



Original Research

The impact of distance from transplant unit on outcomes following kidney transplantation



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HIGHLIGHTS

- Impact of distance between home and transplant unit is considered.
- Distance does not affect acute rejection or renal graft survival.
- Distance does not affect patient survival after transplant.

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ABSTRACT

Background: Following transplantation, many patients travel long distances for follow-up care. Many studies have examined the influence of distance from transplant centre on access to transplantation, but few have examined post-transplant outcomes.

Materials and Methods: Distance from transplant centre was calculated for all kidney transplant recipients transplanted over a 5-year period. Outcomes measured were rates of acute rejection, graft and patient survival.

Results: Complete follow up data was available for 571 of the 585 kidney transplants performed over the study period. Distance from home to transplant centre ranged from 1.3 to 257.4 km (median 33.7 km). Patients were divided into quartiles according to their distance from the transplant centre. Distance from the transplant centre did not influence rates of acute rejection ($p = 0.102$). One-year graft survival for 'nearest' and 'farthest' quartiles was 99% and 97% respectively and five-year graft survival was 78% and 89% respectively (log rank p -value of 0.212). There were no differences in patient survival at 1 and 5 years between the 'nearest' and 'farthest' groups.

Conclusion: Distance from transplant centre does not affect early outcomes following kidney transplantation. The centralized practice which involves a low threshold for rapid assessment and readmission of patients post-transplantation appears to provide good outcomes for kidney transplant recipients.

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1. Introduction

There are 24 renal transplant centers in the United Kingdom (UK) serving a population of 64.1 million. In Wales, the only transplant centre is in Cardiff, serving a population of 2.3 million and covering a geographical area of over 14000 square kilometres. As a result, some patients are required to travel a long distance to the transplant centre both to undergo the transplant procedure and

also for their early transplant follow-up.

Many studies have evaluated the impact of distance on access to transplantation [1–6] but few have specifically evaluated post-transplant outcomes. A study of all patients on the US kidney transplant waiting list from 1999 to 2009 examined the impact of distance from transplant centre and access to deceased donor transplants and found those living further from the centre were less likely to receive a deceased donor transplant and had increased risk of post-transplant death. However this was likely due to the system of offering organs within a geographical region first, and despite an increase in post-transplant death there was no increased risk of

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Abbreviations

DBD	Donation (or Donor) after Brainstem Death
DCD	Donation (or Donor) after Cardiac Death
CIT	Cold Ischaemic Time
BPAR	Biopsy-Proven Acute Rejection

graft failure for those living farther [6]. An Australian study examined the influence on living more or less than 200 km from the national pancreas transplant unit on pancreas graft survival but found no difference despite significantly longer cold ischaemic times [7]. Another study evaluated the impact of distance from home to transplant centre on outcomes after heart transplantation and found that long-distance was not associated with any increase in adverse outcomes [8].

One study from the United States examined the impact of distance on the long term outcomes of all patients undergoing kidney transplantation between 1995 and 2003 and found graft survival to be worse for those living nearer transplant centers but the authors concluded that this was due to poorer socioeconomic status in inner cities [9].

It is well known that socioeconomic deprivation does influence outcomes for patients with various health conditions. Several studies have shown that chronic diseases including ischaemic heart disease, diabetes and renal failure are more prevalent in patients from more deprived areas [10–13]. Patients from poorer socioeconomic areas are also less likely to receive a living donor transplant and have reduced access to deceased donor transplants [14,15]. A study from this centre has also previously shown that socioeconomic deprivation affects outcomes following kidney transplantation, with higher rates of acute rejection and poorer graft survival for those from less economically advantaged areas [16].

The influence of cold ischaemic time following kidney transplantation is also well known. An analysis of kidney transplants performed between 1995 and 2001 in the United Kingdom showed that longer distances between transplant centers adversely influenced graft survival as a result of an increased CIT, although this study did not examine the effect of distance from patient home to centre [17].

Given that both deprivation and cold ischaemic time affect outcomes for kidney transplant recipients it would be interesting to know whether the distance between a patient's home and their transplanting centre might also relate to such outcomes. It is perhaps surprising that there are no previous published studies that have assessed this relationship in the United Kingdom, where although healthcare is universally available free at the point of contact, wide variations exist in terms of the distances individual patients need to travel to receive that care. The need to concentrate specialist services such as transplantation in regional centers is obvious, but how this affects outcomes for patients at the periphery of those regions is less well known.

The aim of this study therefore, was to investigate the impact of distance between a patient's home and their transplant centre on outcomes following kidney transplantation in the United Kingdom.

2. Materials and methods

2.1. Ethical approval

Ethical approval was not required for this observational study as in accordance with Health Research Authority guidelines.

2.2. Patient population

All patients who underwent a kidney-only transplant between April 2009 and March 2014 were identified from a prospectively updated and maintained database. Simultaneous pancreas and kidney transplant patients were excluded. Cardiff Transplant Unit provides all services for its local population and also regional services for surrounding health boards. All patients, regardless of where they live, are followed-up in Cardiff Transplant Unit (CTU) for the first 6 months, after which time follow-up is continued in their local renal unit (that for 60% of the recipients is still Cardiff). During this 6 months patients are living at home but commute to CTU for clinic appointments.

Patients receive a standard immunosuppression regime consisting of: induction (ATG for all DCD transplants under 70, basiliximab for all DBD transplants and DCD over 70) and standard maintenance with triple therapy (tacrolimus, mycophenolate mofetil/mycophenolate sodium and prednisolone).

Demographic data was collected on the donors (age, gender, cold ischaemic time, type of donor) and recipients (age, gender, deprivation score), and HLA-DR mismatch. The primary outcome measures were the presence of biopsy-proven acute rejection (BPAR) episodes, and also one and five year graft and patient survival. Graft failure was defined as re-commencement of dialysis.

2.3. Calculation of distance

Distance and estimated time for travel to the transplant unit was calculated from the patients' postcodes using an online mileage calculator, the AA Route Planner [18].

2.4. Calculation of deprivation

Deprivation scores were calculated using the Welsh Index of Multiple Deprivation (WIMD) based on patients' postcodes. WIMD is the Welsh Government's measure of relative deprivation for small areas in Wales. It is based on 8 domains; income, employment, health, education, access to services, community safety, physical environment and housing. Scores are calculated for each domain and then combined to produce an overall score for every postcode in Wales.

2.5. Statistical analysis

Distance data were analysed in quartiles with quartile 1 being patients living closest to the transplant centre and quartile 4 being those living furthest away. Data were also analysed in 2 groups based on whether the patient lived within the same local health board (local catchment area) as the transplant centre or whether they resided in one of the surrounding health boards.

Data analysis was carried out using GraphPad Prism Version 6 software. Chi squared test for association was used to analyse the observed and expected frequencies and a p-value of <0.05 was used for any differences deemed to be significant.

Graft survival times were censored for death. Graft failure dates were defined as the date for re-commencement of dialysis therapy. Cumulative survival was calculated using the Kaplan-Meier life table method and differences in survival between groups of patients were analysed by the log rank method.

3. Results

3.1. Patient demographics

Between 1st April 2009 and 31st March 2014, 585 kidney-only

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