Antibiotic stewardship at North York General Hospital

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This article summarizes selected points from the presentation given at the First Antibiotic Stewardship Program in September 1997 at Niagara-on-the-Lake. The author's opinions regarding a novel system of antibiotic monitoring called pharmLINK, as used in North York General Hospital (NYGH), are represented.

NYGH is a mid-sized, regional referral hospital in Toronto, Ontario with approximately 450 beds (varying up to a capacity of 650 beds) involved largely in the secondary-level care of patients with a few select tertiary care level units. General medical, surgical, obstetrical/gynecological and paediatric services are provided at the hospital.

While physician autonomy in the prescribing of medications was the norm in the early 1980s, the increasing number of available antibiotics and acknowledgement that both cost effectiveness and rising bacterial resistance were clinically relevant problems spurred the establishment of a Subcommittee on Antibiotic Usage in October, 1987. The committee was established to monitor and control antibiotic use through direct intervention and information bulletins, and by developing policies pertaining to the promotion of appropriate use.

A number of mechanisms of intervention described in the literature have been tried with varying success. Some practitioners viewed direct restrictions or mandatory automatic substitution policies as a threat to the integrity of their practices. The fear of litigation if a 'less broad-spectrum' (implied to be less effective) antibiotic were prescribed was often cited as the reason to prescribe more costly medications. Reluctance to complete paperwork to justify the use of a particular agent and overall unwillingness to accept therapeutic suggestions from other health care professionals were other reasons for incomplete success in employing these interventions. Unlike in most institutions, prescribing of certain antibiotics has never required consultation or review by the Infectious Diseases (ID) specialist thus leading in certain cases to clinically less optimal or more costly outcomes. Staff education by means of 'in--services', grand rounds or seminars, while effective for brief periods of time, required repetition and commitment to maintain an adequate level of awareness.

As the 1990s brought the issues of cost containment and responsible prescribing more urgently to the forefront in Canadian hospitals, alternative mechanisms of antibiotic stewardship were attempted.

Joint efforts among the microbiology laboratory, the infection control practitioner, the (ID) specialist and the pharmacy resulted in the publication of a free handbook for staff that provided guidelines for antimicrobial use. Similar to handbooks available in other institutions, this publication was customized to the environment of the NYGH by using abbreviated information found in known published manuals. Through tables identifying types, frequencies and susceptibility patterns of the most common bacteria isolated at NYGH, as well as the best antimicrobial choices according to common diagnoses, physicians were provided with options and direction rather than inflexible rules. This handbook is periodically updated to reflect changes in bacterial susceptibility trends and as new agents are introduced to the formulary.

To facilitate better prescribing practices and monitor antibiotic use more efficiently a new computer system and software were acquired, linking the microbiology and pharmacy department databases and allowing timely intervention in drug use. The purchase of pharmLINK (Dade MicroScan, West Sacramento) enabled improved antibiotic prescribing and, ultimately, better patient care. Cost savings were realized, and overall satisfaction with this system has been high. A specially trained drug utilization (DU) pharmacist was assigned the task of implementing the system.

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This system interfaces with the currently used Microscan WalkAway 40 system (Dade-Behring, West Sacramento) for bacterial identification and susceptibility testing, and the Microscan Data Management System software (Dade-Behring, West Sacramento), to transmit culture and sensitivity results directly to the pharmacy as they become available; information is downloaded twice daily. Because the hospital is not yet fully computerized, physicians and most patient units receive printed microbiology laboratory results in the afternoon of a given day. PharmLINK merges this database with the pharmacy database and generates a therapy review report that highlights patients who are on 'inappropriate therapy' and patients who are candidates for alternative, more cost effective therapeutic regimens. An 'intervention analysis' is generated that indicates the potential savings (or losses if more expensive but appropriate agents are recommended) for an estimated course of therapy.

Antibiotics displayed are customized in compliance with the formulary and are cascaded in order of efficacy. Price and figures reflect actual hospital formulary costs. Free text entry allows further customizing for specific bacterial isolates and alerts as to the need for additional therapy in the event of antibiotic-related colitis, etc.

Patients on 'inappropriate therapy' are further identified through the pharmALERT report, which identifies patients with isolates resistant to current therapy, patients whose susceptibility results are not yet available for current therapy, patients receiving therapy without any susceptibility results (no specimens obtained) and patients with isolates who are not receiving therapy.

The system can tally frequency and duration of antibiotic use by unit, physician and culture source (ie, potential clinical diagnosis). Concomitant use of other nonantibiotic medications is also indicated.

Pharmacists undertake the main challenge of interpreting the reports and implementing their findings in the patient units. An intervention report citing reasons for therapeutic options and suggestions for more cost effective therapy are provided in the chart.

Identifying patients whose susceptibility results are not yet available for current therapy, or patients with isolates who are not yet receiving therapy, is generally easy with the pharmALERT report. Identifying patients whose susceptibility results are not yet available for current therapy, or patients with isolates who are not yet receiving therapy, is generally easy with the pharmALERT report. However, interpreting reports and making recommendations for patients with isolates resistant to current therapy, or of patients receiving therapy without any organism isolation or susceptibility results expected, requires special training with advanced pharmaceutical knowledge about basic microbiology, infectious diseases and pharmacodynamics. In most cases this is best achieved by prompt ongoing consultation with the ID specialist. A chart review is usually necessary. The system does not distinguish between colonization and infection. It cannot identify whether (empirical) therapy in the absence of a culture and susceptibility reports is still valid. It does not identify a single 'best antibiotic' or combinations if multiple specimens are positive. Also, pharmacists must independently assess optimal dosing for renal function. As well, the decision to 'step down' from intravenous to oral agents must still be made through physician consultation.

Review of the first three years of implementation has identified that the greatest savings were realized in the first year, not only paying for the salary of the DU pharmacist but also covering the system costs and resulting in significant overall savings in the antibiotic budget. The extent of savings has diminished with time; however, a few factors appear to have influenced this occurrence. After the initial year, the task of providing and interpreting pharmLINK reports was taken over by regular unit pharmacists whose superficial training resulted in erratic communication with resource persons. While many of their interventions were valid, opportunities for improving therapeutic choices and cost savings were frequently missed. It has become evident that hiring at least one full-time dedicated DU pharmacist is the best solution for maintaining the higher level of efficacy noted in the first year. Unfortunately, due to hospital restructuring and transient personnel shortages, this problem has not been solved.

Beneficially, part of the seemingly lesser savings is due to increasing physician comfort with the approach of therapy control, resulting in fewer 'errors' in prescribing. It has allowed for easier implementation of already internal policies for automatic substitution (confined to dosage and frequency but not choice of antimicrobial), drug choices for select clinical conditions and step-down to oral therapy equivalents. Thus far, together with the still necessary direct pharmacist-physician interaction, this system has been the most successful in enhancing antibiotic stewardship in the NYGH. Trends in antimicrobial resistance patterns at NYGH have for the most part paralleled those cited in the literature; however, overall resistance of the most commonly infecting pathogens remains low. The exception has been resistance to the quinolones, which has escalated substantially in several organism groups in addition to *Pseudomonas aeruginosa*.

Other areas of concern have included the inappropriate use of 'third generation' cephalosporins, carbapenems, intravenous, and to a lesser extent oral ciprofloxacin, and more recently gross overuse of fluconazole. The cephalosporins as a group comprise the bulk of the pharmacy budget, and the pharmacy has introduced or reinforced several policies in areas of surgical prophylaxis, and dosing and frequency in empirical regimens for, for example, febrile patients and patients with community acquired pneumonia, that have diminished some of the excessive costs. These policies are common knowledge but have been adapted as required to the NYGH environment. The issues of inappropriate use of quinolones and fluconazole are still being resolved.

Introduction of the 'Ontario strain' of methicillin-resistant *Staphylococcus aureus* in late 1991(1) brought its own problems of infection control and had an adverse impact on the hospital budget. Increased costs due to extensive diagnostic surveillance of this strain coupled with the costs of decolonization regimens had not been budgeted for. The perception of

the NYGH as being a 'clean hospital' with rare need for extraordinary measures hindered the more timely handling of optimal surveillance and resulted in escalation of the situation throughout 1997 until it was brought under reasonable control in early 1998.

CONCLUSIONS

While NYGH has traditionally endorsed various known measures of antibiotic stewardship coupled with good infection control policies, the greatest positive monetary impact has been through the implementation of the pharmLINK system. While the system has obvious benefits, it requires ongoing collaboration between a highly skilled DU pharmacist and the ID specialist to optimize these benefits on a continual basis.

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