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Original Article

Renal transplant among type 1 and type 2 diabetes patients in Spain: A population-based study from 2002 to 2013

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ABSTRACT

Background: To describe trends in the rates and short-term outcomes of renal transplants (RTx) among patients with or without diabetes in Spain (2002–2013).
Methods: We used national hospital discharge data to select all hospital admissions for RTx. We divided the study period into four three-year periods. Rates were calculated stratified by diabetes status: type 1 diabetes (T1DM), type 2 diabetes (T2DM) and no-diabetes. We analyzed Charlson comorbidity index (CCI), post-transplant infections, in-hospital complications of RTx, rejection, in-hospital mortality and length of hospital stay.
Findings: We identified 25,542 RTx. Rates of RTx increased significantly in T2DM patients over time (from 9.3 cases/100,000 in 2002/2004 to 13.3 cases/100,000 in 2011/2013), with higher rates among people with T2DM for all time periods. T2DM patients were older and had higher CCI values than T1DM and non-diabetic patients (CCI ≥ 1, 31.4%, 20.4% and 21.5%, respectively; $P < 0.05$). Time trend analyses showed significant increases in infections, RTx-associated complications and rejection for all groups (all P values < 0.05). Infection rates were greater in people with T2DM (20.8%) and T1DM (23.5%) than in non-diabetic people (18.7%; $P < 0.05$). Time trend analyses (2002–2013) showed significant decreases in mortality during admission for RTx (OR 0.75, 95% CI 0.68–0.83). Diabetes was not associated with a higher in-hospital mortality (OR: 1.20, 95% CI 0.92–1.55).
Interpretation: RTx rates were higher and increased over time at a higher rate among T2DM patients. Mortality decreased over time in all groups. Diabetes does not predict mortality during admission for RTx.
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1. Introduction

Prevalence of diabetes is steadily rising. In Spain the number of people with diabetes has more than doubled over the last decade due to an increasing obesity rate and an aging population [1]. This increment in diabetes prevalence is projected to cause a significant increase of the number of patients with end-stage renal disease (ESRD) [2].

Renal transplant (RTx) is the treatment of choice in patients with ESRD of type 1 diabetes (T1DM). In terms of quality of life and survival, it performs better than dialysis [3]. Yet, there is controversy about the results of RTx in patients with type 2 diabetes (T2DM). Patients with T2DM are mostly older, often have diabetes-related long-term complications and have a wider range of comorbidities than people without T2DM [4].

Abbreviations: CCI, Charlson comorbidity index; CMBD, Conjunto Mínimo Básico de Datos, or Minimum Basic Data Set, the Spanish National Hospital Database; ESRD, End-stage renal disease; ICD-9-CM, International Classification of Diseases-Ninth Revision, Clinical Modification; IHM, In-hospital mortality; LOHS, Length of hospital stay; RTx, Renal transplantation; T1DM, Type 1 diabetes mellitus; T2DM, Type 2 diabetes mellitus.

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Previous reports have shown an increased risk of infection, post-transplant rejection, and cardiovascular disease in diabetic patients [5]. However, several studies have reported no differences in survival when compared to non-diabetic patients [6,7]. Maamoun et al. found that one-year survival rates after RTx in patients with diabetes did not significantly differ from patients without diabetes (82% vs. 89%, respectively) [7]. Available studies on patients with RTx who have T1DM and T2DM have shortcomings because they do not differentiate the two types of diabetes [5,8], or were based on single-center experiences [7].

In this study, we used national hospital discharge data to examine trends in rates and outcomes of kidney transplant among patients with or without diabetes in Spain from 2002 to 2013. In particular, we analyzed patient comorbidities, post-transplant infections, in-hospital complications of the transplanted kidney, graft rejection and in-hospital outcomes, such as in-hospital mortality (IHM) and length of hospital stay (LOHS). Because of expected differences in epidemiological characteristics and patient condition between T1DM and T2DM all analyses were conducted by diabetes type.

2. Methods

We performed a retrospective, observational study using the Spanish National Hospital Database (CMBD, Conjunto Mínimo Básico de Datos), which is managed by the Spanish Ministry of Health, Social Services and Equality and compiles all public and private hospital data, covering more than 95% of hospital admissions [9]. The CMBD includes patient variables (sex, date of birth), admission and discharge dates, up to 14 discharge diagnoses, and up to 20 procedures performed during the hospital stay. The Spanish Ministry of Health, Social Services and Equality sets standards for record keeping and performs periodic audits of the database [9]. We analyzed data collected between January 1, 2002 and December 31, 2013 (12 complete years) for subjects aged 18 and over.

The criteria for diseases and procedures were defined according to the International Classification of Diseases-Ninth Revision, Clinical Modification (ICD-9-CM), which is used in the Spanish CMBD. We selected admissions for patients whose medical procedures included RTx, coded as 55.6, 55.61 or 55.69 in any procedure field according to the ICD-9-CM. We grouped admissions by diabetes status as follows: T1DM (ICD-9-MC codes: 250.x1 and 250.x3), T2DM (ICD-9-CM codes: 250.x0 and 250.x2) or no-diabetes in any diagnostic position.

Clinical characteristics included information on overall comorbidity at the time of diagnosis, which was assessed by calculating the Charlson comorbidity index (CCI) (Table 1) [10]. Risk factors considered in the data analysis included obesity (ICD-9-CM code 278.xx) and hypertension (ICD-9-CM codes: 401.0–405.99) coded during the hospitalization for RTx.

Irrespective of the position at the diagnoses or procedures coding list, we retrieved data about in-hospital infection events, like pneumonia

Table 1
Clinical characteristics of hospital admissions for kidney transplantation among patients with or without diabetes in Spain, 2002–2013.

Time period	2002–2004	2005–2007	2008–2010	2011–2013	Total
No diabetes					
N	5084	5164	5206	5565	21,019
Age, mean (SD)*,†,‡	49.0 (13.6)	49.7 (13.9)	50.8 (13.6)	51.8 (13.7)	50.4 (13.8)
18–44 years, n (%)*,†,‡	1844 (36.3)	1836 (35.6)	1676 (32.2)	1622 (29.2)	6978 (33.2)
45–64 years, n (%)†,‡	2541 (50.0)	2506 (48.5)	2620 (50.3)	2838 (51.0)	10,505 (50.00)
≥65 years, n (%)†,‡	699 (13.8)	822 (15.9)	910 (17.5)	1105 (19.9)	3536 (16.8)
Male, n (%)*,†,‡	3053 (60.1)	3202 (62.0)	3211 (61.7)	3489 (62.7)	12,955 (61.6)
CCI 0, n (%)†	4123 (81.1)	4073 (78.9)	4048 (77.8)	4258 (76.5)	16,502 (78.5)
CCI 1, n (%)†	867 (17.1)	960 (18.6)	1004 (19.3)	1113 (20.0)	3944 (18.8)
CCI ≥ 2, n (%)†	94 (1.)	131 (2.5)	154 (3.0)	194 (3.5)	573 (2.7)
Obesity, n (%)*,†,‡	149 (2.9)	168 (3.3)	185 (3.6)	267 (4.8)	769 (3.7)
Hypertension, n (%)*	1397 (27.5)	1490 (28.9)	1133 (21.8)	844 (15.2)	4864 (23.1)
Type 1 diabetes					
N	229	256	291	303	1079
Age, mean (SD)‡,§	40.9 (9.7)	41.4 (10.2)	41.6 (9.8)	43.0 (8.8)	41.8 (9.6)
18–44 years, n (%)‡,§	158 (69)	173 (67.6)	194 (66.7)	177 (58.4)	702 (65.1)
45–64 years, n (%)‡,§	64 (28.0)	78 (30.5)	88 (30.2)	121 (39.9)	351 (32.6)
≥65 years, n (%)‡,§	7 (3.1)	5 (2.0)	9 (3.1)	5 (1.7)	26 (2.4)
Male, n (%)‡	155 (67.7)	178 (69.5)	188 (64.6)	200 (66.0)	721 (66.8)
CCI 0, n (%)§	183 (79.9)	201 (78.5)	231 (79.4)	244 (80.5)	859 (79.6)
CCI 1, n (%)§	43 (18.8)	47 (18.4)	54 (18.6)	51 (16.8)	195 (18.1)
CCI ≥ 2, n (%)§	3 (1.3)	8 (3.1)	6 (2.1)	8 (2.6)	25 (2.3)
Obesity, n (%)‡,§	1 (0.4)	4 (1.6)	7 (2.4)	7 (2.3)	19 (1.8)
Hypertension, n (%)*	64 (28.0)	82 (32.0)	66 (22.7)	42 (13.9)	254 (23.5)
Type 2 diabetes					
N	572	829	925	1118	3444
Age, mean (SD)*,†,§	56.7 (10.0)	58.4 (10.2)	59.3 (10.4)	60.9 (9.4)	59.2 (10.1)
18–44 years, n (%)*,†,§	70 (12.2)	73 (8.8)	88 (9.5)	69 (6.2)	300 (8.7)
45–64 years, n (%)†,§	361 (63.1)	534 (64.4)	523 (56.5)	595 (53.2)	2013 (58.5)
≥65 years, n (%)†,§	141 (24.7)	222 (26.8)	314 (34.0)	454 (40.6)	1131 (32.8)
Male, n (%)*,†	375 (65.6)	557 (67.2)	644 (69.6)	804 (71.9)	2380 (69.1)
CCI 0, n (%)*,†,§	420 (73.4)	582 (70.2)	632 (68.3)	728 (65.1)	2362 (68.6)
CCI 1, n (%)†,§	129 (22.6)	214 (25.8)	253 (27.4)	317 (28.4)	913 (26.5)
CCI ≥ 2, n (%)†,§	23 (4.0)	33 (4.0)	40 (4.3)	73 (6.5)	169 (4.9)
Obesity, n (%)*,†,§	26 (4.6)	77 (9.3)	87 (9.4)	124 (11.1)	314 (9.1)
Hypertension, n (%)*	148 (25.9)	257 (31.0)	224 (24.2)	156 (14.0)	785 (22.8)

N number of admissions, CCI Charlson comorbidity index [10]. The Charlson comorbidity index applies to different disease categories, the scores of which are added to obtain an overall score for each patient. We divided patients into three categories: low CCI (patients with no previously recorded disease), medium CCI (patients with one category), and high CCI (patients with two or more disease categories). To calculate the CCI, we used all disease categories, excluding diabetes and chronic renal disease.

* $P<0.05$ to assess time trend form 2002/04 to 2011/13.

† Significant differences ($P<0.05$) when comparing non diabetic vs. type 2 diabetes.

‡ Significant differences ($P<0.05$) when comparing non diabetic vs. type 1 diabetes.

§ Significant differences ($P<0.05$) when comparing type 1 diabetes vs. type 2 diabetes.