Henry Ford Hospital Medical Journal

Volume 26 | Number 2

6-1978

Length of Perfusion Time in Cadaver Kidney Transplantation

Krishna D. Valjee
Luis H. Toledo-Pereyra
Stanley G. Dienst
Cosme Cruz
Pedro Cortes

See next page for additional authors

Follow this and additional works at: https://scholarlycommons.henryford.com/hfhmedjournal

Part of the Life Sciences Commons, Medical Specialties Commons, and the Public Health Commons

Recommended Citation
Available at: https://scholarlycommons.henryford.com/hfhmedjournal/vol26/iss2/9

This Article is brought to you for free and open access by Henry Ford Health System Scholarly Commons. It has been accepted for inclusion in Henry Ford Hospital Medical Journal by an authorized editor of Henry Ford Health System Scholarly Commons.
Length of Perfusion Time in Cadaver Kidney Transplantation

Authors
Krishna D. Valjee, Luis H. Toledo-Pereyra, Stanley G. Dienst, Cosme Cruz, Pedro Cortes, Godofredo Santiago, Nathan W. Levin, Riad Farah, and Joseph C. Cerny

This article is available in Henry Ford Hospital Medical Journal: https://scholarlycommons.henryford.com/hfhmedjournal/vol26/iss2/9
Length of Perfusion Time in Cadaver Kidney Transplantation

Krishna D. Valjee, MD,* Luis H. Toledo-Pereyra, MD, PhD,* Stanley G. Dienst, MD,* Cosme Cruz, MD,** Pedro Cortes, MD,** Godofedro Santiago, MD,** Nathan W. Levin, MD,** Riad Farah, MD,*** and Joseph C. Cerny, MD***

The results of transplantation survival for 70 consecutive cadaver kidneys preserved under hypothermic pulsatile perfusion at Henry Ford Hospital are reviewed. Pulsatile perfusion for up to 30 hours did not adversely alter the survival rate following transplantation. Thus, kidneys perfused for prolonged periods of time (> 20 hours) can be used for transplantation, if the basic rules for organ retrieval and preservation have been followed. Hypothermic pulsatile perfusion of cadaver kidneys has been demonstrated to be an adequate system for ex-vivo preservation for transplantation.

Introduction

A controversy exists as to whether or not cadaver kidney preservation by hypothermic pulsatile perfusion diminishes the long-term function of transplanted kidneys.1-3 Recently, Toledo-Pereyra and his colleagues4 reported that perfusion of cadaver kidneys for more than 30 hours did not adversely affect either their long-term function after transplantation or the onset of rejection. These findings have been confirmed by Seim and his associates." This paper presents the results of a study of cadaver kidneys harvested at several different hospitals and preserved under hypothermic pulsatile perfusion by the Henry Ford Hospital Preservation Team. All kidneys were transplanted at this institution. Our study was designed to determine the influence of perfusion time on the short- and long-term function of 70 consecutive, perfused cadaver kidneys transplanted at a single center.

Material and Methods

From July, 1973 to June, 1977, 70 cadaver kidneys were perfused and transplanted to patients in end-stage renal failure at Henry Ford Hospital. After transplantation, patients were followed for a minimum of six months. All kidneys in this study were preserved by hypothermic pulsatile perfusion for variable periods of time. The actuarial survival of all kidney transplants was calculated by the method of Merrell and Shulman. All different variables among groups were compared using 2 x 2 chi square statistical analysis. Standard methods were employed for harvesting all cadaver kidneys. After nephrectomy, cold (4°C) Ringer's lactate containing 10,000 U/L of heparin was used to wash out the blood in all kidneys until the venous effluent was clear. The kidneys were then placed in the perfusion system at a systolic perfusion pressure of 60 mm Hg, PO2 of 200 mm Hg, pH of 7.4, and temperature of 7°C. The perfusate was cryoprecipitated plasma, which contained the normal concentration of extracellular electrolytes and osmolarity of 290
mOsm/L. Routinely added to the perfusate were ampicillin (1.0 gm/L), methylprednisolone (500 mg/L), phenolsulphonphthalein (PSP) (2ml/L), magnesium sulfate 50% (2 ml/L), and regular insulin (80 U/L).

We discarded all kidneys with a flow of less than 0.3 ml/min/gm, a perfusion pressure of more than 60 mm Hg, and/or severe vascular or ureteral abnormalities. The warm ischemic time rarely exceeded five minutes. Cold ischemic time from the time of cold flushing until the kidney was placed in the perfusion machine rarely exceeded 15 minutes. Donor peripheral blood and lymph nodes removed at the time of nephrectomy were used for histocompatibility testing. Recipient cytotoxic antibodies directed against donor cells were studied by the microlymphocytotoxicity method developed at the National Institute of Health. The surgical transplant technique, immunosuppression, and postoperative treatment remained relatively constant throughout the study. The recipient immunosuppressive dosage consisted of azathioprine 5.0 mg/K/day for one day, 2.5 mg/K/day for 14 days, then 1.0-2.5 mg/K/day as the white blood count indicated. Patients received prednisolone at a dose of 1.2 mg/K/day on the day of surgery, then reduced by 2.0 mg each day to a maintenance dose of 10 to 30 mg daily. As outpatients, they were randomized for daily or alternate doses. Satisfactory renal function was defined as that sufficient to sustain life without requiring dialysis. Signs of graft failure were permanent restoration of dialysis, graft removal, or patient death.

Results

Figure 1 shows that the actuarial survival rate of all perfused cadaver kidneys without exclusions. Fifty-three per cent of the entire group of grafted kidneys were functioning at six months. Thereafter, the loss of graft function was minimal up to three years after transplantation. There were no significant differences (p>0.08-0.5) among kidneys perfused for different intervals.

Six renal grafts were lost due to technical errors within the first month after transplantation. When these kidneys were eliminated from the total group (Figure 2), data for short-term and long-term function were improved, and the basic pattern of survival among the different groups of perfused kidneys for varying periods was maintained. It has been reported that diabetic patients do not survive as well as nondiabetic patients after transplantation. When they were excluded from the study (Figure 3), there was a tendency toward improved function from six months to three years, although this improvement was not significant (p>0.1-0.5). Figure 4 shows the actuarial survival rate of first cadaver transplants only. The results followed a trend similar to that observed in the entire transplant population.

As expected, patients under 40 years of age and with two or more antigen matches did better than older patients and those with fewer than two antigen matches (Figures 5,6). Women in this study, contrary to other reports, showed better long-term function than men (Figure 7).
Perfusion Time in Kidney Transplantation

The main causes of graft failure were rejection (30%), infection (28%), and other causes associated with delayed kidney function after transplantation (26%), such as acute posttransplant renal failure and/or associated rejection. The main causes of patient death were infection (73%), cardiac (17%), and gastrointestinal bleeding (10%).

Discussion

In this study, we confirm the data from other institutions1-4,5,10 that prolonged perfusion does not hinder long-term renal function after transplantation, nor does it result in an increased rate of rejection. In fact, cadaver kidneys perfused for more than 20 hours had slightly better survival rates than those perfused for 11 to 20 hours. Perfusion for minimal periods (0-10 hrs) did not appear to be detrimental for transplantation either.

Although there has been considerable controversy about the effect on cadaver kidney transplantation of hypothermic pulsatile perfusion as opposed to hypothermic storage,1,2 the data of Toledo-Pereyra and his associates,2 as well as that from the Human Renal Transplant Registry,3 showed no significant differences in graft function between perfused and cold-stored kidneys. Toledo-Pereyra and his group indicated in a prospective and controlled comparative study that perfused kidneys did better than cold-stored kidneys. Other studies carried out by Payne et al12 demonstrated clinically and experimentally that kidneys perfused by hypothermic pulsatile perfusion for 24 to 48 hours had equal or better survival than unperfused grafts or those preserved by cold storage. In this paper, we can say only that
The length of perfusion is not an adverse factor in cadaver kidney transplantation.

In general, our data corroborate the detrimental effect of high-risk factors in cadaver transplantation, such as age, diabetes mellitus, and multiple transplantation. Antigen matching also correlated well with long-term kidney function.

Contrary to the reports of others, our data indicate that kidneys which did not function promptly after transplantation did not do as well as those kidneys that began to function immediately. If kidney function did return, complete recovery was observed. Prolonged preservation under the conditions described had no detrimental effect on immediate kidney function. There was a similar incidence of
Fig. 7
Actuarial functional curves of cadaver kidney transplants in men and women. Women did better than men. Kidneys perfused for 21-30 hours had a better trend of survival in women than in the other groups.

Fig. 8
Actuarial functional curves of first cadaver kidney transplants after diabetics and patients over 40 years old are eliminated. When compared to those in Figure 2, there is overall improvement in long-term function. In parentheses is the number of transplants per group.

nonfunction in all groups of perfused kidneys, regardless of the length of perfusion.

In short, in this study we demonstrate that hypothermic pulsatile perfusion of kidneys is an adequate means of ex-vivo preservation for transplantation.
Valjee, Toledo-Pereyra, Dienst, et al

Fig. 9
Actuarial functional survival curves of perfused cadaver kidneys comparing immediate function after transplantation. Kidneys with immediate function did better than those that did not function immediately after transplantation.

Acknowledgments

The assistance of other members of the Transplant Team from the Department of Surgery (Dr. H. K. Oh), the Division of Nephrology (Dr. F. Dumler), the Department of Urology (Dr. R. C. Klugo), and the Department of Pathology (Dr. H. Hayashi and Dr. D. J. Patt) is greatly appreciated. They participated in various phases of the laboratory testing, clinical management, and treatment.

The help of Louise Bernbeck and Jay Hunter is also appreciated.

References