

Costs of Hemodialysis and Kidney Transplantation in Sudan A Single Center Experience

Mohamed Elhafiz Elsharif,¹ Elham Gariballa Elsharif,¹
Waheeb Hassan Gadour²

¹Department of Nephrology,
Gezira Hospital for Renal
Diseases and Surgery, Gezira,
Sudan

²Department of Accounting and
Finance, University of Gezira,
Gezira, Sudan

Keywords. hemodialysis,
kidney transplantation, costs
and cost analysis

Introduction. End-stage renal disease is a serious illness with major consequences in both health and healthcare expenditures. The growing number of patients with end-stage renal disease in developing countries will consume a greater proportion of healthcare budget. We aimed to assess the costs of hemodialysis and kidney transplantation in a renal care center in Sudan.

Materials and Methods. We conducted a cross-sectional study to estimate the costs of kidney transplantation and compare those with the costs of hemodialysis per year. We enrolled 78 patients on regular hemodialysis for at least 2 years and 33 kidney transplant patients on regular follow-up at Gezira Hospital for Renal Diseases and Surgery in Sudan.

Results. The annual cost of hemodialysis was found to be US \$ 6847.00. The total cost of the first year after transplantation was US \$ 14 825.04 and the cost of kidney transplantation after the first year was US \$ 10 651.00. The total hospitalization days and absence from work were less in the transplant group.

Conclusions. Hemodialysis in Sudan is less expensive than transplantation.

IJKD 2010;4:282-4
www.ijkd.org

INTRODUCTION

End-stage renal disease (ESRD) is a serious illness with major consequence in both health and healthcare expenditures.¹ As seen worldwide, the prevalence of ESRD has significantly increased in developing countries.² The growing number of patients with ESRD will consume a greater proportion of healthcare budget. Consequently, the worldwide demand for and costs of renal replacement therapy is rapidly becoming a major burden for healthcare systems of the developing countries. For this reason, chronic kidney disease and ESRD are considered as emerging public health problems in developing countries, necessitating changes in healthcare policies.^{3,4} We aimed to estimate the costs of hemodialysis and kidney transplantation at our center, in Sudan.

MATERIALS AND METHODS

This cross-sectional study was conducted at Gezira

Hospital for Renal Diseases and Surgery in August 2009. The objective of this study was to estimate the costs of kidney transplantation compared with hemodialysis. We recruited 78 patients with ESRD on regular hemodialysis and 33 kidney transplant recipients on regular follow-up at our center. Patients on hemodialysis were receiving in-center hemodialysis, 2 sessions per week. Patients who were on hemodialysis or had a kidney allograft for less than 2 years were excluded from this study.

Cost analysis was performed including the following: (a) the costs of medications administered by patients on dialysis, all the consumed solutions for dialysis, drugs utilized during the dialysis session, transplantation operation, all medications administered after transplantation, and other medical procedures; (b) costs of laboratory and radiological investigations; (c) costs related to the healthcare staff salaries; (d) nonmedical supply costs; (e) depreciation of installations and equip-

ments (eg, dialysis machines); and (f) depreciation of reverse osmosis machine. The following were not included our cost analysis: transportation costs of patients plus their attendant to the dialysis center, the cost of elapsed time, the expenses related to absence from work, costs of hemodialysis vascular access, dietary costs, and building rental costs.

The SPSS software (Statistical Package for the Social Sciences, version 14.0, SPSS Inc, Chicago, Ill, USA) was used for the analysis of the data. Depreciation value was calculated by using the straight-line method. Data were expressed as mean \pm standard deviation.

RESULTS

The mean age of the patients in the hemodialysis group was 42.5 ± 11.4 years. They were 64 men (82.1%) and 14 women (17.9%). The mean duration of hospitalization per year was 8.56 ± 7.99 days. The mean of absence from work was 27.57 ± 12.34 days per year. The costs of hemodialysis are shown in Table 1.

The mean age of the patients in the transplant group was 40.3 ± 12.0 years. They were 21 men (65.6%) and 11 women (34.4%). The mean duration of hospitalization per year was 4.84 ± 7.62 days. The mean of absence from work was 10.23 ± 3.54 days per year. The costs of renal transplantation are shown in Tables 2 and 3.

DISCUSSION

The annual costs of hemodialysis in Sudan are less than those in the United States,⁵ Italy,^{6,7} Spain,⁸ France,^{9,10,11} Japan,¹² Turkey,¹³ Iran,¹⁴ Mexico,¹⁵ United Kingdom,¹⁶ and Brazil¹⁷; however, its more expensive than those in India.¹⁸ This can be due to both lower costs of hemodialysis sessions and smaller total number of hemodialysis sessions per year. The costs of hemodialysis in this study were calculated based on 2 sessions of hemodialysis per week, which are not adequate according to the National Kidney Foundation Dialysis Outcomes Quality Initiative recommendations¹⁹ and the National Cooperative Dialysis Study.²⁰

Transplantation costs in our series were found to be higher than those in Iran,²¹ India,¹⁸ and Mexico,¹⁵ but lower than the costs in the United state,²² Iceland,²³ Denmark,²³ or Finland.²⁴ In our study, we found that the costs of hemodialysis for 1 year were less than the costs of transplantation for both the first year and the following years, while in Canada,²⁵ New Zealand,²⁶ Mexico,¹⁵ Hungary,²⁷ Serbia,²⁸ and Australia,²⁹ transplantation was found to be less costly than dialysis. Erek and colleagues reported from Turkey¹³ and Salonen and associates from Finland²⁴ that the costs of the first year after transplantation were higher than dialysis and less in following years. Another difference is that the total hospitalization days and absence from work

Table 1. Costs of Hemodialysis

Item	Cost per Hemodialysis Session		Cost per Year	
	SDG	US \$	SDG	US \$
Treatment instruments	96.34	41.89	10019.36	4356.24
Drugs	23.41	10.18	2434.64	1058.54
Staff	16.87	7.33	1754.48	762.82
Nonmedical supplies	6.21	2.70	645.84	280.80
Investigations	3.75	1.63	390.00	169.56
Depreciation of dialysis machines	4.63	2.01	481.52	209.36
Depreciation of reverse osmosis machine	0.21	0.09	21.84	9.49
Total	146.58	65.83	15 747.68	6846.82

*SDG indicates Sudanese Pound.

Table 2. Costs of the First Year After Kidney Transplantation*

Item	Cost	
	SDG	US \$
Preoperative and operative	18 000.00	7826.09
Medications	15 437.85	6712.00
Investigations	660.00	286.96
Total	34 097.85	14 825.04

*SDG indicates Sudanese Pound.

Table 3. Annual Costs of Kidney Transplantation After the First Year*

Item	Cost	
	SDG	US \$
Medications	24 019.00	10 443.04
Investigations	480.00	208.70
Total	24 499.00	10 651.74

*SDG indicates Sudanese Pound.

could be much less in the transplant group.

CONCLUSIONS

Hemodialysis in Sudan is not adequate, but less expensive than kidney transplantation. Hemodialysis costs in Sudan compared with other countries and with kidney are low.

CONFLICT OF INTEREST

None declared.

REFERENCES

- Zelmer JL. The economic burden of end-stage renal disease in Canada. *Kidney Int.* 2007;72:1122-9.
- Prodjosudjadi W. Incidence, prevalence, treatment and cost of end-stage renal disease in Indonesia. *Ethn Dis.* 2006;16:S2-14-6.
- Grassmann A, Gioberge S, Moeller S, Brown G. ESRD patients in 2004: global overview of patient numbers, treatment modalities and associated trends. *Nephrol Dial Transplant.* 2005;20:2587-93.
- Modi GK, Jha V. The incidence of end-stage renal disease in India: a population-based study. *Kidney Int.* 2006;70:2131-3.
- Garella S. The costs of dialysis in the USA. *Nephrol Dial Transplant.* 1997;12 Suppl 1:10-21.
- Tediosi F, Bertolini G, Parazzini F, Mecca G, Garattini L. Cost analysis of dialysis modalities in Italy. *Health Serv Manage Res.* 2001;14:9-17.
- Piccoli G, Formica M, Mangiarotti G, et al. The costs of dialysis in Italy. *Nephrol Dial Transplant.* 1997;12 Suppl 1:33-44.
- Rodriguez-Carmona A, Perez Fontan M, Bouza P, Garcia Falcon T, Valdes F. The economic cost of dialysis: a comparison between peritoneal dialysis and in-center hemodialysis in a Spanish unit. *Adv Perit Dial.* 1996;12:93-6.
- Lee H, Manns B, Taub K, et al. Cost analysis of ongoing care of patients with end-stage renal disease: the impact of dialysis modality and dialysis access. *Am J Kidney Dis.* 2002;40:611-22.
- Jacobs C. The costs of dialysis treatments for patients with end-stage renal disease in France. *Nephrol Dial Transplant.* 1997;12 Suppl 1:29-32.
- Benain JP, Faller B, Briat C, et al. [Cost of dialysis in France]. *Nephrol Ther.* 2007;3:96-106. French.
- Nakajima I, Akamatsu M, Tojimbara T, Toma H, Fuchinoue S. Economic study of renal transplantation: a single-center analysis in Japan. *Transplant Proc.* 2001;33:1891-2.
- Erek E, Sever MS, Akoglu E, et al. Cost of renal replacement therapy in Turkey. *Nephrology (Carlton).* 2004;9:33-8.
- Arefzadeh A, Lessanpezeski M, Seifi S. The cost of hemodialysis in Iran. *Saudi J Kidney Dis Transpl.* 2009;20:307-11.
- Arredondo A, Rangel R, de Icaza E. [Cost-effectiveness of interventions for end-stage renal disease]. *Rev Saude Publica.* 1998;32:556-65. Portuguese.
- Baboolal K, McEwan P, Sondhi S, Spiewanowski P, Wechowski J, Wilson K. The cost of renal dialysis in a UK setting—a multicentre study. *Nephrol Dial Transplant.* 2008;23:1982-9.
- Sesso R, Eisenberg JM, Stabile C, Draibe S, Ajzen H, Ramos O. Cost-effectiveness analysis of the treatment of end-stage renal disease in Brazil. *Int J Technol Assess Health Care.* 1990;6:107-14.
- Prabahar MR, Chandrasekaran V, Soundararajan P. Epidemic of chronic kidney disease in India -what can be done? *Saudi J Kidney Dis Transpl.* 2008;19:847-53.
- [No author listed]. I. NKF-K/DOQI Clinical Practice Guidelines for Hemodialysis Adequacy: update 2000. *Am J Kidney Dis.* 2001;37:S7-S64.
- Gotch FA, Sargent JA. A mechanistic analysis of the National Cooperative Dialysis Study (NCDS). *Kidney Int.* 1985;28:526-34.
- Nourbala MH, Einollahi B, Kardavani B, et al. The cost of kidney transplantation in Iran. *Transplant Proc.* 2007;39:927-9.
- Englesbe MJ, Dimick JB, Fan Z, Baser O, Birkmeyer JD. Case mix, quality and high-cost kidney transplant patients. *Am J Transplant.* 2009;9:1108-14.
- Asgeirsdottir TL, Asmundsdottir G, Heimisdottir M, Jonsson E, Palsson R. [Cost-effectiveness analysis of treatment for end-stage renal disease]. *Laeknabladid.* 2009;95:747-53. Icelandic.
- Salonen T, Reina T, Oksa H, Sintonen H, Pasternack A. Cost analysis of renal replacement therapies in Finland. *Am J Kidney Dis.* 2003;42:1228-38.
- Laupacis A, Keown P, Pus N, et al. A study of the quality of life and cost-utility of renal transplantation. *Kidney Int.* 1996;50:235-42.
- Croxson BE, Ashton T. A cost effectiveness analysis of the treatment of end stage renal failure. *N Z Med J.* 1990;103:171-4.
- Kalo Z, Jaray J, Nagy J. Economic evaluation of kidney transplantation versus hemodialysis in patients with end-stage renal disease in Hungary. *Prog Transplant.* 2001;11:188-93.
- Perovic S, Jankovic S. Renal transplantation vs hemodialysis: cost-effectiveness analysis. *Vojnosanit Pregl.* 2009;66:639-44.
- Howard K, Salkeld G, White S, et al. The cost-effectiveness of increasing kidney transplantation and home-based dialysis. *Nephrology (Carlton).* 2009;14:123-32.

Correspondence to:
 Mohamed Elhafiz Elsharif, MD
 Wad Madeny, PO Box 332, Sudan
 Tel: +249 912 360 661
 Fax: +249 511 846 203
 E-mail: drhafize@hotmail.com

Received September 2009
 Revised March 2010
 Accepted April 2010