12. Management of the infected vascular access

Guideline 12.1. Infection of autogenous AV fistulae without fever or bacteraemia should be treated by appropriate antibiotics for at least 2 weeks (Evidence level III).

Guideline 12.2. Infection of autogenous AV fistulae with fever and/or bacteraemia should be treated by appropriate antibiotics given intravenously for 2 weeks. Excision of the fistula is required in case of infected thrombi and/or septic emboli (Evidence level IV).

Guideline 12.3. Infected graft AVFs should be treated by appropriate antibiotics given intravenously for 2 weeks and continued orally for 4 weeks. Depending on the presence of bacteraemia and/or infected thrombi segmental explantation of the graft with bypass needs to be considered (Evidence level III).

Guideline 12.4. Anastomotic infection is an indication for total graft explantation (Evidence level II).

Guideline 12.5. Catheter removal must be considered when catheter infection is suspected. Immediate removal should be performed in non-tunnelled catheters when infection is diagnosed (Evidence level III).

Guideline 12.6. In tunnelled catheters with a short febrile and/or bacteraemic reaction, a delayed removal may be considered (Evidence level III). In septicaemia, immediate removal should be performed in tunnelled catheters as well.

AVF and prosthetic graft infection

Infection of autogenous AVF usually responds well to appropriate antibiotics given either orally or intravenously according to the presence of fever and/or bacteraemia. Surgical revision or excision of the fistula is required when infected thrombi, aneurysms and/or septic emboli are detected. Infection of graft AVFs is two to three times more frequent than autogenous AVFs [1]. Infection of the graft bears a worse prognosis and requires usually a surgical revision and/or explantation in addition to the antibiotic therapy. Salvaging prosthetic grafts may be attempted in certain circumstances. Several surgical techniques have been described in combination with antibiotic therapy. For localized abscesses, incision and drainage with graft preservation is needed. For more severe infection, such as infected thrombi, false aneurysms, cellulitis, explantation of the infected graft segment and segmental bypass with a new graft is indicated. However, these salvaging techniques may be complicated because of local or generalized infection and sepsis. Therefore, in severe cases a complete explantation of all graft material with drainage is usually necessary.

Central venous catheter infection

Catheter-related infection is the major cause of morbidity in HD patients with central venous catheters [2–4]. Catheter infection is a potentially severe event that requires early diagnosis and appropriate management to prevent further complication. Diagnosis of catheter infection is relatively easy in symptomatic patients presenting with fever, pain, skin exit and/or track infection and bacteraemic episodes. It is much more difficult in silent catheter endoluminal contamination or low grade infection. In these cases, only specific blood and catheter clot culture will help to make the diagnosis [5]. Recently, it was shown that catheter clot culture after endoluminal brushing was more sensitive than blood culture to identify asymptomatic catheter infection (catheter contamination) [6,7]. Symptoms of infection includes chronic fever, bacteraemic episodes, catheter pain, inflammation of the exit site or tunnel. Infection of the catheter exit site or tunnel tract is usually observed by the dialysis nurse while clinical examination is performed at the time of dialysis connection. Silent contamination is suspected when recurrent febrile reactions during haemodialysis occur and bacterial pathogens (Staphylococcus aureus, S. epidermidis or other bacteria such as Gram-negatives) are identified in blood cultures. Catheter-related septicaemia is usually associated with symptoms of endocarditis, arthritis, spondylarthritis or osteomyelitis.

Specific blood markers (leucocyte count and differentiation), C-reactive protein (CRP) and procalcitonin (PCT), help to diagnose early bacterial catheter infection. Catheter-related infection should be considered as a severe and potentially lethal complication. Prevention of infection should be a permanent preoccupation for care providers, that relies on hygienic measures [8] and strict protocols for handling catheters based on aseptic manipulation [9] and using specific dressings [10]. The regular and pre-emptive use of locking solutions (Citrate) with both antithrombotic and/or antiseptic properties has been confirmed to be effective in preventing catheter infection [11–14]. The topical application of antibiotic ointment on the skin exit site has proved to be efficient in reducing the incidence of bacteraemia at the expense of selecting antibiotic-resistant strains of bacteria [15–17]. The use of antibiotic-coated catheters or silver-treated catheters has been proposed to reduce the risk of infection, but conflicting results has been reported [18–20]. Identification of patients at risk of infection is particularly important in diabetic patients and nasal

carriers of methicillin-resistant S. aureus (MRSA). In the latter patients, eradication of bacteria by means of topical antibiotic ointment has been associated with a significant reduction of bacteriaemias [21,22].

Catheter removal should be considered as the first line of treatment. Catheter withdrawal must be immediate when infection occurs in non-tunnelled catheters. Removal may be postponed for several days in tunnelled catheters. When this last option is applied the risk of septic complications of delayed catheter removal should be balanced with the benefits of keeping it in situ. This conservative option implies that the patient is regularly and carefully observed. In addition, the catheters should be disinfected by means of antimicrobial lock solutions and dissemination of the infection must be prevented by adequate systemic antibiotic therapy. When the catheter is left in place and in the absence of precise microbial information, antimicrobial therapy should include systemic antibiotic therapy effective against Staphylococcus species plus an adjunctive antimicrobial catheter lock. Antibiotic therapy is given for 2 weeks in order to sterilize all potential bacterial foci. Topical antibiotic therapy (catheter exit site) is initiated when there is associated local infection.

Imaging techniques may help to diagnose catheter-related infection. Ultrasound doppler methods can detect tunnel infection and/or subcutaneous abscesses along the catheter track. Phlebography and catheterography are indicated to diagnose infected thrombi located in the vein or fibrin sleeves surrounding the catheter tip. Isotopic imaging techniques using positron emission tomography (PET) may help to identify infected venous catheters and port devices [23].

Recommendations for further research

Improvement of needle design and education on strict aseptic cannulation techniques may possibly lower the incidence of infection in fistulae and grafts. Antibiotic-bonded grafts may possibly lower the incidence of graft infection. Newer catheter designs and locking solutions are important issues for further investigation of the prevention of central venous catheter-related infections.

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