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OVERVIEW

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Changing patterns in organ donation in Eurotransplant, 1990–1994

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Abstract Organ transplantation has become the treatment of choice for patients with end-stage organ failure and has led to progressive increases in the size of waiting lists over the past decade. Unfortunately, from 1990 to 1994, the number of organ donors remained stable while the number of organs transplanted from these donors increased by only 10 %. In view of the severity of the current organ shortage, elderly individuals are increasingly being accepted as organ donors. The graft survival rate with kidneys from donors older than 55 years is 5 % lower than that with kidneys from younger donors at 1 year and 9 % lower at 3 years post-transplantation. Graft survival is also significantly lower with organs from donors who die from cerebrovascular accidents than it is with organs from donors whose cause of death is cerebral trauma. The number of patients waiting for a nonrenal donor organ has increased rapidly in the past 5 years, and an increasing number of donor kidneys are now being provided by multiorgan donors. The favorable graft survival rate with multiorgan donor kidneys, which is significantly better than that obtained with single organ donor kidneys, confirms their suitability for renal transplantation.

Key words Organ shortage, kidney transplantation, elderly donors · Elderly donors, organ shortage, kidney transplantation · Multiorgan donors, Eurotransplant · Eurotransplant, multiorgan donors · Donors, multiorgan

Introduction

The Eurotransplant Foundation, founded in 1967, coordinates the matching and exchange of donor organs across five European countries: Austria, Belgium, Germany, Luxemburg, and the Netherlands. The primary goals of Eurotransplant are: (1) to achieve an optimal use of available donor organs, (2) to secure a transparant and objective selection system based upon medical criteria, and (3) to assess the importance of factors that have the greatest influence on transplantation results [1]. These goals have changed very little over the years; however, a fourth goal has recently been added: to support donor procurement activities in order to increase the supply of donor organs. This reflects Eurotransplant's concern with the chronic shortage of organ donors.

This report addresses the consequences of that problem, as reflected in the changing trends in organ donation in the 5-year period between 1990 and 1994. Special attention is paid to the retrieval of multiple organs from individual donors and to the acceptance of organs from donors who would previously have been considered too old.

Waiting lists

The composition of the Eurotransplant waiting lists in 1990 and 1994 is set out in Table 1. The increasing disparity between the number of patients waiting for a re-

Table 1 Eurotransplant waiting lists[a]

Organ	1 January 1990		31 December 1994	
Kidney	10124		12849	
Heart	402		868	
Heart and lung(s)	42		75	
Lung(s)	46	897[b]	243	1736[b]
Liver	220		334	
Pancreas (and kidney)	187		216	
Totals	11021		14585	

Difference between 1990 and 1994: 3564 = 32 %

[a] Including former East Germany since 1991
[b] Total nonrenal organs

Table 2 Kidney waiting list and transplantation in Eurotransplant

Year	Size of waiting list	Annual growth waiting list [%]	Transplants
1990[a]	10124	–	3171
1991	10463	3	3395
1992	11217	7	3101
1993	11956	7	3293
1994	12849	7	2997

[a] Excluding former East Germany

nal transplant and the number of renal transplantations performed is not restricted to the Eurotransplant community (Table 2), but is also observed throughout Europe and in the United States.

An overview of the numbers of organ donations and transplantations in Eurotransplant in the same period is set out in Table 3. Transplants of multiple organs from a single donor to a single recipient are counted as one, irrespective of the number of organs involved. Transplants of multiple organs from a single donor to multiple recipients are counted as multiple transplants.

The substantial increase in the numbers of patients waiting for a transplant – 32 % more in 1994 than in 1990 – did not result in a proportional increase in the total number of transplantations, which rose by only 6 % in the same period. Almost 1800 of the patients on the waiting lists died in the period 1990–1994. The number of patients waiting more than 5 years for a renal transplant is almost 10 % of the total [3].

Nonrenal donors and transplantations

The number of patients waiting for a nonrenal organ increased from 897 in 1990 to 1736 in 1994, an almost twofold increase (Table 1). In order to satisfy the increasing demand for these organs, requests for multiple organ donations were introduced into donor retrieval programs. The proportion of so-called multiorgan donors (MOD) used in Eurotransplant in the study period increased from 48 % in 1990 to 64 % in 1994 (Table 3). These values represent a relative increase of 33 % in 5 years. The number of nonrenal transplantations (with the exception of heart transplantations) increased dramatically during the study period. The number of transplantations per donor rose from 2.8 in 1990 to 3.1 in 1994, an increase of almost 13 %.

Elderly donors

The acceptance of organs from elderly donors is clearly attributable to the shortage of donor organs. In 1983, 10 % of all kidney donors were aged between 46 and 55 years, and only 2 % were over 55. Gradually, donor acceptance criteria changed and led to increased efforts and successes in the retrieval of organs from donors previously considered too old. In 1994, the retrieval rate in the two oldest donor groups was 23 % (Table 4).

Causes of donor death

An overview of the causes of donor death in Eurotransplant in the 5-year study period is presented in Table 5. The most notable changes were in the number of cere-

Table 3 Organ donation and transplantation in Eurotransplant between 1990 and 1994 (*MOD*, multiorgan donors; *Transpl./donors*, number of transplants from one donor)

Year	Donors	MOD [%]	Number of transplantations[a]							
			Kidney	Heart	Heart and lung	Lung	Liver	Pancreas	Total	Transpl./ donors
1990[b]	1615	48	3171	682	19	50	576	72	4570	2.8
1991	1781	54	3395	806	24	71	715	74	5085	2.9
1992	1622	57	3101	753	32	109	765	67	4827	3.0
1993	1720	61	3293	773	28	119	878	100	5191	3.0
1994	1544	64	2997	696	43	138	892	95	4861	3.1

[a] Each transplant operation is counted, regardless of the number of organs per transplant, except for heart/lung transplants, which are regarded as single transplants
[b] Excluding former East Germany

Table 4 Proportion of elderly kidney donors in Eurotransplant

Year	Number of kidney transplantations	Donor ages			
		46 ≤ 55 years		> 55 years	
		n	[%]	*n*	[%]
1990	3171	694	22	385	12
1991	3395	758	22	444	13
1992	3101	696	22	459	15
1993	3293	740	22	618	19
1994	2997	698	23	689	23

Table 5 Causes of donor death in Eurotransplant 1990–1994 (*CVA*, cerebrovascular accident)

Cause of death	1990 [%]	1991 [%]	1992 [%]	1993 [%]	1994 [%]
Cerebral trauma	43	41	40	39	40
CVA	40	42	43	45	45
Brain tumor	3	3	3	2	2
Suicide	4	5	4	4	4
Other	10	9	10	10	9

bral traumas, which decreased from 43 % to 40 %, and in the number of cerebrovascular accidents (CVA), which increased from 40 % to 45 %. In the presence of the same number of organ donors, the former reflects a considerable reduction in traffic accident fatalities, largely due to the use of seat belts and helmets, while the latter is obviously related to the increased number of elderly donors (Table 6). There were only slight changes in brain tumors, suicide, and other.

Outcome of transplanted organs from elderly donors

The average age of 996 donors older than 55 years who provided kidneys to Eurotransplant between 1990 and 1994 was 62 years. The survival rate of primary renal allografts from donors older than 55 years was compared to that of grafts from younger donors (Table 7). All cases of recipient death before graft failure were excluded in order to avoid an unfair bias against elderly recipients. The mean actuarial graft survival rate for transplants from donors aged 6–55 years was 89.7 % (range 86 %–92 %) at 1 year and 85.2 % (range 81 %–91 %) at 3 years post-transplantation. The rates for grafts from donors in the youngest group (0–5 years) were 78 % at 1 year and 73 % at 3 years, while those for grafts from donors in the oldest group (> 55 years) were 83 % at 1 year and 74 % at 3 years post-transplantation ($P < 0.0001$).

The survival rate of primary renal allografts from donors whose cause of death was cerebral trauma differed significantly between younger (< 55 years) and older (> 55 years) donors: 86 % and 79 %, respectively, at 3 years post-transplantation ($P = 0.03$, Fig. 1). Graft survival rates of renal transplantations performed with organs from donors whose cause of death was CVA were also analyzed according to donor ages. Grafts from younger donors (< 55 years) did significantly better ($P = 0.0001$) than those from older donors (> 55 years). The survival rates at 3 years were 85 % and 72 %, respectively (Fig. 2).

Table 6 Donor age and cause of death (*CVA*, cerebrovascular accident)

Age (years)	Head injury [%]	CVA [%]
0–5	50	8
6–10	70	12
11–15	64	14
16–25	74	13
26–35	45	39
36–45	30	57
46–55	26	61
> 55	23	66

Table 7 Actuarial survival of primary renal allografts from donors in different age groups in Eurotransplant 1990–1994

Donor age group (years)	Cases	% Graft survival	
		1st year	3rd year
0–5	190	78	73
6–10	220	86	81
11–15	249	92	91
16–25	1608	92	88
26–35	1291	91	86
36–45	1482	89	84
46–55	1584	87	82
> 55	996	83	74

Results with grafts from single and multiple organ donors

Multiple organ donors (MODs) were mainly young, male donors who more often died as a result of cerebral trauma than the single organ (kidneys only) donors (SODs). The MOD kidneys were transplanted into younger recipients with lower pretransplant panel reactive antibody levels and shorter cold ischemia times, over a slightly less favorable DR mismatch gradient. These grafts were more often preserved with University of Wisconsin (UW) solution than were SOD kidneys [3].

An observational study was carried out by Smits et al. on the results of 8746 MOD kidneys and 6610 SOD kidneys transplanted between 1988 and 1995 in the Eurotransplant community [7]. Renal allograft survival was significantly better for MOD kidneys (85 %, 75 %, and 58 %) than for SOD kidneys (78 %, 68 %, and 46 %; $P = 0.0001$). A multivariate analysis using Cox's proportional hazards model was used to quantify the role of the two different procurement policies,

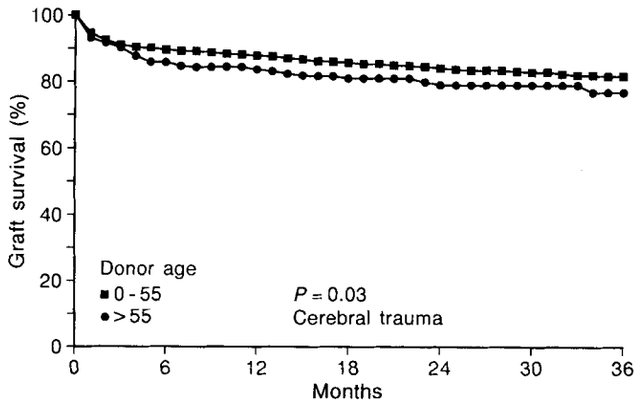

Fig. 1 Survival of primary renal allografts from donors whose cause of death was cerebral trauma (Eurotransplant 1990–1994)

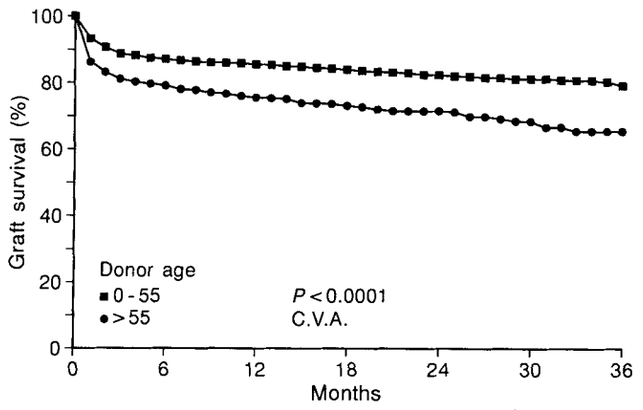

Fig. 2 Survival of primary renal allografts from donors whose cause of death was cerebrovascular accidents (Eurotransplant 1990–1994)

MOD and SOD, on renal allograft survival after adjusting for other prognostic factors. Results showed that recipients of SOD kidneys had a 1.28 times higher risk of graft failure than recipients of MOD kidneys. The superior graft survival of MOD kidneys could not be explained by the fact that the MODs were younger, male, and that UW was used as the preservation solution.

Discussion

In most fields of human endeavor, excess demands for a product or service are normally offset by increases in the production or availability of the service. Unfortunately, that natural process does not function in clinical transplantation. Consequently, the increasing disparity between the number of patients waiting for a transplant and the number of transplants performed is generating a large amount of attention from governmental and public organizations.

Between 1990 and 1994, there was a 27 % increase in the number of patients waiting for a kidney transplant in Eurotransplant, while there was no increase at all in the number of kidney transplantations performed. That disturbing trend is evident not only in kidney but also in heart transplantation.

Renal transplantation continues to be the treatment of choice for patients with end-stage renal failure. Consequently, it is not surprising that patients continue to be placed on waiting lists for such transplantations. However, the number of organ donations still does not satisfy the requirements of those waiting lists, which continue to grow. Attempts have been made to counter that trend via educational programs directed both at the general population and at the specific medical communities. Transplant coordinators have been appointed to expedite the numerous procedures involved in transplantation. There has also been an increase in the number of different organs that may be retrieved from a single donor, as well as an increase in the acceptable age for organ donation.

The survival rate of kidneys transplanted from older donors – 83 % at 1 year – is lower than that from donors aged 6–55 years, which ranges from 86 % to 92 % at 1 year. The survival rate of the older grafts is 74 % at 3 years compared to 81 %–91 % for the younger grafts. Obviously, since transplantation does not confer immortality on the graft, one should not be surprised by the poorer performance of older grafts, which may have a lower functional reserve than younger grafts [6]. Thus, one might consider introducing donor age as a separate "match" criterion, especially for recipients over 55 years of age.

The significantly better results with MOD kidneys, which are not attributable to the fact that MODs were younger, male, and that their grafts were preserved with UW solution, may have been the result of the intensive surveillance that potential MODs receive and the combined expertise of the multiorgan explantation teams. Smits et al. [7] have suggested that "every donor should not only be considered as a potential multiorgan donor but, what is more important, every organ should be treated as one".

The shortage of nonrenal organs may be partly due to the fact that the routine transplantation of these organs is relatively new and has not yet received the same degree of public acceptability as renal transplantation. As such, the number of patients awaiting such transplants may be expected to parallel the increasing availability of those transplants. Indeed, the number of patients on these waiting lists has almost doubled – from 897 in 1990 to 1736 in 1994 – while the number of nonrenal transplants only increased from 1399 to 1864 (33 %) in the same period. Once again, we are observing a serious

disparity between the numbers of waiting and transplanted patients.

Throughout Europe, many initiatives have been introduced to increase organ donation rates, among them transplant legislation, publicity campaigns, distribution of donor cards, appointment of transplant coordinators, and reimbursement of procurement costs. Although all of these initiatives may help to increase organ donation, none has been sufficient to make a significant impact on the supply of donor organs [2].

In light of the continuing organ shortage, it is time to re-examine our strategies to encourage organ donation. Two of the Eurotransplant member countries with presumed consent legislation, Austria and Belgium, are demonstrating that such a system not only provides more donors, but also more organs per donor [3]. Nevertheless, abandoning the system that most European countries currently have, i.e., of voluntary, altruistic organ donation, in favor of presumed consent legislation is unlikely to be introduced. Poor results have been achieved in France, whereas in some other countries, such as Spain, which uses informed consent better results have been achieved [4]. Since 1990, Spain has managed to dramatically increase the renal transplant rate – to 42 per million population in 1994 – and to provide more donors per capita than any other country. This has been achieved despite a continuing decrease in the number of deaths from road traffic accidents, and has been attributed to the coordination system and the support and training provided for transplant coordinators [5].

Still, many potential donors are lost because hospitals lack a clear process for organ donation. Either potential donors are not detected, or families are not given the option of donation, or the manner in which the donation request is made does not meet the family's emotional and informational needs. Despite evidence of considerable public support for organ donation, many countries still report significant refusal rates. In 1994, data from the United Kingdom Transplant Support Service Authority (UKTSSA) and the Spanish Organización Nacional de Trasplantes (ONT) revealed national refusal rates of 26 % and 23.6 %, respectively [5, 8].

The Eurotransplant Foundation, concerned about the rise in organ donation refusals, has taken the initiative of addressing this particular issue. The European Donor Hospital Education Programme (EDHEP) was created in 1991 to meet the widely perceived need to help health professionals deal effectively with bereaved relatives of potential organ donors. Its highly interactive "skills awareness workshops" are moderated by qualified trainers who work to sharpen the communication skills of medical professionals, heighten their sensitivity to the needs of bereaved relatives, and teach them how to go about requesting organ donation. The workshops provide participants with guidelines for establishing hospital protocols for the care of the bereaved and for making requests for organ donation. Since its inception, EDHEP has been translated into 17 languages and is in use in over 30 countries [9], demonstrating the need for this kind of professional training. Several countries are now beginning to incorporate EDHEP into their national medical and nursing training programs. A statistically significant learning effect can be discerned in evaluations of the impact of EDHEP that are under way in the Netherlands and the United Kingdom. This EDHEP effect has also been shown in Israel and Japan. National working groups from all countries confirm that EDHEP adapts easily to all national, religious, cultural, and educational needs. The program generates a more favorable attitude to organ donation among critical care staff and teaches those involved how to communicate more effectively and more confidently.

Recently, the Eurotransplant International Foundation (The Netherlands), ONT (Spain), and the Partnership for Organ Donation (US) decided to integrate their expertise into a program called "Donor Action"[1], also designed to improve the hospital donation process and to make sure that potential donors are detected and families asked about donation in a sensitive and caring manner. This program, combined with the training and support of the professionals involved, is considered to be the most effective way to improve the donation situation in individual hospitals. Research confirms that, with better practices, hospitals can achieve a measurable increase in donation. Specific tools are provided to ensure that all potential donors are identified early enough and referred. Donor Action provides a comprehensive package of tools, resources, guidelines, and training to help a hospital diagnose its own potential for donation and improve its own organ donation procedures. The Donor Action program materials are designed in a modular format so that they can easily be adapted to meet national and local hospital needs, regardless of language or cultural differences. The program calls for a hospital-based committee to use diagnostic tools to carefully analyze its current donation situation. Then, based on this analysis, the committee can identify specific areas for improvement and put in place the corresponding Donor Action modules:

- Donor Detection – early identification of all patients who may be potential donors
- Donor Referral – referral of all potential donors to transplant coordinators
- Family Care and Communication – sensitive communication and support for families of potential donors
- Donor Maintenance – optimal clinical management of potential donors
- Organ Retrieval – optimal retrieval protocols

[1] Donor Action is supported by Sandoz Pharma

It is hoped that this cooperative effort will have a beneficial effect on our efforts to alleviate the organ shortage and help to provide treatment for patients with end-stage organ failure.

Conclusion

The favorable graft survival results of MOD kidneys, which were significantly better than those obtained with SOD kidneys, confirm their suitability for renal transplantation. The results obtained with grafts from donors older than 55 years were 5 % lower than those obtained from donors aged 6–55 years at 1 year and 8 % lower at 3 years. However, graft survival was much lower, and significantly so, for organs from donors whose cause of death was CVA than it was for organs from donors with cerebral trauma. Nevertheless, in view of the severity of the organ donor shortage, we should continue to accept these organs for transplantation.

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