

# A Comparative Study of Ceftriaxone and Ceftriaxone + Sulbactam In the Prevention of Post-Operative Infections in A Surgical Unit.

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## Abstract

**Background:** Microbial infections are commonest in surgical scenarios all over the world. These are easily treatable using antibiotic therapy. They have been classified variously mainly based upon their mechanisms of action, route of administration and methods of synthesis. However, they are routinely related to side-effects and adverse drug reactions.

**Objectives:** This was a comparative study between Ceftriaxone and Ceftriaxone with Sulbactam combination for controlling post-operative infections arising in surgical units. Objectives were- a) to compare complications arising due to both the drug therapies; b) Reduction in morbidity and mortality and c) Reduce the overall treatment cost which may arise due to complications occurring.

**Methods:** Total of 100 subjects were categorized into two groups comprising of 50 participants each- a) Group I (Ceftriaxone alone) and b) Group II (Ceftriaxone with Sulbactam, combination). Patients were examined in following durations: i) Immediately after surgery; ii) 3<sup>rd</sup> day, iii) 7<sup>th</sup> day, iii) 15<sup>th</sup> day and iv) One month post-operative period for complications.

**Result:** Group II drug combination demonstrated lesser incidence of post-operative complications when compared with group I most specifically, pus formation, septicemia, wound gapping, Skin necrosis, incisional hernias, shock, chills, hematuria, urinary infection and burning sensation during micturition. No cases of multiple organ failure or death were reported.

**Conclusion:** Though there were less or no incidence of complications in Group II compared to group I, no statistical significant difference could be determined. Thus, it can be concluded that a large sample size would reflect clearly on clear distinction between the drugs/drug combinations studied.

## **INTRODUCTION**

### **‘ATTACHMENT, INVASION AND MULTIPLICATION OF BACTERIA IS KNOWN AS INFECTION’**

Bacterial infection is one of the most common infection across the world, these infections can be easily treated with antibiotic, antibiotics are economically affordable and almost everyone can afford them, antibiotics are the substance or material which is responsible for inhibiting the growth of microbes or to kill the microbes without severely harming normal body cells. (Marino PL 2006)

Antibiotics can be natural, artificial /manmade or synthesize by one organism which inhibits the growth of other irrespective of their sources they both are capable of killing and inhibiting the growth of bacteria. The very first antibiotic to be discovered was penicillin It was discovered by Dr Alexander Fleming in 1928 working on staphylococcus bacteria, this antibiotic was used to treat the wounded soldiers back in days, by this discovery he earned Nobel prize in 1945. (Hawkey PM 2007)

Antibiotics are those which are used to treat bacterial diseases but if they are used in excess they can cause side effects such as nausea and vomiting apart, from this excessive use of antibiotics can cause the bacteria to develop resistant against it. Due to this anthropogenic resistance antibiotic will have no effect on bacterias. (Unemo G & Golparian D 2011)

### **PROBLEMS WITH THE USE OF ANTIBIOTICS (Tripathi KD 2013)**

Antibiotics help us to get rid of the pathogens but at the same time they are also responsible for causing irritation. And this often occurs at the site of application.

Some antibiotics are also responsible for producing toxicity within the body. Antibiotics increase the level of enzymes in the liver, which damage the liver and often other vital organs like kidney, are also affected.

When antibiotics are taken they reacts with antibodies this sometimes cause reactions, which are sensitive and known as anaphylactic shock. Symptom includes rashes and irritation. Anaphylactic shocks also results in death in severe cases.

Frequent use of antibiotics causes the pathogen to become resistant to that specific antibiotics and they remain Unaffected by them even when use in large amount.

### **CHOICE OF ANTIBIOTICS (Tripathi KD 2013)**

Every person is different and their internal body also therefore an antibiotic must be choose with respect to a particular patient.

Amount of drugs given to a patient varies greatly with age younger children are given low dose otherwise it can cause reactions within the body which can be fatal for small children.

Many people have defective organs such as liver and kidney which are very essential for proper functioning of the body as they help to get rid of toxic substances from the body so a patient with defective organs can have problems with drugs which can further damage the organ.

Many people are allergic to certain chemicals present in the drugs therefore a patient must be questioned and test before giving a drug.

Pregnant women should avoid use of any kind of drugs because these can be lethal for the developing fetus although some antibiotics are safer to use but it's better if avoid.

### **METHODOLOGY**

- All the patients of surgery was included in this study like, hernias, plastic surgery and in infected like acute cholecystitis, appendicitis, enteric perforation, accidental wound suturing, cancer surgeries, amputation etc.
- The Primary investigation was done TLC, HB, PT COUNT, LFT, RFT, BLOOD UREA etc
- Duration of work was six month.

A total of 50 patients were distributed into 2 groups, 25 patients were subjected in group 1 those who underwent ceftriaxone dose, group 2 included 25 patients those who underwent ceftriaxone + sulbactam dose.

A total of 50 cases of all types of surgery were included in this study from 2019-2020 (admitted/operated) in Prankur hospital and cancer research centre, Mahipura Saharanpur UP.

Data was collected from all the patients,

This study was divided into two following groups.

**Group 1:-** In the first group the plane Ceftriaxone was used in post operative infection (min 25 patients)

**Group 2:-** In the second group the Ceftriaxone + Sulbactam was used in post operative infection. (min 25 patients)

All the patients were examined,

- Immediately after surgery,
- 3rd day of post operative,
- 7th day of post operative,
- 15th day of post operative,

- One month of post operative,

All the data regarding post operative complication was recorded.

### **DOSE:-**

For urinary tract infection/soft tissue and skin: 1-2gm i.v or i.m./day.

To prevent the infection, it must be combined with sulbactam or tazobactam.

Dose 1 to 2 gm IV/ IM once a day (or in equally divided doses twice a day) or dose and duration depend on the nature and severity of the infection.

The total dose should not exceed 4 gm/day.

- In clean cases we give any antibiotics as a prophylaxis in order to prevent infection before surgery, but in case of post operative we give both for, prevention and treatment.
- But in infected cases like enteric perforation, trauma, accidental injuries, appendicitis, cholecystitis, osteomyelitis, infected diabetic ulcer, cellulitis and abscess etc we give antibiotic to control the infection, in such cases we start antibiotics as empirical and try to get culture and sensitivity of pus from the microbiology lab and then start the antibiotic.
- In our study we have randomly distributed all types of cases in our study to compare the effect post surgery.
- Listed complication are not exclusively related to the antibiotics given, they may be because of patients factor, so we have to focus more on post operative complication which are related to the antibiotics used.

### **Statistical analysis**

Statistical analysis was performed using the SPSS software (version 22, IBM Corp., NY) and unpaired T test was applied. P value <0.05 was considered statistically significant.

## **5. RESULTS AND OBSERVATION**

Total no of patients = 50

These patients were divided into two groups

Group 1(Ceftriaxone) = 25

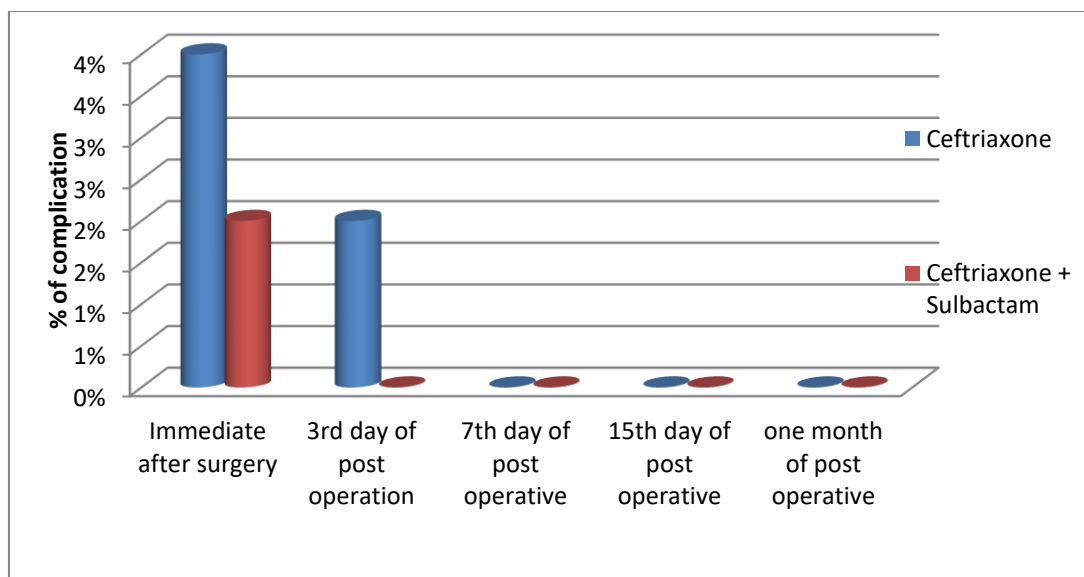
Group 2 (Ceftriaxone + Sulbactam) = 2

**TABLE 2: Percentage of Male –Female**

S.NO	SEX	NO OF PATIENTS	%AGE
1	MALE	35	70%
2	FEMALE	15	30%

**ANNEXURE/ Vomiting****Table 6: Percentage of patients showing post operative complication-vomiting**

CEFTRIAZONE				CEFTRIAZONE + SULBACTAM		
S. NO	Vomiting	No of patients	Percentage of patients	Vomiting	No of patients	Percentage of patients
1	Immediate after surgery	2	4%	Immediate after surgery	1	2%
2	3 <sup>rd</sup> day of post operation	1	2%	3 <sup>rd</sup> day of post operation	0	0%
3	7 <sup>th</sup> day of post operative	0	0%	7 <sup>th</sup> day of post operative	0	0%
4	15 <sup>th</sup> day of post operative	0	0%	15 <sup>th</sup> day of post operative	0	0%
5	One month of post operative	0	0%	One month of post operative	0	0%

**Graph 1: Column graph showing post operative complication - vomiting**

**Table 30: Table demonstrating P values**

<b>Complications</b>	<b>P value</b>
Post-operative vomiting	0.199
Post-operative nausea	0.07
Mild collection	0.189
Moderate pus discharge	0.08
Gapping of wound	0.33
Burst abdomen	0.27
Skin necrosis	0.27
Pyoperitoneum	0.17
Pus discharge P/V	0.086
Increase in pus discharge from drainage site	0.073
Incisional hernias	0.173
Increase in TLC	0.328
Fever	0.199
Septicaemia	0.27
Multiple organ failure	-
Increase in blood urea	0.173
Shock	0.173
Deep wound infection	0.332
Systemic sepsis	0.173
Chills	0.273
Post-operative burning sensation during micturition	0.1
Urinary infection	0.5
Hematuria	0.42
Death	-

## 6. DISCUSSION

Antibiotics are backbone for the treatment and management of numerous infectious conditions. In surgery, these anti-microbial drugs are prescribed for mainly three reasons- 1) As a prophylactic measure; 2) As an adjunct to treatment and 3) As part of treatment. Administration of pre-operative antibiotics reduces incidences of infections at the surgical site. Infection occurring at a surgical site is the most common post-operative complication that significantly affects an individual's mortality along with morbidity. Infection of a surgical wound is the most frequently encountered nosocomial complication in patients who have undergone surgery. Thus, pre-operative anti-microbial prophylaxis is an important aspect of treatment which involves appropriate choice of broad-spectrum antibiotic along with proper administration. Infections at surgical sites account for approximately 14 to 16% of around two million cases of nosocomial infections which involve hospitalized subjects in US. A World Health Organization survey reported a prevalence of nosocomial infection from 3% to 21% of which infection of wounds encompasses roughly 5 to 34% cases.

In this study, comparison between complications caused by Ceftriaxone was made between Ceftriaxone and sulbactam combination.

- (I) **Subject distribution:** 70% of study participants were male subjects while 30% were of female gender (table 2).
- (II) **Age-distribution:** There were no patients enrolled within the age ranges of 11 to 15 years and 16 to 20 years. 6%, 2%, 14%, 12% and 18% each, 16%, 4% each and 6% of the study participants belonged to 21 to 25 years, 26 to 30 years, 31 to 35 years, 36 to 40 years, 41 to 45 years and 51 to 55 years, 56 to 60 years and 61 to 65 years each and above 66 years, respectively (table 3).
- (III) **Clinical diagnosis of patients reporting to the OPD:** Of the study group participants, diabetic foot ulcers were seen in 6%, incisional hernia was reported in 14%, 4% of subjects suffered from accidental injury to facial region, 12% were diagnosed with cholecystitis, 10% had carcinoma of breast, 6% underwent abdominal hysterectomy, 2% reported following post cellulitis of leg, 4% reported with anal fistulas, 8% suffered from acute obstruction in intestines while 4% suffered from third degree bleeding piles, 2% were suffering from Buerger disease, 8% had appendicitis, 4% were detected with urinary bladder stone while 8% each were diagnosed with cancer of urinary bladder and benign prostatic hyperplasia (table 4).
- (IV) **Distribution of patients treated with diabetes:** 50% each (n=25) of categorized groups were treated with Ceftriaxone (Gp.2) and combination of Ceftriaxone and Sulbactam (table 5).

Following are the complications studied and compared between both the group:

- (i) **Post-operative vomiting:** 2% of patients reported post-operative episodes of vomiting immediately following surgery in Group I (Ceftriaxone) while 4% of patients demonstrated this symptom in Group II (Ceftriaxone + Sulbactam). Only 2% of group I patients reported with post-operative vomiting on the 3<sup>rd</sup> post-operative day while no such cases were reported in Group II. No incidences of post-operative vomiting were observed on 7<sup>th</sup> and 15<sup>th</sup> days and one month follow-up (table 6). A non-significant P Value of 0.199 was found on comparing post-operative vomiting in both groups (Table 30).
- (ii) **Post-operative nausea:** 2% each of study participants in group I presented with symptoms of post-operative nausea immediately and on 3<sup>rd</sup> day post-operatively while no similar side-effect was observed in group II subjects and in further follow-up period (table 7). Post-operative nausea was also found to have no significant difference (P=0.07) (Table 30).
- (iii) **Mild collection:** In Group I patients, mild collection was observed in 10%, 6% and 2% cases at 3<sup>rd</sup> day, 7<sup>th</sup> day and one month, respectively post-operatively whereas in group II, 6% and 2% of patients showed these symptoms on 3<sup>rd</sup> and 7<sup>th</sup> day of follow-up. No episodes were observed in further follow-up period (table 8). This symptom also was found to have no significant difference (P=0.189) (Table 30).
- (iv) **Moderate pus discharge:** Moderate amount of pus discharge was reported only in 45 cases on 3<sup>rd</sup> post-operative day while 2% of study participants reported this presentation after one month. No pus discharge was seen on 7<sup>th</sup> and 15<sup>th</sup> day of post-surgical period in group I while no incidence was reported from group II (table 9). Here also, no statistically significant P value (0.08) was obtained (Table 30).
- (v) **Gapping of wound:** This complication was observed in 4% and 2% patients in Group I and II, respectively on 7<sup>th</sup> day following surgery. No cases were reported in any other follow-up duration (table 10). Study group comparison did not yield any statistically significant P value (0.33) (Table 30).
- (vi) **Burst abdomen:** Abdominal burst was noted in 4% and 2% patients on 7<sup>th</sup> day post-operatively in both the groups while no incidences were reported in remaining follow-up (table 11). Cases of burst abdomen in both the study groups also, did not show any statistically significant difference (P=0.27) (Table 30).
- (vii) **Skin necrosis:** Necrosis of skin was seen in 6% and 2% cases on 7<sup>th</sup> day post-operatively in groups I and II, respectively whereas no incidence of skin necrosis was



observed in rest of the follow-up period (table 12). There was statistically significant difference observed between both the groups ( $P=0.27$ ) (Table 30).

- (viii) **Pyoperitoneum:** Only 2% of patients were diagnosed with pyoperitoneum on 7<sup>th</sup> post-operative day in group I while no cases were reported from group II. No patient reported with this complication in follow-up (table 13). Cases of pyoperitoneum also did not show any statistical significance ( $P=0.17$ ) (Table 30).
- (ix) **Pus discharge P/V:** In group I patients, pus discharge was noted in 4% and 2% cases on 7<sup>th</sup> day and one month post-operatively. No incidences were observed immediately following surgery or on 3<sup>rd</sup> and 15<sup>th</sup> day of post-operative period. No pus discharge was reported from group II patients (table 14). Cases within both groups on comparison showed no statistical significance ( $P=0.086$ ) (Table 30).
- (x) **Increase in pus discharge from drainage site:** 2% of patients in group I reported increase in pus discharge from site of drainage while no cases were seen in rest of the follow-up period. None of the patients in group II presented with this complication (table 15). No statistically significant difference ( $P=0.073$ ) was observed between both groups (Table 30).
- (xi) **Incisional hernias:** Incisional hernias were reported in 2% of group I patients one month following surgery while no patients were observed in group II (table 16).no significant difference ( $P=0.173$ ) was observed between groups (Table 30).
- (xii) **Increase in TLC:** In group I patients, an increase in TLC was noted in 10%, 8% and 4% cases on 3<sup>rd</sup>, 7<sup>th</sup> and 15<sup>th</sup> day of post-operative period. No rise in TLC was seen immediately and after one month of surgery. In group II patients, 8%, 6% and 2% cases were reported immediately following surgery and after one month of post-operative period. (table 17) No significant difference ( $P=0.328$ ) between both groups (Table 30).
- (xiii) **Fever:** fever was noted in 4% and 2% of patients immediately following surgery and on third day post-operatively, respectively while no fever was seen on 7<sup>th</sup> day, 15<sup>th</sup> day and one month period post-operatively in group I. In group II, fever was seen in 2% cases immediately following surgery and no incidence in remaining follow-ups (table 18). No statistically significant difference ( $P=0.199$ ) was obtained (Table 30).
- (xiv) **Septicemia:** In group I subjects, cases of septicemia were noted with 6% and 2% incidences on 3<sup>rd</sup> and 7<sup>th</sup> day post-operative period while 2% incidence of septicemia

- cases were noted on similar follow-up interval in group II patients. There were no cases of septicemia recorded in remaining follow-up (table 19). Also, no statistical significance ( $P=0.27$ ) was obtained (Table 30).
- (xv) **Multiple organ failure:** No cases with multiple organ failures were encountered in either of the groups (table 20). Statistical test could not be applied as there were no case subjects in this category (Table 30).
  - (xvi) **Increase in blood urea:** Elevated levels of blood urea were observed in 4% patients immediately after surgery with further similar alteration in remaining follow-up for group I while none of the patients in group II showed increase in blood urea levels (table 21). Non-significant difference ( $P=0.173$ ) was found on comparison of increased blood urea levels in both the groups (Table 30).
  - (xvii) **Shock:** Episode of shock was observed in 4% of patients immediately following surgery in group I. No incidences of shock were seen elsewhere in either of the groups (table 22). No significance was observed between both groups ( $P=0.173$ ) (Table 30).
  - (xviii) **Deep wound infection:** Infection of deep wounds was seen in 4% and 2% patients on 3<sup>rd</sup> day of post-operative period in both the groups while no cases were observed in any other follow-up intervals in either of the groups (table 23). Cases with deep wound infection demonstrated no statistically significant P value (0.332) (Table 30).
  - (xix) **Systemic sepsis:** 4% of group I patients presented with systemic sepsis on 3<sup>rd</sup> day post-operatively with no incidence observed in remaining follow-ups in group I. No patient in group II developed systemic sepsis (table 24). Again, no statistical significance could be observed on analysis ( $P=0.173$ ) (Table 30).
  - (xx) **Chills:** Phenomenon of chills was seen in 6% and 2% of group I subjects immediately following surgery and on 3<sup>rd</sup> post-operative day, respectively whereas 2% each of patients in group II in similar follow-up demonstrated these symptoms. No other patient in any of the study group reported with chills (table 25). There was no statistical significance ( $P=0.273$ ) obtained (Table 30).
  - (xxi) **Post-operative burning sensation during micturition:** This side-effect was noted in 6% and 2% in patients on 15<sup>th</sup> day and one month of post-operative period in group I while in group II, 2% each of patients felt burning sensation during micturition (table 26). No statistically significant difference ( $P=0.1$ ) was observed (Table 30).

(xxii) **Urinary infection:** onset of urinary infection was seen on 7<sup>th</sup> day and after one month of surgical procedure in group I whereas 2% each of patients in group II reported with this presentation in similar follow-up (table 27). Subject groups with urinary infection also, did not demonstrate any statistical significance (P=0.5) (Table 30).

(xxiii) **Hematuria:** Hematuria was seen in 8% and 6% cases immediately following surgery in groups I and II, respectively. No other follow-up cut-off showed this side-effect (table 28). Non-significant difference (P=0.42) was observed in this category (Table 30).

**Death:** No case of death as a result of drug therapy was seen in either of the groups (table 29). No statistical test could be performed as there were no death cases (Table 30).

## 7. SUMMARY AND CONCLUSION

Following is the summary and conclusion of current study-

1. None of the drug combinations demonstrated any significance with the adverse effects studied.
2. A male predilection was observed in the studied sample (70%- males and 30%-females).
3. Vomiting was observed more in the group treated with Ceftriaxone and Sulbactam.
4. There was no difference observed in post-surgical cases of nausea between both the study groups.
5. Mild collection was higher in group I (Ceftriaxone) on 3<sup>rd</sup> and 7<sup>th</sup> days of follow-up.
6. No pus discharge was observed in group II.
7. Higher cases of wound gapping on 7<sup>th</sup> day were noted in group I (4%) than group II (2%).
8. Cases of abdomen bursts were higher in group I on 7<sup>th</sup> day follow-up than group II.
9. Similarly, higher cases with necrosis of skin were observed from group I.
10. Occurrences of pyoperitoneum, pus discharge, increase in pus discharge and incisional hernias were found only in post-surgical management with ceftriaxone.
11. Patients treated with both antibiotic protocols demonstrate an increase in TLC immediately following surgery.
12. Patients belonging to Ceftriaxone treatment group presented with higher percentages of insidious onset of fever and septicemia than group II.
13. No cases of multiple organ failure were reported as a result of any of the antibiotic protocol.
14. Cases of shock (4%) were reported only from first group immediately following surgery.
15. Incidence of deep wound infection and systemic sepsis were observed only in patients treated with Ceftriaxone.
16. Cases with chills, post-operative burning during micturition, urinary infection and hematuria were more commonly seen in group treated with ceftriaxone only.

In current study, the major drawback is the small sample size however, in the study no significant differences were observed between both the antibiotic groups in post-surgical management and related complications. Hence, to be absolutely determinative, larger sample needs to be studied.

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