non-function (PNF) and 1-year patient and graft survival rates were evaluated as primary and secondary endpoints.

RESULTS: The median recipient age was 66 years in both groups and the median cold ischaemia time was 11 h for MP and 10.5 h for CS (P = 0.69). The DGF rate was 29.4% for MP and 34.1% for CS (P = 0.58). Only extended duration of cold ischaemia time was an independent risk factor for the development of DGF (odds ratio 1.2, P <0.0001). PNF was significantly reduced (3.5% MP versus 12.9% CS, P = 0.02). The 1-year patient and graft survival rates were similar for MP and CS (94% versus 95% and 89 versus 81%, P > 0.05). The 1-year graft survival rate was significantly improved after MP in recipients who developed DGF (84% MP versus 48% CS, P = 0.01).

CONCLUSIONS: Continuous pulsatile hypothermic MP for kidneys from donors aged ≥65 years can reduce the rate of never-functioning kidneys and improve the 1-year graft survival rate of kidneys with DGF. In this small cohort, the known advantage of MP for the reduction of DGF could not be confirmed, possibly due to relatively short cold ischaemia times.

60. Machine perfusion in kidney transplantation

Kataria A, Maggon S Makkar B, et al.

Curr Opin Organ Transplant 2019, 24:000–000

ABSTRACT

PURPOSE OF REVIEW: The shortage of kidneys for transplantation has led to an urgent need to efficiently utilize the available cadaveric kidneys. Efficient use of machine perfusion may potentially lead to increased use of marginal kidneys by lowering the incidence of delayed graft function (DGF) and improving graft outcomes.

RECENT FINDINGS: Machine perfusion has had a resurgence in the last 10–15 years over static cold storage (SCS). Hypothermic machine perfusion (HMP), the most commonly utilized type of machine perfusion reduces the rates of DGF when compared with SCS with 4 trend towards improving the overall graft survival.

SUMMARY: Despite reduction in the rates of DGF by HMP, its effect on long-term renal and patient outcomes is not clearly known. There is limited clinical literature in the use of normothermic machine perfusion (NMP) but a few pilot studies have shown its potential to resuscitate commonly discarded kidneys. In addition to preservation, machine perfusion also

allows for various diagnostic and therapeutic interventions during the preservation period to assess and optimize the viability of the procured kidney.

61. Kidney transplantation after oxygenated machine perfusion preservation with Custodiol-N solution

Minor T, Paul A, Efferz P, et al.
Transpl Int. 2015 Sep;28(9):1102-8.

ABSTRACT
Custodiol-N, a new preservation solution, has been shown particularly suitable for hypothermic machine perfusion preservation (HMP) in isolated porcine kidneys. These preliminary results should be confirmed in an actual transplant model in vivo. Kidney function after 21 h of HMP was studied in an autotransplant model using Landrace pigs (25-30 kg; n = 6 per group). Perfusion was performed with oxygenated perfusate, using either Custodiol-N solution including 50 g/l dextran 40 (CND) or kidney perfusion solution 1 (KPS-1) as gold standard. Viability of the grafts was followed for 1 week after bilateral nephrectomy in the recipient pigs. HMP with CND resulted in less acute tubular injury, evaluated by levels of fatty acid-binding protein and better clearance function during the first 24 h after Tx than with KPS-1 ($P < 0.05$, resp.). Serum creatinine tended to be lower in the CND group during the whole observation period. Histological tissue scores one week after Tx were similar in both groups. Expression of endothelin-1 as well as of Toll-like receptor 4 15 min after reperfusion was lower in the CND group ($P < 0.05$), suggesting less endothelial stress response. The data provide first in vivo evidence for the suitability of Custodiol-N as an effective perfusate for renal machine perfusion.

62. Role of temperature in reconditioning and evaluation of cold preserved kidney and liver grafts

Minor T, von Horn C and Paul A.
Curr Opin Organ Transplant 2017, 22:267–273

ABSTRACT
PURPOSE OF REVIEW: Organ shortage in transplantation medicine forces surgical research toward the development of more efficient approaches in organ preservation to enable the application of 'less than optimal' grafts. This review summarizes current techniques aiming to recondition cold-stored organ grafts prior to transplantation to reduce reperfusion-induced tissue injury and improve postimplantation graft function.
RECENT FINDINGS: End-ischemic reconditioning has classically been attempted by cold oxygenated perfusion. By contrast, evaluation of graft performance prior to transplantation might be facilitated by perfusion at higher temperatures, ideally at normothermia. A drastic temperature shift from cold preservation to warm perfusion, however, has been incriminated to trigger a so-called rewarming injury associated with mitochondrial alterations. A controlled gradual warming up during machine perfusion could enhance the restitution of cellular homeostasis and improve functional outcome upon warm reperfusion.
SUMMARY: Machine perfusion after conventional cold storage is beneficial for ulterior function after transplantation. Cold grafts should be initially perfused at low temperatures allowing for restitution of cellular homeostasis under protective hypothermic limitation of metabolic turnover. Delayed slow rewarming of the organ might further mitigate rewarming injury upon reperfusion

and also increases the predictive power of evaluative measures, taken during pretransplant perfusion.

63. Optimized donor management and organ preservation before kidney transplantation
Mundt HM, Yard BA, Krämer BK et al.
Transplant International 2016; 29: 974–984

ABSTRACT
Kidney transplantation is a major medical improvement for patients with end-stage renal disease, but organ shortage limits its widespread use. As a consequence, the proportion of grafts procured from extended criteria donors (ECD) has increased considerably, but this comes along with increased rates of delayed graft function (DGF) and a higher incidence of immune-mediated rejection that limits organ and patient survival.
Furthermore, most grafts are derived from brain dead organ donors, but the unphysiological state of brain death is associated with significant metabolic, hemodynamic, and pro-inflammatory changes, which further compromise patient and graft survival. Thus, donor interventions to preserve graft quality are fundamental to improve long-term transplantation outcome, but interventions must not harm other potentially transplantable grafts. Several donor pretreatment strategies have provided encouraging results in animal models, but evidence from human studies is sparse, as most clinical evidence is derived from single-center or nonrandomized trials. Furthermore, ethical matters have to be considered especially concerning consent from donors, donor families, and transplant recipients to research in the field of donor treatment. This review provides an overview of clinically proven and promising preclinical strategies of donor treatment to optimize long-term results after kidney transplantation.

64. The promise of organ and tissue preservation to transform medicine
Giwa S, Lewis JK, Alvarez L et al.
Nat Biotechnol. 2017 Jun 7;35(6):530-542

ABSTRACT
The ability to replace organs and tissues on demand could save or improve millions of lives each year globally and create public health benefits on par with curing cancer. Unmet needs for organ and tissue preservation place enormous logistical limitations on transplantation, regenerative medicine, drug discovery, and a variety of rapidly advancing areas spanning biomedicine. A growing coalition of researchers, clinicians, advocacy organizations, academic institutions, and other stakeholders has assembled to address the unmet need for preservation advances, outlining remaining challenges and identifying areas of underinvestment and untapped opportunities. Meanwhile, recent discoveries provide proofs of principle for breakthroughs in a family of research areas surrounding biopreservation. These developments indicate that a new paradigm, integrating multiple existing preservation approaches and new technologies that have flourished in the past 10 years, could transform preservation research. Capitalizing on these opportunities will require engagement across many research areas and stakeholder groups. A coordinated effort is needed to expedite preservation advances that can transform several areas of medicine and medical science.

65. Therapeutic Hypothermia in Deceased Organ Donors and Kidney-Graft Function

Miemann CU, Feiner J, Swain S et al.

N Engl J Med 2015;373:405-14.

ABSTRACT

BACKGROUND: Delayed graft function, which is reported in up to 50% of kidney-transplant recipients, is associated with increased costs and diminished long-term graft function. The effect that targeted mild hypothermia in organ donors before organ recovery has on the rate of delayed graft function is unclear.

METHODS: We enrolled organ donors (after declaration of death according to neurologic criteria) from two large donation service areas and randomly assigned them to one of two targeted temperature ranges: 34 to 35°C (hypothermia) or 36.5 to 37.5°C (normothermia). Temperature protocols, which were initiated after authorization was obtained for the organ to be donated and for the donor's participation in the study, ended when organ donors left the intensive care unit for organ recovery in the operating room. The primary outcome was delayed graft function in the kidney recipients, which was defined as the requirement for dialysis during the first week after transplantation. Secondary outcomes were the rates of individual organs transplanted in each treatment group and the total number of organs transplanted from each donor.

RESULTS: The study was terminated early, on the recommendation of an independent data and safety monitoring board, after the interim analysis showed efficacy of hypothermia.

At trial termination, 370 organ donors had been enrolled (180 in the hypothermia group and 190 in the normothermia group). A total of 572 patients received a kidney transplant (285 kidneys from donors in the hypothermia group and 287 kidneys from donors in the normothermia group). Delayed graft function developed in 79 recipients of kidneys from donors in the hypothermia group (28%) and in 112 recipients of kidneys from donors in the normothermia group (39%) (odds ratio, 0.62; 95% confidence interval, 0.43 to 0.92; P = 0.02).

CONCLUSIONS: Mild hypothermia, as compared with normothermia, in organ donors after declaration of death according to neurologic criteria significantly reduced the rate of delayed graft function among recipients. (Funded by the Health Resources and Services Administration; ClinicalTrials.gov number, NCT01680744.)

66. Preservation solutions used during abdominal transplantation: Current status and outcomes

Latchana N, Peck JR, Whitson BA et al.

World J Transplant 2015 December 24; 5(4): 154-164

ABSTRACT

Organ preservation remains an important contributing factor to graft and patient outcomes. During donor organ procurement and transportation, cellular injury is mitigated through the use of preservation solutions in conjunction with hypothermia. Various preservation solutions and protocols exist with widespread variability among transplant centers. In this review of abdominal organ preservation solutions, evolution of transplantation and graft preservation are discussed followed by classification of preservation solutions according to the composition of electrolytes, impermeants, buffers, antioxidants, and energy precursors. Lastly, pertinent clinical studies in the setting of hepatic, renal, pancreas, and intestinal transplantation are reviewed for patient and graft survival as well as financial considerations. In liver transplants there may be some benefit with the use of histidine-tryptophan-ketoglutarate (HTK) over University of Wisconsin solution in

terms of biliary complications and potential cost savings. Renal grafts may experience increased initial graft dysfunction with the use of Euro-Collins thereby dissuading its use in support of HTK which can lead to substantial cost savings. University of Wisconsin solution and Celsior are favored in pancreas transplants given the concern for pancreatitis and graft thrombosis associated with HTK. No difference was observed with preservation solutions with respect to graft and patient survival in liver, renal, and pancreas transplants. Studies involving intestinal transplants are sparse but University of Wisconsin solution infused intraluminally in combination with an intra-vascular washout is a reasonable option until further evidence can be generated. Available literature can be used to ameliorate extensive variation across centers while potentially minimizing graft dysfunction and improving associated costs.

67. Perspectives in Organ Preservation
Maathuis MH1, Leuvenink HG, Ploeg RJ
Transplantation. 2007 May 27;83(10):1289-98.

ABSTRACT
Maintaining organ viability after donation until transplantation is critically important for optimal graft function and survival. To date, static cold storage is the most widely used form of preservation in every day clinical practice. Although simple and effective, it is questionable whether this method is able to prevent deterioration of organ quality in the present era with increasing numbers of organs retrieved from older, more marginal, and even non-heart-beating donors. This review describes principles involved in effective preservation and focuses on some basic components and methods of abdominal organ preservation in clinical and experimental transplantation. Concepts and developments to reduce ischemia related injury are discussed, including hypothermic machine perfusion. Despite the fact that hypothermic machine perfusion might be superior to static cold storage preservation, organs are still exposed to hypothermia induced damage. Therefore, recently some groups have pointed at the beneficial effects of normothermic machine perfusion as a new perspective in organ preservation and transplantation.

68. Organ preservation: from the past to the future
Jing L, Yao L, Zhao M et al.
Acta Pharmacol Sin. 2018 May;39(5):845-857

ABSTRACT
Organ transplantation is the most effective therapy for patients with end-stage disease. Preservation solutions and techniques are crucial for donor organ quality, which is directly related to morbidity and survival after transplantation. Currently, static cold storage (SCS) is the standard method for organ preservation. However, preservation time with SCS is limited as prolonged cold storage increases the risk of early graft dysfunction that contributes to chronic complications. Furthermore, the growing demand for the use of marginal donor organs requires methods for organ assessment and repair. Machine perfusion has resurfaced and dominates current research on organ preservation. It is credited to its dynamic nature and physiological-like environment. The development of more sophisticated machine perfusion techniques and better perfusates may lead to organ repair/reconditioning. This review describes the history of organ preservation,

summarizes the progresses that has been made to date, and discusses future directions for organ preservation.

69. Trends in organ preservation
McLaren AJ, Friend PJ.
Transpl Int. 2003 Oct;16(10):701-8.

ABSTRACT
Organ preservation aims to provide a viable graft with primary function post-transplant. The current basis of preservation for transplantation is static cold storage using specific preservation solutions which minimise cellular swelling and membrane pump activity, thus maintaining cellular ATP levels. The current organ shortage and consequent expansion of donor criteria places even greater reliance on minimising graft injury during preservation. This review focuses on current and future advances in preservation technology. The key areas of advance are additives to preservation solutions, alternatives/adjuncts to preservation solutions including perfluorocarbons. A major area of advance is in the modulation of organs during the storage period. This may be achieved by biochemical additives or genetic manipulation. Machine perfusion technology is improving, and this is discussed together with the recent concept of warm (normothermic) perfusion as an alternative means of preservation. The authors provide an overview over the current methods of organ preservation. Cold storage, effective in the short-term is insufficient for marginal organs, does not allow assessment of viability markers, and provokes ischaemic injury. Potential strategies for minimising ischaemic injury include additives to preservation solutions; the two-layer method with perfluorcarbons and UW solution-at present limited to pancreas preservation; organ modulation; organ preconditioning and genetic modification of organs. In particular, the authors illuminate the potential in a reappraisal of the concept of normothermic perfusion.

70. Hypothermic Machine Preservation in Human Liver Transplantation: The First Clinical Series
Guarrera JV, Henry SD, Samstein B et al.
American Journal of Transplantation 2010; 10: 372–38

ABSTRACT
Hypothermic machine perfusion (HMP) is widely used to preserve kidneys for transplantation with improved results over cold storage (CS). To date, successful transplantation of livers preserved with HMP has been reported only in animal models. In this, the first prospective liver HMP study, 20 adults received HMP preserved livers and were compared to a matched group transplanted with CS livers. HMP was performed for 3–7 h using centrifugal perfusion with Vasosol® solution at 4–6◦C. There were no cases of primary nonfunction in either group. Early allograft dysfunction rates were 5% in the HMP group versus 25% in controls (p = 0.08). At 12months, there were two deaths in each group, all unrelated to preservation or graft function. There were no vascular complications in HMP livers. Two biliary complications were observed in HMP livers compared with four in the CS group. Serum injury markers were significantly lower in the HMP group. Mean hospital stay was shorter in the HMP group (10.9 ± 4.7 days vs. 15.3 ± 4.9 days in the CS group, (p = 0.006). HMP of donor livers provided safe and reliable preservation in this pilot case-controlled series. Further multicenter HMP trials are now warranted.

71. Machine perfusion or cold storage in organ transplantation: indication, mechanisms, and future perspectives

Yuan X, Theruvath AJ, Ge X, et al.

Transpl Int. 2010 Jun;23(6):561-70.

ABSTRACT

Most organs are currently preserved by cold storage (CS) prior to transplantation. However, as more so called marginal donor organs are utilized, machine perfusion has regained clinical interest. Recent studies have demonstrated advantages of pulsatile perfusion over CS preservation for kidney transplantation. However, it remains unclear whether there is a significant benefit of one preservation method over the other in general, or, whether the utilization of particular preservation approaches needs to be linked to organ characteristics. Proposed protective mechanisms of pulsatile perfusion remain largely obscure. It can be speculated that pulsatile perfusion may not only provide nutrition and facilitate the elimination of toxins but also trigger protective mechanisms leading to the amelioration of innate immune responses. Those aspects may be of particular relevance when utilizing grafts with suboptimal quality which may have an increased vulnerability to ischemia/reperfusion injury and compromised repair mechanisms. This review aims to enunciate the principles of organ perfusion and preservation as they relate to indication, aspects of organ protection and to highlight future developments.

72. Organ transplantation: historical perspective and current practice

Watson CJE, Dark JH.

Br J Anaesth. 2012 Jan;108 Suppl 1:i29-42.

ABSTRACT

Over the course of the last century, organ transplantation has overcome major technical limitations to become the success it is today. The breakthroughs include developing techniques for vascular anastomoses, managing the immune response (initially by avoiding it with the use of identical twins and subsequently controlling it with chemical immunosuppressants), and devising preservation solutions that enable prolonged periods of ex vivo storage while preserving function. One challenge that has remained from the outset is to overcome the shortage of suitable donor organs. The results of organ transplantation continue to improve, both as a consequence of the above innovations and the improvements in peri- and postoperative management. This review describes some of the achievements and challenges of organ transplantation.

73. Organ Preservation: Current Concepts and New Strategies for the Next Decade

Guibert EE, Petrenko AY, Balaban CL et al.

Transfus Med Hemother. 2011;38(2):125-142.

ABSTRACT

Organ transplantation has developed over the past 50 years to reach the sophisticated and integrated clinical service of today through several advances in science. One of the most important of these has been the ability to apply organ preservation protocols to deliver donor organs of high quality, via a network of organ exchange to match the most suitable recipient patient to the best available organ, capable of rapid resumption of life-sustaining function in the recipient patient.

This has only been possible by amassing a good understanding of the potential effects of hypoxic injury on donated organs, and how to prevent these by applying organ preservation. This review sets out the history of organ preservation, how applications of hypothermia have become central to the process, and what the current status is for the range of solid organs commonly transplanted. The science of organ preservation is constantly being updated with new knowledge and ideas, and the review also discusses what innovations are coming close to clinical reality to meet the growing demands for high quality organs in transplantation over the next few years.

74. Barriers and Advances in Kidney Preservation

Steichen C, Giraud S, Bon D et al.

Biomed Res Int. 2018 Dec 4;2018:9206257.

ABSTRACT

Despite the fact that a significant fraction of kidney graft dysfunctions observed after transplantation is due to ischemia-reperfusion injuries, there is still no clear consensus regarding optimal kidney preservation strategy. This stems directly from the fact that as of yet, the mechanisms underlying ischemia-reperfusion injury are poorly defined, and the role of each preservation parameter is not clearly outlined. In the meantime, as donor demography changes, organ quality is decreasing which directly increases the rate of poor outcome. This situation has an impact on clinical guidelines and impedes their possible harmonization in the transplant community, which has to move towards changing organ preservation paradigms: new concepts must emerge and the definition of a new range of adapted preservation method is of paramount importance. This review presents existing barriers in transplantation (e.g., temperature adjustment and adequate protocol, interest for oxygen addition during preservation, and clear procedure for organ perfusion during machine preservation), discusses the development of novel strategies to overcome them, and exposes the importance of identifying reliable biomarkers to monitor graft quality and predict short and long-term outcomes. Finally, perspectives in therapeutic strategies will also be presented, such as those based on stem cells and their derivatives and innovative models on which they would need to be properly tested.

75. Effects of oxygen during long-term hypothermic machine perfusion in a porcine model of kidney donation after circulatory death

Venema LH, Brat A, Moers C et al.

Transplantation Publish Ahead of Print. DOI: 10.1097/TP.0000000000002728

ABSTRACT

BACKGROUND: Hypothermic machine perfusion (HMP) has become standard care in many center's to preserve kidneys donated after circulatory death (DCD). Despite a significant reduction in metabolism at low temperatures, remaining cellular activity requires oxygen. Since the role and safety of oxygen during HMP has not been fully clarified, its supply during HMP is not standard yet. This study investigates the effect of administering oxygen during HMP on renal function in a porcine DCD model.

METHODS: After 30 minutes of warm ischemia, porcine slaughterhouse kidneys were preserved for 24 hours by means of cold storage (CS), or HMP with Belzer Machine Perfusion Solution (UWMPS) supplemented with no oxygen, 21% or 100% oxygen. Next, kidneys were reperfused

for 4 hours in a normothermic machine perfusion (NMP) setup.
RESULTS: HMP resulted in significantly better kidney function during NMP. Thiobarbituric acid reactive substances (TBARS), markers of oxidative stress, were significantly lower in HMP preserved kidneys. HMP preserved kidneys showed significantly lower ASAT and LDH levels compared to kidneys preserved by CS. No differences were found between the HMP groups subjected to different oxygen concentrations. ATP levels significantly improved during HMP when active oxygenation was applied.
CONCLUSION: This study showed that preservation of DCD kidneys with HMP is superior to CS. Although the addition of oxygen to HMP did not result in significantly improved renal function, beneficial effects were found in terms of reduced oxidative stress and energy status. Oxygen addition proofed to be safe and did not show detrimental effects.

76. Nanoparticle Release by Extended Criteria Donor Kidneys During Normothermic Machine Perfusion
Woud WW, Merino A, Hoogduijn MJ et al.
Transplantation May 2019; Volume 103, Number 5. DOI: 10.1097/TP.0000000000002642

Abstract not available

77. Are we frozen in time? Analysis of the utilization and efficacy of pulsatile perfusion in renal transplantation.
Schold JD, Kaplan B, Howard RJ, et al.
Am J Transplant 2005;5:1681-1688.

ABSTRACT
Preservation techniques are crucial to deceased donor kidney transplantation (DDTx), but the efficacy of pulsatile perfusion (PP) versus cold storage (CS) remains uncertain. We describe patterns of PP use and explore four fundamental questions. What kidneys are selected for PP? How does PP affect utilization of donated kidneys? What effect does PP have on outcomes? When does PP appear to be most efficacious? We examined rates of PP in DDTx in the United States from 1994 to 2003. We generated models for organ utilization, delayed graft function (DGF) and for the use of PP. We analyzed the long-term effect of PP with multivariate Cox models. The utilization rates for non-expanded criteria donors (ECDs) were similar by storage type, but for ECDs there was a significantly higher utilization rate with PP (70% with PP vs. 59% with CS, $p < 0.001$). Use of PP was widely variable across transplant centers. DGF rates were significantly lower with PP (27.6% vs. 19.6%). PP was associated with a mild benefit on death censored graft survival (adjusted hazard ratio = 0.88, 95% CI 0.85-0.91). Reduced DGF and significantly lower discard rates of ECDs associated with PP suggest an important utility of PP in renal transplantation. Additional evidence of improvement in graft survival, particularly in more recent years, provides further encouraging evidence for the use of PP.

78. Machine perfusion versus cold storage for preservation of kidneys from expanded criteria donors after brain death.
Treckmann J, Moers C, Smits JM, et al

Transpl Int 2011;24(6):548-54

ABSTRACT
The purpose of this study was to analyze the possible effects of machine perfusion (MP) versus cold storage (CS) on delayed graft function (DGF) and early graft survival in expanded criteria donor kidneys (ECD). As part of the previously reported international randomized controlled trial 91 consecutive heart-beating deceased ECDs--defined according to the United Network of Organ Sharing definition--were included in the study. From each donor one kidney was randomized to MP and the contralateral kidney to CS. All recipients were followed for 1 year. The primary endpoint was DGF. Secondary endpoints included primary nonfunction and graft survival. DGF occurred in 27 patients in the CS group (29.7%) and in 20 patients in the MP group (22%). Using the logistic regression model MP significantly reduced the risk of DGF compared with CS (OR 0.460, P=0.047). The incidence of nonfunction in the CS group (12%) was four times higher than in the MP group (3%) (P=0.04). One-year graft survival was significantly higher in machine perfused kidneys compared with cold stored kidneys (92.3% vs. 80.2%, P=0.02). In the present study, MP preservation clearly reduced the risk of DGF and improved 1-year graft survival and function in ECD kidneys. (Current Controlled Trials number: ISRCTN83876362).

79. Machine perfusion: initial results in an expanded criteria donor kidney transplant program.
Burgos Revilla FJ, Hevia V, Diez V, et al.
Transplant Proc 2015;47(1):19-22.

ABSTRACT
BACKGROUND: Delayed graft function (DGF) negatively impacts graft survival. Expanded criteria donors (ECD) show a higher rate of DGF. Hypothermic machine perfusion (HMP) has shown a DGF decrease and an increase of survival at 1 year. Several authors found that renal resistance (RR) at the end of machine perfusion was an independent risk factor for the development of DGF and poorer graft survival. The objective of this study was to analyze HMP results in the context of an ECD program and assess the impact of donor parameters and resistance index (RI) during perfusion in graft survival after kidney transplantation.
METHODS: Donor age, terminal creatinine, machine perfusion time, percentage of glomerulosclerosis, and RI at the end of the perfusion were considered as risk predictors. Univariate and multivariate Cox regression analysis was constructed to find independent risk factors of DGF. Finally, diagnostic validity for RR was determined by sensitivity, specificity, and positive and negative predictive values.
RESULTS: Twenty-three percent of patients developed DGF. We found no difference in the ability of flow or RI to predict the development of DGF. The predictive accuracy of RI for DGF by receiver operator characteristic curve was poor, with a c-statistic of 0.66 (95% CI, 0.50-0.81; P = .046). Our analysis did not identify risk factors that predicted graft survival at 1 year. Patient and graft survival were 98.8% and 89.7%, respectively.
CONCLUSIONS: HMP has reduced the rate of DGF in our cohort of recipients of ECD grafts compared with historical data (23.3% vs 38.0%). Analysis did not identify risk pretransplant factors for graft survival at 1 year.

80. Hypothermic machine perfusion reduces delayed graft function and improves one-year graft survival of kidneys from expanded criteria donors: a meta-analysis.
Jiao B, Liu S, Liu H, et al.
PLoS ONE 2013;8(12):e81826.

ABSTRACT
BACKGROUND: Expanded criteria donors (ECDs) are currently accepted as potential sources to increase the donor pool and to provide more chances of kidney transplantation for elderly recipients who would not survive long waiting periods. Hypothermic machine perfusion (HMP) is designed to mitigate the deleterious effects of simple cold storage (CS) on the quality of preserved organs, particularly when the donor is in a marginal status.
METHODS: We compared the transplant outcomes in patients receiving ECD kidneys with either HMP or CS graft preservation. Articles from the MEDLINE, EMBASE and Cochrane Library databases were searched and all studies reporting outcomes from HMP versus CS methods of kidney preservation were included in this meta-analysis. The parameters analyzed included the incidence of delayed graft function (DGF), primary non-function (PNF) and one-year graft and patient survival.
RESULTS: A total of seven studies qualified for the review, involving 2374 and 8716 kidney grafts with HMP or CS preservation respectively, all from ECD donors. The incidence of delayed graft function (DGF) was significantly reduced with an odd ratio(OR) of 0.59 (95% CI 0.54-0.66, P<0.001) and one-year graft survival was significantly improved with an OR of 1.12 (95% CI 1.03-1.21, P = 0.005) in HMP preservation compared to CS. However, there was no difference in the incidence of PNF (OR 0.54, 95% CI 0.21-1.40, P = 0.20), and one-year patient survival (OR 0.98, 95% CI 0.94-1.02, P = 0.36) between HMP and CS preservation.
CONCLUSIONS: HMP was associated with a reduced incidence of DGF and an with increased one-year graft survival, but it was not associated with the incidence of PNF and one-year patient survival.

81. Machine perfusion versus static cold storage in expanded criteria donor kidney transplantation: 3-year follow-up data.
Gallinat A, Moers C, Smits JM, et al.
Transpl Int 2013;26(6):E52-3.

Letter to editor. Abstract not available

82. Pulsatile perfusion reduces the incidence of delayed graft function in expanded criteria donor kidney transplantation.
Matsuoka L, Shah T, Aswad S, et al
Am J Transplant 6:1473-1478, 2006

ABSTRACT
The use of expanded criteria donors (ECD) has been proposed to help combat the discrepancy between organ availability and need. ECD kidneys are associated with delayed graft function (DGF) and worse long-term survival. The aim of this study is to evaluate the impact of pulsatile perfusion (PP) on DGF and graft survival in transplanted ECD kidneys. From January 2000 to December 2003,

4618 ECD kidney-alone transplants were reported to the United Network for Organ Sharing. PP was performed on 912 renal allografts. The prognostic factors of DGF were analyzed using multivariate logistic regression analysis. Risk factors for reduced allograft viability were greater in donors and recipients of PP kidneys. Three-year graft survival of ECD kidneys preserved with PP was similar to cold storage (CS) kidneys. The incidence of DGF in PP kidneys was significantly lower than CS kidneys (26% vs. 36%, $p < 0.001$). Despite having a greater number of risk factors for reduced graft viability, the ECD-PP kidneys had similar graft survival compared to ECD-CS kidneys. The use of PP, by decreasing the incidence of DGF, may possibly lead to lower overall costs and increased utilization of donor kidneys.

83. Association of lower costs of pulsatile machine perfusion in renal transplantation from expanded criteria donors.
Buchanan PM, Lentine KL, Burroughs TE, et al.
Am J Transplant 2008;8(11):2391-401.

ABSTRACT
Pulsatile machine perfusion (PMP) has been shown to reduce delayed graft function (DGF) in expanded criteria donor (ECD) kidneys. Here, we investigate whether there is a cost benefit associated with PMP utilization in ECD kidney transplants. We analyzed United States Renal Data System (USRDS) data describing Medicare-insured ECD kidney transplant recipients in 1995-2004 (N = 5840). We examined total Medicare payments for transplant hospitalization and annually for 3 years posttransplant according to PMP utilization. After adjusting for other recipient, donor and transplant factors, PMP utilization was associated with a $2130 reduction ($p = 0.007$) in hospitalization costs. PMP utilization was also associated with lower DGF risk ($p < 0.0001$). PMP utilization did not predict differences in rejection, graft survival, patient survival, or costs at 1, 2 and 3 years posttransplant. PMP utilization is correlated with lower costs for the transplant hospitalization, which is likely due to the associated reduction in DGF among recipients of PMP kidneys. However, there is no difference in long-term Medicare costs for ECD recipients by PMP utilization. A prospective trial is necessary as it will help determine if the associations seen here are due to PMP utilization and not differences in the population studied.

84. Machine Preservation Trial Study Group. Machine perfusion or cold storage in deceased-donor kidney transplantation.
Moers C, Pirenne J, Paul A, Ploeg RJ.
N Engl J Med 2012;366(8):770-1.

Abstract not available

85. Machine perfusion preservation versus static cold storage for deceased donor kidney transplantation.
Tingle SJ, Figueiredo RS, Moir JA, et al.
Cochrane Database Syst Rev. 2019 Mar 15;3:CD011671.

ABSTRACT

BACKGROUND: Kidney transplantation is the optimal treatment for end-stage kidney disease. Retrieval, transport and transplant of kidney grafts causes ischaemia reperfusion injury. The current accepted standard is static cold storage (SCS) whereby the kidney is stored on ice after removal from the donor and then removed from the ice box at the time of implantation. However, technology is now available to perfuse or "pump" the kidney during the transport phase or at the recipient centre. This can be done at a variety of temperatures and using different perfusates. The effectiveness of treatment is manifest clinically as delayed graft function (DGF), whereby the kidney fails to produce urine immediately after transplant.
OBJECTIVES: To compare hypothermic machine perfusion (HMP) and (sub)normothermic machine perfusion (NMP) with standard SCS.
SEARCH METHODS: We searched the Cochrane Kidney and Transplant Register of Studies to 18 October 2018 through contact with the Information Specialist using search terms relevant to this review. Studies in the Register are identified through searches of CENTRAL, MEDLINE, and EMBASE, conference proceedings, the International Clinical Trials Register (ICTRP) Search Portal and ClinicalTrials.gov.
SELECTION CRITERIA: All randomised controlled trials (RCTs) and quasi-RCTs comparing HMP/NMP versus SCS for deceased donor kidney transplantation were eligible for inclusion. All donor types were included (donor after circulatory (DCD) and brainstem death (DBD), standard and extended/expanded criteria donors). Both paired and unpaired studies were eligible for inclusion.
DATA COLLECTION AND ANALYSIS: The results of the literature search were screened and a standard data extraction form was used to collect data. Both of these steps were performed by two independent authors. Dichotomous outcome results were expressed as risk ratio (RR) with 95% confidence intervals (CI). Continuous scales of measurement were expressed as a mean difference (MD). Random effects models were used for data analysis. The primary outcome was incidence of DGF. Secondary outcomes included: one-year graft survival, incidence of primary non-function (PNF), DGF duration, long term graft survival, economic implications, graft function, patient survival and incidence of acute rejection.
MAIN RESULTS: No studies reported on NMP, however one ongoing study was identified.Sixteen studies (2266 participants) comparing HMP with SCS were included; 15 studies could be meta-analysed. Fourteen studies reported on requirement for dialysis in the first week post-transplant (DGF incidence); there is high-certainty evidence that HMP reduces the risk of DGF when compared to SCS (RR 0.77; 95% CI 0.67 to 0.90; P = 0.0006). HMP reduces the risk of DGF in kidneys from DCD donors (7 studies, 772 participants: RR 0.75; 95% CI 0.64 to 0.87; P = 0.0002; high certainty evidence), as well as kidneys from DBD donors (4 studies, 971 participants: RR 0.78, 95% CI 0.65 to 0.93; P = 0.006; high certainty evidence). The number of perfusions required to prevent one episode of DGF (number needed to treat, NNT) was 7.26 and 13.60 in DCD and DBD kidneys respectively. Studies performed in the last decade all used the LifePort machine and confirmed that HMP reduces the incidence of DGF in the modern era (5 studies, 1355 participants: RR 0.77, 95% CI 0.66 to 0.91; P = 0.002; high certainty evidence). Reports of economic analysis suggest that HMP can lead to cost savings in both the North American and European settings.Two studies reported HMP also improves graft survival however we were not able to meta-analyse these results. A reduction in incidence of PNF could not be demonstrated. The effect of HMP on our other outcomes (incidence of acute rejection, patient survival, hospital stay, long-term graft function, duration of DGF) remains uncertain.
AUTHORS' CONCLUSIONS: HMP is superior to SCS in deceased donor kidney transplantation. This is true for both DBD and DCD kidneys, and remains true in the modern era (studies performed in the last decade). As kidneys from DCD donors have a higher overall DGF rate, fewer perfusions are

needed to prevent one episode of DGF (7.26 versus 13.60 in DBD kidneys).Further studies looking solely at the impact of HMP on DGF incidence are not required. Follow-up reports detailing long-term graft survival from participants of the studies already included in this review would be an efficient way to generate further long-term graft survival data.Economic analysis, based on the results of this review, would help cement HMP as the standard preservation method in deceased donor kidney transplantation.RCTs investigating (sub)NMP are required.

1.4 CONSIDERACIONES ESPECIALES DEL DONANTE EN ASISTOLIA

86. Continuous Normothermic Ex Vivo Kidney Perfusion Improves Graft Function in Donation After Circulatory Death Pig Kidney Transplantation

Kaths JM, Echeverri J, Chun YM, et al.
Transplantation 2017;101: 754–763.

ABSTRACT

BACKGROUND: Donation after circulatory death (DCD) is current clinical practice to increase the donor pool. Deleterious effects on renal graft function are described for hypothermic preservation. Therefore, current research focuses on investigating alternative preservation techniques, such as normothermic perfusion.

METHODS: We compared continuous pressure-controlled normothermic ex vivo kidney perfusion (NEVKP) with static cold storage (SCS) in a porcine model of DCD autotransplantation. After 30 minutes of warm ischemia, right kidneys were removed from 30-kg Yorkshire pigs and preserved with 8-hour NEVKP or in 4°C histidine-tryptophan-ketoglutarate solution (SCS), followed by kidney autotransplantation.

RESULTS: Throughout NEVKP, electrolytes and pH values were maintained. Intrarenal resistance decreased over the course of perfusion (0 hour, 1.6 ± 0.51 mm per minute vs 7 hours, 0.34 ± 0.05 mm Hg/mL per minute, P = 0.005). Perfusate lactate concentration also decreased (0 hour, 10.5 ± 0.8 vs 7 hours, 1.4 ± 0.3 mmol/L, P < 0.001). Cellular injury markers lactate dehydrogenase and aspartate aminotransferase were persistently low (lactate dehydrogenase < 100 U/L, below analyzer range; aspartate aminotransferase 0 hour, 15.6 ± 9.3 U/L vs 7 hours, 24.8 ± 14.6 U/L, P = 0.298). After autotransplantation, renal grafts preserved with NEVKP demonstrated lower serum creatinine on days 1 to 7 (P < 0.05) and lower peak values (NEVKP, 5.5 ± 1.7 mg/dL vs SCS, 11.1 ± 2.1 mg/dL, P = 0.002). The creatinine clearance on day 4 was increased in NEVKP-preserved kidneys (NEVKP, 39 ± 6.4 vs SCS, 18 ± 10.6 mL/min; P = 0.012). Serum neutrophil gelatinase-associated lipocalin at day 3 was lower in the NEVKP group (1267 ± 372 vs 2697 ± 1145 ng/mL, P = 0.029).

CONCLUSIONS: Continuous pressure-controlled NEVKP improves renal function in DCD kidney transplantation. Normothermic ex vivo kidney perfusion might help to decrease posttransplant delayed graft function rates and to increase the donor pool.

87. Kidney donation after circulatory death (DCD): state of the art

Summers DM, Watson CJ, Pettigrew GJ, et al.
Kidney International (2015) 88, 241–249

ABSTRACT

The use of kidneys from controlled donation after circulatory death (DCD) donors has the potential to markedly increase kidney transplants performed. However, this potential is not being realized because of concerns that DCD kidneys are inferior to those from donation after brain-death (DBD) donors. The United Kingdom has developed a large and successful controlled DCD kidney transplant program that has allowed for a substantial increase in kidney transplant numbers. Here we describe recent trends in DCD kidney donor activity in the United Kingdom, outline aspects of the donation process, and describe donor selection and allocation of DCD kidneys. Previous UK Transplant Registry analyses have shown that while DCD kidneys are more susceptible to cold

ischemic injury and have a higher incidence of delayed graft function, short- and medium-term transplant outcomes are similar in recipients of kidneys from DCD and DBD donors. We present an updated, extended UK registry analysis showing that longer-term transplant outcomes in DCD donor kidneys are also similar to those for DBD donor kidneys, and that transplant outcomes for kidneys from expanded-criteria DCD donors are no less favorable than for expanded-criteria DBD donors. Accordingly, the selection criteria for use of kidneys from DCD donors should be the same as those used for DBD donors. The UK experience suggests that wider international development of DCD kidney transplantation programs will help address the global shortage of deceased donor kidneys for transplantation.

88. Recommendations for donation after circulatory death kidney transplantation in Europe
Hameed AM, Hawthorne WJ and Pleass HC.
Transplant International 2016; 29: 780–789

ABSTRACT
Donation after circulatory death (DCD) donors provides an invaluable source for kidneys for transplantation. Over the last decade, we have observed a substantial increase in the number of DCD kidneys, particularly within Europe. We provide an overview of risk factors associated with DCD kidney function and survival and formulate recommendations from the sixth international conference on organ donation in Paris, for best-practice guidelines. A systematic review of the literature was performed using Ovid Medline, Embase and Cochrane databases. Topics are discussed, including donor selection, organ procurement, organ preservation, recipient selection and transplant management.

89. Trasplante renal de donantes en asistolia
Pérez I, Sánchez AI.
NefroPlus 2016;8(1):1-6

ABSTRACT
La donación en asistolia (DA) es una adicional fuente de órganos para trasplante que puede contribuir a acortar el tiempo y el número de pacientes en lista de espera. La existencia de una mayor proporción de disfunción primaria del injerto (DPI) y función renal retardada (FRR) en comparación con los riñones procedentes de donantes en muerte encefálica (DME), ha hecho que algunos grupos hayan sido más reticentes a implementar el procedimiento. Sin embargo, su difusión se ha ido ampliando al observar que la presencia de FRR no influye en la supervivencia del injerto a largo plazo, existiendo incluso mejores resultados, en la mayoría de las series, con los riñones de DA que con los obtenidos de DME con criterios expandidos. Otro hecho que ha disipado las dudas sobre el uso de este tipo de donantes ha sido el hallazgo de que el trasplante renal de DA reduce la mortalidad de los receptores, frente a permanecer en diálisis en lista de espera de un riñón procedente de DME. La vigilancia estrecha del procedimiento con el fin de evitar lesiones irreversibles derivadas del proceso de isquemia caliente, inherente a este tipo de donación, y una adecuada selección de donante y receptor pueden ayudar a garantizar unos buenos resultados. El esfuerzo por mejorar dichos resultados y la calidad de los riñones procedentes de DA se basan en la capacidad de identificar factores de riesgo y la creación de guías de consenso de adecuada práctica clínica.

90. In Situ Normothermic Regional Perfusion for Controlled Donation After Circulatory Death—The United Kingdom Experience

Oniscu GC, Randle LV, Muiesan P et al.

American Journal of Transplantation 2014; 14: 2846–2854

ABSTRACT

Organs recovered from donors after circulatory death (DCD) suffer warm ischemia before cold storage which may prejudice graft survival and result in a greater risk of complications after transplant. A period of normothermic regional perfusion (NRP) in the donor may reverse these effects and improve organ function. Twenty-one NRP retrievals from Maastricht category III DCD donors were performed at three UK centers. NRP was established postasystole via aortic and caval cannulation and maintained for 2 h. Blood gases and biochemistry were monitored to assess organ function. Sixty-three organs were recovered. Forty-nine patients were transplanted. The median time from asystole to NRP was 16 min (range 10–23min). Thirty-two patients received a kidney transplant. The median cold ischemia time was12 h 30min (range 5 h 25 min–18 h 22min). The median creatinine at 3 and 12 months was 107mmol/L (range 72–222) and 121mmol/L (range 63–157), respectively. Thirteen (40%) recipients had delayed graft function and four lost the grafts. Eleven patients received a liver transplant. The first week median peak ALT was 389 IU/L (range 58–3043). One patient had primary nonfunction. Two combined pancreas– kidney transplants, one islet transplant and three double lung transplants were performed with primary function. NRP in DCD donation facilitates organ recovery and may improve short-term outcomes.

91. Proteins in Preservation Fluid as Predictors of Delayed Graft Function in Kidneys from Donors after Circulatory Death

Oniscu GC, Randle LV, Muiesan P et al.

Clin J Am Soc Nephrol 12: 817–824, 2017

ABSTRACT

BACKGROUND AND OBJECTIVES: Kidney transplantation is the preferred treatment for ESRD, and donor kidney shortage urges proper donor-recipient matching. Zero-hour biopsies provide predictive values for short- and long-term transplantation outcomes, but are invasive and may not reflect the entire organ. Alternative, more representative methods to predict transplantation outcome are required. We hypothesized that proteins accumulating in preservation fluid during cold ischemic storage can serve as biomarkers to predict posttransplantation graft function.

DESIGN, SETTING, PARTICIPANTS, & MEASUREMENTS: levels of 158 proteins were measured in preservation fluids from kidneys donated after circulatory death (Maastricht category III) collected in two Dutch centers (University Medical Center Utrecht and Erasmus Medical Center Rotterdam) between 2013 and 2015. Five candidate biomarkers identified in a discovery set of eight kidneys with immediate function (IF) versus eight with delayed graft function (DGF) were subsequently analyzed in a verification set of 40 additional preservation fluids to establish a prediction model.

RESULTS: Variables tested for their contribution to a prediction model included five proteins (leptin, periostin, GM-CSF, plasminogen activator inhibitor-1, and osteopontin) and two clinical parameters (recipient body mass index [BMI] and dialysis duration) that distinguished between IF and DGF in the discovery set. Stepwise multivariable logistic regression provided a prediction model on the basis of leptin and GM-CSF. Receiver operating characteristic analysis showed an area under the curve (AUC) of 0.87, and addition of recipient BMI generated a model with an AUC

of 0.89, outperforming the Kidney Donor Risk Index and the DGF risk calculator, showing AUCs of 0.55 and 0.59, respectively.
CONCLUSIONS: We demonstrate that donor kidney preservation fluid harbors biomarkers that, together with information on recipient BMI, predict short-term post-transplantation kidney function. Our approach is safe, easy, and performs better than current prediction algorithms, which are only on the basis of clinical parameters.

92. Outcome Improvement for Hypothermic Machine Perfusion Versus Cold Storage for Kidneys From Cardiac Death Donors
Zhong Z, Lan J, Ye S et al.
Artificial Organs 2017, 41(7):647–653

ABSTRACT
Organ shortage has led to an increased use of kidneys from cardiac death donors (DCDs), but controversies about the methods of organ preservation still exist. This study aims to compare the effect of machine perfusion (MP) and cold storage (CS) in protecting kidneys harvested from DCDs. 141 kidney pairs from DCDs between July 2010 and July 2015 were included in this randomized controlled study. One kidney from each donor was randomly assigned to MP and the contralateral kidney was assigned to CS. Delayed graft function (DGF) rate, resistance index of renal arteries, early renal function, and survival rates were used to estimate the effect of preservation. The results showed that MP decreased the rate of DGF from 33.3 to 22.0% (P = 0.033). Ultrasound of the kidneys within 48 h after transplantation showed that the resistance index of renal main artery (0.673 ± 0.063 vs. 0.793 ± 0.124, P < 0.001), sub segmental artery (0.66 ± 0.062 vs. 0.764 ± 0.077, P < 0.001) and interlobular artery (0.648 ± 0.056 vs. 0.745 ± 0.111, P = 0.023) were all significantly lower in the MP group than those in the CS group. Furthermore, compared to the CS group, in the first 7 days following transplantation, the median urine volume was significantly higher (4080 mL vs. 3000 mL, P = 0.047) in kidneys sustained using MP and the median serum creatinine was remarkably lower (180 μmol/L vs. 390 μmol/L, P = 0.024). More importantly, MP group had higher 1- and 3-year graft survival rates (98% vs. 93%, P = 0.026; 93% vs. 82%, P = 0.036, respectively). Hypothermic MP improved the outcomes of DCD kidney transplantation.

93. Donation After Circulatory Death: Current Practices, Ongoing Challenges, and Potential Improvements
Morrissey PE and Monaco AP
Transplantation 2014;97: 258-264.

ABSTRACT
Organ donation after circulatory death (DCD) has been endorsed by the World Health Organization and is practiced worldwide. This overview examines current DCD practices, identifies problems and challenges, and suggests clinical strategies for possible improvement. Although there is uniform agreement on DCD donor candidacy (ventilator dependent individuals with nonrecoverable or irreversible neurologic injury not meeting brain death criteria), there are variations in all aspects of DCD practice. Utilization of DCD organs is limited by hypoxia, hypotension, reduced - then absent- organ perfusion, and ischemia/reperfusion syndrome. Nevertheless, DCD kidneys exhibit comparable function and survival to donors with brain death

kidneys, although they have higher rates of primary graft nonfunction, delayed graft function, discard, and retrieval associated injury. Concern over ischemic organ injury underscores the reluctance to recover extrarenal DCD organs since lack of medical therapy to support inadequate allograft function limits their acceptability. Nevertheless, limited results with DCD pancreas, liver, and lung allografts (but not heart) are now approaching that of donors with brain death organs. Pretransplant machine perfusion of DCD kidneys (vs. static storage) may reduce delayed graft function but has no effect on long-term organ function and survival. Normothermic regional perfusion used during DCD abdominal organ retrieval may reduce ischemic organ injury and increase the number of usable organs, although critical confirmative studies have yet to be done. Minor increases in usable DCD kidneys could accrue from increased use of pediatric DCD kidneys and from selective use of DCD/ECD kidneys, whereas a modest increase could result through utilization of donors declared dead beyond 1 hr from withdrawal of life support therapy. A significant increase in transplantable kidneys could be achieved by extension of the concept of living kidney donation in relation to imminent death of potential DCD donors. Progress in research to identify, prevent, and repair DCD-associated organ retrieval injury should improve utilization of DCD organs. Recent results using ex situ pretransplant organ perfusion of DCD organs has been encouraging in this regard.

94. Kidney donation after circulatory death (DCD): state of the art

Summers DM, Watson CJ, Pettigrew GJ et al.

Kidney Int. 2015 Aug;88(2):241-9.

ABSTRACT

The use of kidneys from controlled donation after circulatory death (DCD) donors has the potential to markedly increase kidney transplants performed. However, this potential is not being realized because of concerns that DCD kidneys are inferior to those from donation after brain-death (DBD) donors. The United Kingdom has developed a large and successful controlled DCD kidney transplant program that has allowed for a substantial increase in kidney transplant numbers. Here we describe recent trends in DCD kidney donor activity in the United Kingdom, outline aspects of the donation process, and describe donor selection and allocation of DCD kidneys. Previous UK Transplant Registry analyses have shown that while DCD kidneys are more susceptible to cold ischemic injury and have a higher incidence of delayed graft function, short- and medium-term transplant outcomes are similar in recipients of kidneys from DCD and DBD donors. We present an updated, extended UK registry analysis showing that longer-term transplant outcomes in DCD donor kidneys are also similar to those for DBD donor kidneys, and that transplant outcomes for kidneys from expanded-criteria DCD donors are no less favorable than for expanded-criteria DBD donors. Accordingly, the selection criteria for use of kidneys from DCD donors should be the same as those used for DBD donors. The UK experience suggests that wider international development of DCD kidney transplantation programs will help address the global shortage of deceased donor kidneys for transplantation.

95. Kidney transplantation from donors after uncontrolled circulatory death: the Spanish experience

Del Río F, Andrés A, Padilla M et al.

Kidney Int. 2019 Feb;95(2):420-428.

ABSTRACT
Donation after uncontrolled circulatory death (uDCD) refers to donation from persons who have died following cardiac arrest and unsuccessful attempt at resuscitation. We report the Spanish experience of uDCD kidney transplantation, and identify factors related to short-term post-transplant outcomes. The Spanish CORE system compiles data on all donation and transplant procedures in the country. Between 2012-2015, 517 kidney transplants from 288 uDCD donors were performed. The incidence of primary non-function was 10%, and the incidence of delayed graft function was 76%. One-year death-censored graft survival was 87%. In a Cox-Model, donor age ≥ 60 years (odds ratio [OR] 2.7; 95% confidence interval [CI] 1.2-6.1), *in situ* cooling of kidneys versus normothermic regional perfusion (OR 5.6; 95% CI 2.7-11.5) or hypothermic regional perfusion based on the use of extracorporeal membrane oxygenation devices (OR 4.3; 95% CI 2.1-8.6), and a recipient history of prior kidney transplant (OR 3.5; 95% CI 1.5-8.3) all significantly increased the risk of graft loss during the first year after transplantation. Kidney transplantation from uDCD donors provides acceptable 1-year outcomes, although there is room for improvement. Hypothermic and normothermic regional perfusion strategies are preferable *to in situ* cooling of kidneys from uDCD donors.

96. Uncontrolled donation after circulatory death: A cohort study of data from a long-standing deceased-donor kidney transplantation program.
Sánchez-Fructuoso AI, Pérez-Flores I, Del Río F, et al.
Am J Transplant. 2019 Jun;19(6):1693-1707.

ABSTRACT
Despite good long-term outcomes of kidney transplants from controlled donation after circulatory death (DCD) donors, there are few uncontrolled DCD (uDCD) programs. This longitudinal study compares outcomes for all uDCD (N = 774) and all donation after brain death (DBD) (N = 613) kidney transplants performed from 1996 to 2015 at our center. DBD transplants were divided into those from standard-criteria (SCD) (N = 366) and expanded-criteria (N = 247) brain-dead donors (ECD). One-, 5-, and 10-year graft survival rates were 91.7%, 85.7%, and 80.6% for SCD; 86.0%, 75.8%, and 61.4% for ECD; and 85.1%, 78.1%, and 72.2% for uDCD, respectively. Graft survival was worse in recipients of uDCD kidneys than of SCD (P = .004) but better than in transplants from ECD (P = .021). The main cause of graft loss in the uDCD transplants was primary nonfunction. Through logistic regression, donor death due to pulmonary embolism (OR 4.31, 95% CI 1.65-11.23), extrahospital CPR time ≥75 minutes (OR1.94, 95%CI 1.18-3.22), and in-hospital CPR time ≥50 minutes (OR 1.79, 95% CI 1.09-2.93) emerged as predictive factors of primary nonunction. According to the outcomes of our long-standing kidney transplantation program, uDCD could help expand the kidney donor pool.

97. Recommendations for donation after circulatory death kidney transplantation in Europe.
van Heurn LW, Talbot D, Nicholson ML et al.
Transpl Int. 2016 Jul;29(7):780-9..

ABSTRACT

Donation after circulatory death (DCD) donors provides an invaluable source for kidneys for transplantation. Over the last decade, we have observed a substantial increase in the number of DCD kidneys, particularly within Europe. We provide an overview of risk factors associated with DCD kidney function and survival and formulate recommendations from the sixth international conference on organ donation in Paris, for best-practice guidelines. A systematic review of the literature was performed using Ovid Medline, Embase and Cochrane databases. Topics are discussed, including donor selection, organ procurement, organ preservation, recipient selection and transplant management.

98. Short-term evolution of renal transplant with grafts from donation after cardiac death: Type III Maastricht category

Salmeron-Rodriguez MD, Navarro-Cabello MD, Agüera-Morales ML et al.
Transplant Proc. 2015 Jan-Feb;47(1):23-6.

ABSTRACT
BACKGROUND: Kidney transplantation from donors after cardiac death (Type III Maastricht category) is a therapeutic option for patients with terminal renal failure.
MATERIALS AND METHODS: We present a cohort of 8 patients who received a kidney transplant from donors after cardiac death (DCD). We analyzed the analytical results for the first 6 months after transplantation.
RESULTS: We included 8 cases of kidney transplants with organs from DCD (Type III Maastricht category). The mean age of donors was 58.40 ± 4.39 years and 3 (60%) were male. The mean creatinine (Cr) level prior to death was 1.10 ± 0.36 mg/dL. The mean age of recipients was 59.88 ± 10.58 years and 7 (87.5%) were male. Seven patients (87.5%) were on hemodialysis, whereas only 1 (12.5%) was on peritoneal dialysis. The median time on renal replacement therapy was 18 months (range, 2-76). Mean total warm ischemia time (WIT) was 24.88 ± 6.72 minutes, whereas the mean real WIT was 20.13 ± 4.51 minutes. The mean cold ischemia time (CIT) was 6 hours and 12 minutes ± 2 hours. Preimplantation biopsy showed acute tubular necrosis (extensive 40%). Tubular atrophy was mild in 100% of cases. After transplantation, 6 patients (75%) had delayed graft function requiring dialysis sessions whereas 2 patients (25%) did not require renal replacement therapy. Mean Cr level at 1, 3, and 6 months after transplantation was 2.37, 1.75, and 1.17 mg/dL, respectively.
CONCLUSION: Kidney transplantation with grafts from donors after cardiac arrest Maastricht Type III evolves favorably in the short term. According to preliminary results, controlled asystole donation could be an effective alternative to transplantation.

99. More donors or more delayed graft function? A cost-effectiveness analysis of DCD kidney transplantation

Snyder RA, Moore DR, Moore DE.
Clin Transplant. 2013 Mar-Apr;27(2):289-96.

ABSTRACT
Expansion of the donor pool with expanded criteria donors and donation after cardiac death (DCD) donors is essential. DCD grafts result in increased rates of primary non-function (PNF) and delayed

graft function (DGF). However, long-term patient and graft survival is similar between donation after brain death (DBD) donors and DCD donors. The aim of this study was to evaluate the cost-effectiveness of the use of DCD donors. A Markov-based decision analytic model was created to simulate outcomes for two wait list strategies: (i) wait list composed of only DBD organs and (ii) wait list combining DBD and DCD organs. Baseline values and ranges were determined from the Scientific Registry of Transplant Recipients (SRTR) database and literature review. Sensitivity analyses were conducted to test model strength and parameter variability. The wait list strategy consisting of DBD donors only provided recipients 5.4 Quality-adjusted life years (QALYs) at $65 000/QALY, whereas a wait list strategy combining DBD + DCD donors provided recipients 6.0 QALYs at a cost of $56 000/QALY. Wait lists with DCD donors provide adequate long-term survival despite more DGF. This equates to an improvement in quality of life and decreased cost when compared to remaining on dialysis for any period of time.

100. Donation after cardiac death: results of the SUMMA 112 - Hospital 12 de Octubre Program
Miranda-Utrera N, Medina-Polo J, Pamplona M et al.
Clin Transplant. 2013 Mar-Apr;27(2):283-8.

ABSTRACT
BACKGROUND: In 2005, our center started a donation after cardiac death (DACD) program, by which patients who present an irreversible cardiac arrest outside hospital are brought to our center with the purpose of organ donation. We reviewed the outcomes of our program of kidney transplants from DACD.
METHODS: We conducted a retrospective study of the DACD, and we reviewed the procedures carried out in our institution between July 2005 and December 2010 and descriptively analyzed the results obtained for kidney donation.
RESULTS: One hundred and fifty-two of 274 potential donors were transferred to our hospital. Of them, 126 (82.8%) were connected to cardiopulmonary bypass machine, and organs were procured in 113 donors (74.3%). The discarded grafts were mainly due to inadequate perfusion. One hundred and fifty-six kidneys were transplanted (51.3%). Over a median follow-up period of 18 ± 13.7 months, the median creatinine clearance was 78.2 ± 10.2 ml/min. 8.6% of the grafts had no primary function, and 85% had a delayed graft function. Recipient survival and graft survival were 98% and 87%, respectively.
CONCLUSIONS: DACD is an adequate source of organs for kidney transplantation. Our functional and survival results are encouraged in the short term, although further work is required to increase the program's benefits.

101. Pulsatile pump decreases risk of delayed graft function in kidneys donated after cardiac death
Lodhi SA, Lamb KE, Uddin I et al.
Am J Transplant. 2012 Oct;12(10):2774-80.

ABSTRACT
Organ storage techniques have been under scrutiny to determine the best preservation method, particularly in donation after cardiac death (DCD) kidneys. Conflicting literature on the benefit of

pulsatile perfusion (PP) over cold storage (CS) warrants further investigation. We analyzed the risk of developing delayed graft function (DGF) in recipients of DCD and donation after brain death (DBD) kidneys undergoing PP or CS. We stratified on basis of cold ischemic time (CIT) to determine the interaction of preservation techniques, CIT and DCD kidneys on developing DGF. Of 54 136 recipients, 4923 received DCD kidneys of which 3330 (67%) underwent PP. Of 49 213 DBD recipients, 7531 (15%) underwent PP. DCD had a higher risk of DGF versus DBD (adjusted odds ratio, AOR 3.2; 3.0-3.5). PP kidneys had less DGF (AOR 0.59; 0.56-0.63) compared to CS. Interaction models of method by donor type referenced to PP/DBD revealed CS/DBD kidneys had higher DGF (AOR 1.8; 1.7-1.9), whereas CS/DCD kidneys had the highest risk of DGF (AOR 5.01; 4.43-5.67). Even though suggestive for a benefit of PP on DGF, this retrospective analysis cannot address whether this is an intrinsic effect of PPor is associated with the logistics of PP such as discard of DCD kidneys based on pump parameters.

102. Impact of donor obesity and donation after cardiac death on outcomes after kidney transplantation

Ortiz J(1), Gregg A, Wen X et al.
Clin Transplant. 2012 May-Jun;26(3):E284-92.

ABSTRACT

The effect of donor body mass index (BMI) and donor type on kidney transplant outcomes has not been well studied. Scientific Registry of Transplant Recipients data on recipients of deceased-donor kidneys between 1997 and 2010 were reviewed. Donors were categorized by DCD status (DCD, 6932; non-DCD, 90,158) and BMI groups at 5 kg/m(2) increments: 18.5-24.9, 25-29.9, 30-34.9, 35-39.9, 40-44.9, and ≥ 45 kg/m(2) . The primary outcome, death-censored graft survival (DCGS), was adjusted for donor, recipient, and transplant characteristics. Among recipients of non-DCD kidneys, donor BMI was not associated with DCGS. Among DCD recipients, donor BMI was not associated with DCGS for donor BMI categories < 45 kg/m(2) ; however, donor BMI ≥ 45 kg/m(2) was independently associated with DCGS compared to BMI of 20-24.9 kg/m(2) (adjusted hazard ratio, 1.84; 95% CI, 1.23, 2.74). The adjusted odds of delayed graft function (DGF) was greater for each level of BMI above reference for both DCD and non-DCD groups. There was no association of donor BMI with one-yr acute rejection for either type of donor. Although BMI is associated with DGF, long-term graft survival is not affected except in the combination of DCD with extreme donor BMI ≥ 45.

103. Equivalent Long-term Transplantation Outcomes for Kidneys Donated After Brain Death and Cardiac Death: Conclusions From a Nationwide Evaluation

Schaapherder A, Wijermars LGM, de Vries DK et al.
EClinicalMedicine. 2018 Oct 9;4-5:25-31.

ABSTRACT

BACKGROUND: Despite growing waiting lists for renal transplants, hesitations persist with regard to the use of deceased after cardiac death (DCD) renal grafts. We evaluated the outcomes of DCD donations in The Netherlands, the country with the highest proportion of DCD procedures (42.9%) to test whether these hesitations are justified.

METHODS: This study included all procedures with grafts donated after brain death (DBD) (n = 3611) and cardiac death (n = 2711) performed between 2000 and 2017. Transplant outcomes were compared by Kaplan Meier and Cox regression analysis, and factors associated with short (within 90 days of transplantation) and long-term graft loss evaluated in multi-variable analyses.
FINDINGS: Despite higher incidences of early graft loss (+ 50%) and delayed graft function (+ 250%) in DCD grafts, 10-year graft and recipient survival were similar for the two graft types (Combined 10-year graft survival: 73.9% (95% CI: 72.5-75.2), combined recipient survival: 64.5% (95 CI: 63.0-66.0%)). Long-term outcome equivalence was explained by a reduced impact of delayed graft function on DCD graft survival (RR: 0.69 (95% CI: 0.55-0.87), p < 0.001). Mid and long-term graft function (eGFR), and the impact of incident delayed graft function on eGFR were similar for DBD and DCD grafts.
INTERPRETATION: Mid and long term outcomes for DCD grafts are equivalent to DBD kidneys. Poorer short term outcomes are offset by a lesser impact of delayed graft function on DCD graft survival. This nation-wide evaluation does not justify the reluctance to use of DCD renal grafts. A strong focus on short-term outcome neglects the superior recovery potential of DCD grafts.

104. Warm ischemic time as a critical risk factor of graft failure from donors after cardiac death: A single-center experience over three decades in the Kidney Donor Profile Index/Kidney Donor Risk Index era in Japan

Kusaka M, Kubota Y, Takahashi H et al.

Int J Urol. 2019 Feb;26(2):247-252.

ABSTRACT
OBJECTIVES: To evaluate the prognostic value of the warm ischemic time and the validity of the Kidney Donor Profile Index/Kidney Donor Risk Index for predicting the survival of donors after cardiac death grafts.
METHODS: We retrospectively assessed 315 kidneys retrieved from donors after cardiac death at Fujita Health University Hospital, Toyoake, Aichi, Japan. The Kidney Donor Profile Index/Kidney Donor Risk Index was calculated and the grafts were enrolled.
RESULTS: The median follow-up period was 11.9 years. The Kidney Donor Profile Index had a markedly asymmetric distribution (median 94%), and the Kidney Donor Risk Index had high index rates (0.79-2.94, median 1.70). The overall 5-, 10- and 15-year graft survival rates were 67.5%, 52.1% and 38.9%, respectively. The Kidney Donor Profile Index correlated with graft survival. The 5-, 10- and 15-year graft survival rates for the Kidney Donor Profile Index <1.2 were 87.7%, 73.5% and 59.2%; those for the Kidney Donor Risk Index >2.0 were 55.0%, 34.7% and 22.1%, respectively. A Cox multivariate analysis identified the Kidney Donor Risk Index (hazard ratio 2.06, 95% confidence interval 1.48-2.86, P < 0.0001) and warm ischemic time (hazard ratio 1.21, 95% confidence interval 1.09-1.34, P = 0.0010) as independent risk factors for graft loss. The addition of warm ischemic time >30 min had a significant effect, as measured by the C-index (0.708-0.731, P = 0.032), improving the net reclassification improvement score (0.256, P = 0.0039) and integrated discrimination improvement score (0.042, P = 0.0022).
CONCLUSIONS: The Kidney Donor Profile Index/Kidney Donor Risk Index is a good prognostic tool for determining the outcomes of donors after cardiac death grafts. However, the warm ischemic time should also be included in the allocation system for donors after cardiac death grafts.

105. Predictive Score Model for Delayed Graft Function Based on Hypothermic Machine Perfusion Variables in Kidney Transplantation

Ding CG, Li Y, Tian XH et al.

Chin Med J (Engl). 2018 Nov 20;131(22):2651-2657.

ABSTRACT

BACKGROUND: Hypothermic machine perfusion (HMP) is being used more often in cardiac death kidney transplantation; however, the significance of assessing organ quality and predicting delayed graft function (DGF) by HMP parameters is still controversial. Therefore, we used a readily available HMP variable to design a scoring model that can identify the highest risk of DGF and provide the guidance and advice for organ allocation and DCD kidney assessment.

METHODS: From September 1, 2012 to August 31, 2016, 366 qualified kidneys were randomly assigned to the development and validation cohorts in a 2:1 distribution. The HMP variables of the development cohort served as candidate univariate predictors for DGF. The independent predictors of DGF were identified by multivariate logistic regression analysis with a $P < 0.05$. According to the odds ratios (ORs) value, each HMP variable was assigned a weighted integer, and the sum of the integers indicated the total risk score for each kidney. The validation cohort was used to verify the accuracy and reliability of the scoring model.

RESULTS: HMP duration (OR = 1.165, 95% confidence interval [CI]: 1.008-1.360, P = 0.043), resistance (OR = 2.190, 95% CI: 1.032-10.20, $P < 0.001$), and flow rate (OR = 0.931, 95% CI: 0.894-0.967, P = 0.011) were the independent predictors of identified DGF. The HMP predictive score ranged from 0 to 14, and there was a clear increase in the incidence of DGF, from the low predictive score group to the very high predictive score group. We formed four increasingly serious risk categories (scores 0-3, 4-7, 8-11, and 12-14) according to the frequency associated with the different risk scores of DGF. The HMP predictive score indicates good discriminative power with a c-statistic of 0.706 in the validation cohort, and it had significantly better prediction value for DGF compared to both terminal flow (P = 0.012) and resistance (P = 0.006).

CONCLUSION: The HMP predictive score is a good noninvasive tool for assessing the quality of DCD kidneys, and it is potentially useful for physicians in making optimal decisions about the organs donated.

106. Outcome of Kidney Transplantation From Donor After Cardiac Death: Reanalysis of the US Mycophenolic Renal Transplant Registry

Zhu D, McCague K, Lin W et al.

Transplant Proc. 2018 Jun;50(5):1258-1263.

ABSTRACT

BACKGROUND: Kidney transplantation is limited by the shortage of donor kidneys. Donation after cardiac death (DCD) has been explored to alleviate this problem. To better understand the outcome of DCD kidney transplantation, we reanalyzed the Mycophenolic Renal Transplant (MORE) Registry.

METHODS: We compared delayed graft function (DGF), biopsy-proved acute rejection (BPAR), graft loss, and patient death between DCD and donation after brain death (DBD) kidney transplantations. Recipients were further stratified into depleting and nondepleting induction groups for exploratory analysis.

RESULTS: There were 548 patients who received kidney transplants from deceased donor in the MORE Registry. Among them, 133 received grafts from DCD donors and 415 received from DBD donors. The incidence of DGF was 29.4% and 23.5% in the DCD group and the DBD group, respectively (P = .1812), and the incidence of BPAR at 12 months was 9.0% and 9.9% respectively (P = .7713). The 1-year graft loss rate in the DCD group was higher than that in the DBD group (7.5% vs 3.1%, P = .0283), and the 4-year graft loss rate and patient death rate were not significantly different between the 2 groups.
CONCLUSIONS: The DCD kidney transplant group had acceptable short-term outcomes and good long-term outcomes as compared with the DBD kidney transplant group.

107. Machine perfusion and long-term kidney transplant recipient outcomes across allograft risk strata

Sandal S, Luo X, Massie AB et al.
Nephrol Dial Transplant. 2018 Jul 1;33(7):1251-1259.

ABSTRACT
BACKGROUND: The use of machine perfusion (MP) in kidney transplantation lowers delayed graft function (DGF) and improves 1-year graft survival in some, but not all, grafts. These associations have not been explored in grafts stratified by the Kidney Donor Profile index (KDPI).
METHODS: We analyzed 78 207 deceased-donor recipients using the Scientific Registry of Transplant Recipients data from 2006 to 2013. The cohort was stratified using the standard criteria donor/expanded criteria donor (ECD)/donation after cardiac death (DCD)/donation after brain death (DBD) classification and the KDPI scores. In each subgroup, MP use was compared with cold storage.
RESULTS: The overall DGF rate was 25.4% and MP use was associated with significantly lower DGF in all but the ECD-DCD donor subgroup. Using the donor source classification, the use of MP did not decrease death-censored graft failure (DCGF), except in the ECD-DCD subgroup from 0 to 1 year {adjusted hazard ratio [aHR] 0.56 [95% confidence interval (CI) 0.32-0.98]}. In the ECD-DBD subgroup, higher DCGF from 1 to 5 years was noted [aHR 1.15 (95% CI 1.01-1.31)]. Also, MP did not lower all-cause graft failure except in the ECD-DCD subgroup from 0 to 1 year [aHR = 0.59 (95% CI 0.38-0.91)]. Using the KDPI classification, MP did not lower DCGF or all-cause graft failure, but in the ≤70 subgroup, higher DCGF [aHR 1.16 (95% CI 1.05-1.27)] and higher all-cause graft failure [aHR 1.10 (95% CI 1.02-1.18)] was noted. Lastly, MP was not associated with mortality in any subgroup.
CONCLUSIONS: Overall, MP did not lower DCGF. Neither classification better risk-stratified kidneys that have superior graft survival with MP. We question their widespread use in all allografts as an ideal approach to organ preservation.

108. Factors affecting the survival of transplants from donors after prehospital cardiac death

Mateos Rodríguez AA, Andrés Belmonte A(2), Del Río Gallegos F et al.
Emergencias. 2017 Jun;29(3):167-172

ABSTRACT
OBJECTIVES: To evaluate factors that influence the survival of transplanted organs from donors after prehospital cardiac death.

MATERIAL AND METHODS: Retrospective observational study of data collected from hospital emergency service records. Information included prehospital cardiac deaths evaluated as donors as well as patients who received transplants.
RESULTS: Two hundred cases from 2008 through 2011 were studied. Sixty-nine potential donors (34.5%) were rejected. Three hundred organs were extracted from the remaining 131 donor cases, to yield a mean (SD) of 2.32 (0.83) transplanted organs/donor or 1.52 (1.29) organs/potential donor. One hundred fifty-two potential donors (76%) were treated with mechanical cardiopumps during transport. We detected no significant differences between cases transported with manual chest compressions and cases treated with cardiopumps regarding age (40.1 vs 43.5 years, P=.06), responder arrival times (13 min 54 s vs 12 min 54 s, P=.45), or transport times (1 h 27 min vs 1 h 32 min). However, case transported with manual chest compressions yielded significantly more kidneys (mean, 1.96/potential donor) than those transported with cardiopump compressions (mean, 1.38/potential donor) (P=.008). Eleven of the 229 kidneys harvested (4%) were not transplanted. The median (interquartile range) serum creatinine concentrations after kidney transplants at 6 and 12 months, respectively, were 1.37 (1.10-1.58) mg/dL and 1.43 (1.11-1.80) mg/dL.
CONCLUSION: Our findings suggest that the use of a cardiopump reduces donor recruitment. Long-term creatinine levels are similar after transplantation of kidneys from donors transported with a cardiopump or with manual compressions.

109. Negative impact of prolonged cold storage time before machine perfusion preservation in donation after circulatory death kidney transplantation

Paloyo S, Sageshima J, Gaynor JJ et al.
Transpl Int. 2016 Oct;29(10):1117-25.

ABSTRACT

Kidney grafts are often preserved initially in static cold storage (CS) and subsequently on hypothermic machine perfusion (MP). However, the impact of CS/MP time on transplant outcome remains unclear. We evaluated the effect of prolonged CS/MP time in a single-center retrospective cohort of 59 donation after circulatory death (DCD) and 177 matched donation after brain death (DBD) kidney-alone transplant recipients. With mean overall CS/MP times of 6.0 h/30.0 h, overall incidence of delayed graft function (DGF) was higher in DCD transplants (30.5%) than DBD transplants (7.3%, P < 0.0001). In logistic regression, DCD recipient (P < 0.0001), longer CS time (P = 0.0002), male recipient (P = 0.02), and longer MP time (P = 0.08) were associated with higher DGF incidence. In evaluating the joint effects of donor type (DBD vs. DCD), CS time (<6 vs. ≥6 h), and MP time (<36 vs. ≥36 h) on DGF incidence, one clearly sees an unfavorable effect of MP time ≥36 h (P = 0.003) across each donor type and CS time stratum, whereas the unfavorable effect of CS time ≥6 h (P = 0.01) is primarily seen among DCD recipients. Prolonged cold ischemia time had no unfavorable effect on renal function or graft survival at 12mo post-transplant. Long CS/MP time detrimentally affects early DCD/DBD kidney transplant outcome when grafts were mainly preserved by MP; prolonged CS time before MP has a particularly negative impact in DCD kidney transplantation.

110. Uncontrolled donation after circulatory death: European practices and recommendations for the development and optimization of an effective programme
Domínguez-Gil B, Duranteau J, Mateos A et al.
Transpl Int. 2016 Aug;29(8):842-59.

ABSTRACT
The shortage of organs remains one of the biggest challenges in transplantation. To address this, we are increasingly turning to donation after circulatory death (DCD) donors and now in some countries to uncontrolled DCD donors. We consolidate the knowledge on uncontrolled DCD in Europe and provide recommendations and guidance for the development and optimization of effective uncontrolled DCD programmes.

111. Donor Hemodynamics as a Predictor of Outcomes After Kidney Transplantation From Donors After Cardiac Death
Allen MB, Billig E, Reese PP et al.
Am J Transplant. 2016 Jan;16(1):181-93.

ABSTRACT
Donation after cardiac death is an important source of transplantable organs, but evidence suggests donor warm ischemia contributes to inferior outcomes. Attempts to predict recipient outcome using donor hemodynamic measurements have not yielded statistically significant results. We evaluated novel measures of donor hemodynamics as predictors of delayed graft function and graft failure in a cohort of 1050 kidneys from 566 donors. Hemodynamics were described using regression line slopes, areas under the curve, and time beyond thresholds for systolic blood pressure, oxygen saturation, and shock index (heart rate divided by systolic blood pressure). A logistic generalized estimation equation model showed that area under the curve for systolic blood pressure was predictive of delayed graft function (above median: odds ratio 1.42, 95% confidence interval [CI] 1.06-1.90). Multivariable Cox regression demonstrated that slope of oxygen saturation during the first 10 minutes after extubation was associated with graft failure (below median: hazard ratio 1.30, 95% CI 1.03-1.64), with 5-year graft survival of 70.0% (95%CI 64.5%-74.8%) for donors above the median versus 61.4 (95%CI 55.5%-66.7%) for those below the median. Among older donors, increased shock index slope was associated with increased hazard of graft failure. Validation of these findings is necessary to determine the utility of characterizing donor warm ischemia to predict recipient outcome.

112. The impact of donor factors on early graft function in kidney transplantation from donation after cardiac death
Ishimura T, Muramaki M, Kishikawa H et al.
Transplant Proc. 2014 May;46(4):1064-6.

ABSTRACT
Donation after cardiac death (DCD) has the potential to significantly increase the number of organ donors. In this study, we investigate the influence of several donor parameters on the early graft function in kidney transplantation from DCD donors. We performed 58 kidney transplantations from DCD donors. Recipients were divided into 2 groups according to their graft function: normal

graft function (NGF), patients who became be free of hemodialysis within 14 days post-transplantation) and delayed graft function (DGF) group, patients who required hemodialysis for longer than 15 days after transplantation). We compared donor age, sex, cause of death, warm and total ischemic time, duration of anuria (urine volume < 10 mL/h), and low blood pressure (systolic blood pressure < 60 mm Hg), usage of catecholamine and vasopressin, serum creatinine on the day of admission and graft retrieval, serum sodium concentration, and body temperature between 2 groups. The number of recipients in NGF and DGF group was 41 and 17. Univariate analysis revealed that duration of anuria (<24 vs ≥ 24 hours) and usage of catecholamine significantly influenced graft function. Duration of anuria was an independent risk factor for early graft function by multivariate analysis. In cadaveric kidney transplantation from DCD donors, there was a trend to poorer early graft function with donors who suffered from anuria for longer than 24 hours before kidney retrieval.

113. Comparison of kidney function between donation after cardiac death and donation after brain death kidney transplantation

Wadei HM, Heckman MG, Rawal B et al.

Transplantation. 2013 Aug 15;96(3):274-81.

ABSTRACT

BACKGROUND: Kidney graft survival is comparable between donation after cardiac death (DCD) and donation after brain death (DBD) kidney transplantation. However, data concerning kidney function after DCD kidney transplantation are lacking.

METHODS: We retrospectively compared kidney function between 64 DCD and 248 DBD kidney transplant recipients. Graft function was assessed using iothalamate glomerular filtration rate at 1, 4, and 12 months, then annually. The primary endpoint was the composite of death-censored graft loss or two consecutive iothalamate glomerular filtration rates less than 50 mL/min/1.73 m^2 occurring within 5 years from transplantation. Secondary endpoints included death and graft loss or death.

RESULTS: Of the 312 patients, 102 (33%) experienced the primary endpoint, 78 (25%) experienced graft loss or death, and 44 (14%) died. In multivariable Cox regression analysis, there was no difference between DCD and DBD recipients regarding the primary endpoint (relative risk [RR], 1.16; P=0.59), death (RR, 0.97; P=0.94), or graft loss or death (RR, 1.09; P=0.79). In the subgroup of 64 DCD recipients, each 10-year increase in donor age was associated with increased risk of the primary endpoint (RR, 1.51; P=0.027) with the highest risk observed for donors older than 45 years (RR, 4.81; P=0.001). Delayed graft function affected 45% of the DCD recipients but had no impact on kidney function, graft survival, or patient survival.

CONCLUSIONS: Posttransplantation kidney function is comparable between DCD and DBD kidney transplantations. In the subgroup of DCD recipients, kidneys from donors older than 45 years may be associated with a higher risk of poor kidney function; however, this finding requires validation in a larger patient group.

114. Machine perfusion versus cold storage of kidneys derived from donation after cardiac death: a meta-analysis

Deng R, Gu G, Wang D et al.

PLoS One. 2013;8(3):e56368.

ABSTRACT
BACKGROUND: In response to the increased organ shortage, organs derived from donation after cardiac death (DCD) donors are becoming an acceptable option once again for clinical use in transplantation. However, transplant outcomes in cases where DCD organs are used are not as favorable as those from donation after brain death or living donors. Different methods of organ preservation are a key factor that may influence the outcomes of DCD kidney transplantation.
METHODS: We compared the transplant outcomes in patients receiving DCD kidneys preserved by machine perfusion (MP) or by static cold storage (CS) preservation by conducting a meta-analysis. The MEDLINE, EMBASE and Cochrane Library databases were searched. All studies reporting outcomes for MP versus CS preserved DCD kidneys were further considered for inclusion in this meta-analysis. Odds ratios and 95% confidence intervals (CI) were calculated to compare the pooled data between groups that were transplanted with kidneys that were preserved by MP or CS.
RESULTS: Four prospective, randomized, controlled trials, involving 175 MP and 176 CS preserved DCD kidney transplant recipients, were included. MP preserved DCD kidney transplant recipients had a decreased incidence of delayed graft function (DGF) with an odd ration of 0.56 (95% CI = 0.36-0.86, P = 0.008) compared to CS. However, no significant differences were seen between the two technologies in incidence of primary non-function, one year graft survival, or one year patient survival.
CONCLUSIONS: MP preservation of DCD kidneys is superior to CS in terms of reducing DGF rate post-transplant. However, primary non-function, one year graft survival, and one year patient survival were not affected by the use of MP or CS for preservation.

115. Kidney transplantation from donors after cardiac death: an initial report of 71 cases from China

Chen GD, Shiu-Chung Ko D, Wang CX et al.
Am J Transplant. 2013 May;13(5):1323-6.

ABSTRACT
Shortage of deceased donors is a severe problem in recent years in China especially in a culture in which brain death criteria is not widely accepted. Donation after cardiac death (DCD) has been reported to expand the donor pool despite higher rates of primary nonfunction (PNF) and delayed graft function (DGF) after transplantation. We collected 71 DCD kidney transplants performed at our hospital between February, 2007 and June, 2012 with aims to demonstrate the feasibility of DCD donation in China. All patients were followed up, and postoperative complications and graft loss were recorded. The PNF rate was 2.8%, and DGF rate was 28.2%. The 1- and 3-year graft survival was 95.7% and 92.4%. In conclusion, graft survival of DCD kidney transplantation in China is excellent despite of higher rates of PNF and DGF after transplantation.

116. Five-year experience with donation after cardiac death kidney transplantation in a Canadian transplant program: Factors affecting outcomes

Moser M, Sharpe M, Weernink C et al.
Can Urol Assoc J. 2012 Dec;6(6):448-52.

ABSTRACT

BACKGROUND: Donation after cardiac death (DCD) has led to an increase of up to 40% in the number of kidney transplants in some programs. Unfortunately, the increase in warm ischemic time results in higher rates of delayed graft function (DGF). The purpose of our study was to examine our initial 5-year experience with DCD kidney transplantation and to determine the factors involved in early postoperative function and function at 1 year.
METHODS: This retrospective study included a review of the recipient and donor charts of 63 DCD kidneys retrieved and transplanted by the London Multi-Organ Transplant Program between July 2006 and October 2011. Comparisons were carried out between our early (n=31, July 2006 to January 2009) and our recent experience (n=32, March 2009 to October 2011). DGF and creatinine clearance at 3, 7 and 365 days were examined with regression analyses.
RESULTS: DGF was seen in 65% of transplanted kidneys. Mean creatinine clearance (CrCl) at 1 year was 66.7 mL/min. Low pre-transplant recipient daily urine output was the most statistically significant predictor of DGF in multivariate analysis ($p < 0.001$). In comparisons between our early and more recent results improvements were noted in time from asystole to flush (16.0 vs. 12.0 minutes, $p = 0.003$), while cold ischemic time increased (464 vs. 725 minutes, $p = 0.006$). Experience contributed to a significant reduction in hospital length of stay (16 vs. 13 days, $p = 0.035$) and improved early renal function (CrCl at 3 days 7.8 vs. 11.9 mL/min, $p = 0.027$). The use of machine cold perfusion and higher recipient preoperative daily urine output predicted improved early renal function, while increasing donor age predicted poorer function at 1 year.
DISCUSSION: Despite early DGF, our results justify the continued transplantation of kidneys from DCD donors.

117. Influence of delayed graft function and acute rejection on outcomes after kidney transplantation from donors after cardiac death

Nagaraja P, Roberts GW, Stephens M, et al.

Transplantation. 2012 Dec 27;94(12):1218-23.

ABSTRACT
BACKGROUND: Delayed graft function (DGF) and acute rejection (AR) exert an adverse impact on graft outcomes after kidney transplantation using organs from donation after brain-stem death (DBD) donors. Here, we examine the impact of DGF and AR on graft survival in kidney transplants using organs from donation after cardiac death (DCD) donors.
METHODS: We conducted a single-center retrospective study of DCD and DBD donor kidney transplants. We compared 1- and 4-year graft and patient survival rates, as well as death-censored graft survival (DCGS) rates, between the two groups using univariate analysis, and the impact of DGF and AR on graft function was compared using multivariate analysis.
RESULTS: Eighty DCD and 206 DBD donor transplants were analyzed. Median follow-up was 4.5 years. The incidence of DGF was higher among DCD recipients (73% vs. 27%, P<0.001), and AR was higher among DBD recipients (23% vs. 9%, P<0.001). One-year and 4-year graft survival rates were similar (DCD 94% and 79% vs. DBD 90% and 82%). Among recipients with DGF, the 4-year DCGS rate was better for DCD recipients compared with DBD recipients (100% vs. 92%, P=0.04). Neither DGF nor AR affected the 1-year graft survival rate in DCD recipients, whereas in DBD recipients, the 1-year graft survival rate was worse in the presence of DGF (88% vs. 96%, P=0.04) and the 4-year DCGS rate was worse in the presence of AR (88% vs. 96%, P=0.04).
CONCLUSION: Despite the high incidence of DGF, medium-term outcomes of DCD kidney transplants are comparable to those from DBD transplants. Short-term graft

survival from DCD transplants is not adversely influenced by DGF and AR, unlike in DBD transplants.

118. Delayed graft function does not harm the future of donation-after-cardiac death in kidney transplantation

Le Dinh H, Weekers L, Bonvoisin C, et al.

Transplant Proc. 2012 Nov;44(9):2795-802.

ABSTRACT

INTRODUCTION: Delayed graft function (DGF) occurs more frequently in kidney transplants from donation after cardiac death (DCD) than from donation after brain death (DBD). We investigated the effect of DGF on posttransplantation outcomes among grafts from controlled DCD kidneys.

PATIENTS AND METHODS: This single-center retrospective study recruited 80 controlled DCD kidneys transplanted from January 2005 to December 2011. Mean patient follow-up was 28.5 months.

RESULTS: There were no primary nonfunction grafts; the DGF rate was 35.5%. Overall graft survival rates between groups with versus without DGF were 92.4% and 95.2% at 1 year, 92.4% and 87.1% at 3 years, and 84.7% and 87.1% at 5 years, respectively (P = not significant (NS)). Patients with versus without DGF showed the same survival rates at the corresponding time 92.4% vs 97.2%, 92.4% vs 93.9%, and 84.7% vs 93.9% (P = NS). Estimated glomerular filtration rate was significantly lower in the DGF compared with the non-DGF group at hospital discharge (29 vs 42 mL/min; P = .00) and at 6 months posttransplantation (46 vs 52 mL/min; P = .04), but the difference disappeared thereafter: 47 vs 52 mL/min at 1 year, 50 vs 48 mL/min at 3 years, and 54 vs 53 mL/min at 5 years (P = NS). DGF did not increase the risk of an acute rejection episode (29.6% vs 30.6%; P = NS) or rate of surgical complications (33.3% vs 26.5%; P = NS). However, DGF prolonged significantly the length of hospitalization in the DGF versus the non- DGF group (18.9 vs 13 days; P = .00). Donor body mass index (BMI) ≥ 30 kg/m(2), recipient BMI ≥30 kg/m(2), and pretransplantation dialysis duration increased the risk of DGF upon multivariate logistic regression analysis.

CONCLUSIONS: Apart from the longer hospital stay, DGF had no deleterious impact on the future of kidney allografts from controlled DCD, which showed comparable graft and patient survivals, renal function, rejection rates, and surgical complications as a group without DGF. Therefore, DGF should no longer be considered to be a medical barrier to the use of kidney grafts from controlled DCD.

119. The Impact of CPR in High-Risk Donation after Circulatory Death Donors and Extended Criteria Donors for Kidney Transplantation

Buggs J, Rogers E, Bowers V.

Am Surg. 2018 Jul 1;84(7):1164-1168.

ABSTRACT

The demand for organs for kidney transplantation (KTX) compels the use of high-risk donation after circulatory death donors (DCDs) and extended criteria donors (ECDs). Many deceased donors receive prehospital CPR, but the literature does not address CPR as a benefit to graft survival. We hypothesized that donor prehospital CPR correlates with improved graft survival with high-risk DCD/ECD kidneys. We retrospectively analyzed KTX recipients and their donor data from 2008 to

2013. A total of 646 cadaveric donors (498 SCDs, 55 DCDs, and 93 ECDs) facilitated 910 KTX. There were 223 KTX performed from 148 high-risk DCDs/ECDs (31 with CPR and 117 without CPR). The mean age of high-risk DCDs/ECDs with CPR was 44.94 versus 53.45 years without CPR (P = 0.005). The recipients of high-risk DCDs/ECDs revealed no significant difference in body mass index, length of stay, discharge Cr, CIT, or DGF with and without CPR. Graft survival at three years was significant with 0/50 failures from high-risk DCDs/ECDs with CPR versus 16/173 without CPR (P = 0.026). Our findings are limited as a single-center retrospective study; however, the result of significant three-year graft survival in high-risk DCDs/ECDs with CPR suggests that prehospital donor CPR should be further investigated for its contribution to the relative quality of the donor.

120. Expanding the Donor Pool Through Intensive Care to Facilitate Organ Donation: Results of a Spanish Multicenter Study

Domínguez-Gil B, Coll E, Elizalde J et al.

Transplantation. 2017 Aug;101(8):e265-e272.

ABSTRACT

BACKGROUND: Intensive Care to facilitate Organ Donation (ICOD) may help to increase the donor pool. We describe the Spanish experience with ICOD.

METHODS: Achieving Comprehensive Coordination in Organ Donation (ACCORD)-Spain consisted of an audit of the donation pathway from patients who died as a result of a devastating brain injury (possible donors) in 68 hospitals during November 1, 2014, to April 30, 2015. We focused on possible donors whose families were interviewed to discuss organ donation once intensive care with a therapeutic purpose was deemed futile and brain death (BD) was a likely outcome.

RESULTS: Of the 1970 possible donors in ACCORD-Spain, in 257, the family was interviewed once the decision had been made not to intubate/ventilate (n = 105), with the patient under intubation/ventilation outside of the intensive care unit (n = 59), or with the patient intubated/ventilated within the intensive care unit (n = 93).Consent to ICOD was obtained in 174 cases. Consent was higher when the donor coordinator participated in the interview (odds ratio, 2.32; 95% confidence interval, 1.33-4.11; P = 0.003). One hundred thirty-one patients developed BD, of whom 117 transitioned to actual donation after BD. Of the 35 patients who did not develop BD, 2 transitioned to actual donation after circulatory death. Sixteen patients subject to ICOD were finally medically unsuitable organ donors. ICOD contributed to 24% of the 491 actual donors registered in ACCORD-Spain.

CONCLUSIONS: Despite the complexity of the interview, the majority of families consented to ICOD. Estimating the probability of BD and assessing medical suitability are additional challenges of the practice. ICOD represents a clear opportunity to increase the donor pool and ensures organ donation is posed at every end-of-life care pathway.

121. Improving the Outcomes of Organs Obtained From Controlled Donation After Circulatory Death Donors Using Abdominal Normothermic Regional Perfusion

Miñambres E, Suberviola B, Dominguez-Gil B et al.

Am J Transplant. 2017 Aug;17(8):2165-2172.

ABSTRACT

The use of donation after circulatory death (DCD) has increased significantly during the past decade. However, warm ischemia results in a greater risk for transplantation. Indeed, controlled DCD (cDCD) was associated with inferior outcomes compared with donation after brain death. The use of abdominal normothermic regional perfusion (nRP) to restore blood flow before organ recovery in cDCD has been proposed as better than rapid recovery to reverse the effect of ischemia and improve recipients' outcome. Here, the first Spanish series using abdominal nRP as an in situ conditioning method is reported. A specific methodology to avoid restoring circulation to the brain after death determination is described. Twenty-seven cDCD donors underwent abdominal nRP during at least 60 min. Thirty-seven kidneys, 11 livers, six bilateral lungs, and one pancreas were transplanted. The 1-year death-censored kidney survival was 91%, and delayed graft function rate was 27%. The 1-year liver survival rate was 90.1% with no cases of ischemic cholangiopathy. Transplanted lungs and pancreas exhibited primary function. The use of nRP may represent an advance to increase the number and quality of grafts in cDCD. Poor results in cDCD livers could be reversed with nRP. Concerns about restoring brain circulation after death are easily solved.

122. Kidney transplant from controlled donors following circulatory death: Results from the GEODAS-3 multicentre study

Portolés JM, Pérez-Sáez MJ, López-Sánchez P et al.

Nefrologia. 2019 Mar - Apr;39(2):151-159.

ABSTRACT

INTRODUCTION: Many European countries have transplant programmes with controlled donors after cardiac death (cDCD). Twenty-two centres are part of GEODAS group. We analysed clinical results from a nephrological perspective.

METHODS: Observational, retrospective and multicentre study with systematic inclusion of all kidney transplant recipients from cDCD, following local protocols regarding extraction and immunosuppression.

RESULTS: A total of 335 cDCD donors (mean age 57.2 years) whose deaths were mainly due to cardiovascular events were included. Finally, 566 recipients (mean age 56.5 years; 91.9% first kidney transplant) were analysed with a median of follow-up of 1.9 years. Induction therapy was almost universal (thymoglobulin 67.4%; simulect 32.8%) with maintenance with prednisone-MMF-tacrolimus (91.3%) or combinations with mTOR (6.5%). Mean cold ischaemia time (CIT) was 12.3h. Approximately 3.4% (n=19) of recipients experienced primary non-function, essentially associated with CIT (only CIT ≥ 14 h was associated with primary non-function). Delayed graft function (DGF) was 48.8%. DGF risk factors were CIT ≥ 14 h OR 1.6, previous haemodialysis (vs. peritoneal dialysis) OR 2.1 and donor age OR 1.01 (per year). Twenty-one patients (3.7%) died with a functioning graft, with a recipient and death-censored graft survival at 2-years of 95% and 95.1%, respectively. The estimated glomerular filtration rate at one year of follow-up was 60.9 ml/min.

CONCLUSIONS: CIT is a modifiable factor for improving the incidence of primary non-function in kidney transplant arising from cDCD. cDCD kidney transplant recipients have higher delayed graft function rate, but the same patient and graft survival compared to brain-dead donation in historical references. These results are convincing enough to continue fostering this type of donation.

123. Protocol of a randomised controlled, open-label trial of ex vivo normothermic perfusion versus static cold storage in donation after circulatory death renal transplantation

Hosgood SA, Saeb-Parsy K, Wilson C et al.

BMJ Open. 2017 Jan 23;7(1):e012237.

ABSTRACT

INTRODUCTION: Ex vivo normothermic perfusion (EVNP) is a novel technique that reconditions the kidney and restores renal function prior to transplantation. Phase I data from a series of EVNP in extended criteria donor kidneys have established the safety and feasibility of the technique in clinical practice.

METHODS AND ANALYSIS: This is a UK-based phase II multicentre randomized controlled trial to assess the efficacy of EVNP compared with the conventional static cold storage technique in donation after circulatory death (DCD) kidney transplantation. 400 patients receiving a kidney from a DCD donor (categories III and IV, controlled) will be recruited into the study. On arrival at the transplant centre, kidneys will be randomised to receive either EVNP (n=200) or remain in static cold storage (n=200). Kidneys undergoing EVNP will be perfused with an oxygenated packed red cell solution at near body temperature for 60 min prior to transplantation. The primary outcome measure will be determined by rates of delayed graft function (DGF) defined as the need for dialysis in the first week post-transplant. Secondary outcome measures include incidences of primary non-function, the duration of DGF, functional DGF defined as <10% fall in serum creatinine for 3 consecutive days in the first week post-transplant, creatinine reduction ratio days 2 and 5, length of hospital stay, rates of biopsy-proven acute rejection, serum creatinine and estimated glomerular filtration rate at 1, 3, 6 and 12 months post-transplant and patient and allograft survival. The EVNP assessment score will be recorded and the level of fibrosis and inflammation will also be measured using tissue, blood and urine samples. Ethics and dissemination.

The study has been approved by the National Health Service (NHS) Health Research Authority Research Ethics Committee. The results are expected to be published in 2020.

124. Enhancing kidney function with thrombolytic therapy following donation after cardiac death: a multicenter quasi-blinded prospective randomized trial

Woodside KJ, Goldfarb DA, Rabets JC et al.

Clin Transplant. 2015 Dec;29(12):1173-80.

ABSTRACT

Kidneys from donors after cardiac death (DCD) are at risk for inferior outcomes, possibly due to microthrombi and additional warm ischemia. We describe an organ procurement organization-wide trial utilizing thrombolytic tissue plasminogen activator (tPA) during machine pulsatile perfusion (MPP). A kidney from each recovered kidney pair was prospectively randomized to receive tPA (50 mg Alteplase) or no tPA (control) in the MPP perfusate. From 2011 to 2013, 24 kidneys were placed with enrolled recipients from 19 DCD kidney donors. There were no significant differences for absolute values of flow or resistance while undergoing MPP between the groups, nor rates of achieving discrete flow and resistance targets. While there was a trend toward lower creatinine and higher glomerular filtration rates in the tPA group at 3, 6, 9, and 12 months, these differences were not significant. Delayed graft function (DGF) rates were 41.7%

in the tPA group vs. 58.4% in the control group (OR 0.51, 95%CI 0.10-2.59, p = 0.68). Death-censored graft survival was similar between the groups. In this pilot study, encouraging trends are seen in kidney allograft function independent of MPP parameters following DCD kidney transplantation for those kidneys receiving thrombolytic tPA and MPP, compared with standard MPP.

125. Outcomes of kidney transplants from non-heart-beating deceased donors as reported to the Japan Organ Transplant Network from April 1995-December 2003: a multi-center report.
Teraoka S, Nomoto K, Kikuchi K et al.
Clin Transplant 2004:91-102.

ABSTRACT
Between April 1995-December 2003, 1,324 deceased donor kidney transplantations were performed in 139 transplant institutes in Japan. Of these, 45 transplants were from heart-beating and 1,279 transplants were from non-heart-beating deceased donors (NHBDD). Clinical outcomes for the 1,279 recipients of NHBDD kidney transplants were investigated. The overall 5-year patient and graft survival rates were 90% and 72%, respectively. A total of 112 NHBDD kidney grafts never functioned after transplantation and the recipients had to remain on dialysis. The causes of nonfunction were rejection, primary nonfunction, death, thrombosis and others in the order of the incidence. The major causes of graft loss were nonfunction, death, chronic rejection and acute rejection in that order. Major causes of recipient deaths were pneumonia, sepsis and CVA within 12 months, and heart diseases, sepsis, malignancy and pneumonia more than 12 months after transplantation. Kidneys from female donors, donors aged 15 or less or over age 60, donors with extrinsic causes of death other than head trauma, recipients over age 60 and those with diabetic nephropathy as their original disease were found to be at risk for poor graft survival. The lowest and last donor serum creatinine level did not influence the incidence of nonfunction or graft survival. However, graft survival was significantly poorer among recipients of older "expanded" donor kidneys than for recipients of younger grafts. The warm and total ischemia times should be kept shorter than 30 minutes (better 15 minutes), and 12 hours, respectively to minimize the incidence of nonfunction and early graft loss. It is especially important in cases with WIT over 30 minutes that the total ischemia should be kept within 12 hours. Cannulation before cardiac standstill was important to reduce the incidence of nonfunction and achieve high graft survival rates with NHBDD kidneys. The discontinuance of ventilator support also reduced the incidence of graft nonfunction. The combination of CsA or Tacrolimus and MMF as both the induction and maintenance regimen significantly improved graft survival. The use of either anti-T cell antibodies or basiliximab was also associated with significantly better graft survival for NHBDD kidneys. The combination of basiliximab, CsA and MMF resulted in a graft survival rate of 98% at one and 2 years.

126. Outcomes of kidneys from donors after cardiac death: implications for allocation and preservation.
Locke JE, Segev DL, Warren DS, et al.
Am J Transplant 2007;7:1797-1807.

ABSTRACT

Although donation after cardiac death (DCD) kidneys have a high incidence of delayed graft function (DGF) and have been considered marginal, no tool for stratifying risk of graft loss nor a specific policy governing their allocation exist. We compared outcomes of 2562 DCD, 62,800 standard criteria donor (SCD) and 12,812 expanded criteria donor (ECD) transplants reported between 1993 and 2005, and evaluated factors associated with risk of graft loss and DGF in DCD kidneys. Donor age was the only criterion used in the definition of ECD kidneys that independently predicted graft loss among DCD kidneys. Kidneys from DCD donors <50 had similar long-term graft survival to those from SCD (RR 1.1, p = NS). While DGF was higher among DCD compared to SCD and ECD, limiting cold ischemia (CIT) to <12 h decreased the rate of DGF 15% among DCD <50 kidneys. These findings suggest that DCD <50 kidneys function like SCD kidneys and should not be viewed as marginal or ECD, and further, limiting CIT <12 h markedly reduces DGF.

127. Short- and long-term outcomes with the use of kidneys and livers donated after cardiac death.
Doshi MD, Hunsicker LG.
Am J Transplant 2007;7:122-129.
ABSTRACT
The shortage of deceased donor kidneys and livers for transplantation has prompted the use of organs from donors deceased after cardiac death (DCD). We used the UNOS database to examine patient and graft survival following transplantation of DCD organs compared to those following grafts from donors deceased after brain death (DBD; for livers, grafts from donors < 60 years old were labeled '< 60 yrs'). Of 44035 deceased donor kidney transplant recipients, 1177 (3%) received a DCD kidney. There was no difference in patient or graft survival at 5 years (DCD vs. DBD: 81.3% vs. 80.8% and 66.9% vs. 66.5%; p = 0.70 and p = 0.52 respectively). Of 24688-deceased donor liver transplant recipients, 345 (1.4%) were from DCD donors and 20289 (82%) were from '< 60 yrs' DBD donors. Three-year patient and graft survival were inferior in the DCD group (DCD vs. '< 60 yrs' DBD: 77% vs. 80% and 65% vs. 75%; p = 0.016 and p < 0.0001 respectively) but were comparable to current alternatives, '>/= 60 yrs' DBD livers (donor age >/= 60) and split livers. DCD livers are a reasonable option when death is imminent. Our study demonstrates good outcomes using DCD kidneys and livers and encourages their use.

128. Does expanded criteria donor status modify the outcomes of kidney transplantation from donors after cardiac death?
Singh SK, Kim SJ.
Am J Transplant 2013;13(2):329-36.

ABSTRACT
The outcomes of kidney transplants that simultaneously exhibit donation after cardiac death (DCD) and expanded criteria donor (ECD) characteristics have not been well studied. We examined the outcomes of DCD versus non-DCD kidney transplants as a function of ECD status and the kidney donor risk index (KDRI). A cohort study of 67 816 deceased donor kidney transplant recipients (KTR), including 562 ECD/DCD KTR, from January 1, 2000 to December 31, 2009 was conducted using the Scientific Registry of Transplant Recipients. In a multivariable Cox proportional hazards model, the modestly increased risk of total graft failure in DCD versus non-DCD KTR was not significantly modified by ECD status (hazard ratio1.07 [95% CI: 1.01, 1.15] for

non-ECD vs. 1.21 [95% CI: 1.04, 1.40] for ECD, p for interaction = 0.14).Moreover, the hazard ratios did not significantly vary by KDRI quintiles (p = 0.40). Similar trends were seen for death-censored graft failure and death with graft function. In conclusion, ECD status or higher KDRI score did not appreciably increase the relative hazard of adverse graft and patient outcomes in DCD KTR. These findings suggest that the judicious use of ECD/DCD donor kidneys may be an appropriate strategy to expand the donor pool.

129. Effect of donor age and cold storage time on outcome in recipients of kidneys donated after circulatory death in the UK: a cohort study.

Summers DM, Johnson RJ, Hudson A et al.

Lancet 2013;381:727-34.

ABSTRACT

BACKGROUND: Use of kidneys donated after controlled circulatory death has increased the number of transplants undertaken in the UK but there remains reluctance to use kidneys from older circulatory-death donors and concern that kidneys from circulatory-death donors are particularly susceptible to cold ischaemic injury. We aimed to compare the effect of donor age and cold ischaemic time on transplant outcome in kidneys donated after circulatory death versus brain death.

METHODS: We used the UK transplant registry to select a cohort of first-time recipients (aged ≥ 18 years) of deceased-donor kidneys for transplantations done between Jan 1, 2005, and Nov 1, 2010. We did univariate comparisons of transplants from brain-death donors versus circulatory-death donors with χ tests for categorical data and Wilcoxon tests for non-parametric continuous data. We used Kaplan-Meier curves to show graft survival. We used Cox proportional hazards regression to adjust for donor and recipient factors associated with graft-survival with tests for interaction effects to establish the relative effect of donor age and cold ischaemia on kidneys from circulatory-death and brain-death donors.

FINDINGS: 6490 deceased-donor kidney transplants were done at 23 centres. 3 year graft survival showed no difference between circulatory-death (n=1768) and brain-death (n=4127) groups (HR 1·14, 95% CI 0·95-1·36, p=0·16). Donor age older than 60 years (compared with <40 years) was associated with an increased risk of graft loss for all deceased-donor kidneys (2·35, 1·85-3·00, p<0·0001) but there was no increased risk of graft loss for circulatory-death donors older than 60 years compared with brain-death donors in the same age group (p=0·30). Prolonged cold ischaemic time (>24 h vs <12 h) was not associated with decreased graft survival for all deceased-donor kidneys but was associated with poorer graft survival for kidneys from circulatory-death donors than for those from brain-death donors (2·36, 1·39-4·02, p for interaction=0·004).

INTERPRETATION: Kidneys from older circulatory-death donors have equivalent graft survival to kidneys from brain-death donors in the same age group, and are acceptable for transplantation. However, circulatory-death donor kidneys tolerate cold storage less well than do brain-death donor kidneys and this finding should be considered when developing organ allocation policy.

FUNDING: UK National Health Service Blood and Transplant; Cambridge National Institute for Health Research Biomedical Research Centre.

2. EVALUACIÓN DEL DONANTE VIVO

GENERALIDADES

130. Health Outcomes for Living Kidney Donors with Isolated Medical Abnormalities: A Systematic Review

Young A, Storsley L, Garg AX et al.

Am J Transplant. 2008 Sep;8(9):1878-90.

ABSTRACT

Individuals with isolated medical abnormalities (IMAs) are undergoing living donor nephrectomy more frequently. Knowledge of health risks for these living donors is important for donor selection, informed consent and follow-up. We systematically reviewed studies with > or = 3 living kidney donors with preexisting IMAs, including older age, obesity, hypertension, reduced glomerular filtration rate (GFR), proteinuria, microscopic hematuria and nephrolithiasis. We abstracted data on study and donor characteristics, perioperative outcomes, longer term renal and blood pressure outcomes and mortality and compared them to those of non-IMA donors. We found 22 studies on older donors (n = 987), 10 on obese donors (n = 484), 6 on hypertensive donors (n = 125), 4 on donors with nephrolithiasis (n = 32), 2 on donors with microscopic hematuria and one study each on donors with proteinuria or reduced GFR. Perioperative outcomes for donors with and without IMAs were similar. Few studies reported longer term (> or = 1 year) rates of hypertension, proteinuria or renal function. Studies were frequently retrospective and without a comparison group. Given the variability among studies and their methodological limitations, uncertainties remain regarding long-term medical outcomes for IMA donors. As transplant centers continue to cautiously screen and counsel potential IMA donors, rigorously conducted, longer term prospective cohort studies are needed.

131. Summary of Kidney Disease: Improving Global Outcomes (KDIGO) Clinical Practice Guideline on the Evaluation and Care of Living Kidney Donors

Lentine KL, Kasiske BL, Levey AS et al.

Transplantation. 2017 Aug;101(8):1783-1792.

ABSTRACT

Kidney Disease: Improving Global Outcomes (KDIGO) engaged an evidence review team and convened a work group to produce a guideline to evaluate and manage candidates for living kidney donation. The evidence for most guideline recommendations is sparse and many "ungraded" expert consensus recommendations were made to guide the donor candidate evaluation and care before, during, and after donation. The guideline advocates for replacing decisions based on assessments of single risk factors in isolation with a comprehensive approach to risk assessment using the best available evidence. The approach to simultaneous consideration of each candidate's profile of demographic and health characteristics advances a new framework for assessing donor candidate risk and for defensible shared decision making.

132. BTS LDKT Guidelines 4th edition
Consultation draft, December 2017

Abstract not available

OBESIDAD

133. Systematic review and meta-analysis of the relation between body mass index and short-term donor outcome of laparoscopic donor nephrectomy
Lafranca JA, Hagen SM, Dols LF et al.
Kidney Int. 2013 May;83(5):931-9.

ABSTRACT
In this era of organ donor shortage, live kidney donation has been proven to increase the donor pool; however, it is extremely important to make careful decisions in the selection of possible live donors. A body mass index (BMI) above 35 is generally considered as a relative contraindication for donation. To determine whether this is justified, a systematic review and meta-analysis were carried out to compare perioperative outcome of live donor nephrectomy between donors with high and low BMI. A comprehensive literature search was performed in MEDLINE, Embase, and CENTRAL (the Cochrane Library). All aspects of the Preferred Reporting Items for Systematic Reviews and Meta-analyses statement were followed. Of 14 studies reviewed, eight perioperative donor outcome measures were meta-analyzed, and, of these, five were not different between BMI categories. Three found significant differences in favor of low BMI (29.9 and less) donors with significant mean differences in operation duration (16.9 min (confidence interval (CI) 9.1-24.8)), mean difference in rise in serum creatinine (0.05 mg/dl (CI 0.01-0.09)), and risk ratio for conversion (1.69 (CI 1.12-2.56)). Thus, a high body mass index (BMI) alone is no contraindication for live kidney donation regarding short-term outcome.

134. Long-Term Renal Function and Cardiovascular Disease Risk in Obese Kidney Donors
Tavakol MM, Vincenti FG, Assadi H et al.
Clin J Am Soc Nephrol. 2009 Jul;4(7):1230-8.

ABSTRACT
BACKGROUND AND OBJECTIVES: Increasing demand for live-donor kidneys has encouraged the use of obese donors despite the absence of long-term outcome data and evidence that obesity can adversely affect renal function. We wished to determine whether obesity increased the risk for renal dysfunction and other medical comorbidities in donors several years after donation.
DESIGN, SETTING, PARTICIPANTS, & MEASUREMENTS: Ninety-eight patients who donated a kidney 5 to 40 years previously were stratified according to body mass index (BMI) at donation and evaluated for renal dysfunction and risk factors for cardiovascular disease. Patients who were from the 2005 through 2006 National Health and Nutrition Examination Survey database; did not have renal disease; and were matched for age, gender, race, and BMI served as two-kidney control subjects.
RESULTS: Renal function in obese (BMI > or =30) and nonobese (BMI <30) donors was similar, and both donor groups had reduced renal function compared with BMI-matched two-kidney control

subjects. Obesity was associated with more hypertension and dyslipidemias in both donors and two-kidney control subjects; however, there were no significant differences between the two groups within each BMI category.
CONCLUSIONS: These results indicate that obese donors are not at higher risk for long-term reduced renal function compared with nonobese donors and that the increased incidence of hypertension and other cardiovascular disease risk factors in obese donors is due to their obesity and is not further exacerbated by nephrectomy. These findings support the current practice of using otherwise healthy overweight and obese donors but emphasize the need for more intensive preoperative education and postoperative health care maintenance in this donor group.

135. The CARI guidelines. Donors at risk: obesity
Isabel N; CARI guidelines
Nephrology (Carlton). 2010 Apr;15 Suppl 1:S121-32. d.

Abstract not available

136. Obesity increases the risk of end-stage renal disease among living kidney donors
Locke JE, Reed RD, Massie A et al.
Kidney Int. 2017 Mar;91(3):699-703.

ABSTRACT
Determining candidacy for live kidney donation among obese individuals remains challenging. Among healthy non-donors, body mass index (BMI) above 30 is associated with a 16% increase in risk of end-stage renal disease (ESRD). However, the impact on the ESRD risk attributable to donation and living with only one kidney remains unknown. Here we studied the risk of ESRD associated with obesity at the time of donation among 119 769 live kidney donors in the United States. Maximum follow-up was 20 years. Obese (BMI above 30) live kidney donors were more likely male, African American, and had higher blood pressure. Estimated risk of ESRD 20 years after donation was 93.9 per 10 000 for obese; significantly greater than the 39.7 per 10 000 for non-obese live kidney donors. Adjusted for age, sex, ethnicity, blood pressure, baseline estimated glomerular filtration rate, and relationship to recipient, obese live kidney donors had a significant 86% increased risk of ESRD compared to their non-obese counterparts (adjusted hazard ratio 1.86; 95% confidence interval 1.05-3.30). For each unit increase in BMI above 27 kg/m2 there was an associated significant 7% increase in ESRD risk (1.07, 1.02-1.12). The impact of obesity on ESRD risk was similar for male and female donors, African American and Caucasian donors, and across the baseline estimated glomerular filtration rate spectrum. These findings may help to inform selection criteria and discussions with persons considering living kidney donation.

137. Nephrectomy Elicits Impact of Age and BMI on Renal Hemodynamics: Lower Postdonation Reserve Capacity in Older or Overweight Kidney Donors
Rook M, Bosma RJ, van Son WJ et al.
Am J Transplant. 2008 Oct;8(10):2077-85.

ABSTRACT

Renal functional reserve could be relevant for the maintenance of renal function after kidney donation. Low-dose dopamine induces renal vasodilation with a rise in glomerular filtration rate (GFR) in healthy subjects and is thought to be a reflection of reserve capacity (RC). Older age and higher body mass index (BMI) may be associated with reduced RC. We therefore investigated RC in 178 consecutive living kidney donors (39% males, age 48 +/- 11 years, BMI 25.5 +/- 4.1). RC was determined as the rise in GFR ((125)I-iothalamate), 4 months before and 2 months after donor nephrectomy. Before donor nephrectomy, GFR was 114 +/- 20 mL/min, with a reduction to 72 +/- 12 mL/min after donor nephrectomy. The dopamine-induced rise in GFR of 11 +/- 10% was reduced to 5 +/- 7% after donor nephrectomy ($p < 0.001$). Before donor nephrectomy, older age and higher BMI did not affect reserve capacity. After donor nephrectomy, the response of GFR to dopamine independently and negatively correlated with older age and higher BMI. Moreover, postdonation reserve capacity was absent in obese donors. The presence of overweight had more impact on loss of RC in younger donors. In conclusion, donor nephrectomy unmasked an age- and overweight-induced loss of reserve capacity. Younger donors with obesity should be carefully monitored.

138. Center variation and risk factors for failure to complete 6 month post-donation follow-up among obese living kidney donors

Reed RD, MacLennan PA, Shelton BA et al.

Transplantation. 2019 Jul;103(7):1450-1456.

ABSTRACT

BACKGROUND: Living kidney donors in the United States who were obese at donation are at increased risk of end-stage renal disease and may benefit from intensive postdonation follow-up. However, they are less likely to have complete follow-up data. Center variation and risk factors for incomplete follow-up are unknown.

METHODS: Adult living kidney donors with obesity (body mass index, ≥30 kg/m) at donation reported to the Scientific Registry of Transplant Recipients from January 2005 to July 2015 were included (n = 13 831). Donor characteristics were compared by recorded serum creatinine at 6 months postdonation, and multilevel logistic regression models were used to estimate odds of 6-month creatinine.

RESULTS: After adjustment, older age, female sex, and donation after implementation of new center follow-up requirements were associated with higher odds of 6-month creatinine, with lower odds for obese donors with a history of smoking, biologically related donors, and at centers with higher total living donor volume. 23% of variation in recorded 6-month serum creatinine among obese donors was attributed to center (intraclass correlation coefficient: 0.232, $P < 0.001$). The adjusted probability of 6-month creatinine by center ranged from 10% to 91.5%.

CONCLUSIONS: Tremendous variation in recorded 6-month postdonation serum creatinine exists among obese living donors, with high volume centers having the lowest probability of follow-up. Moreover, individual-level characteristics such as age, sex, and relationship to recipient were associated with recorded 6-month creatinine. Given increased risk for end-stage renal disease among obese living donors, center-level efforts targeted specifically at increasing postdonation follow-up among obese donors should be developed and implemented.

139. Obesity and long-term mortality risk among living kidney donors
Locke JE, Reed RD, Massie AB et al.
Surgery 2019 pii: S0039-6060 (19) 30167-9.

ABSTRACT
BACKGROUND: Body mass index of living kidney donors has increased substantially. Determining candidacy for live kidney donation among obese individuals is challenging because many donation-related risks among this subgroup remain unquantified, including even basic postdonation mortality.
METHODS: We used data from the Scientific Registry of Transplant Recipients linked to data from the Centers for Medicare and Medicaid Services to study long-term mortality risk associated with being obese at the time of kidney donation among 119,769 live kidney donors (1987-2013). Donors were followed for a maximum of 20 years (interquartile range 6.0-16.0). Cox proportional hazards estimated the risk of postdonation mortality by obesity status at donation. Multiple imputation accounted for missing obesity data.
RESULTS: Obese (body mass index ≥ 30) living kidney donors were more likely male, African American, and had higher blood pressure. The estimated risk of mortality 20 years after donation was 304.3/10,000 for obese and 208.9/10,000 for nonobese living kidney donors. Adjusting for age, sex, race/ethnicity, blood pressure, baseline estimated glomerular filtration rate, relationship to recipient, smoking, and year of donation, obese living kidney donors had a 30% increased risk of long-term mortality compared with their nonobese counterparts (adjusted hazard ratio: 1.32, 95% CI: 1.09-1.60, P = .006). The impact of obesity on mortality risk did not differ significantly by sex, race or ethnicity, biologic relationship, baseline estimated glomerular filtration rate, or among donors who did and did not develop postdonation kidney failure.
CONCLUSION: These findings may help to inform selection criteria and discussions with obese persons considering living kidney donation.

AÑOSOS / REDUCCIÓN FILTRADO GLOMERULAR

140. Outcomes in Kidney Transplant Recipients From Living Donors
Englum BR, Schechter MA, Irish WD et al.
Transplantation. 2015 Feb;99(2):309-15.

ABSTRACT
BACKGROUND: Previous studies demonstrate that graft survival from older living kidney donors (LD; age>60 years) is worse than younger LD but similar to deceased standard criteria donors (SCD). Limited sample size has precluded more detailed analyses of transplants from older LD.
METHODS: Using the United Network for Organ Sharing database from 1994 to 2012, recipients were categorized by donor status: SCD, expanded criteria donor (ECD), or LD (by donor age: <60, 60-64, 65-69, ≥70 years). Adjusted models, controlling for donor and recipient risk factors, evaluated graft and recipient survivals.
RESULTS: Of 250,827 kidney transplants during the study period, 92,646 were LD kidneys, with 4.5% of these recipients (n=4,186) transplanted with older LD kidneys. The use of LD donors 60 years or older increased significantly from 3.6% in 1994 to 7.4% in 2011. Transplant recipients with older LD kidneys had significantly lower graft and overall survival compared to younger LD recipients. Compared to SCD recipients, graft survival was decreased in recipients with LD 70 years

or older, but overall survival was similar. Older LD kidney recipients had better graft and overall survival than ECD recipients.
CONCLUSIONS: As use of older kidney donors increases, overall survival among kidney transplant recipients from older living donors was similar to or better than SCD recipients, better than ECD recipients, but worse than younger LD recipients. With increasing kidney donation from older adults to alleviate profound organ shortages, the use of older kidney donors appears to be an equivalent or beneficial alternative to awaiting deceased donor kidneys.

141. Living Kidney Donors: Impact of Age on Long-Term Safety
Dols LF1, Kok NF, Roodnat JI et al.
Am J Transplant. 2011 Apr;11(4):737-42.

ABSTRACT
The safety of older live kidney donors, especially the decline in glomerular filtration rate (GFR) after donation, has been debated. In this study we evaluated long-term renal outcome in older live kidney donors. From 1994 to 2006 follow-up data of 539 consecutive live kidney donations were prospectively collected, during yearly visits to the outpatient clinic. Donors were categorized into two groups, based on age: < 60 (n = 422) and ≥ 60 (n = 117). Elderly had lower GFR predonation (80 vs. 96 mL/min respectively, p < 0.001). During median follow-up of 5.5 years, maximum decline in eGFR was 38% ± 9% and the percentage maximum decline was not different in both groups. On long-term follow-up, significantly more elderly had an eGFR < 60 mL/min (131 (80%) vs. 94 (31%), p < 0.001). However, renal function was stable and no eGFR of less than 30 mL/min was seen. In multivariate analysis higher body mass index (HR 1.09, 95%CI 1.03-1.14) and more HLA mismatches (HR 1.17, 95%CI 1.03-1.34) were significantly correlated with worse graft survival. Donor age did not influence graft survival. After kidney donation decline in eGFR is similar in younger and older donors. As kidney function does not progressively decline, live kidney donation by elderly is considered safe.

142. Donation from old living donors: how safe is it?
Hourmant M, Lerat L, Karam G.
Nephrol Dial Transplant. 2013 Aug;28(8):2010-4.

ABSTRACT
As the rate of living kidney donor (LKD) transplantations increases, the selection of extended criteria donors such as old donors (>60-65 years) becomes more common. The pool of these old donors is probably wider than we think, especially if we tolerate a lower glomerular filtration rate (GFR) than the gold standard of 80 mL/min/1.73 m(2). Several important studies with large cohorts of living donors including old subjects have been published these last few years and give insights on the outcome in this subpopulation. The risk of death and end-stage renal disease (ESRD) is similar to that of matched controls from the general population. Post-donation GFR, as a result of glomerulopaenia, is lower in old than in younger donors but pre-donation as well as the rate of function loss is not different between young and old donors. Nearly 80% of donors over 60 have <60 mL/min GFR post-donation, the risk of cardiovascular mortality and progression to ESRD in the long term, as in the general population, is under question. Despite reduced renal function of the old kidney, the results of transplantation from an old living donor appeared to be equivalent to

deceased transplantation from a younger donor. Finally, transplantation from an old living donor appeared to be a reasonably safe procedure for both the donor and the recipient and the age per se is certainly not a contraindication to donation.

143. Mortality and Cardiovascular Disease Among Older Live Kidney Donors

Reese PP, Bloom RD, Feldman HI et al.

Am J Transplant. 2014 Aug;14(8):1853-61.

ABSTRACT

Over the past two decades, live kidney donation by older individuals (≥55 years) has become more common. Given the strong associations of older age with cardiovascular disease (CVD), nephrectomy could make older donors vulnerable to death and cardiovascular events. We performed a cohort study among older live kidney donors who were matched to healthy older individuals in the Health and Retirement Study. The primary outcome was mortality ascertained through national death registries. Secondary outcomes ascertained among pairs with Medicare coverage included death or CVD ascertained through Medicare claims data. During the period from 1996 to 2006, there were 5717 older donors in the United States. We matched 3368 donors 1:1 to older healthy nondonors. Among donors and matched pairs, the mean age was 59 years; 41% were male and 7% were black race. In median follow-up of 7.8 years, mortality was not different between donors and matched pairs (p = 0.21). Among donors with Medicare, the combined outcome of death/CVD (p = 0.70) was also not different between donors and nondonors. In summary, carefully selected older kidney donors do not face a higher risk of death or CVD. These findings should be provided to older individuals considering live kidney donation.

144. Donor renal function

Cohney S, Kanellis J, Howell M.

Nephrology 2010; 15, S137–S145

SUGGESTIONS FOR CLINICAL CARE

(Suggestions are based primarily on Level III and IV evidence)

• An accurate assessment of the glomerular filtration rate (GFR) should be undertaken in all potential donors. The benefit of obtaining a directly measured GFR (thought to be more accurate) over an estimated GFR, has not been proven in live donors (refer to CARI guidelines titled 'Use of estimated glomerular filtration rate to assess level of kidney function' and 'Direct measurement of glomerular filtration rate').

• When the GFR is estimated it is recommended that this be on the basis of serum creatinine using, for example, the Cockcroft-Gault (CG) formula or the Modified Diet in Renal Disease (MDRD). Measurement of creatinine clearance calculated from a 24 h urine collection is also acceptable, if collected accurately. The estimated glomerular filtration rate (eGFR) should be confirmed on at least two separate occasions.

• If there is doubt regarding the GFR from estimated methods, further techniques can be used to assess or clarify this. Acceptable methods include a direct evaluation of the GFR by methods such as Cr-EDTA (nuclear GFR), iohexol or inulin clearance.

• It is preferable not to accept kidneys from donors with GFR < 80 mL/min per 1.73 m2.

145. Proteinuria and reduced kidney function in living kidney donors: A systematic review, meta-analysis, and meta-regression

Garg AX, Muirhead N, Knoll G et al.

Kidney Int. 2006 Nov;70(10):1801-10.

ABSTRACT

We reviewed any study where 10 or more healthy adults donated a kidney, and proteinuria, or glomerular filtration rate (GFR) was assessed at least 1 year later. Bibliographic databases were searched until November 2005. 31 primary authors provided additional information. Forty-eight studies from 27 countries followed a total of 5048 donors. An average of 7 years after donation (range 1-25 years), the average 24 h urine protein was 154 mg/day and the average GFR was 86 ml/min. In eight studies which reported GFR in categories, 12% of donors developed a GFR between 30 and 59 ml/min (range 0-28%), and 0.2% a GFR less than 30 ml/min (range 0-2.2%). In controlled studies urinary protein was higher in donors and became more pronounced with time (three studies totaling 59 controls and 129 donors; controls 83 mg/day, donors 147 mg/day, weighted mean difference 66 mg/day, 95% confidence interval (CI) 24-108). An initial decrement in GFR after donation was not accompanied by accelerated losses over that anticipated with normal aging (six studies totaling 189 controls and 239 donors; controls 96 ml/min, donors 84 ml/min, weighted mean difference 10 ml/min, 95% CI 6-15; difference not associated with time after donation (P=0.2)). Kidney donation results in small increases in urinary protein. An initial decrement in GFR is not followed by accelerated losses over a subsequent 15 years. Future studies will provide better estimates, and identify those donors at least risk of long-term morbidity.

HTA / INTOLERANCIA H DE C

146. Long-term risk for kidney donors with hypertension at donation – a retrospective cohort study

Haugen AJ, Langberg NE, Dahle DO et al.

Transpl Int. 2019 Apr 15.

ABSTRACT

In the general population, small increases in blood pressure are associated with increased mortality. In kidney donors this association is less certain. We therefore assessed long-term overall and cardiovascular mortality in donors who were hypertensive at the time of donation compared with normotensive donors. Hypertension was defined as blood pressure >140/90 mmHg or use of antihypertensive drugs. Adequate records available in 2131 donors revealed that 140 were hypertensive and 1991 were normotensive. Multivariable regression analyses were performed for overall and cardiovascular mortality. Hypertensive donors were significantly older (mean 57.7 vs. 46.9 years), more were males (44.3% vs. 41.5%), had higher body mass index (26.4 vs. 24.7) and lower estimated glomerular filtration rate (91.8 vs. 101.2 ml/min/1.73 m2). After a median observation time of 20.8 years (interquartile range 11) 71 hypertensive donors had died and 26 of the deaths were cardiovascular. Multivariable analysis did not suggest a generalizable association between hypertension and long-term overall mortality [hazard ratio (HR) 1.1, 95% confidence interval (CI) 0.9-1.5, P = 0.34] or cardiovascular mortality (HR 1.1, 95% CI 0.7-1.8, P = 0.55). These data may support the use of older healthy kidney donors with hypertension at donation.

147. Donors at risk: hypertension

Ierino F, Boudville N, Kanellis J.

Nephrology 2010; 15, S114–S120 doi:10.1111/j.1440-1797.2009.01220.x

SUGGESTIONS FOR CLINICAL CARE

• Potential living kidney donors should have their blood pressure (BP) measured on at least three occasions with a level less than 140/90 mmHg on all three occasions.

• If one or more office BP measurements are elevated, white-coat hypertension may be excluded by:

– 12 home BP measurements with an average less than 135/85 mmHg or

– 24 h ambulatory blood pressure measurement (ABPM) with an average less than 135/85 mmHg.

• An elevated BP on the above definitions is a relative contraindication to donation.

• Donors with:

– evidence of end-organ damage related to hypertension (e.g. retinopathy, left ventricular hypertrophy, proteinuria), or

– poorly controlled BP (e.g. requiring more than two medications or BP still elevated), or

– other cardiovascular risk factors (e.g. elevated cholesterol, overweight, smoker, family history of cardiovascular disease) should not be considered for donation.

148. Blood Pressure and Renal Function after Kidney Donation from Hypertensive Living Donors

Textor SC, Taler SJ, Driscoll N et al.

Transplantation. 2004 Jul 27;78(2):276-82.

ABSTRACT

BACKGROUND: Rising numbers of patients reaching end-stage kidney disease intensify the demand for expansion of the living-kidney-donor pool. On the basis of low risk in white donors with essential hypertension, our transplant center undertook a structured program of accepting hypertensive donors if kidney function and urine protein were normal. This study reports outcomes of hypertensive donors 1 year after kidney donation.

METHODS: We studied detailed measurements of blood pressure (oscillometric, hypertensive therapy nurse [RN], and ambulatory blood pressure monitoring [ABPM]), clinical, and renal characteristics (iothalamate glomerular filtration rate [GFR], urine protein, and microalbumin) in 148 living kidney donors before and 6 to 12 months after nephrectomy. Twenty-four were hypertensive (awake ABPM>135/85 mm Hg and clinic/RN BP>140/90 mm Hg) before donation.

RESULTS: After 282 days, normotensive donors had no change in awake ABPM pressure (pre 121 +/- 1/75 +/- 2 vs. post 120 +/- 1/ 5 +/- 1 mm Hg), whereas BP in hypertensive donors fell with both nonpharmacologic and drug therapy (pre 142 +/- 3/85 +/- 2 to post 132 +/- 2/80 +/- 1 mm Hg, P<.01). Hypertensive donors were older (53.4 vs. 41.4 years, P<.001) and had lower GFR after kidney donation (61 +/- 2 vs. 68 +/- 1 mL/min/1.73m, P<.01). After correction for age, no independent BP effect was evident for predicting GFR either before or after nephrectomy. Urine protein and microalbumin did not change in either group after donor nephrectomy.

CONCLUSIONS: Our results indicate that white subjects with moderate, essential hypertension and normal kidney function have no adverse effects regarding blood pressure, GFR, or urinary protein

excretion during the first year after living kidney donation. Although further studies are essential to confirm long-term safety, these data suggest that selected hypertensive patients may be accepted for living kidney donation.

149. Donors at risk: impaired glucose tolerance
Boudville N, Isbel N; CARI.
Nephrology (Carlton). 2010 Apr;15 Suppl 1:S133-6.

Abstract not available

150. Prediabetic Living Kidney Donors Have Preserved Kidney Function at 10 Years After Donation
Chandran S, Masharani U, Webber AB et al.
Transplantation. 2014 Apr 15;97(7):748-54.

ABSTRACT
BACKGROUND: Potential living kidney donors with prediabetes are often excluded from donation because of concerns about the development of type 2 diabetes mellitus (DM) and progression to end-stage renal disease (ESRD). This strategy may be unnecessarily restrictive. Previous studies of living kidney donors have not specifically examined subsets with prediabetes.
METHODS: We ascertained the vital status and development of ESRD in 143 living kidney donors from 1994 to 2007 with predonation impaired fasting glucose (IFG). We then compared the development of DM, the estimated glomerular filtration rate, and the level of albumin excretion in 45 of these IFG donors to 45 matched controls with normal predonation fasting glucose.
RESULTS: The majority (57.8%) of IFG donors had reverted to normal fasting glucose at a mean follow-up of 10.4 years. Compared with donors with normal fasting glucose, a higher proportion of IFG donors had developed DM (15.56% vs. 2.2%, P=0.06). Predonation characteristics including age, sex, and body mass index did not correlate with the risk of developing DM. At follow- up, estimated glomerular filtration rate by the Modification of Diet in Renal Disease equation (70.7±16.1 mL/min/1.73 m vs. 67.3±16.6 mL/min/1.73 m, P=0.21) and albumin excretion (urine albumin/ creatinine 9.76±23.6 mg/g vs. 5.91±11 mg/g, P=0.29) were similar in IFG and normal glucose donors.
CONCLUSION: Carefully screened prediabetic living kidney donors often revert to normal fasting glucose and do not seem to have a significantly increased risk of impaired kidney function in the short term.

151. Living kidney donors ages 70 and older: recipient and donor outcomes
Berger JC, Muzaale AD, James N et al.
Clin J Am Soc Nephrol 2011

ABSTRACT
BACKGROUND AND OBJECTIVES: The profound organ shortage has resulted in longer waiting times and increased mortality for those awaiting kidney transplantation. Consequently, patients

are turning to older living donors. It is unclear if an upper age limit for donation should exist, both in terms of recipient and donor outcomes.
DESIGN, SETTING, PARTICIPANTS, & MEASUREMENTS: In the United States, 219 healthy adults aged ≥70 have donated kidneys at 80 of 279 transplant centers. Competing risks models with matched controls were used to study the independent association between older donor age and allograft survival, accounting for the competing risk of recipient mortality as well as other transplant factors.
RESULTS: Among recipients of older live donor allografts, graft loss was significantly higher than matched 50-to 59-year-old live donor allografts (subhazard ratio [SHR] 1.62, 95% confidence interval [CI] 1.16 to 2.28, P = 0.005) but similar to matched nonextended criteria 50-to 59-year-old deceased donor allografts (SHR 1.19, 95% CI 0.87 to 1.63, P = 0.3). Mortality among living kidney donors aged ≥70 was no higher than healthy matched controls drawn from the NHANES-III cohort; in fact, mortality was lower, probably reflecting higher selectivity among older live donors than could be captured in National Health and Nutrition Examination Survey III (NHANES-III; HR 0.37, 95% CI 0.21 to 0.65, P < 0.001).
CONCLUSIONS: These findings support living donation among older adults but highlight the advantages of finding a younger donor, particularly for younger recipients.

152. Outcomes of kidney transplantation from older living donors to older recipients
Gill J, Bunnapradist S, Danovitch GM et al.
Am J Kidney Dis. 2008 Sep;52(3):541-52

ABSTRACT
BACKGROUND: More than half the newly wait-listed patients for kidney transplantation in 2005 were older than 50 years, and 13% were older than 65 years. As waiting times for a deceased donor kidney increase, these older candidates are disadvantaged by rapidly deteriorating health, often resulting in death or removal from the wait list before transplantation.
STUDY DESIGN: An observational cohort study was conducted using data from the Organ Procurement Transplant Network/United Network for Organ Sharing.
SETTING & PARTICIPANTS: All adult kidney-only transplantations performed in recipients 60 years and older from 1996 to 2005 were included.
PREDICTOR: The recipient cohort was stratified into 4 groups based on donor source: older living donor (OLD: living donor age > 55 years), younger living donor (YLD: living donor age </= 55 years), standard criteria deceased donor (SCD), and expanded criteria deceased donor (ECD).
OUTCOMES & MEASUREMENTS: Early posttransplantation outcomes, graft survival, patient survival, renal function 1 year posttransplantation, and relative risk of graft loss and patient death were compared.
RESULTS: Of 23,754 kidney transplantations performed in recipients 60 years and older, 7,006 were living donor transplantations (1,133 were > 55 years [OLD] and 5,873 were <or= 55 years [YLD]), 12,197 from SCDs, and 4,551 from ECDs. Early posttransplantation outcomes were best in YLD transplantations, followed by SCD and OLD transplantations. OLD transplantations were associated with inferior 3-year graft survival rates (85.7%), but similar 3-year patient survival rates (88.4%) compared with YLD (3-year graft survival, 83.4%; patient survival, 87.4%) and had superior graft survival compared with all deceased donor options. Compared with OLD transplantations, ECD transplantations were associated with a greater risk of graft loss (hazard ratio, 2.36; 95% confidence interval, 1.18 to 4.74).

LIMITATIONS: Observational retrospective studies using registry data are subject to inherent limitations, including the possibility of selection bias.
CONCLUSIONS: With superior graft and patient survival in recipients of transplants from OLDs compared with SCDs and ECDs, OLDs may be an important option for elderly transplantation candidates and should be considered for older patients with a willing and suitable older donor.

153. Outcomes in kidney transplant recipients from older living donors.
Englum BR, Schechter MA, Irish WD et al.
Transplantation 2015

ABSTRACT
BACKGROUND: Previous studies demonstrate that graft survival from older living kidney donors (LD; age>60 years) is worse than younger LD but similar to deceased standard criteria donors (SCD). Limited sample size has precluded more detailed analyses of transplants from older LD.
METHODS: Using the United Network for Organ Sharing database from 1994 to 2012, recipients were categorized by donor status: SCD, expanded criteria donor (ECD), or LD (by donor age: <60, 60-64, 65-69, ≥70 years). Adjusted models, controlling for donor and recipient risk factors, evaluated graft and recipient survivals.
RESULTS: Of 250,827 kidney transplants during the study period, 92,646 were LD kidneys, with 4.5% of these recipients (n=4,186) transplanted with older LD kidneys. The use of LD donors 60 years or older increased significantly from 3.6% in 1994 to 7.4% in 2011. Transplant recipients with older LD kidneys had significantly lower graft and overall survival compared to younger LD recipients. Compared to SCD recipients, graft survival was decreased in recipients with LD 70 years or older, but overall survival was similar. Older LD kidney recipients had better graft and overall survival than ECD recipients.
CONCLUSIONS: As use of older kidney donors increases, overall survival among kidney transplant recipients from older living donors was similar to or better than SCD recipients, better than ECD recipients, but worse than younger LD recipients. With increasing kidney donation from older adults to alleviate profound organ shortages, the use of older kidney donors appears to be an equivalent or beneficial alternative to awaiting deceased donor kidneys.

154. The association of predonation hypertension with glomerular function and number in older living kidney donors.
Lenihan CR, Busque S, Derby G et al.
J Am Soc Nephrol. 2015 Jun;26(6):1261-7.

ABSTRACT
The effect of preexisting hypertension on living donor nephron number has not been established. In this study, we determined the association between preexisting donor hypertension and glomerular number and volume and assessed the effect of predonation hypertension on postdonation BP, adaptive hyperfiltration, and compensatory glomerular hypertrophy. We enrolled 51 living donors to undergo physiologic, morphometric, and radiologic evaluations before and after kidney donation. To estimate the number of functioning glomeruli (NFG), we divided the whole-kidney ultrafiltration coefficient (Kf) by the single-nephron ultrafiltration coefficient (SNKf). Ten donors were hypertensive before donation. We found that, in donors ages >50 years old,

preexisting hypertension was associated with a reduction in NFG. In a comparison of 10 age- and sex-matched hypertensive and normotensive donors, we observed more marked glomerulopenia in hypertensive donors (NFG per kidney, 359,499±128,929 versus 558,239±205,152; P=0.02). Glomerulopenia was associated with a nonsignificant reduction in GFR in the hypertensive group (89±12 versus 95±16 ml/min per 1.73 m(2)). We observed no difference in the corresponding magnitude of postdonation BP, hyperfiltration capacity, or compensatory renocortical hypertrophy between hypertensive and normotensive donors. Nevertheless, we propose that the greater magnitude of glomerulopenia in living kidney donors with preexisting hypertension justifies the need for long-term follow-up studies.

155. Quality of life of elderly live kidney donors

Klop KW, Dols LF, Weimar W et al

Transplantation. 2013 Oct 15;96(7):644-8.

ABSTRACT

BACKGROUND: Expanding the use of elderly live donors may help meet the demand for kidney transplants. The aim of this study was to quantify the effect of the surgical procedure on the quality of life (QOL) of elderly donors compared with younger donors.

METHODS: Alongside three prospective studies (two randomized) running between May 2001 and October 2010, we asked 501 live donors to fill out the Short Form-36 questionnaire preoperatively and at 1, 3, 6, and 12 months postoperatively. We defined live donors 60 years or older as elderly. Between-group analyses regarding QOL were adjusted for baseline values and gender.

RESULTS: One hundred thirty-five donors were older and 366 donors were younger than 60 years. The response rate was high, with 87% at 12 months postoperatively. Elderly donors less often scored as American Society of Anaesthesiology classification 1 (60% vs. 81%; P<0.001) indicating a higher rate of minor comorbidity. At 1 month postoperatively, between-group analysis showed a significant advantage in QOL in favor of the elderly group regarding the dimensions "bodily pain" (7 points; P=0.001), "role physical" (18 points; P<0.001), and "vitality" (5 points; P=0.008). At 3 months, "bodily pain" (3 points, P=0.04) and "role physical" (8 points, P=0.02) were still in favor of the older group. At 6 and 12 months, "physical function" was in favor of the younger group (3 and 5 points, respectively; P=0.04 and P<0.001).

CONCLUSIONS: This study demonstrates that elderly donors recover relatively fast. The perspective of excellent postoperative QOL may help convince elderly individuals to donate.