

Donation and transplantation report, 2002

Acknowledgements

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Introduction

This report has been written, for the most part, using data retrieved from the registry of donors and patients awaiting an organ transplant. The registry was created according to the SSS/250/2002 Order of 1 July for the regulation of computer files containing data of a personal nature in the setting of the Catalan Health Service. The registry is managed by the Catalan Transplant Organization (OCATT), within the Catalan Health Service.

The data arrive to the Registry through the Organ Sharing Coordination Office, which collates all data from the lists of patients waiting for a hepatic, cardiac, pulmonary or pancreatic organ and processes the offers of organs to transplant or share with other organizations in Spain National Transplant Organization (ONT) and, in the international setting, between Spain and foreign organ sharing organizations.

This report also includes data from the hematopoietic progenitor cell transplant registry and data on tissue graft activity.

Solid Organs

Evolution of donation and transplantation activity in Catalonia

Table 1 shows the data for donation and transplant activity in Catalonia during the year 2002. The data are expressed in the number of cases and the rate per million population (pmp). The reference population used to calculate these rates was the 2002 Catalan resident census update.

Table 1. Donation and transplantation activity in Catalonia, 2002

The changes in these parameters over the last five years are shown in Table 2. Data on donation and transplantation activity are expressed in number of cases and rates per million population. The reference population used to calculate these rates was the yearly update of the Catalan resident census (from 1998 to 2002).

Donation rates have been relatively stable at 55 to 58 potential donors pmp and 36 to 39 confirmed donors pmp. From 10% to 15% of potential donors are excluded because of medical contraindications, 20% to 23% are excluded because of family refusal and less than 2% because of judicial refusal. Figure 1 shows the data on potential donors for the period of 1993 to 2002.

The number of transplants of the different organs has also remained relatively stable over this period. Transplant rates are a measure of activity and they are calculated from the total number of transplants performed, regardless of the origin of the donor and recipient, as related to the population of Catalonia for each year. In Catalonia, 350 to 390 kidney transplants are performed annually, which represents a rate of more than 57 transplants pmp. The number of liver transplants ranges from 190 to 200, and represents a rate of more than 30 transplants pmp. The yearly lung and pancreas transplant activity is lower than that of the other organs; from 30 to 36 lung transplants and some 20 pancreas

transplants are performed, with rates of 5 lung transplants pmp and 3 pancreas transplants pmp.

Table 2. Donation and transplant activity in Catalonia, 1998-2002

Figure 1. Number of potential donors, 1993-2002

Figure 2. Number of confirmed donors and donation rates, 1993-2002

Figure 1 shows the changes in the number of potential donors over the last ten years. A trend to increases in both potential donors and confirmed donors is apparent. The percentage of medical contraindications among the total of potential donors has remained quite stable (12% to 17%) as has the percentage of donation refusals (17% to 22%).

The rate of donations per million population increased from 24.6 in 1993 to 36.0 in 2002. Despite slight fluctuations, there is a clear increasing trend. It should be taken into account that the constant population growth in Catalonia, which increased last year by more than 150,000 persons, requires a parallel increase in donation activity just to maintain the previous year's rate. Figure 2 depicts these changes, together with the donation rate per million population.

International comparisons

In Figure 3 the donation rate in Catalonia is compared with the rates in several European countries and the United States. The donation rate in Catalonia is the highest and is quite similar to that of Spain.

Figure 3. Annual donation rate by countries, 2002

Description of the characteristics of confirmed donors

There has been a trend to increases in the number of confirmed cadaveric donors over the past ten years. The mean age of donors more than 15 years old is also higher: from 40.7 years of age in 1993 to 50.1 in 2002. This increase in the age of confirmed donors may be attributable to the implementation of broader criteria for organ transplant eligibility, particularly for kidney and liver transplants, and to related medical advances (e.g., in preservation fluids and immunosuppressor treatments), which allow the use of organs from older donors (Figure 4).

Figure 4. Mean age of cadaveric donors over 15 years old, 1993-2002

Figure 5. Distribution of confirmed cadaveric donors according to age and sex, 2000-2002

The number of male cadaveric organ donors was higher than females in all the age groups except in the donors more than 69 years of age, where the numbers are similar. Males accounted for 60.2% of the total. Among the total of cadaveric donors, 34.6% were over 60 years old (Figure 5).

The causes of death differ considerably according to the age of the donor. Head trauma accounted for 81.6% of deaths in the group aged 10 to 19 years old, 68.9% in the group aged 20 to 29, 35% in the following group and less than 20% in the remaining groups. The opposite occurred in the case of stroke, which accounted for less than 17% of deaths in donors under 30 years old and more than 62% in donors over 60 (Figure 6). It is difficult to analyze this factor in the group under 10 years of age because of the small number of cases (20 children).

Figure 6. Causes of death in confirmed cadaveric donors, 1990-2002

Other characteristics of the cadaveric donor were also analyzed, such as the weight in relation to sex, and blood type and serology. As is shown in Figure 7, mean weight was higher in male organ donors than in female (77 kg. in men and 67 kg. in women).

Figure 7. Weight of confirmed cadaveric donors according to sex, 2000-2002

Figure 8. Blood type of confirmed cadaveric donors, 2000-2002

Blood types A and O were the most frequent, seen in 45.8% and 41.8% of cadaveric donors. Types B and AB accounted for 7.8% and 4.5%, respectively (Figure 8).

With regard to the serology data shown in Figure 9, there was a small percentage of Australia (AgHbs)-positive donors (1.8%) and a slightly higher percentage of hepatitis C virus (HCV)-positive donors (4.5%). It should be mentioned that some programs accept these organs for transplantation in correspondingly positive recipients. Most of the donors were cytomegalovirus (CMV)-positive (82.3%).

Figure 9. Serology data for confirmed cadaveric donors, 2000-2002

Table 3. Differences according to donor typology, 2000-2002

Removal and destination of organs procured in Catalonia

Once the organs are removed, 9% to 21% cannot be subsequently transplanted because of medical contraindications.

As shown in Table 4, most of the transplantations of organs procured in Catalonia and considered suitable are performed in Catalonia, particularly in the case of pancreas (100%), liver (91.7%) and kidney transplants (90.7%).

Table 4. Destination of the organs procured in Catalonia, 2002

Organ sharing with foreign organizations

Among the OCATT's activities, there is a service for the coordination of organ sharing that runs continuously 24 hours a day, every day of the year.

This activity takes place in Catalonia among the Catalan centers, between Catalonia and the rest of Spain through the ONT, and between Spain and international organ-sharing organizations.

Figure 10 shows the allocation of various organs to foreign organizations in the year 2002. More than half of the kidney and liver grafts offered were transplanted, whereas the percentage of heart and lung grafts was smaller. In general, the reasons why organs were

not accepted for transplantation included a lack of appropriate recipients or certain donor characteristics (e.g., very advanced age, HCV-positive status).

Figure 11 shows the allocation of organs from foreign organizations to Spain through the OCATT. The percentage of transplants carried out with these organs was very low, less than 10% in the case of heart, kidney and lung. However, more than 30% of the livers offered were transplanted. The reasons why these organs were not transplanted are diverse, as is shown on the figure (e.g., inappropriate recipients, donors with medical problems, or organs accepted previously by another organization).

Finally, Figure 12 shows the number of organs allocated to European transplant organizations with subsequent transplantation, and the number of organs received from these organizations and transplanted in Spain.

Figure 10. Organ-sharing between Spain and foreign organizations: organs offered by Spain, 2002

Figure 11. Organ-sharing between Spain and foreign organizations: organs offered to Spain, 2002

Figure 12. Organ sharing between Spain and foreign organizations: transplanted organs, 2002

Although Catalonia has broad criteria for renal transplantation regarding the use of organs from cadaveric donors (donors of advanced age are accepted, since there are recipients in this age group on the waiting lists), 20 kidneys were allocated for transplantation by other teams because there were no appropriate recipients here.

In the case of liver grafts, more organs were received than were sent; in part, this may be due to the organ-sharing agreement with Portugal, a country that sends these organs because domino transplants are not performed there.

Renal transplantation

In 2002, 372 kidneys were transplanted in Catalonia, representing a transplant rate of 57.2 pmp, slightly lower than last year.

The growing renal transplantation rate over the last 10 years and the number of renal transplants by type of donor (living or cadaveric) is shown in Figure 13. There has been an increase in the number of living donors in recent years.

Figure 13. Number and rate of renal transplantations, 1993-2002.

Table 5. Origin of kidneys transplanted in Catalonia, 2000-2002

The origin of the organs transplanted in the period of 2000 to 2002 is shown in Table 5. The total number of kidneys transplanted does not coincide with the number of transplantations performed per year, since several double renal transplants were carried out. This type of transplantation was initiated in 1997 with the aim of taking better advantage of the resources: certain kidneys that were considered valid for double transplant would not have been accepted as single organ transplants because of their characteristics. Sixteen double transplants were performed in 2002 in Catalonia. An increase in transplants from living donors is observed (19 cases in 2002).

Figure 14. Age distribution of cadaveric renal donors, 1993-2002

Kidneys from cadaveric donors over 50 years old accounted for 28% of the total in 1993 and 47% of the total in 2002. Moreover, 9% of the donors in 2002 were over 70 years old, whereas in 1993 to 1994 only 1% to 2% were in this age group. Thus, the mean age of kidney donors has increased from 37.0 years of age in 1990 to 46.7 in 2002 (Figure 14).

The last years have witnessed changes in some of the characteristics of cadaveric donors. Besides their increasing age, there has been a decrease in head trauma and an increase in stroke as the cause of donor death (Figure 15).

The number of renal transplants performed has followed an increasing trend in the last 10 years that has not resulted in reductions in the number of patients on the waiting lists. From 1993 to 1997 the waiting list decreased by 200 patients, but it was later seen to increase once again (Figure 16). Variations in the number of patients on the waiting list are due to many factors, such as changes in the criteria for eligibility and the incorporation of patients from other autonomous communities.

Figure 15. Distribution of the causes of death among renal donors, 1993-2002

Figure 16. Patients on the waiting list and number of renal transplants, 1990-2002

International comparisons

Comparison of the rates of renal transplantation in Catalonia with those of other countries shows that the rates in Catalonia are among the highest, together with those of the United States (Figure 17).

Figure 17. Renal transplant rates in various countries, 2002

Liver transplantation

In 2002, 204 liver transplants were performed in Catalonia, representing a rate of 31.4 pmp, which is equal to the year before.

Figure 18 shows the changes in liver transplant rates over the last 10 years and the number of transplants according to the type of donor (living or cadaveric). An increase in the number and rate of these transplants is apparent in the last years.

A liver transplantation program with living donors was initiated in Catalonia in 2000 and this has contributed to maintain the transplant rates above 30 pmp. In 2002, 13 transplants from living donors were performed and from 2000 to 2002, 31 transplants of this type have been carried out (Table 6).

Figure 18. Number and rate of liver transplants, 1993-2002

Table 6. Origin of the livers transplanted in Catalonia, 2000-2002.

Table 6 shows the origin of the livers transplanted in Catalonia: 75% to 80% were extracted in Catalan centers, nearly 15% were allocated through the ONT and only 3% were allocated from other European organizations.

Eight liver transplants were performed in 2002 using the split technique; thus 16 patients, 8 adults and 8 children, benefited from these 8 organs.

Figure 19 shows donor distribution by age group. There is a gradual increase in donors over 60 years old. As was seen in Table 3, the oldest are only donors of livers (mean age, 62 years).

Figure 19. Age distribution of liver donors, 1993-2002

Figure 20. Distribution of the causes of death among liver donors, 1993-2002

The change in the causes of death of cadaveric liver donors is similar to that described for the overall donor population. There is, however, a larger contribution of donors in whom the cause of death was stroke (Figure 20).

Despite the persistent increase in the annual number of liver transplantations, the number of patients on the waiting list at the end of the year continues to grow. As occurs in renal transplantation, this is attributable to a broadening of the criteria for transplant eligibility (Figure 21).

Figure 21. Waiting list patients and number of liver transplants, 1990-2002

During 2002, 271 patients were placed on the transplant waiting list. Among them, 12 were in urgency status 0 and 4 in urgency status 1. During the same year, 11 patients were excluded from the list because of improvements in their condition and 11 because of worsening. Twenty-four patients died while waiting for a transplant; thus waiting list mortality was 7.0%.

The mean waiting period for patients in the urgency 0 category requiring a transplant was one day, whereas the waiting period for the remaining patients was 140 days.

There were no statistically significant differences in the probability of receiving a transplant according to blood type among the A, B and O groups. Only blood type AB recipients received a transplant in a shorter time; nevertheless, it should be remembered that this is a very small group of patients and the data are not very stable. These recipients can receive organs from all the donors, but in group O, the universal donor group, the probability of receiving a transplant was not decreased (Figure 22).

Figure 22. Probability of receiving a liver transplant according to blood type. Waiting list patients, 2000-2002

International comparisons

Figure 23 shows the liver transplant rates for different countries during 2002.

Figure 23. Liver transplant rates in various countries, 2002

Heart transplantation

In 2002, 50 heart transplants were performed in Catalonia, representing a transplant rate of 7.7 pmp, which is equal to the previous year.

Figure 24. Number and rate of heart transplants, 1993-2002

Figure 24 shows the number and rate of heart transplants over the last 10 years. A gradual decrease is apparent in the last years. Nevertheless, since 1993 there has been a significant increase from 4.9 heart transplants pmp in 1993 to 10.4 in 2000, which is related with the opening of a new heart transplant unit in 1998.

The decrease in the last two years is linked with the reduction in the number of hearts proceeding from other autonomous communities through the ONT, a fact that might be due to an increase in the transplant activity of these autonomous communities (Table 7).

Table 7. Origin of the hearts transplanted in Catalonia, 2000-2002

Generally, heart donors are younger than the donors of other organs are, since stricter criteria are applied in the donor assessment. Given the low number of these transplants per year, the distribution is less stable and it is more difficult to analyze the trends. However, there seems to be an increase in the percentage of donors over 40 years of age (Figure 25).

Figure 25. Age distribution of heart donors, 1993-2002

Figure 26. Distribution of the causes of death among heart donors, 1993-2002

Given the donor characteristics, changes are also apparent in the causes of death as compared to donors of other organs. There is a higher percentage of donor deaths due to head trauma, although the last years have seen an increase in donors due to stroke (Figure 26).

Figure 27. Waiting list and number of heart transplants, 1990-2002

Figure 27 shows the number of transplants and the waiting list since 1990. Since there are very few patients annually, the small variations that occur are seen as large changes on the figure. The pattern is similar to those of the other transplant waiting lists. Although there has been an increase in the number of transplants, there is no waiting list reduction because of several intervening factors.

During 2002, 83 patients were placed on the list, 12 in urgency status 0 and 2 in urgency status 1. At the end of the year 24 patients were waiting for a transplant. Also during 2002, 6 patients were excluded from the list due to improvement and 8 due to worsening of their conditions. Six patients died while waiting for a transplant; thus heart transplant waiting list mortality was 6.9%.

The mean number of days on the list for urgency 0 patients requiring a transplant was 6 days, whereas the time on the list for the remaining patients who received a transplant in 2002 was 119 days.

Figure 28 shows that there were no differences in the probability of receiving a heart transplant according to the blood type among patients on the waiting list during the period of 2000 to 2002.

Figure 28. Probability of receiving a heart transplant according to blood type. Patients on the waiting list, 2000-2002

International comparisons

Figure 29 contains the heart transplant rates in various countries for 2002. The rate in Catalonia is comparable to that of the rest of Spain and is slightly lower than that of the United States, Belgium and Austria.

Figure 29. Heart transplant rates in various countries, 2002

Lung transplantation

In 2002, 36 lung transplants were performed in Catalonia, representing a transplant rate of 5.5 pmp, the highest over the entire period. As is seen in Figure 30, the increased activity has occurred with an increase in double lung transplants; single lung transplants have decreased considerably in recent years. Three single lung transplants and 33 double lung transplants were performed in 2002.

Figure 30. Number and rate of lung transplants, 1993-2002

The decrease in the 2001 rate coincides with a reduction in the number of lungs allocated from other autonomous communities through the ONT. The increase in the last year is related to a new increase in these organs proceeding from the ONT (Table 8).

Table 8. Origin of the lungs transplanted in Catalonia, 2000-2002

Figure 31. Age distribution of lung transplant donors, 1993-2002

Figure 32. Distribution of the causes of death among lung transplant donors, 1993-2002

Figure 33. Waiting list and number of lung transplants, 1990-2002

Generally lung transplant donors are similar to heart donors, i.e., they are younger than the donors of other organs. Nevertheless, over the last ten years there has been an increasing percentage of these organs from donors over 40 and 50 years old (Figure 31).

There are some differences in the causes of death as compared to donors of other organs. A higher percentage of deaths are due to head trauma, though this cause has decreased in recent years. Nearly 60% of donor deaths were due to head trauma in 1993, whereas in 2002 this proportion dropped to 38% (Figure 32).

The number of transplants and the waiting list data since 1990 are shown in Figure 33. Once again, the number of cases per year is small, making the changes depicted on the graph seem marked. As in other organ transplants, the increase in activity and waiting list volume run in parallel.

During 2002, 74 patients were placed on the waiting list, 11 categorized as urgency 0. At the end of the year 31 patients were waiting for a lung transplant. During the same year there was one exclusion from the list due to improvement and 21 exclusions due to worsening of the patient's condition. Seven patients died while waiting for a transplant, giving a lung transplant waiting list mortality of 8.2%.

In 2002, the mean wait for a lung transplant in patients categorized as urgency status 0 was 6 days, whereas for the remaining patients the wait was 155 days.

Blood type had an influence on the speed with which a patient received the transplant. Figure 34 shows the probability of receiving a lung transplant for the patients on the waiting list in the period of 2000 to 2002. At three months, 35% of blood type A patients had received a transplant as compared to only 8% of type O patients. Data from blood types B and AB are not presented because of the extremely small number of cases.

Figure 34. Probability of receiving a lung transplant according to blood type. Waiting list patients, 2000 to 2002

International comparisons

Figure 35. Lung transplant rates in various countries, 2002

Figure 35 shows lung transplant rates in several countries for the year 2002. The rate in Catalonia is slightly higher than in the rest of Spain and is situated among the highest, though slightly less than Austria and the United States.

Pancreas Transplantation

Figure 36. Number and rate of pancreas transplants, 1993-2002

In 2002, 19 pancreas transplants were performed in Catalonia, which represents a transplant rate of 2.9 pmp. The rate has remained stable at around 3 since 1993, as seen in Figure 36. In 2002, 2 pancreas transplants and 17 kidney-pancreas transplants were carried out.

Table 9. Origin of the pancreases transplanted in Catalonia, 2000-2002.

Figure 37. Age distribution of pancreas donors, 1993-2002

Figure 38. Distribution of the causes of death among pancreas donors, 1993-2002

In general, pancreas donors are quite young (Figure 37). Because of the small number of cases, the evolution over these 10 years is difficult to assess.

Since the donors are generally young, there is a large percentage of deaths due to head trauma in this group (Figure 38).

Figure 39. Waiting list and number of pancreas transplants, 1990-2002

Figure 39 shows the evolution in the number of transplants and the patients on the waiting list. The number of transplants annually has shown little change over the years, remaining stable at around 20, whereas the number of patients on the waiting list has clearly grown.

During 2002, 33 patients were placed on the waiting list and at the end of the year there were 40 patients waiting for a transplant. In the same period there were 3 exclusions from the list because of improvement in the patient's status and 3 exclusions because of worsening. One patient died while waiting for a transplant, which represents a waiting list mortality of 1.5%.

The mean number of days on the list waiting for a pancreas transplant was 331 days.

Blood type was a factor affecting the speed with which a patient received a pancreas transplant, as is seen in Figure 40. At 3 months 31% of patients with blood type A had received a transplant as compared to only 11% of type O patients. Data for type B and type AB patients are not presented because of the small number of cases.

Figure 40. Probability of receiving a pancreas transplant according to blood type. Waiting list patients, 2000-2002

International comparisons

Figure 41 shows the 2002 pancreas transplant rates in several countries. The rate for Catalonia is in an intermediate position in our geographical area. Countries such as Austria and the United States nearly double our rate and the rate in Belgium is fourfold higher.

Figure 41. Pancreas transplant rates in different countries, 2002

Tissues

Evolution of donation and transplant activity in Catalonia

Tissues destined for transplantation can come from multiorgan donors, from non-heart-beating donors and, in some cases, from living donors. There is also the possibility to secure a single type or several types of tissues from the same donor. Because of these factors, overall enumeration of the donors, as is done for organ donors, is not performed in this case. The only cases enumerated are those in whom the donation implies a certain differentiation with regard to the type of donor or the type of tissue obtained, such as, for example, the case of bone and tendinous tissue and corneal tissue.

In any case, the donation and procurement of tissues from the different types of donors is high and the existing availability covers the demand.

For certain specific tissues (e.g. corneas), there is a short waiting list that does not depend on the availability of the tissue, but instead on the other intervening factors, such as the search for suitable tissues according to the disease to be treated, the need to conform to donor and recipient characteristics, and the fact of giving priority to the most frequently performed procedures when programming the surgery, as is done in most hospitals.

Cold-preserved bone and tendinous tissue

Most bone and tendinous tissue comes from tissue donors and multiorgan donors, although in numerical terms, the most significant donation is from living donors. The tissue obtained from living donors includes femoral heads and tibial condyles, which are removed in surgical procedures for the placement of a hip or knee prosthesis.

Figure 42. Types of bone and tendinous tissue donors, 1998-2002

As the use of tissues and the demand on tissue banks has risen, the practice of requesting informed consent for the donation of tissues from the cadaveric donor and multiorgan donor has extended. As is shown in Figure 42, there is a generally steady increase in the number of donors, though a slight reduction in live donors and an increase in tissue donors is evident.

This increase in the number of tissue donors is the basis for the rise in available tissue seen in Figure 43. In 2002, there was a 33% increase in tissue procurement as compared to the previous year.

Another aspect to keep in mind is the advancements in the viability of the tissue obtained (Figure 44), which was 91% in 2002 as compared to 87% the year before. This parameter reflects both the methods applied in removal of the tissue and the systems of processing

and preservation used in the tissue banks. Application of strict quality control procedures in both these steps has helped to optimize the quality of the donated tissue.

Figure 43. Type of bone and tendinous tissue, 1998-2002

Figure 44. Viability of bone and tendinous tissue, 1998-2002

Vascular tissue

The procurement of vascular tissue is subject to careful selection of the type of donor. In addition, the removal procedure and the necessary manipulation by the tissue banks to process the graft, has resulted in a maintained vascular tissue viability rate of 70% to 80% (Figures 45 and 46).

Figure 45. Procurement and viability of valvular tissue, 1998-2002

Figure 46. Procurement and viability of arterial segments, 1998-2002

Skin and cultures

Skin donations, although not abundant, cover the demand (Figure 47). The most important indication for skin implants is in major burn patients. The different processing and preservation methods have decreased the immunogenic component and have broadened the application of these grafts to vascular pathologies.

Figure 47. Skin procurement and viability, 1998-2002

Evolution of transplant activity

Table 10 shows the number and rate of transplants for the different tissues over the last five years.

Table 10. Evolution of tissue transplantation activity in Catalonia, 1998-2002

Hematopoietic progenitor cell transplantation

In 2002, 386 hematopoietic progenitor cell transplants (HPT) were performed. Among these, 254 (65.8%) were autogenous transplants and 132 (34.2%) were allogeneous transplants (Figure 48).

From 1988 to 2002, 4633 HPT were performed in 4358 patients. Among these transplants, 963 (20.8%) were in children 0 to 16 years old and 3670 (79.2%) were in adults (Figure 49). HPT activity, in both the pediatric and adult populations, seems to have stabilized in the last years; the overall HPT rate for 2002 was 59.3 pmp.

Figure 48. Number of hematopoietic progenitor cell transplants according to type of transplant, 1993-2002

Figure 49. Number and rate of transplantations, 1993-2002

Indications

The most frequent transplant indications in 2002 in both the pediatric and adult populations were hematological, accounting for 352 HPT (91.2%) (Table 10). Among this group, 27.6% of the activity was for the treatment of acute leukemia, 23.3% for monoclonal gammopathy and the remaining transplants were for several indications, among which the group of non-Hodgkin's lymphoma stands out with 67 transplants (19.0%).

Table 10. Distribution of hematopoietic progenitor cell transplants according to indication groups, 2002

In the period of 1993 to 2002, acute leukemia was the most frequent reason for transplantation in children, with 372 cases (56.7%). Acute lymphoblastic leukemia stands out in this group, with 258 cases. The second most important group regarding activity was non-malignant hematological disease (Figure 50).

In contrast, the largest group in the adult population was breast cancer, with 703 cases (21.7%). This indication has shown a significant descent in the last two years, however, since now this treatment can only be given within clinical research protocols in Catalonia. The second most important indication is acute leukemia and, specifically, acute non-lymphoblastic leukemia, with 382 cases (11.8%).

Figure 50. Distribution of hematopoietic progenitor cell transplants according to indication, 1993-2002

Origin of progenitor cells

The HPT Registry of Catalonia contains data on the origin of the progenitor cells for transplantation since 1995.

The use of peripheral blood progenitor cells has increased every year for both autogenous and allogeneous transplants (Figures 51 and 52). In 84.5% of the transplants in 2002, the cells came from peripheral blood. Taking into account the patients' age group, the percentage in the pediatric population was 56.3%, whereas in the adult population it reached 90.1%.

Figure 51. Autogenous transplants, 1995-2002

Figure 52. Allogeneous transplants, 1995-2002

Cornea transplantation

The annual number of cornea transplants performed from 1993 to 2002 has shown a sustained increase. As can be seen in Figure 53, 996 corneas were transplanted in 2002, 422 more than in 1993 (implying a 73.5% increase for an identical period).

The establishment of a registry of activity in 1994 and the creation of the Advisory Committee for Eye Transplantation in 1997, with the participation of representatives from the related professional areas (ophthalmologists, hospital coordinators, eye tissue banks and the OCATT), has been essential to favor a consensus in the adoption of measures aimed at improving the efficacy of this activity.

Figure 53. Number and rate of corneal transplantations, 1993-2002

Indications

Table 12 summarizes the causes leading to the corneal transplantations performed during 2001 and 2002.

Table 12. Distribution of corneal transplants according to indication, 2001 and 2002

Cornea procurement

Improved knowledge of the level of activity in this type of transplant and of the level of demand has favored a trend to optimizing the procurement of this tissue. Moreover, tissue

viability has improved because of the active implication of hospital transplant coordinators and tissue bank professionals.

A comparison of 2002 and 1993 activity shows a 77% increase in the procurement of corneas suitable for transplantation, accomplished with a 54.7% increase in the number of donors.

Figure 54. Procurement of corneas suitable for transplantation and donor rates, 1993-2002

Preserved amniotic membrane

During these years there has been a growing use of preserved amniotic membrane grafts to repair conjunctival lesions, for corneal ulcers and to favor the resolution of processes affecting the corneal limbus. Table 3 summarizes this activity for 2002.

Table 13. Processing amniotic membrane, 2002

Bone and tendinous tissue transplantation

Cold preservation

A sustained overall increase that reached 10% this year is apparent in transplant activity (Table 14). The tissue most frequently required for transplantation is still spongy bone, which is used to fill cavitory defects. Structural bone tissue, either alone or together with synthetic prostheses, is used mainly in oncologic orthopedics to replace structural defects; there is a relatively stable level of use of this material. The most marked increase has been in the use of tendinous tissue, including tendons, ligaments, meniscus, and fascia lata, which has experienced a 26% increase as compared to the previous year.

Table 14. Number and type of bone and tendinous tissue, 1998-2002

The increase in the use of this tissue has led to an rise in the number of patients treated, with 16% more receiving this treatment as compared to the previous year (Figure 55).

Figure 55. Patients treated with bone and tendinous tissue, 1998-2002

Autologous implants of cultured chondrocytes were first applied in 2001 as an alternative therapy for a specific disease of the knee cartilage affecting young patients. This treatment is now being assessed in several hospitals all over Spain to determine its efficacy. In Catalonia chondrocyte implants are being applied as alternative therapy in two hospitals; 10 patients were treated in 2001 to 2002. The tissue for culture is obtained by arthroscopy. Cells are prepared and cultured in the tissue banks.

Lyophilization

Lyophilization is a way of processing and preserving tissue so that it can be vacuum-packed and stored at room temperature for lengthy periods, allowing immediate availability. What is noteworthy is not so much the use of this tissue processing method, which increased by 26% as compared to last year (Figure 56), but the fact that it is distributed from a tissue bank; usually these materials are distributed by the industry. Distribution through the tissue banks on our country is an important health guarantee. The clinical history of the donor, the screening tests performed and the "traceability" (tracking) of all the steps from donor to recipient are well monitored.

Figure 56. Use and distribution of lyophilized bone and tendinous tissue, 1998-2002

Vascular tissue transplantation

Implantation of vascular tissue of human origin such as artery segments or heart valves is indicated in very specific diseases; thus its use is relatively stable.

Heart valves are used in the treatment of congenital heart disease, severe valve infections and in some cases of valve replacement. Vessel segments are mainly used for infections in previously implanted arterial prostheses, in cases where there is a lack of small vessels, and for substituting or reinforcing large or small sections of arteries (Table 15).

Table 15. Number and type of vascular tissue implants, 1998- 2002

Skin and culture transplantation

Because of the development of new synthetic alternatives for the treatment of some pathologies in which allogeneous skin grafts are indicated, the number of patients treated with these grafts has not experienced a large increase in the period of 1998 to 2000 (Figure 57).

Figure 57. Patients treated with skin grafts and the diagnoses, 1998-2002