Impact of Collaborative Drug Therapy Management by Pharmacists

Many studies have documented that clinical pharmacists can enhance patient care, improve drug administration management, and reduce or shorten hospital stays.[1-6] In acknowledgment of pharmacists' expertise in the management of drug therapy, regulating bodies have recognized and allowed predefined prescribing authority for qualified pharmacists.[7,8] Such predefined authority can be described as collaborative drug therapy management, whereby the pharmacist independently adjusts patients' drug therapy under previous authorization by a physician. The impact of pharmacists' activities through such collaborative management of prescription drug therapy in a hospital setting has not been widely studied. To assess impact on quality of patient care, the authors of this letter documented the outcomes of hospital pharmacists' collaborative drug therapy management according to recently granted authority to alter specific therapies.

All pharmacists at the authors' hospital had recently been granted additional authorities for collaborative drug therapy management by the institution and its physician staff, through the Pharmacy and Therapeutics Committee. Specifically, the pharmacists were authorized to make dosage adjustments on the basis of a patient's renal function, measured serum drug concentrations, or application of pharmacokinetic principles for dosage adjustments. The pharmacists were authorized to use published literature and personal experience in making dosage adjustments in individual patients without prior approval from any individual physician.

Methods

The study was conducted between May 13 and August 20, 2001, inclusive, at a 440-bed teaching facility serving a predominantly adult population. All changes in drug dosage made according to the new authorities for collaborative drug therapy management were reviewed to assess the impact on patient outcome. The hospital's pharmacists reported to the investigators all independent interventions resulting from the implementation of the authorities. Independent changes were defined as changes in drug regimens that occurred without any discussion with a physician. The investigators were notified of each such change within 48 h and before the impact of the intervention was known. The investigators reviewed each patient's health care record to determine the indication for the drug and to establish the monitoring parameters that would be used in that patient to assess the drug's efficacy and toxic effects. Any change in the patient's condition in response to the intervention was monitored concurrently by both investigators. The frequency of evaluation for efficacy and toxic effects was variable and was based on the pharmacokinetics and pharmacodynamics of the specific drug. The investigators did not initiate additional therapy or monitoring tests for any patient. Each clinical intervention was evaluated for achievement of therapeutic treatment goals and evidence of potentially beneficial or harmful effects as a result of the altered drug dosage. The evaluation lasted for the duration of the drug therapy, for a suitable time after discontinuation of drug therapy according to the drug's pharmacokinetics, or until the patient was discharged from the hospital. On the basis of the specific criteria to assess the patient's condition, the response to the clinical intervention was classified as harmful or as having no significant benefit, significant benefit, or very significant benefit (Table 1).[9]

Results

A total of 127 independent interventions were evaluated. The 77 patients consisted of 49 men (64%) and 28 women (36%) age 20 to 92 years (mean 63 years). Twenty-seven (21%) of the interventions were classified as resulting in significant benefit and 1 (1%) as resulting in very significant benefit. None of the independent interventions showed evidence of detrimental outcomes. The most frequent intervention (89 or 70%) was decreasing the drug dosage in response

Table 1. Scale for Assessing Impact of Clinical Intervention[9]

Assessed Level of Impact	Criteria
Harmful	Deterioration in signs and symptoms of the medical condition in a time period and pattern consistent with inappropriate drug therapy
	Development of new signs or symptoms of an adverse drug reaction resulting from inappropriate dose
No significant benefit	No detectable changes (i.e., patient did not display improvement or deterioration in the signs and symptoms of the medical condition)
Significant benefit	Improvement in signs or symptoms of the medical condition
	Avoidance of signs and symptoms predictable from the patient's history
	Decrease in the signs and symptoms of the medical condition resulting from initiation, discontinuation, or alteration in therapy
Very significant benefit	Successful treatment of the medical condition
	Avoidance of potentially life-threatening condition
	Avoidance of impaired organ function resulting from initiation or discontinuation of therapy

Table 2. Reasons for 127 Interventions Made by Pharmacists through Collaborative Drug Therapy Management

Intervention	Reason	No. (and %) of Interventions	
Decrease dose	Increasing creatinine level	53	(42)
	High therapeutic level	26	(20)
	Excessive prophylactic dose	4	(3)
	Excessive dialysis dose	3	(2)
	Excessive dose for weight	3	(2)
	All reasons	89	(70)
Increase dose	Low therapeutic level	27	(21)
	Increased renal function	9	(7)
	Low prophylactic dose	1	(1)
	Low dose for weight	1	(1)
	All reasons	38	(30)
All interventions		127	(100)

to a high dosage or decreased renal function (Table 2). The most commonly adjusted medications were vancomycin (52 interventions [41%]), quinolones (18 interventions [14%]), aminoglycosides (15 interventions [12%]), and ranitidine (12 interventions [9%]) (Table 3).

Discussion

These findings suggest that pharmacists can improve patient outcome when allowed to use their clinical skills independent of physician participation. Other researchers have found a beneficial impact of pharmacists performing many of the same patient care activities as described above, but those studies involved consultation with the patients' physicians.[10-12] The findings reported here suggest that such physician involvement may not be necessary and that application of pharmacists' clinical knowledge of drug therapy and dosage requirements achieves equivalent beneficial results. Allowing the pharmacist to function independently improves the efficiency of use of both pharmacists' and physicians' time.

Most (99 or 78%) of the interventions were classified as demonstrating no significant benefit. The investigators found that these interventions had no discernible impact on the patient's clinical status. This does not imply that the interventions were inappropriate or trivial, but rather that the impact could not be demonstrated in the time frame of the drug therapy or the hospital stay. Although such interventions did not lead to observed improvement in the patient's clinical status, they might have prevented toxic effects or ineffective therapeutic regimens.

Comprehensive independent prescribing authority involves the decision to initiate therapy; determination of the specific therapy; the initial dosage, route, and duration of treatment; subsequent adjustment of dose; and discontinuation of therapy.[8] Pharmacists at this institution did not have independent prescribing authority, but rather had authority for collaborative drug

Table 3. Frequency of Adjustments for Various Drugs

Drug	No. (and %) of Interventions	
Vancomycin	52	(41)
Quinolones (levofloxacin, ciprofloxacin)	18	(14)
Aminoglycosides (tobramycin, gentamicin)	15	(12)
Ranitidine	12	(9)
Phenytoin	9	(7)
Cephalosporins (cephalexin, cefuroxime, cefazolin)	8	(6)
Allopurinol	4	(3)
Penicillin (ampicillin, piperacillin/tazobactan)	4	(3)
Fluconazole	2	(2)
Sulfonamides	1	(1)
Digoxin	1	(1)
Metronidazole	1	(1)
Total	127	(100)

therapy management, whereby they received delegated authority from independent prescribers. Usually this authority takes the form of protocols whereby the pharmacists have the authority to adjust care on the basis of pre-established treatment patterns. The Pharmacy and Therapeutics Committee at this institution, representing the medical staff of the hospital, granted the pharmacists specific authorities for specific clinical scenarios. These authorities were not linked to specific physicians, but rather were applicable to all appropriate patients throughout the institution.

The delegation to pharmacists of the authority to independently adjust drug dosages has been incorporated into law in many US states.[13,14] Such protocols have specific requirements outlining what pharmacists can and cannot do independently. The delegation of authority to pharmacists can be applicable to many practice formats, both inpatient and outpatient,[15] although many of the most effective practices involve outpatient anticoagulant or psychiatry clinics.[16] When pharmacists have used their authority for independent dosage adjustments within authorized protocols, they have found improvements in the quality of patient care and increases in patient convenience.[17] Only in a limited number of US states do pharmacists have the authority to initiate prescription drug therapy without the involvement of a physician.[14] Even in this situation, the pharmacist is limited to a small number of medications for treatment of a limited number of indications.[14]

The modification of drug therapy on the basis of estimates of an individual patient's renal function can be enhanced through a pharmacist's participation, as reported by Falconnier and colleagues.[18] However, these investigators found that having the pharmacist inform the physician about abnormal renal function did not result in dosage adjustments, unless a specific dosage adjustment was recommended by the pharmacist.[18] This finding suggests that the pharmacist is relied upon to identify patients at risk, to determine an appropriate dosage adjustment, and to initiate action to obtain the dosage change. The authority granted to pharmacists at the authors' institution allows each individual pharmacist to complete these steps independently and to efficiently use pharmacists' and physicians' time in achieving adjustments in therapy.

The limitations of this study include the absence of a control group (patients for whom no dosage adjustments were performed by pharmacists through the authority of collaborative drug therapy management). In the absence of a control group, it is not known to what extent these dosage adjustments might have been made anyway by the physician. The study did not evaluate physicians' perception of the impact or value of the new process. The evaluation technique required some subjective assessment and could have been affected by the investigators' bias. However, a more rigorous methodology would have been logistically difficult.

We encourage all pharmacists to consider exploring methods to improve their practice efficiency and their impact on patient care. In many situations, this may include requesting expansion of authority for drug therapy adjustment from institutions or regulatory bodies. As with any change, barriers will be encountered, including resistance from other health care workers and from pharmacy colleagues.[19,20] Other Canadian health care disciplines, such as nursing, are also requesting more prescriptive authority to improve patient care and improve the efficiency of the health care system.[21] Pharmacists should exercise their professional skills to the maximum extent to improve patient care, and this requires establishing practices that allow their skills to be used. The Canadian Society of Hospital Pharmacists has provided valuable suggestions to individual pharmacists who wish to explore the development of collaborative drug therapy management authority in their institutions.[22]

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Anti-Factor Xa Monitoring in Overweight and Obese Patients

In a recent literature review of thromboembolic treatment, Rosenbloom and Ginsberg concluded that there is no evidence to support the utility of monitoring anti-factor Xa levels to determine the safety or efficacy of low-molecular-weight heparin (LMWH) therapy.[1] However, they suggested that further studies to determine the value of monitoring anti-Xa levels in obese patients might be appropriate. Indeed, other authors have suggested that periodic monitoring of peak anti-Xa levels in adults with body weight greater than 150 kg might be prudent, to minimize the risk of bleeding complications or thrombosis.[2]

We performed a pilot study to determine if patients of various body weights had the same response to weight-based dosing of LMWH as indicated by measurement of anti-Xa levels.[3] Patients being treated with dalteparin for venous thromboembolism were stratified *a priori* into 3 weight classes: within 20% above ideal body weight, between 20% and 40% above ideal body weight, and more than 40% above ideal body weight. The largest patient weighed 190 kg. No difference between these groups was observed for any of the levels monitored (day 3 and 5 trough levels and day 3 peak levels of anti-Xa). No thromboembolic or bleeding complications occurred in any of the patients during LMWH therapy.

The apparent volume of distribution of LMWHs is confined to the intravascular space, which corresponds to lean body mass. Adipose tissue has relatively low blood volume, and plasma volume does not increase substantially with obesity.[4] Although true weight-based LMWH dosing was safe and effective in our study, it is still unclear whether obese patients should be dosed according to ideal or actual body weight.

Overall, published data are lacking regarding the safety and efficacy of LMWH treatment in obese patients. The results of our small pharmacokinetic study seem to imply that there is no rationale for monitoring anti-Xa levels in this population.

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