



**IMPACT OF EDUCATIONAL INTERVENTION ON SURGICAL PROPHYLAXIS
PRACTICES TO CONTAIN ANTIBIOTIC RESISTANCE**

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ABSTRACT

1. To assess the surgical prophylaxis practices in a specific group of surgeries (elective clean uncomplicated surgeries).
2. To orient the surgical team regarding surgical prophylaxis and its implication by developing an educational learning module as part of antibiotic stewardship programme.
3. To assess post educational surgeon's compliance of adhering to the surgical prophylaxis guidelines

Methodology: - This was a part of multi-institutional interventional study carried out at a local level in Government Medical College & Hospital, Amritsar; a 1000 bedded tertiary care health institution. With approval from institutional ethics committee, total of 150 consecutive patients were studied for pre and post-intervention for 1 year as per predefined inclusion and exclusion criteria. Pre existing data including choice of antibiotics, route, dose and timing of first and repeat doses were recorded from case-records of inpatients in surgical ward. Data was compared with clinical practice guidelines for antimicrobial prophylaxis in surgery. After recognizing the extent of problem, experts gathered and prepared a module to educate the surgeons. Prescriptions not in accord to guidelines were discussed with the group of surgeons in their monthly meet by conducting Lecture using PowerPoint slides (1 hour). **Result:** Use of prophylactic antibiotics was compared with Clinical Practice Guidelines for Antimicrobial Prophylaxis in Surgery in 150 post operative patients. Choice of antibiotic, dose, timing of first and repeat dose was compared with the guidelines and was found that these were in accord to guidelines in 75%, 68%, 34% and 10% patients respectively. Post-interventional data showed adherence to educational module resulting in 75% improvement in antibiotic utilization in patients without altered incidence of SSI. **Conclusion:** Educational intervention and training of surgeons has vital role in eliminating irrational use of antibiotics, checking the emergence of antibiotic resistance. Antibiotics are unique drugs as they lose efficacy over time and they must be used sparingly so we need institutional multidisciplinary committee for guideline development & implementation.

KEYWORDS: Antibiotic stewardship, Resistance, Prophylaxis.

INTRODUCTION

Surgical site infections (SSI) are the second most common nosocomial infections in surgical patients resulting in prolonged hospital stay, re-admissions to the hospital and increased morbidity and mortality.^[1] The incidence of surgical site infections varies significantly in different countries, ranging between 2.5-41.9% and account for approximately a quarter of all hospital acquired infections (HAI). Prophylactic antibiotic has proven to be effective in reducing the incidence of SSI in many surgical procedures.^[2] Prophylactic antibiotic if used inappropriately in terms of prolonged duration and use of antibiotics with broader spectrum can lead to emergence of resistant microorganisms.^[3] All these factors in turn lead to high costs and failure of the treatment. Moreover, incorrect timing of prophylaxis reduces its efficacy. These patients are also 60% more

likely to require an ICU admission, remain in the hospital twice as long, and have a 6 times higher rate of readmission than those with no infection. Appropriate evidence based antibiotic prophylaxis, hair removal by clipping as needed, avoidance of hypothermia (Except in cardiac surgery) and normoglycemia for diabetic patients are the measures prescribed in national and international guidelines to reduce surgical site infections.^[4] The choice of prophylactic antibiotic depends on the type of surgery, patient risk factors, most frequent pathogens seen with the procedure, the safety and efficacy profile of the antimicrobial agent, current literature evidence to support its use, cost and also institutional antimicrobial resistance patterns. Therefore, it is essential to follow the standard guidelines developed to support the correct use of prophylactic antibiotic and emphasized among the treating surgeons, to strictly adhere to them. The aim of

the study was to standardise surgical prophylaxis practices at our institution to contain antibiotic resistance. The study was conducted with an objective to assess surgeon's compliance of adhering to the surgical prophylaxis guidelines prior to educational intervention, to orient the surgical team regarding surgical prophylaxis and its implication. Other objective was to assess surgeon's compliance of adhering to the surgical prophylaxis guidelines post educational intervention and to rationalize the use of surgical prophylaxis.

METHODOLOGY

This was a Prospective interventional study conducted in the Department of Surgery of a tertiary care hospital. Pre-existing data from case files of patients admitted was recorded as per the Performa which included demographic profile of the patients, surgical procedure and timing along with the frequency of the antibiotics administered.

Inclusion Criteria

- Elective Clean uncomplicated surgeries performed on patients >15yrs.
- Surgeries included
 - Herniorrhaphy
 - Hydrocele surgery
 - Clean Breast surgery
 - Thyroid surgery
 - Cholecystectomy
 - Elective appendicectomy.
 - Laproscopic appendicectomy
 - Clean Skin & soft tissue surgeries

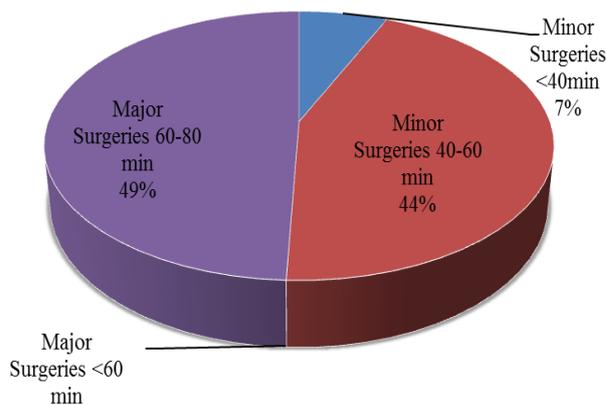
Exclusion Criteria

- Clean contaminated, contaminated and dirty surgeries
- Patients with the history of antibiotic usage 2 weeks prior to the surgical procedure.
- Patient already on antibiotics.
- Immunocompromised patients.

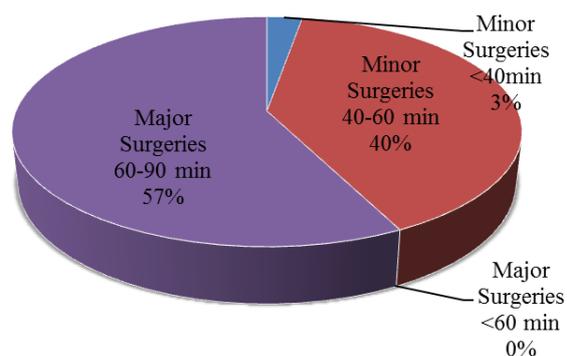
Type of intervention: Educational intervention was done by conducting lecture sessions within the hospital as well as in the monthly surgeon society meet for the Surgeons.

RESULTS

Data for 150 patients undergoing elective surgery irrespective of the age was analyzed for the study. Majority (51%) of the analyzed surgeries were of minor type and 49% were major surgeries in the pre intervention period where as post interventional phase these were 47% and 53% respectively. (Graph 1,2) Choice of antibiotic, dose, timing of first and repeat dose was compared with the guidelines before surgery in both the phases.

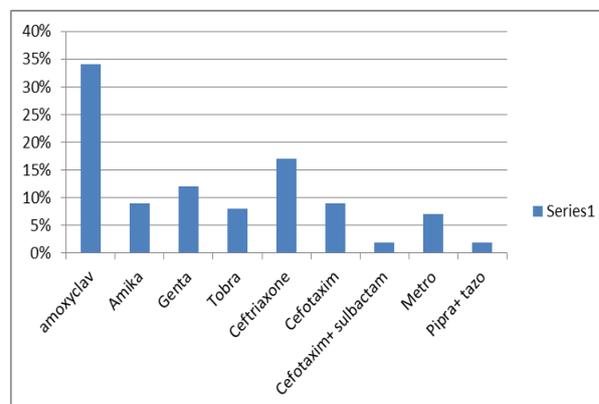


Graph 1: Pre Interventional: Timing of first dose.



Graph 2: Post Interventional: Timing of first dose.

The most commonly prescribed antibiotic was combination of amoxicillin plus clavulanic acid (34%). Single antimicrobial was given to 52%, two, three and more than three were prescribed in 38.7%, 8% and 1.3% patients respectively. (Graph 3) Choice of antimicrobial, dose, timing of first and repeat dose when compared with the guidelines and was found that these were in accordance to guidelines in 45.33%, 92%, 50.67% and 10% patients respectively (Graph 4,5).



Graph 3: Prescribed Antibiotics.

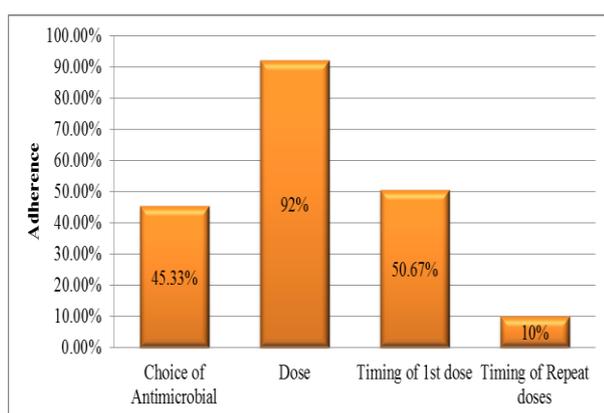
All the patients were given two shots of antibiotics in the post operative period during pre-interventional phase and third dose was given in 62.67% of patients. Post interventional repeat single dose was in 70.67%, two

doses in 20% and three or more than that in 9.33% of patients. (table1)

Table 1: Number of repeat doses in Pre and Post interventional phase.

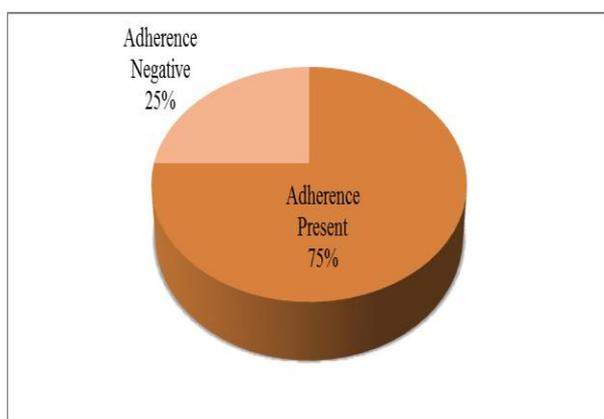
Column1	Pre-intervention	Post intervention
Pre-operative	100%	100%
Post op one dose	100%	70.67%
Post op 2 doses	100%	20%
Post op 3 or more doses	62.67%	9.33%

Choice of antimicrobial, dose, timing of first and repeat dose when compared with the guidelines and was found that these were in accordance to guidelines in 45.33%, 92%, 50.67% and 10% patients respectively (Graph 4,5)



Graph: 4 Adherence to the guidelines in pre-interventional phases.

Post-interventional data showed adherence to educational module resulting in 75% improvement in antimicrobial utilization in patients without altered incidence of surgical site infections.



Graph 5: Adherence to the guidelines in post-interventional phases.

DISCUSSION

The results shown in our study had a wide deviation from the standard international and national guidelines regarding surgical prophylaxis. Adherence to the

guidelines regarding indication, antibiotic choice, dose, timing of first dose and repeat dosing was seen in 45.33%, 92%, 50.67% and 10% respectively in pre-interventional phase but was attained in 75% of all cases evaluated in post interventional phase. This non-adherence was mainly because of the lack of awareness among the treating surgeons in our hospital and there was a remarkable improvement after educational intervention.

Combination of amoxicillin and clavulanic acid was the most commonly (34%) prescribed prophylactic antibiotic in our study. Guideline recommendations for using antimicrobial agents for the clean elective uncomplicated surgeries is the one with narrowest spectrum of activity and should be efficacious enough in preventing postoperative infections.^[5] First-generation cephalosporin esp. cefazolin with a narrow spectrum is highly effective in combating Gram-positive cocci including staphylococci, which are the main culprit in postoperative surgical site infections.^[6] Second generation cephalosporins such as cefazolin plus metronidazole, are recommended for operations below diaphragm for coverage of additional pathogens to staphylococci such as anaerobes, *Escherichia coli*, and other enterobacteriaceae.^[5]

Results of our study have shown that single antimicrobial (52%), two, and three and more than three were prescribed in 38.7%, 8% and 1.3% respectively were administered to the patients pre-operatively. International guidelines advocate the use of a single dose of antibiotic prophylaxis with enough half-life to cover the entire length of the procedure although the optimal duration of antibiotic prophylaxis is not known.^[7] Most of the patients received therapeutic doses of amoxicillin and clavulanic acid (34%) or ceftriaxone (17%) at an improper timings varying from 60-80 min before surgery which was partly improved in post-interventional phase. This is crucial because antibiotic dose and timing is a foremost determinant of achieving satisfactory serum and tissue concentrations of antimicrobial agents for effective prophylaxis of SSIs.^[8]

For reducing the rates of postoperative SSIs, evidence showed that antibiotics should be administered within 60 min before the incision to provide sufficient serum and tissue levels exceeding the minimum inhibitory concentrations for the anticipated organisms.^[9]

Our results have shown prolonged administration of antibiotic in postoperative period which is considered inappropriate as per the guidelines. 100% of the patients in our study received prolonged postoperative antibiotics for more than 72 hrs but it was reduced to just 9.33% patients in post interventional phase. Unnecessary postoperative antibiotic administration promotes the emergence of resistant micro-organisms such as cephalosporin-resistant enterobacteriaceae, vancomycin-

resistant enterococci, and *Clostridium difficile*, in addition to the ensuing increases in medical care costs.

CONCLUSIONS

This study revealed a clear deviation in the prophylactic antibiotic prescription patterns and the ASHP guidelines. Educational intervention improved the selection and usage of antimicrobials thus achieving rational prophylactic administration. Interventions in the form of educational module, guidelines, reminders, audit and feedback can improve antibiotic prescribing practices. To achieve the goals of restricting irrational use, antibiotic selection, dose, route and duration of treatment has to be optimized for best outcomes while minimizing unintended detrimental adverse events. Excessive costs to the consumer and emergence of resistance can be resolved by introducing institutional multidisciplinary committee for guideline development & implementation; Standardized protocols should be developed and disseminated in collaboration with surgeons and other medical personnel along with prospective audits and feedback.

BIBLIOGRAPHY

1. Badia JM, Casey AL, Petrosillo N, Hudson PM, Mitchell SA, Crosby C. Impact of surgical site infection on healthcare costs and patient outcomes: a systematic review in six European countries. *J Hosp Infect*, May, 2017; 96(1): 1–15.
2. Lilani SP, Jangale N, Chowdhary A, Daver GB. Surgical site infection in clean and clean-contaminated cases. *Indian J Med Microbiol*, Oct, 2005; 23(4): 249–52.
3. Hecker MT, Aron DC, Patel NP, Lehmann MK, Donskey CJ. Unnecessary use of antimicrobials in hospitalized patients: current patterns of misuse with an emphasis on the antianaerobic spectrum of activity. *Arch Intern Med.*, Apr 28, 2003; 163(8): 972–8.
4. Young B, Ng TM, Teng C, Ang B, Tai HY, Lye DC. Nonconcordance with Surgical Site Infection Prevention Guidelines and Rates of Surgical Site Infections for General Surgical, Neurological, and Orthopedic Procedures[▽]. *Antimicrob Agents Chemother*, Oct, 2011; 55(10): 4659–63.
5. Bratzler DW, Dellinger EP, Olsen KM, Perl TM, Auwaerter PG, Bolon MK, et al. Clinical practice guidelines for antimicrobial prophylaxis in surgery. *Am J Health-Syst Pharm AJHP Off J Am Soc Health-Syst Pharm.*, Feb 1, 2013; 70(3): 195–283.
6. Hidron AI, Edwards JR, Patel J, Horan TC, Sievert DM, Pollock DA, et al. NHSN annual update: antimicrobial-resistant pathogens associated with healthcare-associated infections: annual summary of data reported to the National Healthcare Safety Network at the Centers for Disease Control and Prevention, 2006-2007. *Infect Control Hosp Epidemiol*, Nov, 2008; 29(11): 996–1011.
7. Tolba YYA, El-Kabbani AO, Al-Kayyali NS. An observational study of perioperative antibiotic-prophylaxis use at a major quaternary care and referral hospital in Saudi Arabia. *Saudi J Anaesth*, Jan 1, 2018; 12(1): 82.
8. Levison ME, Levison JH. Pharmacokinetics and Pharmacodynamics of Antibacterial Agents. *Infect Dis Clin North Am.*, Dec, 2009; 23(4): 791–vii.
9. Jonge S de, Gans S, Atema J, Solomkin J, Dellinger P, Boermeester M. Timing of preoperative antibiotic prophylaxis in 54,552 patients and the risk of surgical site infection: A systematic review and meta-analysis. *Medicine (Baltimore) [Internet]*, 2017 Jul [cited 2019 Aug 21]; 96(29). Available from: insights.ovid.com.