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Short report

Pharmacists' impact on opportunistic infection prophylaxis in patients with HIV/AIDS

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SUMMARY

Pharmacists have demonstrated a positive impact on the care of patients with human immunodeficiency virus/acquired immunodeficiency syndrome through enhancing patient outcomes associated with antiretroviral therapy. This pre- and postintervention study assessed the impact of pharmacist intervention on improving the use of prophylactic medications for opportunistic infections (OI). Of the 139 patients screened, 42 patients were included in the prospective intervention group. A total of 27 interventions were made on 15 patients, and 24 recommendations (89%) were accepted by providers. Compared with the retrospective control group, prescribing of OI prophylaxis increased from 58% to 93% ($P<0.001$) with the addition of pharmacist intervention.

Introduction

Human immunodeficiency virus (HIV) is an incurable disease that weakens the immune system predisposing patients to multiple complications, including opportunistic infections (OI) and progression to acquired immunodeficiency syndrome (AIDS).[1] Over recent decades, advances in the medical management of these patients have resulted in significant reductions in mortality and morbidity. One report estimated that the addition of pneumocystis pneumonia (PCP) and disseminated *Mycobacterium avium* complex (MAC) prophylaxis added a 24.4-month survival benefit in patients with HIV/AIDS.[2] Nevertheless, approximately 20% of patients with undiagnosed HIV or AIDS will present with an OI as the initial indicator of their illness.[1] In 2012, the Centers for Disease Control and Prevention reported that approximately one in seven people living with HIV were unaware of their disease and therefore not receiving treatment.[3] OI remain a prominent issue due to the fact that patients may be unaware of their HIV status, non-adherent to antiretroviral therapy (ART), or may not achieve an adequate virological response from therapy due to unexplained biologic factors.[1]

The CD4 lymphocyte (CD4) count is a marker of a patient's immune function.[4] Consequently, HIV-mediated reduction in CD4 count becomes particularly concerning once the cell count drops to <200 cells/μL, as this increases the risk for developing an OI. In an attempt to prevent the occurrence of an OI, current guidelines proposed by the Department of Health and Human Services (HHS) recommend that patients should receive medication for primary prophylaxis once their CD4 count drops

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below a prespecified level. They also recommend that patients should be continued on prophylaxis until a sustained recovery in their immune system occurs, and that they should be monitored by a healthcare professional throughout this process.[1]

Pharmacists have extensive training on the appropriate use of medications, and are indispensable members of the healthcare team. While data exist to support the added value of a pharmacist to ART, there is a lack of evidence demonstrating the advantage they may provide regarding the appropriate use of OI prophylaxis in patients with HIV/AIDS. Recently, a study performed by Chiampas *et al.* evaluated the occurrence and type of medication errors involving ART and OI therapy. They found that out of 166 patients requiring OI prophylaxis, 37 experienced a total of 39 medication errors. The most common error was medication omission, which accounted for 31 errors (79%).[5] Eginger *et al.* found similar results in their investigation of medication errors associated with ART and OI prophylaxis. This study reported that dose omission was the most common error, accounting for 46% of errors among ART and OI prophylaxis regimens, and that a pharmacist was able to amend 90% of correctable combined ART and OI prophylaxis errors.[6] Given the positive impact that pharmacists have demonstrated on patients receiving ART, the purpose of this study was to identify if pharmacist intervention could also improve adherence to the HHS OI prophylaxis guidelines in hospitalized patients.

The primary objective of this study was to assess the impact of pharmacist recommendations on appropriate prophylaxis for select OI (PCP, *Toxoplasma gondii* encephalitis and MAC) in an inpatient setting through a comparison of OI prescribing rates for pre- and postintervention groups. Secondary objectives were to assess the acceptance rates of pharmacist interventions regarding OI prophylaxis by prescribers, and continuation rates of OI prophylaxis upon discharge.

Methods

This single-centre, prospective intervention study with a retrospective control group was reviewed and approved by the Institutional Review Board at Carolinas Medical Center, Charlotte, NC, USA; an 864-bed academic medical centre. The retrospective, pre-intervention group was identified through chart review of patients with documented HIV/AIDS, per the Centers for Medicare and Medicaid Services (CMS) International Classification of Diseases, 9th edition (ICD-9) code, to identify baseline OI prophylaxis rates in patients admitted to the medical centre.[7] This retrospective review was performed on patients admitted to the medical centre from 1st January 2014 to 31st May 2014, and served as the comparison control group to the prospective intervention group.

Patients were included if they were non-pregnant adults (age $\geq$18 years) who were admitted to the medical centre with a documented diagnosis of HIV or AIDS per ICD-9 code.[7] Patients were excluded if there was no documented CD4 count within the six months prior to hospital admission, or if all necessary information could not be retrieved from the electronic medical record. Additionally, patients in the intervention group being treated with antimicrobials for an active OI were excluded due to the difficulty in distinguishing between prophylactic and treatment therapy.

For the prospective intervention group, a daily report was generated from 3rd September 2014 to 31st January 2015 that identified all patients admitted to an inpatient floor or observation unit with an ICD-9 code indicating a diagnosis of HIV/AIDS.[7] If a patient met the inclusion criteria (CD4 count $<$200 cells/μL^3), the pharmacist assessed if OI prophylaxis was indicated, if OI prophylaxis was already prescribed, or if the current OI prophylaxis regimen was appropriate according to current HHS guideline recommendations.[1] If the patient had appropriate OI prophylaxis, the pharmacist documented that the regimen was initiated by the provider (physician or advanced care practitioner). If the patient did not have appropriate prophylaxis, the pharmacist contacted the provider to recommend either initiation or adjustment of the OI prophylaxis regimen to qualify as appropriate therapy. Interventions were made primarily by telephone, but may have been made during interdisciplinary rounds if the pharmacist was part of the medical team responsible for the care of that patient. Both accepted and rejected interventions were recorded. The results of the prospective group were compared with the retrospective group to determine if the pharmacist was able to demonstrate a significant impact on appropriate OI prophylaxis in patients with HIV/AIDS.

Data collected included patient demographics, medication allergies, most recent CD4 count, presence of ART, presence of OI prophylaxis, and documented history of an OI. Other information recorded included the prophylactic medications that were prescribed for an OI, and any information documented in the electronic medical record indicating why the patient was not receiving prophylaxis (e.g. allergy). Data were collected using REDCap; a secure, web-based data collection program.[8]

SAS Enterprise Guide Version 6.1 (SAS, Cary, NC, USA) was used for all statistical analyses. A two-tailed *P*-value $<$0.05 was considered statistically significant. Descriptive statistics including means and standard deviations or counts and percentages were calculated. Categorical data were analysed using Chi-squared test or Fisher's exact test. The Wilcoxon rank sum test was employed for all non-parametric continuous variables.

Results

In total, 139 patients were screened for inclusion into the study between 3rd September 2014 and 31st January 2015. Of the patients screened, only 42 met the criteria for the prospective group. Over half of the patients screened were excluded for a documented CD4 count $>$200 cells/μL. Other reasons for exclusion included a CD4 count not documented within the past six months, incorrect diagnosis of HIV/AIDS, hospital stay $<$24 h, active OI, or inability to tolerate oral medications. Patients in both groups were similar in terms of baseline characteristics (Table I).

Twenty-seven interventions were made on 15 patients, with some recommendations involving the addition of more than one prophylactic medication, depending upon the patient's CD4 count. A total of 27 patients (64%) had OI prophylaxis therapy continued during their inpatient stay without pharmacist intervention. With the addition of pharmacist intervention, baseline prescribing rates of appropriate OI prophylaxis increased from 58% in the retrospective group to