

In-Vitro Assessment of Antimicrobial Activity of Three Commercially Available Central Venous Catheters

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INTRODUCTION:

The occurrence of blood stream infections associated with the use of central venous catheters is a significant problem. One infection prevention strategy is to treat catheters with known antimicrobial agents, including antibiotics and antiseptic agents. Various studies have looked at the antimicrobial properties of commercially available antimicrobial catheters. In this study, we compared three commercially available treatments in agar diffusion testing using daily transfers to study spectrum of activity and duration of antimicrobial effect. The purpose of this study was to compare the antimicrobial effect of three commercially available antimicrobial catheters against gram positive and gram negative bacteria and yeast.

MATERIALS AND METHODS:

Catheters

Sterile triple-lumen 7-French antimicrobial intravenous catheters were used for this study. Minocycline/Rifampin (MR), Silver/Carbon/Platinum (SCP), and Chlorhexidine Silver Sulfadiazine (CS) catheters were tested, and all catheters were marketed product within current expiration dating. Single lumen untreated polyurethane 7.0 French tubing was utilized as a negative control. Prior to testing, all catheter materials were aseptically cut into 6 mm segments. Catheters were cut and tested directly from the package and were not presoaked in plasma of any other fluids prior to testing.

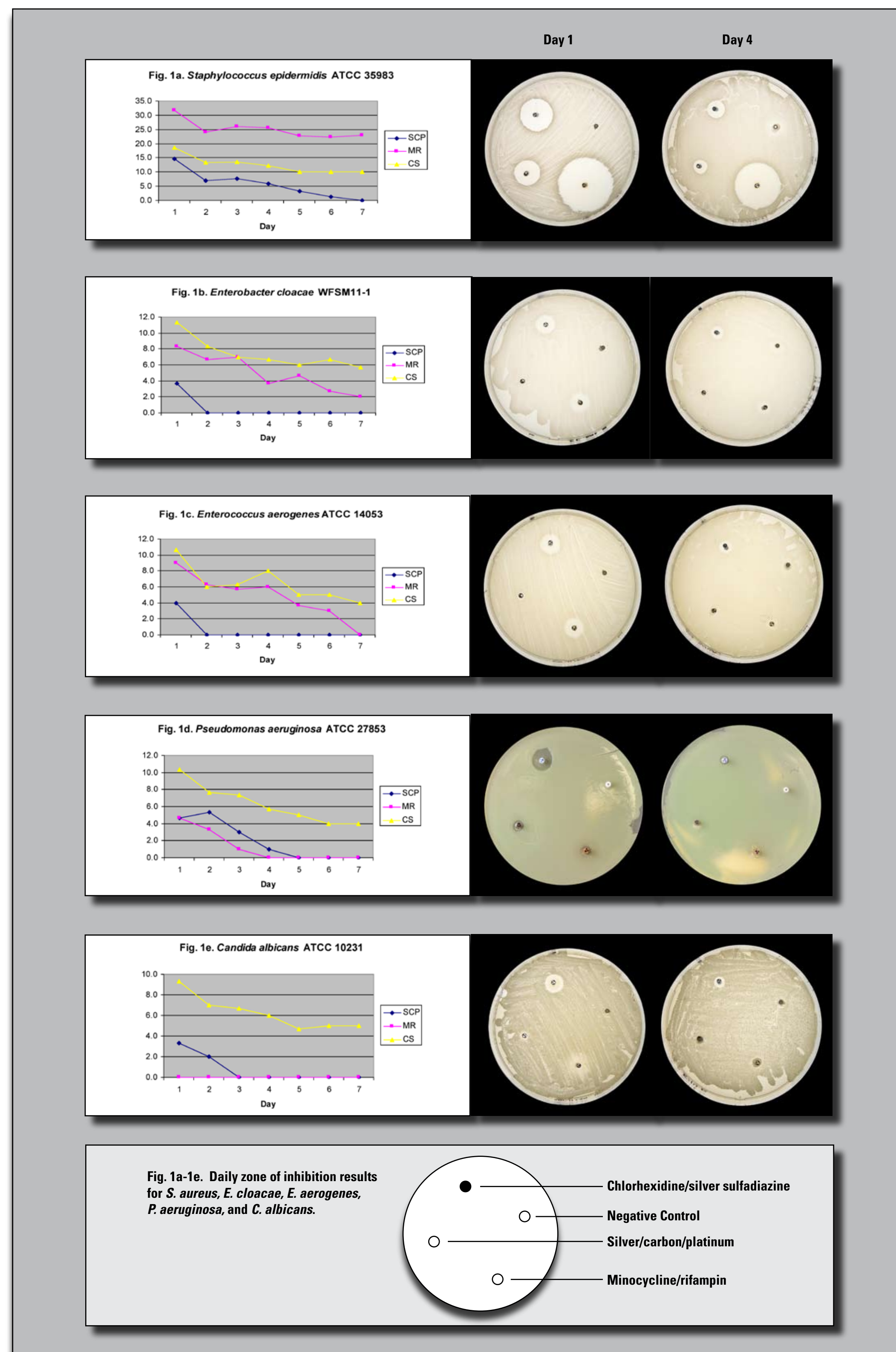
In-vitro antimicrobial activity of catheters

Challenge organisms: *Staphylococcus epidermidis* ATCC 35983, *Pseudomonas aeruginosa* ATCC 27853, *Candida albicans* ATCC 10231, *Enterococcus aerogenes* ATCC 14053, and *Enterobacter cloacae* WFSM 11-1 (clinical isolate from Columbia Presbyterian Hospital provided by Dr. S. Modak of Columbia University). Using a modified Kirby Bauer method, plates were swab inoculated with overnight cultures of the challenge organisms grown in TSB. Bacteria were diluted 1:10 in buffered saline to a concentration of 10^8 CFU/mL. *C. albicans* was tested undiluted at a concentration of 10^6 CFU/mL.

All bacterial testing was performed on Mueller Hinton II agar (BD Falcon) while *C. albicans* was tested on Yeast Mold Agar (YMA) from Sigma. All testing was performed in triplicate. To each seeded plate, a 6 mm long catheter segment of each treatment was inserted vertically. Plates were incubated at 37°C overnight.

Zones of inhibition were measured as the edge to edge diameter of the zone surrounding the catheter segment (including diameter of catheter). Subsequently, segments were transferred to freshly seeded plates and incubated overnight at 37°C. Zones of inhibition were read daily for the 7 day duration of the study.

RESULTS:



DISCUSSION:

While all three treatments showed some level of activity against *S. epidermidis*, ZOI with MR treatment was twice that seen with CS at day 7, and SCP had no ZOI against this organism at day 7. MR produced no ZOI with *C. albicans*, and by day 4 had no activity against *P. aeruginosa*. CS treatment produced a slightly larger ZOI than MR against *E. cloacae* and *E. aerogenes*, and was the only treatment of the three tested showing activity against *C. albicans* and *P. aeruginosa* for the duration of the study. While SCP showed initial activity against all five challenge organisms, by day 2 there was no ZOI with *E. aerogenes* and *E. cloacae*. At day 3, SCP showed no ZOI with *C. albicans*, and at day 5 no ZOI was seen for *P. aeruginosa*.

CONCLUSIONS:

CS treated catheters demonstrated the broadest spectrum of activity against the 5 challenge organisms included in this study. While MR produced the largest ZOI against *S. epidermidis*, it was ineffective against *C. albicans* and *P. aeruginosa*. SCP generally had the shortest duration antimicrobial effect and smallest overall ZOIs, although it was superior to MR in terms of activity against *C. albicans* and *P. aeruginosa*.

REFERENCES:

- 1 Tcholakian, R., Raad, I. Durability of Anti-Infective Effect of Long-Term Silicone sheath Catheters Impregnated with Antimicrobial Agents. *Antimicrobial Agents and Chemotherapy*, July 2001, 1990-1993.
- 2 Rupp et al. Effect of a Second-Generation Venous Catheter Impregnated with Chlorhexidine and Silver Sulfadiazine on Central Catheter Related Infections *Annals of Internal Medicine* 18 Oct. 2005, Vol. 143, No. 8;570-580.
- 3 Sampath, L., Suhas, T, Modak, S. In Vitro and In Vivo Efficacy of Catheters Impregnated with Antiseptics of Antibiotics: Evaluation of the Risk of Bacterial Resistance to the Antimicrobials in Catheters. *Infection Control and Hospital Epidemiology*, Oct. 2001;640-646.
- 4 Munson, E, Heard, S, Doern, G. In Vitro Exposure of Bacteria to Antimicrobial Impregnated Central Venous Catheters Does Not Directly Lead to the Emergence of Antimicrobial Resistance. *CHEST* 2004;126;1628-1635.