Original Article

Ureter and bladder urinary oxygen pressure relation with graft function and acute tubular necrosis after living non related renal transplantation

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Abstract

Objectives: To asses the value of urinary oxygen pressure for evaluation of renal graft outcome.

Material and Methods : In this prospective study we evaluated the oxygen pressure of urine samples obtained from urether (Puuo2)and bladder (pbuo2) as a predictor of graft function and outcome in 30 patients whom underwent kidney transplantation.

Results: There was statistically significant relationship between puuo2 and pbuo2 and occurrence of acute tubular necrosis (p=0.001). In addition, there was statistically significant relationship between systemic blood pressure and cold ischemic time and occurrence of acute tubular necrosis. Acute tubular necrosis was higher in patients with systolic blood pressure less than 130 mmhg (p= 0.021).

Conclusion: This study showed that puuo2 and pbuo2 of recipients is a noninvasive and sensitive test for determination of graft outcome. (Rawal Med J 2007;32:67-69)

Key words: kidney transplantation, urethra, bladder urinary O_2

INTRODUCTION

Kidney transplantation is the best therapeutic choice for end stage renal disease.[1] This normalize many physiologic functions of kidney and confers a 40 %-to 60 % decrease in the death rate when compared with those remaining on dialysis.[2] Transplantation outcome is affected by co morbidities and optimizing of these derangements in preoperative period is recommended.[3-5] Kidney transplantation always accompanies with periods of ischemia and hypoxemia in transplanted kidney which, may affect transplantation outcome and sometimes leads to acute tubular necrosis (ATN). Therefore, predicting and preventing these insults have an important role in prognosis of transplanted kidney. Intra operative conditions of recipients including blood volume and perfusion pressure of transplanted kidney can affect graft function.[6] Aim of this study was to asses the value of puo2 of obtained urine from transplanted kidney for evaluation of graft function and detection of risk of ATN in transplanted kidney.

METHODS

After obtaining institutional review board approval at Imam medical center, Tabriz, Iran and written informed consent from participants, 30 adults (20-55 years old) undergoing kidney transplantation were enrolled in this prospective study. Exclusion criteria were recipients with hemoglobin level less than 100 g/l, uncontrolled co morbidities including

poor LV function (EF<50%) and BP >160/110. All underwent kidney transplantation from living none related donors during 2004 and 2005. Optimal control of co morbidities such as diabetes mellitus, anemia and hypertension had been achieved preoperatively. Standard monitoring was used intraoperativly. Hemodynamic parameters were optimized before unclamping of transplanted renal vessels and central venous pressure (CVP) was maintained in range of 12-15 cm H2o by infusion of vasopressor or normal saline loading. Anesthetic technique and surgical team were the same for all patients of study.

Four urine samples were taken from each pair of recipient and donor. In donor, first urine sample was obtained from ureter after cutting of ureter and simultaneously arterial blood sample was obtained. Second urine sample was collected from Foley catheter of recipient. First and second samples were obtained from ureter of transplanted kidney and Foley catheter respectively. Urinary oxygen tension (puo2) was measured in urine samples. During sampling, hemodynamic parameters such as arterial blood pressure and CVP were recorded. We recorded early voiding in recipients and blood urea nitrogen (BUN) and creatinine (Cr) values were measured after transplantation on days 1, 2 and 3. All data were analyzed using the SPSS version 13. Students t test and chi-square test were used for descriptive statistics. Two–tailed Pearson correlation was performed to determine correlation between Pao2 and Puo2, arterial blood pressure and puo2.

RESULTS

Variable	Donor	Recipient
	Mean & SD or percent	Mean & SD of percent
Age (year)	28.10±3.30	39.56±8.1
Gender(male)	90%	70%
Weight (kg)	71.30± 7.55	65.43±7.00
SBP (mmHg)	123.4±11.79	133.03±19.45
Pao2(room air)	90±2	82±6

Demographic characteristics of donors and recipients are shown in table 1. 22 subjects had early diuresis and decreased level of BUN and Cr postoperatively. Eight recipients experienced delayed diuresis and rising BUN and Cr in postoperative days 1, 2 and 3.

Table 2. Relationship between pao2, SBP, BUN and ischemic time with Puo2 (Puuo2, Pbuo2) in recipients and donors.

Variable		Recipient	P	Donor	p
		Mean ± SD		Mean ± SD	
Pao2 (1)		135.26±15.10	0.000	169.94±22.57	0.000
Puuo2*		73.81±		76.79±6.96	
Pao2 (2)		153.33±32.04	0.000	172.92±20.65	0,000
Pbuo2 **		71.03±13.28		78.57±8.32	
S		137.46±17.16	0.002	137.46±17.16	0.001
BP (1)		133.03±19.45	0.23	121.66±10.11	0.26
SBP (2)		44.7±19.4			
	day 1	36.46±17.29	0.000		
BUN	day 2	36.26±22.38			
	day3	2.57±1.54			
	day 1	2.41±1.72	0.000		
Cr	day2	2.24±1.90			
	day3	4.53±1.16	0.415		
Cold ischemic time(min)		48.4±4.28	0.001		
Warm ischemic time(min)					

* uretric urinary oxygen pressure sampled simultaneously with Pao2 (1) and SBP (1),
**bladder urinary oxygen pressure sampled simultaneously with Pao2 (2) and SBP (2)
Correlation is significant at the 0.01 level (2-tailed).

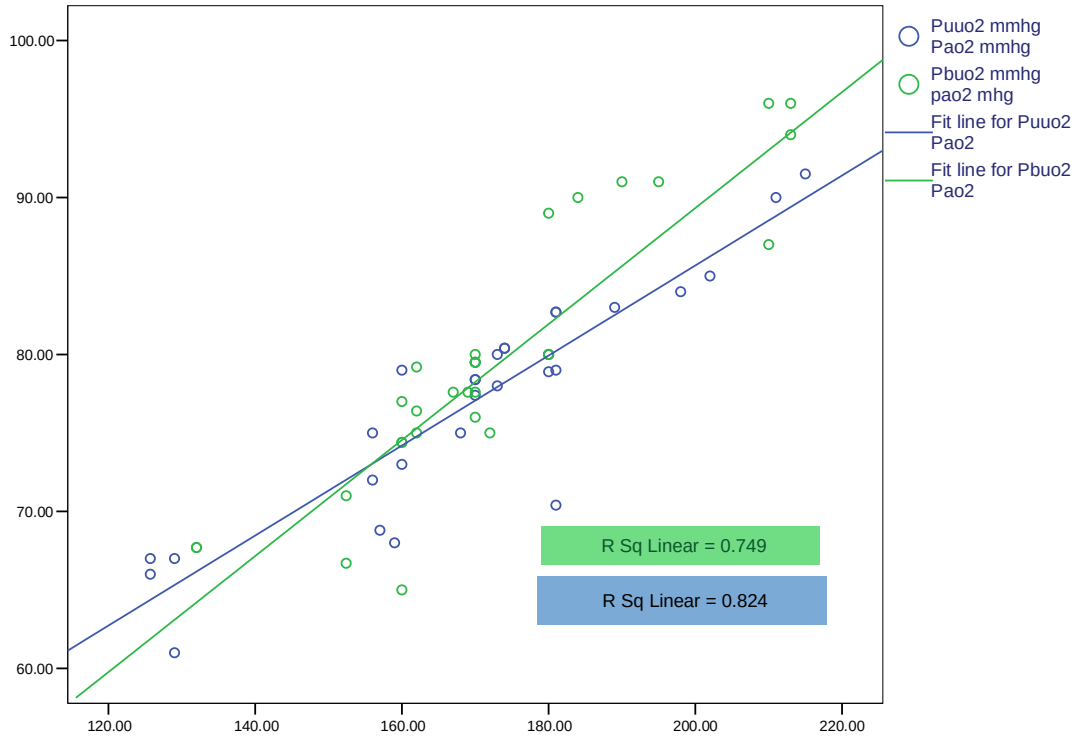
Table 2 illustrates means values and standard deviations of arterial blood oxygen pressure (Pao2), urinary oxygen pressure of uretric urine sample (Puuo2) and bladder urine sample (Pbuo2) in donor and recipients. Relationship between pao2 and (Puuo2 Pbuo2) showed significant results. There was linear relation between pao2 and (Puuo2 Pbuo2) (figure 1). There was statistically significance relationship between Puo2 (ureter and bladder O_2 tension) and post transplantation rising of cr and BUN levels (p=0.001). Six subjects out of eight recipients who had delayed diuresis showed rising levels of cr and BUN postoperatively (p=0.0053). Mean Puo2 in patients with early and delayed diuresis was 80.56±7.02, 55.25 ±10.59 respectively (p= 0.000).

DISCUSSION

Renal blood flow comprises 20% of cardiac output.[7] In a study performed by Watanobe on 24 patients it was found that puo2 correlates with renal perfusion.[8] Anesthesia with nitrous oxide, O^2 and isoflurane or sevoflurane decrease renal perfusion and infusion of dopamine or prostaglandin E1 increase renal blood flow.[9] Another study performed on pigs by wong and coworkers shows that when renal blood flow, renal O^2 consumption and cardiac output is maintained constant, significant decrease occurs in renal venous O^2 pressure.[10] Puo2 cannot be used as a sensitive test and indicator for systemic hypoxia but when the renal perfusion is constant its relation with renal venous oxygen pressure is preserved.[10] We couldn't find any human clinical study on kidney transplantation

showing relationship between Puo2 and graft function. Our findings confirm the results of previous studies and show Puo2 of transplanted kidney urine sample is very useful and has a good prognostic value.

Figurer 1:relationship between Pao2 & Puo2(Puuo2,pbuo2)



In this study, the relationship between puo2 of transplanted kidney uretric sample and occurrence of ATN was statistically significant. Although bladder urine sample obtained through Foley catheter has puo2 higher than uretric urine sample because of o2 diffusion from air to urine, however there is close relation between these two parameters and can be used instead of each other. In conclusion, in kidney transplant recipients, monitoring urinary oxygen pressure of bladder and ureteric urine samples (Puo2, Pbuo2) can be useful noninvasive and inexpensive method for assessing graft function.

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