

# Home dialysis therapies

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## ABSTRACT

Home dialysis therapies offer a significant benefit to patients in respect of quality of life and autonomy, as compared with in-centre haemodialysis. There is significant unwarranted variation across the world in the availability of both peritoneal dialysis (PD) and home haemodialysis, which has led in the UK to a recommendation of a minimum 20% prevalent rate of dialysis patients at home. Key advances in PD have included changes in the approach to prescribing PD and the use of assisted dialysis. Peritonitis remains a significant complication which may present to general physicians and needs prompt recognition and treatment. The development of novel small dialysis machines has led to a resurgence of interest in home haemodialysis.

## Introduction

Home dialysis therapies enable people with kidney failure (end-stage kidney disease) to receive treatment in their own home, forming one part of the range of kidney replacement therapies available to treat the 70,000 people across the UK with kidney failure. Pre-emptive renal transplantation (transplantation prior to the need for dialysis) remains the ideal treatment where possible. However, due to a variety of factors, including late presentation to renal services, the absence of a live donor, or the burden of comorbidity, this is not achieved often. Equally, for a number of people with significant frailty or of advanced age, then a non-dialytic supportive care approach may optimise quality and possibly length of life. Approximately 7,000 people started kidney replacement therapy in the UK in 2022,<sup>1</sup> but only 6% did so with a pre-emptive transplant; the remainder started on dialysis, with the majority (72% of all patients) receiving in-centre haemodialysis, attending hospital or a clinic three times a week for treatment.

## Home dialysis uptake

Home dialysis has been available in the UK for decades, in the form of either peritoneal dialysis (PD) or home haemodialysis (HHD). Initially, dialysis was predominantly delivered at home due to the financial and logistical constraints associated with the long dialysis regimens, but the increasing number of people needing dialysis and the possibility of shorter treatment sessions delivered at scale led to a movement towards in-centre haemodialysis.

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More recently there has been an increased focus on supporting access to HHD and PD, culminating in the GIRFT (Getting It Right First Time) Renal Medicine report,<sup>2</sup> which identified improved access to home dialysis as a key recommendation, with the expectation that 20% of the prevalent dialysis population at each renal unit is dialysing at home. This is based upon good evidence that home dialysis therapies offer advantages to patient experience and quality of life, without any clear differences in clinical outcomes between in-centre haemodialysis, HHD and PD.<sup>3</sup> The inflexibility and rigidity of in-centre haemodialysis is one of its major drawbacks, with patients having little control over the thrice-weekly slots of 3–4 hours in length. This is compounded by the need for transport to and from dialysis, which patients consistently report as a poor experience, with long journeys and waiting times.<sup>4</sup> Home dialysis therapies avoid transport and offer a far greater degree of autonomy, flexibility and 'life participation', which is valued by patients. HHD and PD are at

## Key points

Home dialysis therapies includes home haemodialysis and peritoneal dialysis; these therapies are associated with improved patient experience and quality of life when compared with in-centre haemodialysis

The renal medicine Getting It Right First Time (GIRFT) recommendations have identified that each renal unit should be ensuring home therapies are promoted and that a minimum of 20% of prevalent dialysis patients should be dialysing at home in an attempt to address unwarranted variation.

Peritoneal dialysis (PD) offers a simple home dialysis therapy that can be offered initially to many people, particularly those with residual kidney function.

Physicians should suspect PD-associated peritonitis in any PD patient presenting unwell with non-specific or gastrointestinal symptoms and should initiate prompt treatment.

Novel home haemodialysis technologies, predominantly the development of smaller machines, have lowered the barrier for haemodialysis at home.

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least cost-equivalent if not cheaper than in-centre haemodialysis.<sup>5</sup> The portability of PD, in particular, lends itself to facilitating travel both locally and worldwide.

These advantages were further accentuated by the increased risk experienced during the COVID-19 pandemic by individuals on in-centre haemodialysis, who despite their increased vulnerability to the virus through comorbidity and age still had to attend dialysis appointments thrice-weekly even in the period of lockdown,<sup>6</sup> while patients on home dialysis were able to continue to shield.

The major drawback associated with dialysis at home is the space taken up by dialysate and supplies, though with careful delivery schedules the disruption can be minimised. There are also concerns about the burnout associated with the ongoing responsibility for self-care; this can be mitigated for those on HHD with respite in-centre care.

Despite the potential advantages of home dialysis, there are wide disparities in uptake across the UK; 23% of people start dialysis at home, predominantly on PD, but this varies from 6% to 43% dependent upon the unit.<sup>1</sup> This unwarranted variation arises in part due to differences in clinical culture, capacity and practices between renal units.

## Peritoneal dialysis

PD is the most widely used home dialysis therapy in part due to its simplicity – training takes 2–5 days – and is most likely to be used at the start of dialysis. It is most effective when patients still have residual kidney function, ie there remains some contribution from the failing kidneys to both solute clearance and fluid control. To be most effective, it needs to be used as a continuous therapy, such that there is consistently fluid in the patients peritoneal cavity, with regular exchanges. This, however, ensures that the side-effects associated with the intensity of haemodialysis sessions, in particular post-dialysis fatigue as well as cardiovascular instability, are reduced.

PD is available in two predominant formats: continuous ambulatory PD (CAPD) and automated PD (APD). APD allows a large number of dialysis exchanges to be automated overnight by the use of an APD machine, increasing patient freedom during the day, but it requires the patient to be attached via their PD catheter throughout the night, in contrast to CAPD where the only attachment is during the two to four exchanges across the day. Innovations in remote patient monitoring have improved the support at home for people on APD, with teams able to monitor and intervene upon the APD machine at a distance.

Historically, the prescription of PD was based upon arbitrary measures of small molecule clearance, particularly urea ( $Kt/V_{urea}$ ), for which there is little evidence from randomised trials of association with mortality. With an increasing recognition of the harm associated with dialysis delivery,<sup>7</sup> there has been a shift from biochemical concepts of dialysis ‘adequacy’ towards a person-centred approach. This addresses wellbeing, nutrition and fluid status, where biochemistry is only one part of an assessment to personalise the dialysis prescription with the intent to deliver high quality goal-directed dialysis, balanced against the burden of dialysis.

A significant innovation of the last 20 years has been the development of assisted PD programmes in the UK. While, in the broadest sense, assisted PD includes family supporting the patient with dialysis exchanges, this usually involves 1–2 visits per day by a community healthcare worker to support either APD machine set-up or perform CAPD exchanges. This has enabled the delivery of PD to the

### Box 1. Diagnostic criteria for peritoneal dialysis (PD)-related peritonitis

Diagnosis of PD-peritonitis requires two of the following three features:

- > Clinical features consistent with peritonitis
- > Abdominal pain and/or cloudy dialysis effluent
- > Raised white cell count in dialysis effluent
- > >100 white cells/ $\mu$ L after a dialysis dwell time of at least 2 hours
- > >50% polymorphonuclear leukocytes
- > Positive dialysis effluent microbiological culture

older and/or frail patient, who historically would not have had access to a home therapy and would have had to default to in-centre treatment.<sup>8</sup>

The most common complication of PD is infection, notably peritonitis; however, haemodialysis carries similar infection risk. Ideally, patients should have direct access to their renal unit 24 hours a day, as management, including intra-peritoneal antibiotics, requires specialist care.<sup>9</sup> Nonetheless, many patients will present to the general physician; peritonitis should be suspected in any patient on PD who presents with abdominal pain, gastrointestinal symptoms, reports cloudy peritoneal fluid, or is non-specifically unwell. Diagnosis is based upon clinical assessment and peritoneal dialysate microbiological assessment (Box 1). There is a significant morbidity and mortality associated with peritonitis which can be reduced by prompt antibiotic treatment, which, when intra-peritoneal delivery is not immediately possible, can be initiated with parenteral antibiotics covering both Gram positive and negative organisms (Box 2). Peritonitis rates are a key marker of quality of care at unit level and are a target of ongoing quality improvement initiatives in many regions to improve both peritonitis rates<sup>10</sup> and outcomes to improve patient care.

## Home haemodialysis

While many patients may start dialysis on PD, HHD offers more effective fluid removal in those who have lost residual kidney function. Training is more complex and takes 2–4 weeks. It is possible to train

### Box 2. Initial management of suspected peritoneal dialysis (PD)-related peritonitis

#### First steps:

- > Carry out clinical evaluation
- > Examine PD catheter exit site and tunnel for evidence of infection
- > Ask patient, if possible, to drain out fluid
- > Send dialysis effluent for urgent white cell count and differential, Gram stain and culture
- > Contact local renal unit

#### If evidence of PD-peritonitis:

- > Start treatment immediately once samples are sent
- > If intra-peritoneal antibiotics cannot be administered, commence intravenous antibiotics
- > Ensure Gram-positive and -negative cover
- > If using intraperitoneal antibiotics, allow to dwell for 6 hours
- > Arrange urgent transfer to local renal unit

patients directly onto HHD, but many start dialysis in-centre before transitioning home. This transition has been improved by the Shared Haemodialysis Care programme,<sup>11</sup> a quality-improvement project implemented across the UK to empower patients on in-centre HD to participate and manage their own care through a range of tasks, with some moving to dialyse independently at home.

Despite the advantages in quality of life, the UK HHD population is small (around 1,400 people), but for this group the flexibility of doing more frequent but shorter dialysis sessions or long nocturnal dialysis sessions can translate into an improved symptom burden and possibly a relative survival advantage compared to in-centre haemodialysis.<sup>12</sup> One of the challenges with in-centre haemodialysis is the 2-day-long gap that occurs with thrice-weekly sessions spread over 7 days.<sup>13</sup> This inter-dialytic gap is associated with increased mortality and hospitalisation, but can be overcome by the use of alternate-day dialysis at home.

In the last few years, developments in HHD technology have meant that patients have access to smaller machines, which are robust, easy to troubleshoot, quick to set up and put away, and are associated with the generation of minimal waste, reducing the barrier to dialysis at home.<sup>14</sup> Examples of these machines include the SC+ device (Quanta Dialysis Technologies), the Tablo<sup>®</sup> machine (Outset Medical) and the NxStage system (Fresenius Medical Care). While each system has its advantages and disadvantages and patient training is system-specific, these innovations may allow more people to benefit from HHD.

## Summary

There is a resurgence in enabling patients to be able to choose to dialyse at home, either through home haemodialysis or peritoneal dialysis based upon improvements in quality of life compared to in-centre haemodialysis. Innovations in assisted PD, personalised dialysis prescriptions and novel dialysis technologies may enable more people to with kidney failure to be treated at home. ■

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