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A Study on Efficiency of Antibiotics in Post-Operative Patients in The Prevention of Wound Infection in Both Elective and Emergency Surgeries in A Tertiary Care Teaching Hospital

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Keywords: Surgical site infection, SSI, wound infection, antibiotics, prevention, Surgical Antibiotic Prophylaxis, SAP.

ABSTRACT

Aim: To study the efficiency of antibiotics in post-operative patients in the prevention of wound infection in both elective and emergency surgeries in a tertiary care teaching hospital. **Methodology:** A prospective cross-sectional observational study (2021 – 2022) was conducted at the Department of Surgery, GCMC, Chidambaram. Demographic details such as age, gender, chief complaints, past medication history, operation record, post-operative local examinations, and therapeutic management were collected from the case sheets. The collected data were analyzed using statistical tools. **Results:** In our study, 100 patients were enrolled, the majority belonging to the age group of 21 to 25 years. About 96% of patients have undergone major type of surgery, and only 4% have undergone minor surgery. After surgery, patients were prescribed antibiotics like Cefotaxime, Metronidazole, Gentamycin, Ceftriaxone, and so on. The surgical site was monitored regularly for surgical site infection. From this study, we have observed, that the majority of patients have healthy wounds with no discharge from the surgical site (92%). It is also found that all the enrolled patients (100%) have healthy wounds with no pus discharge from the surgical site during patient discharge from the hospital. In this study, among the 5 infected patients, 4 patients have pus cells of gram-positive bacilli. The most common micro-organism identified from the infected patients is E. coli. **Conclusion:** In our study, we have observed that Cefotaxime is the most prescribed antibiotic and is very efficient in the prevention of postoperative wound infection. Tab. Taxim O (Cephalosporins) is commonly prescribed and is more efficient when compared to other antibiotics.

INTRODUCTION:

Surgical antibiotic prophylaxis is defined as the usage of antibiotics to avert surgical site wound infections. It can be given 1 or 2 hours before the surgery or else after the surgery in order to prevent surgical site wound infections. Prophylaxis has become the standard medical care for surgery and for surgery that involves insertion of surgical devices. For surgical prophylaxis, 30 – 50% of antibiotics are used now- a-days. [(1)]. Recently, it is estimated that the global antibiotics consumption, expressed in defined daily doses (DDD), increased from 21.1 to 34.8 billion DDDs-an increase of 65% [(2)].

Antibiotics are well organized to prevent the surgical site wound infections such as: contaminated wounds, penetrating wounds, abdominal trauma, and wounds with devitalized tissue [(3)]. Antibiotic Prophylaxis should be given or continued for 1 day or more after surgery to prevent surgical wound infections [(4)].

Optimal prophylaxis includes a precise selection of safe and effective antibiotics, initial dosing at an appropriate time and redosing if required. Inappropriate usage and prolonged post operative usage does not provide any added benefit and they may increase the incidence of resistant pathogens or microbes in the subsequent nosocomial infections [(5)].

A Surgical site infection is defined as an infection that occurs at or near a surgical incision. The Centers for Disease Control and Prevention (CDC) estimates that approximately 5000000 surgical site infections occur annually in the United States. These surgical wound infections greatly reduce the patient's quality of life. Surgical wound infections remain a major source of post operative morbidity, accounting for about a quarter of the total number of nosocomial infections [(6)].

SSI is dependent on type of operation and may occur in 5-20% after surgery, activates 7 to 11 extra post operative days in hospitals and results in 2 to 11 times higher risk of death when compared to non-infected patients. The process of wound infection is quite complex and involves an interplay between several biological pathways at the molecular levels [(7)].

TYPES OF SSI:

Superficial incisional SSI

Deep incisional SSI

Organ or space SSI.

The etiology of post operative wound infections is tangled by the heterogenous nature of these infections. They vary by geographical region, surgical subspecialty, and the wide array of procedures performed [8]. Symptoms include redness and swelling at the incision site, drainage of yellow or cloudy pus from the incision site**,** fever that spikes about 100.3 F (38° Celsius) or higher more than for 24 hours [9]. Risk factors include age, obesity, alcoholism, and> 3hr surgery.

All surgical wounds are contaminated by bacteria, but only a minority can demonstrate clinical infections. In most patients, infection does not develop because innate host defenses are quite efficient in the elimination of contaminants at the surgical site [10]. Prevention of SSI include pre operative phase, hair removal, antibiotics prophylaxis, patient theatre wear, intraoperative phase, post operative phase.

MAJOR PATHOGENS IN SURGICAL WOUND INFECTIONS:

- Staphylococcus aureus, Enterobacter spp, & Escherichia coli, Group D streptococci, Coagulase -ve staphylococcus & Other gram +ve cocci.

ANTIBIOTICS:

Surgical antibiotic prophylaxis (SAP) is the utilization or usage of antibiotics to prevent the infection at surgical site. SAP is an effective management strategy for reducing post-operative infections provided that appropriate antibiotics are given at correct time for appropriate durations and appropriate surgical procedures [11]. Antibiotics are medicines used to prevent and treat bacterial infections. Antibiotic resistance occurs when bacteria change in response to the use of these medicines. Bacteria, not humans or animals, become antibiotic-resistant [12]. Goals of surgical prophylaxis include Preventing the post operative infections at the surgical site, prevent post-operative infectious morbidity and mortality, does not cause any adverse effects and it must be cost effective.

MATERIALS AND METHODS:

Ethical clearance: This prospective study was approved by Institutional Human Ethics Committee, Number: IHEC/881/2022 and permitted by Member Secretary, Institutional Human Ethics Committee, Government Cuddalore Medical College and Hospital (RMMCH), Annamalai University. The registration number of IEC is EC/NEW/INST/2020/1249.

Study site: Department of Surgery, Government Cuddalore Medical College Hospital (RMMCH), 1200 bedded multi-specialty tertiary care teaching hospital, Annamalai University, Chidambaram, Tamil Nadu. **Study type:** A Prospective cross-sectional observational study. **Study period:** 6 Months (Nov 2021- April 2022). **Study tools:** Data collection form. **Sources of Data:** The data required for the study was collected from the case sheets (In-patients) and personal interactions with patients**.**

Study recruitment:

The study method involves the enrolment of patients based on inclusion and exclusion criteria. **Inclusion criteria:** Patients who are admitted in Surgery department and get operated. Patients who are willing to participate in the study. **Exclusion criteria:** Pregnant and lactating women, Patients under 12 years of age.

Study procedure:

Study period was conducted for 6 months (Nov 2021- April 2022). Selection of subjects based on inclusion and exclusion criteria. Prior to starting the study, informed consent form was obtained from patients. Data collection form is designed to collect all the details like In-patients' number, name, age, chief complaints, past surgical history, lab investigation, diagnosis operation record, post operative local examination and therapeutic management. The present study was carried out among the patients visiting the inpatient department under the Department of Surgery, Government Cuddalore medical college & Hospital (RMMCH). From the case sheet,

Local examination of the surgical site was noted. Patient counseling was provided. The net result of treatment was recorded and tabulated. The results were interpreted based on the data collected during the treatment course. The conclusion drawn from study. Submission of report. Collected data will be stored in department library for future reference in the form of thesis book. **Data analysis:** The data gathered were recorded using Microsoft Excel and analysed using relevant statistical tools to provide significant results.

RESULTS AND DISCUSSION:

In this study, we have endeavored to study the efficiency of antibiotics in post-operative patients in the prevention of wound infection in both elective and emergency surgeries on inpatients of Rajah Muthiah medical college and hospital, Chidambaram. Cefotaxime is the

mostly prescribed antibiotic and is very efficient in the prevention of post operative wound infection. Thus, Cephalosporins are more efficient compared to other classes of prescribed antibiotics.

DEMOGRAPHIC DATA:

Based on inclusion and exclusion criteria, a total of 100 patients were enrolled in the study.

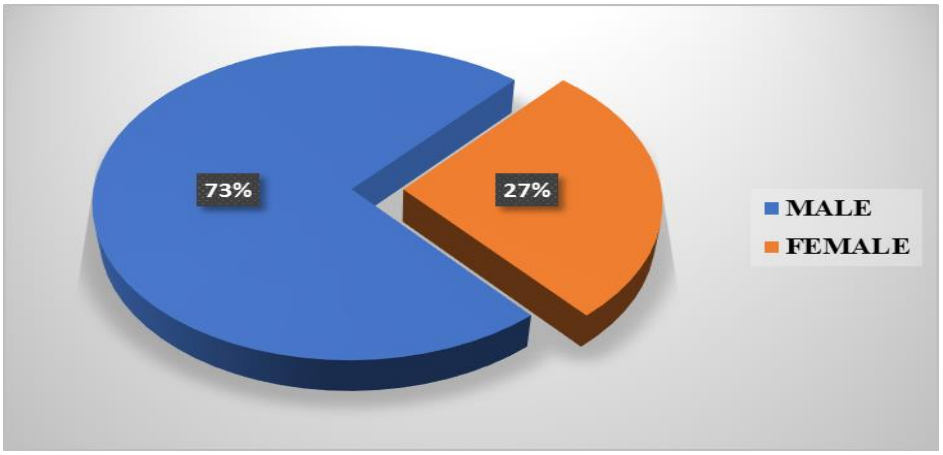

FIGURE 1: GENDER DISTRIBUTION

Our study includes 100 patients. Out of these 73 (73%) were males and 27 (27%) were females.

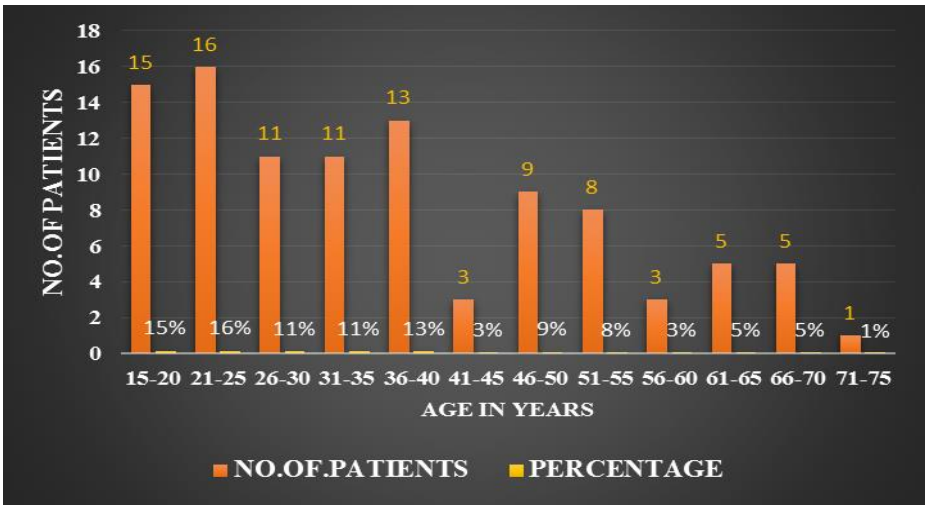

FIGURE 2: BAR DIAGRAM SHOWS THE AGE GROUP OF PATIENTS

The above figure depicts the percentage of patients belonging to various age group enrolled in the study. The majority of patients were in the age group of 21-25 years (16%).

Mean, μ=37.1

SD: 15.714

Mean ±SD: 37.1 ± 15.71

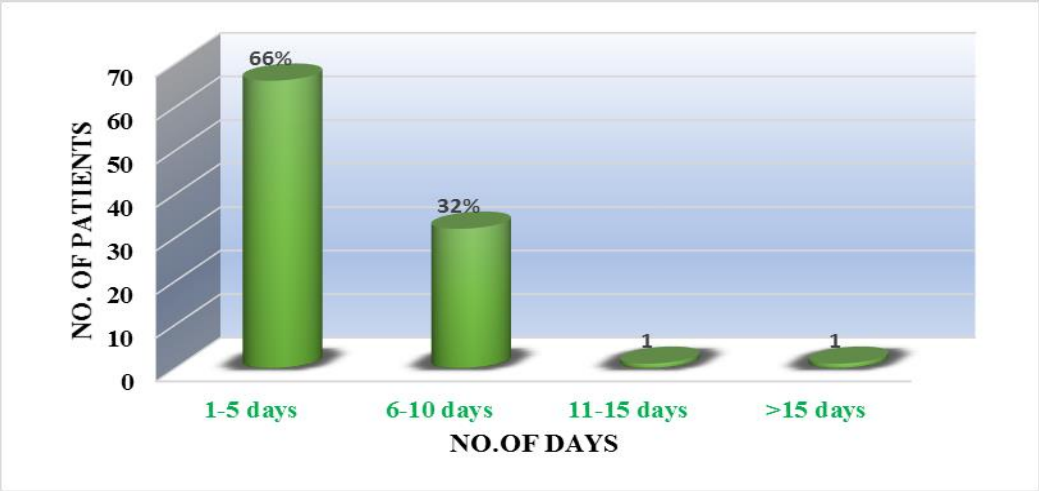

FIGURE 03: DEPICTS THE NUMBER OF DAYS IN THE SURGERY WARD.

The above figure shows the duration of the patient's stay in the hospital after surgery. The majority of the patients were discharged within 5 days (66 %) followed by 6-10 days (32%), 11 -15 days (1%), and more than 15 days including 1 patient.

Mean, μ=4.99

SD=2.586

Mean ±SD =2.586±4.99

TABLE 1: WHITE BLOOD CELL COUNT OF THE PATIENTS.

S. N0	WBC (cells/cu.mm)	NO. OF PATIENTS	PERCENTAGE
1	<4500	1	1%
2	4500-11000	66	66%
3	>11000	33	33%

The above table represents the white blood cells of the patients. An increase in white blood cell count may be one of the indications of the infection.

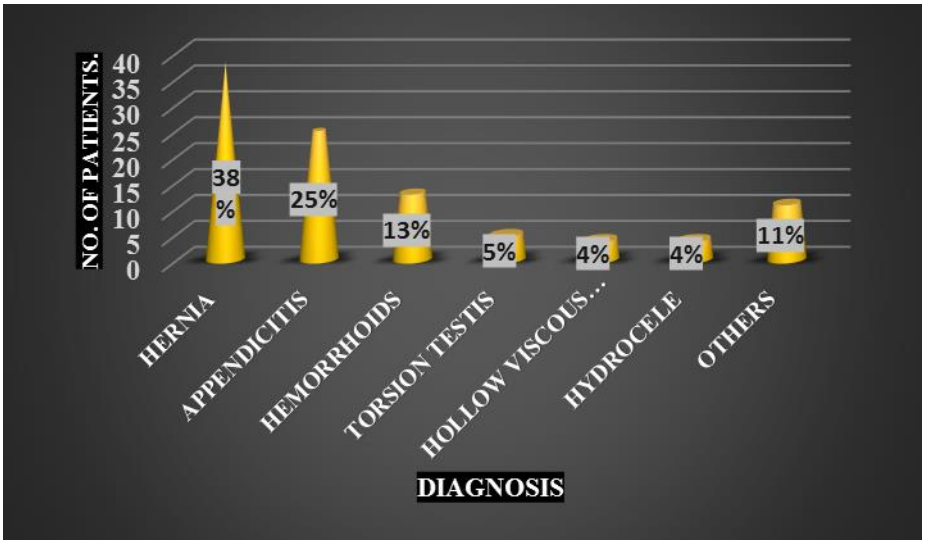

FIGURE 04: INDICATES THE DISEASE CONDITION OF THE PATIENTS

The majority of the disease condition enrolled in the study are hernia 38%, followed by appendicitis 25%, hemorrhoids 13%, torsion testis 5%, and hollow viscous perforation and hydrocele are 4%.

OPERATION RECORD:

TABLE 02: OPERATIVE PROCEDURE EXECUTED

S.NO	OPERATIVE PROCEDURE	NO. OF PATIENTS	PERCENTAGE (%)
1	APPENDECTOMY	25	25
2	HERNIOPLASTY	38	38
3	HEMORRHOIDECTOMY	13	13
4	LAPAROTOMY	4	4
5	ORCHIDOPEXY/ORCHIDECTOMY	5	5
6	EVERSION OF SAC	4	4
7	PLIS	7	7
8	INCISION & DRAINAGE	1	1
9	EXCISION & BIOPSY	3	3
10	OTHERS	3	3

Majority of the patients have undergone hernioplasty (38%), appendectomy (25%), haemorrhoidectomy (13%), orchidectomy (5%) eversion of sac (4%), excision and biopsy (3%) and incision and drainage (1%).

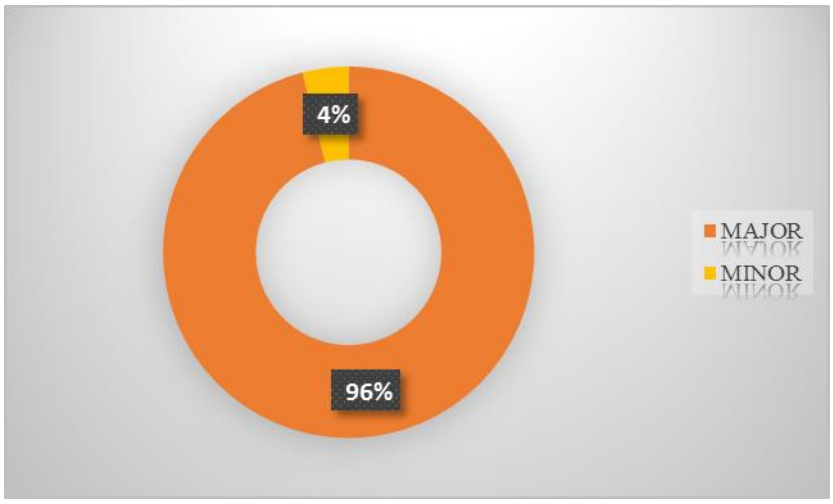

FIGURE 05: TYPE OF OPERATIVE PROCEDURE.

Out of 100 patients, 96% of patients have undergone major type of surgery and 4% of patients have undergone minor type of surgery.

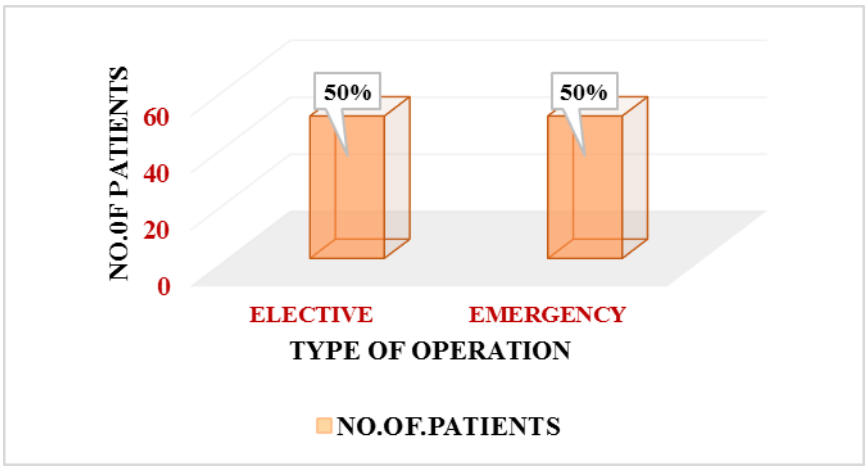

FIGURE 06: TYPE OF OPERATIVE PROCEDURE

Out of 100 patients, 50% of patients have undergone elective type of surgery and 50% of patients have undergone the emergency type of surgery.

THERAPEUTIC MANAGEMENT:

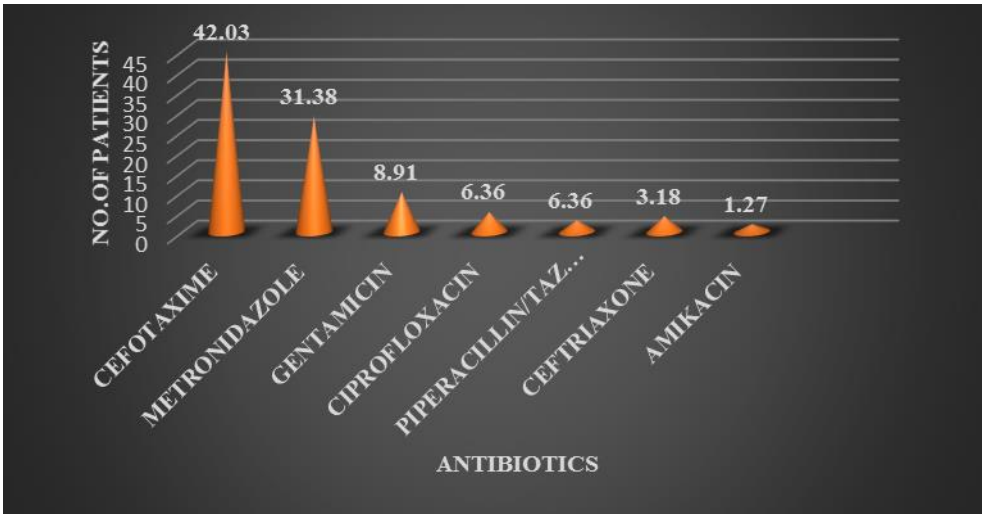

FIGURE 07: THERAPEUTIC MANAGEMENT

Antibiotics have more efficient to prevent the post-operative wound infections. In our study, majority of the patients were prescribed with CEFOTAXIM(42.03) followed by METRONIDAZOLE(31.38), GENTAMICIN(8.19), PIPERCILLIN/TAZOBACTUM, CIPROFLOXACIN(6.36), CEFTRIAXONE(3.18), and AMIKACIN(1.27). This chart includes the administration of both single and combinational therapy.

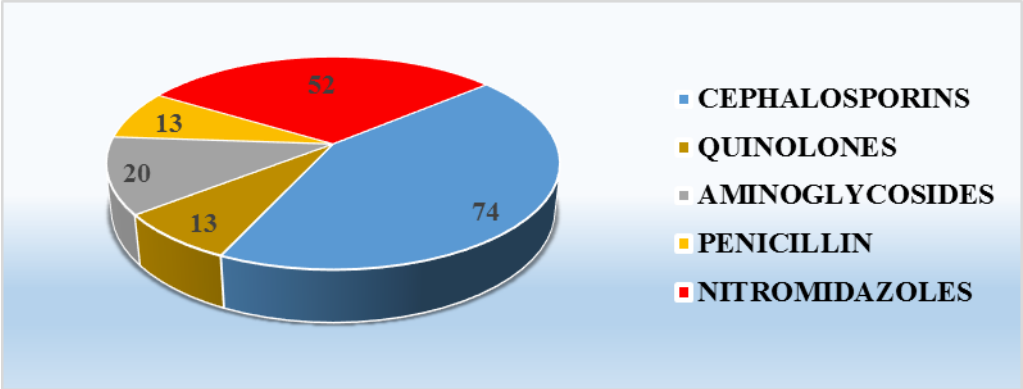

FIGURE 08: CLASS OF ANTIBIOTICS.

In our study, majority of the patients were prescribed CEPHALOSPORIN class of antibiotics followed by AMINOGLYCOSIDES, PENICILLIN, QUINOLONES and NITROMIDAZOLES.

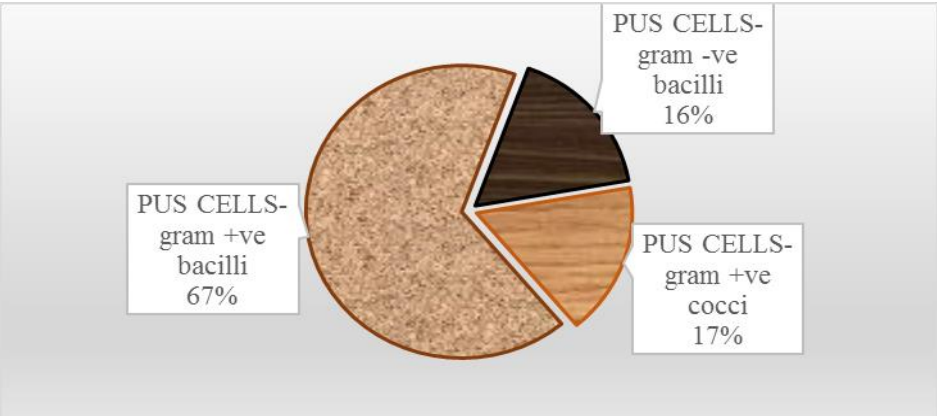

FIGURE 09: THE PIE DIAGRAM SHOWS THE PERCENTAGE OF PUS CELLS IN THE INFECTED PATIENTS.

The above table shows that majority of patients (4) have pus cells of gram-positive bacilli followed by pus cells of gram-negative bacilli (1) and pus cells of gram-positive cocci (1).

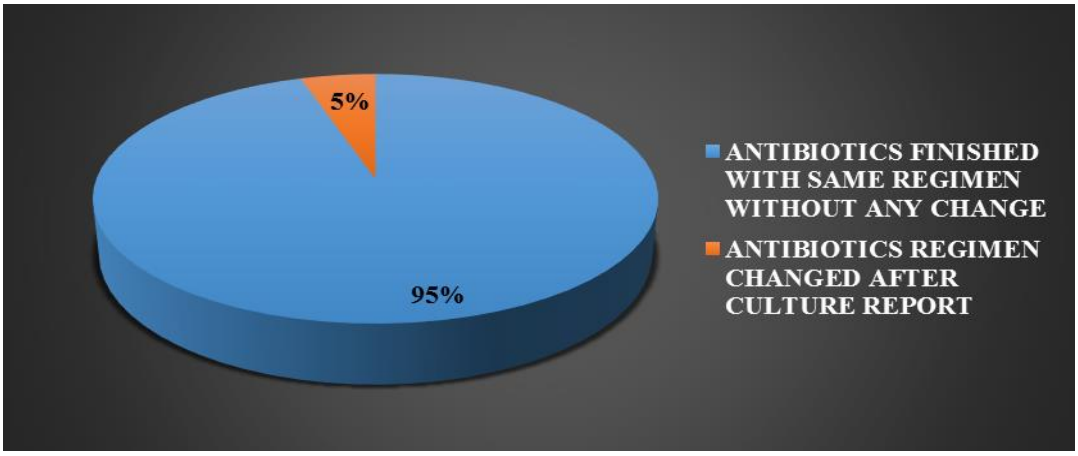

FIGURE 10: SHOWS THE CHANGES IN THE ANTIBIOTIC REGIMEN

The above table represents that the antibiotic was finished with same regimen without any change during the entire treatment period (95%), only 5% of patients have infection at the surgical site, so antibiotics regimen had changed after the culture report.

Antibiotic Sensitivity Pattern of E. Coli (N=3)

3 isolates of Escherichia coli from pus were observed. 33.33% were susceptible to tetracyclines, 66.66% were susceptible to gentamicin, 66.66% were susceptible to ceftriaxone, 33.33% were susceptible to co-trimoxazole, 33.33% were susceptible to amoxiclav,100% were susceptible to amikacin, 66.66% were susceptible to ciprofloxacin,100% were susceptible to piperacillin/ tazobactam.

66.66% were resistant to tetracyclines,33.33% were resistance to gentamicin,100% were resistant to efeperazone, 33.33% were resistance to ceftriaxone, 66.66% were resistance to amoxiclav, 33.33 were resistance to ciprofloxacin.

Antibiotic Sensitivity Pattern of Mrsa (N=1)

1 isolate of MRSA from the pus was observed.100% were susceptible to clindamycin,100% were susceptible to amikacin.

100% were resistance to erythromycin, 100% were resistant to oxacillin,100% were resistance to ampicillin,100% were resistance to linezolid,100% were resistance to gentamycin, 100% were resistant to ciprofloxacin,100% were resistance to chloramphenicol,100% were resistance to co-trimoxazole.

Antibiotic Sensitivity Pattern of Klebsiella (N=2)

2 isolates of klebsiella from the pus was observed.100% were susceptible to amikacin,100% were susceptible to gentamicin, 50% were susceptible to ciprofloxacin,50% were susceptible to cefepime.

100% were resistance to piperacillin/tazobactam, 50% were resistance to ciprofloxacin, 50% were resistance to cefepime.

OUTCOMES:

TABLE 03: POST OPERATIVE LOCAL EXAMINATION OF THE WOUND.

S.NO	POST OP L/E	NO. OF PATIENTS	PERCENTAGE
1	WOUND HEALTHY, NO DISCHARGE	92	92%
2	WOUND HEALTHY, MILD DISCHARGE	3	3%
3	WOUND UNHEALTHY, DISCHARGE	5	5%

The above table describes that majority of patients have healthy wound with no discharge (92%), followed by healthy wound with mild discharge (3%) and unhealthy wound with discharge (5%).

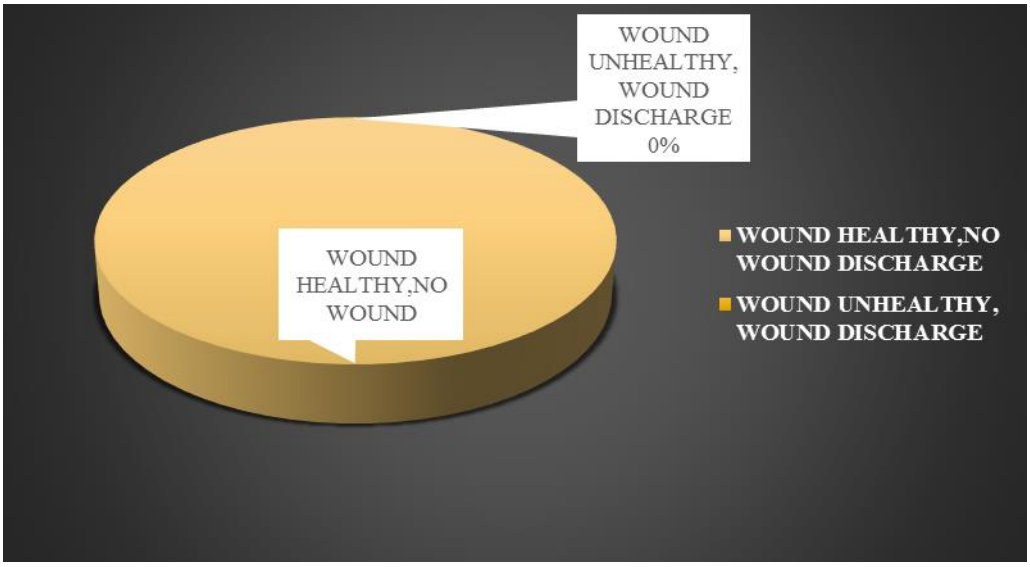

FIGURE 11: THE PIE DIAGRAM INDICATES THE CONDITION OF WOUND DURING DISCHARGE OF THE PATIENTS.

The above pie diagram shows that all the enrolled patients (100%) have healthy wounds with no pus discharge from the surgical site during discharge of the patients.

CONCLUSION:

In summary, we have presented the efficiency of antibiotics in post operative patients in the prevention of wound infection. In our study, we enrolled 100 patients. Out of these patients (73%) were males and 27 (27%) were females. After the enrollment of subjects, we have observed that majority of the patients were in the age group of 21-25 years. In this study, we have observed that majority of the patients have healthy wound with no pus discharge from the wound (95%). In this study, among the 5 infected patients, 4 patients have pus cells of gram-positive bacilli. The most common micro-organism identified from the infected patients are E. coli. All the enrolled patients have healthy wounds with no discharge from the surgical site during patients discharge from the hospital (100%). Majority of the patients got discharged from the hospital without infection within 10 days (98%). The rate of infection is 0% at the time of patient discharge from the hospital. Antibiotics like Cefotaxime, Metronidazole, Gentamicin, Piperacillin/tazobactam, Ciprofloxacin and Amikacin were prescribed. Out of these antibiotics, Cefotaxime is mostly prescribed and is very efficient in the prevention of post operative wound infection.

In our study, Cephalosporins are more efficient compared to other prescribed antibiotics. At the time of patient discharge from the hospital, they were advised to take antibiotics to

prevent the secondary infections and pain relievers like paracetamol and Multi-Vitamins. Tab. Taxim O (Cephalosporins) is commonly prescribed and is more efficient when compared to other antibiotics. Cost analysis shows the cost burden of antibiotics which has been greatly reduced by PMJAY scheme by the central government of India.

ETHICAL CLEARANCE:

This prospective study was approved by Institutional Human Ethics Committee, Number: IHEC/881/2022 and permitted by Member Secretary, Institutional Human Ethics Committee, Government Cuddalore Medical College & Hospital (RMMCH), Annamalai University. The registration number of IEC is EC/NEW/INST/2020/1249. Patient Informed Consent forms were obtained, since human participants were involved in this investigation.

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AUTHOR CONTRIBUTION:

Conceptualization and methodology including data collection: Nivetha A, Jagatheeswararay R, Kottaimuthu A, Anvar Ali A; Writing - original draft preparation and literature search: Nivetha A, Jagatheeswararay R; Writing – Review and Supervision: Kottaimuthu A. The final manuscript has been read and approved by all the authors.

CONFLICT OF INTEREST:

The authors affirm that the publishing of this paper is free of conflict of interest.

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