Saudi Pharmaceutical Journal (2014) 22, 516–521

King Saud University

Saudi Pharmaceutical Journal

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ORIGINAL ARTICLE

The impact of clinical pharmacist and ID intervention in rationalization of antimicrobial use

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Received 9 January 2014; accepted 16 February 2014
Available online 26 February 2014

KEYWORDS

Clinical pharmacy;
Antimicrobial utilization;
Infectious disease;
Pharmacist intervention

Abstract *What is known and objective:* There is little research on the impact of implementing and monitoring antimicrobial policy in Saudi hospitals. The purpose of this study is to measure the impact of the clinical pharmacist (CP) and infectious disease consultant (ID) interventions on the use of three antimicrobials (caspofungin, imipenem, meropenem) in hospitalized patients in the King Abdullah Medical City hospital.

Methods: The study was carried out in the King Abdullah Medical City, in Mekkah, Saudi Arabia. The hospital is a tertiary center that provides CCU, CSICU, Cardiac, Hematology, ICU, Medical, Neuroscience, Oncology, and specialized surgery services. The use of three antimicrobials (caspofungin, imipenem, meropenem) was reviewed by the clinical pharmacist for four periods, pre and post implementation of policy. Relevant data were collected in four periods. In the first period, before policy implementation, data were collected retrospectively to be used as baseline status reference, and in the three remaining periods that followed data were collected prospectively, and compared to baseline data, to evaluate the role of clinical pharmacist and ID interventions in optimizing antimicrobial therapy.

Results and discussion: Caspofungin duration of therapy was not affected significantly by the intervention. Statistically significant reduction in antimicrobial therapy duration was observed in imipenem (37%) and meropenem (37%) from baseline, which indicate a better control on antimicrobial use and reduction in antimicrobial resistance.

What is new and conclusion: The impact of the clinical pharmacist and ID interventions, in reducing antimicrobial therapy duration using imipenem and meropenem, is clear from the result presented above. However, lack of restriction and follow up in the antimicrobial policy in case

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Peer review under responsibility of King Saud University.

Production and hosting by Elsevier

http://dx.doi.org/10.1016/j.jsps.2014.02.003

of negative culture makes antimicrobial use uncontrollable in these cases. Establishing good and accepted policy may help reduce consumption and total cost of therapy.

1. What is known and objective

Little is known about the impact of implementing and monitoring an antimicrobial policy in Saudi hospitals. Most drug related problems in hospitals are caused by anti-infectives (Khdour et al., 2012). The rational of antimicrobial prescribing is to use the safest and most effective antimicrobial agent against relevant pathogens, with least impact on normal flora (Berild and Haug, 2008). Increased total consumption and use of broad spectrum antibiotics are associated with increased costs, medication errors and widespread antimicrobial resistance (Berild and Haug, 2008; Scheetz et al., 2009). Dynamics of resistance is a function of interacting variables (e.g., introduction of resistance, infection control practices, and antimicrobial use) (Nijssen et al., 2006). Rules and guidelines alone may not be enough to optimize antimicrobial prescribing practice (Charani et al., 2010). Need for intervention by clinical pharmacist (CP) and infectious disease (ID) consultants in managing the policy is well established. Clinical pharmacist interventions eliminate (37.4%) of treatment problems related to efficacy and monitoring of medications (Aburuz et al., 2013), promote efficacy of therapy (Jarab et al., 2012), and enhance desired health outcomes (Jarab et al., 2011). Frequent and prolonged use of broad-spectrum antimicrobial agents promote emergence of resistance (Velickovic-Radovanovic et al., 2012). Reserved antimicrobials should be used cautiously as the last resort. From this reserve we selected one antifungal (caspofungin), and two antibiotics (imipenem, and meropenem). These are of interest because of cost (as in caspofungin), emerging resistance, and being the last line of defense. Our study aimed at assessing the role of the clinical pharmacist and ID in optimizing antimicrobial therapy and preventing misuse of antimicrobials.

Caspofungin is an echinocandin that inhibits the synthesis of β(1,3)-D-glucan, an essential component of the cell wall of susceptible Aspergillus and Candida species. It has been approved by the FDA for use in adults and pediatric patients ($\geqslant$3 months of age) for empirical therapy for presumed fungal infections in febrile, neutropenic patients; treatment of candidemia and the Candida infections (intra-abdominal abscesses, peritonitis, and pleural space infections); treatment of esophageal candidiasis; and treatment of invasive aspergillosis in patients who are refractory to or intolerant of other therapies (e.g., amphotericin B, lipid formulations of amphotericin B, itraconazole) (Merck Sharp et al., 2013).

Imipenem is a Thienamycin that inhibits cell-wall synthesis. Cilastatin is a dehydropeptidase I inhibitor that prevents renal metabolism of imipenem. Imipenem has been approved by the FDA for the treatment of lower respiratory tract infections (LRTI), skin and skin structure infections (SSSI), and intra-abdominal and gynecologic infections caused by susceptible strains of microorganisms (Merck Sharp et al., 2013).

Meropenem is a carbapenem that penetrates bacterial cell walls to reach penicillin-binding-protein targets, thus inhibiting cell wall synthesis, resulting in cell death. The FDA has approved meropenem for the treatment of intra-abdominal infections (complicated appendicitis and peritonitis), bacterial meningitis, and complicated skin and skin structure infections (cSSSI) caused by susceptible strains of microorganisms. It is useful as presumptive therapy in the indicated condition prior to identification of causative organisms (AstraZeneca Pharmaceuticals LP, 2013).

2. Methods

2.1. Study design

This is a retrospective follow up chart review study. The study included 559 orders of antimicrobials in 357 patients in the King Abdullah Medical City, in Mekkah, Saudi Arabia. The hospital is a tertiary center that provides CCU, CSICU, Cardiac, Hematology, ICU, Medical, Neuroscience, Oncology, and specialized surgery services.

2.2. Measured outcome

Duration of antimicrobial therapy's pre- and post-policy implementation was measured, as well as, WHO-defined daily doses as per 100 bed days (DBD) as a marker for antimicrobial consumption. DBD calculate treatment period in a standardized fashion and allow inclusion of periods of shortage of either 70 mg or 50 mg dosage-forms resulting in the replacement of one dosage form for the other, and variation in doses used (Chandwani et al., 2009; Kotapati et al., 2004). Same approach can verify the captured actual duration of therapy parallels WHO-standardized defined daily doses (DDD) a patient should receive on average to achieve cure.

2.3. Inclusion and exclusion criteria

Our study included patients who received any of the three antimicrobials in-hospital, during the study period, regardless of their condition, age, sex, ward, or other variables. Patients not on any of these medications were excluded from the study.

2.4. Study methodology

On a daily basis, the CP reviewed medical chart, lab tests and culture reports and provided therapeutic interventions as needed to the treating physicians regarding doses, interactions and duration of antimicrobial therapy.

As a member of multidisciplinary team, the ID consultant has the authority to change or stop any antimicrobial agent and carries the responsibility of assuring proper antimicrobial use in terms of agent selection, appropriate indication and optimal duration of therapy.