Editorial

Control of Antibiotic Resistant Organisms

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Recent major articles in *Science, The Annals of Internal Medicine,* and the *New England Journal of Medicine* have focused on the serious problem of antibiotic resistant organisms (1-4). What is at issue is the stark realization that for the first time we are faced with serious infections for which no known therapy exists. For nosocomial infections this is highlighted by the appearance of vancomycin-resistant *Enterococcus faecium* (5-6), and for the community at large by multi-drug resistant tuberculosis (7-8) and penicillin resistant pneumococci (9-10). Other problems include multiply antibiotic resistant gonococcus and Shigella, methicillin-resistant *Staphylococcus aureus* and coagulase-negative staphylococci, vancomycin-resistant coagulase-negative staphylococci and others. Various experts have called the situation a crisis (1) or a calamity (3), some suggesting the beginning of the end of the great antibiotic era (2).

The prevalence of antibiotic resistance--the number of new and old (but active) cases at a single point divided by the number surveyed--is a function of both introduction and spread (11). Introduction can be by way of de novo emergence or movement of colonized or infected persons to new locations. Spread involves transfer of antibiotic-resistant strains from one person to others. If we are to control antibiotic resistance, we must consider both introduction and spread.

In general the more that populations of organisms are exposed to antibiotics, the greater the likelihood that resistance will emerge and be introduced to a population. When antibiotic "pressure" is lowered, the proportion of resistant organisms often declines (10). Control, therefore, must focus at least on minimizing the use of antibiotics. Secondly, regarding the movement of infected or colonized patients, effective treatment of the initial infection and eradication of the offending pathogen are our best hopes so that even with population mobility, the antibiotic-resistant organisms will have been eliminated. Thirdly, with respect to spread, infection control is the answer : handwashing, proper isolation, barrier precautions.

Recent evidence from Hungary shows that reducing the volume of antibiotics has a strong effect on the prevalence of resistant organisms nationally (10). When penicillin usage declined from over 10 defined daily doses/1000 population/day to approximately 2/1000/day in the years 1976 to 1992, the proportion of penicillin-resistant pneumococci in the country declined from a peak of 50% to 34% (10). With respect to adequate therapy of initial infections, a recently published study has clearly demonstrated that effective directly observed therapy (DOT) for tuberculosis has reduced the rate of both primary and secondary resistance (8). Lastly, with respect to infection control, we have known for years that simple and inexpensive measures are effective in reducing the in-hospital prevalence of methicillin-resistant *Staphylococcus aureus* (12).

How best to implement programs to address antibiotic control, proper treatment, and optimal infection control ? This is difficult but at first requires well trained leaders in each area, well informed health care providers, and motivated teams for infection control. We know least about antibiotic use: we should use less when possible, but how should a hospital's formulary be managed? Should there be a limited number of drugs, automatic stop orders, written indications before use of antibiotics ? Are some antibiotics less likely to cause

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the emergence of class resistance than others over an equal time period ? We reluctantly admit that we do not know the answers. Yet in our ignorance and frustration, we need to move ahead and ***quantify*** specific usage of antibiotics, examine usage versus resistance over time, and examine the reasons for prescription from all health care givers and for individual clinicians in seeking some answers. Surely we must examine separately the usage of a drug for prophylaxis versus usage as directed therapy for proven infections versus empiric treatment for suspected but not proven infections. Prophylaxis and empiric therapy offer areas where major reduction in usage might occur.

Proper treatment depends on an excellent patient-physician relationship, good knowledge of a reasonable course of antibiotics and a competent patient. Even as we approach the year 2000, we must realize that the elements characterizing each of these areas are poorly understood and that studies of each area are surely needed. As nations around the globe face economic difficulties and attempt health care reform, the risk is especially great of unfavorably altering the patient-physician relationship since cost, not quality of care will be paramount initially (13). As a result we might expect unfavorable consequences for controlling antibiotic resistance. It is fair to speculate, however, that limited pharmacy budgets and economic pressures to reduce antibiotic use may offset the former.

Lastly the major issue facing infection control is motivation since risk is low even if consequences of infection are great. Many health care workers have to observe excellent handwashing practices all the time to prevent one nosocomial infection. Sometimes this reality translates to a trivialization of handwashing, proper isolation practices, and barrier precautions, and a relaxation of such practices. The challenge is to keep health care workers motivated. Since our science alone has had minimal success, we need help from our colleagues in psychology, marketing and sociology to help us in these endeavors (14).

It has been only 50 years since the introduction of antibiotics yet as we approach the 21st century, we face the grim possibility of loosing all that we have gained. We need more information and better implementation, more studies and even more action.

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