REVIEW ARTICLE

Current status of pediatric donor en bloc kidney transplantation to young adult recipients

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Abstract

Context and objectives: In recent years, despite the increased number of kidney transplants performed in Spain, we observed a gradual increase in waiting lists. The need to increase the number of transplants performed in our centers forces us to accept as donors the patients previously rejected.

Acquiring of evidence: We performed a systematic review using PubMed of published articles in the last 10 years, that include the words trasplante renal en bloque, “en bloc kidney transplantation” or its initials EBKT.

Synthesis of evidence: The pediatric donor to adult recipient has been included in the expanded criteria donors group, such donors being rejected nevertheless in most centers. However, in recent published series comparing the en bloc kidney transplantation from pediatric donor to adult recipients with other transplanted groups, the authors observe similar results between this kind of transplantation and the “optimal” donor group or living kidney donor group, regarding renal function and graft survival, and better results than the transplanted kidneys with expanded criteria donors group.

Conclusions: The results published in the current series lead us to consider this kind of transplant as an option to increase the number of transplants performed.

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PALABRAS CLAVE
Trasplante renal; Donante pediátrico; Técnica quirúrgica

Estado actual del trasplante renal en bloque de donante pediátrico en receptor adulto joven

Resumen

Contexto y objetivo: En los últimos años, a pesar del aumento del número de trasplantes renales realizados en España, hemos observado un incremento progresivo en las listas de...
Evolution of kidney transplantation in our country

After introducing the concept of brain death in 1968 (Committee of the Harvard Medical School) and its subsequent legislation in Spain in the 1980s, our country has come to lead the world kidney donation list. These results have been possible thanks to the work of the National Transplant Organization (ONT), the progressive awareness of the population, and the great work done by the transplant teams. However, in the late 1990s, the number of cadaveric kidney donors has remained stable, with the consequent impairment of the number of transplants performed in Spain. The decline in the number of cadaveric implants has been partially compensated by the introduction of programs for living donor kidney transplantation in the various centers.

If we analyze the ‘quality’ of the donated kidneys, we can observe that, in parallel to the decrease in the number of donors, an increase in their age can be observed. The introduction of mandatory helmet use for motorcycle drivers and various traffic campaigns have reduced the number of brain deaths in young patients, main donors in the 1990s (up to 40% according to the ONT), relegated to 15% in 2006, and donors currently being mostly elderly patients who die from stroke (50–60% of donors in 2006 according to the ONT). The search for new donors has led the transplant teams to accept previously rejected kidney transplant donors, including on the list of potential donors the so-called marginal donors or expanded criteria donors. All these maneuvers to increase the number of kidney donations, associated with the change in the current donor type, made it possible to partially alleviate the increase in waiting lists reported in recent years. However, this increase in the number of transplants performed has been achieved at the expense of transplanting increasingly older patients, younger patients being relegated to the background, with a diminishing chance to receive a graft appropriate to their age, living donation being sometimes their only chance. It will, therefore, be the aim of this review to analyze the current evidence that would enable us to increase the number of kidneys for the young recipient.

History of the en bloc kidney transplantation

Pediatric donor en bloc renal transplant for adult recipient is a surgical technique consisting of implanting the kidneys of a pediatric donor in an adult recipient using the aorta and the cava of the donor as single vascular tree. It was originally described by Alexis Carrel in animals, being developed in humans from the 1970s.

The first results published in the 1980s and 1990s had a high incidence of vascular and urologic complications (up to 80%), acute rejection, and damage by hyperfiltration, associated with lower graft survival. These results, together with the low incidence of kidney donations of this type, caused an abandonment of the technique in most hospitals, being relegated to a few centers worldwide.

The first article published by Spanish authors where an en bloc transplant was performed was in 1987. It was a 3-day anencephalic donor, which included donor ureters and bladder, with loss of graft after 5 months due to rejection.

Despite the disappointing initial results, several centers continued to make this type of transplant, there being in our country only 2 that carry out this kind of technique. The first is the Hospital Clínico de San Carlos, being the benchmark with 73 cases reported in 2007. The second is Dr. Peset in Valencia, with 14 cases reported in November 2010.

Chronological evolution of en bloc kidney transplantation

The articles published by Satterthwaite et al. in 1997, and more recently by Besnahan et al. in 2001, compare pediatric donor transplants implanted as simple graft versus en bloc, and they show that the age and weight of the donor influence the number of postoperative complications (mainly vascular thrombosis) and the subsequent evolution and survival of the graft, being worse the younger the donor
and this trend being more pronounced in donors younger than 5 years. This tendency is only altered when the grafts are implanted en bloc, achieving a reduced incidence of rejection and higher graft survival.\textsuperscript{10,11} The threshold from which a donor may be a candidate to 2 simple grafts or an en bloc transplant has been established on the basis of these studies.\textsuperscript{9,10,12–14} We accept as a donor for en bloc transplant patients younger than 5 (the group of the Hospital de San Carlos sets the limit at 3 years) but weighing less than 15 kg or renal length lower than 6 cm, although a study has recently been published which concludes that the weight limit could decrease to 10 kg, being able to perform 2 simple transplants in older or heavier donors, thus, increasing the number of transplants, without decreasing the “quality” of the transplant performed.\textsuperscript{12,13}

In 2010, a review performed by the United Network of Organ Sharing Standard/Transplant Analysis and Research (UNOS/STAR) was published with over 1600 implants performed en bloc. We conducted a comparative study between this group and the transplants from pediatric donors younger than 5 implanted as simple graft, adult donors between 18 and 59 years old, and expanded criteria donors (19,188 recipients in total).\textsuperscript{15} If we analyze the results of the long-term follow-up of the published series mentioned above, we can see that it is a technique that has a greater number of postoperative complications (artificial and venous thrombosis), compared to the standard adult donor, but only 5% is described (lower percentage compared to previous series), comparing it with 1.8% in the adult group. The follow-up of these patients shows that en bloc implants have a better renal function at the beginning of the study, with a significant lower initial graft dysfunction and better glomerular filtration, this one increasing during the follow-up. It has been demonstrated by means of performing ultrasounds and functional reserve measures that these kidneys have a better functional reserve compared to standard donors and an implant growth, reaching adult size at 18 months of the transplant.\textsuperscript{16} These results indicate that, as published in the 1980s, there is a higher incidence of complications, causing a greater graft loss during the first few months, but much lower than expected. Progressive loss of adult kidneys due to immune problems compared with the progressive improvement of the renal function and the growth of the implants performed en bloc makes the graft survival curves of the 4 groups crossed from the 6th year of follow-up, with better survival, of the en bloc transplants (Fig. 1).

In more recent studies, the en bloc kidney transplantation has been compared with living donor transplant. Kalathil et al. published in 2006\textsuperscript{17} a review of 72 transplants en bloc versus 75 transplants from living donors. With comparable groups of recipients, despite increased cold ischemia time, greater initial graft dysfunction, and greater initial loss of grafts due to vascular complications, they showed superiority to living donor transplants in relation to the glomerular filtration, renal function, and comparable proteinuria ranges, in an 8-year follow-up. The fact of reporting 26.3% initial graft dysfunction can be attributed to the prolonged cold ischemia of this group of transplants (30 h).

Amit et al. published in 2011\textsuperscript{18} a series comparing 22 en bloc transplants versus 215 living donor transplants. In this study, with comparable groups of recipients, the authors

Figure 1 Kidney graft survival in young recipient adjusted according to donor type. EC Donor: expanded criteria; standard donor: 18–59-year-old donor; simple pediatric donor: simple graft donor <5 years old; EBKT: en bloc kidney transplant <5 years old.

describe 0% loss of grafts transplanted en bloc due to vascular thrombosis, despite having 1/3 of the donor group aged less than 12 months and weighing less than 10 kg. The authors relate the shorter cold ischemia time with the absence of venous thrombosis and the low percentage of rejection episodes with the absence of thrombosis/arterial stenosis. With regard to the follow-up of these patients, greater graft survival and lower levels of creatinine of the patients transplanted en bloc are described compared to living donor recipient at 5 years.

Conclusions

After this review, we could consider that the en bloc kidney transplant from pediatric donor to adult recipient is feasible, and it can increase the number of transplants performed in a center, being a valid option (and clearly superior to transplants with expanded criteria) for young patients who are on the waiting list for kidney transplant.

It would be necessary to thoroughly evaluate the predictive causes of arterial or venous thrombosis of this type of transplants (weight/age of the donor, surgical technique, cold ischemia time, rejection episodes), since it is the leading cause of graft loss.

Conflict of interest

The authors declare that they have no conflict of interest.

References


