Should Vascular Catheters Be Removed from All Patients with Candidemia? An Evidence-Based Review

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(See the editorial commentary by Walsh and Rex on pages 600–2)

The removal of all central venous catheters (CVCs) from all patients with candidemia is considered to be standard care. However, this practice is not always possible, and it is associated with significant cost and potential complications. To evaluate the effect of CVC removal on the outcome of patients with candidemia, a literature review was conducted that selected studies that evaluated CVC removal as a prognostic factor (of mortality) in candidemia, performed a multivariate analysis with odds ratios and 95% confidence intervals, and included a validated severity of illness score. Of 203 studies of candidemia, only 4 fulfilled these criteria. One study showed a benefit from CVC removal in a subset of 21 neutropenic patients; another study showed no benefit; and the remaining 2 studies showed a marginal benefit from this strategy. Although it is possible that removal of CVCs may reduce the rate of complications due to candidemia, including death, the findings of this literature review do not substantiate this consensus recommendation.

Vascular catheters have been associated with candidemia, both as risk and prognostic factors [1–5]. Hence, removing all vascular catheters from patients with candidemia is considered to be standard practice [6, 7]. Removal of a vascular catheter is believed to reduce the rates of morbidity and mortality that can occur if a nidus of infection is left in place. However, arguments against removal of all catheters from patients with candidemia include the limited supportive evidence for this recommendation, the gastrointestinal origin in a large subset of cases of candidemia [8], the cost and complications associated with catheter replacement, and the problems that can be encountered in patients with difficult vascular access. A large proportion of patients with candidemia continue to be treated without removal of all intravascular catheters, yet no recommendations exist to guide clinicians in this setting.

To address this question and to provide additional guidelines for clinical settings in which removal of intravenous catheters may be difficult, we reviewed the literature, with particular emphasis on studies that evaluated important confounding variables and performed appropriate statistical analyses.

**MATERIALS AND METHODS**

**Data source.** We performed a computerized search of the MEDLINE database for appropriate articles published from January 1966 through December 2000 in any language. The keywords used were “candidemia,” “catheter,” and “outcome.” Abstracts presented from 1987 through 2000 at the yearly meetings of the American Society for Microbiology, the Infectious Diseases Society of America, and the Society of Healthcare Ep-
Studies selected. We selected studies that (1) evaluated catheter removal as a prognostic factor (of mortality) in candidemia, (2) performed a multivariate analysis with ORs and 95% CIs, and (3) included in the multivariate analysis any severity of illness score that had been validated as a predictor of death. We selected mortality as our main outcome measure because of its objective nature. We did not analyze complications or duration of candidemia, because none of the published studies reported the routine and systematic evaluation of these end points. We included confounding variables because of the importance of such variables on the outcome of patients with candidemia. Indeed, the severity of illness score [4, 5, 9–13] and persistent neutropenia [9, 10] have been consistently shown to strongly influence the survival of patients with candidemia. Appropriate statistical evaluation using multivariate analysis with ORs and 95% CIs was selected as one of our inclusion criteria because of the concerns about the validity of results when relying on P values only [14].

Data extraction. We reviewed methodology, patient characteristics, definitions of outcome variables, and influence of confounding variables.

RESULTS

Studies selected. We identified 203 studies of candidemia (figure 1). Of those studies, only 14 evaluated outcome in relation to catheter removal or retention (tables 1 and 2). Seven of these 14 studies performed multivariate analysis, but only 4 provided information on the ORs with 95% CIs and included confounding variables, such as severity of illness score, neutropenia, and other variables. These 4 studies are the focus of our review.

Anaissie et al. [9] retrospectively evaluated 491 episodes of candidemia in patients with cancer. This study was undertaken to specifically identify predictors of poor outcome. The authors used 2 severity of illness scores, the Simplified Acute Physiologic Score (SAPS) and the Acute Physiology and Chronic Health Evaluation (APACHE) III score, both of which had been shown to have excellent correlation with mortality rates [25, 26]. The influence of the removal of a central venous catheter (CVC) on outcome was analyzed in 363 patients who had also received antifungal therapy. The CVC exchange was associated with higher cure rate, and earlier exchanges had greater effects. However, patients who had the catheters retained had significantly higher APACHE III scores (P = .001; table 3) and were more likely to have neutropenia (P < .001). By multivariate analysis, severity of illness (OR, 1.05 per additional point; 95% CI, 1.03–1.07), visceral dissemination (OR, 6.0; 95% CI, 3.3–11), persistent neutropenia (OR, 11; 95% CI, 4.6–24), and treatment with antifungal therapy (OR, 0.21; 95% CI, 0.09–0.50) were found to be important predictors of death. In the subgroup of patients who had CVCs, full exchange of the catheter had a marginally beneficial effect (OR, 2.0; 95% CI, 1.4–2.9; P = .06).

Nucci et al. [10] evaluated 54 patients with cancer with fungemia (43 of whom had candidemia) in a prospective, observational study. The scoring system used to evaluate severity of illness was the Karnofsky performance status scale, which is predictive of death in patients with cancer [27] and in patients with infectious diseases [28]. CVC retention was associated with higher mortality rates by univariate analysis. However, patients whose catheters were retained had poorer performance status scores than did patients whose catheters were removed (P = .002), and they were more likely to experience neutropenia (P = .09; table 3). Multivariate analysis found that catheter retention was not significantly associated with death; however, severity of illness (OR, 46.6; 95% CI, 6.33–861), persistent neutropenia (OR, 33.1; 95% CI, 2.2–498), and older age (OR for each additional year, 1.06; 95% CI, 1.01–1.11) were.

In another prospective observational study of 145 cases of candidemia in patients with different underlying conditions, Nucci et al. [5] evaluated risk factors for death. The Karnofsky performance status scale was used to evaluate severity of illness. Analysis of the influence of CVC management on the prognosis was performed in 75 patients who had both a CVC in place and Karnofsky scale evaluated. The median performance status score was significantly higher in patients who had the catheter removed (40 vs. 30; P = .002; table 3). Nevertheless, catheter retention was the only variable associated with increased risk of death on multivariate analysis (OR, 4.22; 95% CI, 2.0–11.6). However, in a subsequent analysis (authors’ unpublished data), the authors observed that, in patients who received antifungal treatment, catheter removal was associated with a lower mortality rate only in the 21 patients with neutropenia (OR, 15; 95% CI, 1.16–316.66); this variable was not significant in the 52 patients without neutropenia (OR, 1.94; 95% CI, 0.53–7.19).

Luzzati et al. [15] retrospectively analyzed 189 adult non-neutropenic patients with candidemia. The authors used the McCabe scale for severity of illness, which has been shown to correlate with the mortality rate in patients with infectious diseases [29, 30]. A CVC was in place in 173 patients, but only 123 patients were assessable for catheter removal. Severity of illness was not significant by univariate analysis. Catheter removal had a modest impact on mortality by multivariate analysis (OR, 0.62; 95% CI, 0.38–0.99; P = .047). The other significant variables were duration of positive blood cultures (OR, 1.06; 95% CI, 1.01–1.12), receipt of adequate antifungal treatment (OR, 0.52; 95% CI, 0.32–0.84), and hospitalization ward (OR for worse prognosis in intensive care units compared with surgical and medical wards, 2.06; 95% CI, 1.21–3.51). This latter finding is puzzling, in light of the authors’ conclusion that severity of illness score was not a significant predictor of
mortality, because patients admitted to intensive care units usually have a significantly higher severity of illness score than do patients treated in other hospital wards.

Some studies performed multivariate analysis but did not provide ORs, 95% CIs, or important confounding variables. These studies are discussed below. As expected, studies performed in the 1980s and early 1990s did not benefit from the newer statistical methodologies or from our recent knowledge of the confounding variables of the outcome of candidemia.

Goodrich et al. [16] retrospectively evaluated 171 bone marrow transplant recipients with invasive candidiasis, 104 of whom had candidemia. The authors analyzed risk factors for tissue invasion and death associated with candidemia by univariate and multivariate analyses. However, a severity of illness score was not included in their analysis. Tissue involvement occurred in 21 (62%) of 34 patients who had their CVCs removed and in 36 (55%) of 66 of patients whose catheter was left in place \( (P = .5) \). Univariate predictors of outcome were not reported, but multivariate analysis indicated that catheter retention was not a risk factor for death. Patients who had their catheters removed had a longer duration of candidemia \( (P < .001) \) between catheter removal and number of positive blood cultures may be explained by the practice of removing catheters in patients with multiple positive blood cultures.

In a large multicenter, prospective observational study of 427
Table 1. Influence of central venous catheter (CVC) removal or retention on mortality in candidemia studies that involved multivariate analyses

<table>
<thead>
<tr>
<th>Reference, year</th>
<th>Design</th>
<th>Population</th>
<th>Patients with neutropenia, %</th>
<th>Assessment of severity of illness</th>
<th>OR and 95% CI provided</th>
<th>Effect of CVC removal or retention and comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>[11], 1995</td>
<td>Prospective cohort</td>
<td>427 Patients; cancer in 46%</td>
<td>DNP</td>
<td>4-Point grading system</td>
<td>No</td>
<td>Prognostic factor for death on univariate and multivariate analyses. Other prognostic factors on multivariate analysis: critical illness, older age, recent administration of corticosteroids, lung involvement.</td>
</tr>
<tr>
<td>[12], 1996</td>
<td>Prospective cohort</td>
<td>118 Adult patients; cancer in 58%</td>
<td>15</td>
<td>4-Point grading system</td>
<td>No</td>
<td>Prognostic factor for death on univariate and multivariate analyses. Other prognostic factors: persistent candidemia, higher severity 4 of illness score, no antifungal treatment.</td>
</tr>
<tr>
<td>[16], 1991</td>
<td>Retrospective</td>
<td>102 BMT recipients</td>
<td>DNP</td>
<td>None</td>
<td>Yes</td>
<td>Longer duration of fungemia but no influence on mortality. Prognostic factors for death: female sex (RR, 1.8), acute lymphoid leukemia (RR, 3.6), conditioning regimen (RR, 2.0), no. of days of candidemia (RR, 1.1), engraftment (RR, 0.6).</td>
</tr>
<tr>
<td>[9], 1998</td>
<td>Retrospective</td>
<td>476 Patients with cancer</td>
<td>45</td>
<td>SAPS and APACHE III</td>
<td>Yes</td>
<td>Modest improvement in mortality rates in a subgroup of patients whose CVCs were changed over a guidewire; OR was 2.2 for catheter retention (95% CI, 1.6–3.2). Other prognostic factors: higher APACHE III score (OR, 1.05; 95% CI, 1.04–1.07), visceral dissemination (OR, 6.2; 95% CI, 3.5–11), remained or became neutropenic (OR, 13; 95% CI, 5.9–28), antifungal treatment (OR, 0.21; 95% CI, 0.09–0.50).</td>
</tr>
<tr>
<td>[10], 1998</td>
<td>Prospective cohort</td>
<td>54 Patients with cancer</td>
<td>48</td>
<td>Karnofsky scale</td>
<td>Yes</td>
<td>Prognostic factor for death on univariate but not on multivariate analysis. Prognostic factors: poor performance status score (OR, 46.6; 95% CI, 6.33–861), persistent neutropenia (OR, 33.1; 95% CI, 2.2–498), older age (OR, 1.06; 95% CI, 1.01–1.11)</td>
</tr>
<tr>
<td>[5], 1998</td>
<td>Prospective cohort</td>
<td>145 Patients; cancer in 34%</td>
<td>24</td>
<td>Karnofsky scale</td>
<td>Yes</td>
<td>Prognostic factor for death. OR for catheter retention was 4.81 (95% CI, 2.0–11.6). Other prognostic factors: <em>Candida parapsilosis</em> (OR, 0.27; 95% CI, 0.09–0.79), older age (OR, 1.02; 95% CI, 1.00–1.03).</td>
</tr>
<tr>
<td>[15], 2000</td>
<td>Retrospective</td>
<td>189 Adult patients; cancer in 21%</td>
<td>0</td>
<td>McCabe scale</td>
<td>Yes</td>
<td>Modest improvement in mortality; OR for catheter removal was 0.62 (95% CI, 0.38–0.99, P = 0.047). Other prognostic factors: duration of positive blood cultures (OR, 1.08; 95% CI, 1.01–1.12), being in an ICU (OR, 2.06; 95% CI, 1.21–3.51), adequate antifungal treatment (OR, 0.52; 95% CI, 0.32–0.84).</td>
</tr>
</tbody>
</table>

**NOTE.** APACHE, Acute Physiology and Chronic Health Evaluation; BMT, bone marrow transplant; DNP, data not provided; ICU, intensive care unit; SAPS, Simplified Acute Physiologic Score.

* A 95% CI was not provided.
<table>
<thead>
<tr>
<th>Reference, year</th>
<th>Design, methodology</th>
<th>Population</th>
<th>Patients with neutropenia, %</th>
<th>Assessment of severity of illness</th>
<th>Effect of catheter removal</th>
</tr>
</thead>
<tbody>
<tr>
<td>[17], 1989</td>
<td>Retrospective comparison between 2 groups</td>
<td>21 children</td>
<td>0</td>
<td>No</td>
<td>Persistent candidemia: 6 of 8 patients whose catheter was retained vs. 2 of 13 patients whose catheter was removed; no effect on mortality.</td>
</tr>
<tr>
<td>[18], 1990</td>
<td>Retrospective comparison between 2 groups</td>
<td>31 children</td>
<td>DNP</td>
<td>No</td>
<td>Death: 3 of 5 patients whose catheter was retained died vs. 2 of 26 patients whose catheter was removed.</td>
</tr>
<tr>
<td>[19], 1994</td>
<td>Prospective comparison between 2 groups</td>
<td>237 adults; cancer in 61%</td>
<td>0</td>
<td>APACHE II</td>
<td>Lower duration of candidemia with catheter removal; survival differences not analyzed. Higher APACHE II score in patients whose catheter was retained.</td>
</tr>
<tr>
<td>[20], 1992</td>
<td>Retrospective, descriptive analysis</td>
<td>155 patients with cancer</td>
<td>63</td>
<td>No</td>
<td>No difference in mortality rates; recurrence of fever or fungemia in 9 of 11 patients whose catheter was retained.</td>
</tr>
<tr>
<td>[21], 1996</td>
<td>Retrospective, descriptive analysis</td>
<td>35 patients with candidemia due to Candida parapsilosis who had hematological malignancies</td>
<td>74</td>
<td>No</td>
<td>Death: 5 of 22 patients whose catheter was removed died vs. 7 of 13 patients whose catheter was retained ($P = .07$). Catheter was not removed in 6 of 13 patients because of critical underlying condition.</td>
</tr>
<tr>
<td>[22], 1995</td>
<td>Retrospective</td>
<td>70 children; cancer in 15%</td>
<td>15</td>
<td>No</td>
<td>Death: 9 of 19 patients whose catheter was retained died vs. 4 of 42 patients whose catheter was removed ($P = .002$). Other variables associated with death: neonatal age and sustained candidemia.</td>
</tr>
<tr>
<td>[23], 2000</td>
<td>Prospective</td>
<td>104 infants</td>
<td>DNP</td>
<td>NTISS</td>
<td>Lower duration of candidemia, similar overall death rates but lower death rate attributed to candidemia (1 of 50 died vs. 10 of 54; $P = .008$).</td>
</tr>
</tbody>
</table>

**NOTE.** APACHE, Acute Physiology and Chronic Health Evaluation; DNP, data not provided; NTISS, National Therapeutic Intervention Scoring System.
subsequent candidemic patients with several underlying diseases, Nguyen et al. [11] evaluated risk factors for mortality. The authors used a 4-point grading system to assess severity of illness, which had proven to be highly predictive of death in patients with bloodstream infections [31]. CVC retention was a risk factor for death on multivariate analysis ($P < .001$).

Severity of illness ($P < .001$), lung involvement ($P < .001$), age of >60 years ($P = .004$), and use of steroids ($P = .02$) were the other risk factors for death. Unfortunately, ORs and 95% CIs were not provided to further strengthen the validity of these findings.

In a prospective observational study, Hung et al. [12] evaluated 118 cases of candidemia in adults with various underlying conditions. The severity of illness score used was the same 4-point grading system used in the study by Nguyen et al. [11]. Multivariate analysis indicated that removal of a CVC was associated with a lower mortality rate. The other factors associated with mortality were persistent candidemia, higher severity of illness score, and no receipt of antifungal therapy. However, ORs and 95% CIs, as well as $P$ values for the significant variables determined by multivariate analysis, were not provided.

The authors of some studies did not perform multivariate analysis and did not include confounding variables. We now turn our attention to these studies. Eppes et al. [17] reviewed the outcome of 21 cases of candidemia in 19 children. Thirteen patients whose CVC was removed were compared with 8 patients whose catheter was retained. Patients whose catheter was retained had more persistent candidemia. Although the mortality rate was higher in patients whose catheter was retained (37% vs. 15%), the difference was not statistically significant. No other variables were analyzed, including possible confounding variables, such as a severity of illness score, duration of neutropenia, and presence of disseminated candidiasis at diagnosis.

Dato and Dajani [18] retrospectively analyzed the frequency of complications in relation to CVC removal in 31 children with candidemia. The mortality rate among patients whose catheter was retained was 60% (3 of 5 patients died), as compared with a rate of 8% (2 of 26) among patients who had the catheter removed ($P = .02$). Furthermore, the frequency of complications (meningitis, arthritis, renal abscess, osteomyelitis, and endocarditis) was higher if the time to removal of the catheter was longer. However, the authors did not analyze the influence of confounding variables, and the number of patients whose catheter was left in place was too small (5 patients) to allow a meaningful conclusion.

Rex et al. [19] analyzed the influence of catheter exchange on the duration of candidemia (but not survival) as part of the first and largest multicenter, randomized trial of candidemia. The study compared the efficacy and safety of fluconazole and amphotericin B in this setting [24]. Among 173 patients with a CVC in place, 97 underwent removal and replacement without a guidewire; in 17 patients, the exchange was made over a guidewire. Catheter removal and replacement with ($P = .02$) or without ($P < .001$) exchange over a guidewire were associated with shorter duration of candidemia, as compared with different means of catheter management. However, the subset of patients who were not treated with catheter replacement had a higher severity of illness score (mean APACHE II score, 16.9 vs. 14.5; $P = .03$) and a higher number of catheters in place (mean number of catheters, 1.8 vs. 1.2; $P < .001$). In addition, only 66 (53%) of 124 of the CVCs removed had a tip that tested positive for *Candida* species [24], indicating that a large proportion of patients who had the vascular catheter removed did not have catheter-related candidemia and, thus, were unlikely to have benefited from removal. Finally, the influence of catheter removal on mortality (the end point in this review) was not analyzed.

Lecciones et al. [20] reviewed 155 episodes of fungemia in 149 patients with CVCs who had cancer (98% of whom had candidemia). Eleven of the 155 patients did not have the catheter removed, and 9 of these patients had an unfavorable outcome (death in 4 patients and recurrence of fever in 5). However, the mortality rate for patients who had the catheter retained was not statistically different than that for patients whose catheter was removed (36% vs. 50%; $P = .37$). Other confounding variables, such as severity of illness, were not analyzed, because these were not well-established factors of outcome for candidemia at the time of the study.

Girmenia et al. [21] retrospectively analyzed data from 35 patients with hematological malignancies who developed candidemia due to *Candida parapsilosis*. The mortality rate for patients whose CVC was maintained in place was not statistically significantly different from the rate for patients whose catheter was removed (5 [23%] of 22 patients vs. 7 [64%] of 11 patients; $P = .12$). As in other studies, confounding variables were not analyzed.

<table>
<thead>
<tr>
<th>Reference, year</th>
<th>Method of evaluation</th>
<th>Score $^a$ with CVC</th>
<th>RemOed</th>
<th>Retained</th>
<th>$P$</th>
</tr>
</thead>
<tbody>
<tr>
<td>[9], 1998</td>
<td>SAPS and APACHE III$^b$</td>
<td>45 $\pm$ 8</td>
<td>53 $\pm$ 16</td>
<td>0.001</td>
<td></td>
</tr>
<tr>
<td>[10], 1998</td>
<td>Karnofsky$^c$</td>
<td>70</td>
<td>30</td>
<td>0.002</td>
<td></td>
</tr>
<tr>
<td>[11], 1998</td>
<td>Karnofsky$^c$</td>
<td>40</td>
<td>30</td>
<td>0.004</td>
<td></td>
</tr>
</tbody>
</table>

**NOTE.** APACHE, Acute Physiology and Chronic Health Evaluation; CVC, central venous catheter; SAPS, Simplified Acute Physiologic Score.

$^a$ Data are mean score $\pm$ SD or median score.

$^b$ A lower score is better.

$^c$ A higher score is better.
Figure 2. Proposed management of central venous catheters (CVCs) in nonneutropenic patients with candidemia. aHigh risk of bleeding or pneumothorax; serious complication with bleeding or pneumothorax (such as patients with limited lung function). bValue of quantitative blood cultures not established. cEspecially in patients with Candida parapsilosis (typically associated with CVC-related candidemia). dMost cases of cellulitis at the CVC site are not infectious and occur within a few days of CVC insertion. Patients with severe neutropenia and mucositis are unlikely to benefit from CVC removal. eCandidemia caused by contaminated intravenous fluids and total parenteral nutrition may occur. Removal of CVC recommended in addition to elimination of source of contamination.

Stamos and Rowley [22], who studied a population of children with candidemia, observed that the mortality rate for 19 patients whose catheter was retained was 36%, compared with no deaths among 42 patients who had the catheter removed ($P < .0001$). Neonates ($P = .002$) and patients with sustained candidemia ($P = .007$) had also higher mortality rates. However, the authors did not analyze possible confounding variables or perform multivariate analysis with ORs and 95% CIs.

In a study by Karkowicz et al. [23], 50 infants who had their CVCs removed or replaced over a guidewire within 3 days after the first blood culture yielded Candida species were compared with 53 infants who had late CVC removal or replacement (>3 days after the first positive blood culture). The severity of illness score was higher in the late-removal group ($P = .08$). Three patients who died early in the course of infection (within 2 days of diagnosis) were excluded. Early removal was associated with shorter duration of candidemia ($P = .0002$) and lower mortality rate attributed to candidemia (1 [2%] of 50 vs. 10 [19%] of 54; $P = .008$). However, the authors did not analyze possible confounding variables or perform multivariate analysis with ORs and 95% CIs.

**DISCUSSION**

The first remarkable finding of our review is the small number of studies that evaluated outcome of candidemia in relation to vascular catheter removal. Among >200 studies of candidemia, there was not a single randomized trial in a defined patient population that was designed to specifically address the effects of catheter removal versus retention in patients with candidemia, and only 4 (3 of which we wrote) of the 14 studies that evaluated the role of catheter removal on the outcome of patients with candidemia fulfilled our study criteria. Our second finding was that these 4 studies yielded conflicting results, with only 1 study showing a clear benefit from CVC removal in a subset of 21 neutropenic patients; another study showed no benefit; and the remaining 2 showed that this strategy had a marginal benefit.

These 4 studies had important differences, including patient population (e.g., patients had cancer or other underlying diseases), inclusion criteria (all patients vs. only those who received antifungal therapy), sample size (as few as 54 patients and as many as 476), and severity of illness score used (APACHE,
SAPS, Karnofsky, McCabe). It is notable that, unlike the SAPS or APACHE scores, which are based on objective parameters, the McCabe and the Karnofsky performance scores include an element of subjectivity.

In the 3 studies for which data are available, patients whose CVC was retained had significantly higher severity of illness scores (table 3). Even the most sophisticated statistical analyses cannot control for all confounding variables, including those that are known—such as the tendency of doctors to remove CVCs in healthier subsets of patients and in patients whose life expectancy is considered acceptable—and those that are unknown. Although it is possible (even likely) that removal of CVCs may reduce the rate of complications caused by candidemia, including death, our critical review of the published literature could not substantiate this widely held consensus.

Our analysis, however, suffers from the limited power of a literature review, the paucity of data available, and, most importantly, the lack of prospective studies whose primary end point was evaluation of vascular catheter removal in patients with candidemia. In addition, and because of the limited data on systematic evaluation of duration of candidemia and its complications, our review focused on survival as the only objective end point for evaluation. It is likely that removal of vascular catheters is of great benefit (by shortening the duration of candidemia and reducing the risk of complications) in certain subsets of patients, particularly those with an obvious endovascular source (such as septic thrombophlebitis or endocarditis), and that CVC removal should indeed be a key component of managing cases of candidemia. However, removal of all vascular catheters in all patients with candidemia may be impractical, expensive, difficult, or even dangerous, as exemplified by the fact that an important proportion of patients with candidemia are treated with catheter retention, despite clear and long-standing recommendations for immediate removal of all CVCs [5, 9–12, 15, 16, 19]. Indeed, catheter insertion and removal are associated with increased cost and may result in significant morbidity, especially in certain clinical settings, such as in patients with cancer. These patients frequently have thrombocytopenia, have difficult venous access, and need to receive several intravenous products, including blood transfusions, antibiotics, antineoplastic agents, and total parenteral nutrition. A significant proportion of these patients may also have limited lung reserve as a result of their underlying disease or its therapy, and, thus, there is risk of severe complications should bleeding or pneumothorax result from CVC replacement. Therefore, strategies that take into considerations these clinical settings are needed and should focus on a risk/benefit analysis of CVC removal for a given patient.

The Infectious Diseases Society of America has recently provided practice guidelines for the treatment of candidiasis that include removal of all existing vascular catheters in patients with candidemia while acknowledging the moderate supportive evidence (BII level of evidence—i.e., moderate evidence to support the recommendation with data from cohort or case-control studies) [6]. We agree with these recommendations and propose to expand them to take into account those situations in which removal of all vascular catheters is not possible. Our additional recommendations are based on the need for central venous access, the type and number of CVCs in place, the ease and safety of CVC removal, and the presence or absence of severe neutropenia (figure 2). Indeed, candidemia is almost always primarily of gastrointestinal origin in patients with cancer who have severe neutropenia and mucositis (acute leukemia, stem cell transplant, other), and removal of CVCs is least likely to have an impact on outcome in this setting.

It must be pointed out, however, that these recommendations reflect our own opinion and are not supported by any of the studies we review here. Given the limitations of the studies published to date, a definitive answer to this question can only be provided by a prospective, randomized trial aimed at evaluating the effect of CVC removal on morbidity (duration of candidemia, complications, length of hospital stay) and mortality. Such a trial needs to take into consideration all known confounding variables and needs to use appropriate statistical analyses.

References


