ferences between the different types of water used to rinse endoscopes. Lacking in the medical literature is a clear description of the parameters of sterile water, how it is produced, and how it compares to, and differs microbiologically from, filtered water claimed to be bacteria-free or sterile. Finally, although the CDC does not recommend routine microbiological sampling of endoscopes or the water used to rinse them, I recommend revisiting the conditions under which such a practice might be indicated to reduce the risk of patient infection.

REFERENCES

1. Struelens MJ, Rost F, Deplano A, Maas A, Schwan V, Serruys E, et al. *Pseudomonas aeruginosa* and *Enterobacteriaceae* bacteremia after biliary endoscopy: an outbreak investigation using DNA macrorestriction analysis. *Am J Med* 1993;95:489-498.
2. Alvarado CJ, Stolz SM, Maki DG. Nosocomial infections from contaminated endoscopes: a flawed automated endoscope washer. An investigation using molecular epidemiology. *Am J Med* 1991;91(suppl 3B): 272S-280S.
3. Centers for Disease Control and Prevention. Nosocomial infection and pseudoinfection from contaminated endoscopes and bronchoscopes—Wisconsin and Missouri. *MMWR* 1991;40:675-678.
4. Centers for Disease Control and Prevention. Bronchoscopy-related infections and pseudoinfections—New York, 1996 and 1998. *MMWR* 1999;48:557-560.
5. Berlau J. A new risk for high-tech surgery? *Investor's Business Daily* February 14, 2000;16:A1, A26.

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Triclosan and Antibiotic Resistance in *S aureus*

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The debate on the connection between chemical germicides and antibiotic resistance continues. Suller and Russell, from the Welsh School of Pharmacy, Cardiff University, recently reported on their studies with triclosan. Triclosan (2,4,4'-trichloro-2'-hydroxydiphenyl ether) is an antimicrobial agent used in hygiene products, plastics, and kitchenware. Handwashing products containing triclosan are used by healthcare workers in wards with patients infected with methicillin-resistant *Staphylococcus aureus. S aureus* strains with low-level resistance to triclosan have emerged. It has been claimed that strains with decreased susceptibility to biocides may also be less susceptible to antibiotics.

They tested the susceptibility of *S aureus* clinical isolates to triclosan and several antibiotics. Triclosan minimum inhibitory concentrations (MICs) ranged between 0.025 and 1 mg/L. Some, but not all, strains were resistant to several antibiotics and showed low-level triclosan resistance. *S aureus* mutants with enhanced resistance to triclosan (<1 mg/L) were isolated. In several cases this resistance was stably inherited in the absence of triclosan. These mutants were not more resistant than the parent strain to several antibiotics. Changes in triclosan MICs associated with the acquisition of a plasmid encoding mupirocin resistance were not observed, suggesting that the triclosan and mupirocin co-resistance seen in a previous study was not the result of a single resistance gene or separate genes on the same plasmid.

The continuous exposure of a triclosan-sensitive *S aureus* strain to sub-MIC concentrations of triclosan for 1 month did not result in decreased susceptibility to triclosan or to several antibiotics tested. Triclosan-induced potassium leakage and bactericidal effects on a triclosan-sensitive strain, a resistant strain, and a strain selected for increased resistance were compared with those of non-growing organisms, exponentially growing organisms, and organisms in the stationary phase. No significant differences between the strains were observed under these conditions despite their different MICs.

The authors point out that biocides have multiple target sites, and so MICs often do not correlate with bactericidal activities. The ability of *S aureus* to develop resistance to triclosan and the current view that triclosan may have a specific target in *Escherichia coli,* namely enoyl reductase, underline the need for more research on the mechanisms of action and resistance.

FROM: Suller MT, Russell AD. Triclosan and antibiotic resistance in *Staphylococcus aureus. J Antimicrob Chemother* 2000;46:11-18.