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Research article

USES OF ANTIBIOTICS IN SURGICAL PROPHYLAXIS

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ABSTRACT

Antibacterial s, popularly known as antibiotics are the class of medications that destroy, kill or slow down the process of growth of bacteria. They are widely used all around the world to treat the diseases that are caused due to the bacteria. They however cannot kill the most popular infections such as cold cough and flu. Alexander Fleming, as the history says in his work accidentally discovered penicillin after he returned from a holiday in Suffolk, in 1928 he noticed that a fungus named Penicillium Notatum, caused contamination to a plate that have another species named Staphylococcus bacteria. That plate was left accidentally before he left for a holiday. The fungus was seen a mark of free zone where ever it grew on the Petri plate. Widely accepted indications for antibiotic prophylaxis are contaminated and clean contaminated surgery and operations involving the insertion of an artificial device or prosthetic material. Less well – accepted indications for prophylaxis include clean operations in patients with impaired host defenses or patients in whom the consequences of infection may be catastrophic, for example neurosurgery, open heart surgery and ophthalmic surgery. The present study was aimed to acknowledge the use of antibiotics on surgical patients at secondary care hospital. A total of 100 patients were admitted into the department of general surgery in the government hospital, Chittoor were analyzed according to the study parameter and results were shown in the article. In conclusion, the current project reported the importance of the antibiotics used in the surgical care during the pre-operative and post-operative procedures. This study shows that the antibiotics that are widely used prevent the surgical site infections, reduce the recovery time and also prevent any unwanted infections caused by the bacteria. Antibiotics are found to have shown the clinical effectiveness on the patients that undergo surgery and there were almost negligible cases of the patients that had any serious surgical site infections. In the case of post-operative drug 'ceftriaxone' is the most efficient antibiotics to prevent any bacterial infection post-surgery infections. Ceftriaxone is a third-generation antibiotic with excellent activity against the gram negative and reasonable activity with most gram-negative organisms.

Key Words:-Surgery, Prophylaxis, Therapeutic Efficacy, Adverse Effects.

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INTRODUCTION

Antibacterial s, popularly known as antibiotics are the class of medications that destroy, kill or slow down the process of growth of bacteria. [Hall, Brian, 2008] They are widely used all around the world to treat the diseases that are caused due to the bacteria. [Laxminarayan R, et. Al., 2013] they however cannot kill the most popular infections such as cold cough and flu. [Tan SY, Tatsumura, et. Al., 2015] Alexander Fleming, as the history says in his work accidentally discovered penicillin after he returned from a holiday in Suffolk, in 1928 he noticed that a fungus named Penicillium notatum, caused contamination to a plate that have another species named Staphylococcus bacteria.[Bickal, L. Florey, 1972] That plate was left accidentally before he left for a holiday. The fungus was seen a mark of free

zone where ever it grew on the petri plate. [Houbraken, et. Al., 2011]

After this accident happened Fleming isolated and grew the mould separately to extract its content. He happens to find that penicillin notatum showed very positive effect even in low concentration and it prevented the growth of staphylococcus even it was diluted for 800 times yet very mild that the disinfectant.[Hibbett, et. Al., 2013]

This penicillin came out during the World War 2 as a result of the work of a group of scientists led by Howard Florey and his companion Ernst chain and that resulted in a Nobel prize that was shared with the discoverer Alexander Fleming.[Frith J, 2017]

The first antibiotic was then; Salvarsan was deployed in the year 1910. In just a period of 100 years antibiotics have drastically changed the face of the modern medicine. [Gonzalez – Estrada A, 2015]

The antibiotic usage also extended the life span of an average human being by 23 years.

This discovery of the penicillin in 1928 initiated the golden era of the antibiotics that peaked in the mid 1950's. Now it has been evolved to an unmatchable state in the history of modern medicine. [Kardos N, Demain Al, 2011]

Today there are a very few novel antibiotics under the development. Because the bacteria now a days is becoming more and more common making the available antibiotics ineffective. [Steven J. Martin, 2015].

ANTIBIOTIC IN SURGICAL PROPHYLAXIS

Surgical antibiotic prophylaxis is defined as the use of antibiotics to prevent infections at the surgical site.

Antibiotic prophylaxis is most commonly used beforehand dental surgery or medical surgery, however may be used in other cases, such prior to sexual intercourse for patients who suffer from recurrent urinary tract infections.

Even when sterile techniques are adhered to, surgical procedures can introduce bacteria and other microbes in the blood (causing bacteremia), which can colonize and infect different parts of the body, leading to life threatening infections.

An estimated 5 to 10 percent of hospitalized patients undergoing otolaryngology ("head and neck") surgery acquire a nosocomial (hospital) infection, which adds a substantial cost and an average of 4 extra days to the hospital stay.

Antibiotics can be effective in reducing the occurrence of such infections. Patients should be selected for prophylaxis if the medical condition or the surgical procedure is associated with a considerable risk of infection or if a postoperative infection would pose a serious hazard to the patient's recovery and well-being [Narasimha Kumar GV, 2016].

Principle in the Surgical Antibiotic Prophylaxis

- Decide if prophylaxis is appropriate.
- Determine the bacterial flora most likely to cause postoperative infection (not every
- species needs to be covered)
- Choose an antibiotic, based on the steps above, with the narrowest antibacterial spectrum required.
- Choose the less expensive drug if two drugs are of equal antibacterial spectrum, efficacy, toxicity, and ease of administration.
- Administer dose at the right time
- Administer antibiotics for a short period (one dose if surgery of four hour duration or less)
- Avoid antibiotics likely to be of use in the treatment of serious sepsis
- Do not use antibiotic prophylaxis to overcome poor surgical technique
- Review antibiotic prophylaxis protocols regularly as both cost and hospital antibiotic resistance patterns may change.

Indication for Surgical Antibiotic Prophylaxis

A classification system which ranks procedures according to their potential risk for infectious, complications has greatly facilitated the study of surgical antibiotic prophylaxis.

Widely accepted indications for antibiotic prophylaxis are contaminated and clean contaminated surgery and operations involving the insertion of an artificial device or prosthetic material. Less well – accepted indications for prophylaxis include clean operations in patients with impaired host defenses or patients in whom the consequences of infection may be catastrophic, for example neurosurgery, open heart surgery and ophthalmic surgery [John M A Bohnen,, 2001].

AIM OF THE STUDY

A prospective study to acknowledge the use of antibiotics on surgical patients at secondary care hospital.

OBJECTIVES

1. To assess the clinical effectiveness of the antibiotics used in the surgical prophylaxis.
2. To compare the safety and effectiveness of different types of antibiotics in surgical ward [single\ combination].
3. To assess the safety of different types of the antibiotics used in the surgical prophylaxis.
4. To promote the awareness among the patients and reduce the incidence of the surgical site infections.
5. To study the adverse reactions or other possible effects of the use of antibiotics during the treatment.
6. To study pre operative medications.
7. To study intra operative medications.

8. To study post operative medications.

METHODOLOGY:

Study Design

This is a single centered, observational and comparative study.

Study Site

This study was conducted in district head quarter (secondary care referral hospital) located in rural settings Chittoor, Andhra Pradesh, India

Sample Size (n)

100

Study Population and Study Duration

This study included patients undergoing surgery in secondary care hospital, between the ages of 20-90 years receiving antibiotic agents single or combination as post-operative medications over a period of 5 months from December 2021 to April 2022

Study Criteria

Inclusion criteria

- Patient aged between 20-90 years,
- Patients of both sex,
- Patients undergoing surgical procedures and admitted in the ward,
- Patients receiving antibiotics(single or combinational in oral and IV).

Exclusion criteria

- Patients and their correspondents who are not willing to participate in the study,
- Patients not receiving any kind of antibiotics,
- Patients having other physical and mental condition which will interfere with antibiotics,
- Patients under the needed age group.

STUDY PROCEDURE

Initiation of patient counseling and development of questionnaire form; this is a single centered, observational and comparative study where eligible patient will be involved after obtaining their consent. The patient questionnaire form is designed and is used for collecting the details. This form mainly contains demographic details (age, gender, case, date of surgery, date of admission, etc.), type of surgery (major/minor), and anesthesia (Y/N). A detailed counseling is done for better outcomes. While collecting the data, patient case sheet, medication chart, patient or patient care taker interview and laboratory reports will be used to get the complete details.

RESULTS AND DISCUSSIONS:

Total number of 100 patients were selected from the department of general surgery in the government hospital, Chittoor were analyzed according to the study parameter and results were shown below.

The results were obtained from 100 patients that underwent surgery and they were enrolled in the study filled after selection criteria on obtaining consent from the same 100 patients.

NON-STATISTICAL ANALYSIS:

The subjects between 12 -90 years were included in the study. From table No.1 the total subjects were between 12 -45 and 45 -90 were 39% and 61% respectively. The subjects between the height 150 to 190 were included in the study. From table No. 2 42% of the patients were between 150 -170 and 58% of the subjects were between 171-190 cm of height.

The subjects that were included in the study were of two categories. From the table No.3 its seen 46% of the people were up to 65 kg and rest 54% of the persons were between the weight of 66-90 kg. The BMI of the subjects were of two categories. From the table No.4 the graph shows 32% of the subjects were between BMI 18-24.9 and 68% of the subjects were between the BMI 25.0 and above.

A total of 100 subjects were included into the study. As the table NO.5 is seen 42% of the subjects were female and 58% of the subjects included were male. This explains that male patients opted towards surgery rather than the pharmacological therapy. A total of 100 subjects underwent some kind of laboratory examination before surgery, all the subjects performed Complete blood count, 94 of them were checked for blood sugar level , 78 of them checked for their complete urine examination , 34 for liver function test and 70 of them underwent many other laboratory examinations respectively.

A total of 100 patients undergone surgery, according to the table No.7- 33% of them were diagnosed with hernia, 21% with appendicitis, 14% with lipoma, 11% with hydrocele, 5 % with cholelithiasis and 16% were admitted with other conditions respectively. Total subjects included were given an antibiotic as pre operative measure. According to table No 8 94% of them were given cefixime, 85% with metronidazole, 9% of them with ceftriaxone, 20% of them with ciprofloxacin, 11% with amoxiclav and 6% of them were given other suitable antibiotics.

All the subjects employed into the study were given post operative antibiotics. According to the table No.9 – 91% of them were ceftriaxone, 83% with metronidazole, 22% with cefixime, 30% with ciprofloxacin, 14% with amikacin and 7% of other suitable antibiotics were given respectively. A total of 100 subjects receiving antibiotics experienced ADR. According to the table No.10- 48% of them experienced at least 1 ADR, 28% with mild ADR, 19 % with severe ADR and 8% of them experienced unknown or no ADR.

A total of 100 patients taking antibiotics were examined for their Route of administration. According to the table No.11 –86% of them were given intravenously, 11% of them received per oral and 3% of them were given with other routes. A total of 100 patients receiving antibiotics were segregated according to their doses and ROA. According to the table No.12 – to each person 1000mg of cefixime was given through IV, 1000mg of ceftriaxone IV, 675mg amoxiclav IV, 500mg of amikacin IV, 500mg ciprofloxacin per oral and 500mg metronidazole IV respectively.

A total of 100 patients taking antibiotics with divided according to their duration. According to table No.13-11%of them took for 3 days,57% for 5 days,22%for 7 days. A total 100 patients were admitted into general surgery ward and were divided according to their length of duration. According to table No.14- 21% of patients stayed up to 5 days,42% for 5-7 days,19% for 7-9 days, 12% for 9-12 days and 6% above 12 days respectively.

STATISTICAL ANALYSIS:

Statistical analyses were carried out using International Business Machines – Statistical Package for the Social Sciences (IBM – SPSS) 20.0. Statistical significance of difference in population means between and within subjects was assessed by independent two sample and paired samples t-test respectively. Descriptive summary statistics are presented either as mean ± SD or as median (minimum, maximum). Choice of descriptive and inferential statistical method was based on distribution normality as determined through normal probability plot (Normal P-P) (Table 1).

PROPHYLAXIS:

- As, we observe from the table of clinical lab investigations, we could clearly find a strong relationship between the pre surgical and post-surgical prophylaxis.
- The parameters like RBC, Hematocrit, Hemoglobin, WBC and Platelet count are observed having a significant correlation ship.
- Other parameters like PCV, lymphocytes, polymorph, Eosinophil, RBS, and bilirubin Urea are not significantly showing a casualty.
- We understand by the end of our study that the levels showing significant p value are alleviated during post-surgical prophylaxis.

Duration of hospitalization vs. Economical status Between the Gender

- The duration of Hospitalization is seen relatively lesser in Male Population with a Mean± Std of 7.9±2.03 when compared to female population with a Meanest of 8.3±1.7
- Conversely when the total percentage of population below poverty line 58% (out of 100), of which the female population were seen slightly with a higher percentage of 64% whereas male with 36%.
- This clearly indicated us a significant relationship between the economic and social history to the disease/ surgical prophylaxis. We have used independent student-t test to perform the analysis and got a p- value of 0.067 and the graph below represents the same (figure 1).

ANTIBIOTICS ON X-AXIS:

1. Cefazoline
2. Cefixime
3. Ceftriaxome
4. Cefuroxime
5. Amoxyclav

The most commonly given drugs were selected to check the linearity index of the given treatment, duration of Hospitalization, and outcome of therapy (figure 2).

As shown in the graph, the linearity index of DOH and Amoxyclav is 2.3(Normal range is – 3to+3. This suggest us that a greater number of patients are actively responding to Amoxyclav. Similarly, Cefazoline has got relatively lesser linearity index of 0.987. It is a special case where our results suggest that no. of patients responding to this therapy are good in number but their DOH is relatively high. It says that this drug fails the criteria of cost-benefit therapy but satisfies cost-effective therapy (figure 3) (figure 4).

We have used kwauss test of NON-PARAMETRIC variable test to find out this index values.

- All the figures presented here the percentages converted using Graph Pad Prism 7.0 version for the convenience of understanding.
- As the summary graph and p values of the table says, Variables like DOH, Noncompliance, no of antibiotics used etc., our results suggest that there exists a significant correlation up to an extent to most of the variables.
- The above figures are achieved by neutralizing the values for the statical analysis's purpose (table 2).
- However manual formula is also used wherever required, as Below.

The variable X(Y) – Y/%Z(100) x 100.

TABLE 1: Comparison of Pre-Surgical and Post Surgical

	RBC (million/mm$^{3)}$	5.04±0.42	4.41±0.37	<0.0001*
	Haemoglobin (g/dL)	13.65±1.06	13.14±1.0	0.0042*
	Haematocrit (%)	43.35±2.14	38.21±2.08	<0.0001*
	Total WBC count (cells/mm^{3})	8385.7±2469.4	6871.4±1572.7	0.0146**
	Polymorphs (%)	58.07±5.22	57.92±7.95	0.9431
	Lymphocytes (%)	32.07±6.04	35.71±7.76	0.0526
	Eosinophils (%)	4.85±2.89	4.14±1.12	0.3889
	Platelet (lakh cells/mm^{3})	259.5±56.5	2.57±0.57	<0.0001*
	Random Blood Sugar (mg/dL)	89.14±12.97	95.57±10.21	0.2579
	Blood Urea Nitrogen (mg/dL)	10±3.29	7.57±2.45	0.0702
	Serum Creatinine (mg/dL)	0.77±0.11	0.96±0.09	0.0001*

Table 2: A table showing the significant correlation in both intra and inter individual variables

	Lipoma	Hydrocele	Hernia	Cholelithiasis	Appendicitis	P value
No. of Antibiotics	15	12	23	31	19	**0.00063**
Invasive surgery	12	23	15	18	32	**0.042**
patient non-compliance	36	14	22	16	12	**0.003**
Follow-up required	9	26	21	20	24	0.098
P value	0.9	0.7004	**0.0069**	**0.0047**	**0.0581**	

Figure 1: A graph representing a spike in BPL level of female correlating to the increased DOH

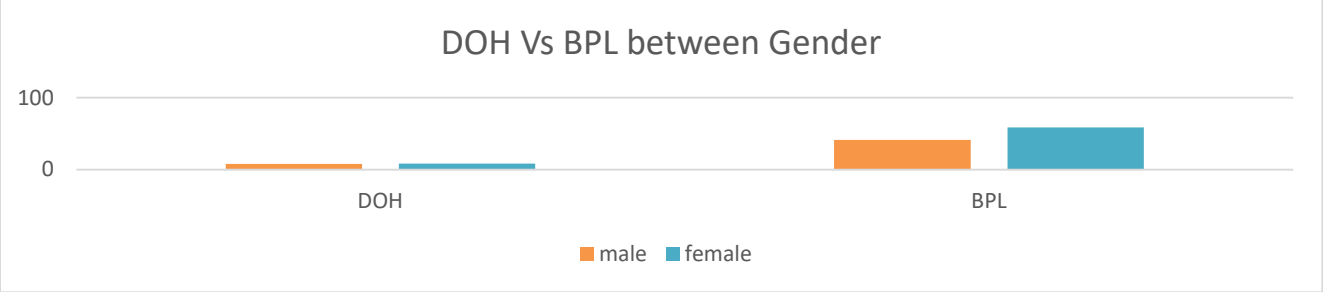


FIGURE 2: Comparative Analog Of Linearity Axis Between Drugs Used In Surgical Prophylaxis

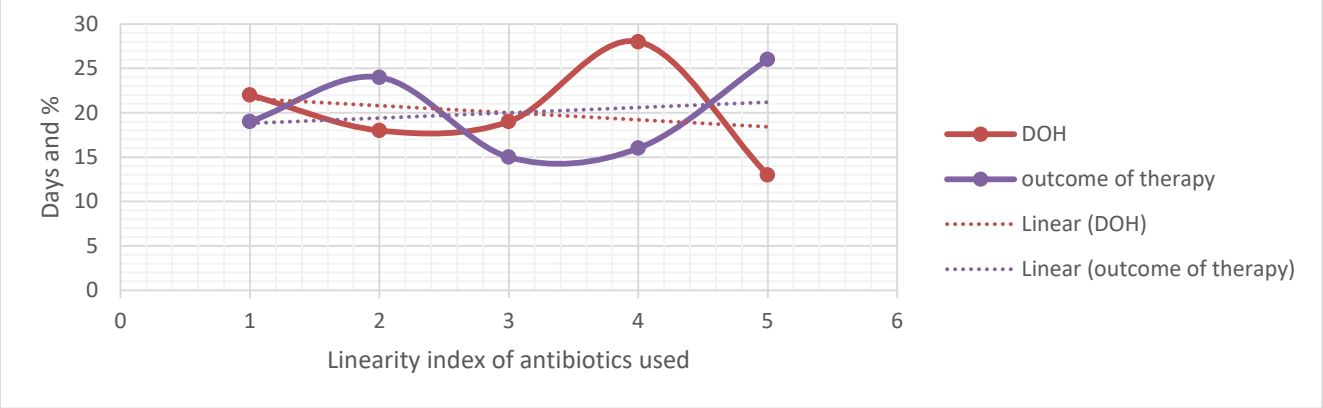


FIGURE 3: A Graph Explaining The Objectives Of Our Study: Diagnostic Parameter With Respect To Antibiotics, Invasive Surgeries, Non Compliance and Follow up Of Patients Altogether

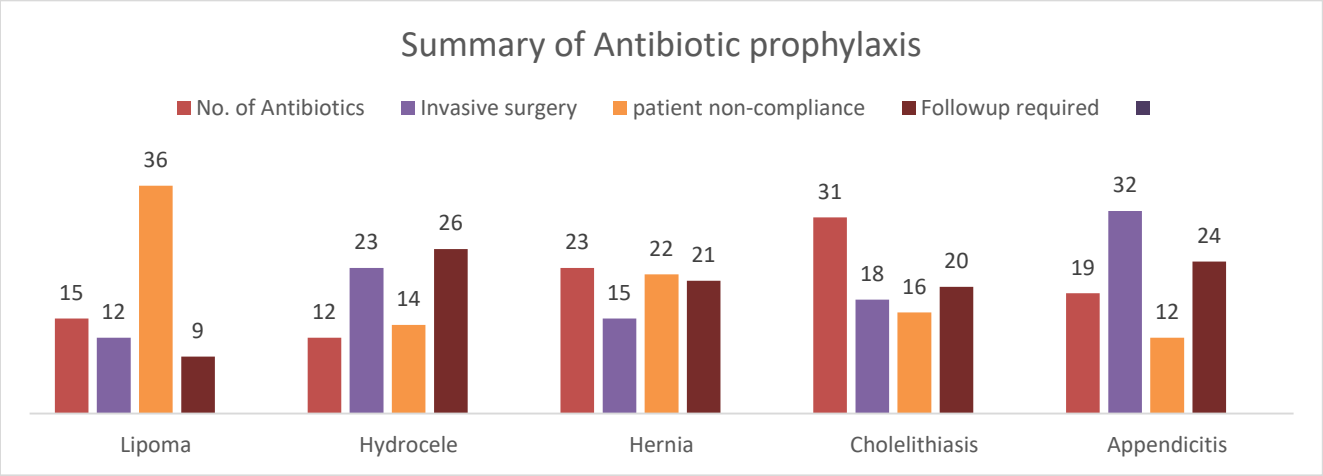
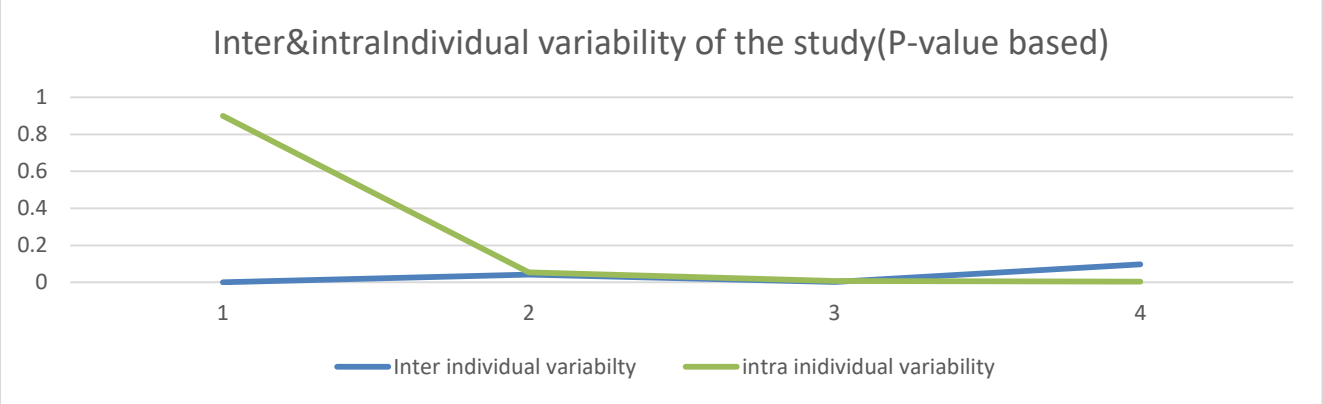


Figure 4: Inter and intra individual variability is tested using parametric t-test. This includes all variables that are related to this study.



CONCLUSION:

In conclusion, the current project reported the importance of the antibiotics used in the surgical care during the pre-operative and post-operative procedures. This study shows that the antibiotics that are widely used prevent the surgical site infections, reduce the recovery time and also prevent any unwanted infections caused by the bacteria.

Antibiotics are found to have shown the clinical effectiveness on the patients that undergo surgery and there were almost negligible cases of the patients that had any serious surgical site infections.

After comparing the different kind of antibiotics and their effectiveness of them either in single or in combination 'Cefixime' is the most widely used antibiotic and this is a third-generation antibiotic and the most efficient pre-operative drug.

In the case of post-operative drug 'ceftriaxone' is the most efficient antibiotics to prevent any bacterial infection post-surgery infections. Ceftriaxone is a third-generation antibiotic with excellent activity against the gram negative and reasonable activity with most gram-negative organisms.

This study also showed that almost 50% of the patient experienced at least 1 adverse drug reaction and most commonly they included nausea and loss of appetite and also intravenous route is the most effective route of administration as it has almost 100% bioavailability.

However, further studies are being done on the usage of antibiotics and in-depth analysis and understanding of the field of antibiotics. This need to be intensified because of the resistance nature of most of the antibiotics.

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