

Review

Peritoneal Dialysis Related Infections: Exit Site Infection & Care A quick review

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Abstract:

Catheter related infection is a major risk factor for catheter loss. Exit site infection is a type of catheter related infection. Infectious complications are the most common cause of technique failure and switching of peritoneal dialysis patients to hemodialysis. Adhering to hand hygiene principles that have been advocated by WHO can reduce the infectious complications. Exit site care starts prior to the implantation of the peritoneal dialysis catheter and includes proper positioning, use of prophylactic antibiotics and patient education. The early identification of exit site infection is the key to proper treatment and prevention of peritoneal dialysis catheter loss. The empirical antibiotics therapy should be started immediately after taking the culture swabs. In conclusion, healthy exit site is key for successful peritoneal dialysis program. It can only be accomplished by regular surveillance of exit site and proper patient education.

Key Words: *Exit site care, tunnel infection, catheter related infection, cuff infection,*

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Introduction:

Exit site infections (ESIs) and tunnel infections (Tis) are together grouped as catheter related infections and pose a major risk for peritonitis.¹ Exit site infection is defined as “The presence of purulent drainage, with or without erythema of the skin at the catheter epidermal interface” . Peri catheter erythema without purulent drainage is sometimes an early indication of infection but it may represent a simple skin reaction in a newly placed catheter. It may also occur as an allergic reaction or after trauma to the catheter.^{2,3} Other primary skin or allergic conditions can also cause local inflammation and complicate exit-site care. Materials used in the manufacturing of the catheter may have an impact. The silastic material used in the manufacturing of most catheters can produce mild local inflammation that usually goes away quickly, but the Dacron cuff can cause a foreign body reaction that can last much longer. This local inflammation could leave the exit site and tunnel vulnerable to bacterial growth.⁴

A clinical judgment is therefore needed to differentiate a local inflammation from infective process and to treat it as ESI.² Catheter-related infection is one of the most common peritoneal dialysis (PD)-related complications and can lead to peritonitis and exit-site infections (20%), permanent loss of peritoneal catheter (20%), and transfer to hemodialysis (15%-20%).⁵ Hence for a successful PD program a closed attention is required towards exit site care.¹

ISPD recommendations are available for monitoring of exit site care and PD related infections. These guidelines have been updated multiple times with a latest update in 2017.⁶ these recommendations are evidence based and ISPD suggests monitoring of individual rates of catheter related infections in every unit. ⁷ The ESI infections should be monitored as patients per month as a part of continuous quality initiative (CQI).⁷ In addition to the rate of ESI infections the organism involved should also be as well as the infection rate of specific organisms (especially *Staphylococcus aureus* and *Pseudomonas* species) and the spectrum of antibiotic sensitivity.⁸

According to the 2011 ISPD Position statement on reducing the risks of peritonitis-related infection, *Staphylococcus aureus* (S.aureus) and *Pseudomonas aeruginosa* (P.aeruginosa) are most common pathogens that cause catheter infections, and may lead to peritonitis if not

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treated promptly.^{1,9,10} *P.aeruginosa* infections are less common compared to *S.aureus*, but are more difficult to eradicate and usually require longer treatment. Coagulase negative Staphylococci, fungi and other Gram-positive organisms account for the remaining infections.¹⁰

Factors effecting Exit Site:

Multiple factors have been proposed that might have an impact on the ESI and subsequent peritonitis. These include the type of catheter used, exit-site and tunnel configuration, PD exchange method or PD modality.⁶

Several types of catheters have been used in an attempt to improve the PD outcomes. The different types of catheters lead to multiple different configurations of the tunnel and exit site.¹¹ Whether the number of cuffs affects the clinical outcomes is also inconclusive. An analysis of the U.S. CAPD Registry data showed that single-cuff catheter placed in deep fascia had lower catheter survival rate than double-cuff and subcutaneously placed single-cuff catheters. Subcutaneously placed single-cuff catheters were also associated with higher rates of catheter removal from ESIs compared to double-cuff catheters (13% vs.7%), but lower rates of catheter removal from peritonitis compared to single-cuff catheter placed in deep fascia (14% vs. 24%)¹². A study from Canada showed lower rates of *S. aureus* infections in patients with double-cuff catheters who started PD between 1996 and 2000; however, the difference was insignificant in those who started PD after 2000.¹³ Based on these and multiple other reports, the latest update the ISPD guidelines state that there is no conclusive evidence to support that a certain type of catheter has better outcomes than the standard, silicone Tenckhoff catheter.⁶

The tunnel should be deep enough and away from the dermis so that superficial erosion of the external cuff can be avoided. The recommended practice is to place the external cuff 1-2 cm from the skin opening.^{14,15} There is no evidence to suggest that the length and orientation of the tunnel has any impact on the incidence of ESI. A downward orientation of the catheter exit site was first recommended by Tenckhoff and is considered best practice.¹⁵ It is suggested that downward directions reduces exit-site infections by facilitating drainage.^{14,16}

The use of disconnect systems has markedly reduced The Infectious complications of PD including ESIs and peritonitis caused by ESIs, has been reduced markedly after introduction of disconnection system. Some studies have suggested some benefit of APD over CAPD in terms of peritonitis and catheter related infections.^{17,18} However, conflicting results have been shown by some other studies.^{19,20} Several prospective studies comparing the Y-connection systems with the “flush before fill” design with the traditional spike systems showed that the risk of peritonitis was reduced by the Y-systems but there was no significance difference in the rate of catheter-related infection.²¹⁻²³ Similarly, trials comparing the double-bag system with the Y-connection systems (both with the “flush before fill” design), found no significant difference in the rate of catheter-related infections.^{23,24} The ISPD guidelines suggests that the risk of peritonitis may be similar in both modalities (APD & CAPD); therefore, the decision to use method should not be based on peritonitis risk.⁶

Pre-operative care:

The exit site care starts from the pre-operative period. It includes the decision of placing the exit site in a manner that it is away from skin folds and belt lines with a goal to avoid infection in healing phase. The exit site should not lie on a scar. It should be determined with patient in upright (seated and standing) position. Trauma and hematoma should be avoided at the site of exit sited during catheter placement. The exit site should be round and the tissue should fit snugly around the catheter. Sutures around the exit-site increase the risk of infection and should be avoided.¹⁶

Prophylactic antibiotics are recommended prior to going for peritoneal dialysis catheter insertion. Antibiotic penetration into the coagulum is poor, antibiotics should be present in sufficient concentration in the blood and tissue fluids before the coagulum is formed.²⁵ This can be achieved if systemic antibiotics are given preoperatively. Early colonization of exits is predominantly by Gram-positive bacteria; however, some exits were colonized by Gram-negative bacteria, and these cases developed early infection.²⁶ Systemic coverage for both Gram-positive and Gram-negative organisms seems desirable for prophylaxis. Topical antibiotics may not be effective during the early post implantation period, because they can be washed away by drainage from the exit.²⁵ Although conflicting data has been presented by different studies. ISPD suggest use of antibiotics according to the local epidemiology. Covering for both gram positive and gram-negative bacteria is beneficial.^{6,27}

Screening for nasal carriage of *S. Aureus* is also suggested. Although it has also a controversial data.⁶ It is suggested to get pre-catheter insertion nasal swabbing for patient and caregiver. Any incidence of *S. aureus* positive cultures should be treated with the use of chlorhexidine body wash daily and nasal mupirocin three times a day for one week and re-swabbing should be done week later.²⁸ If that swab was positive for *S. aureus*, another week of nasal mupirocin should be commenced and further re-swabbed. Following formal algorithm directing the management of nasal and ES swabs has been suggested.⁷ (Figure 1)⁷

Early exit site care:

It is suggested that the exit site should be covered with several layers of sterile gauze post operatively. Gauze dressings are generally preferred over transparent occlusive dressings. The gauze based dressing helps in keeping the exit site dry whereas secretions may pool at exit site if occlusive dressing is used.²⁹ The initial surgical dressing should remain intact for 5 to 10 days. If there is no obvious bleeding or signs of infection, dressing changes should be avoided in the immediate post-implantation period in order to minimize contamination and local trauma to the exit site.³⁰ The nurses should be trained on the use of aseptic techniques, and strictly follow these while changing the dressings once weekly until the exit site is completely healed.^{1,31}

An observational study found that the rate of ESI was reduced 10-fold with a program that incorporated intensive training of nursing staff and patients, improved operative aseptic technique and reduction in *S. aureus* nasal carriage.³² In addition, patients should be clearly instructed to keep the exit site dry. Bathing and showering are not recommended until healing is complete, which may take two or more weeks. Submerging the exit site in water may cause exposure to water-borne pathogens and result in bacterial colonization.¹ ISPD

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guidelines emphasis on the patient training and education regarding peritoneal dialysis and catheter related infections. The training should be started prior to the catheter insertion and should be carried out by trained staff.^{6,33}

When cleansing the exit sites, non-cytotoxic agents such as normal saline or pure soap are recommended during early exit-site care. Antiseptic agents may be utilized as well; however, they should be non-cytotoxic because cytotoxic agents such as high concentration povidone iodine and hydrogen peroxide may cause tissue damage and delay wound healing.¹ Antibiotic prophylaxis should be employed

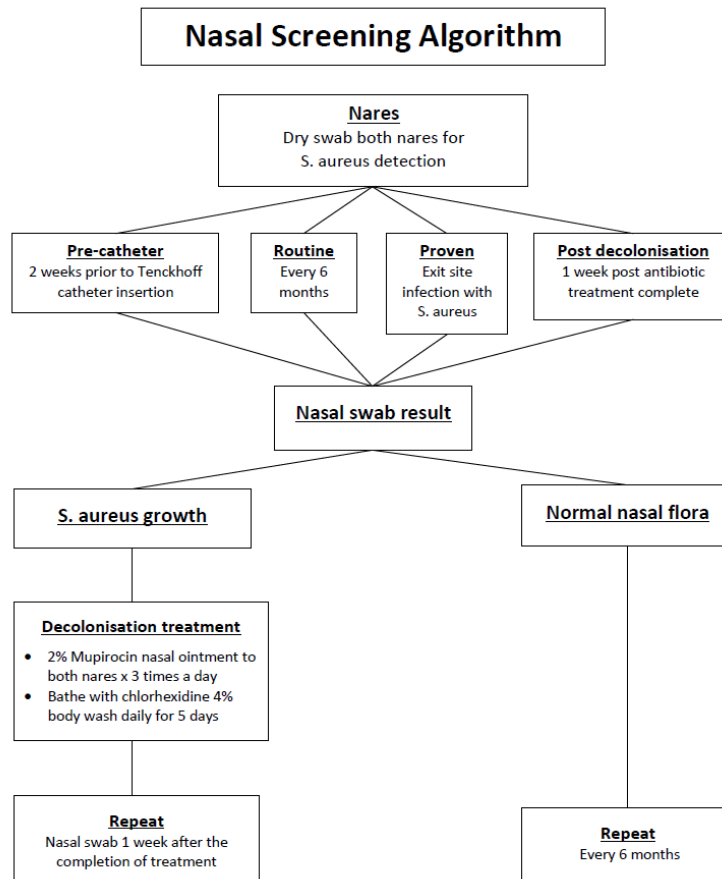


Figure 1: Assessment of nasal carriage of Staphylococcus species for prevention of recurrent exit site infection.

to reduce the risk of *S. aureus* and *P. aeruginosa* catheter infections. Antibiotics should be utilized daily as part of routine exit-site care.³⁴ according to ISPD recommendations that patients should use one of the following protocols: a topical antibiotic cream applied at the exit site, an intranasal antibiotic, or a combination of both antibiotic protocols in order to maximize efficacy. The antibiotic preparation for local use at exit site should be selected carefully, as topical antibiotic ointments, as opposed to creams, are not recommended for use at the exit site of polyurethane type catheters. They have the potential to cause spontaneous catheter rupture.³¹

Routine Exit Site Care:

Patients may switch from early exit-site care to routine care once the exit site is completely healed or when it can be classified as good or equivocal according to Twardowski's exit-site evaluation and classification system.³⁵

The patients should be advised to wash the catheter exit sites daily with liquid or antibacterial soap. The use of povidone iodine every 2-3 days has also been shown to decrease infection rates when compared to daily nonbacterial soap and water.³ The crusts or scabs should not be removed forcibly during cleansing because this may traumatize the exit, causing a break in the skin and increasing the risk of infection. The exit site should be dried gently after cleansing. It is not necessary to use sterile gauze for care of the healed exit; a clean washcloth and towel would work well. Sudden or extreme traction on the catheter should be avoided to prevent extrusion of the external cuff. Although daily dressing is not needed, once the exit site has been healed, the use of dressings may help keep the exit site clean,

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protect it from trauma, and help to stabilize the catheter.^{3, 16, 29, 35} A recent study however didn't show any extra advantage of dressing over keeping it open once the wound healing is completed.³⁶

Patients and caregivers should be educated on aseptic techniques including proper hygiene and hand washing to prevent touch contamination. Use of 70% of alcohol-based hand rubs for 15 seconds is the most effective according to the U.S. Center for Disease Control and Prevention. However, visibly dirty hands must be washed with soap and water.¹ All the patients may be supplied with WHO guidelines during the training period (Figure 2).⁷ Regular monitoring of the exit site for *S. aureus* colonization has also been proposed. It has led to significant improvement in ESI (Figure 3).⁷

How to Handwash?

WASH HANDS WHEN VISIBLY SOILED! OTHERWISE, USE HANDRUB

Duration of the handwash (steps 2-7): 15-20 seconds

Duration of the entire procedure: 40-60 seconds



Figure 2: Proper hand washing techniques.

Chronic exit site care:

Chronic PD patients need to continue to monitor the exit site and perform routine care to prevent catheter infections. Patients should be educated how to assess the exit site, including visual inspection and palpation of the tunnel, recognizing signs and symptoms of exit-site infection, and when to notify the PD unit of exit-site problems.⁶ A scoring system has been proposed that may help in the recognition of ESI.^{6, 37}

Table 1: Exit Site Scoring System^{6, 37} developed to assess and manage the possible infection.

Score	0 Point	1 Point	2 Point
Swelling	No	< 0.5	> 0.5 or involve tunnel
Crust	No	< 0.5	> 0.5
Redness	No	< 0.5	> 0.5
Pain	No	Slight	Severe
Drainage	No	Serous	Purulent
Infected if	Total score > 4. Purulent discharge alone is sufficient to indicate infection		

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Treating exit site infection:

Empirical antibiotics should be started as soon as exit site infection is identified.^{6,30} The empirical therapy should at least cover *S. aureus* and if the patient has a history of *P. aeruginosa* ESI, empiric therapy should include an antibiotic that would cover this organism.³⁰ Cultures should be sent at the same time. Both aerobic and anaerobic culture swabs should be sent. Cultures should be sent in a medium to make sure survival of anaerobic organisms. The exit site is usually colonized in a few days after catheter insertion. The resident flora might not be the actual culprit. Therefore, it's important to culture the discharge rather than the skin around exit site.²⁵ The antibiotic therapy should be continued for at least 2 weeks for infections other than *Pseudomonas* and 3 weeks for *Pseudomonas* infection or unless the exit site appears normal again.^{6,30}

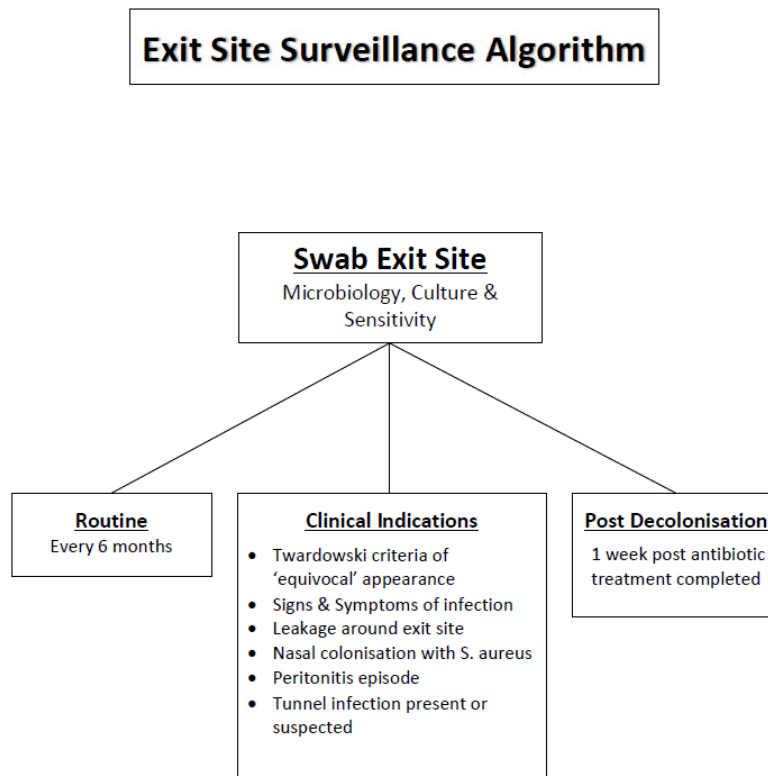


Figure 3: Exit site Surveillance for exit site infection detection.

Vancomycin should not be used routinely and should be reserved for the patients suffering from MRSA (methicillin resistant *Staph. aureus*) infections.^{6,30} The infections with *P. aeruginosa* are difficult to treat and need a prolonged treatment with two antibiotics. The first line therapy is fluoroquinolones. The resistance may occur quickly. If the patient has recurrent or slow healing ESI, second line anti *Pseudomonas* drugs aminoglycoside or ceftazidime, should be added intra peritoneally.⁶

Usually the treatment of mild or equivocal ESIs has been successful with topical antibiotics; however, they have proved to be of limited utility in cases with profuse drainage.^{34, 38-40} Care of the infected exit site should occur once or twice daily. Forcibly removing scabs or crusts is discouraged. Instead, soften them using soap and water, hydrogen peroxide, saline, or an exit site soak.⁴¹ Additionally, proud flesh may need to be cauterized to expedite the healing process.⁴² Nonocclusive sterile dressings should be used. These help to absorb drainage, protect from microorganisms, and prevent trauma to the site.⁴³

Catheter removal should be considered if a cuff, exit site, or tunnel infection is associated with simultaneous peritonitis or followed by peritonitis caused by the same microorganism, unless the organism is *Staphylococcus epidermidis*. The catheter should be removed in cases of refractory or recurrent peritonitis associated with exit or tunnel infections, as well as in extensive cellulitis that is unresponsive to antibiotic treatment.^{44,45} Early catheter removal is necessary in cases of fungal ESIs or in pseudomonal ESIs that fail to respond to antibiotic therapy and shaving of the external cuff.¹ Latest ISPD guidelines suggest that for patients with simultaneous exit-site or tunnel infections and peritonitis, PD catheter removal should be followed by temporary hemodialysis with no attempted reinsertion of the PD catheter until at least 2 weeks after catheter removal and complete resolution of peritoneal symptoms.⁶

Various salvage techniques have been described in patients with chronic or recurrent exit site infections. These include cuff shaving, unroofing with or without en bloc resection of the skin and tissues around the peripheral cuff of the tunnel.⁴⁶⁻⁴⁸ The cuff shaving technique

has been associated with high risk of peritonitis.⁶ Partial catheter re implantation and diversion with renewal of exit site has also been advocated for catheter salvage.^{49, 50}

Conclusion:

A good exit site care is necessary for a healthy exit site, and healthy exit site is mandatory for successful peritoneal dialysis program. At all stages of exit site care proper hand hygiene and aseptic techniques should be emphasized to avoid touch contamination. Routine use of local antibiotics can help reduce the incidence of exit site infections. The patients and caregivers should be educated to vigilantly monitor the exit site and report to the parent unit in case of any suspicion of infection.

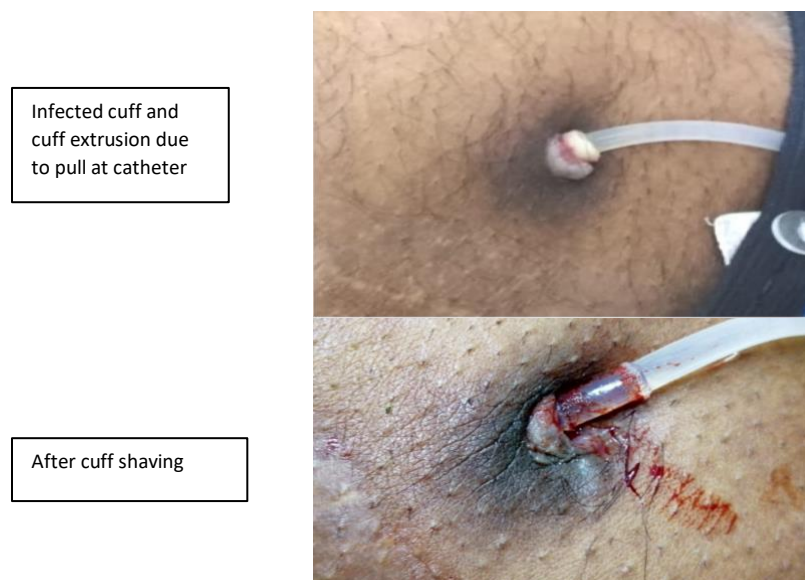
*Pictures of various exit site infection at the end of references.

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Picture1:



Infected cuff and
cuff extrusion due
to pull at catheter

After cuff shaving

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Picture 2:

Perfect Exit site: More than 6 months



Picture 3:

Infected Exit Site: Culture showed: Pseudomonas



Picture 4:

Infected Exit site; Day 1



Healing Exit Site; after 8 days of antibiotics

