Title: STERILITY OF PULMONARY ARTERY CATHETERS WITH STERILE PROTECTIVE SLEEVES AND THE INCIDENCE OF CATHETER-RELATED BACTEREMIA

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Introduction. Quantitative assessment of the incidence of bacterial colonization of pulmonary artery catheters (PACs) within sterile protective sleeves is clinically important because manipulation of a PAC with a colonized tip could produce a bacteremia with the identical organism, i.e., a catheter-related bacteremia (CRB).[1, 2] Previous studies have only examined colonization of the catheter within the sleeve during a brief period in a small number of patients.[3] This investigation was designed to examine (1) the frequency of bacterial colonization of the segment of PAC within a sterile protective sleeve, (2) the temporal course of the development of such colonization, (3) the relationship of the method of catheter insertion to colonization of the PAC segment within the sleeve, and (4) the relationship of colonization of the PAC tip and the PAC segment within the sleeve to blood cultures and CRB in patients in our surgical intensive care unit.

Materials and Methods. Eighty-seven PACs (Edwards Laboratories) were removed from 68 surgical intensive care unit patients. All PACs had been inserted in the operating room or intensive care unit through catheter introducers (Cook) by using sterile technique and were protected with sterile protective sleeves (Cook) covering approximately 25 cm of the PAC protruding from the introducer hub. Insertion sites included the internal and external jugular and subclavian veins bilaterally. PACs were inserted by one of two methods: through a new percutaneous site (n = 64) or through a pre-existing cannulation site by exchanging an in-dwelling catheter for a PAC introducer (n = 23). Subsequent to insertion, PACs were manipulated within the sleeve as clinically indicated without disrupting the seal at either end of the sleeve. Frequency of manipulation was not quantified. PACs were removed by sterile technique without disrupting the seal of the sleeve. After removal, the PAC tip and a 5-cm segment of PAC from within the sleeve were placed in 10 ml of buffered saline and sonicated (80,000 Hz, 100 watts) for 60 s. After sonication, semiquantitative culturing was done by using agar pour-plate dilution. Organisms were counted after 48 h. Blood cultures were obtained from peripheral veins at the time the PAC was removed. Additional peripheral blood cultures were drawn as clinically indicated. Statistical analyses were accomplished by Fisher's exact probability test.

Results. Eleven of 87 sleeve segments (12%) were positive for bacterial growth. Among catheters inserted through new introducers, 23 PACs were removed $\leq$ 48 h after insertion and all had negative cultures from the PAC segment within the sleeve. Of 41 PACs removed > 48 h after insertion, 7 had positive cultures from the PAC segment within the sleeve ($P < 0.05$) (Table). Among PACs placed by exchanging introducers, there was no statistically significant difference in culture results from the PAC segment within the sleeve when the two periods of catheterization were compared (Table). Blood cultures were obtained at the time PACs were removed for 75 of the 87 PACs. There were 4 cases of identical organisms grown from both the PAC tip and blood (5.3%). In 3 of these cases, the PAC tip grew > 10^3 organisms. The fourth case grew < 10^3 organisms but a central venous catheter removed at the same time also grew the same organism. In contrast, among 66 of 71 patients with either negative blood cultures or different organisms grown from the blood and the PAC tip at the time the PAC was removed, the PAC tip had either no growth or < 10^3 organisms ($P < 0.004$).

Discussion. The principal finding of this study is that the PAC segment within the sleeve remains sterile if pulmonary artery catheterization is briefer than 48 h. PAC tips colonized with > 10^3 organisms were associated with bacteremia caused by the same organism. PACs within sterile protective sleeves, some of which were manipulated as clinically indicated, were associated with a 5.3% incidence of CRB, a rate similar to that in studies in which PACs without sterile protective sleeves were not manipulated.[4]

References

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TABLE. Culture Results from Pulmonary Artery Catheter (PAC) Segments Within Sterile Protective Sleeves

Duration of Catheterization (hours)	Culture Result	Method of PAC Insertion: New Introducer (N = 64)	Method of PAC Insertion: Exchanged Introducer (N = 23)
$\leq$ 48	Positive	0	2
	Negative	23	8
> 48	Positive	7	2
	Negative	34	11

$P = 0.085$ when comparing frequency of positive cultures by method of PAC insertion for duration of catheterization $\leq$ 48 h.

$P = 0.036$ when comparing frequency of positive cultures by duration of catheterization ($\leq$ 48 h vs > 48 h) for PACs inserted through new introducers.