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A STUDY ON PROPHYLACTIC ADMINISTRATION OF ANTIBIOTICS AND THE RISK OF SURGICAL-SITE INFECTION

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ABSTRACT
Surgical Site Infections were classified according to American Centre for Disease Control (CDC) criteria and identified by active bedside surveillance and post discharge follow up. Antibiotics were selected according to Indian Council Of Medical Research (ICMR), American Society Of Health-System Pharmacists (ASHP), Center For Disease Control And Prevention Guideline for prevention of surgical site infection, 2017, WHO Surgical Site Infection Prevention Guidelines and surgeon's point of view. The prescribing pattern of antibiotics in general surgery department was studied for a period of one month followed by randomization of patients into two groups. Out of all the 100 surgeries performed in group 1 and group 2, Herniotomy was the major surgery performed in both the groups followed by Lap chole. In group 1, 13 combinations of antibiotics were prescribed, out of which the combination of Cefotaxime and Amoxicillin were majorly prescribed for duration of 7 Days In group 2, 3 antibiotics were prescribed individually, out of which cefotaxime was majorly prescribed (80%) And all the antibiotics were stopped within 24 hours of surgery in group 2. It has been concluded that the timing of administration of antibiotics plays an important role in the prevention of SSI rather than multiple post operative doses. It has been also conclude that the entire team of health care professionals at every step of hierarchy are responsible for taking precautions in the prevention of SSI and everyone should follow the recommendations made by WHO.

KEYWORD: (SSI)Surgical site infection, Nosocomial Infections Surveillance (NNIS), System.

INTRODUCTION
To promote appropriate prophylactic administration of antibiotics to reduce surgical site infections. To observe closely and study the prescription patterns of antibiotics in patients undergoing clean, clean-contaminated, contaminated surgical procedures and the risk of SSI in them in general surgery department. To compare the associated risk of surgical site infections in control and interventional group after a period of one month. Surgical site infection (SSI) can be defined as an infection that is present up to 30 days after a surgical procedure if no implants are placed and up to one year if an implantable device was placed in the patient. Joseph lister inspired by Louis Pasteur germ theory of putrefaction introduced antiseptic surgical methods; the administrations of routine antibiotic prophylaxis were breakthrough initiations in reducing SSI, however the incidence of SSI is still high. According to the National Nosocomial Infections Surveillance (NNIS) system, SSI are the third most frequently reported nosocomial infections, accounting for 12%-16% of all nosocomial infections among hospitalized patients. The development of SSI requires a local inoculum which is sufficient to overcome the local host defense and it depends on microbial virulence factors, the local environment, systemic factors, e.g., comorbidity, and surgical technique.

While the SSI rates have decreased in countries with more resources, the relatively few studies conducted in countries with more limited health budgets identified higher rates 11. Extending nosocomial infection surveillance and prevention efforts to countries that presently lack effective programme is therefore viewed as a challenge for the future.

Although there are various ways of preventing SSIs, the most appropriate way is administering antibiotic prophylaxis at the appropriate time, Antibiotic prophylaxis plays an important part in prevention of wound infections. Numerous findings from non clinical and clinical studies state that the timing of administration of prophylactic antibiotics plays a crucial role in SSI, the guidelines developed jointly by the American Society of Health-System Pharmacists (ASHP), the Infectious Diseases Society of America (IDSA), the Surgical

Infection Society (SIS), and the Society for Healthcare Epidemiology of America (SHEA) recommend administration of antibiotics within 60 minutes prior to incision. The center for disease control and prevention states to administer preoperative antimicrobial agent(s) only when indicated, based on published clinical practice guidelines and timed such that a bactericidal concentration of the agent(s) is established in the serum and tissues when the incision is made, this reduces the risk of SSI and decreases the dose and duration of postoperative antibiotics which in turn reduce resistance and promotes rational use of antibiotics.

MATERIALS AND METHODS

MATERIALS:- Case Report forms, Laboratory Reports.
METHODOLOGY:- Study site:-General surgery department in Malla reddy Hospital, Suraram, Secunderabad.
Study design:- prospective, interventional.
Sample size:-150.
Study period:- The study will be carried out for period of 6 months.

Patient selection criteria

* INCLUSION CRITERIA: -Patients undergoing clean, clean contaminated and contaminated surgical procedures.

*EXCLUSION CRITERIA:- Prior administration of antibiotics administered as treatment for known or suspected infection, Immune compromised patients, patients undergoing emergency surgical procedures.

Study approval:- Institutional Human Ethics Committee (IHEC) approval was Obtained for initiating and conducting the study IHEC/MRIMS/41/2019. The protocol of the study which includes the aim, objectives, methodology and plan of work was submitted to the ethics committee of the hospital. The authorization was obtained and permission was given to utilize the hospital facilities to conduct the study and follow up of the patients in the selected department.

Patient consent:- Patient consent form is used as a sign of acceptance from the patient to participate in this study. The consent form, all the information regarding the study was explained to the patient and his/her consent was obtained. Also confidentiality of the data was assured to the patient.

Study procedure:- Method of sampling was non-random, purposive. After admission short history was taken and physical examination was conducted on each patient admitted in General surgery unit. Only very essential investigations were done urgently for taking correct decision about the management. Patients requiring emergency abdominal surgery were considered in exclusion criteria.

All the traumatic cases were also excluded from the study. All the necessary information regarding the study was explained to the patients or their valid guardian. Informed written consent was taken from the patients or their guardian willing to participate in the study. Detailed history was taken from the study group to establish proper diagnosis and to know about the presence of the risk factors regarding surgical site infection. Thorough physical examination was done in each case.

Only essential investigations were done for proper diagnosis and reduction of risk. Data collection sheets were filled in by the investigator thou self. Preoperative factors related to SSI present in the patient were noted down in the data sheet. After proper resuscitation (where applicable) and preparation, patients were sent to operation theatre for operation, patients in group 2 were administered an antibiotic at the time of anesthesia induction. Strict aseptic precautions were followed during the operation. Meticulous techniques were practiced as far as possible.

The operation procedure and related preoperative factors were observed directly and recorded in the data collection sheet instantly. During the postoperative period all the patients were closely monitored everyday up to the discharge of the patient from the hospital. If any symptom or sign of infection appear during this period then proper investigation was instituted for the diagnosis of infection and to assess the type and severity of the infection.

Proper antibiotic was given to every patient both preoperative and post-operative periods(in group 1). Postoperative events were recorded in the data sheet during every day follow up. After completing the collection of data it was compiled in a systematic way.

RESULTS

The Prospective interventional study was carried on prophylactic use of administration of antibiotics and the risk of surgical site infections.100 subjects were selected based on exclusion and inclusion criteria, out of which 50 subjects belonged to group 1 and the other 50 subjects belonged to group 2.

Results of group 1:- Out of 50 surgeries performed, 50 % were on Men and 50% were performed on women.

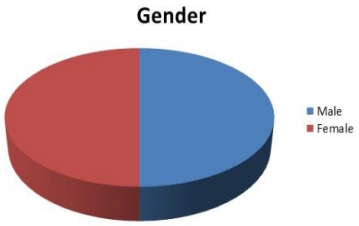


Fig. 1:-Illustrates gender wise distribution of the subjects in group 1.

Table 1: Represents Distribution of subjects according to class of surgery.

CLASS	RATIO
CLEAN	70.0%
CLEAN - CONTAMINATED	30.0

Out of 50 surgeries performed, 70% belonged to clean class and 30% belonged to clean contaminated class.

Table 2: Distribution of subjects according to type of surgery.

TYPE OF SURGERY	PATIENTS	%
HERNIOTOMY	23	46%
THYROIDECTOMY	7	14%
MAXILLECTOMY	1	2%
LAP CHOLE	7	14%
HERNIPLASTY	2	4%
LAP APPENDIX	5	10%
LUMPECTOMY	2	4%
EXCISION	3	6%
Total	50	100%

Out of 50 surgeries performed, It was found out that herniotomy was the major surgery performed and Thyroidectomy and Lap chole were the second major surgeries performed.

Table 3: Distribution of combination of antibiotics.

ANTIBIOTIC PRESCRIBED	TOTAL
Cefotaxime+Cefixime	1
Cefotaxime+Amoxicillin	19
Cefotaxime+Amoxicillin+Metronidazole	4
Cefotaxime+Metronidazole	8
Cefotaxime+Cefoperazone	2
Cefotaxime+Amikacin	4
Cefixime+Amoxicillin	6
Cefixime+Metronidazole	1
Amoxicilline+Cefixime	1
Amoxicilline+Cefoperazone+Amikacin	1
Metronidazole+Cefotaxime	1
Metronidazole+Cefoperazone	1
Metronidazole+Cefoperazone+Amikacin	1

13 Combinations of antibiotics were administered, out of which combination of cefotaxime and amoxicillin was majorly prescribed followed by cefotaxime and metronidazole. It was found that majority of the patients were receiving antibiotics post operatively for a duration of 5 or 7 days.

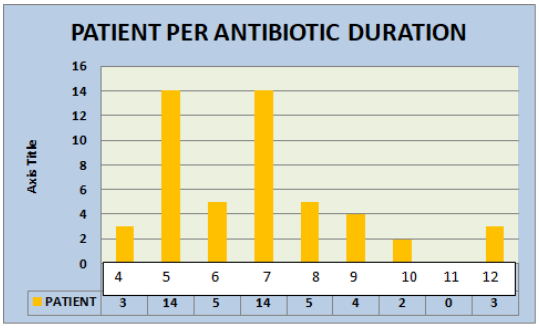


Fig 2. Illustrates distribution of patients according to antibiotic duration.

Fig 3. Illustrates that there is no incidence of SSI in any of the 50 subjects.

RESULTS OF GROUP 2

Table 4: Distribution of subjects according to gender.

GENDER	NO. OF PATIENTS n=50	%
FEMALE	41	82%
MALE	9	18%

Inference: Out of 50 surgeries performed, 82% were performed on women and 18% surgeries were performed on male.

Out of 50 surgeries performed, 66% belonged to clean class of surgery and 34% belonged to clean contaminated class of surgery.

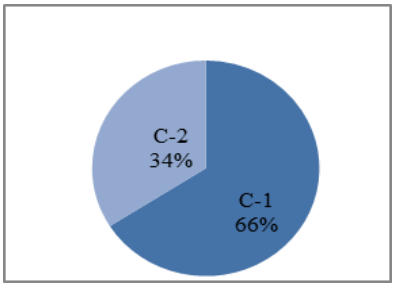
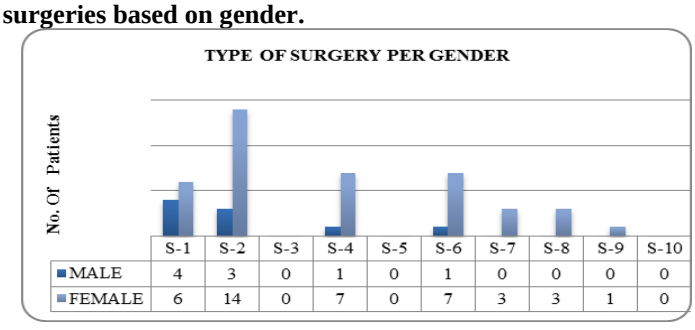


Fig4. Illustrates distribution of subjects according to class of surgery.

Table 5: Distribution os surgeries based on gender.



Out of 50 surgeries performed, Thyroidectomy was the major clean surgery consisting more number of female patients over male and Lap chole was the second major surgery**.**

Out of 50 surgeries performed, 40 subjects were administered Cefotaxime, 8 subjects were administered ceftriaxone and 2 subjects were administered metronidazole.

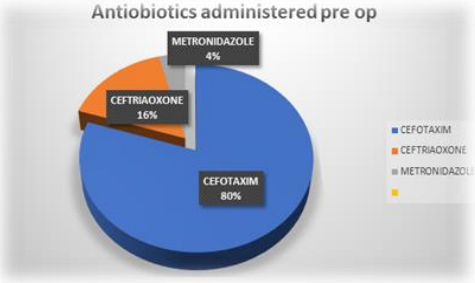


Fig 5. Illustrates Distribution of subjects according to antibiotics.

Table 6: Time of pre dose with respect to duration of surgery.

	IV8-DURATION OF SURGERY (MINS)		
IV7-TIME OF PRE DOSE(MINS)	**>60MINS**	**<60 MINS**	**TOTAL**
LESS THAN 2 HOURS	29	21	50
GREATER THAN 2 HOURS	0	0	0
TOTAL	**29**	**21**	**50**

The timing of administration of predose for all the 50 surgeries was lesser than 2 hours in which the duration of 29 surgeries was >60 minutes and duration of 21 surgeries was <60 minutes.

There was no incidence of SSI in the fifty subjects included in the study.

Fig 6. Incidence of SSI.

We observed that there was no incidence of ssi in both groups. Therefore we conclude that the risk of SSI can be reduced even though the antibiotics are stopped post operatively within 24 hours.

DISCUSSION

SURGERIES: - Out of all the 100 surgeries performed in group 1 and group 2, Herniotomy was the major surgery performed in both the groups followed by Lap chole.

CLASS OF SURGERY: Out of the 100 surgeries performed, the majority belonged to clean class of surgery, 70% in group 1 and 66% in group 2.

ANTIBIOTICS:- In group 1, 13 combinations of antibiotics were prescribed, out of which the combination of Cefotaxime and Amoxicillin were majorly prescribed for duration of 7 Days

- In group 2, 3 antibiotics were prescribed individually, out of which cefotaxime was majorly prescribed (80%).
- And all the antibiotics were stopped within 24 hours of surgery in group 2.

SKIN DISINFECTANT: In group 1 povidone Iodine was used as a skin disinfectant, in group 2 chlorhexidine gluconate was used as a skin disinfectant.

CONCLUSION

In Our Present study about "Prophylactic administration of antibiotics and risk of surgical site infections"

We conclude that the risk of SSI can be greatly reduced by following these methods such as

- Before surgery, patients should shower or bathe (full body) with soap (antimicrobial or non antimicrobial)

or an antiseptic agent on at least the night before the operative day.

- Antimicrobial prophylaxis should be administered only when indicated based on published clinical practice guidelines and timed such that a bactericidal concentration of the agents is established in the serum and tissues when the incision is made.
- Skin preparation in the operating room should be performed using an alcohol-based agent unless contraindicated.
- For clean and clean-contaminated procedures, additional prophylactic antimicrobial agent doses should not be administered after the surgical incision is closed in the operating room, even in the presence of a drain.
- Topical antimicrobial agents should not be applied to the surgical incision.
- During surgery, glycemic control should be implemented using blood glucose target levels less than 200 mg/dl, and normothermia should be maintained in all patients.
- Increased fraction of inspired oxygen should be administered during surgery and after extubation in the immediate postoperative period for patients with normal pulmonary function undergoing general anesthesia with endotracheal intubation.
- Transfusion of blood products should not be withheld from surgical patients as a means to prevent SSI.

We conclude that the timing of administration of antibiotics plays an important role in the prevention of SSI rather than multiple post operative doses, at the time of induction of anaesthesia/ 30-60 minutes before the incision maintains adequate tissue concentration throughout the procedure, a peri dose in longer surgeries ensures that t1/2 of the antibiotic is maintained. We also conclude that the entire team of health care professionals at every step of hierarchy are responsible for taking precautions in the prevention of SSI and every one should follow the recommendations made by WHO.

ACKNOWLEDGEMENTS

BIBLIOGRAPHY

1. World Health Organization (WHO). Global Guidelines for the Prevention of Surgical Site Infection. Geneva: WHO, 2016. Accessed Aug 14, 2017. http://apps.who.int/iris/bitstream/10665/250680/1/9789241549882-eng.pdf?ua=1.
2. Berríos-Torres SI, et al. Centers for Disease Control and Prevention Guideline for the Prevention of Surgical Site Infection, 2017. JAMA Surg. Epub 2017 May 3. Accessed Aug 9, 2017. http://jamanetwork.com/journals/jamasurgery/fullarticle/2623725.
3. Ban KA, et al. American College of Surgeons and Surgical Infection Society: Surgical site infection guidelines, 2016 update. J Am Coll Surg, 2017 Jan; 224(1): 59–74.
4. Anderson DJ, et. al. Strategies to prevent surgical site infections in acute care hospitals: 2014 update. Infect Control Hosp Epidemiol, 2014 Jun; 35(6): 605–627.
5. Institute for Healthcare Improvement (IHI). How-to Guide: Prevent Surgical Site Infections. Cambridge, MA: IHI, 2012. Accessed Aug 14, 2017. http://www.ihi.org/resources/Pages/Tools/HowtoGuidePreventSurgicalSiteInfection.aspx.
6. Centers for Disease Control and Prevention. National Safety Healthcare Network (NHSN). (Updated: Oct 21, 2016.) Accessed Aug 14, 2017. https://www.cdc.gov/nhsn/.
7. World Health Organization (WHO). WHO Guidelines on Hand Hygiene in Health Care: First Global Patient Safety Challenge: Clean Care Is Safer Care. Geneva: WHO, 2009. Accessed Aug 14, 2017. http://whqlibdoc.who.int/publications/2009/9789241597906_eng.pdf.
8. World Health Organization (WHO). A Guide to the Implementation of the WHO Multimodal Hand Hygiene Improvement Strategy. Geneva: WHO, 2009. Accessed Aug 14, 2017. http://whqlibdoc.who.int/hq/2009/WHO_IER_PSP_2009.02_eng.pdf.
9. World Health Organization. Infection Prevention and Control: Countries or Areas Running Hand Hygiene Campaigns. Accessed Aug 14, 2017. http://www.who.int/infection-prevention/campaigns/clean-hands/country_list/en/.
10. Centers for Disease Control and Prevention. Hand Hygiene in Healthcare Settings: Clean Hands Count Campaign. (Updated: Apr 13, 2017.) Accessed Aug 14, 2017. https://www.cdc.gov/handhygiene/campaign/index.html
11. Centers for Disease Control and Prevention. Hand Hygiene in Healthcare Settings. (Updated: Mar 24, 2017.) Accessed Aug 14 2017. https:// www.cdc.gov/handhygiene/index.html.
12. Jaussen PA Palaeopathology: Diseases and infections of Pre-historic man. London, John Baker Publishers. 1st Edition 1970 pg. 167- 168.
13. Robert FH The code of Hammurabi, King of Babylon, Law book Exchange Limited, 5td Edition. 2001. page 37-39.
14. Flexiner JT. Doctors on Horseback: Pioneers of American medicine. New York Dove Publications. 4th Ed 1969, page 23- 24.
15. Jones J. Notes upon history of hospital gangrene. South Med. Surg, 1973; 1; 55: 1866 – 7.
16. Koch R Investigations into aetiology of traumatic infective disease. Trans W.W. Cheyne London. New sychenhan society. 4th Ed, 1880 Page 403-406.
17. Howe CW. Post operative wound infections due to staphylococcus aureus. N. Engl. J. Med., 1954; 251: 411 – 7.

18. McKittrick LS. The routine use of antibiotics in elective abdominal surgery. Surg. Gyn. Obstet, 1954; 99: 376–7.
19. Burke JF. The effective period of preventive antibiotic action in experimental incisions and dermal lesions. Surg, 1961; 50: 161 – 8.
20. Nicholls RL. Surgical infections: prevention and treatment 1965 – 1995. Am. J. Surg, 1996; 172: 68–79.
21. ICMR: Treatment Guidelines for Antimicrobial Use in Common Syndromes, 2017; 88-98.
22. Kirk R.M., Ribbans, W.J., 2004. Clinical surgery in general (RCS course manual), 4th ed. Churchill livingstone, London, UK, 206-382.
23. Williams, N.S., Bulstrode, C.J.K., O'conel, P.R., 2008. Bailey and Loves Short Practice of Surgery, 25th ed. 338 Euston Road, London NW1 3BH: Hodder Arnold, 32-48.
24. Stadelmann, W.K., Digenis, A.G., Tobin G.R., 1998. Physiology and healing dynamics of chronic cutaneous wounds. The American Journal of Surgery, 176(2): 26S-38S.
25. Midwood, K.S., Williams, L.V., Schwarzbauer, J.E., 2004. Tissue repair and the dynamics of the extracellular matrix. The International Journal of Biochemistry & Cell Biology, 36(6): 10311037.
26. Chang H.Y., Sneddon J.B., Alizadeh A.A., Sood R., West R.B., Montgomery K., et al. 2004. Gene Expression Signature of Fibroblast Serum Response Predicts Human Cancer Progression: Similarities between Tumors and Wounds.c Public Library of Science, 2(2). PMID 14737219. [Accessed January 20, 2008].
27. Enoch, S., Price, P., 2004. Cellular, molecular and biochemical differences in the pathophysiology of healing between acute wounds, chronic wounds and wounds in the elderly. Worldwidewounds.com.
28. JCI SSI, Evidence based principles and practices for prevention of surgical site infection.
29. Garg, H., G., 2000. Scarless Wound Healing. New York, Marcel Dekker, Inc. Electronic book.
30. Janeway, C.A., Travers, P., Walport, M., Shlomchik, M.J., 2001. Immunobiology (5th ed.). New York and London: Garland Science. P 106-7. ISBN 0-8153-4101-6. Available at:http://www.ncbi.nlm.nih.gov/books/bv.fcgi?call=bv.View.ShowTOC&rid=imm.TOC&depth=10
31. Shapiro M, Townsend TR, Rosner B, Kass EH. Use of antimicrobial drugs in general hospitals: patterns of prophylaxis. N Engl J Med, 1979; 301: 351–5.
32. Crossley K, Gardner LC. Antimicrobial prophylaxis in surgical patients. JAMA, 1981; 245: 722–6.
33. American Society of Health-System Pharmacists. ASHP therapeutic guidelines on antimicrobial prophylaxis in surgery. Am J Health-Syst Pharm., 1999; 56: 1839-88.
34. Jaeger M, Maier D, Kern WV et al. Antibiotics in trauma and orthopedic surgery—a primer of evidence based recommendations. Injury, 2006; 37: s74-80.
35. Moss JP. Historical and current perspectives on surgical drainage. Surg Gynecol Obstet, 1981; 152(4): 517-27.
36. Galandiuk S, Fazio VW. Postoperative irrigation-suction drainage after pelvic colonic surgery. A prospective randomized trial. Dis Colon Rectum, 1991; 34(3): 223-8.
37. Sagar PM, Couse N, Kerin M, May J, MacFie J. Randomized trial of drainage of colorectal anastomosis. Br J Surg, 1993; 80(6): 769-71.
38. Berliner SD, Burson LC, Lear PE. Use and abuse of intraperitoneal drains in colon surgery. Arch Surg, 1964; 89: 686-9.