Editorial:

Rational Use of Antibiotics in Surgical Practice

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The terms *antimicrobial, antibiotic*, and *anti-infective*cover a wide variety of pharmaceutical agents that include antibacterial, antiviral, antifungal, and antiparasitic drugs. Of these, antibacterial agents are by far the most commonly used and therefore the focus is on antibacterial agents or commonly called antibiotics. Antibiotics are some of the most extensively, and often thoughtlessly, used therapeutic drugs worldwide. Correct use of antimicrobial agents is indispensably imperative from a clinical perspective, and is crucial if the usefulness of antibiotics is to be well looked-after and the bacterial resistance should be minimized. Pervasive use of antimicrobial agents has contributed to antibiotic resistance among common bacterial species. Inappropriate use of antibiotics is common in office as well as indoor clinical situations. Studies have shown that on one hand it is wastage of resources on the other hand it is causing undesirable reactions and resistance to common microbes[1]. It was determined that more than half the antibiotics used are not required, or that an inappropriate antimicrobial agent is selected, or the dose is incorrect. While prescribing antibiotics it is paramount to obtain an accurate diagnosis of infection; mindfully differentiating the empiric and definitive therapy; one must be able switch to narrow-spectrum, cost-effective oral antibiotics for the necessary and shorter possible durations. The drug pharmacodynamics, accuracy of doses, adverse effects and appropriate host response in term of control of infection and accounting for side effects as well as interaction with other drugs being used by the individual patient must be taken in to account[2]. Antibiotics should only be prescribed when indicated considering the cost-effectiveness and clinical appropriateness. Antimicrobial stewardship programs are aimed at "optimizing antimicrobial selection, dosing, route, and duration of therapy to maximize clinical cure, prevention of infection while limiting the unintended consequences, such as the emergence of resistance, adverse drug events, and cost. Where for continuous use of antibiotics even in acute surgical setting, a coordinated effort is preferred where, apart from treating surgeon, coordination with clinical pharmacist, and infection diseases specialist should be a routine process. A computer based prospective audit and feedback antimicrobial prescriptions to clinicians, education and formulary restriction are mandatory measures for setting a system of judicious use of antibiotics even using hospital guidelines, de-escalation of therapy, and intravenous to oral antimicrobial conversion dictated by the clinical situations[3]. All clinical facilities must develop flawless guideline for the use of antimicrobial agents, specifically in surgical practice. This policy must be balance, evidence based, flexible and universal to make the antimicrobial use a judicious and rationalized process taking in to consideration all aspect of best practices,inclusive of finances and social aspects.

Use of antimicrobial agents in surgical practice: In surgical practice antibiotics are used for prophylactic and therapeutic reasons, whereas a logical approach to manage the infected patient (choosing appropriate antimicrobial agents, giving them by the optimal route and for the correct duration) is essential. The rationale behind judicious antimicrobial prescription in surgical practice which in its pretentious sense, is based on empirical and targeted therapy apart from prophylactic use based on intelligent guess. In surgical practice, prophylactic antibiotics are prescribed to prevent surgical site infections (SSI) which are related to an operative procedure that occurs at or near the surgical incision (incisional or organ/space) within 30 days of the surgical procedure, where prosthetic material is not used or within 90 days if prosthetic material is implanted at surgery[4].

Prophylactic use of antibiotics: Surgical site

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infections (SSI) is one of the major factor impacting patient's post-operative recovery, quality of life and contribute substantially to the financial cost in patient care. Apart from increase morbidity and mortality in different surgical procedure, SSI contribute to over 20-30% additional cost on health care beside prolong hospital stay and loss of working days of the patient in additionto social issues related to increase morbidity. SSI require sufficient bacterial load to overcome host defenses and establish growth[5]. While preventing surgical wound infections care giver attempt to modify the host factors like, preoperative optimization of comorbid illness, control of the operative environment, proper cleansing of the skin and use of aseptic surgical technique. Use of prophylactic antibiotics contribute relatively minor effort among numerous preventive measures, in spite of the fact that prophylactic antibiotic use has significant efficacy and impact on surgical outcome. However there is no substitute to ritual adherence to the good surgical practices including judicious use of antibiotics in an effort to prevent surgical complications including SSI. Intelligent use of antibiotics depends upon the types of wounds and expected wound infection rate. For example, reported infection rate in clean wound is less than 2% but it rises to nearly 10% in clean contaminated, 20% in contaminated and nearly 40% in contaminated wounds[6]. In clean procedures, which constitute nearly 60% of all surgical procedures, infection rate is low, however increase morbidity and price of even occasional infection can justify the prophylactic use of antibiotics and this use is even justified in case of insertion of prosthetic devices like joint replacement, heart valve replacement, vascular graft, use of mesh etc. Systemic host risks factors like; diabetes, obesity, extreme of age, malnutrition, use of corticosteroids, massive transfusion, multiple comorbidities including malignancy and recent previous surgery as well as ASA class 3, 4 and 5 and local factors like wound drains, foreign bodies, excessive use of elctrocautery, adrenaline local injection, previous irradiation of the site and even hair shave may increase the risk of SSI[7]. The justification beyond the single prophylactic dose of antibiotics, in clean cases may be sort depending upon the peculiar situations particularly when procedures not classified as clean. Selection of antimicrobial agent depends upon nature of the procedure and expected flora to be covered. For example, for cutaneous and soft tissues procedures non or single dose of antibiotics suffice if the other systemic host and local factors are not present while in case of head and neck surgery either penicillin or cephalosporin-based prophylaxis is effective.In case of orthopedic procedure where S. aureus and S. epidermidis predominate in wound or joint infections, cefazolin provides adequate coverage. The additional aminoglycosides and extension beyond operative period is not supported by sufficient evidences. Likewise, antibiotic prophylaxis should be prescribed in other procedures depending upon the nature of the procedure, systemic and local hostfactors[8].

Therapeutic use of antibiotics: Treatment of established infections: About As many as 60 percent of SSI are preventable but once the SSI is established apart from immediate surgical measures like drainage, debridement and special wound care, antibiotics are prescribed that covers the likely causative organisms[9]. An infectious disease diagnosis is reached by determining the site of infection, defining the host factors and establishing, when possible, a microbiological diagnosis and commence with the empirical antibiotic therapy which should be brad spectrum, and guided by the clinical presentation. For accurate diagnosis, clinicians should ensure that diagnostic specimens are properly obtained and promptly submitted to the microbiology laboratory, preferably before the institution of antimicrobial therapy. Further antimicrobial therapy is prescribed according to the bacterial culture and established sensitivity[10]. One should not forget about non infective condition might be contributing in clinical manifestations of infections, especially when the diagnosis is not established. The scheduling of initial therapy is based on clinical situation, when patient is critically ill antibiotics are empirically administered immediately, after taking specimens for culture and sensitivity, in more stable clinical circumstances, antimicrobial therapy should be deliberately withheld until appropriate specimens have been collected and submitted to the laboratory. On receiving the microbiology results, antimicrobial agents will be administered, where every attempt should be made to narrow the antibiotic spectrum. Mostly single-agent antimicrobial therapy is preferred, a combination of 2 or more antimicrobial agents is recommended in a few scenarios like: when agents exhibit synergistic effectiveness, against a microorganism, when critically ill patients require empiric therapy before microbiological etiology and/or antimicrobial susceptibility can be determined, for the extension of antimicrobial spectrum beyond that achieved by use of a single agent or for treatment of polymicrobial infections and to prevent emergence

of resistant strains. We must also consider host factors while prescribing antibiotics like patient with renal or hepatic failure, pregnant and lactating women, and allergies and recent past antibiotic use apart from age groups and genetic variations[11]. The duration of therapy for many infections depends upon the antibacterial response, control of infection and clinical situations.

Preventing antibiotic resistance: Resistance to antibiotics is the ability of a microorganism to withstand the effects of antimicrobial agent rather the bacteria survive and continue to multiply causing more harm to the host even in the presence of an antibiotic[12]. Resistance to antimicrobial agents develops through one of the three ways; natural resistance in certain types of microorganisms; genetic mutation of microorganisms; or by one species acquiring resistance from another. Resultantly some microorganism develop the ability to neutralize the antimicrobial agent before it can do harm, others can rapidly pump the antibiotic out, and still others can alter the antibiotic attack site so it cannot affect the function of the bacteria. Even one bacterium survives because it can neutralize or escape the effect of the antibiotic; that one bacterium can then multiply and replace all the bacteria that were killed off[13]. Apart from other reasons the important reason to develop resistance in microorganism is due to widespread and often inappropriate—use of antimicrobial agents is the single most important cause of the emergence of drug resistance, both in the community and hospital settings. It is obvious that the emergence of antimicrobial resistance can be prevented or delayed through judicious use of antimicrobial agents: WHO devised a global action plan to minimize the antimicrobial resistance, has 5 strategic objectives:

1. To improve awareness and understanding of antimicrobial resistance.
2. To strengthen surveillance and research.
3. To reduce the incidence of infection.
4. To optimize the use of antimicrobial medicines.
5. To ensure sustainable investment in countering antimicrobial resistance.

It is also important to curtail the frequent prescription of "*broad-spectrum antibiotics*", in place of a better targeted antibiotic, through more precise diagnosis and control the inadequate use by the patient, not respecting either dosage or duration of the treatment, which means that some of the bacteria may survive and become resistant[14]. The judicious antibiotic use means: a) restraining from prolonged prophylactic therapy which merely sets the stage for the emergence of antimicrobial resistance; b) limiting frequent and excessive use of single antibiotics like fluoroquinolones in urosepsis has created resistant strain of *C difficile* responsible for nosocomial infectious diarrhea; c) Avoid prolonged empiric use of antibiotics without clear evidence of infection where symptoms might be due to non-infective causes; d) should not treat positive cultures in the absence of active disease; e) Once the culture and susceptibility data are available, an antibiotic with the narrowest possible spectrum should be selected for continuation of therapy rather than continuation of broadspectrum empiric antibiotics even if the symptoms improve on broad spectrum antibiotics[15-16]. Though antibiotics used to treat and prevent bacterial infections in animals belong to the same chemical groups as those used for humans, animals may acquire bacteria that are resistant to antibiotics also used against human infections but antibiotics used in food production contribute little to the antibacterial resistance in human.

Conclusion: A judicious use of antibiotics means; prudent use of available antibacterial agents, take precautions for the control of cross-transmission of resistant strains, isolate carriers patients, obtain accurate diagnosis, antibiotics must be administering in proper dose with proper interval and for appropriate period, tailoring treatment to host characteristics, using the narrowest spectrum and shortest duration of therapy, and switching to oral agents as soon as possible. Antibiotics should only be prescribed when they are required and we must conduct more research to development antibiotics with a novel mechanism of action.

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