Central and peripheral venous catheters are used in >50% of hospitalized patients, with >5 million central venous catheters inserted each year.\(^1\)\(^,\)\(^2\) Tunneled central venous catheters are usually surgically implanted and are used to provide prolonged access for patients needing dialysis, cancer chemotherapy, or parenteral nutrition. Common types of tunneled central venous catheters are Broviac, Hickman, Groshon, and Quinton. In contrast, totally implanted intravenous access devices have a subcutaneous pocket or reservoir and are commonly referred to as ports.\(^3\)\(^-\)\(^5\)

It is estimated that >120 000 catheter-related bloodstream infections (CRBSIs) occur annually in hospitalized patients.\(^5\)\(^,\)\(^6\) The estimated mortality rate associated with these infections is 10–20%, with a marginal cost to the healthcare system of up to $40 000 per episode.\(^6\) The commonly accepted definition of CRBSI requires that both peripheral vein and catheter site cultures grow the same organism.\(^7\)\(^,\)\(^9\)

Two risk factors for catheter-related infections that have been identified are the material of which the device is made and the intrinsic virulence of the infecting organism(s).\(^5\)\(^,\)\(^8\) Catheters made of teflon or polyurethane have been reported to result in fewer infections than those made of polyvinyl chloride or polyethylene.\(^5\) Coagulase-negative staphylococci are the most common cause of hospital-acquired CRBSIs. The initial bacterial adhesion to the catheter depends on bacteria–biomedical surface interactions including Van der Waals forces, electrostatic interactions, and hydrophobic interactions.\(^10\) Once attached, *Staphylococcus epidermidis* and other staphylococci produce extra-

---

**Antibiotic Lock Technique: A Review of the Literature**

Marisel Segarra-Newnham and Ellen M Martin-Cooper

**OBJECTIVE:** To review the literature on the use of the antibiotic lock technique (ALT) as a treatment option for patients with highly needed catheters.

**DATA SOURCES:** MEDLINE and *International Pharmaceutical Abstracts* were searched (1980–August 2004). Search terms included antibiotic lock, catheter infection, and topical treatment.

**STUDY SELECTION AND DATA EXTRACTION:** Articles describing use of ALT in the treatment of catheter infections in humans and studies evaluating in vitro stability of antibiotics were included.

**DATA SYNTHESIS:** ALT has been used in patients with highly needed catheters, usually for parenteral nutrition, cancer chemotherapy, or dialysis. Catheters are considered highly needed when removal is not feasible or desirable due to lack of alternative injection sites for required therapy. Success rates in saving the infected catheter have been variable and may depend on the infecting organism. In addition, there are conflicting data in terms of compatibility of antibiotics with heparin solutions.

**CONCLUSIONS:** Consensus appears to be that the ALT can be tried for patients with highly needed catheters when infection with coagulase-negative staphylococci is documented and no systemic signs of sepsis, such as hypotension, are evident. Most of these patients are likely to need systemic therapy as well. Infection of the catheter associated with systemic gram-negative bacteremia or fungemia will most likely require removal of the catheter to prevent systemic complications. Additional research with the ALT is warranted given unanswered questions.

**KEY WORDS:** catheter infection, topical antibiotic.
cellular biofilm, which acts to protect bacteria against host defenses and antimicrobial agents.\textsuperscript{5,6,11} It has been reported that antimicrobial concentrations >100–1000 times the concentration needed to kill the bacteria in solution are required to eradicate bacteria in biofilm.\textsuperscript{1} The 3 main types of catheter infection are exit site infection with drainage; tunnel infection with induration, tenderness, and erythema around the catheter site; and device-related bacteremia when blood cultures drawn from both the catheter and peripheral sites grow the same organism.\textsuperscript{12–15} Most literature reports about the antibiotic lock technique (ALT) describe patients with the latter type of infection. It is important to draw blood specimens for both catheter and peripheral site cultures. Cultures of blood drawn through the catheter alone may grow a variety of organisms that colonize the site, but are not the cause of true CRBSIs. Growth from peripheral sites alone cannot differentiate between transient bacteremias and a true CRBSI.\textsuperscript{8}

Management of the infection depends on the type of catheter, the infecting organism, and the patient’s status.\textsuperscript{1} Usually, catheter removal is the treatment of choice, especially for infections caused by gram-negative rods.\textsuperscript{15,16} Highly needed catheters are defined as tunneled central venous catheters and totally implanted devices or ports for patients who require long-term parenteral nutrition or dialysis and catheters used in patients with AIDS or cancer. If catheter removal is not possible, treatment with the ALT is indicated.\textsuperscript{11,14,17} The major threat of infection due to long-term catheter placement is intraluminal migration of bacteria from the catheter hub\textsuperscript{1,6,11,16}; hence, the ALT was developed. The ALT is essentially a salvage technique usually reserved for patients in whom intravenous access is difficult to establish and who typically need long-term intravenous access.

**Antibiotic Lock Technique**

The ALT consists of filling the lumen of the catheter with antibiotic at concentrations 100- to 1000-fold higher than usual target systemic concentrations and allowing it to dwell (lock) for a period of time while the catheter is not in use in order to sterilize it.\textsuperscript{1,17,18} Some clinicians prefer a 24-hour dwell time, which may not be possible for patients requiring additional therapies using the catheter.\textsuperscript{12} Attempting to salvage current catheters seeks to avoid the risks, time, costs, and inconveniences associated with replacement of implanted catheters, which is often performed in the operating room.\textsuperscript{1,20} Advantages of the ALT are decreased risk of antibiotic adverse effects due to negligible systemic concentrations if no systemic therapy is used concurrently, increased local concentrations at the infection site, ease of administration, and ability to administer in the outpatient setting.\textsuperscript{11,14,17,21} It is also possible that the ALT would offer cost-savings compared with replacing the catheter as a surgical procedure or needing parenteral systemic therapy; this has been a main incentive in attempting ALT to salvage catheters. Krzywda et al.\textsuperscript{22} reported average cost-savings of 87% by using the ALT ($8.53 per day) compared with conventional parenteral antibiotic therapy ($64.17 per day) in 19 episodes of central venous catheter infection. Some disadvantages of the ALT include the lack of activity against organisms at distant sites; paucity of clinical data, including compatibility of antibiotics with heparin; and possible delay in curing the infection if the ALT fails.\textsuperscript{1} Delaying cure of the infection may result in systemic bacteremia and potential for septic shock and other complications.\textsuperscript{23} Successful ALT has been defined in most case series as negative follow-up cultures a few days after completion of a 14-day treatment course.\textsuperscript{17,24–26} However, it has been recommended that successful catheter salvage with the ALT be defined as use of the device for at least 3 months after the initial prescription.\textsuperscript{27}

Due to paucity of data in the pharmacy literature regarding the ALT, a review of published studies and reports was conducted to assess the level of evidence addressing the benefits and risks of the ALT.

**Data Sources**

A systematic search of MEDLINE and International Pharmaceutical Abstracts (1980–August 2004) databases for English-language reports was performed to identify publications describing use of the ALT. Search terms included antibiotic lock, catheter infection, and topical treatment. Citations were evaluated for inclusion in the review using title and abstract. Bibliographies of reports were reviewed to identify additional references.

Table 1 presents a summary of cases from reports identified in the search.\textsuperscript{12–15,17,20,21,23–26,28–38} A total of 383 patients have received the ALT, with 295 (77%) reported as successful. However, treatment success was not equally defined in all cases, different antibiotics and concentrations were used, and at least 70% of patients received concomitant systemic antibiotics.

**Parenteral Nutrition**

The majority of published experience with ALT comes from small case series in patients receiving home parenteral nutrition via tunneled catheters. The first identified description of ALT was in 22 patients with a variety of gram-positive and -negative CRBSIs.\textsuperscript{29} In this series, only blood cultures drawn from the catheter needed to be positive. Peripheral blood cultures were not required, making it possible that patients with colonized catheters were treated and included in the analysis. Patients were treated based on the judgment of the physician. Patients were not randomly assigned to treatment and investigators were not blinded. Eleven patients were treated with short-term systemic antibiotic therapy (mean 3 days) along with ALT containing vancomycin 1 mg/mL, amikacin 1.5 mg/mL, or minocycline 0.2 mg/mL, depending on the organism isolated. An additional 11 patients were treated with the ALT alone. Solutions were allowed to dwell for 12 hours per day for 14 days.

Twenty of the catheters in this study were salvaged, 10 in each group. Two catheters required removal due to fungal infection, one in each group. The authors concluded
that there was no difference between the treatment groups. This same cohort of 22 patients was then followed for 2 years. Twenty-seven CRBSIs were treated with the ALT alone, of which 25 (93%) catheters were salvaged. Benoit et al. enrolled 7 patients receiving parenteral nutrition with 9 catheter infection episodes in an open uncontrolled study. Patients with *Staphylococcus aureus* infections were excluded. Peripheral blood cultures were required. Posttreatment blood cultures were repeated only if symptoms recurred. Four patients received systemic therapy plus ALT with vancomycin 5 mg/mL, ciprofloxacin (concentration not reported), or gentamicin 5 mg/mL for

<table>
<thead>
<tr>
<th>Reference</th>
<th>ALT Indication</th>
<th>CRBSI Episodes Cured</th>
<th>Peripheral Culture Collected†</th>
<th>Systemic Antibiotics</th>
<th>ALT Antibiotics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Messing et al. (1988)</td>
<td>PN</td>
<td>10 91</td>
<td>no</td>
<td>yes</td>
<td>vancomycin, amikacin, minocycline</td>
</tr>
<tr>
<td>Messing et al. (1990)</td>
<td>PN</td>
<td>25 93</td>
<td>no</td>
<td>no</td>
<td>minocycline, amikacin</td>
</tr>
<tr>
<td>Arnow et al. (1991)</td>
<td>PN (fungal)</td>
<td>1 100</td>
<td>yes (negative)</td>
<td>no</td>
<td>amphotericin B</td>
</tr>
<tr>
<td>Doudard et al. (1991)</td>
<td>cancer (children)</td>
<td>2 100</td>
<td>yes</td>
<td>yes</td>
<td>vancomycin, teicoplanin</td>
</tr>
<tr>
<td>Rao et al. (1992)</td>
<td>cancer (children)</td>
<td>3 100</td>
<td>yes (negative)</td>
<td>no</td>
<td>vancomycin</td>
</tr>
<tr>
<td>Capdevila et al. (1993)</td>
<td>dialysis</td>
<td>9 82</td>
<td>yes</td>
<td>yes</td>
<td>vancomycin + heparin, ciprofloxacin + heparin</td>
</tr>
<tr>
<td>Johnson et al. (1994)</td>
<td>PN (children)</td>
<td>10 83</td>
<td>no</td>
<td>no</td>
<td>amphotericin B</td>
</tr>
<tr>
<td>Capdevila et al. (1994)</td>
<td>AIDS</td>
<td>12 80</td>
<td>yes</td>
<td>no</td>
<td>vancomycin</td>
</tr>
<tr>
<td>Williams et al. (1994)</td>
<td>PN</td>
<td>4 100</td>
<td>yes</td>
<td>yes</td>
<td>NR</td>
</tr>
<tr>
<td>Krzywda et al. (1995)</td>
<td>PN</td>
<td>14 64</td>
<td>no</td>
<td>no</td>
<td>vancomycin, gentamicin, amphotericin B, cefazolin, erythromycin, nafcillin, ceftriaxone, clindamycin, ceftazidime</td>
</tr>
<tr>
<td>Benoit et al. (1995)</td>
<td>PN</td>
<td>3 75</td>
<td>yes</td>
<td>yes</td>
<td>vancomycin, gentamicin, amphotericin B, ciprofloxacin, teicoplanin</td>
</tr>
<tr>
<td>Capdevila et al. (1995)</td>
<td>dialysis</td>
<td>40 100</td>
<td>yes</td>
<td>yes</td>
<td>NR</td>
</tr>
<tr>
<td>Bregenzer et al. (1996)</td>
<td>cancer</td>
<td>1 100</td>
<td>NR</td>
<td>yes</td>
<td>teicoplanin</td>
</tr>
<tr>
<td>Domingo et al. (1999)</td>
<td>AIDS</td>
<td>22 79</td>
<td>yes</td>
<td>unclear†</td>
<td>teicoplanin</td>
</tr>
<tr>
<td>Boorgu et al. (2000)</td>
<td>dialysis</td>
<td>14 100</td>
<td>yes</td>
<td>yes</td>
<td>vancomycin + heparin, penicillin + heparin, piperacillin + heparin, amoxicillin + heparin</td>
</tr>
<tr>
<td>Domingo et al. (2001)</td>
<td>AIDS</td>
<td>1 50</td>
<td>yes</td>
<td>yes</td>
<td>vancomycin</td>
</tr>
<tr>
<td>Longuet et al. (2001)</td>
<td>AIDS, cancer</td>
<td>5 31</td>
<td>yes</td>
<td>yes</td>
<td>vancomycin, teicoplanin, amikacin</td>
</tr>
<tr>
<td>Krishnasami et al. (2002)</td>
<td>dialysis</td>
<td>40 51</td>
<td>yes†</td>
<td>yes</td>
<td>vancomycin + heparin, cefazolin + heparin, gentamicin + heparin</td>
</tr>
<tr>
<td>Guédon et al. (2002)</td>
<td>PN</td>
<td>15 63</td>
<td>yes</td>
<td>unclear‡</td>
<td>teicoplanin</td>
</tr>
<tr>
<td>Viale et al. (2003)</td>
<td>AIDS, cancer</td>
<td>15 100</td>
<td>yes</td>
<td>no</td>
<td>vancomycin, amikacin, teicoplanin</td>
</tr>
<tr>
<td>Abraham et al. (2003)</td>
<td>dialysis</td>
<td>1 100</td>
<td>yes</td>
<td>NR</td>
<td>vancomycin + heparin</td>
</tr>
</tbody>
</table>

ALT = antibiotic lock technique; CRBSI = catheter-related bloodstream infections; NR = not reported; PN = parenteral nutrition.

†Peripheral cultures were required to be positive when collected, unless otherwise indicated.

‡Nine patients received concomitant systemic therapy; however, authors did not specify how many of these patients had the catheter removed; only total number was provided.

§No catheter cultures drawn.

¶Twenty patients received concomitant systemic therapy; the number of these patients cured not specified.
an 8- to 12-hour dwell time. Three patients received the ALT alone. Catheters in 8 of the 9 (89%) episodes were salvaged after an average of 8.6 days of ALT and 21 days of systemic antibiotics. Duration of ALT in this study was much lower than the usual 14 days seen in most reports, and systemic therapy was given for a longer period of time, making conclusions about the usefulness of ALT alone unclear. In addition, one of the patients classified as a success received an antibiotic lock alone with gentamicin and amphotericin 2.5 mg/mL chronically for at least 250 days due to previous catheter infections that required removal of the line.

A case series report included 6 patients, most receiving parenteral nutrition, who experienced 22 episodes of CRBSIs. The specific number of patients receiving parenteral nutrition was not provided. One patient accounted for 10 of the infections over a 14-month period. Three of the infection episodes were with more than one organism in this patient, including gram-negative rods and fungi. Since peripheral cultures were not performed in any patient, it is possible that some, if not all, of the episodes reported were the result of catheter colonization rather than CRBSI. Follow-up catheter specimens were cultured at the end of treatment and 2 months later to document cure. Patients received a variety of antibiotics at different doses depending on the organism(s) isolated for an average of 8 days. Of the 12 episodes in the other 5 patients, 11 (92%) were salvaged with the ALT; 9 of these episodes were due to S. epidermidis. However, the patient that accounted for 10 infections had 3 catheters removed and only 3 posttreatment cultures that were negative over the course of follow-up. If this patient and all 22 episodes are counted, then salvage was obtained in only 14 episodes.

One retrospective study seems to contradict positive reports of ALT use. The authors reviewed the medical records of 265 patients who received parenteral nutrition through subclavian, subcutaneous tunneled catheters from January 1997 to December 1999. Catheter-related S. epidermidis sepsis was diagnosed if blood drawn from catheters had at least 5 times as many colony-forming units on culture as peripheral blood samples. Infected catheters were treated with a teicoplanin lock (2.5 mg/mL), with a dwell time of 12 hours daily for 14 days. During the study period, there were 24 episodes of S. epidermidis catheter sepsis in 14 patients. Five were hospitalized patients (5 episodes) and 9 home-care patients (19 episodes). Catheters were not removed in 15 of 24 episodes.

The authors concluded that teicoplanin ALT was not effective for S. epidermidis catheter-related sepsis due to their low salvage rate. Seventy-nine percent of the S. epidermidis isolates were methicillin-sensitive, which is rare in American hospitals today. If the glycopeptide teicoplanin is not as effective as cefazolin in methicillin-sensitive staphylococcal infections, as is the case with vancomycin, the low salvage rate could have been due to the antibiotic used rather than the lock technique. Furthermore, inpatients who likely needed short-term parenteral nutrition were included in the analysis. These patients are not likely to be considered as having highly needed catheters as parenteral nutrition therapy is not usually long term.

### Dialysis

Similar case series on patients receiving dialysis have been published. In a report of 11 dialysis patients with 13 bacterial CRBSIs, both catheter and peripheral cultures were required. Subjects were treated with a combination of systemic antibiotics and locks for 15 days; 9 (82%) cases were successfully treated with the initial course of therapy. Patients received the ALT with vancomycin 0.1 mg/mL or ciprofloxacin 0.1 µg/mL in a 5% heparin solution with dwell time until the next dialysis period for 15 days depending on the organism isolated. Systemic antibiotics were given through the same catheter over 4 hours. Two patients had catheters that were infected with Pseudomonas spp., and the infection relapsed after treatment ended at 4 and 6 weeks. These 2 patients were considered cured after a second antibiotic course.

The authors reported an overall success rate of 100%. Catheters were used for an average of an additional 12.7 weeks (range 6–26) after the ALT. Eight of the lines were sterile when removed for non-infectious reasons because lines were no longer needed. Therefore, application of the ALT for use in highly needed catheters in this study is unclear given that 73% of the patients no longer needed the catheters after treatment. It was not reported whether the dialysis access was temporary while a fistula was maturing for long-term dialysis access.

Another open study reported 100% success with the ALT in patients receiving dialysis via a subcutaneous access device. Of 26 devices implanted, 14 bacteremic episodes were reported in 8 patients. Both catheter and peripheral cultures were required. Half of the episodes were due to S. epidermidis. No follow-up cultures were performed. Patients received concomitant systemic antibiotics. Locks contained a variety of antibiotics according to isolates, including vancomycin 1–3 mg/mL in a heparin solution of 100–2500 units/mL. Solutions were allowed to dwell until the next dialysis session and continued for 2–3 weeks. The authors reported that the ALT is their standard of care for bacteremic episodes with the devices. After follow-up of 329 patient-months (average 11), no devices had been removed.

In contrast, a prospective open study in 79 bacteremic patients receiving dialysis showed a success rate of 51% with the ALT and systemic antibiotics. Only peripheral cultures were obtained during febrile episodes. Catheters were treated throughout periods between dialysis with locks containing vancomycin 2.5 mg/mL, cefazolin 5 mg/mL, gentamicin 1 mg/mL, or a combination of these according to isolates, in addition to heparin 2500 units/mL. Systemic therapy was given with loading doses of vancomycin 20 mg/kg and gentamicin 1.5 mg/kg, followed by maintenance doses of vancomycin 500 mg and gentamicin 1 mg/kg, to a maximum of 100 mg after each dialysis session. No drug concentrations were monitored or doses adjusted, and treatment was continued for 3 weeks.
Catheter retention was prolonged by a median of 64 days. Eleven (18%) patients had serious complications from the infected catheters, including septic shock in 5 patients and endocarditis in 3 patients. Gram-negative organisms caused 6 of the 11 infections that resulted in serious complications. Sensitivities of these organisms to gentamicin were not provided. It appears that single blood cultures positive for coagulase-negative staphylococci were counted as infection even if skin contamination of the blood culture bottle was a possibility, given that no catheter cultures were drawn. While the authors reported that the ALT salvaged the catheter in over half of the cases and offers clinical advantages over removing the catheter, the serious complication rate was high and increased life of the catheter was limited.23

Cancer or AIDS

A one-year open study was conducted in 8 children (mean age 6 y) with cancer who had 14 catheter infection episodes.14 Patients received the ALT alone, and a 100% success rate was reported. Over half (56%) of the isolates were gram-negative rods in non-neutropenic patients. Amikacin 40 mg/mL was used in the lock containing heparin 1000 units/mL. Only catheter cultures were required. It is possible that these organisms represented colonization of the catheter site with transient bacteremias as a result of accessing the catheter rather than an infection.

Viale et al.15 tested the ALT in an open uncontrolled study of 30 patients with bacterial CRBSIs. Forty-seven percent of patients were HIV-positive. Patients with pocket, tunnel, or secondary infections were excluded. Fifteen patients received additional systemic antibiotics, while 15 were treated with the ALT alone. Both peripheral and catheter cultures needed to be positive for the same organism to be included in the study. Patients received vancomycin 20 mg/mL, amikacin 10 mg/mL, or another antibiotic at 100 times the minimum inhibitory concentration for the isolate. The solutions were locked for at least 12 hours per day for 14 days.

The infections in 28 of 30 (93%) patients were cured, with cure defined as negative cultures from a peripheral vein and the catheter 14 days after completion of therapy. All patients treated with ALT alone were cured, as well as 13 of those receiving ALT plus systemic antibiotic therapy. The 2 patients who failed ALT had mixed infections including gram-negative isolates and received a glycopeptide antibiotic lock with combined systemic therapy. Eight of 9 S. aureus isolates were methicillin-resistant. The authors proposed that ALT can be an alternative to line removal/replacement in CRBSIs for HIV-positive patients.17

An open study limited to patients with port-related bacteremia reported a success rate of 7 of 16 (44%) patients treated with ALT and systemic therapy.24 Ten patients were HIV-positive with CD4+ counts <30 cells/mm³. Both catheter and peripheral cultures were required. Patients received ALT with vancomycin 5 mg/mL or teicoplanin 5 mg/mL with or without amikacin ALT (concentration not specified) according to organism(s) isolated. Patients received ALT once or twice a day depending on the antibiotic used, but no further details were provided regarding dwell time. Patients were treated for only 8 days; this may have contributed to the high failure rate. In addition, as the authors theorized, it is possible that the reservoirs of ports are not as effectively treated with the ALT as other catheter types. Furthermore, given the low CD4+ cell count of the HIV-positive patients, patients with less immunosuppression may have had different results.

Fungal Infections

While several case series have excluded patients with fungal infections,17,23,24,26,30,31 others have reported using the ALT against fungi.20,21,25,29,32-34 Only 3 successful cases,21,32 2 in pediatric patients,21 with at least 20 failures,20,25,29,33,34 have been reported in the literature reviewed here. One successful case involved a 35-year-old man who had a catheter infection with Malassezia furfur and was treated with amphotericin B 2.5 mg/mL for a 12-hour dwell time per day over 21 days without systemic therapy. The patient was followed for 16 months without recurrence of infection after ALT use.32 He had received 435 mg of systemic amphotericin B to treat a catheter infection with the same organism 2 years earlier. Both children were infected with Candida albicans.23 However, no peripheral cultures were performed, and catheter colonization may have been treated in these patients. From these limited data, ALT does not appear to be useful for patients with fungal catheter infections.

Infection Prophylaxis

Using the ALT is not recommended for infection prevention because the limited data available included studies that used vancomycin-containing solutions,39-42 and use of those solutions may increase the incidence of vancomycin-resistant enterococci.9 Carratalá et al.41 performed a randomized double-blind trial comparing the efficacy of heparin 10 units/mL alone (n = 57) versus vancomycin 25 µg/mL and heparin 10 units/mL (n = 60) dwelling for one hour every 2 days in preventing CRBSIs in neutropenic patients with cancer. Nine patients in the heparin arm and no patients in the heparin/vancomycin arm experienced hub colonization over the follow-up period of 35 days (p = 0.001). The authors concluded that the use of heparin with vancomycin is effective in preventing hub colonization with gram-positive bacteria and subsequently preventing bacteremia. Similar results were reported in 45 pediatric patients followed for a mean of 247 days.39 However, the use of minocycline- and rifampin-impregnated catheters may be a better option for prevention of CRBSIs compared with the ALT and is the recommended strategy by the Centers for Disease Control and Prevention.9,42

Compatibility

Data regarding compatibility of antibiotic solutions with heparin are conflicting. The use of heparin combined with
antibiotics is theoretically necessary to increase antibiotic penetration in the fibrin sheath; however, this may be more critical for catheters that are only used occasionally (eg, dialysis) and therefore require prolonged dwell times as opposed to catheters used for daily parenteral nutrition or antimicrobial agents. Some authors reported that heparin and vancomycin are compatible when dilute concentrations are used (eg, 0.025 mg/mL of vancomycin and 9.75 units/mL of heparin) or when vancomycin <4 mg/mL and heparin 2.5–25 units/mL are employed. Other studies have found that vancomycin 0.5 and 2 mg/mL were compatible and stable with heparin 100 units/mL. Vancomycin 2.5 mg/mL was also shown to be compatible with 2500 units/mL of heparin. A commonly cited study reported that vancomycin 10 mg/mL was compatible with heparin 5000 units/mL. In contrast, some data suggest that high concentrations of heparin are problematic.

It appears that, primarily, patients receiving dialysis with an infected catheter would require use of heparin in the lock due to expected dwell times of ≥24 hours between dialysis periods. Heparin 2500–5000 units/mL is recommended in these cases. One study found that vancomycin 10 mg/mL given with gentamicin 5 mg/mL and heparin 5000 units/mL were compatible in vitro for 48 hours. Some clinicians have reported anecdotally that, even though these concentrations have been shown to be stable, a precipitate may form when the drugs are mixed. However, it appears that after light spinning, the precipitate disappears.

Guidelines

Based on the above reports and expert opinion, the Infectious Diseases Society of America (IDSA) recommends that, for uncomplicated infections of central venous catheters when catheter salvage is the goal and no tunnel infection is documented, the ALT should be used for 2 weeks. The IDSA recommends this therapy for infections caused by coagulase-negative staphylococci, S. aureus, or gram-negative organisms. However, most of the data that appear to support use of the ALT relate to uncomplicated coagulase-negative staphyloccoci, S. aureus, or gram-negative organisms. It is not clear at this time whether the ALT should be attempted in patients who responded initially and present with recurrence of infection.

It would be prudent for providers who use ALT to audit their results and report their outcomes. Additional randomized studies are warranted, especially since many of the reports discussed in this review are small case series that are several years old and because resistance patterns and treatment options have changed over time. However, due to the low number of patients that may be available to be followed in a particular institution, these studies may be difficult to conduct unless collaborative efforts are carried out.

References


EXTRACTO

OBJETIVO: Resumir la literatura existente sobre la técnica de utilizar antibióticos en la vía de los catéteres como una alternativa de tratamiento para pacientes con catéteres altamente necesarios. Se consideran altamente necesarios los catéteres que no pueden o deben ser removidos por la falta de accesos venosos necesarios para la administración endovenosa de terapias tales como nutrición parenteral, diálisis, o quimioterapia.


SÉLECTION DES ÉTUDES/EXTRACTION DES DONNÉES: Les articles décrits l’utilisation de la technique du cathéter à demeure avec antibiotique dans le traitement d’infections du cathéter chez les humains et les études évaluant la stabilité in-vitro des antibiotiques ont été inclus.

SYNTHÈSE DES DONNÉES: La technique du cathéter à demeure avec antibiotique a été utilisée chez les patients avec des besoins hautement nécessaires en cathéters fonctionnels, généralement pour l’alimentation parentérale, la chimiothérapie anticancéreuse, ou la dialyse. Les taux de succès dans la sauvegarde du cathéter infecté sont variables et dépendent du microorganisme infectieux impliqué. De plus, des données conflictuelles existent en ce qui à trait aux compatibilités des antibiotiques avec les solutions d’héparine.

CONCLUSIONS: Un consensus semble être établi à l’effet que la technique de cathéter à demeure avec antibiotique peut être tentée pour les patients avec besoin hautement nécessaire en cathéter lorsqu’une infection à staphylocoques à coagulase négative est documentée et qu’aucun signe systémique de sepsie, tel que l’hypotension, n’est évident. La majorité de ces patients ont probablement besoin également d’une thérapie systémique. Une infection du cathéter associée à une bactérie gram-négative ou une septicémie à champignons nécessitera probablement le retrait du cathéter afin de prévenir les complications systémiques. Des études additionnelles avec la technique du cathéter à demeure avec antibiotique sont justifiées face aux questions laissées sans réponse.

Chantal Guévremont

RÉSUMÉ

OBJECTIF: Revoir la littérature médicale concernant l’utilisation de la technique de cathéters à demeure avec antibiotiques comme option de traitement pour les patients qui ont un besoin essentiel en cathéters fonctionnels. Les cathéters sont considérés comme besoin hautement nécessaire lorsque leur retrait est impossible ou non désiré en l’absence de sites d’injection alternatifs pour des thérapies tels que l’alimentation parentérale, la dialyse, ou une chimiothérapie anticancéreuse.


SÉLECTION DES ÉTUDES/EXTRACTION DES DONNÉES: Les articles décrits l’utilisation de la technique du cathéter à demeure avec antibiotique dans le traitement d’infections du cathéter chez les humains et les études évaluant la stabilité in-vitro des antibiotiques ont été inclus.

SYNTHÈSE DES DONNÉES: La technique du cathéter à demeure avec antibiotique a été utilisée chez les patients avec des besoins hautement nécessaires en cathéters fonctionnels, généralement pour l’alimentation parentérale, la chimiothérapie anticancéreuse, ou la dialyse. Les taux de succès dans la sauvegarde du cathéter infecté sont variables et dépendent du microorganisme infectieux impliqué. De plus, des données conflictuelles existent en ce qui à trait aux compatibilités des antibiotiques avec les solutions d’héparine.

CONCLUSIONS: Un consensus semble être établi à l’effet que la technique de cathéter à demeure avec antibiotique peut être tentée pour les patients avec besoin hautement nécessaire en cathéter lorsqu’une infection à staphylocoques à coagulase négative est documentée et qu’aucun signe systémique de sepsie, tel que l’hypotension, n’est évident. La majorité de ces patients ont probablement besoin également d’une thérapie systémique. Une infection du cathéter associée à une bactérie gram-négative ou une septicémie à champignons nécessitera probablement le retrait du cathéter afin de prévenir les complications systémiques. Des études additionnelles avec la technique du cathéter à demeure avec antibiotique sont justifiées face aux questions laissées sans réponse.

Annette Perez