Nocturnal hemodialysis: three-year experience

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
Nocturnal home dialysis. Patients were dialysed while asleep, connected to an automated computer operated dialysis machine (a modified Fresenius 2008H machine) and with remote monitoring from the hospital nocturnal dialysis centre. Frequency of dialysis was 6 or 7 nights per week and the duration was 8 to 10 hours per night. Blood flow was 300 ml/min and dialysate flow 100 ml/min.

Type of intervention
Treatment.

Economic study type
Cost-effectiveness analysis.

Study population
Patients with end-stage renal disease who were able to be trained for home dialysis and were motivated to perform home dialysis at least 6 nights in 7.

Setting
Community and hospital. The economic study was carried out in Toronto, Canada.

Dates to which data relate
The effectiveness and resource use data were collected between April 1994 and January 1997. No dates were given for costs.

Source of effectiveness data
Effectiveness data were derived from a single study.

Link between effectiveness and cost data
Costs were not based on the same sample as that used in the effective study, but were projected from the sample used in the effectiveness study to a hypothetical unit size of 30.

Study sample
Power calculation were not used to determine sample size. The sample was chosen from a pool of 160. It is not clear whether this pool fulfilled all of the eligibility criteria. The main eligibility criteria were a willingness to participate and capability of being trained. The ability to speak English was considered necessary as was appropriate housing. All patients selected were stable. Sample size was limited by lack of funding and there were more available patients than could be used. How the sample was chosen was not explained and the percentage excluded and reasons for exclusion
were not given. 13 patients were selected for training and 12 completed the training.

**Study design**
This was a before-and-after study, carried out in a single centre. Duration of follow up was from 3 to 34 months (mean of 15.6 months) from the end of training. Patients were monitored for 3 months before entry to the programme to provide "before" data. One patient was removed from the programme after training because of poor adherence to the dialysis method. This gave a drop out rate of 8.3%.

**Analysis of effectiveness**
Analysis was based on treatment completers only. A further patient left the programme after 18 months due to a kidney transplant and was kept in the analysis. Primary health outcomes were multiple and included:

1. subjective improvement in patient well being measured by the ability to work,
2. haemodynamic stability,
3. weekly removal of phosphate,
4. beta2 microglobin levels,
5. the need for patients to use phosphate binders,
6. the amount of blood pressure control and number of medications needed.

As this was a before and after study, groups had the same age, sex and clinical characteristics.

**Effectiveness results**
Most patients reported increased energy and well being. Eight patient were of working age and not disabled and, before the programme 3 were not working, 3 worked part time and 2 worked full time. After conversion to the programme 6 were working full time and 1 part time while the remaining patient was seeking employment.

Haemodynamic stability was good in patients under both regimes.

Phosphate removal during each session of nocturnal dialysis was similar to conventional dialysis and the weekly removal of phosphate was 150 (+/- 47) versus 82 (+/- 22) mmol, (p=0.0006).

The amount of beta2 microglobin removed per week was 52.13 (+/- 10.6) mmol under nocturnal dialysis and 12.14 (+/- 2.09) mmol under conventional dialysis, (p < 0.0001).

The need for patients to use phosphate binders was less under nocturnal dialysis.

The amount of blood pressure control and number of medications needed was reduced. Of 11 patients with more than 6 months follow up, 10 were on antihypertensives at conversion and only 5 remained on them at exit from the programme or at last follow up. The average number of hypertensives agents taken decreased from 2.67 (+/- 1.12) to 1.78 (+/- 1.2) at 6 months and to 1.67 (+/- 1.17) at 12 months, (p=0.03).

**Clinical conclusions**
Nocturnal haemodialysis is the most efficient form of dialysis and is well tolerated by patients. It "provides the highest clearance of any dialysis modality currently in use in chronic dialysis patients."

**Measure of benefits used in the economic analysis**
The authors did not use a specific measure of benefit.

**Direct costs**
Costs were not discounted. Quantities and costs were not analysed separately. Costs were projected assuming a unit servicing 30 patients rather than the 11 who actually followed the programme and were estimated as a cost per patient year. Consumables, telecommunications and personnel were included. Purchase of the dialysis machine, water treatment and alterations to the patient's home were not included. Methods of estimating costs were not given and the cost boundary was not clear, although it appears to have been that of the health service. No cost estimates were given for the comparator and no cost date was reported.

**Currency**
Canadian dollars (Can$).

**Estimated benefits used in the economic analysis**
Not applicable.

**Cost results**
Using nocturnal dialysis the cost of consumables was Can$23,000 per patient year and, in a unit of 30, the approximate cost of remote monitoring would be Can$2,000 to Can$3,000 per patient year. This is said to be comparable to continuous ambulatory peritoneal dialysis and only slightly higher than conventional home dialysis. However cost estimates for these were not given. No costs were given for the comparator used in the study.

**Synthesis of costs and benefits**
Costs and benefits were not combined.

**Authors' conclusions**
Nocturnal dialysis was the most efficient form of dialysis at low cost. If the number of patients per unit were increased to 30 being monitored at one time, cost-effectiveness would be increased.

**CRD COMMENTARY - Selection of comparators**
The reason for the selection of the comparator was clear.

**Validity of estimate of measure of benefit**
This was a very small study of a before-and-after design and, as such, was not as reliable as a randomised controlled trial. However, the authors made clear that this was a preliminary publication and that the benefits found in this small group of patients were highly significant.

**Validity of estimate of costs**
The authors stated that detailed financial analysis had not yet been undertaken, and, until this was done, no estimate could be made of the cost-effectiveness of the strategy. It would have been helpful, as an interim measure, if cost estimates could have been provided for the comparator. As acknowledged by the authors, cost results may differ in other settings or countries.

**Other issues**
This innovation in dialysis may be highly important and it was therefore worthwhile publishing preliminary data.
However, until more data are available and, in particular, reliable cost estimates, no judgement can be made of its cost-effectiveness.

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