

Special article

Spanish Heart Transplant Registry. 28th Official Report of the Spanish Society of Cardiology Working Group on Heart Failure (1984–2016)



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ABSTRACT

Introduction and objectives: The present article reports the characteristics and results of heart transplants in Spain since this therapeutic modality was first used in May 1984.

Methods: We summarize the main features of recipients, donors, surgical procedures, and outcomes of all cardiac transplants performed in Spain up to December 31, 2016.

Results: A total of 281 cardiac transplants were performed in 2016. The whole historical series consisted of 7869 procedures. The main features of transplant procedures in 2016 were similar to those observed in recent years. A high percentage of procedures were urgent, particularly those with use of pretransplant continuous-flow left ventricular assist devices (19.1% of all transplants). Survival significantly improved in the last decade compared with previous periods.

Conclusions: During the last few years, transplant activity in Spain has remained steady, with approximately 250–300 transplants/year. Despite a more complex clinical context, survival has improved in recent years.

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Registro Español de Trasplante Cardíaco. XXVIII Informe Oficial de la Sección de Insuficiencia Cardíaca de la Sociedad Española de Cardiología (1984–2016)

RESUMEN

Introducción y objetivos: El presente artículo presenta las características y resultados del trasplante cardíaco en España, desde que empezó su actividad en mayo de 1984.

Métodos: Se realiza un análisis descriptivo de las características de los receptores, donantes, procedimiento quirúrgico y resultados de los trasplantes cardíacos realizados en España hasta el 31 de diciembre de 2016.

Resultados: Durante 2016 se han realizado 281 procedimientos, con lo que la serie histórica consta de 7.869 trasplantes. Las características generales del procedimiento son similares a las observadas en los últimos años y destacan el alto porcentaje de procedimientos realizados en código urgente y, sobre todo, la extensión del uso de dispositivos de asistencia circulatoria, particularmente de asistencia ventricular de flujo continuo (el 19,1% del total de trasplantes). La supervivencia ha aumentado significativamente en la última década con respecto a periodos anteriores.

Palabras clave:

Trasplante cardíaco
Registro
Supervivencia

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◇ Collaborators are listed in [Appendix](#).

Conclusiones: La actividad de trasplante cardiaco en España permanece estable en los últimos años, con alrededor de 250-300 procedimientos al año. A pesar de la mayor complejidad del contexto clínico, se observa una mejoría de la supervivencia en los últimos años.
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Abbreviations

ECMO: extracorporeal membrane oxygenation
 RETC: Spanish Heart Transplantation Registry (*Registro Español de Trasplante Cardiaco*)

INTRODUCTION

As in previous years, we present the Spanish Heart Transplant Registry (*Registro Español de Trasplante Cardiaco* [RETC]), containing the updated data related to the heart transplant activity performed in 2016 in Spain.¹⁻²⁷ The Registry reports the clinical characteristics and the outcome of transplant procedures. The continuous updating of information since May 1984, as well as the use of a common database created by consensus, provides an overall perspective of this important clinical activity that enables detection of potential shortcomings and areas for improvement.

METHODS

Patients and Centers

Of the 19 centers that have contributed data to the RETC, 18 are now currently active (Table 1). Two centers are exclusively devoted to pediatric transplant procedures, whereas 4 others carry out transplants in both pediatric patients and adults. The number of procedures performed per year is shown in Figure 1. The total activity recorded in the Registry comprises 7869 procedures. Data were missing for 12 procedures, including follow-up information. These were omitted from the analysis, which left a final sample of 7857 transplant surgeries. Of 281 procedures carried out in 2016, 20 (7.1%) were performed in pediatric patients (age < 16 years).

Table 1

Centers Participating in the Spanish Heart Transplant Registry by Order of First Transplant Performed (1984-2016)

1. Hospital de la Santa Creu i Sant Pau, Barcelona
2. Clínica Universitaria de Navarra, Pamplona
3. Clínica Puerta de Hierro, Majadahonda, Madrid
4. Hospital Marqués de Valdecilla, Santander
5. Hospital Reina Sofía, Cordoba (adults and pediatric)
6. Hospital Universitario y Politécnico La Fe, Valencia (adults and pediatric)
7. Hospital Gregorio Marañón, Madrid (adults and pediatric)
8. Fundación Jiménez Díaz, Madrid (1989-1994)
9. Hospital Virgen del Rocío, Seville
10. Hospital 12 de Octubre, Madrid
11. Hospital Universitario de A Coruña, A Coruña (adults and pediatric)
12. Hospital Bellvitge, L'Hospitalet de Llobregat, Barcelona
13. Hospital La Paz, Madrid (pediatric)
14. Hospital Central de Asturias, Oviedo
15. Hospital Clínic, Barcelona
16. Hospital Virgen de la Arrixaca, El Palmar, Murcia
17. Hospital Miguel Servet, Zaragoza
18. Hospital Clínico, Valladolid
19. Hospital Vall d'Hebron, Barcelona (pediatric)

The types of procedures performed in 2016 and in the total recorded series are summarized in Table 2.

Procedures

The database includes 175 clinical variables established by consensus among all the transplant teams. The variables include data on the recipient, donor, surgical technique, immunosuppression used, and the follow-up. Since 2013, the data have been

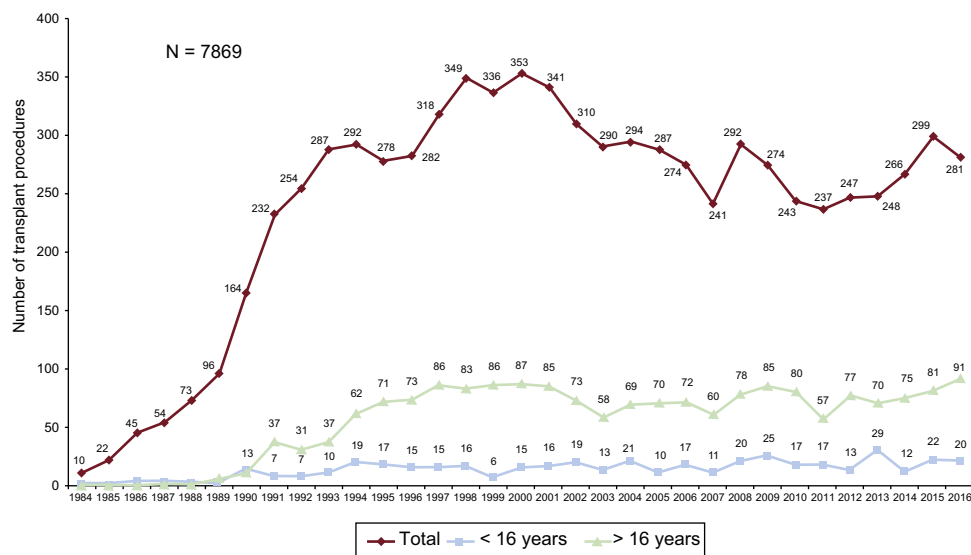


Figure 1. Yearly number of transplant procedures performed (1984-2016), in the total series and by age groups.

Table 2
Spanish Heart Transplant Registry (1984–2016). Type of Procedure

Procedure	2016	1984–2016
<i>De novo heart transplant</i>	268	7511
<i>Retransplant</i>	5	188
Combined retransplant	0	6 ^a
<i>Combined transplant</i>	8	158
Heart-lung	4	78
Heart-kidney	3	70 ^b
Heart-liver	1	10
<i>Total</i>	281	7857

^a All were renal transplants.

^b Heart retransplants are included.

electronically recorded and updated in real time using a web-based program specifically designed for this purpose. The data are provided in a Microsoft Excel file. This system replaces the previous one, in which each center sent data to the Registry director by e-mail in a Microsoft Access file. An external contract research organization (CRO), currently ODDS S.L., carries out database maintenance, quality assurance, and the statistical analyses.

Ethics committee approval, auditing, and registration with the Spanish Ministry of Health were done in keeping with the requirements set down in the Organic Law on Data Protection 15/1999.

Statistics

Continuous quantitative variables are expressed as the mean \pm standard deviation and categorical variables as percentages. The results were categorized according to the year of transplant, with the overall sample being divided into 4 time periods (1984–1993, 1994–2003, 2004–2013, and 2014–2015). Certain variables were also analyzed according to the yearly data from the series, such as donor age, urgent transplant, and ischemia time. Differences between

groups were analyzed using a nonparametric test for temporal trends (Kendall tau) for categorical variables and analysis of variance (ANOVA) with polynomial fitting for continuous variables. Survival curves were calculated with the Kaplan-Meier method and were compared using a log rank test. A *P* value $< .05$ was considered statistically significant in the comparisons.

RESULTS

Recipient Characteristics

In 2016, the mean age of the recipients was 49.5 ± 17.5 (range, 0.18–72) years. Males accounted for 74.7%, and the main baseline diagnoses were ischemic cardiomyopathy (35.2%), nonischemic dilated cardiomyopathy (29.2%), valvular cardiomyopathy (3.9%), and other diagnoses (31.7%). The characteristics of the recipients by transplant period are summarized in Table 3. The age and sex of recipients has remained stable over the last 2 decades. Significant trends were seen toward an increase in unusual underlying heart disease and in pretransplant conditions having a recognized prognostic effect, such as insulin-dependent diabetes mellitus and infection, as well as cardiac surgery and mechanical ventilation prior to transplant. Although the differences did not reach statistical significance, the percentage of retransplants fell below 2% from 2014 to 2016, and accounted for 2.4% of the total series. In contrast, there was a significant decrease in pretransplant pulmonary vascular resistance values and a decrease approaching significance in severe pretransplant renal impairment over time in the total sample.

In 2016, urgent transplant accounted for more than 50% of the procedures. This maintains a trend observed since 2013, with urgent transplants being performed in more than 40% of patients (Figure 2). The increasing use of pretransplant ventricular assist devices detected since 2009 was also confirmed in 2016 ($P < .001$) (Figure 3). Furthermore, 2016 showed a predominance of continuous-flow ventricular assist devices (44.9%) and a reduction in the use of pretransplant balloon pumps (Figure 4).

Table 3
Recipient Characteristics in the Spanish Heart Transplant Registry(1984–2016)

	1984–1993 (n = 1230)	1994–2003 (n = 3148)	2004–2013 (n = 2633)	2014–2016 (n = 846)	<i>P</i> (trend)	2016 (n = 281)
<i>Age, y</i>	46.7 \pm 13.4	50.4 \pm 14.6	49.5 \pm 16.5	49.7 \pm 16.6	$< .001$	49.5 \pm 17.5
< 16 y	3.9	4.8	6.8	6.4	$< .001$	7.1
> 60 y	10.0	24.3	27.3	29.2	$< .001$	32.4
<i>Males</i>	85.8	81.1	76.1	75.4	$< .001$	74.7
<i>BMI</i>	24.2 \pm 4.0	25 \pm 4.5	24.9 \pm 4.7	24.6 \pm 4.5	$< .001$	24.5 \pm 4.7
<i>Underlying heart disease</i>					$< .001$	
Dilated nonischemic	40.8	37.8	37.5	37.8		37.7
Ischemic	40.2	43.7	36.5	37.1		35.2
Valvular	10.4	7.6	7.8	4.0		3.9
Others	8.6	10.8	18.1	21.0		23.1
<i>PVR, WU</i>	2.6 \pm 1.8	2.3 \pm 1.8	2.4 \pm 2.2	2.2 \pm 1.4	$< .001$	2.3 \pm 1.5
<i>Creatinine > 2 mg/dL</i>	7.0	6.1	8.3	6.0	.049	6.4
<i>Bilirubin > 2 mg/dL</i>	19.7	17.8	18.2	17.4	.582	19.2
<i>Insulin-dependent diabetes</i>	8.5	12.9	17.0	23.3	$< .001$	22.0
<i>Moderate-severe COPD</i>	9.3	11.2	9.4	11.7	.05	10.8
<i>Previous infection</i>	4.0	9.4	13.7	15.0	$< .001$	19.9
<i>Previous cardiac surgery</i>	25.3	26.5	28.9	32.2	.001	28.8
<i>Previous heart retransplant</i>	2.8	2.1	2.6	1.8	.62	1.8
<i>Pretransplant mechanical ventilation</i>	8.3	10.3	16.2	14.6	$< .001$	16.5
<i>Urgent transplant</i>	18.1	23.6	34.6	46.4	$< .001$	50.2

BMI, body mass index; COPD, chronic obstructive pulmonary disease; PVR, pulmonary vascular resistance. Data are expressed as the percentage or the mean \pm standard deviation.

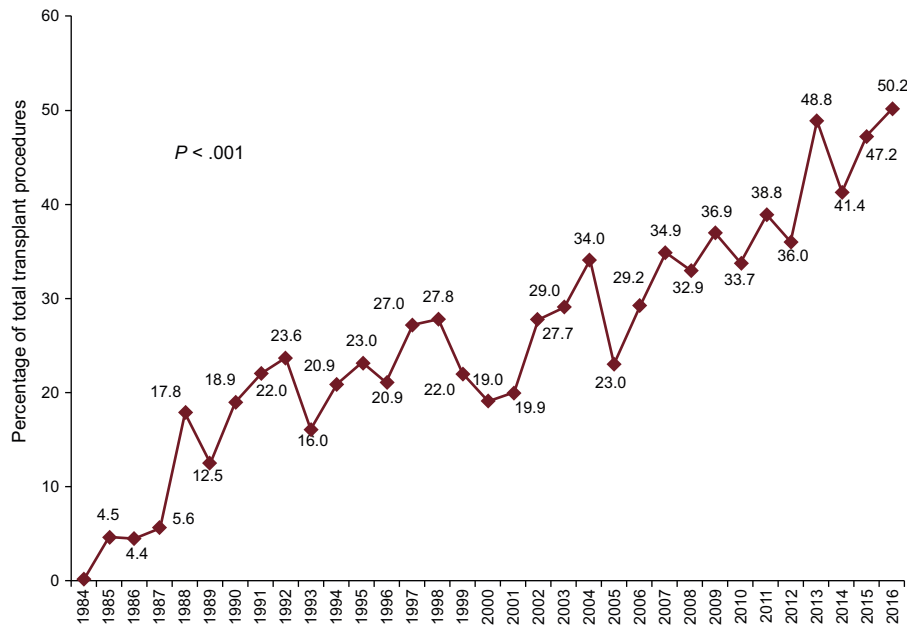


Figure 2. Percentage of urgent transplant procedures performed by year in the total series (1984–2016).

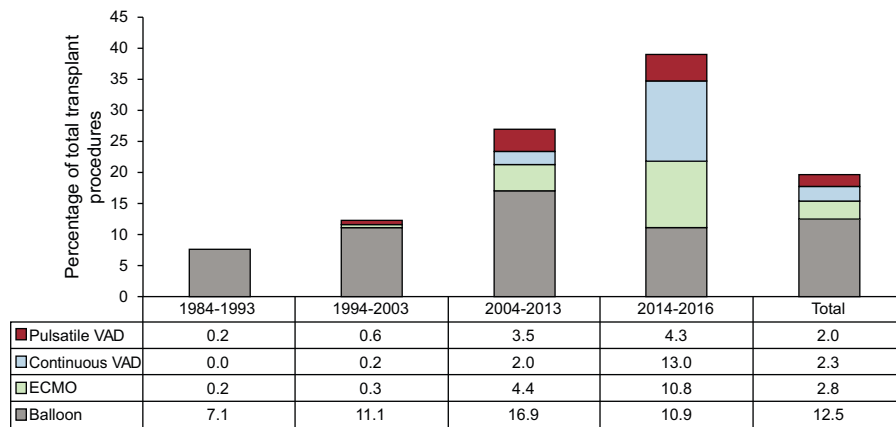


Figure 3. Type of pretransplant circulatory support used by time period. ECMO, extracorporeal membrane oxygenation; VAD, ventricular assist device.

Donor Characteristics and Ischemia Time

The characteristics of the donors by time period and in 2016 are summarized in Table 4. Donor age has significantly increased throughout the total recorded series, and in 2016, 57% of donors were in the age range considered suboptimal (> 45 years) (Figure 5). The percentage of transplant surgeries performed with grafts from female donors to male recipients was somewhat lower in 2016 (24.1%) than in 2015 (26.4%). Furthermore, there was an increase in donors who died due to stroke and a decrease in those who died due to trauma (Figure 6).

The ischemia time has risen throughout the total recorded series. As in the previous decade, more than one-quarter of the patients underwent transplant with an ischemia time greater than 240 minutes in 2016 (Table 4 and Figure 7).

Immunosuppression

In 2016, 82.4% of recipients received some type of induction immunosuppressive therapy, mainly basiliximab

(78.4%) (Figure 8), confirming a trend described in previous reports and observed since 2009.

A summary of the immunosuppressive drugs used initially and at completion of follow-up in the total recorded series is provided in Figure 9. At a mean follow-up of 7.3 years, 63.7% of patients continued receiving corticosteroid therapy, and at the last follow-up, 30% of patients were under treatment with mTOR inhibitors (everolimus or sirolimus).

In 2016, the initial immunosuppressive regimen mainly consisted of tacrolimus (91.1%) as a calcineurin inhibitor, mycophenolate mofetil or mycophenolic acid (97.0%) as an antiproliferative agent, and steroids (98.9%). Yearly changes in the use of calcineurin inhibitors and antimitotic agents for initial immunosuppression are shown in Figure 10 and Figure 11, respectively, whereas changes in the use of mTOR inhibitors (sirolimus, everolimus) are shown in Figure 12.

Survival

With the latest update on 31 December 2016, actuarial survival in the total recorded series at 1, 5, 10, 15, and 20 years is

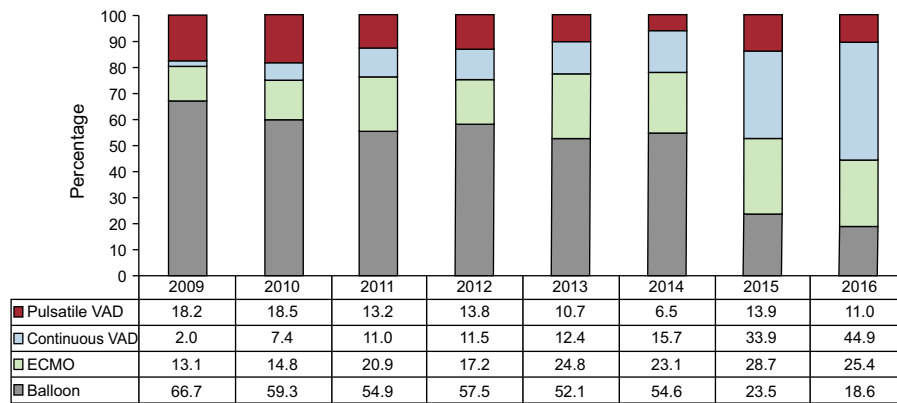


Figure 4. Type of pretransplant circulatory support used by year (2009–2016). ECMO, extracorporeal membrane oxygenation; VAD, ventricular assist device.

Table 4

Donor Characteristics and Ischemia Time in the Spanish Heart Transplant Registry (1984–2016)

	1984–1993 (n = 1230)	1994–2003 (n = 3148)	2004–2013 (n = 2633)	2014–2016 (n = 846)	P (trend)	2016 (n = 281)
Age, y	26.5 ± 10.3	31.3 ± 12.9	36.7 ± 14.4	43.3 ± 14.7	< .001	43.5 ± 15.4
Age > 45 y, %	7.6	19.3	35.6	56.1	< .001	57.3
Males	78.4	70.9	66.1	59.3	< .001	58.0
Female donor–male recipient	17.8	20.9	21.1	24.7	.003	24.1
Weight, kg	69.4 ± 13.4	70.1 ± 16.1	72.5 ± 17.7	74.4 ± 18.3	< .001	74.7 ± 19.0
Recipient/donor weight	0.99 ± 0.2	1.0 ± 0.3	0.96 ± 0.3	0.97 ± 0.7	< .001	0.96 ± 0.8
Recipient/donor weight > 1.20	13.3	15.8	11.1	7.3	< .001	6.7
Recipient/donor weight < 0.8	13.8	14.7	19.5	21.7	< .001	25.2
Pretransplant cardiac arrest ^a	3.0	7.2	10.1	18.4	< .001	15.4
Predonation echocardiography ^b					< .001	
Not done	52.5	21.0	5.3	1.0		0.9
Normal	47.1	77.7	92.2	96.3		96.4
Mild generalized dysfunction	0.3	1.2	2.5	2.7		2.7
Ischemia time, min	160.8 ± 61.4	184.8 ± 61.7	206.4 ± 63.3	197.7 ± 72.3	< .001	199.0 ± 71.0
≤ 120 min	27.0	18.0	11.2	16.4		19.2
120–180 min	36.2	28.3	22.2	22.6		22.3
180–240 min	28.1	36.7	39.0	34.1	< .001	29.8
> 240 min	8.7	17.1	27.6	26.9		28.7

Data are expressed as the percentage or the mean ± standard deviation.

^a Of 4268 transplant procedures.

^b Of 6585 transplant procedures.

depicted in Figure 13. The findings indicate a mean yearly mortality rate of around 2% to 3% after the first year after transplant, with a median survival of 11.2 years. The 1-year conditional survival curve is shown in Figure 14. The conditional median survival after the first posttransplant year was 15.1 years. As shown in Table 5, there were significant differences in recipient age, donor age, type of procedure (single transplant, combined transplant, and retransplant), the urgency code for transplant, and the type of circulatory support at the time of transplant (no support, balloon pump, extracorporeal membrane oxygenation [ECMO], ventricular assist device), similar to the findings from the previous year. Of particular note, survival rates were comparable in patients undergoing elective transplant and those undergoing transplant with balloon pumps or ventricular assist devices. Survival was significantly lower in transplant procedures performed in patients with previous ECMO than in those with no devices.

Survival rates have shown a steady increase throughout the total recorded series (Figure 15). Significant differences were found for the decade from 1984 to 1993 relative to later decades and for the period from 2014 to 2016. Compared with the first decade, the superior survival in later years was mainly attributable to increased survival in the first year after transplant. Nonetheless, starting from the decade from 2004 to 2013, survival rates after the second posttransplant year also showed an improvement. In the most recent period (2014–2016), a trend to greater early and longer-term survival was detected, although statistical significance was not reached because of the relatively small available sample size.

Causes of Death

In the total series, the most common cause of death was graft vascular disease/cardiac arrest (20.3%), followed by infection

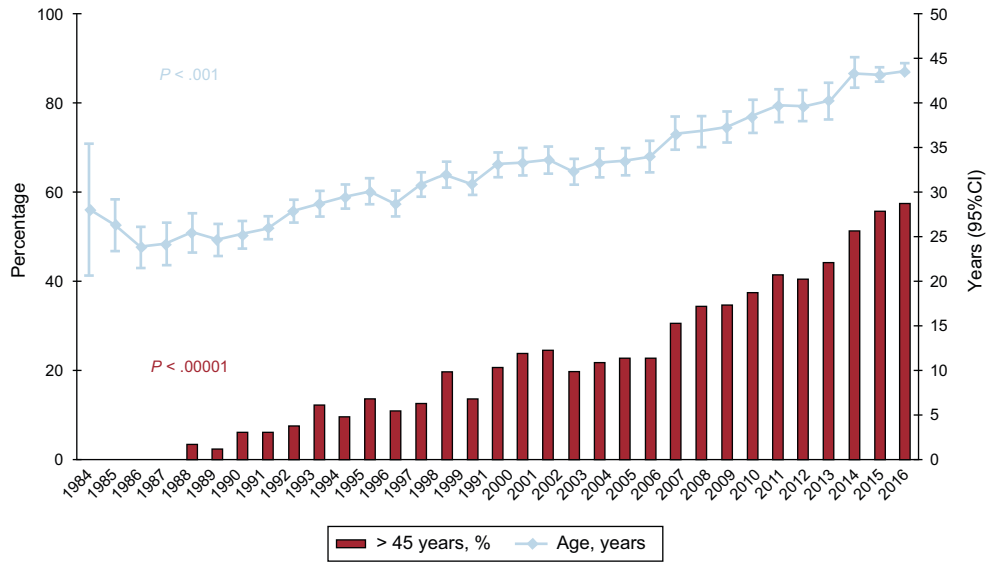


Figure 5. Yearly changes in donor age and percentage of donors older than 45 years (1984-2016). 95%CI, 95% confidence interval.

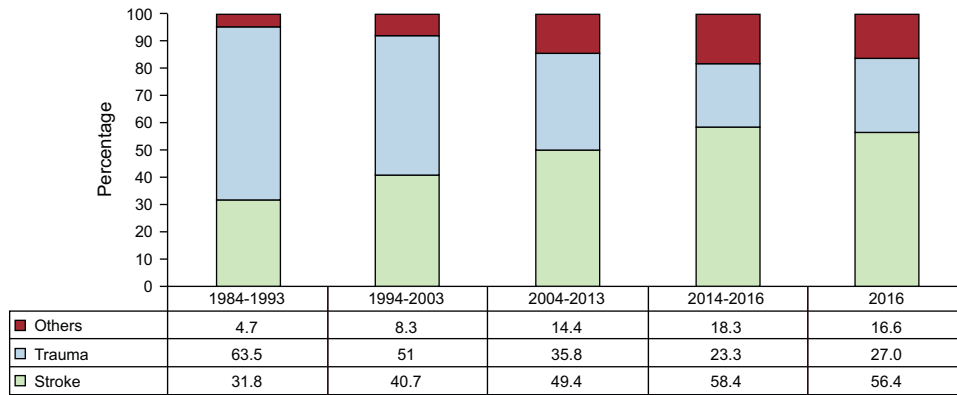


Figure 6. Causes of death in heart donors, by time period.

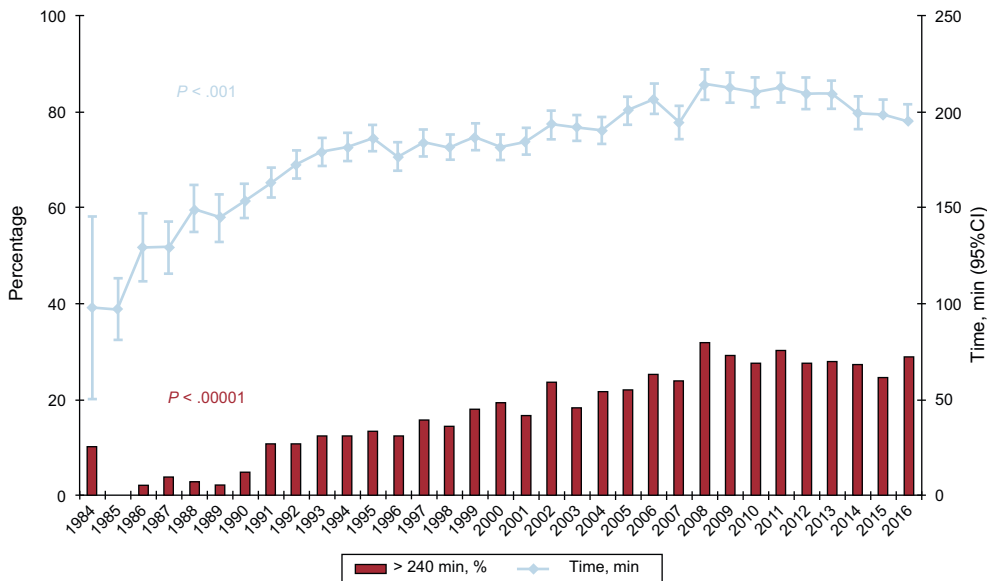


Figure 7. Yearly changes in ischemia time and percentage of procedures with ischemia time > 240 minutes (1984-2016). 95%CI; 95% confidence interval.

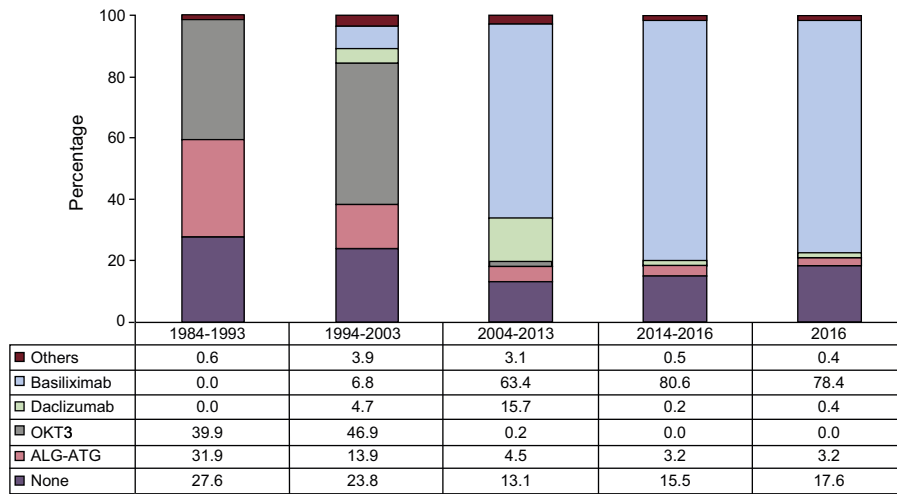


Figure 8. Drugs used for induction immunosuppression. ALG, antilymphocyte globulin; ATG, antithymocyte globulin.

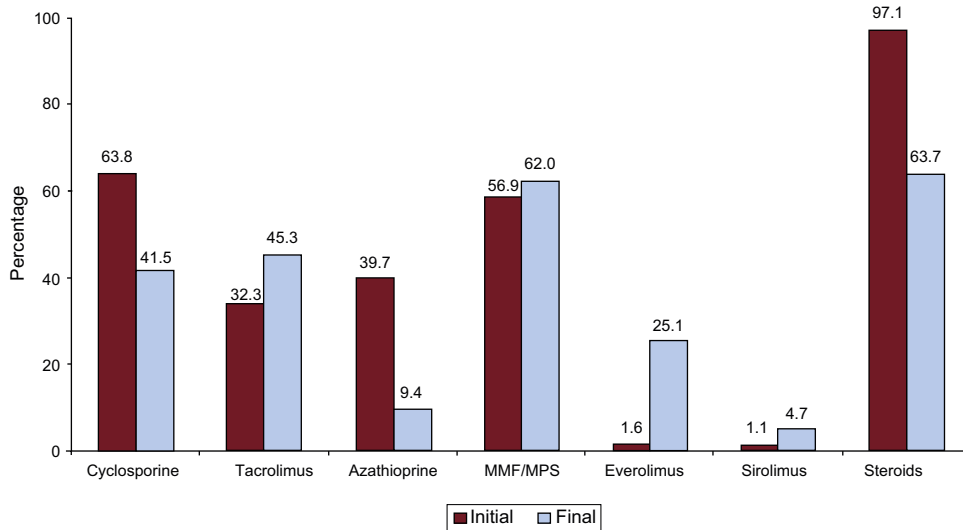


Figure 9. Initial and maintenance immunosuppression in the total series (1984-2015). Changes according to the type of drug at the start of transplant and at completion of follow-up. MMF, mycophenolate mofetil; MPS, mycophenolate sodium.

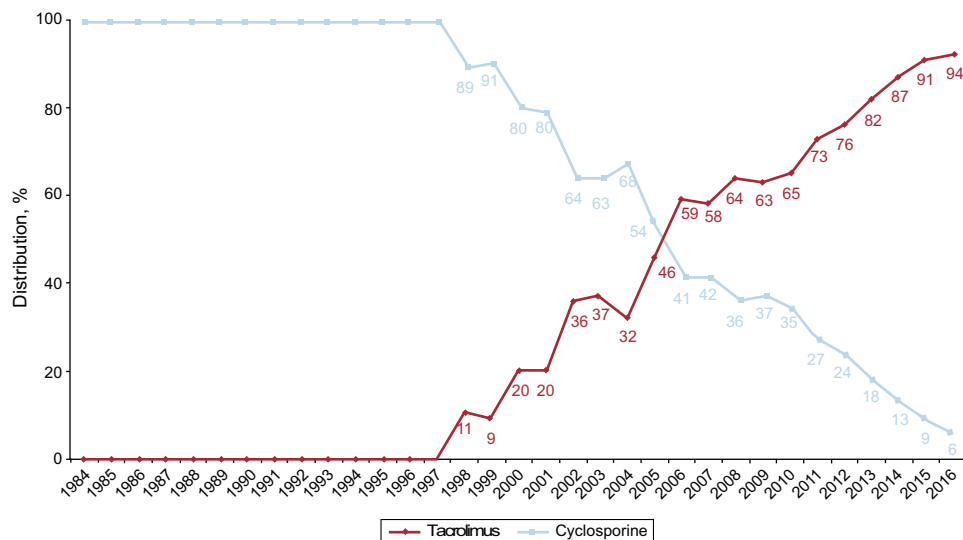


Figure 10. Yearly changes in the use of calcineurin inhibitors (cyclosporine and tacrolimus) for initial immunosuppression in the total sample (1984-2016).

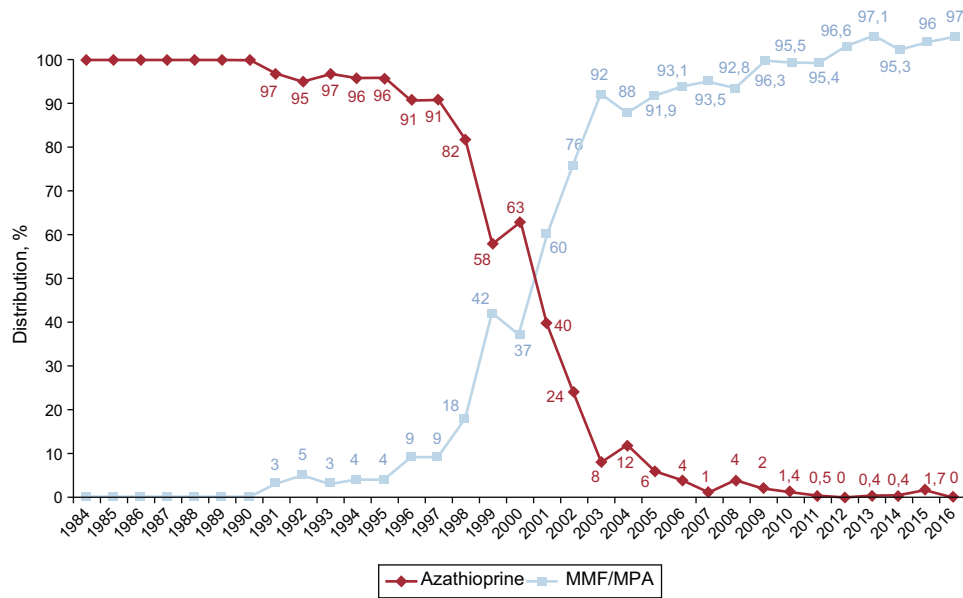


Figure 11. Yearly changes in the use of antimitotic drugs (azathioprine and mycophenolate mofetil/mycophenolic acid) for initial immunosuppression in the total series (1984–2016). MMF, mycophenolate mofetil, MPA, mycophenolic acid.

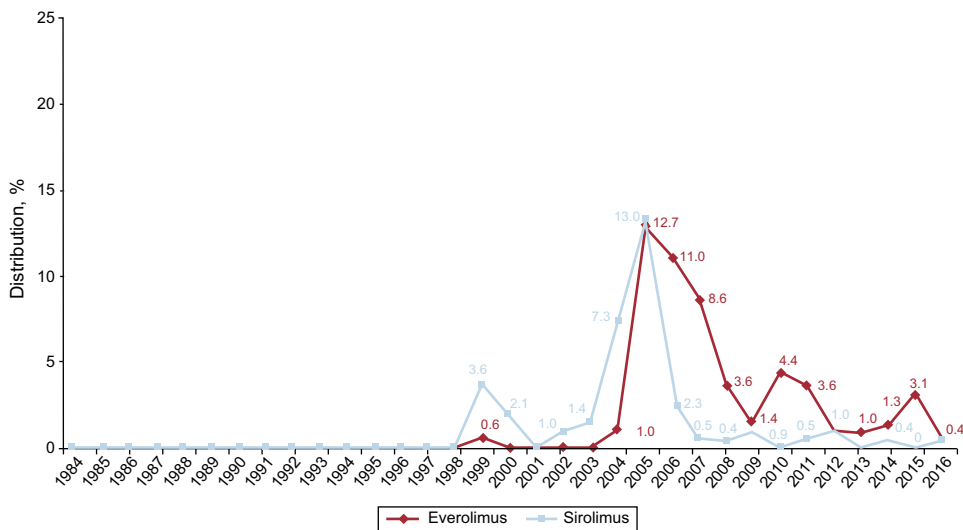


Figure 12. Yearly changes in the use of mTor inhibitors (sirolimus and everolimus) for initial immunosuppression in the total series (1984–2016). Unlabeled points have a value of 0.

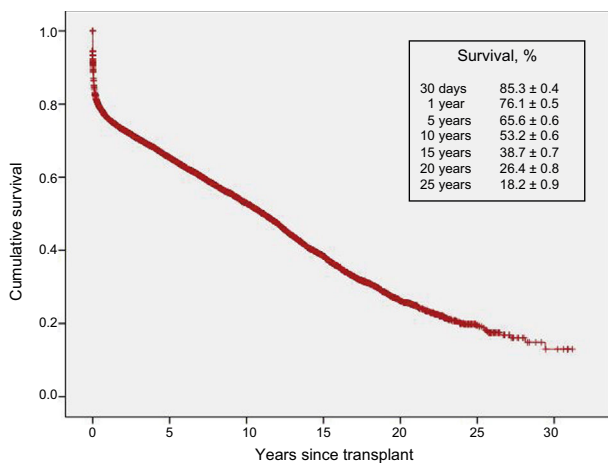


Figure 13. Survival curve for the total series (1984–2016).

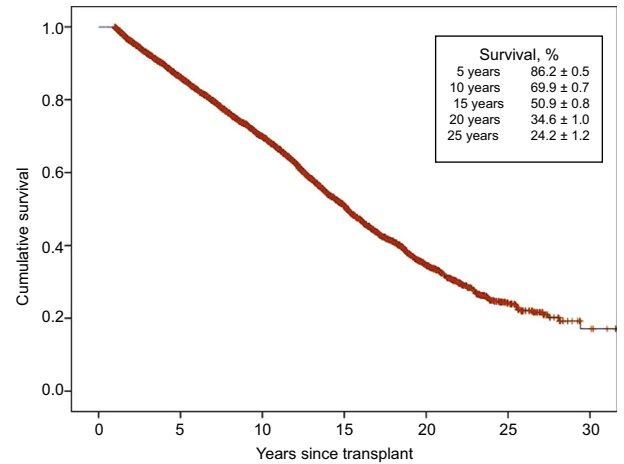


Figure 14. One-year conditional survival curve in the total series (1984–2016).

Table 5
Univariate Survival Analysis by Baseline Characteristics of the Recipient, Donor, and Procedure (1984-2016)

	HR (95%CI)	P	Survival, y, median (95%CI)
<i>Recipient age</i>			
< 16 years	1		18.7 (14.1-23.3)
16-60 years	1.3 (1.1-1.5)	.002	11.8 (11.2-12.3)
> 60 years	1.6 (1.4-1.9)	< .001	8.7 (7.9-9.5)
<i>Type of transplant</i>			
Single transplant	1		11.4 (11.0-11.9)
Combined transplant	1.3 (1.0-1.6)	.02	7.2 (3.9-10.6)
Retransplant	1.8 (1.5-2.1)	< .001	3.7 (1.0-6.5)
<i>Donor age</i>			
≤ 45 years	1		11.7 (11.2-12.2)
> 45 years	1.2 (1.1-1.3)	< .001	9.3 (8.4-10.1)
<i>Urgency code</i>			
Elective	1		11.6 (11.1-12.0)
Urgent	1.1 (1.1-1.2)	< .001	10.3 (9.1-11.5)
<i>Type of support*</i>			
No support	1		–
Balloon pump	1.1 (0.9-1.3)	.42	–
ECMO	1.5 (1.2-2.0)	.001	–
Ventricular assist device	0.9 (0.7-1.2)	.72	–

95%CI, 95% confidence interval, ECMO, extracorporeal membrane oxygenation; HR, hazard ratio.

* Patients undergoing transplant between 2009 and 2016.

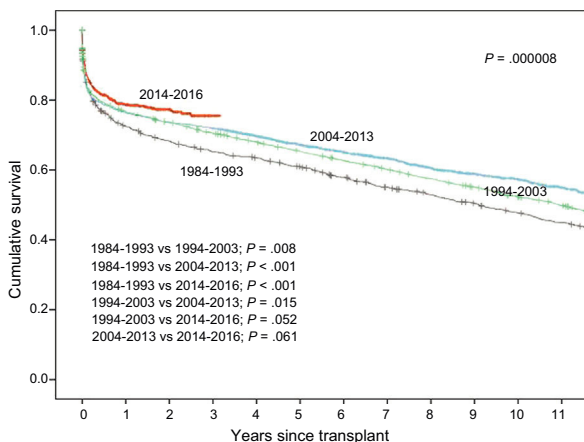


Figure 15. Survival curves in the total series by transplant period (10-year intervals from 1984 to 2013, and the 2014-2016 period).

(17.0%), neoplasm (13.5%), and primary graft failure (13.3%) (Figure 16). The causes of death varied according to the time considered following transplant (Figure 16). In the first post-transplant month, nearly half the deaths were due to primary graft failure. From the first month to the end of the first year, the main causes of death were acute rejection (15.1%) and particularly infections (36.8%). After the first year, the main causes were the various manifestations of graft vascular disease (29.9%) and tumors (22.5%). The main causes of death at 1 year have changed significantly over time, with a drop in cardiac arrests due to acute rejection and a rise in deaths caused by primary graft failure, although this latter event showed a decrease in the period from 2014 to 2016 (Figure 17). Analysis of mortality occurring between the first and fifth year following transplant showed a significant decrease in deaths caused by graft vascular disease/cardiac arrest and a significant increase in deaths due to acute rejection (Figure 18).

DISCUSSION

The data compiled up to 2016 on heart transplant in Spain confirm the trends observed in previous years regarding the procedural characteristics and survival results. The period from 2014 to 2016 has shown a strong trend to improved survival relative to the previous decade, although the results have not reached statistical significance because of the relatively small sample size of this period. The improvement is evident in both short- and mid-term survival rates. In the first year after transplant, mortality caused by acute rejection has been controlled and there is a strong trend toward control of mortality due to primary graft failure. Beyond the first year, and awaiting data from expanded follow-up in the coming years, there is already evidence of better control of mortality due to graft vascular disease and cardiac arrest (the latter considered a manifestation of graft vascular disease in the immediate posttransplant period in most cases). In absolute numbers, deaths due to acute rejection far exceed those resulting from these 2 causes during this period.

In procedures as complex as heart transplant, improvements in outcome can hardly be attributed to a single cause. It is true that in general terms there is a trend over time to perform transplant surgery in patients in an apparently poorer clinical condition (eg, a larger number of urgent procedures, patients intubated and having undergone previous surgeries, pretransplant infections, and pretransplant circulatory support devices). However, the expanded use of continuous-flow ventricular assist devices before transplant and the subsequent decrease in ECMO use has led to patients having a more satisfactory pretransplant clinical status, including, for example, better renal function. The availability of circulatory support in the immediate postoperative period is undoubtedly a contributing factor to the decrease in deaths due to primary graft failure, a complication that is typically reversible in a few hours or days if the patient can be kept alive with these devices. After the first year after transplant, successful control of mortality from graft vascular disease likely lies in better knowledge of

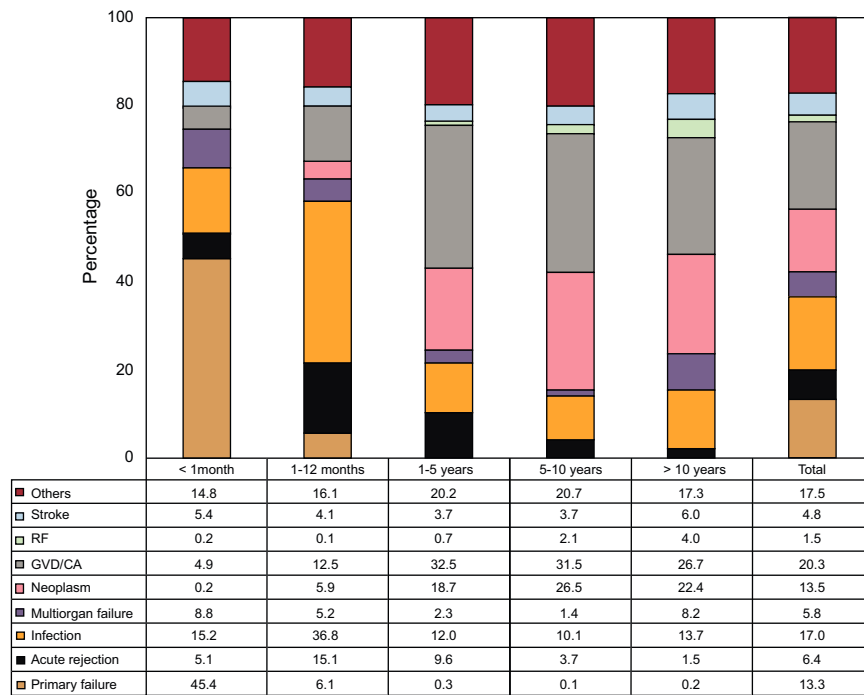


Figure 16. Main causes of death in the total series and by time since transplant (1984-2016). CA, cardiac arrest; GVD, graft vascular disease; RF, renal failure.

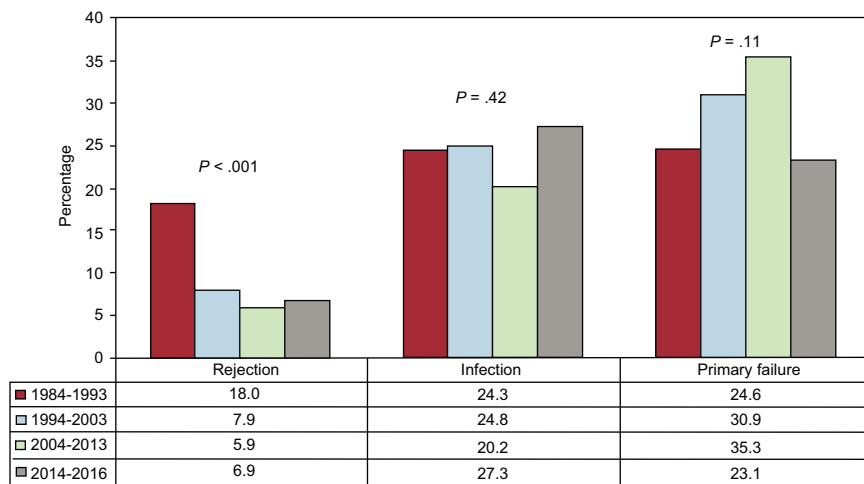


Figure 17. Main causes of death occurring in the first year after transplant in the total series (1984-2016).

pathophysiological factors, the treatment used (eg, lipid-lowering, antihypertensive, and antiplatelet therapies, and control of early rejection and cytomegalovirus infection), and the availability of immunosuppressive agents with recognized antiproliferative activity (eg, mTOR inhibitors, which are being widely used according to the available data).

Of particular note, these favorable results are being obtained despite the acceptance of donors until recently considered only marginally suitable. The expanded accepted age of donors is especially striking, and for the time being, this factor does not seem to affect mid-term survival in a quantitatively relevant manner.

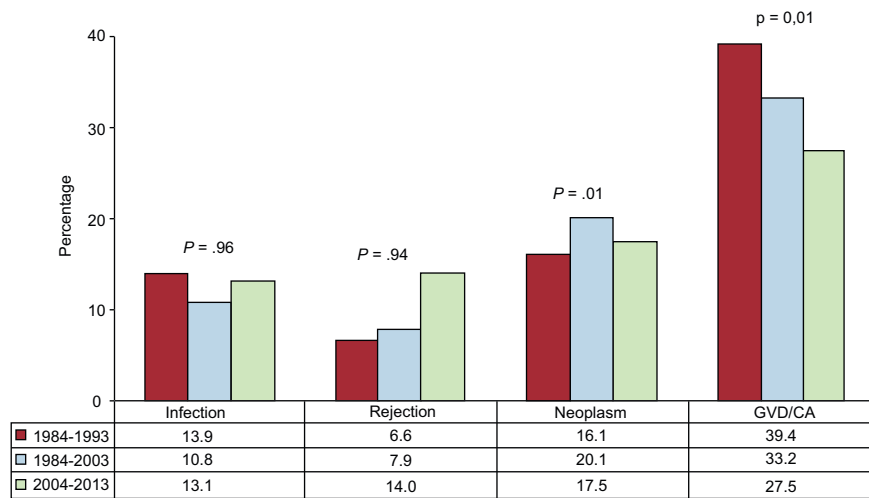


Figure 18. Main causes of death occurring between the first and fifth years after transplant in the total series (1984-2013). CA, cardiac arrest; GVD, graft vascular disease.

CONCLUSIONS

This 2016 RETC update does not show substantial differences with respect to reports from the immediately preceding years regarding the number of transplant surgeries performed or the characteristics of the donors, recipients, and procedures. The survival results continue to show a gradual improvement in transplant procedures performed in the most recent years.

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CONFLICTS OF INTEREST

None declared.

APPENDIX. COLLABORATORS IN THE SPANISH HEART TRANSPLANT REGISTRY, 1984-2016

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Hospital Universitario Reina Sofía, Córdoba	Amador López-Granados, Carmen Segura-Saintgerons, Dolores Mesa, Martín Ruiz, Elías Romo, Francisco Carrasco, José López Aguilera
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Hospital Gregorio Marañón (adults), Madrid	Paula Navas, Eduardo Zatarain, María Jesús Valero, Juan Fernández Yáñez, Adolfo Villa, Manuel Martínez-Sellés
Hospital Universitario 12 de Octubre, Madrid	María Dolores García-Cosío, Laura Morán-Fernández, Carlos Ortiz-Bautista, Enrique Pérez-de la Sota
Hospital de la Santa Creu i Sant Pau, Barcelona	Sònia Mirabet, Eulàlia Roig y Laura López
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Clínica Universitaria de Navarra, Pamplona	Gregorio Rábago-Aracil
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Hospital Universitario Central de Asturias, Oviedo	José Luis Lambert, Beatriz Díaz-Molina, María José Bernardo-Rodríguez
Hospital Universitario Gregorio Marañón (infantile), Madrid	Manuela Camino, Constancio Medrano
Hospital Universitario Virgen de la Arrixaca, El Palmar, Murcia	Iris Garrido-Bravo, Domingo Pascual-Figal, Francisco Pastor-Pérez
Hospital Universitario Miguel Servet, Zaragoza	Teresa Blasco-Peiró, Ana Portoles-Ocampo, Marisa Sanz-Julve, Carmen Aured-Guallar
Hospital Clínic Universitario, Valladolid	Luis de La Fuente-Galán, Luis Varela-Falcón, Ana María Correa-Fernández
Hospital Universitario La Paz, Madrid	Luis García-Guereta, Carlos Labrandero-de Lera, Viviana Arreo-del Val, Álvaro González-Rocafort, Luz Polo López
Hospital Universitario Vall d'Hebron, Barcelona	Dimpna C. Albert-Brotos, Ferrán Gran-Ipiña, Raúl Abella

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