NEPHROLOGY

Nephrology **19** (2014) 69–71

Original Article

KHA-CARI Guideline: Peritonitis treatment and prophylaxis

AMANDA WALKER,[1] KYM BANNISTER,[2] CHARLES GEORGE,[3] DAVID MUDGE,[6] MAHA YEHIA,[7] MAUREEN LONERGAN[5] and JOSEPHINE CHOW[4]

[1]Department of Nephrology, Royal Children's Hospital, Melbourne, Victoria, [2]Renal Unit, Royal Adelaide Hospital, Adelaide, South Australia, [3]Renal Office, Concord Repatriation General Hospital, [4]Renal Service, South Western Sydney Local Health District, Sydney, and [5]Renal Department, The Wollongong Hospital, Wollongong, New South Wales, [6]Department of Nephrology, Princess Alexandra Hospital, Brisbane, Queensland, Australia; and [7]Department of Renal Medicine, Auckland City Hospital, Auckland, New Zealand

Correspondence:
Dr Amanda Walker, Department of Nephrology, Royal Children's Hospital, 50 Flemington Road, Parkville, Vic. 3052, Australia; Department of Paediatrics, Monash University, Clayton, Vic. 3168, Australia. Email: amanda.walker@rch.org.au

Accepted for publication 8 August 2013.
Accepted manuscript online 15 August 2013.

doi:10.1111/nep.12152

GRADING OF EVIDENCE

These guidelines were developed before the uptake of the GRADE framework by the KHA-CARI Guidelines organization. Accordingly, the writers have followed an adapted version of the NHMRC evidence rating system published in 1999.[1] A description of the ratings applied to the evidence is shown in Table 1. Guideline Recommendations are based on Level I or II evidence and Suggestions for Clinical Care are based on Level III or IV evidence.

SCOPE OF GUIDELINE

This guideline addresses issues relevant to the development, prevention and management of peritonitis and catheter-related infections in peritoneal dialysis patients.

PERITONITIS AND CATHETER-RELATED INFECTIONS IN PERITONEAL DIALYSIS PATIENTS

Recurrent or severe exit site infections (ESI) and peritonitis are a problem with peritoneal dialysis (PD) and represent the major causes of Tenckhoff catheter removal and PD technique failure. Peritonitis is the most common complication of PD. Up to one-third of all PD peritonitis episodes lead to hospitalization[2] and 5–10% of cases end in patient death.[3] ESI are associated with a greatly increased risk of subsequent peritonitis and when ESI and peritonitis occur together, catheter removal occurs in approximately 50% of cases.[4]

1. The influence of peritoneal dialysis systems and solutions on the incidence of peritonitis and catheter-related infections

Guideline recommendations

a. Disconnect systems of continuous ambulatory peritoneal dialysis (CAPD) result in lower rates of peritonitis than 'spike' systems and this older system should no longer be used (Evidence level I).
b. Twin bag systems have lower rates of peritonitis than Y-disconnect systems and are recommended as the preferred CAPD technique (Evidence level I).
c. There is insufficient high level evidence (one adequate small RCT only) to support a difference in peritonitis rates when biocompatible fluids are used compared with standard dextrose solutions in PD patients (Evidence level II).

Suggestions for clinical care

- The choice of APD or CAPD regimens in PD patients should not be influenced by a possible effect on peritonitis rates.
- The choice of conventional or biocompatible PD solutions should not be unduly influenced by potential benefits in peritonitis rates until stronger evidence becomes available.

Table 1 Designation of levels of evidence

Level of evidence	Study design
I	Evidence obtained from a systematic review of all relevant randomized controlled trials
II	Evidence obtained from at least one properly designed randomized controlled trial
III	Evidence obtained from comparative studies (cohort studies, case control studies, pseudo-randomized controlled trials etc.)
IV	Evidence obtained from case series (either post-test or pre-test/post-test)

2. Management of peritoneal dialysis-associated peritonitis in adults and children

Guideline recommendations

a. In peritoneal dialysis patients with a provisional diagnosis of peritonitis, treatment should commence with a combination of intraperitoneal antibiotics that will adequately cover Gram-positive and Gram-negative organisms. Once bacterial diagnosis is made, then a change to appropriate antibiotic should be made. Treatment should be of adequate duration to reduce recurrence (Evidence level II).

Suggestions for clinical care

- Where local or international guidelines are available they should be used to guide therapy.
- Peritoneal dialysate effluent should be collected and processed in appropriate manner to ensure culture-negative episodes account for <20% of all PD-associated peritonitis.
- While there is no good evidence to support specific antibiotic choice, empiric intraperitoneal therapy should consider local microbiological resistance profiles and cover Gram-positive and Gram-negative bacteria. Gram-positive organisms may be covered by vancomycin or a cephalosporin and Gram-negative organisms by a third generation cephalosporin or aminoglycoside.
- When there is a suitable alternative, aminoglycoside use should be limited to avoid their adverse effects of nephrotoxicity and ototoxicity.
- Dual antibiotic therapy is indicated for *Pseudomonas* spp. peritonitis.

3. Catheter removal, adjunct therapies and timing of reinsertion of peritoneal dialysis catheter after peritonitis

Guideline recommendations

a. The use of antibiotics with catheter replacement is superior to antibiotics with urokinase to treat peritoneal dialysis-associated peritonitis (Evidence level II).

Suggestions for clinical care

- The appropriate timing for reinsertion of a peritoneal dialysis catheter that has been removed because of peritonitis is not known.
- Anecdotal recommendations range from simultaneous removal and reinsertion to waiting for a minimum of three weeks after removal before reinsertion.

4. Type of peritoneal dialysis catheter

Guideline recommendations

a. No peritoneal dialysis catheter has proven to be superior to the two-cuff standard Tenckhoff catheter in the prevention of peritonitis (Evidence level II).
b. Coiled-tipped catheters are associated with increased risk of technique failure as compared with straight-tipped catheters (Evidence level II).

5. Technique of insertion of peritoneal dialysis catheter

Guideline recommendations

a. Laparoscopy for insertion of peritoneal dialysis catheters has been shown to have similar complication rates to laparotomy (Evidence level I).
b. Peritoneoscopic insertion of peritoneal dialysis catheters may be superior to dissective insertion in the prevention of peritonitis, leaking of peritoneal dialysis fluid around the cuff and technique failure (Evidence level II).

Suggestions for clinical care

- Peritoneal dialysis catheters should be inserted by experienced operators working as part of a multidisciplinary team as this is associated with low reported infectious complication rates.

6. Prophylactic antibiotics for insertion of peritoneal dialysis catheters

Guideline recommendations

a. Intravenous antibiotic prophylaxis should be used prior to peritoneal dialysis catheter insertion to reduce the risk of early peritonitis (Evidence level I).
b. Vancomycin, cephalosporins and gentamicin have demonstrated effectiveness in reducing the risk of peritonitis (Evidence level II).

Suggestions for clinical care

- Protocols for antibiotic prophylaxis prior to catheter insertion should be guided by local infectious disease guidelines and local bacterial resistance profiles. Vancomycin use

should be restricted to avoid emerging vancomycin-resistant enterococci (VRE) and *Staphylococcus aureus* (VRSA). Vancomycin use should be guided by the infectious disease guidelines of individual treatment units.

7. Timing of commencement of peritoneal dialysis following catheter insertion

Guideline recommendations

No recommendation possible based on Level I or II evidence.

Suggestions for clinical care

- Commencement of peritoneal dialysis should preferably be delayed until 14 days after catheter placement. This is to reduce the risk of dialysate leakage, subsequent infections as well as mechanical complications.
- Early initiation of peritoneal dialysis had no demonstrable impact on infection risk in various trials. It is also possible to initiate peritoneal dialysis early in the presence of uraemia to avoid bridge haemodialysis and emergency use of central venous catheters. If an early start is attempted, then small dialysate dwell volumes should be used, preferably using a cycler in the recumbent position.

8. Treatment of peritoneal dialysis-associated fungal peritonitis

Guideline recommendations

a. Oral antifungal prophylaxis should be considered when antibiotics are administered to patients undergoing peritoneal dialysis to reduce the risk of developing fungal peritonitis (Evidence level II).

Suggestions for clinical care

- Urgent removal of the peritoneal dialysis catheter within 24 h is indicated when fungi are identified by microscopy or culture.
- Although no specific agent can be recommended for prophylaxis, oral nystatin may be preferred to fluconazole because of the risk of developing resistance to fluconazole with increased exposure.
- Prophylactic antifungals should be administered before gynaecological procedures.
- No recommendation can be provided about specific treatment, duration of treatment, or timing for reinserting peritoneal dialysis catheters. Fungi species and their sensitivities should be identified to guide treatment choice.

9. Peritoneal dialysis catheter-related infection: exit site and tunnel

Guideline recommendations

No recommendation possible based on Level I or II evidence.

Suggestions for clinical care

- Effective antibiotic therapy is recommended for peritoneal dialysis catheter-related infection.
- Either intraperitoneal or oral antibiotics may be considered.

10. Prophylaxis for exit site/tunnel infections using mupirocin

Guideline recommendations

a. Prophylactic therapy using mupirocin ointment, especially for *S. aureus* carriage (intranasally or at the exit site) is recommended to decrease the risk of *S. aureus* catheter exit site/tunnel infections and peritonitis (Evidence level I).
b. Mupirocin prophylaxis is also effective at preventing ESI because of non-Staphylococcal organisms (Evidence level I).

Suggestions for clinical care

- There is variable practice as to when to start using prophylactic mupirocin, the site of administration, frequency and duration of treatment. In most of the published studies, nasal mupirocin ointment was applied twice daily for 5 consecutive days every 4 weeks during the trial. Alternatively, mupirocin ointment was applied to the exit site daily and continuously.
- We suggest cleaning the peritoneal dialysis catheter exit site daily and applying a topical antimicrobial agent (either mupirocin or gentamicin).

CONFLICT OF INTEREST

KB received a consultancy from Fresenius Medical Care and an honorarium from Baxter for teaching at the PD Academy in 2013.

AW, CG, DM, MY, ML and JC have no relevant financial affiliations that would cause a conflict of interest according to the conflict of interest statement set down by KHA-CARI.

REFERENCES

1. NHMRC. *A Guide to the Development, Implementation and Evaluation of Clinical Practice Guidelines*. Canberra: NHMRC, 1999.
2. Fried L, Abidi S, Bernardini J, Johnston JR, Piraino B. Hospitalization in peritoneal dialysis patients. *Am. J. Kidney Dis.* 1999; **33**: 927–33.
3. Mujais S. Microbiology and outcomes of peritonitis in North America. *Kidney Int. Suppl.* 2006; **103**: S55–62.
4. Davies SJ, Ogg CS, Cameron JS, Poston S, Noble WC. *Staphylococcus aureus* nasal carriage, exit-site infection and catheter loss in patients treated with continuous ambulatory peritoneal dialysis (CAPD). *Perit. Dial. Int.* 1989; **9**: 61–4.