

## Editorial

# Yes, Virginia, Aseptic Technique Is Very Important: Maximal Barrier Precautions During Insertion Reduce the Risk of Central Venous Catheter-Related Bacteremia

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*“Yes, Virginia, there is a Santa Claus.”*

-Frances Pharcellus Church

There long has been controversy over the level of sterile barrier precautions that should be used during the insertion of a short-term, noncuffed central venous catheter. Most authorities stress the need for “good aseptic technique,” “stringent asepsis,” or “surgical asepsis,” and many explicitly advocate use of *maximal* sterile barriers,<sup>1-9</sup> namely the use of sterile gloves, a long-sleeved surgical gown, a large sterile drape, and possibly a surgical cap and mask as well. However, most authors have not addressed the issue explicitly or endorsed the widespread practice of using *only* sterile gloves and drapes.<sup>10-19</sup> Even the expert panel that wrote the first Centers for Disease Control and Prevention (CDC) Guideline for Prevention of Intravascular Infections could not bring itself to recommend sterile barriers beyond gloves and drapes.<sup>20</sup> No cardiologist performing a cardiac catheterization would use less than complete barrier precautions, despite the fact that the catheter remains in place for only an hour or two in most cases and rarely for more than 24 hours, even when the introducer is left in place for a percutaneous transcatheter angioplasty the following day. Realizing that a short-term, percutaneously inserted, noncuffed central venous catheter is the

intravascular device most likely to cause nosocomial bloodstream infection,<sup>8,21,22</sup> I have long believed--admittedly without conclusive supportive data--that maximal sterile barrier precautions should be mandatory during the insertion of any central venous catheter (realizing that such precautions are unnecessary and would not be cost-effective for insertion of peripheral venous catheters or intraarterial catheters used for hemodynamic monitoring in an ICU).<sup>8</sup>

The problem with imposing such a standard on the 5 million short-term central venous catheters placed in U.S. hospitals each year has been the lack of scientific data affirming clearcut benefits in terms of reduction of device-related infection and, in the maelstrom of impending “healthcare reform,” economic cost-benefit. As a consequence, central venous catheters currently are inserted by physicians who wear sterile gloves, but often use little else in terms of barrier precautions. Personally having inserted hundreds of central venous catheters and supervised the insertion of several thousand over the past 20 years using a long floppy guidewire (as is the common practice), I would submit that without maximal sterile barriers--including a long-sleeved gown and a large sterile sheet-drape--touch contamination of the guidewire, the catheter, or both is very common (but rarely appreciated).

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*93-ED-218. Maki DG. Yes, Virginia, aseptic technique is very important: maximal barrier precautions during insertion reduce the risk of central venous catheter-related bacteremia. Infect Control Hosp Epidemiol 1994;15:227-230.*

**TABLE**  
**IMPACT OF A DEDICATED IV TEAM ON THE RATE OF CATHETER-RELATED BLOODSTREAM INFECTION**

Type of Study, Authors (Reference)	Type of Catheter*	Care Given By	No. of Catheters	Incidence of Catheter-Related Bloodstream Infection (per 100 Catheters)	P Value
<b>Historic Controls</b>					
Sanders <sup>25</sup>	CVC-TPN	Ward nurses	335	28.6	<0.001
		IV team	172	4.7	
Keohane <sup>26</sup>	CVC-TPN	Ward nurses	51	33	<0.001
		IV nurses	48	4	
<b>Concurrent But Not Randomized</b>					
Bentley <sup>27</sup>	PIV	House officers	4,270	0.4	<0.001
		N team	470	0.4	
Freeman <sup>28</sup>	CVC-TPN	Ward nurses	33	21.2	<0.001
		N nurses	78	2.3	
Nehme <sup>29</sup>	CVC-TPN	Ward nurses	391	26.2	<0.001
		N team	284	1.3	
Faubion <sup>30</sup>	CVC-TPN	Ward nurses	179	24	<0.001
		N team	377	3.5	
Nelson <sup>31</sup>	CVC-TPN	House officers	45	28.8	<0.001
		N nurses	30	3.3	
<b>Randomized, Concurrent Controls</b>					
Tomford <sup>32</sup>	PIV	House officers	427	2.1	<0.05
		N team	433	0.2	
Soifer <sup>33</sup>	PIV	House officers	453	1.5	<0.02
		N team	412	0	

⊠ PW = peripheral IV catheter; CVC = central venous catheter; TPN = total parenteral nutrition.

From: Maki DG. **Infection due** to infusion therapy. In: Bennett JV, Brachman RB. eds. *Hospital Infections*. 3rd ed. Boston, MA: Little Brown and Co: 1992:880.

Centers that mandate maximal aseptic precautions during insertion of central venous catheters, usually implemented most consistently with an institutional IV therapy team or nutritional support team, experience substantially lower rates of central venous catheter-related bloodstream infection than do centers that do not subscribe to such a standard of care.<sup>1,2,8</sup> Moreover, Mermel et al,<sup>23</sup> in a prospective study of the pathogenesis and epidemiology of infection of Swan-Ganz pulmonary artery catheters, found that insertion of these catheters with lesser barrier precautions (sterile gloves and a small fenestrated sterile drape *without* a sterile surgical gown or large sterile sheet drape) was associated with a significantly increased risk of catheter-related infection (odds ratio, 2.2;  $P=0.03$ ). However, the value of using maximal sterile barrier precautions had not been proved by a prospective randomized clinical trial, nor had the cost-benefit of using maximal barrier precautions been established.

Raad et al,<sup>24</sup> as reported in this issue of the journal, have done a great service in successfully carrying out a prospective, randomized trial in 343

vulnerable patients in the M.D. Anderson Cancer Center, showing that the use of maximal sterile barrier precautions—including a long-sleeved surgical sterile gown and large sterile sheet drape, as well as sterile gloves—reduced the incidence of central venous catheter-related bloodstream infection nearly sixfold (odds ratio, 0.16;  $P=0.01$ ). The use of maximal barriers was shown to be highly cost-effective.

The findings of this study provide additional important insights into the pathogenesis and prevention of central venous catheter-related infection.

First, physicians and nurses all learned as students that “good aseptic technique” during insertion of an invasive device is not only desirable but is mandatory. However, we were not provided scientific data to prove the importance of good technique. Excellent technique is important. An analysis of the impact of IV therapy teams<sup>25-33</sup> (Table), which now includes two prospective, randomized trials,<sup>32,33</sup> shows most convincingly that giving a team of trained, dedicated specialists the responsibility for insertion and followup care of intravascular devices greatly reduces the risk of IV catheter-related bloodstream

infection. Raad and his colleagues' data reaffirm that good aseptic technique during insertion of central venous catheters, which now includes the use of maximal barrier precautions, makes a huge difference in terms of protecting patients from iatrogenic catheter-related bloodstream infection.

Second, since the benefit of maximal barriers increased the longer the catheter was in place, it appears clear that many—perhaps most—catheter-related bloodstream infections derive from microorganisms introduced into the transcutaneous tract at the time the catheter is inserted, and the most likely source of infecting microorganisms is the patient's skin or the skin of the person inserting the catheter.<sup>8</sup>

Third, there has been much controversy about the safety of transparent polyurethane adhesive films for dressing intravascular devices. A recent meta-analysis suggested that the risk of central venous catheter-related infection associated with these dressings is increased as contrasted with the risk if conventional sterile gauze and tape dressings are used.<sup>34</sup> This meta-analysis, in my opinion, was flawed by the inclusion of studies in which the two groups were not comparable and also by the failure to include the results of several recent comparative trials. It must be pointed out that most of the controlled, prospective, randomized trials of polyurethane dressings on central venous catheters<sup>35-45</sup> found no significant differences in the risk of catheter-related infection, particularly catheter-related bloodstream infection.<sup>36-38,40,42-45</sup> Whereas the jury still may be out in terms of the true effect of polyurethane dressings, the largest prospective randomized studies have not shown significant differences in risk. In the study by Raad et al,<sup>24</sup> polyurethane dressings were placed over gauze on most of the catheters studied—the “island dressing”—which probably is a less permeable dressing than the use of either gauze and tape or a high-quality polyurethane dressing alone. Use of polyurethane-gauze dressings was associated with a very low risk of infection when maximal barrier precautions were used, ie, optimal aseptic technique was employed. No dressing can be considered as fail-safe if aseptic technique is less than optimal.

And finally, Raad et al's study strongly reaffirms prospective studies that have shown that the prophylactic use of sterile barriers in patient care—gloves and gown, vis-a-vis protective isolation—can reduce the risk of device-related nosocomial infections of all types in patients who are heavily exposed to invasive devices and have a very high risk of nosocomial infection.<sup>46-50</sup>

In sum, maximal barrier precautions now can be added to the use of chlorhexidine, rather than povidone-iodine or alcohol, for cutaneous disinfection

of the insertion site<sup>51</sup>; the use of povidone-iodine ointment on central venous catheters for short-term hemodialysis<sup>52</sup>; the use of an attachable subcutaneous silver-impregnated cuff<sup>53-55</sup>; and the use of antibiotic-coated<sup>56</sup> or antiseptic-impregnated<sup>57</sup> central venous catheters as measures shown to reduce significantly the risk of central venous catheter-related bloodstream infection, based on prospective, randomized, clinical trials. Maximal barriers, as Raad and his colleagues have shown, are inexpensive and highly cost-effective, and now should be considered the standard of care for insertion of central venous devices of all types.

*“Primum non nocere.”—Hippocrates*

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