Original Article

Erectile function in end-stage renal disease before and after renal transplantation

Bunyatat Yanyothin, Siwat Phuriyaphan

Division of Urology, Department of Surgery, Faculty of Medicine, Chiang Mai University, Chiang Mai, Thailand

Keywords:
Erectile dysfunction, renal transplantation, International Index of Erectile Function, IIEF-5, testosterone, end stage renal disease

Abstract

Objective: Erectile dysfunction (ED) can be defined as the inability to achieve or maintain an erection of sufficient firmness for vaginal penetration and sexual satisfaction. Details pertaining to erectile function among end-stage renal disease (ESRD) and renal transplant patients remains controversial. The objective of this study was to evaluate erectile function before and after renal transplantation in all male renal transplant recipients in Chiang Mai University Hospital.

Materials and Methods: This study included 35 patients with ESRD who underwent renal transplantation at Chiang Mai University Hospital. Erectile function in these patients was assessed using the 5-item Thai version of the International Index of Erectile Function (IIEF-5) and serum testosterone levels were measured before and 3, 6 and 12 months after renal transplantation. After the transplant, changes in IIEF-5 scores were analyzed based on the duration of dialysis.

Results: Out of 35 patients, 6 (17.1%) patients had severe ED, 12 (34.2%) patients were scored as moderate, 8 (22.8%) as mild to moderate, 7 (20%) as mild, and 2 (5.7%) patients had no ED in the period before renal transplantation. Twelve months after renal transplantation 2 (6.2%) patients had severe ED, 2 (6.2%) patients had moderate ED, 5 (15.6%) patients had mild to moderate ED, 7 (21.8%) patients had mild ED and 16 (50%) had no ED. There was a significant difference between before- and after-transplant IIEF-5 scores ($p < 0.05$) in patients who had been on dialysis for more than six months. Serum levels of testosterone had increased significantly at the 12 month check following transplantation (3.25 ± 1.54 vs. 5.76 ± 1.73 ng/ml, $p < 0.001$).

Conclusion: After successful renal transplantation, many patients showed a significant improvement in erectile function score, especially in those with a history of longer duration of dialysis. Increase in testosterone levels can contribute to the improvement of ED

Insight Urol 2022;43(2):134-9. doi: 10.52786/isu.a.59

Corresponding author: Siwat Phuriyaphan

Address: Division of Urology, Department of Surgery, Faculty of Medicine, Chiang Mai University, Chiang Mai 50200, Thailand

E-mail: siwatphuriyaphan@gmail.com

Manuscript received: March 30, 2022

Revision received: October 14, 2022

Accepted after revision: October 30, 2022

Introduction

Erectile dysfunction (ED) is the inability to achieve or maintain an erection of sufficient firmness for vaginal penetration and sexual satisfaction.[1] ED is a major medical problem that can affect a patient's quality of life, causing anxiety, depression and loss of self-esteem.[2] ED cannot be traced back to a single cause, but can be as a result of a multisystem disease, psychological factors or chronic diseases.[3]

End-stage renal disease (ESRD) is one of the chronic diseases that cause erectile dysfunction due to organic failures (neuroendocrine disorders, uremia, anemia and atherosclerosis), psychogenic factors (depression, anxiety), and drugs used to treat concomitant chronic renal disease such as antihypertensive drugs, immunosuppressants, H_2 blockers, etc. ESRD patients are often on regular dialysis and approximately 25% of dialysis patients are mentally depressed at some point, which contributes to ED.[4,5]

Renal transplantation has been widely accepted as the best treatment option for ESRD and recipients have reported a significant improvement in their quality of life post-transplant over the past twenty years.[6,7] In patients with uremia, renal transplantation has shown positive results in improving sexual function when compared to other non-dialysis or dialysis treatments.[8] In addition, there are reports that sex hormone levels may be altered or improved in male uremic patients after successful renal transplantation.[2,9] However, these benefits of renal transplantation for ED are not consistent and, therefore, controversial.[10]

Although, numerous published studies have shown altered erectile function and sex hormone profiles after renal transplantation in Western uremic patients, fewer data are available pertinent to Thai renal transplant recipients.

The objectives of this study are to evaluate erectile function, biochemical and serum testosterone levels before and after renal transplantation in all male renal transplant recipients at Chiang Mai University Hospital.

Materials and Methods

The study was carried out in ESRD patients who underwent living and deceased renal transplantation between June 2019 and February 2021 at Chiang Mai University Hospital.

The inclusion criteria included male patients aged 18 years and older who could commit to follow up until 12 months after surgery.

The exclusion criteria included patients who had graft rejection within three months after transplantation and secondary renal transplantation.

Thirty-five patients were enrolled onto this study. Of these, 32 patients (91%) had a follow-up period of 12 months after renal transplantation. The other 3 patients had died. All patients gave informed consent, and the ethics committee of Chiang Mai University approved this study (Study Code: SUR-2562-06746).

Erectile function was evaluated using the 5-item Thai version of the International Index of Erectile Function (IIEF-5) during the period of dialysis before renal transplantation. IIEF-5 is used to determine the presence of ED in accordance with degree of severity (Severe ED: 5-7, Moderate ED: 8-11, Mild to moderate ED: 12-16, Mild ED: 17-21, No ED: 22-25).[11] None of the patients enrolled onto the study received any treatment for erectile dysfunction in the pre-transplantation and post-transplantation period.

Other data collected included morning serum testosterone and blood chemistry of blood urea nitrogen (BUN), creatinine (Cr), and fasting blood sugar (FBS), hemoglobin, cholesterol, and triglyceride levels. These data sets were evaluated before renal transplantation.

At 3, 6 and 12 months after successful renal transplantation patients were reassessed for ED using the IIEF-5 score and biochemical and hormonal assays were also evaluated (Figure 1).

Statistical analysis

All statistical analyses were performed using standard statistical software (STATA version 16.0). Data was described in terms of frequency and percentages in the case of categorical variables and mean ± SD for continuous variables. A paired t-test was used for analysis of continuous data and a $p < 0.05$ was considered statistically significant.

Results

Thirty-five male patients were enrolled. Of these patients, twenty-two received renal transplants from cadavers and thirteen from living

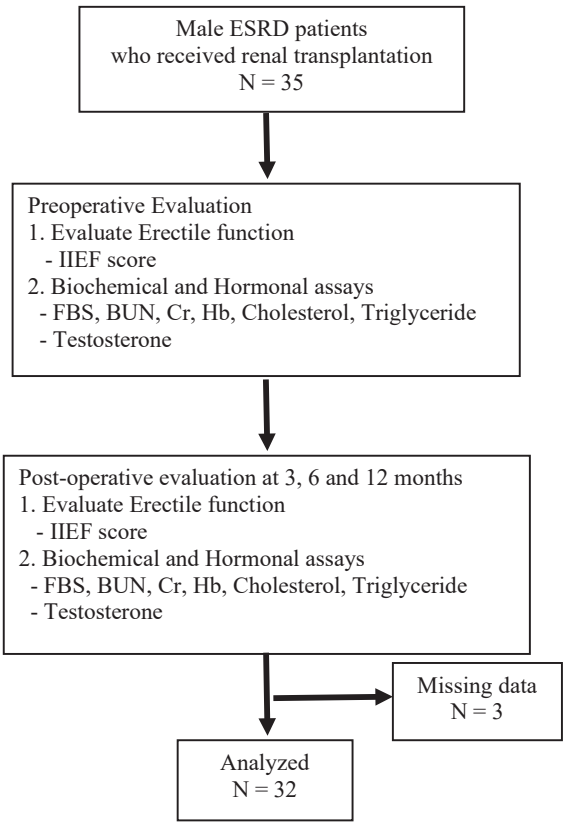

Figure 1. Flow chart of the present study

donors. All patients had undergone external iliac vein and artery vascular anastomoses. At the 12-month follow up, 25 (71.4%) patients had no complications. Complications among the other 10 patients included delayed graft function [3 (8.6%) patients], lymphocele [2 (5.7%) patients], anastomosis stricture [2 (5.7%) patients] and deceased [3 (8.6%) patients]. The clinical characteristics of patients are summarized in Table 1.

In the period before renal transplantation, 2 (5.7%) patients had no ED and 33 (94.3%) patients had ED with differences in severity (severe, n = 6 [17.1%]; moderate, n = 12 [34.2%]: mild to moderate, n = 8 [22.8%]; mild, n = 7 [20%]). Twelve months after renal transplantation, 16 (50%) patients had fully recovered erectile function (severity of ED before-transplant: severe, n = 1; moderate, n = 4; mild to moderate, n = 5; mild, n = 4; No ED, n = 2). The other 16 (50%) patients still had ED after transplantation with various degrees of severity (severe, n = 2 [6.2%]; moderate, n = 2 [6.2%]: mild to moderate, n = 5 [15.6%]; mild, n = 7 [21.8%]). Data pertaining to severity of ED before and after renal transplantation are displayed in Table 2.

Mean IIEF-5 scores before and after transplantation 12 months were 14.72 and 20.52 respectively.

To stipulate the relationship between dialysis duration and the effect of renal transplantation on ED, patients were divided by duration of dialysis into three subgroups specifically < 6 months, 6-24 months, > 24 months. IIEF-5 scores before renal transplantation were compared to 3, 6 and 12 months after transplantation as shown in Table 3.

Table 1. Patient clinical characteristics

Characteristic	Range (Mean±SD) (n = 35)
Duration of dialysis (months)	0-120 (47.03±34.23)
Age (years)	26-61 (42.66±9.44)
BMI (kg/m^2)	15.8-30.06 (22.58±3.30)
Systolic pressure (mmHg)	110-185 (146.23±16.58)
Diastolic pressure (mmHg)	62-113 (89.37±13.78)
	Number (%)
Cause of End-Stage Renal Disease	
Hypertension alone	8 (22.86)
Diabetes mellitus alone	4 (11.43)
Calculi	3 (8.57)
Chronic glomerulonephritis	2 (5.71)
Lupus nephritis	2 (5.71)
IgA nephropathy	1 (2.86)
Autosomal dominant polycystic kidney disease	2 (5.71)
Bilateral ureteropelvic junction obstruction	1 (2.86)
Unknown cause	12 (34.29)

Table 2. Severity of ED before and after renal transplantation (3, 6, 12 months follow-up)

	IIEF-5 score				
	Severe 1-7 n (%)	Moderate 8-11 n (%)	Mild to mod 12-16 n (%)	Mild 17-21 n (%)	No ED 22-25 n (%)
Before transplantation	6 (17.14)	12 (34.29)	8 (22.86)	7 (20.00)	2 (5.71)
3 months after transplantation	2 (5.71)	8 (22.86)	9 (25.71)	12 (34.29)	4 (11.43)
6 months after transplantation	1 (3.03)	4 (12.12)	6 (18.18)	13 (39.39)	9 (27.27)
12 months after transplantation	2 (6.25)	2 (6.25)	5 (15.63)	7 (21.88)	16 (50.00)

Table 3. Patient IIEF-5 before and after renal transplantation (subgroup by dialysis duration)

Dialysis duration (months)	N	IIEF-5 score mean (SD)				P-value		
		[A] Before-transplant	[B] 3 months after-transplant	[C] 6 months after-transplant	[D] 12 months after-transplant	A vs B	A vs C	A vs D
< 6	3	19.00 (5.29)	20.33 (3.21)	21.00 (3.61)	23.67 (1.15)	0.762	0.650	0.297
6-24	10	12.70 (5.03)	14.27 (5.69)	18.40 (6.31)	19.90 (6.03)	0.233	0.038	0.007
> 24	19	12.47 (5.38)	15.24 (5.38)	17.05 (5.10)	18.00 (5.72)	0.005	0.001	<0.001

First subgroup: duration of dialysis less than 6 months. There were no significant changes in the IIEF-5 scores between before and 3, 6 and 12 months after renal transplantation.

Second subgroup: duration of dialysis 6 to 24 months. IIEF-5 scores significantly increased between before and at 6 and 12 months after renal transplantation ($p = 0.038$, $p = 0.007$, respectively). There were no significant changes in IIEF-5 scores between the period before and 3 months after renal transplantation.

Third subgroup: duration of dialysis more than 24 months. IIEF-5 scores significantly increased between before renal transplantation and 3, 6 and 12 months after surgery with scores of $p = 0.005$, $p = 0.001$, and $p = < 0.001$, respectively.

Serum testosterone levels after renal transplantation were significantly increased ($p < 0.001$) compared with before renal transplantation. Moreover, serum BUN, Cr and FBS were significantly decreased ($p < 0.001$) in comparison with before renal transplantation. Other blood chemistry data including cholesterol, triglyceride and hemoglobin levels are summarized in Table 4.

Discussion

A high prevalence of ED has been previously reported in patients with ESRD and on dialysis, levels reaching even higher than 80%.[12,13] This is consistent with the findings in our study, specifically that 33 (94.3%) patients with ESRD had some degree of ED during regular dialysis before renal transplantation. Out of these 6 (17.1%) patients had severe ED, 12 (34.2%) patients had moderate ED, 8 (22.8%) patients had mild to moderate ED and 7 (20%) patients had mild ED. The increase in IIEF-5 scores after renal transplantation represented a significant decrease in prevalence of ED, a finding in accordance with the report by Pourmand et al.[14]

This study showed that the duration of dialysis was a significant factor in the recovery of erectile function after renal transplantation. The most improvement in erectile function was noted in patients who had previously had dialysis for more than six months. There is a significant difference between our observed results and those reported by previous studies. Conversely, Teng et al. have previously reported a greater improvement in ED was found in those patients who underwent shorter dialysis (< 6 months) compared to patients who had a longer dialysis duration.[15] This difference may be due to the small number of subjects in the subgroup with shorter dialysis in our study, and the base line IIEF-5 scores of this subgroup are high.

Table 4. Blood chemistry and testosterone profile before and after renal transplantation

	Mean (SD)					
	Testosterone	**BUN**	**Creatinine**	**Hemoglobin**	**Cholesterol**	**Triglyceride**
Before transplantation	4.31 (1.9)	61.41 (23.4)	12.50 (3.1)	11.03 (1.76)	154.64 (44.31)	159.07 (87.43)
3 months after transplantation	6.92 (1.9)	28.35 (14.4)	1.84 (0.8)	12.65 (2.08)	188.52 (43.03)	181.30 (110.43)
P-value	< 0.001	< 0.001	< 0.001	< 0.001	0.005	0.557
Before transplantation	3.25 (1.5)	60.94 (23.6)	12.62 (3.1)	10.96 (1.75)	155.62 (44.87)	137.07 (82.39)
6 months after transplantation	5.42 (1.7)	28.00 (17.3)	1.65 (0.6)	13.99 (2.77)	182.37 (44.14)	140.65 (119.25)
P-value	< 0.001	< 0.001	< 0.001	< 0.001	0.012	0.821
Before transplantation	3.25 (1.5)	62.52 (23.4)	12.61 (3.1)	10.9 (1.733)	150.25 (43.36)	144.94 (96.60)
12 months after transplantation	5.76 (1.7)	24.16 (15.2)	1.57 (0.7)	14.12 (2.85)	185.77 (39.11)	130.17 (44.84)
P-value	< 0.001	< 0.001	< 0.001	< 0.001	0.004	0.577

BUN = blood urea nitrogen

Although 16 patients in our study regained partial or full erectile function after renal transplantation, that represents only 50% of the participants. ED remained an issue after transplantation with various degrees of severity in the other half of our subjects (severe ED, 6.2%; moderate ED, 6.2%; mild to moderate ED, 15.6%; mild ED, 21.8%). Uremia may have caused irreversible impairment in some of these patients. Some patients also reported being afraid of causing injury to the transplanted kidney during sexual activity which potentially affected their IIEF-5 scores.

Uremia and dialysis can result in a lower testosterone level, a factor well established as being causative in ED.[16,17] Our results were similar to that of Teng et al. who reported that the serum testosterone levels were increased after renal transplantation and were related to recovery of ED [15]. We observed a significant increase in serum testosterone levels after transplantation compared to before transplantation. This data suggests that increased serum testosterone levels may assist in the improvement of erectile function in men with ESRD following renal transplantation.

There was no observable impact of cholesterol, triglyceride and hemoglobin levels in the study as regards having an impact on ED. The same was observed in a study by Bahnsawy et al.18

There are some very interesting findings from our study however it only included a small sample size. The data warrant a further study using a larger population. There was an absence of any etiological characterizations of ED.

A potential limitation of this study was that some patients are hesitant to talk about ED due to its highly sensitive nature, especially those raised in a traditional Thai culture. We were extremely mindful of this and were careful to conduct private interviews in order to obtain accurate data.

Conclusions

The ESRD patients we studied had a very high prevalence of ED. After successful renal transplantation, many of these patients showed an improvement in erectile function score, especially those with a history of longer duration of dialysis (> 6 months). An increase in testosterone levels following renal transplantation may contribute to the improvement of ED in ESRD patients.

Acknowledgements

The authors would like to offer their sincere gratitude for research funding from the Faculty of Medicine Research Fund, Chiang Mai University, Chiang Mai, Thailand.

Conflict of Interest

The authors declare no conflict of interest.

References

1. Shamloul R, Ghanem H. Erectile dysfunction. Lancet 2013;381:153-65.
2. Russo D, Musone D, Alteri V, Cindolo L, Lanzillo B, Federico S, et al: Erectile dysfunction in kidney transplanted patients, efficacy of sildenafil. J Nephrol 2004;17:291-5.

3. Ayub W, Fletcher S. End-stage renal disease and erectile dysfunction. Is there any hope? Nephrol Dial Transplant 2000;15:1525-8.
4. Barrou B, Cuzin B, Malavaud B, Petit J, Pariente JL, Buchler M, et al. Early experience with Sildenafil for the treatment of erectile dysfunction in renal transplant recipients. Nephrol Dial Transplant 2003;18:411-7.
5. Carson CC, Patel MP. The epidemiology, anatomy, physiology, and treatment of erectile dysfunction in chronic renal failure patients. Adv Rev Replace Ther 1999;6:296-309.
6. Griva K, Davenport A, Newman SP. Health-related quality of life and long-term survival and graft failure in kidney transplantation: a 12-year follow-up study. Transplantation 2013;95:740-49.
7. Doubles F, De Bleser L, De Geest S, Fine RN. Quality of life after kidney transplantation: the bright side of life? Adv Chronic Kidney Dis 2007;14:370-8.
8. Peskircioglu L, Tekin MI, Demirag A, Karakayali H, Ozkardes H. Evaluation of erectile function in renal transplant recipients. Transplant Proc 1998;30:747-9.
9. Barroso LVS, Miranda EP, Cruz NI, Medeiros MAS, Araujio ACO, Filho FHAM, et al. Analysis of sexual function in kidney transplanted men. Transplant Proc 2008;40: 3489-91.
10. Mirone V, Longo N, Fusco F, Verze P, Creta M, Parazzini F, et al. Renal transplantation does not improve erectile function in hemodialyzed patients. Eur Urol 2009;56:1047-53.
11. Sangkum P, Sukying C, Viseshsindh W, Kochakarn W, Patcharatrakul S, Khongcharoensombat W. Validation and Reliability of a Thai Version of the International Index of Erectile Dysfunction (IIEF) for Thai Population. J Med Assoc Thai 2017;100:S73-9.
12. Zamd M, Gharibi MB, Ramadni B Zaid D. Sexual dysfunction in male patients undergoing HD in Morocco. Saudi J. Kidney Dis Transplant 2005;16:33-9.
13. Ali ME, Abdel-Hafez HZ, Mahran AM, Mohamed HZ, Mohamed ER, El-Shazly AM, et al. Erecrile dysfunction in chronic renal failure patients undergoing HD in Egypt. Int J Impot Res 2005;17:180-5.
14. Pourmand G, Emamzadeh A, Moosavi S Mehrsai A, Taherimahmoudi M, Nikoobakht M, et al. Does renal transplantation improve erectile dysfunction in hemodialysed patients? What is the role of associated factors? Transplant Proc 2007;39:1029-32.
15. Teng LC, Wang CX, Chen L. Improved erectile function and sex hormone profiles in male Chinese recipients of kidney transplantation. Clin Transplant 2011;25:265-9.
16. Akbari F, Alavi M, Esteghamati A, Mehsai A, Djaladat H, Zohrevand R, et al. Effect of renal transplantation on sperm quality and sex hormone levels. BJU Int 2003;92:281-3.
17. Handelsman DJ. Hypothalamic-pituitary-gonadal dysfunction in renal failure, dialysis and renal transplantation. Endocr Rev 1985;6:151-82.
18. El-Bahnasawy MS, El- Assmy A, El-Sawy E, Ali-El Dein B, El Dein ABS, Rafaie A, et al. Critical evaluation of the factors influencing erectile function after renal transplantation. Int J Impot Res 2004;16:521-6.