Reducing peritoneal dialysis catheter exit site infections by implementing a standardised postoperative dressing protocol

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Abstract

Background Peritoneal dialysis (PD) catheter management is critical in the early postoperative period to minimise the risk of exit site infection (ESI) which can lead to peritonitis and catheter loss. Best practice guidelines on the optimal care of the PD catheter exit site in the postoperative period are based on broad recommendations and general principles including suitable dressings which should remain undisturbed and dry, immobilising the catheter and, ideally, dressings should be attended by trained PD nurses.

Method A retrospective review of ESI was conducted in a large PD training unit for the year 2009. There was a high level (29%) of ESI in the first three weeks post-catheter insertion. A multidisciplinary team of PD nurses, nephrologists and surgeons reviewed current unit practices. We aimed to introduce a standard dressing protocol which would be in line with the recommendations of best practice guidelines. A dressing protocol was developed using available products including a sponge dressing impregnated with polyhexamethylene biguanide (PHMB). The dressing protocol was implemented in February 2010.

Results By the end of December 2010, ESI in the three weeks post-insertion period reduced to 11%. In 2011 to 31 August, there have been no ESI within three weeks post-PD catheter insertion.

Conclusion By standardising the postoperative PD catheter dressing and following best practice recommendations, we have been able to reduce the rate of ESI in the first three weeks of PD catheter placement to recommended best practice levels.

Keywords

Peritoneal dialysis, exit site infection, polyhexamethylene biguanide.

Acknowledgement

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Introduction

Peritoneal dialysis (PD) is an accepted treatment modality for people with advanced chronic kidney disease (CKD). PD is an effective treatment that can be carried out at home. PD is relatively easier to learn compared to haemodialysis (HD), making it an attractive alternative for patients considering a home dialysis therapy. A major clinical challenge for those caring for PD patients is the prevention of infection (Odudu & Wilkie 2011).

PD technique survival rates in Australia are lower than in other parts of the world; infective complications, mainly peritonitis, accounts for approximately 25% of these technique failures (Jose *et al.*, 2011). In Australia there are over 2,200 patients on PD, which is only 21% of the total dialysis population (McDonald *et al.*, 2009). Poor technique survival and the continued problem with infective complications could be a major barrier for this treatment modality. The purpose of this paper is to outline how exit site infection (ESI) in the early postoperative period was reduced by the introduction of a standardised postoperative dressing protocol. Changes made were in line with current best practice guidelines.

ESI and catheter tunnel infection are interrelated; both these conditions putting the patient on PD at increased risk of peritonitis and eventual catheter loss (Bender *et al.*, 2006; Piraino, 2009; Li *et al.*, 2010). Prevention of ESI is paramount and should commence as soon as the catheter is inserted. There are no controlled studies for the optimal care of PD catheters in the postoperative period; therefore, reliance on general principles in regard to dressings and immobilisation of the catheter, serve as a basis for clinical care (Flanigan & Gokal, 2005).

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The International Society of Peritoneal Dialysis (ISPD) defines an ESI by the presence of purulent drainage with or without erythema of the skin at the catheter epidermal interface (Li *et al.,* 2010). It is important to note that in the early postoperative period, pericatheter erythema without purulent drainage can be a skin reaction to the newly inserted catheter, but it can also be an early indication of an ESI (Li *et al.*, 2010). Expert clinical judgement is required when assessing PD catheter exit sites. This emphasises the need for an experienced PD nurse to be responsible for exit site care from the early postoperative period.

This PD unit is based in the Sydney metropolitan area and is responsible for the PD training and ongoing care of patients under the care of a nephrologist from two major hospitals. Catheters are inserted by experienced surgeons in the two hospitals. Patients attend the training unit once discharged from hospital for follow-up exit site dressings, exit site care and PD training. There was no standard protocol for PD catheter dressings in the early postoperative period. In an attempt to improve outcomes for our PD patients, a quality improvement initiative was undertaken to review current practice against best practice guidelines.

Method

A retrospective review of ESI within the first three weeks of the post-insertion period was undertaken. Nursing and medical entries in the dialysis training unit records were reviewed for all new PD patients for the year 2009. ESI was determined as per the entries and observations recorded by the training nurses and/or medical officer; this included the presence of erythema and purulent drainage from the exit site. Results of exit site swabs were obtained from the hospital's electronic pathology site.

What do best practice guidelines say?

A key factor for improving PD technique survival is the management of dialysis catheters. The overall goal in the early postoperative period is to promote healing and to minimise bacterial colonisation of the catheter and tunnel as the open wound is at increased risk of infection (Gokal *et al.*, 1998).

National and international best practice guidelines (Figueiredo *et al.*, 2010: Piraino *et al.*, 2005; Flanigan & Gokal, 2005; Caring for Australians with Renal Impairment (CARI) 2004) have made several recommendations to minimise the risk of infection both before and after catheter placement which include:

1. Eradication of nasal carriage of *Staphylococcus aureus.*
2. Ensuring an experienced operator for catheter insertion.
3. Placement of catheter with a downward facing exit site.
4. Prophylactic antibiotics at time of catheter insertion.
5. The catheter exit site should be protected and kept clean and dry until the exit site is healed (approximately two to three weeks).
6. Trauma to the exit site and traction on the cuffs should be prevented by immobilising the external portion of the PD catheter.
7. Dressings should be changed by an experienced PD nurse.

ISPD guidelines (Gokal *et al.*, 1998) for postoperative recommendations in regard to dressing are:

1. After implantation, the exit site should be covered with an absorbent dressing to soak up any drainage from the exit site.
2. Transparent occlusive dressings should not be used alone because they allow moisture accumulation at the exit site which can add to the infection risk.
3. Frequent dressing changes in the immediate postoperative period are not necessary unless there is excessive oozing, bleeding or signs of infection. Excessive dressing changes will increase the risk of contamination of the exit site and can cause trauma or traction on the cuffs by unnecessary movement of the catheter. Therefore, weekly dressing changes are recommended for the first two to three weeks or until the exit site is healed.
4. The dressing must be kept dry and it should be recommended that the patient avoid bathing/showering for two to three weeks.

Findings

In 2009 there were 42 new patients who had a Tenckhoff catheter inserted in the two major hospitals. There were 19 male and 23 female patients. Mean age of all patients was 69 years (range 42–88 years).

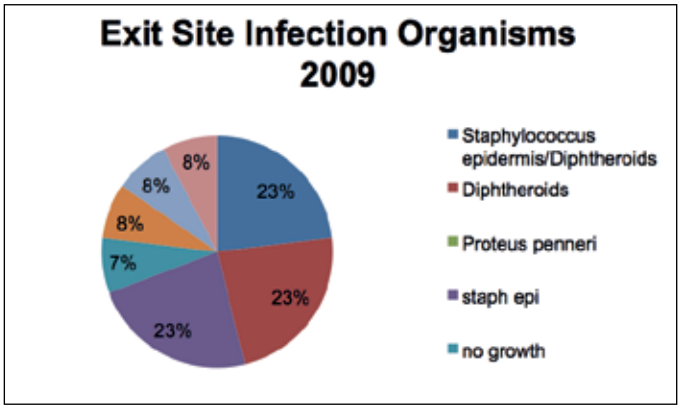
Twelve patients or 29% were found to have ESIs in the first three weeks of the post-insertion period confirmed by wound swab and required antibiotic treatment. This is well above the current recommended ISPD standard of <5% (Figueiredo *et al.*, 2010).

ESIs in our group of patients were primarily due to *Staphylococcus epidermidis* and diphtheriods or a combination of both organisms (Figure 1).

A review of clinical practice in the postoperative period revealed that:

1. Post-catheter insertion dressings were dependent on surgeon preference.

Figure 1.



2. Extension lines or minilines were attached to the Tenckhoff catheter postoperatively again as per surgeon preference.
3. Postoperative dressings were not necessarily reviewed by the PD nurse prior to the patient being discharged from hospital.
4. Postoperative exit site dressings were attended at day 5, day 10 and at day 14 when the patient commenced training.
5. The choice of postoperative dressings by nurses was not consistent.
6. In most instances, patients were allowed to shower after the day 10 dressing.

The findings of the retrospective review in our unit were disseminated to nursing, medical and surgical staff involved in the care of PD patients. It was decided that in the first instance a postoperative dressing protocol be developed. The dressings consisted of current available products in the unit. The dressing protocol was implemented in February 2010.

It was also decided to change practice in regard to:

1. The extension line or miniline would not be attached postoperatively; therefore, making it easier to immobilise the catheter.
2. Aseptic technique including the wearing of sterile gloves, which was not routinely done, would be used in the postoperative period by PD nurses when attending dressings.
3. Povidone iodine should be used as the skin cleaning solution.
4. The dressings should, whenever possible, be changed only by experienced PD nurses from the training unit.

The dressings chosen for the new protocol were:

1. Excilon™ AMD™ (Tyco Healthcare) an absorbent antimicrobial sponge dressing which contains polyhexamethylene biguanide (Polihexanide or PHMB). This sponge dressing is placed around the catheter exit site (Figure 2).

Figure 2.

2. Primapore™ (Smith & Nephew) 2 required; non-woven, adhesive protective dressing is applied over the Excilon™ AMD™ and helps to secure PD catheter.
3. IV 3000™ (Smith & Nephew) 3 required; a waterproof transparent dressing which is highly permeable to water vapour completely covers all the dressing and the external section of the PD catheter. This keeps it all intact and immobilises the PD catheter (Figure 3).

Figure 3.

Frequency of dressings

The first dressing is applied immediately postoperation, preferably in the operating theatre by the surgeon. The dressing is checked within 24 hours by a trained PD nurse. If there is excessive ooze or bleeding, the dressing is changed using the same dressing procedure, otherwise it is left intact. Patients are reviewed by a PD nurse prior to discharge. The dressing is again checked to ensure it is intact. Patients are instructed on maintaining the dressing intact and dry once at home.

The dressing is changed by an experienced PD nurse in the dialysis training unit on day 7 postoperation unless a dressing change is required earlier for excessive oozing or bleeding.

On the 14th day postoperation, patients usually commence PD training. If the exit site is not completely healed, Excilon™ sponge dressing and Primapore™ will be applied to the exit site for another week. An extension line is attached to the Tenckhoff catheter for the commencement of dialysis and the catheter is immobilised with tape as for chronic care protocol. If the exit site is healed, the patient will be advised to shower daily and instructed in routine self-care of the PD catheter exit site. This routine self-care involves: daily cleansing of the exit site with antibacterial soap and water; applying antiseptic solution (povidone iodine) daily to the exit site; and ensuring the catheter is immobilised to prevent traction and trauma at the exit site. These practices are in line with established recommendations for chronic exit site care (Piraino *et al.*, 2005: Bender *et al.*, 2006).

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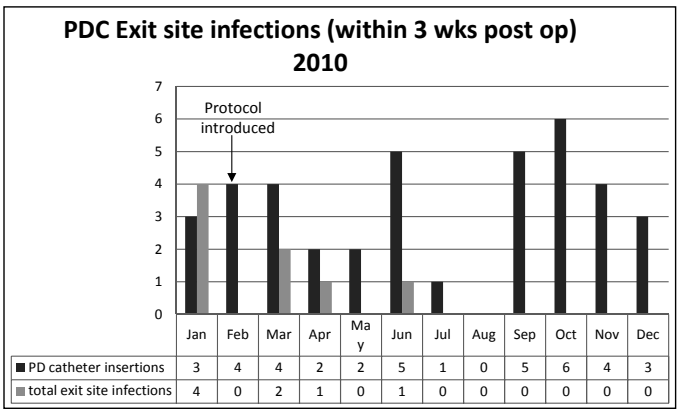
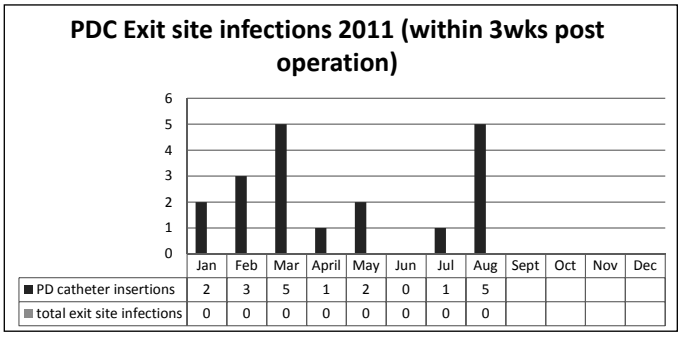
Figure 4.



Results

Our dressing protocol commenced in February 2010. There were 36 new patients who had a PD catheter inserted after the introduction of our dressing protocol in 2010 (Figure 4). There were 26 male and 10 female patients. The mean age of all patients was 62 years (range 18–87 years). There were four ESIs in the first three weeks of the postoperative period, which occurred in the first half of 2010. Two of these infections occurred in the early stages of the implementation period and the dressing protocol was not followed. In the second half of 2010 (July onwards), there were no ESIs in the first three weeks post-catheter insertion. This result was a reduction in ESI from 29% in 2009 to 11% in 2010. In 2011, up to 31 August, there have been 19 new PD catheter insertions. There have been no ESIs in the three weeks postoperative period (Figure 5). This is in keeping with best practice recommendation of <5%.

Figure 5.



Discussion

Clinical practice guideline recommendations for ESIs in the early postoperative period refer to infection rates within the first two weeks post-catheter insertion (Figueiredo *et al.*, 2010). However, the aim of this renal unit is to maintain this benchmark for three weeks postoperation, when in most cases the exit site is healed and chronic exit site care is performed by the patient at home.

To improve outcomes for our PD patients, standardising dressings and care of PD catheters in the postoperative period the following practice was instigated:

- The catheter exit site would be protected and kept clean and dry until the exit site is healed.
- Trauma to the exit site and traction on the cuffs would be prevented by immobilising the external portion of the PD catheter. Avoiding the connection of the extension line would also assist with immobilisation.
- Dressings would be changed by an experienced PD nurse.

This is in keeping with three key areas identified by ISPD guidelines as recommendations to minimise the risk of infection post-PD catheter placement as previously stated. Other key recommendations: ensuring an experienced operator for catheter insertion; placing the catheter with a downward-facing exit site; and prophylactic antibiotics at the time of catheter insertion, are all standard current practice. We have not addressed the eradication of nasal carriage of *S. aureus* in our patients; however, this will form part of the ongoing quality review of our practice.

To prevent the risk of infection to the PD exit site, prophylactic antibiotic ointment has been used successfully for acute and chronic care (Bender *et al.,* 2006; Odudu & Wilkie, 2011). The use of dressings containing PHMB has not been evaluated in PD exit site care but was used in this unit with positive results. In a study by Mueller & Krebsbach (2008), surgical site infections were reduced by 24% and methicillin-resistant *S. aureus* (MRSA) surgical site infections were reduced by 47% when gauze dressings were replaced by dressing impregnated with 0.2% PHMB. This not only improved patient outcomes but also resulted in a considerable cost saving. Polihexanide has a greater antimicrobial efficacy then chlorhexidine and PVP iodine; it is used not only in surgical dressings but also in the preservation and disinfection of contact lenses, in preoperative eye antisepsis and in mouth rinses (Hubner & Kramer, 2010).

Polihexanide has a broad antimicrobial spectrum including gram-positive and gram-negative bacteria; it has been found to have low toxicity, high tissue compatibility, low absorption and the antimicrobial efficacy is not impaired in human wound fluid or high loads of blood or albumin (Hubner & Kramer, 2010; Mueller & Krebsbach, 2008). Because of its mode of action, Hubner & Kramer (2010) report that the development of resistance to polihexanide is highly unlikely. The same cannot be said for antibiotic ointments, especially mupirocin and is of concern with increased use and its inactivity against gram-negative organisms (Bender *et al.*, 2006; Mahaldar *et al.*, 2009). Therefore, the low probability of resistance combined with relative low cost ($0.33 per sterile pack current cost to this unit in 2011) make dressings impregnated with PHMB an attractive alternative to antibiotic ointment use and warrants further study.

Standardising the postoperative care of the PD exit site has led to significant reduction in the infection rate. However, there is a limitation to this study. Several clinical practice changes were made and, therefore, it is difficult to ascertain whether a single factor such as the use of PHMB dressing, wearing of sterile gloves or leaving the dressing dry and intact or, a combination of all factors, contributed to the improvement. Because of our poor ESI rate in the early postoperative period a quality activity was initiated to change clinical practice in several areas that were identified as not meeting best practice guidelines.

Conclusion

By implementing a standardised dressing protocol we have been able to reduce the number of ESIs in the first three weeks of the postoperative period initially from 29% to 11%. In the first eight months of 2011 there have been no ESIs in the three weeks post-PD catheter insertion. Our dressing protocol follows best practice recommendations by keeping the exit site dry and protected and reducing the number of dressing changes. This also minimises catheter movement and handling and helps to promote healing. The catheter is completely immobilised in the postoperative period to prevent movement and traction on the cuffs. Postoperatively the dressing is checked prior to the patient being discharged and is attended by experienced dialysis nurses. Patients are asked to avoid showering or wetting the dressing for at least two to three weeks.

The use of dressings containing PHMB may also be of value to reduce the risk of ESI in the early postoperative period or for chronic exit site care and warrants further study. ESI continues to be routinely monitored and reviewed with the aim of maintaining the improvements achieved thus far.

Our results have been achieved with the diligence and cooperation of all involved and has led to improved outcomes for our PD patients. Results to date are positive and on track to achieve ISPD recommendation of <5% ESI in the postoperative period for the year 2011.

References

Bender, F.H., Bernardini, J., & Piraino, B. (2006). Prevention of infectious complications in peritoneal dialysis: best demonstrated practices. *Kidney International, 70*:S44–S54.

Caring for Australians with Renal Impairment (CARI) (2004). Prophylaxis for exit site/tunnel infections using mupirocin. Retrieved 20 May 2011 from http://www.cari.org.au/guidelines.php

Caring for Australians with Renal Impairment (CARI) (2004). Prophylactic antibiotics for insertion of peritoneal dialysis catheter. Retrieved 20 May 2011 from http://www.cari.org.au/dialysis_ptp_publ2004.php

Figueiredo, A., Goh, B.L., Jenkins, S., Johnson, D., Mactier, R., Ramalakshmi, S., Shiestha, B., Struijk, D., & Wilkie, M. (2010) Clinical practice guidelines for peritoneal dialysis access. *Peritoneal Dialysis International, 30*:424–429.

Flanigan, M., & Gokal, R. (2005). Peritoneal Catheters and Exit Site Practices Toward Optimum Peritoneal Access: A review of current developments. *Peritoneal Dialysis International, 25*, 132–139.

Gokal, R., Alexander, S., Ash, S., Tzen, C., Danielson, A., Holmes, C., Joffe, P.,Moncrief, J., Nichols, K., Piraino, B., Prowant, B., Slingeneyer, A.,Stegmayr, B., Twardowski, Z., & Vas, S.(1998). *Peritoneal catheters and exit site practices toward optimum peritoneal access: official report from the International Society for Peritoneal Dialysis* Retrieved from http://www.ispd.org/media/pdf/Optimum.pdf

Hubner, O-N., & Kramer, A. (2010). Review on the efficacy, safety and clinical applications of Polihexanide, a modern wound antiseptic. *Skin Pharmacology and Physiology, 23* (suppl 1), 17–27.

Jose, M., Johnson, D., Mudge, D., Traneus, A., Voss, D., Walker, R., & Bannister, K. (2011). Peritoneal dialysis practice in Australia and New Zealand: A call to action. *Nephrology, 16*, 19–29.

Li, P., Szeto, C., Piraino, B., Bernardini, J., Figueiredo, A., Gupta, A., Johnson, D., Kuijper, E., Lye, W., Salzer, W., Schaefer, F., & Struijk, D. (2010). Peritoneal dialysis related infections recommendations: 2010 update, *Peritoneal Dialysis International, 30*, 393–423.

Mahaldar, A., Weisz, M., & Kathuria, P. (2009). Comparison of Gentamicin and Mupirocin in the prevention of exit site infections and peritonitis in peritoneal dialysis. *Advances in Peritoneal Dialysis. 25*, 56-59

McDonald, S., Excell, L., & Dent, H. (2009). Australian and New Zealand Dialysis and Transplantation Registry Report. Adelaide, South Australia.

Mueller, S., & Krebsbach, L. (2008). Impact of an antimicrobial-impregnated gauze dressing on surgical site infections including methicillin-resistant *Staphylococcus aureus* infections. *American Journal Infection Control*,36;(9)651-655.

Odudu, A., & Wilkie, M. (2011). Controversies in the management of infective complications of peritoneal dialysis. *Nephron Clinical Practice*, 118;c301-c308.

Piraino, B. (2009). Insights on Peritoneal dialysis-related infections *Contributions to Nephrology.* Basel: Karger. *163*, 161–168.

Piraino, B., Bailie, G., Bernardini, J., Boeschoten, E., Gupta, A., Holmes, C., Kuijper, E., Li, P., Lye, W., Mujais, S., Peterson, D., Fontan, M., Ramos, A., Schaefer, F., & Uttley, L. (2005). Peritoneal dialysis infections recommendations;2005 update. *Peritoneal Dialysis International*, *25*, 107–131.

Smith & Nephew Product Information IV 3000 Standard; Moisture Responsive catheter dressing. http://wound.smith-nephew.com/uk/Product.asp?NodeId=843

Smith & Nephew Product Information Primapore http://wound.smith-nephew.com/au/node.asp?NodeId=3555

Tyco Healthcare Excilon™ AMD™ Antimicrobial Drain and I.V. Sponges http://www.kendallhq.com/kendallhealthcare/pageBuilder.aspx?topicID=69399&breadcrumbs=0:121623,154339:0,155106:0,155151:0