·Clinical Research·

Results of cataract surgery in renal transplantation and hemodialysis patients

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Abstract

• AIM: To compare the effect of cataract surgery in renal transplantation and hemodialysis patients.

• METHODS: We evaluated 51 eyes of 31 renal transplantation patients, 41 eyes of 29 hemodialysis patients and 45 eyes of 32 normal control patients who received phacoemulsification and intraocular lens (IOL) implantation from January, 2000 to August, 2014 in the Beijing Friendship Hospital. Each individual underwent a blood routine and a kidney function examination. Routine ophthalmologic examination included best-corrected visual acuity (BCVA), a slit-lamp examination to detect cataract type, determination of intraocular pressure, a corneal endothelial count, and fundus examination. All patients received phacoemulsification and an IOL implantation.

• RESULTS: For the types of cataract in the three groups, transplantation group was significantly different from normal control group (P=0.04), the most kind is posterior subcapsular cataract (PSC) in transplantation group 33 (64.7%), hemodialysis group had no significantly difference from normal control group (P=0.43), and the difference between transplantation group and hemodialysis group also had significantly difference (P=0.02). For postoperative BCVA in the three groups, transplantation group had significantly difference from normal control group (P=0.03), hemodialysis group was significantly different from normal control group (P=0.00), and the difference between transplantation group and hemodialysis group also had significantly difference (P=0.00). The multiple linear regression equation is Y=0.007 hemoglobin (Hb)-0.000233 serum creatinine (Cr), R^2=0.898. Postoperative fundus examination showed that hemorrhage, exudation, and macular degeneration were greater in the hemodialysis group.

• CONCLUSION: This study showed that the PSC was more in the renal transplantation patients. BCVA was better and fundus lesions were less frequent in the renal transplantation group than in the hemodialysis group after cataract surgery. The multiple linear regression was showed that the Hb was positively correlated with postoperative BCVA, while Cr was negatively correlated with postoperative BCVA. These results may act as indicators in predicting visual acuity for the renal transplantation and hemodialysis patients.

• **KEYWORDS:** hemodialysis; renal transplantation; cataract; phacoemulsification; intraocular lens

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INTRODUCTION

Cataract is the leading cause of blindness worldwide[1,2], and is common in renal transplanted and hemodialysis patients [3-6]. In previous studies, corticosteroids and immunosuppressive agents were recognized as causes of cataract in transplanted patients, while cataract development in hemodialysis may be due to urea disequilibrium and calcifications [3,5,6]. One adverse event of corticosteroids, posterior subcapsular cataract (PSC), is the most common ocular complication following renal transplantation. The incidence of PSC following renal transplantation varies from 23% to 58%[4].

Clinically, we found that uremic patients treated by kidney transplantation or hemodialysis normally had different best-corrected visual acuity (BCVA) after intraocular lens (IOL) implantation. The objective of this study was to compare the effect of cataract surgery in the renal transplantation and hemodialysis patients.

SUBJECTS AND METHODS

Subjects We evaluated 51 eyes of 31 renal transplantation patients, 41 eyes of 29 hemodialysis patients and 45 eyes of 32 normal control patients who received phacoemulsification and IOL implantation from January, 2000 to August, 2014 in the Beijing Friendship Hospital. Institutional review board approval and informed consent were obtained, and this study abided by the Declaration of Helsinki. All 31 renal transplant patients underwent kidney transplant surgery in our hospital

were 20 males and 11 females with average age of 51.59±9.86y. There were 26 patients with hypertension, 6 with diabetes mellitus. In the 29 uremic patients were 11 males and 18 females with average age of 63.54±11.46y, There were 22 patients with hypertension, 10 with diabetes mellitus. In the 32 normal control patients were 16 males and 16 females with average age of 66.51±10.42y. There were 19 patients with hypertension, 10 with diabetes mellitus.

Routine examination included a blood routine [red blood cells (RBC) and hemoglobin (Hb)], systolic blood pressure (SBP), diastolic blood pressure (DBP), and an examination of kidney function [serum creatinine (Cr) and blood urea nitrogen (BUN)]. Prospective, regular ophthalmic examinations of the two groups were conducted primarily at the Beijing Friendship Hospital. A baseline examination was performed before and 1wk after phacoemulsification and IOL implantation. The ophthalmic examination included measurement of the BCVA and slit-lamp observation to classify the type of cataract into one of three basic subtypes (cortical, nuclear, or posterior subcapsular). Preoperative application included the measurement of intraocular pressure using a non-contact tonometer (Topocon), determination of corneal endothelial morphology using a corneal endothelial meter (Topocon), and fundus examination using indirect ophthalmoscope (Keeler).

All patients from the three groups were treated with phacoemulsification and implantation of IOL. All patients were prescribed a 4wk course of tobramycin dexamethasone drops, with doses and dosing schedules tapered in accordance with routine clinical postoperative response.

Following ocular topical anesthesia, an incision was made 3.2 mm above the transparent cornea, a second entry was made by 1.5 mm disposable straight knife and the anterior chamber was injected with a viscoelastic agent. An approximately 55.5 mm diameter continuous curvilinear capsulorhexis was performed. After the lens nucleus was water-separated, phacoemulsification was performed in the capsular bag. The lens cortex was removed using an automatic irrigation/aspiration system. Before and after capsule polishing, the viscoelastic agent was injected into the capsular bag and an IOL was implanted into it. The viscoelastic agents were then removed by suction to restore the anterior chamber.

Statistical Analysis Analysis was carried out using SPSS 11.5 (Serial: 9506888 Claritas Inc.) for windows. Categorical variables were presented as percentages, and continuous variables as mean±SD. Multiple groups parameter comparison were performed using one-way analysis of variance (ANOVA), if the variance is not neat, we used Kruskai-Wallis Test. The between-group comparisons were performed using the Student-Newman-Kuels procedure to adjust for the multiple comparisons. R×C Chi-square test for the types of cataract, preoperative and postoperative BCVA. For each outcome variable, a multiple linear regression was performed. All parameters were compared for significant (P<0.05).

RESULTS

Participants´ Demographic and Clinical Data Before Operation For the participants' demographic and clinical data before cataract operation (Table 1), several statistically significant differences were observed. For RBC, transplantation group had no significantly different from normal control group (P=0.78), hemodialysis group was significantly different from normal control group (P=0.00), and the difference between transplantation group and hemodialysis group also had significantly difference (P=0.00). For Hb, transplantation group had no significantly different from normal control group (P=0.70), hemodialysis group was significantly different from normal control group (P=0.00), and the difference between transplantation group and hemodialysis group also had significantly difference (P=0.00). For Cr, transplantation group was significantly different from normal control group (P=0.00), hemodialysis group was significantly different from normal control group (P=0.00), and the difference between transplantation group and hemodialysis group also had significantly difference (P=0.00). For BUN transplantation group was significantly different from normal control group (P=0.00), hemodialysis group was significantly different from normal control group (P=0.00), and the difference between transplantation group and hemodialysis group also had significantly difference (P=0.00).

There were no significant difference in the three groups about non-contact intraocular pressure, corneal endothelial count, SBP, DBP and preoperative BCVA (P>0.05).

Types of Cataract For the types of cataract in the three groups (Table 2), transplantation group was significantly different from normal control group (P=0.04), the most kind is PSC in transplantation group 33 (64.7%), hemodialysis group had no significantly difference from normal control group (P=0.43), and the difference between transplantation group and hemodialysis group also had significantly difference (P=0.02).

Postoperative Best –corrected Visual Acuity For postoperative BCVA in the three groups (Table 3), transplantation group had significantly difference from normal control group (P=0.03), hemodialysis group was significantly different from normal control group (P=0.00), and the difference between transplantation group and hemodialysis group also had significantly difference (P=0.00).

Table 1 Demographic and clinical data *n* (%)

Demographic and clinical data	Transplantation group	Hemodialysis group	Normal control group
RBC (10^{12}/L)[a]	4.18±0.94	3.63±0.53	4.09±0.49
Hb (g/L)[a]	126.47±21.68	113.66±16.54	129.40±14.56
Cr (μmol/L)[a]	124.68±52.95	588.57±285.04	76.75±1.39
BUN (mmol/L)[a]	8.32±3.52	19.67±8.48	5.25±1.02
Non-contact intraocular pressure (mm Hg)	15.49±2.89	15.22±2.68	15.05±1.97
Corneal endothelial count (mm^2)	2368.39±345.43	2243.61±303.89	2341.16±296.26
SBP (mm Hg)	131.08±13.42	132.37±14.40	130.40±20.49
DBP (mm Hg)	78.45±12.22	80.24±7.70	78.20±8.70
Preoperative BCVA			
<0.3	34 (66.7)	30 (73.2)	32 (71.1)
≥0.3	17 (33.3)	11 (26.8)	13 (28.9)

RBC: Red blood cells; Hb: Hemoglobin; Cr: Creatinine; BUN: Blood urea nitrogen; BCVA: Best-corrected visual acuity; SBP: Systolic blood pressure; DBP: Diastolic blood pressure. [a]Statistically significant differences.

Table 2 The type of cataract between the three groups *n* (%)

Type of cataract	Transplantation group	Hemodialysis group	Normal control group
Cortical	17 (33.3)	18 (43.9)	24 (53.3)
Nuclear	1 (2)	6 (14.6)	3 (6.7)
Posterior subcapsular	33 (64.7)	17 (41.5)	18 (40)

Table 3 Postoperative best corrected visual acuity examinations *n* (%)

Postoperative BCVA	Transplantation group	Hemodialysis group	Normal control group
<0.5	3 (5.9)	12 (29.3)	0 (0)
0.5-1.0	15 (29.4)	21 (51.2)	24 (53.3)
≥1.0	33 (64.7)	8 (19.5)	21 (46.7)

BCVA: Best corrected visual acuity.

Multiple Linear Regression Preoperatively, the RBC, Hb, Cr and BUN have statistical significance between the two groups (Table 1). The multiple linear regression was performed using this 4 items, showing that the Hb was positively correlated with postoperative BCVA, while the Cr was negatively correlated with postoperative BCVA. The multiple linear regression equation is Y=0.007Hb-0.000233Cr, R^2=0.898.

Postoperative Fundus Examination In the transplantation group there were two eyes with fundus hemorrhage and exudation, while in the hemodialysis group there were three eyes with fundus hemorrhage and exudation, two with macular degeneration. We observed on postoperative fundus examination that hemorrhage, exudation, and macular degeneration were more common in the hemodialysis group.

DISCUSSION

Transparency of the normal lens results from the high concentration and arrangement of protein molecules within lens fibers, preventing light scatter, and maintaining structural and functional integrity [7,8]. Cataract development in hemodialysis may be due to urea disequilibrium [5]. Renal failure occurs through increased blood urea, with urea entering the lens. After dialysis, the aqueous humor urea concentration rapidly equilibrates with the serum, whereas urea release from the lens is very slow, leading to urea retention and osmotic disequilibrium. To maintain the osmotic balance, water moves from the aqueous humor into the lens, inducing swelling. This readjustment takes time. Repeated dialysis causes recurring imbalance, so that the urea level in the lens remains high and water accumulates inside the lens. This process ultimately leads to an osmotic cataract [6]. In previous studies, cataract formation after transplantation was associated with corticosteroid use [9-12]. A ten-years study showed prednisone-related cataract can be minimized in a protocol incorporating rapid discontinuation of prednisone for maintenance immunosuppression [13]. The second risk factor may because of immune suppression [14,15]. The last risk factor may be older age, with age-related cataract occurring commonly in the lens cortex[16,17].

For the types of cataract in the three groups, transplantation group was significantly different from normal control group (P=0.04), the most kind is PSC in transplantation group 33 (64.7%), which was with the same of previous studies[4,5,15]. hemodialysis group had no significantly difference from normal control group (P=0.43), and the difference between transplantation group and hemodialysis group also had significantly difference (P=0.02). While we thought about the type of cataract in hemodialysis group may be have some related to the older age.

For postoperative BCVA, transplantation group had significantly difference from normal control group (P=0.03), hemodialysis group was significantly different from normal control group (P =0.00), and the difference between transplantation group and hemodialysis group also had significantly difference (P =0.00). That may be with the relevant of the funds of the eyes. This research found a higher incidence of fundus hemorrhage, exudation, and macular degeneration in the hemodialysis group. Our study showed that preoperative Cr, BUN in the hemodialysis group were significantly higher than the renal transplantation group, and preoperative RBC, Hb in the hemodialysis group were significantly lower than the renal transplantation group. This indicates that patients on hemodialysis have continuously poor renal function and anemia, which may cause fundus lesions[18]. Renal function clearly improved after transplantation [19,20]. This result would help to explain the differences between the visual acuity of the two groups.

The multiple linear regression equation is Y=0.007Hb-0.000233Cr, R^2=0.898. For hemodialysis and renal transplantation patients, it was necessary to pay more attention about Hb, Cr according to the regression equations in this research. Therefore, higher Hb and lower Cr may be good for the postoperative BCVA.

In conclusion, this study showed that the PSC was more in the renal transplantation patients. The BCVA was better and fundus lesions were less frequent in the renal transplantation group than in the hemodialysis group after cataract surgery. The multiple linear regression was showed that the Hb was positively correlated with postoperative BCVA, while the Cr was negatively correlated with postoperative BCVA. These results may act as indicators in predicting visual acuity for the renal transplantation and hemodialysis patients.

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REFERENCES

1 Bourne RR, Stevens GA, White RA, Smith JL, Flaxman SR, Price H, Jonas JB, Keeffe J, Leasher J, Naidoo K, Pesudovs K, Resnikoff S, Taylor HR; Vision Loss Expert Group. Causes of vision loss worldwide, 1990-2010: a systematic analysis. *Lancet Glob Health* 2013;1(6):339-349

2 Tan AC, Wang JJ, Lamoureux EL, Wong W, Mitchell P, Li J, Tan AG, Wong TY. Cataract prevalence varies substantially with assessment systems: comparison of clinical and photographic grading in a population-based study. *Ophthalmic Epidemiol* 2011;18(4):164-170

3 Pai RP, Mitchell P, Chow VC, Chapman JR, O'Connell PJ, Allen RD, Nankivell BJ. Posttransplant cataract: lessons from kidney-pancreas transplantation. *Transplantation* 2000;69(6):1108-1114

4 Albert K, Sennesael J, Haentjens P. Incidence and risk factors for posttransplant subcapsular cataract: a long-term retrospective cohort study. *Transplant Proc* 2011;43(9):3465-3469

5 Wang YL, Qi F, Xie JL, Qi L, Zhou C, Zhu XR, Ding X, Yang B, Jin P. Analysis of the relationship between postoperative ophthalmic complications and dialysis time of pre-kidney transplantation. *Int J Ophthalmol* 2012;5(3):370-373

6 Vrabec R, Vatavuk Z, Pavlovic D, Sesar A, Cala S, Mandic K, Bucan K. Ocular findings in patients with chronic renal failure undergoing hemodialysis. *Coll Antropol* 2005;29(1):95-98

7 Kong Z, Zhu X, Zhang S, Wu J, Luo Y. Phase contrast microscopy of living cells within the whole lens: spatial correlations and morphological dynamics. *Mol Vis* 2012;18:2165-2173

8 Bassnett S, Shi Y, Vrensen GF. Biological glass: structural determinants of eye lens transparency. *Philos Trans R Soc Lond B Biol Sci* 2011;366 (1568):1250-1264

9 Sheng H, Lu Y, Chen H. Ocular complications of heart transplantation in a Chinese population. *Transplant Proc* 2008;40(10):3590-3593

10 Krause I, Snir M, Cleper R, Fraser A, Kovalski Y, Axer Siegel R, Bar-Nathan N, Davidovits M. Ocular complications in children and adolescents following renal transplantation. *Pediatr Transplant* 2010;14(1): 77-81

11 James ER. The etiology of steroid cataract. *J Ocul Pharmacol Ther* 2007;23(5):403-420

12 Nakamura T, Sasaki H, Nagai K, Fujisawa K, Sasaki K, Suzuki K, Tsugawa R. Influence of cyclosporin on steroid-induced cataracts after renal transplantation. *Jpn J Ophthalmol* 2003;47(3):254-259

13 Rizzari MD, Suszynski TM, Gillingham KJ, Dunn TB, Ibrahim HN, Payne WD, Chinnakotla S, Finger EB, Sutherland DE, Kandaswamy R, Najarian JS, Pruett TL, Kukla A, Spong R, Matas AJ. Ten-year outcome after rapid discontinuation of prednisone in adult primary kidney transplantation. *Clin J Am Soc Nephrol* 2012;7(3):494-503

14 Yang S, Wu Z, Wu W, Lin W, Xu T, Cai J, Wang Q, Liao L, Tan J. Characteristics of long-term immunosuppressive therapy in chinese pediatric renal transplant patients: a single-center experience. *Transplant Proc* 2009;41(10):4169-4171

15 White SA, Shaw JA, Sutherland DE. Pancreas transplantation. *Lancet* 2009;373(9677):1808-1817

16 Song S, Landsbury A, Dahm R, Liu Y, Zhang Q, Quinlan RA. Functions of the intermediate filament cytoskeleton in the eye lens, *J Clin Invest* 2009;119(7):1837-1848

17 Gao XT, Wong DWK, Ng TT, Cheung CYL, Cheng CY, Wong TY. Automatic grading of cortical and psc cataracts using retroillumination lens images. *Computer Vision-ACCV 2012* 2013;7725:256-267

18 Akbulut A, Tayanç E, Cetinkaya A, Akman A, Yilmaz G, Oto S, Akova Y, Aydin P, Haberal M. Results of cataract surgery in renal transplantation patients. *Eye (Lond)* 2003;17:346-349

19 Aktaş A. Transplanted kidney function evaluation. *Semin Nucl Med* 2014;44(2):129-145

20 Legendre C, Canaud G, Martinez F. Factors influencing long-term outcome after kidney transplantation. *Transpl Int* 2014;27(1):19-27