

CONCISE COMMUNICATION

Antimicrobial Stewardship at Transition of Care from Hospital to Community

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Mandatory infectious disease consultation for parenteral antimicrobials at hospital discharge resulted in avoiding postdischarge parenteral antimicrobials in 28% of patients. No emergency department visit or rehospitalization within 30 days for these patients was a consequence of parenteral antimicrobial avoidance. Antimicrobial stewardship at transition of care is effective in reducing unnecessary antimicrobial use.

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Antimicrobial stewardship programs have been strongly supported by the Infectious Diseases Society of America, the Society for Healthcare Epidemiology of America, and the American Society of Hospital Pharmacists.^{1,2} Major goals of such programs are to slow the development of antimicrobial resistance and to use antimicrobials in a cost-effective manner.

A substantial proportion of antimicrobial use in hospitals is inappropriate.³ A multidisciplinary antimicrobial utilization team has been shown in a randomized controlled trial to improve the appropriateness of antimicrobial use.⁴ Most antimicrobial stewardship efforts are based on the 2 core strategies of prior authorization and/or prospective audit and feedback.¹ Such programs thus focus on the front end of antimicrobial therapy in hospital settings. Many patients who receive antimicrobials in hospital are also discharged on antimicrobial therapy, to complete the treatment course at home or in long-term acute care centers, skilled nursing facilities, outpatient infusion centers, or dialysis centers.⁵ In the absence of antimicrobial stewardship, there is little to prevent patients from being discharged from hospital on inappropriate antimicrobial therapy.

All patients who are to be discharged from the Cleveland Clinic hospital on parenteral antimicrobial therapy must be evaluated by an infectious disease (ID) staff physician, who shapes and approves the treatment plan and assumes responsibility for oversight of the antimicrobial treatment course.⁶ This process ensures that some patients who would have otherwise been discharged on community-based parenteral anti-infective therapy (CoPAT) will not leave the hospital on the same therapy, or, indeed, on any parenteral antimicrobial therapy, as a consequence of the ID consultation. However, overzealous antimicrobial avoidance in the name of stewardship could harm patients through inadequate treatment and could undermine the benefits of hospitalization.

The purpose of this study was to examine whether parenteral antimicrobial avoidance through antimicrobial stewardship at the terminal end of hospitalization led to harm from inadequately treated infection, by comparing emergency department (ED) visits and rehospitalizations for patients in whom CoPAT was approved and those in whom it was avoided.

METHODS

This was a retrospective cohort study. The study protocol was reviewed and approved by the institutional review board.

The Cleveland Clinic CoPAT Registry identifies all patients discharged from hospital on parenteral antimicrobial therapy. The relevant fields in this registry are obtained from data entered in a structured data entry form (the CoPAT form) in the electronic health record (EHR), populated by ID attending physicians as part of routine work flow in the hospital. No patient can leave the hospital on parenteral antimicrobials without having a CoPAT form filled out. In February 2010 an electronic form for requesting ID consultation was introduced in the computerized provider order entry system of the Cleveland Clinic EHR. One of the required fields in the ID consultation request form is whether the consultation includes a CoPAT request. This infrastructure allows for easy identification of all ID consultations and also for all CoPAT consultation requests.

All electronic ID consultation requests were examined to identify CoPAT consultations. All such consultations for patients 18 years or older between February 14, 2010, and May 14, 2010, were included. There were no exclusions. CoPAT avoidance was defined as cessation of all antimicrobials prior to hospital discharge or switching from a parenteral to an all-oral antimicrobial regimen.

Patient demographic and clinical characteristics were collected by review of the EHR. All ID consultations were reviewed for final CoPAT disposition and divided into 2 groups (approved or avoided). The clinical course was followed for all patients for the 30 days following discharge from hospital to determine whether they had any ED visit or hospital readmission within that time. The proportions of consultations with at least 1 subsequent ED visit or rehospitalization within 30 days of hospital discharge were compared across the 2 groups. Reasons for ED visits and hospital readmissions were also noted for those patients in whom CoPAT was avoided.

RESULTS

During the above 3-month period, 244 CoPAT consultation requests were received by the ID department. CoPAT was approved in 175 (72%) and avoided in 69 (28%) of the consultations. Of the 69 where CoPAT was avoided, oral anti-

microbials were prescribed instead in 42 (17% of all consultations), and antimicrobials were avoided altogether in 27 (11% of all consultations). Characteristics of consultations in which CoPAT was approved and avoided are outlined in Table 1. Outpatient infectious disease follow-up with an ID physician familiar with the patient was scheduled in 167 (75%) of consultations: 150 of 175 approved (86%) and 17 of 69 avoided (25%).

In the CoPAT-avoided group, there was an ED visit or rehospitalization in 27 of 69 (39%), compared to 46 of 129 (26%) in the CoPAT-approved group (odds ratio, 1.80; 95% confidence interval, 0.99–3.29; $P = .05$), a difference that did not reach statistical significance. There was also no significant difference when ED visits and readmissions were compared separately for the 2 groups. Figure 1 depicts the reason for ED visit or rehospitalization for consultations where CoPAT was avoided, with the most common cause being the occurrence of new clinical problems. No ED visit or rehospitalization was for relapsed or untreated infection and thus was not a direct result of avoidance of parenteral antimicrobials.

DISCUSSION

This study demonstrates that an antimicrobial stewardship strategy of antimicrobial oversight at care transition via an institutional policy of mandatory ID consultation requirement for every patient being discharged from hospital on parenteral antimicrobials results in avoidance of CoPAT in more than one-fourth of all patients, without increasing the risk of ED visit or readmission for an untreated or inadequately treated infection. Although not statistically significant, the CoPAT-avoided group appeared to have more ED visits and rehospitalizations, but the relatively small sample size limited the study's ability to detect significant differences. The study was nevertheless reassuring in showing that none of

the ED visits or rehospitalizations for the CoPAT-avoided patients was because of an infection that was missed or inadequately treated. CoPAT avoidance was associated with lower ID follow-up appointments made, but it would not be fair to state that this may have contributed to the increased ED visits and rehospitalizations. Most of the CoPAT-avoided patients did not have a reason to warrant ID follow-up. One could argue that the ID follow-up prevented ED visits and rehospitalizations for non-ID reasons in the CoPAT-approved group, but that would be difficult to prove.

A limitation of the study is that the retrospective review may not have identified all ED visits and rehospitalizations outside the Cleveland Clinic. About 75%–80% of patients for whom an ID appointment is made actually show up for the appointment, increasing the likelihood that any outside ED visit or rehospitalization would be noted in the EHR. Because one of the ID physicians at Cleveland Clinic is listed as the physician overseeing the home care episode, we are usually notified whenever a patient receiving antimicrobial therapy at home is rehospitalized elsewhere. For the CoPAT-avoided patients, our ability to identify outside ED visits and rehospitalizations would have been a little more limited. However, we should still have identified the majority of such events. Although the hospital is a large referral hospital, more than 60% of our hospitalized patients are from Cuyahoga County. The integrated nature of our EHR allowed us to identify all ED visits and rehospitalizations at the Cleveland Clinic and in all 8 regional hospitals of the Cleveland Clinic Health System. Most of the ED visits and rehospitalizations would have occurred within this network of hospitals.

Antimicrobial stewardship efforts provide value to hospitals. Controlling antimicrobial prescribing has been shown to result in demonstrable reductions in antimicrobial resistance and *Clostridium difficile* infections.⁷ Antimicrobial steward-

TABLE 1. Consultation Characteristics

Characteristic	CoPAT avoided (<i>n</i> = 69)	CoPAT approved (<i>n</i> = 175)
Patient age, mean (SD), years	59 (16)	59 (14)
Male patient	38 (55)	101 (58)
Patient race		
Caucasian	47 (68)	138 (79)
African American	17 (25)	33 (19)
Other	5 (7)	5 (3)
Duration of hospitalization, median (IQR), days	8 (5–16)	10 (5–21)
Type of consultation		
Urgent consultation	4 (6)	15 (9)
Weekend consultation	8 (12)	13 (7)
Days to respond to consultation request, median (IQR)	0 (0–0)	0 (0–1)
Duration followed by the ID service, median (IQR), days	2 (1–3)	2 (1–4)
Outpatient ID follow-up scheduled with ID physician familiar with the patient	17 (25)	150 (86)

NOTE. Data are no. (%) unless otherwise indicated. CoPAT, community-based parenteral anti-infective therapy; ID, infectious disease; IQR, interquartile range; SD, standard deviation.

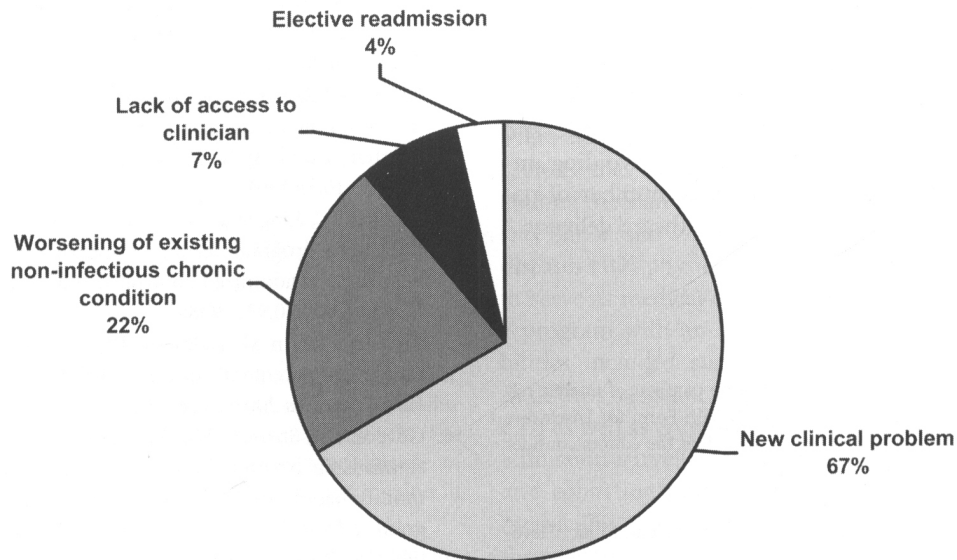


FIGURE 1. Emergency department visit and rehospitalization reasons for patients in whom community-based parenteral anti-infective therapy was avoided.

ship programs have also been shown to produce cost savings.⁸ Expanding antimicrobial stewardship efforts to encompass antimicrobial evaluation at discharge from hospital would be expected to have still greater impact on overall appropriate antimicrobial use in society.

It would be a huge and impractical undertaking for any facility to monitor each and every antimicrobial prescribed at the time of discharge from hospital. However, targeting higher-risk antimicrobial treatment plans is a reasonable goal. Parenteral antimicrobial therapy places patients at risk for both drug adverse effects and vascular access complications. Antimicrobial adverse effects have been reported to occur frequently in patients receiving parenteral antimicrobials at home, with the frequency of different adverse effects varying from 2% to 16% and vascular access complications varying from 9% to 11%.⁹ Antimicrobial stewardship programs do not have a direct reach in the community; thus, efforts to control parenteral antimicrobial therapy when patients are transitioning from hospital to community would target higher-risk antimicrobial treatment plans before patients leave the hospital.

There are many factors that contribute to the success of the Cleveland Clinic CoPAT program. Expectation of ID review for every patient leaving the hospital on parenteral antimicrobial therapy is part of the organizational culture of the Cleveland Clinic. Postdischarge arrangements are made by case managers, whose standard work flow dictates the arrangement of postdischarge parenteral antibiotic therapy based on instructions in the CoPAT form (which can be signed electronically only by an ID attending physician). These conditions make it extremely unlikely that any patient can leave the hospital on parenteral antimicrobial therapy

without having been seen by an ID physician. There are no standard criteria for antimicrobial selection or duration. The ID physicians have the freedom to prescribe antimicrobials as they see fit, and there is certainly practice variation among them. The philosophy of the program is that ID physicians are generally more likely to use antimicrobials appropriately than are non-ID physicians. The Cleveland Clinic culture of having all postdischarge parenteral antimicrobial therapy managed by ID physicians was built up and has been maintained by positioning the ID consultation as a service rather than a requirement. An ID consultation ensures that the patient will have continuity of care of his or her infectious illness across the transition from hospital to community, with a specified ID physician accepting responsibility. When a patient is discharged from the hospital, it is still possible for a physician to prescribe an oral antimicrobial other than what is recommended by an ID physician. In reality it rarely happens, because there is the appreciation that the ID recommendations are based on a full evaluation of the patient and the ID consultation ensures that there is an identified ID physician who can be held accountable if there are consequences of denial of antimicrobial therapy. There is no question that it requires commitment to deliver on this expectation, but our model of care demonstrates that it can be done.

We believe that a mandatory ID consultation requirement at discharge for all patients leaving hospital on parenteral antimicrobials is a critical component of an effective antimicrobial stewardship strategy at this important care transition point. Not having a mandatory requirement is likely to be less effective. It has previously been shown that antimicrobial stewardship efforts were circumvented when cli-

nicians had an option that allowed them to bypass the process.¹⁰

In summary, a policy of mandatory pre-discharge ID consultation for every patient anticipated to be discharged from hospital on parenteral antimicrobials serves as a safe and effective antimicrobial stewardship strategy by avoiding unnecessary antimicrobial use in a substantial number of patients at a critical transition of care in healthcare delivery.

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