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Major article

Antimicrobial stewardship to optimize the use of antimicrobials for surgical prophylaxis in Egypt: A multicenter pilot intervention study

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Objective: To measure the impact of an antimicrobial stewardship (AMS) program on the use of antibiotics for surgical prophylaxis at acute care hospitals in Egypt.
Methods: This was a before-and-after intervention study conducted in 5 tertiary, acute-care surgical hospitals. The baseline, intervention, and follow-up periods were 3, 6, and 3 months, respectively. The impact of the intervention was measured by preintervention and postintervention surveys for surgical patients with clean and clean-contaminated wounds. Information was collected on demographic characteristics and antibiotic use. The intervention focused mainly on educating surgical staff on the optimal timing and duration of antibiotics used for surgical prophylaxis. Only 3 hospitals identified a surgeon to audit antibiotic surgical prescriptions. The primary outcome measures were the percentages of surgical patients receiving optimal timing and duration of surgical prophylaxis.
Results: Data were collected for 745 patients before the intervention and for 558 patients after the intervention. The optimal timing of the first dose improved significantly in 3 hospitals, increasing from 6.7% to 38.7% ($P < .01$), from 2.6% to 15.2% ($P < .01$), and from 0% to 11% ($P < .01$). All hospitals showed a significant rise in the optimal duration of surgical prophylaxis, with an overall increase of 3%-28% ($P < .01$). Days of therapy per 1000 patient-days were decreased significantly in hospitals A, B, C, and D, with no change in hospital E.
Conclusions: An AMS program focusing on education supported by auditing and feedback can have a significant impact on optimizing antibiotic use in surgical prophylaxis practices.

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The excessive and inappropriate use of antibiotics in acute care hospitals is common in developing and developed countries,[1,2] and is associated with emergence of antimicrobial resistance, prolonged hospital stays, and high costs of health care.[3] Several studies have shown that approximately 30% of antimicrobial use is inappropriate or suboptimal.[4,5] In the developing countries of the eastern Mediterranean region, limited studies have documented the inappropriate use of antibiotics in hospitals.[6,7] In Egypt, a point prevalence survey of antibiotic use was conducted in 18 Egyptian hospitals in March 2011 using the European Surveillance of Antimicrobial Consumption Network methodology.[8] Among 3194 antibiotic prescriptions, surgical prophylaxis accounted for 38.4% of overall antibiotics prescribed in the hospitals, and 66.5% of the antibiotics prescribed in the surgical departments. Two percent of the antibiotics prescribed for surgical prophylaxis were given within 1 hour before incision and discontinued within 24 hours after the surgery.[9]

Consequently, we aimed to pilot an antimicrobial stewardship (AMS) program to optimize antimicrobial use for surgical prophylaxis, focusing on the education of surgeons to promote optimal timing and duration of surgical prophylaxis. The impact of the intervention was measured through repeated surveys measuring antibiotic prescribing practices related to surgical prophylaxis.

METHODS

Setting

This intervention study was performed at 5 tertiary acute care surgical hospitals performing a variety of surgical procedures, including general surgeries (eg, herniorrhaphy, colectomy), orthopedic surgeries (eg, joint replacements, spinal fusion), and obstetric and gynecologic surgeries. All 5 hospitals have functioning infection control programs with full time infection control teams (Table 1). None of the hospitals had any previous activity related to AMS.

Study design

Preintervention and postintervention surveys were conducted to measure the antibiotic prescribing practices of surgical prophylaxis for clean and clean-contaminated elective surgeries before and after implementation of the AMS program. The preintervention surveys were conducted between January and March 2013, the interventions were performed between April and September 2013, and the postintervention surveys were done between October and December 2013.

Study patients

All surgical patients undergoing clean or clean-contaminated operations at select surgical wards were enrolled in the surveys. Patients of all ages were eligible to participate. A standardized data collection form was completed for each enrolled patient, on which information was collected on patient demographics, surgery type and date, indication for antibiotic use, and dose and duration of antimicrobial therapy. Hospital infection control teams extracted the data from the patient files and drug prescription sheets. A sample size of 473 surgeries was required for both the preintervention and postintervention surveys to detect an improvement in the timing and duration of surgical prophylaxis ranging from 24% to 48% ($\alpha = 0.05$ and 80% power).

Intervention

The 6-month AMS intervention aimed to launch appropriate strategies for improving the timing of the first dose before surgery and the duration of antimicrobial therapy for clean and clean-contaminated surgeries. The intervention targeted hospital staff responsible for surgical prophylaxis, who were either surgeons or anesthesiologists.

Leadership

Leadership of the AMS program was established within the scope of the hospital's infection control team. The elements of the AMS were developed by the hospital infection control teams through advocacy workshops with senior surgeons and pharmacists, and hospital administration approved the plan. They all agreed that education of surgeons on the international guidelines for surgical prophylaxis would form the basis of the AMS activities.

Education

Education targeted personnel responsible for surgical prophylaxis procedures, who were either surgeons or anesthesiologists. A 2-day training curriculum was developed focusing on the principles of antibiotic use for surgical prophylaxis, such as the type of operations eligible for surgical prophylaxis, optimal timing of the first dose, and duration of postoperative antibiotic use.[10] In addition, on-the-job training on the optimal use of antibiotics was provided to junior surgeons and residents during morning rounds. A wall-mounted poster was developed to remind prescribers of the optimal timing and duration of antibiotic administration for surgical prophylaxis.

Auditing and feedback

Three of the 5 participating hospitals (hospitals B, D, and E) nominated a senior surgeon as a champion to audit antibiotic prescriptions for surgical prophylaxis and provide feedback to the prescribers. The senior surgeon visited the surgical departments at least twice weekly and reviewed the documented prescribed antibiotics in the patient records. In the event that the patient file specified suboptimal timing of the first dose, noted suboptimal duration of surgical prophylaxis, or lacked sufficient information on the antibiotics prescribed, the senior surgeon discussed the antibiotic prescription plan with the prescriber and provide feedback.

Outcome measures

The outcome measure was the change in the proportion of surgical patients who received optimally timed prophylaxis, defined as the proportion of patients who received at least one prophylactic dose administered within 60 minutes before the incision (120 minutes for the administration of fluoroquinolones or vancomycin). When more than 1 antibiotic was administered, timing was based on the antibiotic given closest to the time of the incision. The second primary outcome was the change in the proportion of surgical patients in whom duration of the antibiotic prophylaxis was no longer than 24 hours after the completion of surgery.

Secondary outcome measure was the changes in days of therapy (DOT; the number of days on which a patient receives at least 1 dose of an antibiotic for surgical prophylaxis, summed for each antibiotic/1000 patient-days). Patient-days were calculated as the sum of lengths of hospital stay for each individual patient.

Statistical analysis

Statistical analyses were performed using Stata version 12 (StataCorp, College Station, TX). Proportions were compared using the Z-test, and rates of antimicrobial use (measured by DOT/1000 patient-days) were compared using incidence rate ratios (IRRs). All statistical tests were 2-tailed; a P value $\leq .05$ was considered significant.