Economic evaluation of kidney transplantation versus hemodialysis in patients with end-stage renal disease in Hungary

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Record Status
This is a critical abstract of an economic evaluation that meets the criteria for inclusion on NHS EED. Each abstract contains a brief summary of the methods, the results and conclusions followed by a detailed critical assessment on the reliability of the study and the conclusions drawn.

Health technology
The use of cadaveric kidney transplantation (CKT) in patients with end-stage renal disease (ESRD).

Type of intervention
Treatment.

Economic study type
Cost-effectiveness analysis.

Study population
The study population comprised ESRD patients receiving CKT or haemodialysis, who were potential candidates for transplantation.

Setting
The setting appears to have been secondary and tertiary care. The economic study was carried out in Hungary.

Dates to which data relate
The effectiveness evidence was collected between 1994 and 1997. The resource use data appear to relate to the same period. The price year was 1997.

Source of effectiveness data
The effectiveness data were derived from a single study. The authors also made a number of assumptions when extrapolating the effectiveness results from the single study.

Link between effectiveness and cost data
It was unclear whether the resource use data were collected from the same sample population as that used in the effectiveness analysis. These data were collected retrospectively.

Study sample
No power calculations, to assure a certain power, were performed in the planning phase of the study. The ESRD patients included in the subset of the European Dialysis and Transplant Association during 1994 were considered for the effectiveness analysis. All the patients who underwent CKT in the authors' setting during the first half of 1994 were included in the intervention group (242 patients), while those on the waiting list for transplantation were included in the control group (840 patients). Therefore, the study sample comprised 1,082 patients. The authors reported that, on average, the patients in the control group (44.9 years) were younger than those receiving dialysis whom were not on a
waiting list (59.9 years).

**Study design**
This was a retrospective cohort study, which appears to have been multicentred. The duration of follow-up was 3 years or until the patient died, whichever was earlier. During the study period, 410 control patients received CKT. These patients were therefore excluded from the control group and included in the intervention group when they underwent transplantation: 123 of them during 1994, 170 during 1995, 82 during 1996, and 35 during 1997. The authors reported that there were no losses to follow-up.

**Analysis of effectiveness**
The primary health outcomes assessed at 3 years of follow-up were:

- the number of patients in the CKT group who died;
- the number of CKT patients who suffered graft loss and the number of them who received successful retransplants;
- the standardised mortality hazard functions and the standardised survival functions for both the intervention and the control groups;
- the relative risk of dying for patients continuing on dialysis in comparison with CKT patients;
- the absolute and relative reductions in mortality rates; and
- the number-needed-to-treat (NNT) by transplantation to avoid one death in comparison with haemodialysis.

A Cox regression analysis was used to calculate differences in mortality between the intervention and the control groups for potential confounding factors (age, gender and length of ESRD before the study commenced). The patients in the control group were older and had a longer average period of renal replacement therapy than those in the intervention group.

**Effectiveness results**
The number of CKT patients who died after 3 years' follow-up was 40 (16.5%).

The number of CKT patients who suffered graft loss was 44 (18.2%). Seven of them received successful retransplants during the study period.

Patients continuing on dialysis had 3.5 times greater risk of dying after 3 years' follow-up than did CKT patients, (p<0.0001).

Compared with control patients, the absolute reduction in mortality rates for CKT patients was 5.6% and the relative reduction was 27.7%.

The NNT by transplantation to avoid one death after 3 years' follow-up, compared with haemodialysis, was 18.

**Clinical conclusions**
Patients receiving CKT had a higher probability of surviving after 3 years of transplantation than did those receiving haemodialysis.

**Methods used to derive estimates of effectiveness**
The authors made assumptions to derive some estimates of effectiveness.
Estimates of effectiveness and key assumptions
The absolute and relative reductions in mortality rates, and the NNT by transplantation, were extrapolated to 5 years by assuming that the mortality hazard function would remain the same during years 4 and 5. The resulting values for these effectiveness estimators were 13.4% (absolute reduction), 42.5% (relative reduction) and 7.5 (NNT), respectively.

Measure of benefits used in the economic analysis
The summary measure of benefit used in the economic analysis was the number of life-years saved. It was not stated how the number of life-years gained (LYG) was estimated, although it may have been obtained from the standardised survival functions for CKT and haemodialysis patients estimated in the effectiveness analysis. The mortality and survival data, however, referred to a standard 41.8 year-old patient with a 2.5-year history of ESRD.

Direct costs
The resource quantities were not reported separately from the costs. The direct costs considered in the economic analysis were those of the health service. These costs were for transplantation, haemodialysis, transportation for dialysis, outpatient care, inpatient care (excluding transplantation) and medication (both immunosuppressive therapy and dialysis drugs). The transplantation costs included the costs of donor reporting, donor management, donor procuring, and those costs related to second kidney transplant. The resource use data came from the National Health Insurance Fund database, the Gyogyinfok department, and the Hungarian Nephrological Society. Therefore, the costs appear to have been estimated from actual data. Discounting was not performed in the base-case analysis, although it would have been relevant since the costs were incurred during the whole study period (i.e. 3 years). The study reported the average 3-year costs per patient. The price year was 1997. The authors reported that inflationary adjustments were unnecessary as the 1997 costs were applied to the resource use data obtained.

Statistical analysis of costs
The authors provided mean values and standard deviations (SDs) for each cost category considered in the economic analysis. They stated that the costs of the treatments considered at analysis were compared using parametric tests, but they did not report the type of test applied. They also did not report whether they tested that the data followed some specific distribution in order to assure the validity of these parametric tests.

Indirect Costs
The indirect costs were not reported.

Currency
US dollars ($). The conversion rate was Hungarian Forints 85.59 = $1.

Sensitivity analysis
One-way sensitivity analyses were performed to assess the robustness of the conclusions when the discount rate was modified (discount rates of 3% and 6%).

Estimated benefits used in the economic analysis
The numbers of life years gained with either CKT or haemodialysis were not reported. It was not stated whether the side effects were considered when estimating the benefits.

Cost results
The 3-year costs per patient were $109,197 (SD=47,548) for haemodialysis and $70,297 (SD=29,860) for CKT. The costs of adverse effects appear to have been considered.
Synthesis of costs and benefits
The costs and benefits were combined by means of cost-effectiveness ratios (CERs). These measured the cost per LYG with CKT and haemodialysis. The CERs were $44,846 per LYG with haemodialysis and $26,557 per LYG with CKT, (p<0.0001). The sensitivity analyses showed that the conclusions did not change when discounting was performed using rates of 3% and 6%.

Authors' conclusions
Kidney transplantation was more effective and cost-effective than haemodialysis for the treatment of patients with end-stage renal disease (ESRD), because it increased survival at 3 years after surgery at a reduced level of treatment costs.

CRD COMMENTARY - Selection of comparators
Haemodialysis was chosen as the comparator since it was the most commonly used treatment for ESRD patients in the authors' setting. An alternative comparator used in the authors' setting (i.e. peritoneal dialysis) was mentioned, but it was not chosen for this study. The authors justified the exclusion of peritoneal dialysis because the number of patients receiving it in their setting was small. You should consider which is the most commonly used health technology in your own setting.

Validity of estimate of measure of effectiveness
The study was a retrospective cohort study, which may have been appropriate to adapt the study to the available data. However, a randomised controlled trial, using randomised allocation and blinded assessment of outcomes, would have been more likely to avoid bias. Moreover, the retrospective nature of the study may have led to additional bias due to the loss of information. The authors showed that the control group (i.e. patients on the waiting list) presented significant differences in terms of age when compared with the ESRD patients not on the waiting list for kidney transplantation. It should be considered, however, that patients might not be on the waiting list because their age renders them ineligible for transplantation.

The study sample appears to have been representative of the study population since all ESRD Hungarian patients who underwent kidney transplantation during 1994, and those receiving haemodialysis while waiting for a transplant during the same period, were included in the analysis. The patient groups presented statistically significant differences in terms of age and average period of renal replacement therapy. These confounding factors appear to have been considered when estimating the effectiveness results in a Cox regression analysis. The authors reported that the study did not have sufficient power to show statistically significant advantages for transplantation in comparison with haemodialysis. This may be the reason why only some statistical analyses of effectiveness were reported and the effectiveness results appear to have been reported selectively.

Validity of estimate of measure of benefit
The estimation of benefits seems to have been directly obtained from the effectiveness analysis, although it was unclear how the authors estimated the number of LYG with each of the alternative treatments. It would also have been useful if the number of quality-adjusted life-years (QALYs) gained had been considered. However, the authors commented that data on QALYs were not available, but kidney transplant patients enjoy better quality of life in comparison with haemodialysis patients. The authors acknowledged the limitation of assuming that the mortality hazard function would remain the same in extrapolated years 4 and 5, but stated that this protocol was required to examine longer-term survival.

Validity of estimate of costs
No indirect costs associated with the treatments analysed were considered in the analysis. However, they are relevant and it would have been interesting had they been included. The perspective adopted was that of the health service. All the categories of costs related to the health service perspective appear to have been included in the economic analysis. The resource quantities and the costs were not reported separately, which hinders generalising the results to other settings. The mean values and SDs of the different cost categories were reported, and some parametric tests were
performed. The price year was clearly stated. Discounting was not performed in the base-case analysis, although it was relevant since the costs were incurred during more than 2 years. Sensitivity analyses applying alternative discount rates showed that the conclusions did not alter when discounting was varied.

Other issues
The authors made some comparisons of their findings with those from other studies. They stated that their findings confirmed those from other studies, which showed kidney transplantation to be more effective and cost-effective than haemodialysis. The issue of the generalisability of the results was not addressed. The authors' conclusions reflected the scope of the analysis.

Implications of the study
The authors stated that this is the first comprehensive Eastern European economic evaluation comparing CKT and haemodialysis. They recommended that efforts should be made to increase organ donation rates in Hungary.

Source of funding
None stated.

Bibliographic details

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Other publications of related interest


Indexing Status
Subject indexing assigned by NLM

MeSH
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