

## Spanish Registry on Heart Transplantation. 13th Official Report of the Working Group on Heart Transplantation of the Spanish Society of Cardiology (Years 1984-2001)

Luis Almenar Bonet, on behalf of the Spanish Heart Transplantation Groups

Sección de Trasplante Cardíaco de la Sociedad Española de Cardiología. Madrid. España.

This report describes the general characteristics and results of heart transplantation in Spain after including the data from 2001. In that year 341 heart transplantations were performed. Since 1984, a total of 3,786 procedures have been performed.

The average clinical profile of the patient receiving a heart transplant in Spain is a male about 50 years-old, blood group A, with a non-revascularizable coronary artery disease and IV/IV functional condition (NYHA).

The percentage of emergency heart transplantations performed in 2001 was 19%, slightly lower than 20% to 25% in earlier years. The average early mortality rate in the last 10 years is 15%.

After adding the 2001 results to those of previous years, a slight increase can be seen in the survival rate. The probability of survival in the first, fifth and tenth years was 76%, 63%, and 50%, respectively. The most frequent cause of death is acute graft failure in the first month, infection and rejection in the first year, and tumors and the combination of vascular disease of the graft with sudden death in the long term.

Comparative analysis of survival rates shows that our long-term results are slightly better than those published in literature. However, we face a real challenge in our efforts to improve the early results of transplantation.

**Key words:** *Transplantation. Registry. Survival.*

Full English text available at: [www.revespcardiol.org](http://www.revespcardiol.org)

### INTRODUCTION

As is the practice of the Working Group on Heart Transplantation of the Sociedad Española de Cardiología, the analysis of the results of transplantation activity carried out in Spain has been

Correspondence: Dr. L. Almenar Bonet.  
Avda. Primado Reig, 189-37. 46020 Valencia. España.  
E-mail: Lu.almenarb5@comv.es

### Registro Español de Trasplante Cardíaco. XIII Informe Oficial de la Sección de Trasplante Cardíaco de la Sociedad Española de Cardiología (Años 1984-2001)

En este artículo se describen las características generales y los resultados obtenidos con el trasplante cardíaco en España tras incluir los datos del año 2001. El año pasado se realizaron 341 trasplantes que, junto con los llevados a cabo desde 1984, hacen un total de 3.786.

El perfil clínico medio del paciente que se trasplanta en España corresponde a un varón de aproximadamente 50 años, grupo sanguíneo A, enfermedad coronaria no revascularizable y clase funcional IV/IV (NYHA).

El porcentaje de trasplantes cardíacos urgentes fue del 19%; esta cifra es ligeramente inferior a la de los últimos años, que estaba situada entre el 20 y el 25%. La mortalidad precoz media de los últimos 10 años es del 15%.

Al incorporar los resultados del pasado año a los previos se aprecia un ligero incremento de la supervivencia. De modo que la probabilidad de supervivencia al primer, quinto y décimo años es del 76, el 63 y el 50%, respectivamente. La causa más frecuente de fallecimiento en el primer mes es el fallo agudo del injerto; en el primer año, la infección y el rechazo, y a largo plazo, los tumores y el combinado de enfermedad vascular del injerto y muerte súbita.

El análisis comparativo de la supervivencia evidencia que los resultados a largo plazo son ligeramente superiores a los publicados en la bibliografía mundial. Sin embargo, tenemos el gran reto de intentar mejorar la supervivencia en la etapa temprana del trasplante.

**Palabras clave:** *Trasplante. Registro. Supervivencia.*

presented. This analysis covers the time period from the first use of this therapeutic modality in May 1984 until 31 December of the year before publication.<sup>1-12</sup>

This registry includes all the transplantations carried out by all the groups at every center. For that reason, it faithfully reflects the true situation of this technique in Spain. Its reliability is enhanced by the fact that all the transplantation groups use a similar database that was developed by consensus. This makes the possibilities of response more uniform, and the variables more homogeneous.

**TABLE 1. Spanish Registry of Heart Transplantation, 1984-2001. Participating centers**

1. Hospital de la Santa Creu i Sant Pau, Barcelona
2. Clínica Universitaria de Navarra, Pamplona
3. Clínica Puerta de Hierro, Madrid
4. Hospital Marqués de Valdecilla, Santander
5. Hospital Reina Sofía, Córdoba
6. Hospital La Fe, Valencia
7. Hospital Gregorio Marañón, Madrid
8. Fundación Jiménez Díaz, Madrid
9. Hospital Virgen del Rocío, Sevilla
10. Hospital 12 de Octubre, Madrid
11. Hospital Juan Canalejo, La Coruña
12. Hospital de Bellvitge, Barcelona
13. Hospital La Paz, Madrid
14. Hospital Central de Asturias
15. Hospital Clínic, Barcelona
16. Hospital Virgen de la Arrixaca, Murcia
17. Hospital Miguel Servet, Zaragoza
18. Hospital Clínico, Valladolid

**TABLE 2. Spanish Registry of Heart Transplantation, 1984-2001. Type of procedure**

Procedure	Number
Orthotopic heart transplantations	3640
Heterotopic heart transplantations	6
Heart re-transplantations	75
Combined transplantations	
Heart-lung	33
Heart-kidney	28
Heart-liver	4
Total	3786

**ACTIVITIES**

Currently, 18 centers participate in the registry

(Table 1), although only 17 centers had transplantation activity in 2001. In the past year, the number of transplantation centers in Spain again increased. This point will be discussed below, when the benefits of reducing the distance that patients have to travel are weighed against the drawback that new centers take longer to acquire sufficient experience.

In 18 years of activity, a total of 3786 transplantations have been made. The distribution of the number of transplantations per year is shown in Figure 1. Ninety-six percent were isolated orthotopic transplantations. The distribution of transplantations according to the type of procedure is shown in Table 2.

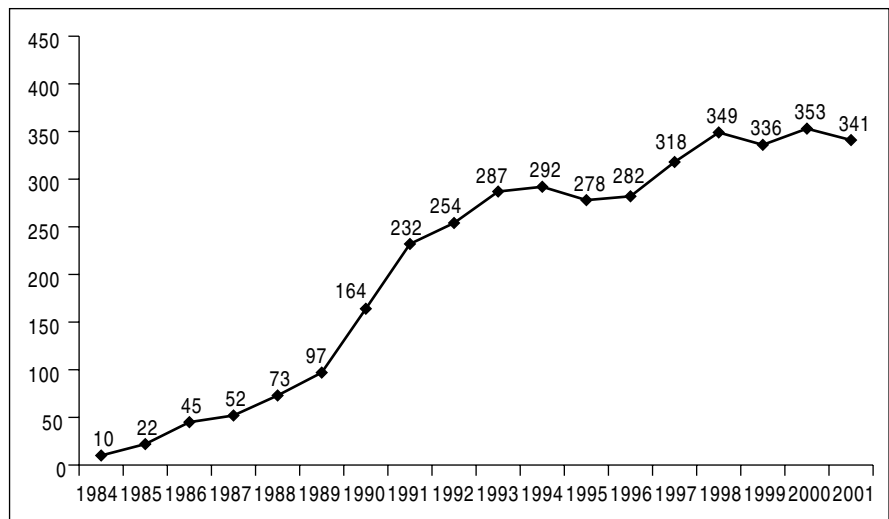
**PROFILE OF THE TRANSPLANTED PATIENT AND UNDERLYING HEART DISEASE**

In Spain, the mean profile of the patient undergoing transplantation is a man about 50 years old, blood group A. The percentage of pediatric, elderly, or female patients transplanted is small. The general characteristics of patients who undergo transplantation in Spain are summarized in Figure 2.

The heart disease that most frequently motivates transplantation is ischemic heart disease, followed by dilated idiopathic cardiomyopathy. These two are responsible for 74% of all transplantations. The rest are infrequent, except cardiac valve diseases, which motivate 11% of transplantations. The distribution of the pathological processes treated by transplantation is shown in Figures 3 and 4.

**WAITING LIST MORTALITY AND EMERGENCY TRANSPLANTATIONS**

In 2001, the waiting list mortality was slightly lower than 10%. The percentage of patients excluded after



**Fig. 1.** Number of transplantations per year.

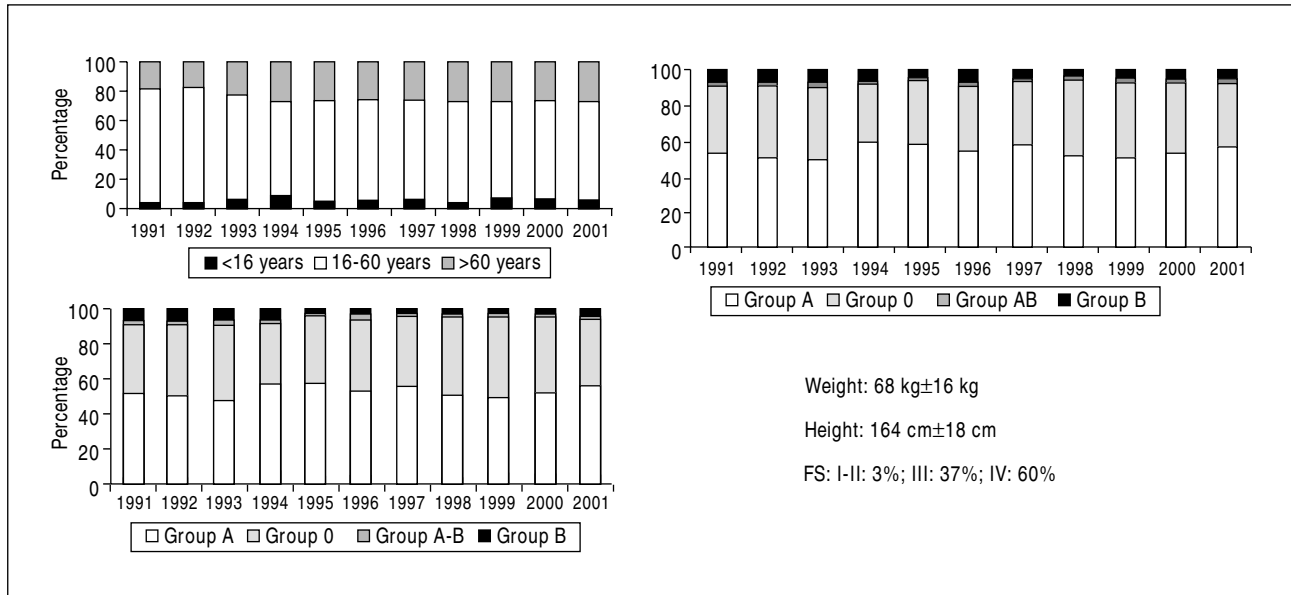


Fig. 2. Annual distribution by age, blood group, and sex. Weight, height, and functional situation of receptors.

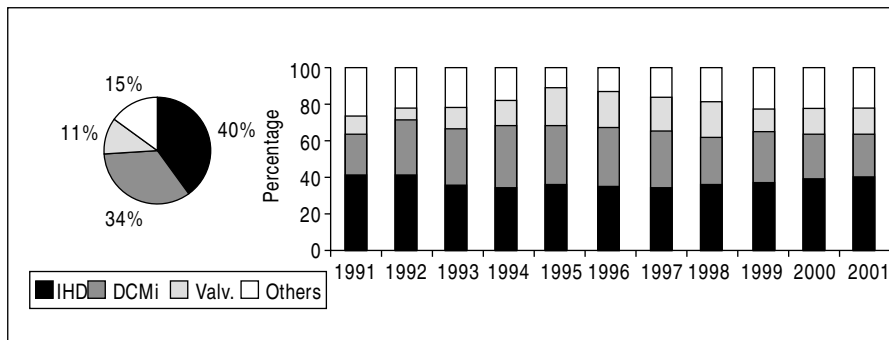


Fig. 3. Underlying disease that motivates transplantation and its annual distribution. IHD indicates ischemic heart disease; DCMi, idiopathic dilated cardiomyopathy; valv., cardiac valve

being placed on the list was 18%. In Figure 5 are shown the annual rates of patients included on the waiting list who finally underwent transplantation, were excluded from the list, or died before undergoing transplantation, respectively.

The frequency with which emergency transplantation was indicated has varied, sometimes widely, from one year to another. On many occasions there is often no clear explanation for this finding. The percentage of emergency transplantations performed last year was 19%. This figure is consistent with the percentage of unscheduled transplantations performed in recent years. Figure 6 shows how the indication for transplantations coded «extremely urgent» has evolved over the years.

## RESULTS

### Survival

The early mortality (first 30 days after

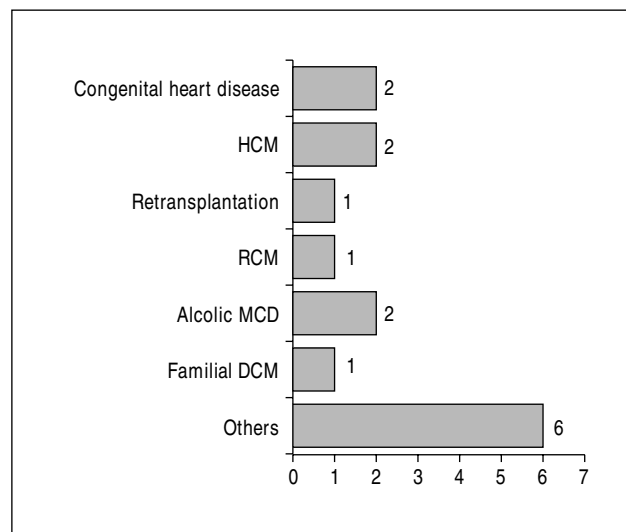


Fig. 4. Infrequent pathologies that motivate transplantation. The number after each bar indicates the percentage of the total. HCM indicates hypertrophic cardiomyopathy; RCM, restrictive cardiomyopathy; DCM, dilated cardiomyopathy.

transplantation) was 14% in 2001. The evolution of the early mortality over the years is shown in Figure 7.

When the survival data of 2001 was added to that of previous years, the actuarial probability of survival for the first, fifth, and tenth years was 76%, 63%, and 50%, with a half-life of 10 years. The actuarial curve of survival is shown in Figure 8. In the first year there was an abrupt initial decrease (mainly at the expense of the first month), followed by a smaller slope of approximately 3% for the year.

**Causes of death**

The most frequent cause of death in the early stage was acute graft failure, 35%. Figures 9 and 10 show the distribution of causes of death in the first month.

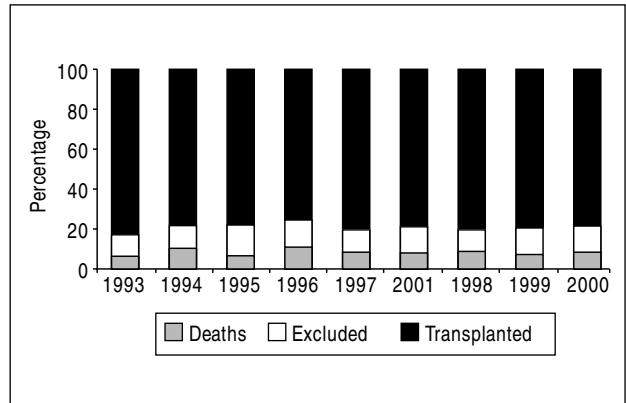


Fig. 5. Annual distribution of the percentage of patients on the waiting list who are transplanted, die, or are excluded.

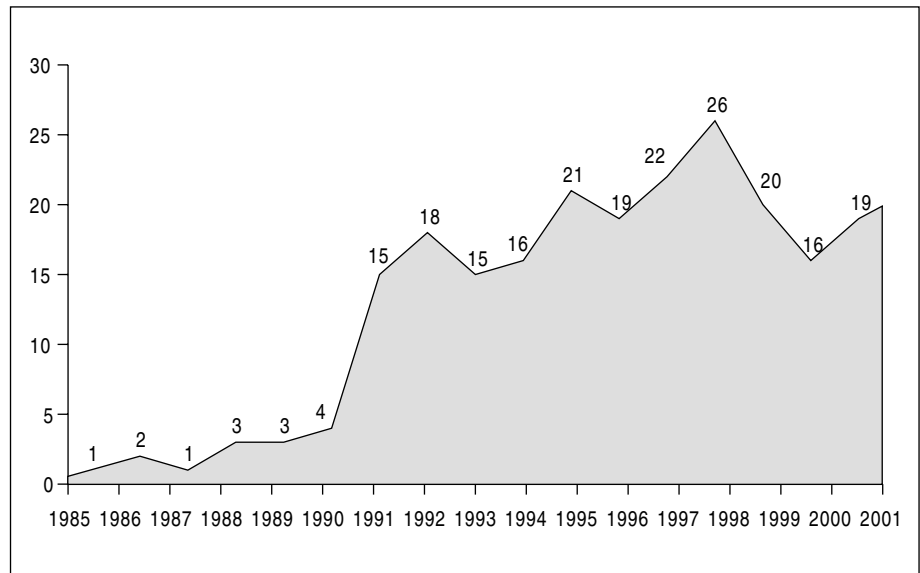


Fig. 6. Annual evolution of the indication for emergency transplantation, in percentages.

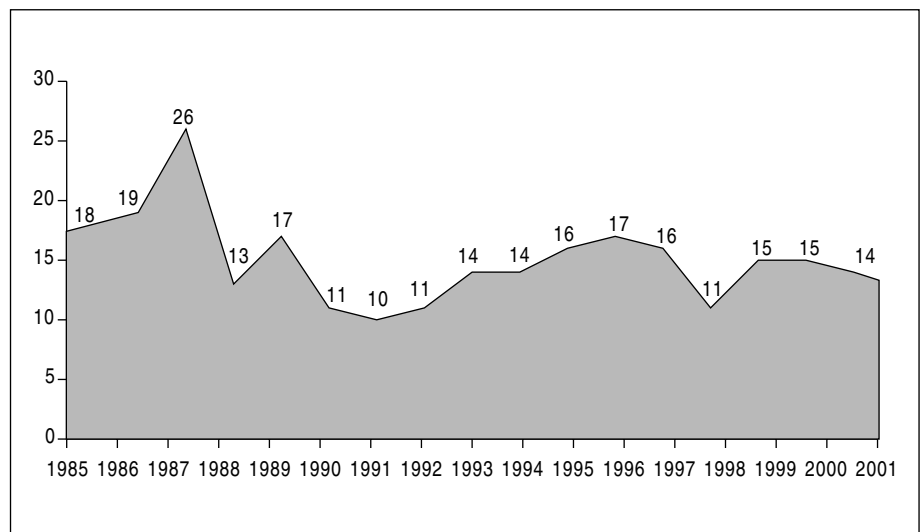
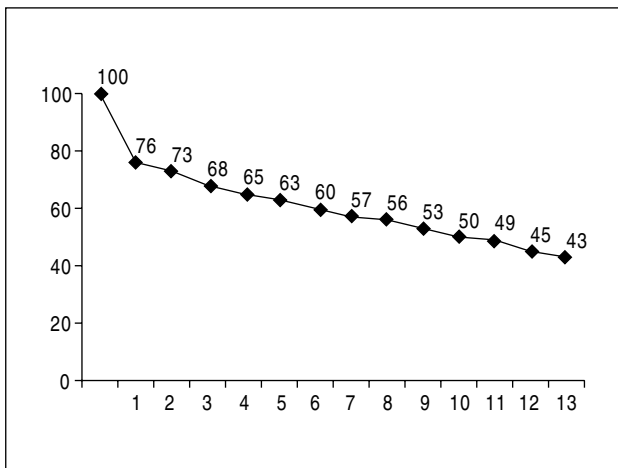


Fig. 7. Annual evolution of early mortality, in percentages.



**Fig. 8.** Actuarial survival curve (Kaplan-Meier). Horizontal axis: Years since transplantation.

In relation to overall mortality, the most common causes of death were infection and acute graft failure, both 18%. The incidences of different causes of overall mortality is shown in Figures 11 and 12.

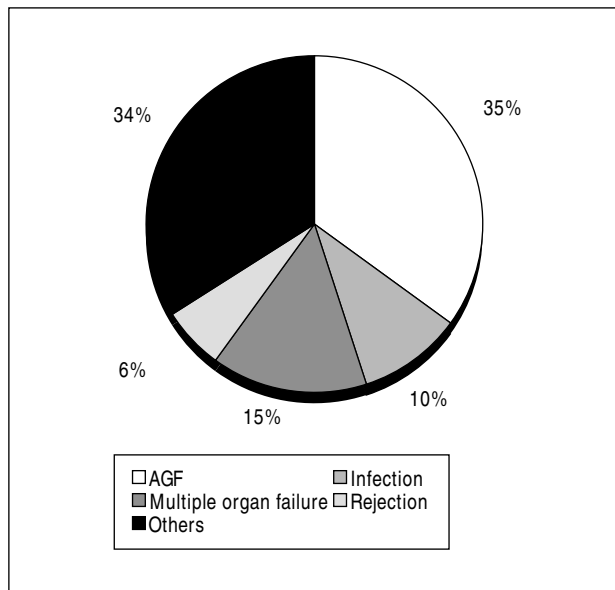
The distribution of causes of mortality by periods shows that the cause of mortality varied in the first month (acute graft failure), from the first month to the end of the first year (infections), and from the first year on (tumors and the combination of sudden death and vascular graft disease). The distribution of causes of mortality by periods are shown in Figure 13.

**DISCUSSION**

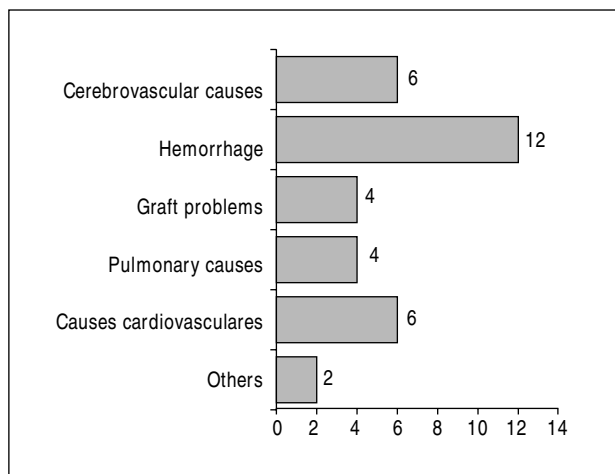
In Spain, the initial phases of heart transplantation are a distant memory and a great deal of experience has been acquired with this procedure. Our results are similar to those of other European and North American countries. This is evident from an analysis of the annual publication of the Registry of the International Society for Heart and Lung Transplantation.<sup>13,14</sup> We would like to emphasize that one of the advantages of our registry is a homogeneous database of all the possibilities of response that was developed by consensus among all the transplantation groups. Every year, all the groups update their data and send it to the person in charge of the registry. Using a custom computer program designed for this purpose, the data is entered in a common database for statistical analysis of the variables.

We feel that this method makes the results highly reliable and eliminates the sort of «senseless» information that often appears in less standardized databases.

In the past year, the number of centers that carry out transplantation activities has increased, as has occurred regularly in recent years. This continues to



**Fig. 9.** Causes of early mortality. AGF indicates acute graft failure.



**Fig. 10.** Infrequent causes of early mortality. The number after each bar indicates the percentage of the total.

concern most groups because the number of optimal donors in Spain has remained practically constant, so the number of transplantations/center is decreasing. The performance of a smaller number of transplantations leads to underuse of the resources of hospitals that are prepared to perform a large number of transplantations and also increases the learning period necessary to achieve satisfactory results. The only real benefit for patients is the convenience of not having to go to another geographic area for transplantation.

Ever since this technique was first performed in Spain, this trend has increased practically without pause. Nevertheless, the increase was greatest in the period between 1989 and 1993, when the number of

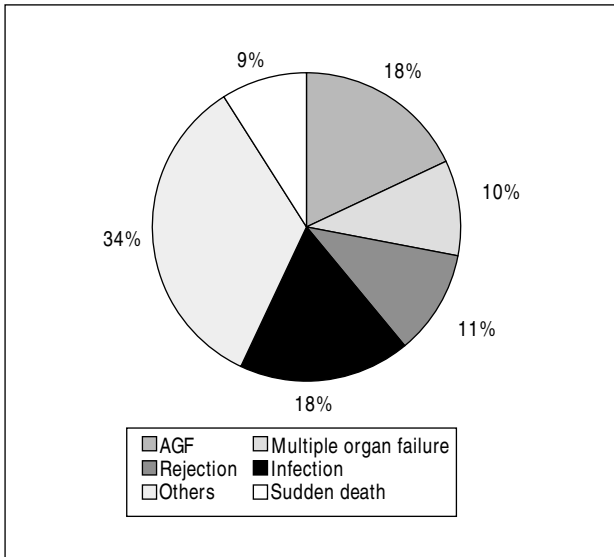


Fig. 11. Causes of overall mortality. AGF indicates acute graft failure.

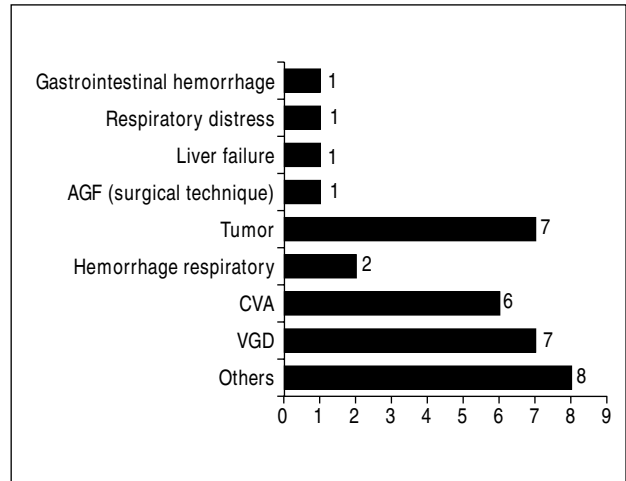


Fig. 12. Less frequent causes of overall mortality. The number after each bar indicates the percentage of the total. CVA indicates cerebrovascular accident; VGD, vascular graft disease; AGF, acute graft failure.

transplantations grew from 97 to 287. As of 1993, the increase has slowed. The year 2000 was the only year in which somewhat more than 350 transplantations were performed. This figure is considered an annual plateau, given the number of foreseeable donors per year and current criteria for evaluating the acceptability of the heart as a donor organ.

The future of cardiopulmonary transplantation is still not fully established. Few groups carry out these procedures and the annual number performed is small. In the past year, only four procedures of this type were done in Spain. In 1998, the maximum number of cardiopulmonary transplantations was carried out, with 7 interventions. Its development is complicated by technical difficulties, the «consumption» of organs, and a substantially less favorable prognosis than separate heart or lung transplantation. Among other types of combined transplantation interventions, the most developed one is cardiorenal. Although the number of procedures continues to be low, its prognosis is clearly better than that of cardiopulmonary transplantation.

For years, the heart disease that has motivated the largest number of transplantation procedures has been ischemic heart disease. This is not surprising, given the prevalence of this disease in Spain. In some international registries, dilated cardiomyopathy is the most frequent cause. There may be some terminological problems when ischemic heart disease with major ventricular dilatation is defined as dilated cardiomyopathy.

Waiting list mortality can be underestimated, since it only includes patients who pass away while on the list. It does not include patients who are removed for severe decompensation with multiple organ failure and

die shortly after being removed from the list. In 2001, there was a small increase in the number of patients who died while on the waiting list (10% in 2001 versus 9% in 2000), whereas the percentage of patients excluded from the waiting list was similar (18% in 2001 and 18% in 2000).

Emergency heart transplantations are controversial, to some extent because they are interventions that by their very nature (receptors in worse clinical condition, donors who are often less suitable, and a more prolonged ischemia time) have a worse prognosis than scheduled transplantations. Last year, the percentage of patients who received this type of transplantation rose again to the usual rate, after a decline in the previous year (19% in 2001 versus 16% in 2000). Although emergency transplantations are riskier,

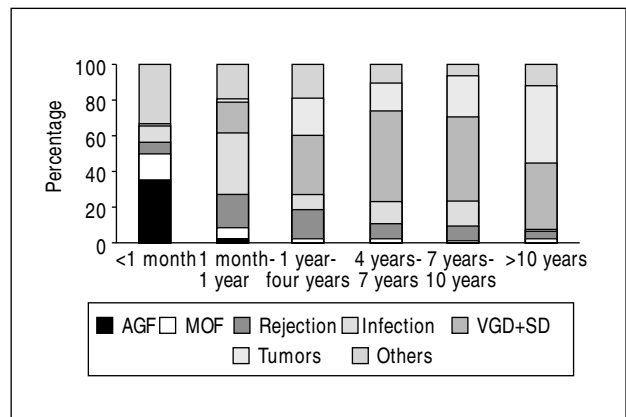


Fig. 13. Causes of mortality by periods. MOF indicates multiple organ failure; SD, sudden death; AGF, acute graft failure; VGD, vascular graft disease.

transplantation groups are of the opinion that they should still be performed because this is the only therapeutic option for the subgroup of patients with advanced heart failure and uncontrollable acute decompensation.

Over the years, overall survival has shown a clear tendency to improve progressively. However, as is logical, the number of patients included in the registry each year is a relatively smaller percentage of the total. Consequently, the likelihood of large changes in any given year is remote.

When this registry is assessed and compared with others, it is important to remember that it includes all the transplantations performed in Spain and faithfully reflects the reality of this procedure in our country. In addition, the analyses are overall and include high-risk transplantations (emergency procedures, receptors of advanced age or children, re-transplantations, heterotopic transplantations, combined heart and lung, kidney, liver transplantations, etc.).

In 2001, there was a slight reduction in the percentage of patients who died early (14% in 2001 versus 15% in 2000), although it is similar to the last 10 years. The most frequent cause of early mortality was acute graft failure. Thirty-five percent of the patients who die early have this syndrome. The impact of this complication is so large that, despite being a postoperative problem, it is responsible for a large percentage of the deaths that occur in any post-transplantation stage (18%). It is interesting to note that mortality due to rejection (early mortality, 6%; overall mortality, 11%) is less frequent than mortality due to infections (early mortality, 10%; overall mortality, 18%). Perhaps transplantation groups should consider the convenience of reducing the total immunosuppressor load, even if the number of episodes of rejection increase.

To conclude:

1. The number of heart transplantations is currently about 350 procedures/year.
2. The future of cardiopulmonary transplantation is

still uncertain.

3. The general survival rates are higher than those of many international registries.

4. We faced the important challenge of reducing the high incidence of acute graft failure, which would have a very positive effect on the probability of early survival.

## ACKNOWLEDGMENTS

We would like to thank the Transplantation Groups for promptly submitting their results, and the Revista Española de Cardiología, for their willingness to publish results quickly.

## REFERENCES

1. Vázquez de Prada JA. Registro Español de Trasplante Cardíaco. Primer Informe Oficial. Rev Esp Cardiol 1991;44:293-6.
2. Vázquez de Prada JA. Registro Español de Trasplante Cardíaco. Segundo Informe Oficial 1991. Rev Esp Cardiol 1992;45:5-8.
3. Arizón JM, Segura J, Anguita M, Vázquez de Prada JA. Registro Español de Trasplante Cardíaco. Tercer Informe Oficial. Rev Esp Cardiol 1992;45:618-21.
4. Arizón del Prado JM. Registro Español de Trasplante Cardíaco. Cuarto Informe Oficial (1984-1992). Rev Esp Cardiol 1993;46: 791-5.
5. Arizón del Prado JM. Registro Español de Trasplante Cardíaco. Quinto Informe Oficial (1984-1993). Rev Esp Cardiol 1994;47: 791-5.
6. Arizón del Prado JM. Registro Español de Trasplante Cardíaco. Sexto Informe Oficial (1984-1994). Rev Esp Cardiol 1995;48: 792-7.
7. Arizón del Prado JM. Registro Español de Trasplante Cardíaco. Séptimo Informe Oficial (1984-1995). Rev Esp Cardiol 1996;49: 781-7.
8. Arizón del Prado JM. Registro Español de Trasplante Cardíaco. VIII Informe Oficial (1984-1996). Rev Esp Cardiol 1997;50:826-32.
9. Almenar Bonet L. Registro Español de Trasplante Cardíaco. IX Informe Oficial (1984-1997). Rev Esp Cardiol 1999;52:152-8.
10. Almenar Bonet L. Registro Español de Trasplante Cardíaco. X Informe Oficial (1984-1998). Rev Esp Cardiol 1999;52:1121-9.
11. Almenar Bonet L. Registro Español de Trasplante Cardíaco. XI Informe Oficial (1984-1999). Rev Esp Cardiol 2000;53:1639-45.
12. Almenar Bonet L. Registro Español de Trasplante Cardíaco. XII Informe Oficial (1984-2000). Rev Esp Cardiol 2001;54:1305-10.
13. Hosenpud JD, Bennett LE, Keck BM, Boucek MM, Novick RJ. The Registry of the International Society for Heart and Lung Transplantation: Eighteenth Official Report-2001. J Heart Lung Transplant 2001;20:805-15.
14. Boucek M, Edwards I, Keck B, Trulock E, Taylor D, Mohacs P, et al. The Registry of the International Society for Heart and Lung Transplantation: Fifth Official Pediatric Report-2001 to 2002. J Heart Lung Transplant 2002;21:827.