The American Journal of Surgery (2016) 212, 592-595

The American Journal of Surgery®

Association of Women Surgeons

Virtual microscopy improves sharing of deceased donor kidneys

Adena J. Osband, M.D.[a,*], Billie Fyfe, M.D.[b], David A. Laskow, M.D.[a]

[a]*Department of Surgery, The Transplant Center, Rutgers/Robert Wood Johnson Medical School, 10 Plum St, 7th floor, New Brunswick, NJ 08901, USA;* [b]*Department of Pathology, Rutgers/Robert Wood Johnson Medical School, New Brunswick, NJ, USA*

KEYWORDS:
Deceased donor;
Kidney transplant;
Biopsy

Abstract

BACKGROUND: Donor kidney biopsies used for offer evaluation may lengthen cold ischemia time. Our organ procurement organization began processing wedge biopsies and having them read using virtual microscopy (VM), as opposed to its prior routine of processing/reading at local hospitals. We hypothesized that VM would decrease time to biopsy results and kidney acceptance.

METHODS: All donor kidneys biopsied over 1 year were compared with those biopsied during the previous year ($n = 43, 40$).

RESULTS: Time to biopsy result was shortened using VM (5:04 vs 6:30, $P = .04$), and especially for those cases with cross-clamp between 5 pm and 5 am (4:49 vs 8:12, $P < .01$). Time to local acceptance was also significantly improved using VM for both the entire group (7:01 vs 9:52, $P < .01$) and the overnight subset (7:25 vs 11:10, $P < .01$).

CONCLUSIONS: Use of VM decreased time to biopsy result, with the most prominent effects seen during the overnight hours, resulting in shortened time to local acceptance of organs.

Many factors are considered when evaluating a deceased donor kidney offer including biopsy data.[1] Although there is no consensus on strict biopsy criteria for organ acceptance, pathology remains a concern.[2,3] Biopsy results are a dominant reason for organ refusal, but obtaining this information may significantly lengthen cold ischemia time.[4] The kidneys usually biopsied are extended criteria donors (ECDs) and higher kidney donor profile index, where ischemic times are especially important and timing becomes paramount.[5,6] In addition, there is wide variation among organ procurement organization (OPO) protocols for processing and reading of biopsies.[7] Many are done at the donor hospitals, which can shorten the time to biopsy read, but may be done by a pathologist with little kidney experience. Others are done at transplant centers, providing experienced reads but frequently adding time delays. The ideal system would provide standardized processing and biopsy reading by an experienced pathologist any time of day without significant delay.

Our local OPO began using a novel setup for donor biopsies in January 2013. Wedge biopsies are taken on the backtable, returned to the OPO laboratory for processing (frozen section and hematoxylin and eosin staining), and then read remotely by an experienced pathologist using virtual microscopy (VM). Before this system, biopsies were processed and read on a rotating basis at the local transplant

There were no relevant financial relationships or any sources of support in the form of grants, equipment, or drugs.

The authors declare no conflicts of interest.

* Corresponding author. Tel.: (732) 253-3699; fax: (732) 448-7319.

E-mail address: adena.osband@rwjuh.edu

Manuscript received December 30, 2015; revised manuscript April 28, 2016

0002-9610/$ - see front matter © 2016 Elsevier Inc. All rights reserved.
http://dx.doi.org/10.1016/j.amjsurg.2016.06.009

centers. Our OPO protocol outlines biopsies of all ECD kidneys and standard criteria donor kidneys at the request of local transplant physicians. The aim of this study was to determine the effect of VM on timing issues in deceased donor kidney allocation. Namely, to assess if time to biopsy read is shorter, and therefore time to local kidney acceptance. Differences in cold ischemia times and rates of delayed graft function (DGF) were also analyzed.

Time to local acceptance was used as a surrogate for cold ischemia time, as there are many other issues that factor into transplant timing. These may include surgeon or operating room timing constraints and patient-related matters such as need for preoperative testing, dialysis, or travel time. In addition, limiting the data set to locally used kidneys eliminates transportation time as a possible confounding factor.

Methods

All locally procured deceased donor kidneys biopsied over 12 months since inception of VM were compared with those of the previous year. Donor characteristics and local kidney placement were obtained from Donornet. The OPO case documentation records provided all time points, kidney disposition, and incidence of DGF. End points of the study include time to biopsy result, time to local acceptance, cold ischemic time, and DGF incidence. All quantified time intervals were calculated from a starting point of aortic cross-clamp time. Data were analyzed using chi-square and unpaired 2-tailed Student t test. Values of $P < .05$ were considered statistically significant.

Results

For those kidneys that were biopsied and included in this study, the donor characteristics were comparable. Between the two groups, there was no difference in donor age, sex, race, %ECD, kidney donor profile index, nadir, peak, or terminal creatinine (Table 1). Each overnight subset consisted of 23 used kidneys, comprising 53% of the 2012 group and 58% of 2013. Total group discard rates were 36% for 2012 and 29% for 2013, and for ECD were 50% and 31% respectively (P values not significant).

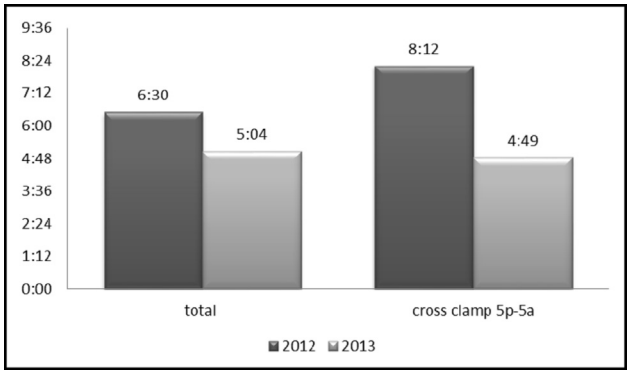

Figure 1 Distribution of time to biopsy read without (2012) and with (2013) VM in hours and minutes.

Use of VM resulted in shortening of time to biopsy result by nearly 1.5 hours (Fig. 1). For the overnight subset, with cross-clamp between 5 pm and 5 am, the time to biopsy read was nearly 3.5 hours shorter using VM (Table 2). This translated into improvement in time to local acceptance but not in cold ischemia time or DGF rate. Cold ischemic time was actually longer by 27 minutes, and DGF rate was decreased by only 4% (P values = NS). Local acceptance was shortened using VM in the total group by almost 3 hours and in the overnight cohort by almost 4 hours. Of note, cold ischemia time in the overnight subset was no longer than the total group (see Table 2 for details).

Comments

Deceased donor kidney transplant has become almost routine, with expectations of outstanding outcomes.[4] Despite this experience, opportunities still exist to better certain outcomes. DGF rates nationwide remain high, and its occurrence has potentially significant sequelae, providing an arena for improvement.[5,8,9] Shortening ischemic times, especially for kidneys prone to DGF, would ideally lead to lower incidence of DGF and its consequences.

Because of the growing discrepancy between organs available and potential recipients, there is also a push to minimize organ discard rates. Currently, the discard rate for kidneys is 18%, with over 50% of those discards as ECD.[4] Unsurprisingly, the most common reason for discard (37%) is attributed to biopsy results.[4] Any effort to improve both the timeliness and quality of information from biopsies should be encouraged.

Over a year ago, significant changes were made in the kidney allocation scheme (KAS). This recent implementation of KAS has already resulted in both longer cold ischemic times and higher DGF rates.[10] With more kidneys being shipped over distances due to increased regional and national sharing, timing issues are becoming even more critical. KAS will likely continue to provide more opportunities to improve sharing logistics and outcomes.

The utility of preimplantation biopsies has been much debated. Recent studies have clarified the need for experienced pathology reads as compared with those done by an on-call pathologist.[11,12] In addition, Muruve[13] found significant variability among frozen sections, attributed to differences in processing. A review of UNOS data demonstrated reasonable correlation of glomerulosclerosis between biopsies of paired kidneys especially for those with very little glomerulosclerosis.[14] There has also been much debate about which particular pathologic features may be of more or less concern.[12–20] Different groups stress the importance of percent glomerulosclerosis, atherosclerosis, and fibrosis, as well as some aggregate indices which combine multiple findings. In fact, a recent retrospective