Catheter lock solutions are instilled into central venous access systems to have certain effects in this location. These access systems can be either dialysis catheters, Hickman- type lines or port-a-cath systems. The latter are used mainly in parenteral nutrition and for the administration of medication in oncology patients. These access systems are approved as medical devices and are CE marked. The central venous access is inserted in the subclavian, jugular or femoral veins.

The use of Antimicrobial Lock Solutions have been recommended in the “Hygiene Guideline complementing the German Dialysis Standard” and in the Position statement of European Renal Best Practice (ERBP)”. Pure heparin solutions containing no antimicrobial agent do not meet this criterion. Antibiotics are associated with the development of resistancy which is a major drawback. Highly concentrated citrate solutions and taurolidine-citrate solutions are therefore conceivably useful in this application.

Highly concentrated citrate solutions (30% and 46.7%) cause major adverse effects such as cardiac arrests and embolisms that are a significant risk for the patient. TauroLock™ as an antimicrobial lock solution has proven useful in dialysis, oncology and parenteral nutrition for many years and has meanwhile become established in the prevention of catheter-related infections.

TauroLock™ prevents catheter infections:

The requirements of antimicrobial catheter lock solutions:

What should they do and what can they do?

Antimicrobial catheter lock solutions:

- What should they do and what can they do?
- Catheter lock solutions are instilled into central venous access systems to have certain effects in this location. These access systems can be either dialysis catheters, Hickman- type lines or port-a-cath systems. The latter are used mainly in parenteral nutrition and for the administration of medication in oncology patients. These access systems are approved as medical devices and are CE marked. The central venous access is inserted in the subclavian, jugular or femoral veins.

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TauroLock™ is safe:

- TauroLock™ is biocompatible and non toxic. In contrast to highly concentrated citrate there is no protein precipitation if using TauroLock™.


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Peritoneal dialysis home visits: A review of timing, frequency and assessment criteria

Trish Buena, Peter Tregaskis and Malcolm Elliott

Submitted: 7 November 2017, Accepted: 4 June 2018

Abstract

Peritoneal dialysis is a type of renal replacement therapy required by patients with end-stage renal disease. Visits by nurses to the homes of these patients are a common clinical practice and may increase the likelihood of therapy compliance or reduce the risk of technique-associated infections. Although the International Society for Peritoneal Dialysis provides guidelines on reducing the risks of dialysis-related infections, it provides few recommendations for other home visit practices.

This paper is a narrative review of literature on peritoneal dialysis home visit practices. The review focuses on clinical practices such as how frequently nurses complete home visits and what is assessed during the visit. The aim of the review is to provide evidence-based recommendations for providing peritoneal dialysis home visit services.

Nine publications were reviewed. This literature is characterised by case studies, recommendations and expert opinion, but with little overall consensus or evidence-based guidelines. The literature therefore represents a weak form of evidence.

Research using rigorous designs is needed to determine the impact home visit services have on peritoneal dialysis patients’ outcomes and how these visits should best be performed.

Introduction

Peritoneal dialysis (PD) is a type of renal replacement therapy required by patients with end-stage renal disease (ESRD). If eligible patients are trained and supported, they will be able to perform and manage their PD in the comfort of their home environment. Visits by PD nurses to the patient’s home serve as an opportunity to observe and assess many aspects of the patient’s ability to successfully complete their therapy.

Despite the importance of home visits, there are currently no evidence-based policies or protocols specific to the timing, frequency and assessment criteria for the monitoring and scheduling of these visits. The International Society for Peritoneal Dialysis (ISPD) states that visits by a PD nurse are usually recommended to detect problems with exchange technique, adherence to protocols, and other issues that increase the risk of infection (Szeto et al., 2017).

Keywords

peritoneal dialysis, home visits, guidelines.
The ISPD, however, does not provide further guidelines or recommendations for home visit practices.

This paper is a narrative review of literature focussed on PD home visit practices. The review focusses on practices, such as how frequently nurses complete home visits, what is assessed during the visit, and how effective the home visit structure is at managing patients. The aim of this review is to provide evidence-based recommendations for providing PD home visit services.

**Method**

**Search strategy**

A search was conducted of the CINAHL, Medline and Pubmed databases. Search terms used in various combinations were: peritoneal dialysis, patient home visits, guidelines, policies or recommendations.

**Inclusion criteria**

Publications were reviewed if they made recommendations for PD patient home visits and focussed on staff completing home visits, frequency of home visits, or the assessments conducted during visits. Publications were excluded for review if they were published before 2008 or were not in English.

**Evidence quality**

The Joanna Briggs Institute (JBI) Levels of Evidence for Effectiveness (JBI, 2014) and the National Health and Medical Research Council (NHMRC, 2009) additional levels of evidence were used to critically appraise publications (Tables 1 and 2).

**Results**

The initial search identified 59 studies. The title and abstract of publications were reviewed for relevance. After inclusion and exclusion criteria were applied, nine publications were identified for review (see Table 3). Based on the JBI criteria, the studies were level 3, 4 or 5 evidence (see Table 4). Using the NHMRC’s criteria, six studies were Level IV evidence and 3 received no classification (see Table 5).

### Why are home visits needed?

Numerous reasons were cited for performing home visits. These include the benefits of infection prevention, improved therapy compliance, retraining, preservation of residual renal function (RRF) and fostering patient autonomy and empowerment. The trending shift in patient preference for remaining home is also described (Baillie & Lankshear, 2014).

#### Infection prevention

Although infection prevention is cited as a reason for performing home visits, few studies demonstrated a link between home visits and reduced infection rates. Two which did found home visits reduced the rate of gram-positive peritonitis and patient hospitalisation, leading to improved longevity of PD therapy, and played a pivotal role in preventing infections by helping patients maintain a safe home environment (Kazancioglu et al., 2008; Martino et al., 2014).

Two studies recommend observing the patient's hand washing technique as part of the home visit (Alcaraz et al., 2008; Sayed et al., 2013). Sayed et al., (2013, p. 364) noted that the most commonly neglected steps of hand hygiene were the application of hand disinfectant before disconnection (84% of patients), application of hand disinfectant before connection (78%), avoidance of air drafts (40%) and washing hands with soap and water before the exchange (30%). Assessing the patient or caregiver’s daily exit-site care and dressing technique was also recommended (Sayed et al., 2013).

#### Therapy compliance

For the purpose of the review, PD compliance was defined as “the performance of at least 90% of all prescribed exchanges” (Bernardini & Piraino, 1997, p. 339). One study suggested that home visit programs can improve patient compliance, though the reasons were not clear (Ellis et al., 2010). The ISPD recommends that therapy retraining include the observation and correction of dialysis exchange technique, hand hygiene practices and catheter exit-site care to reduce the risk of developing PD-related infections (Piraino et al., 2011). No other recommendations were made for ensuring therapy compliance.

#### Autonomy and empowerment

Few studies explored the link between home visits and patient...
Table 3: Reviewed studies

<table>
<thead>
<tr>
<th>Authors</th>
<th>JBI level</th>
<th>NHMRC level</th>
<th>Sample population</th>
<th>Number of staff present at visit</th>
<th>Frequency of home visit</th>
<th>Assessment criteria at home visit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Szeto (2015)</td>
<td>3.b — systematic review of comparable cohort studies and other lower study designs</td>
<td>No classification: systematic review of comparable cohort studies and other lower study designs</td>
<td>Not applicable</td>
<td>Not specified</td>
<td>Not specified</td>
<td>Dialysis environment — home environment Knowledge and skill — exchange technique</td>
</tr>
<tr>
<td>Martino et al. (2014), Italy</td>
<td>3.d — case-controlled study</td>
<td>III-3: case-controlled study</td>
<td>188 PD adult patients</td>
<td>Not specified</td>
<td>Every three months Additional visit if medically suggested</td>
<td>Dialysis environment — exchange room — dialysis stock storage Knowledge and skill — exchange technique — dialysis compliance Medications</td>
</tr>
<tr>
<td>Peters (2014)</td>
<td>5.c — single expert opinion</td>
<td>No classification: single expert opinion</td>
<td>Not applicable</td>
<td>Not specified</td>
<td>Early visit ASAP Periodic visits Recently hospitalised</td>
<td>Dialysis environment — housing situations — water services — cleanliness — adequate lighting — hand washing facility — paper towels for drying hands — presence of ceiling or room fans, windows — presence of pets — dialysis stock storage — physical environment — safety hazards Knowledge and skill — exchange technique Patient health — equipment Medications Family and support — patient’s community — social support network — family functioning</td>
</tr>
<tr>
<td>Sayed et al. (2013), Sudan</td>
<td>4.c — case series</td>
<td>IV — case series</td>
<td>50 adult PD patients</td>
<td>Not specified</td>
<td>Start of home dialysis Regular intervals, no specified time frame</td>
<td>Dialysis environment — home environment Knowledge and skill — exchange technique — hand washing — exit site care — fluid maintenance Patient health — nutrition</td>
</tr>
</tbody>
</table>
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<th>Authors</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Ellis et al. (2012), USA</td>
<td>4.b</td>
<td>IV: A cross-sectional study</td>
<td>22 paediatric PD patients from 1 PD unit</td>
<td>Not specified</td>
<td>Not specified</td>
<td>Dialysis environment — home environment — exchange room — disposal of dialysis waste — dialysis stock storage — presence of pets Knowledge and skill — exchange technique — if patient had episode of peritonitis the preceding year Patient health — dialysis records — medical equipment: blood pressure, weigh scales, thermometer — state of dialysis machine Medications — correct dose, within date, storage Family and support — type of surrounding community (urban, city, rural) — type of living quarters — single family home, apartment, trailer</td>
</tr>
<tr>
<td>Alcaraz et al. (2008)</td>
<td>4.c</td>
<td>IV — case series</td>
<td>52 Adult PD patients</td>
<td>Not specified</td>
<td>Within first week after start of home dialysis</td>
<td>Dialysis environment — exchange room — dialysis stock storage Knowledge and skill — solution warming procedure — exchange technique — hand washing technique</td>
</tr>
<tr>
<td>Kazancioglu et al. (2008), Turkey</td>
<td>4.b</td>
<td>IV: A cross-sectional study</td>
<td>32 adult PD patients from 1 PD unit</td>
<td>2 nurses</td>
<td>Not specified</td>
<td>Dialysis environment — exchange room — home environment — dialysis waste disposal — condition of bathroom and/or toilet — dialysis stock storage Knowledge and skill — exchange technique — treatment details Patient health — personal hygiene — dialysis records — patient’s socio-economic status</td>
</tr>
</tbody>
</table>
Peritoneal dialysis home visits: A review of timing, frequency and assessment criteria

Table 3: Reviewed studies

<table>
<thead>
<tr>
<th>Authors</th>
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<th>NHMRC level</th>
<th>Sample population</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Kazancioglu et al. (2008a), Turkey</td>
<td>3.e</td>
<td>IV</td>
<td>32 adult PD patients</td>
<td>Not specified for some patients</td>
<td>2 nurses</td>
<td>Dialysis environment – home exchange room, Knowledge and skills – peritonitis prevention knowledge, Infection prevention knowledge, Patient health – constipation, Nutrition hygiene, Medications – handwashing and showering guidance</td>
</tr>
<tr>
<td>Lo et al. (2008)</td>
<td>5.b</td>
<td>Not defined</td>
<td>Not defined</td>
<td>Pre-dialysis for some patients</td>
<td>Not specified</td>
<td>Dialysis environment – home environment, Nutrition hygiene, Medications – handwashing and showering-guidance</td>
</tr>
</tbody>
</table>

autonomy. In one British study, PD patients expressed gratitude towards being able to manage their treatment at home, despite the challenges this can impose (Baillie & Lankshear, 2014). The long-term benefits of this, though, were not clear. Peters (2014) argues that feelings of depression or isolation that may lead to therapy noncompliance can be reduced by vigilant support, contact and monitoring by the PD team, though no evidence was provided for this.

Retraining

The need for retraining patients on the knowledge and skills acquired during pre-dialysis training was emphasised by five studies (Kazancioglu et al., 2008; Martino et al., 2014; Peters, 2014; Piraino et al., 2011; Szeto, 2015). However, despite the ISPD’s suggestion that retraining can reduce the
risk of peritonitis (Szeto, 2015), there are no evidence-based guidelines or policies that outline a schedule for periodic retraining. Peters (2014) suggests that retraining should occur at regular intervals and after significant events such as infectious episodes, prolonged hospitalisations or when PD staff suspect the patient may be performing unsafe practices.

**Staff performing visits**

Few studies specified the number of staff required per home visit. Two studies recommended that two PD nurses perform each visit, but reasons for this were not stated (Kazancioglu et al., 2008; Kazancioglu et al., 2008a). No rationales or evidence were prove for these recommendations.

**When should visits be performed?**

Five of the nine studies made recommendations for when home visits should be performed (Alcaraz et al., 2008; Lo et al., 2008; Martino et al., 2014; Peters, 2014; Sayed et al., 2013). There was little consistency in the literature, though, with recommendations including prior to therapy starting, within the first few weeks of therapy, and after a recent hospitalisation. None of these recommendations were supported by evidence.

**Follow-up**

There was no consistency in recommendations for the timing of home visits after the initial visit. One study recommended every three months (Martino et al., 2014). Two studies recommended follow-up visits but not a specific interval (Peters, 2014; Sayed et al., 2013). No rationales or evidence were prove for these recommendations.

**What should be assessed?**

Once the PD nurse is in the patient’s home, there are many issues requiring assessment. Those identified in the literature related to the patient’s health, the dialysis environment, and the patient’s knowledge and skill level, medication management and support system.

**Nutrition**

Two studies recommended assessing the patient’s nutritional status during a home visit (Kazancioglu et al., 2008; Sayed et al., 2013). One PD unit used a questionnaire to assess nutritional status by relying on the patient’s ability to recall their daily food intake and the amount of salt added to meals (Kazancioglu et al., 2008). Sayed et al. (2013) discuss the importance of assessing the patient’s understanding of their fluid maintenance, so that the patient can modify their fluid intake in the case of fluid overload or depletion.

**Personal hygiene**

As a part of the patient’s overall health and for infection-prevention measures, assessment of the patient’s personal hygiene was recommended by three studies (Kazancioglu et al., 2008; Kazancioglu et al., 2008a; Lo et al., 2008). These assessments include asking how frequently the patient bathed and washed their hands (Kazancioglu et al., 2008). One PD unit assessed if the patient had changed their underwear daily, taken a bath and changed the catheter dressing at least twice-weekly, had short, clean fingernails, brushed their teeth daily, and had performed genital cleaning and hair removal (Kazancioglu et al., 2008).

**PD records**

Most PD units required patients to keep daily records of their PD data, blood pressure and weight, in order to monitor therapy progress. These records are then reviewed by the PD nurse at the home visit. For a patient that is performing continuous ambulatory PD, Kazancioglu et al. (2008) discussed assessment of the patient’s dialysis records in further detail including if PD solutions are weighed and ultrafiltration calculated, blood pressure is measured and urine is measured once a week.

**Medical equipment**

Peters (2014) recommends assessment of the patient’s medical equipment at home. Ellis et al. (2010) specify the importance of having a working thermometer and smoke detector. Peters (2014, p.90) also suggests observing the patient operate the equipment in the home with “the distractions, interruptions, and disturbances that are inherent in that environment”, in order to ensure its proper usage.

**Dialysis stock**

Assessing storage of the dialysis stock and ancillary items is recommended by five studies (Alcaraz et al., 2008; Ellis et al., 2010; Kazancioglu et al., 2008; Martino et al., 2014; Peters, 2014). One unit evaluated if PD solutions were kept under non-humid conditions, were not exposed to direct sunlight, within the expiry date, kept in original packaging and if the packages were kept in the dialysis room (Kazancioglu et al., 2008). Peters (2014) recommended assessing for evidence of moisture, vermin, or extreme temperature changes in the storage area.

**Home environment**

All nine studies stated that holistic assessment of the home environment is paramount to ensure the patient has been able to adapt the environment to facilitate dialysis treatment. One study involving frequent home visits demonstrated the importance of maintaining a safe and convenient home environment for preventing PD-associated infections (Kazancioglu, 2008). Evidence from three studies suggests that a home visit allows for the detection of problems that may impact the safe performance of home therapy and thus the opportunity to either provide appropriate solutions or to make the necessary referrals to the allied health team (Peters, 2014; Sayed et al., 2013; Szeto, 2015).
Dialysis room

Five studies recommend the area the patient is performing PD be examined during the home visit (Alcaraz et al., 2008; Ellis et al., 2010; Kazancioglu et al., 2008; Kazancioglu et al., 2008a; Martino et al., 2014). Two studies recommended assessing how frequently the area was cleaned, and room configuration and ventilation (Kazancioglu et al., 2008, 2008a).

Pets

Pets are recognised as a safety hazard and potential risk factor for PD-related infections (Ellis et al., 2010). Despite this, no study recommended that pets be removed from the home environment or even when therapy is occurring.

Utilities and waste disposal

Three studies recommended assessment of the patient's bathroom and toilet, as this is where the majority of personal hygiene is performed (Ellis et al., 2010; Kazancioglu et al., 2008; Lo et al., 2008). One unit's practice included observing if dialysis fluid was appropriately disposed of (Ellis et al., 2010). Another evaluated if bleach was used to disinfect the toilet after dialysis disposal and if the medical waste was regularly collected by the council (Kazancioglu et al., 2008).

Knowledge and skill

Eight of the nine studies discussed the importance of reviewing the patient’s dialysis exchange technique at the home visit (Alcaraz et al., 2008; Ellis et al., 2010; Kazancioglu et al., 2008, 2008a; Martino et al., 2014; Peters, 2014; Sayed et al., 2013; Szeto, 2015). Whilst this was a common recommendation, it was not supported by evidence.

Exchange technique

Seven studies discussed the importance of observing the patient’s dialysis exchange or machine set-up technique to ensure that the patient continues to abide by the recommended procedures (Alcaraz et al., 2008; Ellis et al., 2010; Kazancioglu et al., 2008; Martino et al., 2014; Peters, 2014; Sayed et al., 2013; Szeto, 2015). Some argue that “a clean exchange procedure and good connection technique are essential factors in the prevention of peritonitis” (Alcaraz et al., 2008, p. 422). It is also recommended to evaluate the patient’s exchange technique after an episode of peritonitis, especially if the cause of the infection was touch contamination (Ellis et al., 2010; Szeto, 2015).

Therapy compliance

Patient compliance with PD therapy is critical for their health. Therefore, two studies recommend that compliance be closely monitored (Martino et al., 2014; Szeto, 2015).

Medications

Four studies recommended a review of the patient’s medications during the home visit (Ellis et al., 2010; Kazancioglu et al., 2008; Martino et al., 2014; Peters, 2014). One suggestion was to note the latest prescribed medications on record prior to the home visit and then comparing this with what the patient is actually taking (Ellis et al., 2010). Peters (2014, p. 90) highlighted the importance of not only performing home medication reconciliation, but to also identify if there is a “presence of home or non-traditional therapies”, which may negatively impact or cause unsafe interactions with the patient's prescribed medications.

Family and support

Two studies recommended assessing the type of family or social support the patient has (Ellis et al., 2010; Peters, 2014). This might include the patient’s social network or community support (Peters, 2014).

Discussion

Nine publications that focussed on the characteristics of PD home visits were reviewed. This literature is heavily characterised by case studies, recommendations and expert opinion, but with little overall consensus or evidence-based guidelines for PD home visit practices. The Joanna Briggs Institute rates this literature as Grade B evidence. The NHMRC rates the literature as Level D, which must be applied with caution. Despite the lack of high-level evidence literature to support the practice of PD patient home visits, the JBI (2013, p. 212) argues that health professionals should consider the “opinion of experts and the views of experienced clinicians and their professional bodies as valid forms of evidence for practice, especially when some intervention or activity is required in practice, even if no evidence from research exists”.

The literature makes many recommendations when visiting PD patients at home. These include assessing the patient’s therapy technique and support network. If the primary purpose of a home visit is to keep the patient at home and out of the hospital setting, then such visits are clearly worthwhile, despite limited evidence to support this. An example of the benefits of PD home visits is in reducing infections. The Australia and New Zealand Dialysis and Transplant Registry (ANZDATA) maintains data on PD-related peritonitis episodes in Australia (ANZDATA, 2016). The 2015 ANZDATA report (2016) showed a considerable overall drop in peritonitis rates in recent years. Despite this drop, peritonitis was the most common cause of technique failure in Australia in 2015 (ANZDATA, 2016). The ISPD (2016) guidelines for the prevention and treatment of peritonitis support home visit services by the PD unit, describing the practice as being “useful in detecting problems with exchange technique, adherence to protocols, and other
environmental and behaviour issues which increase the risk of peritonitis” (Kam-Tao Li et al., 2016, p. 3).

Endeavouring to address the varying factors that contribute to PD-related infections can be challenging and at times difficult for PD units. During the home visit, assessment of the dialysis environment, retraining the patient and family/carer, and assessment of patient knowledge and technique may contribute to reducing the risk of PD-related infections. Furthermore, noncompliance with performing all of the prescribed PD exchanges can be attributed to adverse health outcomes, increased rates of transfer to haemodialysis and increased hospital admissions (Bernardini et al., 2000). Russo et al. (2006) argue that patient adherence to the procedural technique and prescribed treatment is crucial for the prevention of adverse complications.

A home visit creates an opportunity to reinforce the importance of completing all prescribed exchanges and allows the nurse to identify patients who are non-compliant. The home visit also provides an opportunity for the PD nurse to assess the patient’s support network, community safety, and family dynamics within their own environment (Peters, 2014). It creates the opportunity to have a conversation with the patient and family about any cultural, religious or family-specific practices that may have an impact on the patient’s ability to perform the prescribed PD exchanges (Peters, 2014). The PD nurse could then work out a routine that is tailored to the patient’s lifestyle, as “failure to work within the patient’s value system is a recipe for failure and can lead to unsafe practices” (Peters, 2014, p. 89).

Finally, the physical and emotional health of the patient can also be assessed. Any concerns that require multidisciplinary intervention can then be referred to the appropriate services.

Conclusion
Home visits to patients performing PD are conducted for a variety of reasons, as identified in the literature. There are many recommendations for performing these visits, but the literature is characterised by weak forms of evidence. This review highlights the need for further research using rigorous designs to determine the impact that home visit services have on PD patients’ health outcomes and how these visits should best be performed.

References


TAKE THE FLEXIBLE APPROACH

ARGYLE™ FISTULA CANNULA FOR HAEMODIALYSIS

DATA & PRESSURE LIMITS

<table>
<thead>
<tr>
<th>Length (mm)</th>
<th>15G Flow Rate (ml/min)</th>
<th>Arterial Pressure (mmHg)</th>
<th>16G Flow Rate (ml/min)</th>
<th>Arterial Pressure (mmHg)</th>
<th>17G Flow Rate (ml/min)</th>
<th>Arterial Pressure (mmHg)</th>
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<tr>
<td>38 mm*</td>
<td>450</td>
<td>-214</td>
<td>300</td>
<td>-221</td>
<td>200</td>
<td>-188</td>
</tr>
</tbody>
</table>

Notes: Arterial Pressure should not exceed care provider guidelines. Results shown above achieved using 3-4cP Glyverin/Water Solution. The extracorporeal circuit includes devices in addition to the fistula cannula: observe the lowest flow rate for all devices within the system.

* The longest cannula was tested to represent the worst case scenario.