State of living kidney donation in Europe

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Abstract
For more than two decades, living donation has been an important part of kidney transplantation. This article discusses commonalities and differences of living donation across Europe, focussing on donor risks and ways to support the donor and enhance living donation practices.

Keywords: donor programmes; Europe; kidney transplantation; living donation

Why living donation?

Over the last decades, the number of living donations has markedly increased; there are a number of factors responsible for this. In former times, transplantation was a somewhat risky undertaking which was suitable only for relatively healthy patients. Thus, although there were postmortem donors and this was a sought after resource, waiting time was relatively short as the proportion of donors was rather high in comparison to the few potential recipients. Furthermore, dialysis was so demanding that elderly patients were hardly ever considered for the treatment. At present, not only has the quality of dialysis improved but also medical progress in general, so that survival on dialysis has improved remarkably and elderly patients are put on dialysis in most countries [1, 2]. Nowadays, seniors are the fastest growing part of the dialysis population [3].

On the other hand, the number of potential postmortem donors decreased not only due to better medical therapies but also due to other circumstantial measures [4]. In most European countries, seatbelts are now required when driving a car, or a helmet when riding a motorcycle. Further developments in intensive care and modes of dialysis enable a larger quantity of otherwise potential donors to survive or a donation becomes impossible due to serious infections as a result of a long duration on the intensive care ward.

This is not to say that there have been no successes in the promotion of donation after death, particularly in the south of Europe. In Croatia, for example, a few years ago there
was a rather small number of cadaveric donors but now they are even ahead of Spain thanks to new legislation and a lot of political efforts. However, even in these countries, the number of deceased donors is not sufficient as the dialysis-dependent population is increasing even faster.

With these facts in mind, the waiting times for a graft are getting longer and longer despite huge efforts to increase the rate of post-mortem donation, like the senior programme of Eurotransplant [5]. Thus, more and more patients will not live long enough to receive a graft. As we know that transplantation improves survival, given the right choice of organ and recipient, patients need a solution and the best solution available is living donation [4]. Thus, it is no wonder that living donation is rapidly growing in most countries.

Who benefits from living donation?

First of all, the patient receives a lot of benefits from living donation. They can receive an organ of a healthy person without cytokine release syndrome, without prior damage and without underlying or additional disease.

Not only patients benefit from living donation, the operation can be planned in advance, so everyone involved can plan ahead and look for the most beneficial time for the transplantation. While postmortem transplantation is always a sudden emergency situation, often performed during the late hours and involving much stress for all participants, a living donor kidney is planned and thus the kidney can be retrieved and transplanted during daytime, after a period of relaxation.

It is no surprise that every surgeon and transplant physician prefers transplantation during daytime, nor is it surprising that such an organ is more likely to grant a longer graft and patient survival than an organ retrieved from a postmortem donor.

There is a large benefit for society in general as well. A patient is off dialysis faster and for a longer period of time than would be possible with postmortem donation, adding 6–7 years of financial gain to transplantation. With costs ranging in European countries from 20 000 to 60 000€ for 1 year of dialysis, a living donation is likely to save an average of 280 000€.

At times in which there is a shortage of organs, living transplantation is a vital way of increasing the number of organs available for the benefit of our patients. We must also mention that the higher the number of transplantations, the better the reputation for the transplant centre. Furthermore, in some centres, the number of transplantations is so high that it is responsible for a substantial part of the hospital budget. This income can be used for the benefit of the centre, the surgeons and/or the transplant physicians. In other words, if a centre performs fewer transplantations, it may be inclined to reduce the number of physicians or other personnel involved in the field of transplantation.

Ultimately, the society saves a substantial amount of money, the transplant centre and the physicians earn a better reputation and the recipients gain precious lifetime. However, what is the gain for the donor? The only real benefit for them is most probably emotional well-being. Under these conditions, a lot of emphasis has to put on the safety of the living donor.

What are the risks for the donor?

The risks for the living donor have to be categorized into survival, surrogate parameters for survival and financial issues.

The most important question is whether a donor is risking his life or whether a living donation may shorten their life expectancy. Currently, in all publications, living donors have been found to have a longer or equal lifespan when compared with matched healthy controls; thus, there is not yet any evidence that live donation reduces the life expectancy of the donor [6]. However, there is an important bias because only well-screened donors are allowed to donate their kidneys and the so-called healthy controls include ill persons, too [7]. There should be no doubt that a living donation is a surgical procedure and carries some small but inherent risks. Thus, a living donor is certainly better off if he does not donate a kidney. So the question should be rephrased. How many, if any, life years are lost due to donation?

There are some circumstances associated with living donation which give rise to the thought that there might be a shortening of lifetime due to donation. We now know that an increase in creatinine and the development of hypertension ranks among the most important risk factors for cardiovascular events and, thus, cardiovascular death.

After donation, a number of donors develop an elevated creatinine [8], which could be associated with an increased cardiovascular mortality. At present, we cannot define a creatinine threshold above which a donation is associated with an increased cardiovascular mortality. There are a number of problems with the definition of a creatinine threshold. While in former times mostly people below the age of 50 years were considered potential donors, the age of donation is now rapidly increasing. It is well known that the glomerular filtration rate (GFR) decreases with age. Thus, although the creatinine may be in the normal range, the calculated or measured GFR may be markedly reduced. Thus, as the GFR will decrease after donation, the donor may have a GFR <40 afterwards. Does this render him unsuitable for donation? There are no data on this issue, but one might speculate that an elderly donor will die from causes unrelated to donation, such as infections or accidents, before he suffers from relevant problems due to donation.

If we define a GFR below which a donation is unsuitable, where could be the limit? To answer this question, it might be helpful to look at it from the other direction. A donation is thought to help the recipient in such a way that he is off dialysis, has a better quality of life and generally longer survival. An elderly donor may view the donation as a direct gift to his or her partner in life or family member, although only in rare cases does a grandmother donate a kidney to her granddaughter, for example. Of course, in a perfect world, the recipient and the donor should be off dialysis for the rest of their lives.

It may be argued that for the elderly in particular, kidney function is of utmost importance as renal function is known to decline with age. On the other hand, most of these donors
would gladly accept a modest shortening of their lifespan if they could live this period with their partners or family member. Let us not forget that in the vast majority of cases, the motivation for donation is determined by emotions. In these cases, it is sometimes hard to prevent a donation even in situations of enormous risk to the donor.

Both the recipient and the donor should be without the risk of starting dialysis during their respective life spans. Based on the available data, a minimum GFR of 30 mL/min 1 year after transplantation should be the goal. This implies a GFR of \( > 70 \text{ mL/min} \) in the donor as \( -10-20 \text{ mL/min} \) are lost due to the operation.

Unfortunately, this suggestion cannot be based on real-life data as the number of these donors has increased only recently and thus the follow-up is not yet long enough for a large enough population. Even for younger donors, the follow-up is limited to 5- or 15-year data, which is not particularly beneficial as life expectancy in modern societies ranges between 75 and 85, implying a minimum follow-up of 20–30 years is necessary in order to offer meaningful data. Even for people who have lost one of their kidneys due to an accident or a tumour, such long-term data does not exist in large enough numbers. Furthermore, in these patients, the underlying disease or accident necessitating the nephrectomy may have an additional impact on survival. Probably, the most important factor which has an additional impact on survival is hypertension. There is no question that an increasing number of donors suffer from hypertension. This is likely attributable to donation and/or imperfect donors are accepted and some of them have hypertension. This is likely attributable to donation questions and an increasing number of donors suffer from additional impact on survival is hypertension. There is no question that an increasing number of donors suffer from hypertension. This is likely attributable to donation. An increasing number of donors suffer from hypertension. This is likely attributable to donation. An increasing number of donors suffer from hypertension. This is likely attributable to donation. An increasing number of donors suffer from hypertension. This is likely attributable to donation. An increasing number of donors suffer from hypertension. This is likely attributable to donation. An increasing number of donors suffer from hypertension. This is likely attributable to donation. An increasing number of donors suffer from hypertension. This is likely attributable to donation. 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An increasing number of donors suffer from hypertension. This is likely attributable to donation. An increasing number of donors suffer from hypertension. This is likely attributable to donation. An increasing number of donor
acceptance of donors is more selective than in countries with a low rate of postmortem donors (Table 1) [13].

Today, the steps being taken to strengthen donor rights are somewhat small and half-hearted. The only step taken by the EU is the implementation of a donor registry.

However, it has not been explicitly stated for what period a donor has to be followed. In some countries, the follow-up stops with release from the hospital, in some after 1, 2 or 3 years. Only in very few countries are donors mandatorily followed for life. As the overall numbers are small, it is unlikely that, with such perfunctory measures, we will be able to adequately advise transplant centres and donors about the real risk of donation in the near future.

Current mode of donation in Europe: should we change?

From a medical perspective, basically no contraindications remain against living donation from an immunological standpoint. A living donation can be achieved, at least in the majority of cases, despite blood group incompatibility or pre-existing antibodies. However, such transplantations are very cost intensive. In these cases, a certain donor pairing is impossible without prior aggressive and expensive pretreatment. Therefore, a number of alternatives came into play such as crossover or domino transplantation [15].

Under these conditions, a willing donor from another pair with similar problems is used to solve the problem.

In case of domino transplantation, Donor A may donate to Recipient B, Donor B donates to Recipient C and Donor C may donate to Recipient A. Such a domino transplantation is even able to adjust for age, kidney quality and matching. Thus, it could be wise to apply such a system in the greater context of Europe whereby the donor travels to the recipient centre even across country borders.

What can be additionally helpful for donor and recipient?

With respect to the donor risks, it is of utmost importance to give the donor and the recipient the best possibility for informed consent, in other words, they should be given information in such a way that both can make the decision on their own terms.

As the transplant physician may have his own agenda and is likely to be in favour of donation, and the potential donor may feel some emotional pressure, the pure exclusion of a commercial donation does not seem to be enough. It may be advisable to involve an ombudsman or donor attorney. This person should have a substantial medical background in the field of nephrology without active past or present involvement in transplantation other than the special education required to become a nephrologist. He should not be a member of a transplant centre but rather a private practitioner or nephrologist from a hospital not involved in transplantation. Further, this person should have no connections to donor or recipient. He can then advise both recipient and donor of the risks and benefits of transplantation. In some cases, he may refrain from transplantation based on poor recipient condition or likely problems.

Table 1. Comparison of the number of various types of kidney donation between the countries

<table>
<thead>
<tr>
<th>EU countries</th>
<th>Actual deceased donors included NHBD (p.m.p.)</th>
<th>TX-including all types of donation (p.m.p.)</th>
<th>Deceased donor TX (p.m.p.)</th>
<th>Living TX (p.m.p.)</th>
<th>NHB kidney TX (p.m.p.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Austria</td>
<td>196 (23.3)</td>
<td>405 (48.5)</td>
<td>348 (41.4)</td>
<td>59 (7.0)</td>
<td>5 (0.6)</td>
</tr>
<tr>
<td>Belgium</td>
<td>221 (20.5)</td>
<td>453 (41.9)</td>
<td>404 (37.7)</td>
<td>49 (4.5)</td>
<td>61 (5.6)</td>
</tr>
<tr>
<td>Bulgaria</td>
<td>20 (2.7)</td>
<td>48 (6.4)</td>
<td>36 (4.8)</td>
<td>12 (1.6)</td>
<td>ND</td>
</tr>
<tr>
<td>Czech Republic</td>
<td>206 (19.6)</td>
<td>364 (34.7)</td>
<td>347 (33.0)</td>
<td>17 (1.6)</td>
<td>480 (4.9)</td>
</tr>
<tr>
<td>Denmark</td>
<td>73 (13.0)</td>
<td>232 (41.4)</td>
<td>130 (23.2)</td>
<td>102 (18.2)</td>
<td>ND</td>
</tr>
<tr>
<td>Estonia</td>
<td>23 (17.7)</td>
<td>39 (30.0)</td>
<td>35 (26.9)</td>
<td>4 (3.1)</td>
<td>ND</td>
</tr>
<tr>
<td>Finland</td>
<td>92 (17.0)</td>
<td>175 (32.4)</td>
<td>164 (30.4)</td>
<td>11 (2.0)</td>
<td>ND</td>
</tr>
<tr>
<td>France</td>
<td>1538 (23.8)</td>
<td>2892 (44.7)</td>
<td>2609 (40.3)</td>
<td>283 (4.4)</td>
<td>79 (1.2)</td>
</tr>
<tr>
<td>Germany</td>
<td>1295 (15.8)</td>
<td>2003 (35.9)</td>
<td>2272 (27.8)</td>
<td>665 (8.1)</td>
<td>0</td>
</tr>
<tr>
<td>Greece</td>
<td>44 (3.9)</td>
<td>135 (12.1)</td>
<td>108 (9.6)</td>
<td>27 (2.4)</td>
<td>0</td>
</tr>
<tr>
<td>Hungary</td>
<td>159 (15.9)</td>
<td>307 (30.7)</td>
<td>265 (26.5)</td>
<td>42 (4.2)</td>
<td>0</td>
</tr>
<tr>
<td>Ireland</td>
<td>58 (12.6)</td>
<td>174 (37.8)</td>
<td>151 (32.8)</td>
<td>23 (5.0)</td>
<td>ND</td>
</tr>
<tr>
<td>Italy</td>
<td>1298 (12.6)</td>
<td>1694 (28.2)</td>
<td>1512 (25.2)</td>
<td>182 (3.0)</td>
<td>0</td>
</tr>
<tr>
<td>Latvia</td>
<td>34 (14.8)</td>
<td>66 (28.7)</td>
<td>64 (27.8)</td>
<td>2 (0.9)</td>
<td>17 (7.4)</td>
</tr>
<tr>
<td>Lithuania</td>
<td>36 (10.9)</td>
<td>71 (21.5)</td>
<td>63 (19.1)</td>
<td>8 (2.4)</td>
<td>0</td>
</tr>
<tr>
<td>Luxembourg</td>
<td>3 (6.0)</td>
<td>6 (12.0)</td>
<td>6 (12.0)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Malta</td>
<td>9 (22.5)</td>
<td>14 (35.0)</td>
<td>11 (27.5)</td>
<td>3 (7.5)</td>
<td>0</td>
</tr>
<tr>
<td>Netherlands</td>
<td>227 (13.7)</td>
<td>867 (52.2)</td>
<td>394 (23.7)</td>
<td>473 (28.5)</td>
<td>129 (7.8)</td>
</tr>
<tr>
<td>Poland</td>
<td>509 (13.3)</td>
<td>999 (26.2)</td>
<td>949 (24.9)</td>
<td>50 (1.3)</td>
<td>0</td>
</tr>
<tr>
<td>Portugal</td>
<td>323 (30.2)</td>
<td>573 (53.6)</td>
<td>522 (48.8)</td>
<td>51 (4.8)</td>
<td>0</td>
</tr>
<tr>
<td>Romania</td>
<td>70 (3.3)</td>
<td>212 (10.0)</td>
<td>124 (5.8)</td>
<td>88 (4.1)</td>
<td>4 (0.2)</td>
</tr>
<tr>
<td>Slovakia</td>
<td>91 (16.8)</td>
<td>169 (31.3)</td>
<td>162 (30.0)</td>
<td>7 (1.3)</td>
<td>0</td>
</tr>
<tr>
<td>Slovenia</td>
<td>41 (20.5)</td>
<td>61 (30.5)</td>
<td>61 (30.5)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Spain</td>
<td>1502 (32.0)</td>
<td>2225 (47.3)</td>
<td>1985 (42.2)</td>
<td>240 (5.1)</td>
<td>158 (3.4)</td>
</tr>
<tr>
<td>Sweden</td>
<td>118 (12.6)</td>
<td>370 (39.4)</td>
<td>202 (21.5)</td>
<td>168 (17.9)</td>
<td>ND</td>
</tr>
<tr>
<td>UK</td>
<td>1015 (16.4)</td>
<td>2724 (44.0)</td>
<td>1698 (27.4)</td>
<td>1026 (16.6)</td>
<td>580 (9.4)</td>
</tr>
</tbody>
</table>

*NHBD, non-heart beating donation; p.m.p., per million population; TX, transplantation; NHB, non-heart beating; ND, not done; UK, United Kingdom.
after transplantation in other cases, he may protect the donor based on individual risks despite emotional stress.

In a number of countries, this issue is taken up by a local or regional ethics committee which may be independent from the transplant centre or part of it. But it remains rather difficult to fathom the depth of the human hearts. What kind of pressure is put on the potential donor by emotion or stress within the family? Can we really be sure of a decision of the free will of the donor even though there may be no money involved? If donor and recipient both want the transplantation, the ethics committee will not be able to exclude commercial donation.

It could be considered to donate some kind of gift to the donor who is taking a small but somewhat unforeseeable risk from which the society profits immensely, although this is not an advocacy of commercial donation. For certain, we have to exclude donation in the form of ‘bread for kidney’, in other words, the recipient needs the donation to survive or to support his otherwise disabled family. However, there are examples for state-controlled donation such as in Iran [16]. While this is illegal in Europe so far, it is worth considering.

In such a model, the donor receives a defined amount of money or other forms of reimbursement for his donation. The obvious risk is that younger people in particular may be inclined to buy a car or a small house or to pay off debts, in other words to gain an immediate benefit from the donation. This bears the risk that the potential donor may reevaluate his decision a few years later as the time for immediate reflection may be too short.

Other ideas could be a better retirement fund, an earlier age of retirement or free health insurance. Such a model has increased the number of living donors in Israel, for example [17]. This model has the clear benefit of no immediate effect of donation. It is a way to demonstrate the worth of donation to the society; it should be seen as a reward rather than a payment.

At present, there is not even a public acknowledgement of the society to demonstrate the worth of donation. In all these models, the recipient should not pay the donor. The donor should be rewarded by the society or a special health fund. Such a reward should not be immediate in order to protect the donor from donation to pay his consumer credit or buy his car 1 month earlier than without donation. Therefore, a better retirement fund seems to be the best option as it gives no immediate benefit [13, 18, 19].

Conclusions

In the foreseeable future, living donation will increase in importance primarily due to the low rate of postmortem donation and the ever-increasing number of patient on per-

Conflict of interest statement. None declared.

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Conflict of interest statement. None declared.

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