Can 2% chlorhexidine aqueous solution provide better infection control in PD exit site care when compared with 10% povidone-iodine: a single unit experience

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Submitted: June 2014, Accepted: August 2014

Abstract

Background: Exit site infection (ESI) is a significant contributing factor to high mortality and poor treatment outcomes in peritoneal dialysis (PD) patients. The aim of this review of clinical practice was to compare the effectiveness of two commonly used antiseptic solutions in PD exit site care.

Objective: To investigate if 2% chlorhexidine aqueous is more effective in PD exit site care when compared with 10% povidone-iodine for treatment of acute and suspected ESIs.

Context: A community dialysis unit and nephrology ward in regional Australia.

Methods: A retrospective review was conducted to compare the infection rate of using two different antiseptic solutions on acute and suspected infectious PD exit site care. From February 2012 a change in clinical practice was implemented; all existing PD patients were switched to 2% chlorhexidine aqueous solution from 10% povidone-iodine for treatment of acute and suspected ESIs. Infection rates were retrospectively identified for patients using 10% povidone-iodine in 2011 and compared with the infection rates for patients using 2% chlorhexidine aqueous in 2012.

Results: ESI rate decreased from 14 episodes (average 1 in 69 patient-months) in 2011 to 5 episodes (average 1 in 165 patient-months) in 2012.

Conclusion: This project provides data indicating that chlorhexidine aqueous is a good alternative antiseptic solution in the management of PD ESI when compared with povidone-iodine. Chlorhexidine aqueous may be more suitable for use as the first-line antiseptic solution on acute exit sites and suspected ESI.

Keywords
ESI, infection, exit site, PD, chlorhexidine, peritoneal dialysis, povidone-iodine

Introduction

Peritoneal dialysis (PD) is an effective treatment for end-stage kidney disease (ESKD) and is a good choice for patients wishing to perform a home dialysis modality (Lee & Park, 2012). PD patients require a Tenckhoff catheter to be inserted into the peritoneal cavity via the abdomen in order to complete this treatment. One of the risks associated with PD catheter implantation is exit site infection (ESI) (Crabtree, Fisherman, Siddiqi, & Hadnott, 1999). ESI is a significant contributing factor to high mortality rates and poor treatment outcomes in the PD population (O’Seaghdha & Foley, 2005); inappropriately treated ESI can develop into a tunnel infection and progress to peritonitis (Hain & Chan, 2013). In many cases, this means increased patient care hours, hospitalisation, and in certain cases catheter removal and modality transfer (Firanek & Guest, 2010). With this in mind, the development of superior infection prevention strategies is integral to the long-term success of PD (Lockwood, Hodgkinson, & Page, 2004).

Literature review

A review of the literature was conducted using a CIAP search system. Search terms used were: Betadine, povidone-iodine 10%, chlorhexidine gluconate 2%, aqueous solution, peritoneal
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dialysis, PD, exit site, ESI, central venous dialysis catheter (CVDC) and haemodialysis. The search was limited to full text articles printed in the English language and published between the years 1990 and 2013.

An antiseptic solution is recommended for exit site care to reduce numbers of microorganisms and avoid ESIs. The use of different antiseptic solutions for PD exit site care has been well discussed by Wong, who concluded that when choosing an antiseptic solution the goal of cleaning should be taken into consideration (2003). It is suggested that clinicians need to have a good understanding on the use of antiseptic solutions at different phases of wound healing; however, there is no clear recommendation on the best antiseptic solution for PD exit site care.

Povidone-iodine has been a favourite in wound management and PD exit site care due to its broad spectrum of germicidal activity including gram-positive and gram-negative bacteria, fungi and viruses (Atiyeh, Dibo & Hayek, 2009). However, research has identified that 10% povidone-iodine is cytotoxic in open wounds and delays wound healing (Wong, 2003; Tomlins, 2008). Apart from the risk of cytotoxicity to the patient, povidone-iodine can be absorbed through the percutaneous and mucous membrane, which can cause hypothyroidism and should be avoided with pregnant women, infants and patients with thyroid disorders (Thornton Spann, Taylor, & Weinberg, 2003; Atiyeh, Dibo & Hayek, 2009). Therefore, it is important that an alternative antiseptic solution is available to this patient cohort.

The literature review revealed minimal research into the use of chlorhexidine for PD exit site care, despite strong evidence from the literature of CVDC and surgical interventions supporting the use of this solution (Bhavan & Warren, 2009; Mimoz et al., 2007; Nishihara, Kajiura, Yokota, Kobayashi, & Okubo, 2012). Moreover, povidone-iodine shows less reduction in colonising skin micro-flora and shorter residual activity when compared with chlorhexidine (Thornton Spann, Taylor, & Weinberg, 2003; Bhavan & Warren, 2009); for this reason, chlorhexidine was considered by the project team as a potentially better solution for PD exit site care.

**Project aim**

To investigate if 2% chlorhexidine aqueous is a more effective antiseptic solution for acute and suspected infected PD exit site care when compared with 10% povidone-iodine.

**Ethics consideration**

Ethics approval was sought due to this project requiring the introduction of a new treatment product and photographing the exit site, and was approved by the Research Ethics and Governance Unit. (HNEHREC Reference No.12/02/15/5.09).

**Definitions**

There is no current standard definition for acute exit site, as units have different duration of break-in period after catheter insertion (Kopriva-Altfahrt, Konig, Mundle, Prischl, Roob, Weisholzer & Vychytil, 2009). The acute exit site was defined by the project team as the time from the break-in period; usually two weeks post-operation, until the catheter has been inserted for three months. After the three-month period, the exit site is considered healed appropriately to continue with chronic exit site care.

The International Society for Peritoneal Dialysis (ISPD) guideline recommends that healthy chronic PD exit sites do not require regular antiseptic solution; soap and water with daily dry dressing should maintain the cleanliness of exit sites (Li et al., 2010; Tomlins, 2008). As such, in this study the 2% chlorhexidine was only applied to acute exit site and chronic exit sites when pain or inflammation was identified, and regular antiseptic solution was not encouraged as a daily cleansing product for healthy chronic exit sites.

ESI was defined as “the presence of purulent drainage, with or without erythema of the skin at the catheter-epidermal interface.” (Li et al., 2010, p. 394). For the purpose of this project, we categorised the definition ESI into early- and late-stage ESI. Early-stage ESI was defined by the presence of pain or redness at the exit-site, and late ESI was defined by inflammation and/or purulent drainage at the PD exit site, confirmed by a positive wound swab and requiring treatment with antibiotic therapy. The Twardowski criterion scales for exit site appearance (Texido & Arias, n.d; Twardowski, 1996) was used by the project team to grade the patient’s exit site appearance to identify early signs of ESIs.

**Methods**

A 12-month retrospective review was conducted in a nephrology ward and large community dialysis centre responsible for an average of 100 PD patients. The project team consisted of a clinical nurse consultant, a home therapies unit team leader and three community home visiting nurses. All patients were switched to 2% chlorhexidine in 2012, excluding patients who were: (1) under 18 years of age; (2) allergic to chlorhexidine or povidone-iodine solution; (3) outreach home dialysis patients living outside the local catchment area.

All patients had their exit site photographed at the initial consultation to identify what each patient’s normal exit site looked like. The photo of the patient’s exit site was taken by either the home visiting nurse or the research team member, and entered by the home training team leader in password-protected software.

The patient’s exit site was reviewed and monitored for 12 months by a home visiting nurse at each visit. The Twardowski scoring system was used by the project team to identify exit site condition and this was also recorded into PD-specific computer software, together with the picture of the patient’s exit site appearance (Twardowski & Prowant, 1996). Pathology wound swabs were used to confirm suspected infection.

**Data analysis**

PD ESI data were collected by the home therapies unit team leader and recorded using Centre of Excellence PD outcomes data computer software owned by the Baxter Medical Company. The Centre of Excellence program was introduced by the Baxter Company in 2008 for PD units to keep a record of all key aspects of PD care, including ESI rate, and to promote excellence in PD care across Australian and New Zealand.
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dialysis units. It is recognised software used in various PD units across Australia at the time of study. Unit staff reviewed the data monthly, and the ESI is calculated as patient-months, with the nominator being episodes of infection and denominator as patient numbers.

The aggregate rate presented by Centre of Excellence programme was 1 in 30 patient-months in 2011 and 1 in 50 patient-months in 2012. The ISPD recommended the goal of 1 infection in 50 patient-months being the minimum achievable goal for all PD units (Piraino, Bernardini, Brown, Figueiredo, Johnson, Lye, Price, Ramalaskshmi, & Szeto, 2011). The unit’s ESI infection rate was benchmarked against these goals.

Results

Twelve months after switching all suitable patients to 2% chlorhexidine aqueous for acute exit site and suspected ESI care, the PD ESI rate decreased from 14 episodes in 2011 to 5 episodes (Graph 1). Due to the variations in PD patient numbers, we also compared the infection rate per patient-months. This result shows the improvement from 1 in 68.6 patient-months to 1 in 163.4 patient-months (Graph 2).

In summary, this project provides a small-scale, retrospective comparison between 2% chlorhexidine and 10% povidone-iodine in PD exit site care in a single unit. The results indicated that the introduction of 2% chlorhexidine may be effective in preventing ESI. A larger, longitudinal, randomised controlled trial will be required in future to validate the long-term use of 2% chlorhexidine and its benefits in PD exit site care.

Discussion

There has been limited research directly comparing different antiseptic solutions to PD exit site outcomes in the last decade. The most comprehensive analysis on the use of antiseptic solutions at the acute PD exit site was an article published in *Peritoneal Dialysis International*, which indicated that povidone-iodine is cytotoxic in open wounds and delays the wound healing process (Wong, 2003), and chlorhexidine was found to be low in toxicity when used as a skin antiseptic solution.

The result from our project indicated that 2% chlorhexidine solution may be more effective in managing PD exit site care when compared with 10% povidone-iodine. Even though the results have shown a significant improvement in preventing ESIs when 2% chlorhexidine was used, the authors would like to acknowledge that there are many variables during the project that could potentially contribute to the outcomes presented.

Firstly, the design of a retrospective review has limited the power to directly compare different antiseptic solutions to similar groups of patients (Polit & Beck, 2010). It was not a randomised controlled trial, and the basic characteristics of the two groups reviewed were not comparable with respect to influencing factors such as: age; level of PD knowledge; co-morbidity; and social support, all of which have a significant impact on ESI rates.

Secondly, many studies have shown that chlorhexidine is more effective against gram-positive than gram-negative bacteria; whereas povidone-iodine is broad in both gram-positive and gram-negative bacteria (Atiyeh, Dibo, & Hayek, 2009; Wong, 2003). Without knowing the major organisms that caused ESIs during the review period, the result represents all ESI cases.

Moreover, Bender, Bernardini & Piraino (2006) stressed the importance of home visits in reducing the risk of infection in PD patients. Throughout this project, the team was able to standardise the home visiting nurses’ practice in PD exit site care, and increase the number of home visits for patients identified as at high risk of contamination. The authors believe this significantly contributed to reducing the number of ESIs, along with the implementation of using 2% chlorhexidine solution. Further limitations of this project included a small cohort of patients suitable for inclusion and decreased numbers of patients commencing on PD throughout the review period.

Conclusion

The data presented from this change of clinical practice appears to be promising; however, this does not exclude the limitation of a retrospective review and small patient population. Following the positive outcomes offered through this study, 2% chlorhexidine aqueous has now been implemented as the first-line antiseptic solution for PD exit site care in our local health district. PD ESI rates have remained consistently low. The project team will continue to monitor ESI rates to determine the long-term effectiveness of chlorhexidine on PD exit site care.

Acknowledgements

The authors would like to thank the nursing staff, managers and educators from John Hunter Hospital Nephrology ward and Wansley community dialysis home training centre for their contribution to the successful implementation of this project, especially Ms Kelly Adams (NM), Michaela Munn (PD Nurse), Debbie McGregor (PD Nurse), Jennifer Cousin (PD Nurse), Brendan Brown (PD nurse) & Desree Rodier (PD nurse) for their support and involvement in this project.
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References


