Cost effective analysis of tab. nitrofurantoin vs. inj. ceftriaxone as an empirical therapy in patients of urinary tract infection at a tertiary health care centre

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INTRODUCTION

Urinary tract infection involves upper urinary tract (kidneys and ureter) and/or lower urinary tract (urethra and urinary bladder), urinary tract infections are caused by wide range of pathogens including Escherichia coli, Klebsiella pneumoniae, Proteus mirabilis, Staphylococcus aureus, clinically urinary tract infections are divided into complicated and uncomplicated urinary tract infections. Uncomplicated urinary tract infections takes place in healthy individuals with no structural defects and neurological deficits, complicated UTI are defined as those compromising host defence, urinary tract (obstruction) and neurological integrity which leads to urinary tract infections. Urinary tract infections are common in developing countries affecting women more than men, it is necessary to minimize the cost of therapy while providing optimum health benefits to the patients. Patients of UTI are prone to recurrence and high costs of treatment leads to increase burden of costs of treatment on patients.

RESEARCH ARTICLE

ABSTRACT

Background: Urinary tract infections (UTI) are commonly seen in adults, Urinary tract infection and asymptomatic bacteriuria in adults are a significant health care burden. In a developing country it is necessary to minimize the cost of therapy while giving maximum health benefits to the patient. Appropriate antimicrobial selection is clearly important, as treatment failures will increase the cost of care and result in additional morbidity for patients. Empirical treatment of urinary tract infection is common at tertiary health care center, authors conducted a pharmacoeconomic study to evaluate cost effectiveness of the empirical treatment.

Methods: Patients with similar symptoms suffering from UTI were divided into 5 groups with 10 patients in each group. Each group was subdivided into two subgroups with subgroup A having five patients receiving tab nitrofurantoin and subgroup B having 5 patients receiving inj ceftriaxone. Out of the total cost of therapy, percentage of cost attributed to tab nitrofurantoin was compared with inj ceftriaxone. Most cost-effective antibiotic was analysed. Average number of admission days for groups of UTI patients receiving tab nitrofurantoin and inj ceftriaxone were calculated and compared. Group of UTI patients receiving antibiotic with least number of admission days was calculated.

Results: Percentage of cost attributed to Nitrofurantoin therapy out of total cost in urinary tract infection patient was less than percentage of cost attributed to inj Ceftriaxone in all five groups of patients and was found to be statistically significant (p <0.05). However, there was no statistically significant difference in average number of admission (IPD) days between groups of patients receiving tab nitrofurantoin and inj ceftriaxone (p>0.05).

Conclusions: In current study authors found tab nitrofurantoin to be more cost effective than inj ceftriaxone as an empirical therapy in UTI patients.

Keywords: Cost effectiveness, Nitrofurantoin, Urinary tract infection
Urinary tract infections are a frequent cause of hospitalisation and have a great economic impact on healthcare systems. The annual cost of UTI acquired through community is significant and goes beyond 1.6 million dollars. In developing countries because of increased antimicrobial resistance and increased cost of treatment, patients are left with few therapeutic options.

Intravenous antibiotic given in urinary tract infection requires admission of patient, despite admission the other costs incurred by the patient is increased i.e. price of intravenous antibiotics and cost of syringes and needles. Injection ceftriaxone shows wide spectrum of antibiotic activity especially in urinary tract infection, it is highly efficacious against many gram negative UTI causing Enterobacteriaceae i.e. E coli, Klebsiella, however increased cost of antibiotic and other cost (syringes and needles) required for ceftriaxone should restrict its use in developing country like India.

Nitrofurantoin has been found to be effective in causing remissions of symptoms in patients of urinary tract infections. Nitrofurantoin is a bactericidal antibiotic with a broad-spectrum activity and can be used to treat urinary tract infection caused by Enterobacter spp, Klebsiella spp, Staphylococcus aureus spp and Enterococcus spp. Nitrofurantoin is the first choice recommended for treatment of uncomplicated cystitis and pyelonephritis in women. Nitrofurantoin has become the choice of antibiotic in UTI due multi drug resistant pathogens, especially in developing countries like India and is highly effective against gram negative and gram positive bacteria causing UTI and is also cost effective with fewer adverse effects.

Pharmacoeconomics is the application of economics to assess the pharmaceutical and health care products that helps evaluate economic, clinical and humanistic outcomes of health care products and interventions. In a developing country like India where there are so many prevalent infections and limited resources, study of pharmacoeconomics of antibiotics is of utmost importance. In authors’ tertiary health care center antibiotics are sometimes prescribed empirically with most of the patients of UTI being admitted, therefore we planned a study to compare cost effectiveness of two most commonly prescribed antibiotics for urinary tract infection i.e. nitrofurantoin and ceftriaxone.

The aim of the present study was to Compare cost effectiveness of tab. nitrofurantoin with inj. ceftriaxone in adult IPD patients suffering from Urinary tract infection.

**Objectives**

- To calculate percentage of cost of total therapy attributed to tab. nitrofurantoin
- To calculate percentage of cost of total therapy of attributed to inj. ceftriaxone
- To compare percentage of cost of total therapy attributed to tab. nitrofurantoin with inj. ceftriaxone and find out most cost-effective antibiotic for urinary tract infection
- To find out average number of admission days until patients (receiving tab nitrofurantoin) became symptom free
- To find out average number of admission days until patients (receiving inj. ceftriaxone) became symptom free
- To compare average number of admission days of patients receiving tab nitrofurantoin with average number of admission days of patients receiving inj ceftriaxone and find out the antibiotic with least number of admission days.

**METHODS**

The study was undertaken after receiving letter of approval from Institutional Ethical Committee, DMIMS, dated 31/03/2017 with Ref. No. DMIMS(DU)/IEC/2017-18/6348.

**Table 1: patients were grouped into five groups based on symptoms each group divided into two subgroups.**

| Groups | Subgroup | Symptoms |
|--------|----------|----------|
| Group I | Subgroup I A (receiving nitrofurantoin) | Burning micturition, lower abdominal pain, increased frequency of urination, fever |
|        | Subgroup I B (receiving ceftriaxone) | |
| Group II | Subgroup II A (receiving nitrofurantoin) | Burning micturition, fever, increased frequency of urination |
|         | Subgroup II B (receiving ceftriaxone) | |
| Group III | Subgroup III A (receiving nitrofurantoin) | Burning micturition, lower abdominal pain, increased frequency of urination |
|          | Subgroup III B (receiving ceftriaxone) | |
| Group IV | Subgroup IV A (receiving nitrofurantoin) | Lower abdominal pain, increased frequency of urination, fever |
|          | Subgroup IV B (receiving ceftriaxone) | |
| Group V  | Subgroup V A (receiving nitrofurantoin) | Burning micturition, increased frequency of urination |
|          | Subgroup V B (receiving ceftriaxone) | |

The study was performed on 50 cases of urinary tract infection in adult population admitted at Acharya Vinoba Bhave rural hospital (Sawangi). The study was carried out from 1st April 2017 till 1st June 2017 (two months). Inclusion criteria for this study was male and female patient admitted in medicine/surgery/Obgy ward with patient age >18 years. Exclusion criteria for the study was
Statistical analysis

Statistical analysis was done by using descriptive and inferential statistics using student’s unpaired t test and software used in the analysis was SPSS 22.0 version and p<0.05 is considered as level of significance.

RESULTS

The average number of admission days of urinary tract infection patients in group IA (receiving nitrofurantoin) was 4.4 days, total average cost of therapy for urinary tract infection in group IA was 277 rupees out of which 70.4 rupees was attributed to nitrofurantoin therapy. Percentage of cost attributed to nitrofurantoin out of total cost of therapy was 26% as shown in Table 2.

The average number of admission days of group IB (receiving inj ceftriaxone) was 5.2 days, total average cost of therapy for urinary tract infection in group IB was 911 rupees out of which 676 rupees was attributed to ceftriaxone therapy. Percentage of cost attributed to ceftriaxone out of total cost of therapy was 75% as shown in Table 3.

By using unpaired student t test statistically significant difference was found between average cost (in percentage) attributed to injection ceftriaxone (group IB) and tablet nitrofurantoin (group IA) (p-value <0.05) Table 12. By using unpaired student t test no statistical significant difference between average number of admission days was found within each group receiving Inj ceftriaxone (group IB) and tablet nitrofurantoin (group IA) (p-value>0.05) Table 13.

Table 2: No of admission (IPD) days of UTI patients in group IA and percentage of cost of therapy attributed to nitrofurantoin out of total cost.

| Age (yrs) | No. of IPD days | Cost of nitrofurantoin (rupees) | Total cost of therapy for UTI (rupees) | Percentage of cost attributed to nitrofurantoin out of total cost (%) |
|-----------|-----------------|----------------------------------|----------------------------------------|---------------------------------------------------------------------|
| 45        | 3               | 48                               | 213                                    | 23                                                                  |
| 42        | 4               | 64                               | 258                                    | 25                                                                  |
| 47        | 4               | 64                               | 260                                    | 25                                                                  |
| 48        | 5               | 80                               | 304                                    | 27                                                                  |
| 44        | 6               | 96                               | 349                                    | 28                                                                  |
| Avg.      | 4.4 days        | 70.4 rupees                      | 277 rupees                             | 26%                                                                 |

Table 3: No of admission (IPD) days of UTI patients in group IB and percentage of cost of therapy attributed to ceftriaxone out of total cost.

| Age (yrs) | No. of IPD days | Cost of ceftriaxone (rupees) | Total cost of therapy for UTI (rupees) | Percentage of cost attributed to ceftriaxone out of total cost (%) |
|-----------|-----------------|-------------------------------|----------------------------------------|---------------------------------------------------------------------|
| 60        | 6               | 780                            | 1040                                   | 76                                                                  |
| 55        | 5               | 650                            | 880                                    | 74                                                                  |
| 48        | 4               | 520                            | 720                                    | 73                                                                  |
| 56        | 5               | 650                            | 876                                    | 75                                                                  |
| 58        | 6               | 780                            | 1040                                   | 75                                                                  |
| Avg.      | 5.2 days        | 676 rupees                     | 911 rupees                             | 75%                                                                 |
Table 4: No of admission (IPD) days of UTI patients in group IIA and percentage of cost of therapy attributed to nitrofurantoin out of total cost.

| Age (yrs) | No. of IPD days | Cost of nitrofurantoin (rupees) | Total cost of therapy for UTI (rupees) | Percentage of cost attributed to nitrofurantoin out of total cost (%) |
|-----------|-----------------|---------------------------------|----------------------------------------|---------------------------------------------------------------------|
| 26        | 4               | 64                              | 264                                    | 25                                                                  |
| 45        | 4               | 64                              | 274                                    | 25                                                                  |
| 50        | 5               | 80                              | 304                                    | 27                                                                  |
| 47        | 4               | 64                              | 269                                    | 24                                                                  |
| 44        | 4               | 64                              | 260                                    | 25                                                                  |
| Avg.      | 4.2 days        | 67.2 rupees                     | 274.2 rupees                           | 25%                                                                 |

Table 5: No of admission (IPD) days of UTI patients in group IIB and percentage of cost of therapy attributed to ceftrixone out of total cost.

| Age (yrs) | No. of IPD days | Cost of ceftrixone (rupees) | Total cost of therapy for UTI (rupees) | Percentage of cost attributed to ceftrixone out of total cost (%) |
|-----------|-----------------|-----------------------------|----------------------------------------|---------------------------------------------------------------------|
| 40        | 4               | 390                          | 555                                    | 71                                                                  |
| 44        | 4               | 520                          | 720                                    | 73                                                                  |
| 21        | 5               | 650                          | 885                                    | 74                                                                  |
| 55        | 5               | 650                          | 876                                    | 75                                                                  |
| 48        | 4               | 520                          | 725                                    | 72                                                                  |
| Avg.      | 4.4 days        | 546 rupees                   | 752.2 rupees                           | 73%                                                                 |

The average number of admission days of urinary tract infection patients in group IIA (receiving nitrofurantoin) was 4.2 days, total average cost of therapy for urinary tract infection in group IIA was 274.2 rupees out of which 67.2 rupees was attributed to nitrofurantoin therapy. Percentage of cost attributed to nitrofurantoin out of total cost of therapy was 25% as shown in Table 4.

The average number of admission days of group IIB (receiving inj ceftrixone) was 4.4 days, total average cost of therapy for urinary tract infection in group IIB was 752.2 rupees out of which 546 rupees was attributed to ceftrixone therapy. Percentage of cost attributed to ceftrixone out of total cost of therapy was 73% as shown in Table 5.

By using unpaired student t test statistically significant difference was found between average cost (in percentage) attributed to injection ceftrixone (group IIB) and tablet nitrofurantoin (group IIA) (p-value <0.05) as shown in Table 12. By using unpaired student t test no statistical significant difference between average number of admission days was found within each group receiving inj ceftrixone (group IIB) and tablet nitrofurantoin (group IIA) (p-value >0.05) as shown in Table 13.

The average number of admission days of urinary tract infection patients in group IVA (receiving nitrofurantoin) was 5.4 days, total average cost of therapy for urinary tract infection in group IVA was 312.40 rupees out of which 86.4 rupees was attributed to nitrofurantoin therapy. Percentage of cost attributed to nitrofurantoin out of total cost of therapy was 28% as shown in Table 6.

The average number of admission days of group IIIB (receiving inj ceftrixone) was 5.6 days, total average cost of therapy for urinary tract infection in group IIIB was 984 rupees out of which 728 rupees was attributed to ceftrixone therapy. Percentage of cost attributed to ceftrixone out of total cost of therapy was 74% as shown in Table 7.

By using unpaired student t test statistically significant difference was found between average cost (in percentage) attributed to injection ceftrixone (group IIIB) and tablet nitrofurantoin (group IIIA) (p-value <0.05) as shown in Table 12. By using unpaired student t test no statistical significant difference between average number of admission days was found within each group receiving inj ceftrixone (group IIIB) and tablet nitrofurantoin (group IIIA) (p-value >0.05) as shown in Table 13.

The average number of admission days of urinary tract infection patients in group IVB (receiving nitrofurantoin) was 5.4 days, total average cost of therapy for urinary tract infection in Group IVB was 720 rupees out of which 260 rupees was attributed to nitrofurantoin therapy. Percentage of cost attributed to nitrofurantoin out of total cost of therapy was 25% as shown in Table 8.

The average number of admission days of group IVB (receiving inj ceftrixone) was 5.4 days, total average cost of therapy for urinary tract infection in Group IVB was 725 rupees out of which 274 rupees was attributed to ceftrixone therapy. Percentage of cost attributed to ceftrixone out of total cost of therapy was 73% as shown in Table 5.
980.6 rupees out of which 702 rupees was attributed to ceftriaxone therapy. Percentage of cost attributed to ceftriaxone out of total cost of therapy was 72%, as shown in Table 9. By using unpaired student t test statistically significant difference was found between average cost (in percentage) attributed to injection ceftriaxone (group IVB) and tablet nitrofurantoin (group IVA) (p-value <0.05) as shown in Table 12. By using unpaired student t test no statistical significant difference between average number of admission days was found within each group receiving inj ceftriaxone (group IVB) and Tablet nitrofurantoin (group IVA) (p-value >0.05) as shown in Table 13.

### Table 6: No of admission (IPD) days of UTI patients in group IIIA and percentage of cost of therapy attributed to nitrofurantoin out of total cost.

| Age (yrs) | No. of IPD days | Cost of nitrofurantoin (rupees) | Total cost of therapy for UTI (rupees) | Percentage of cost attributed to nitrofurantoin out of total cost (%) |
|-----------|-----------------|---------------------------------|----------------------------------------|-------------------------------------------------|
| 35        | 5               | 80                              | 294                                    | 28                                              |
| 45        | 5               | 80                              | 294                                    | 28                                              |
| 37        | 6               | 96                              | 340                                    | 29                                              |
| 45        | 5               | 80                              | 294                                    | 28                                              |
| 44        | 6               | 96                              | 340                                    | 29                                              |
| Avg.      | 5.4 days        | 86.4 rupees                     | 312.40 rupees                          | 28%                                             |

### Table 7: No of admission (IPD) days of UTI patients in group IIB and percentage of cost of therapy attributed to ceftrixone out of total cost.

| Age (yrs) | No. of IPD days | Cost of ceftrixone (rupees) | Total cost of therapy for UTI (rupees) | Percentage of cost attributed to ceftrixone out of total cost (%) |
|-----------|-----------------|------------------------------|----------------------------------------|-------------------------------------------------|
| 50        | 5               | 650                           | 864                                    | 76                                              |
| 36        | 6               | 780                           | 1024                                   | 76                                              |
| 54        | 6               | 780                           | 1124                                   | 70                                              |
| 56        | 5               | 650                           | 864                                    | 76                                              |
| 48        | 6               | 780                           | 1024                                   | 75                                              |
| Avg.      | 5.6 days        | 728 rupees                    | 984 rupees                             | 74%                                             |

### Table 8: No of admission (IPD) days of UTI patients in group IVA and percentage of cost of therapy attributed to nitrofurantoin out of total cost.

| Age (yrs) | No. of IPD days | Cost of nitrofurantoin (rupees) | Total cost of therapy for UTI (rupees) | Percentage of cost attributed to nitrofurantoin out of total cost (%) |
|-----------|-----------------|---------------------------------|----------------------------------------|-------------------------------------------------|
| 56        | 5               | 80                              | 332                                    | 24                                              |
| 57        | 6               | 96                              | 376                                    | 26                                              |
| 53        | 5               | 80                              | 301                                    | 27                                              |
| 38        | 5               | 80                              | 388                                    | 21                                              |
| 46        | 5               | 80                              | 301                                    | 27                                              |
| Avg.      | 5.2days         | 83.2 rupees                     | 339.5 rupees                           | 25%                                             |

### Table 9: No of admission (IPD) days of UTI patients in group IVB and percentage of cost of therapy attributed to ceftrixone out of total cost.

| Age (yrs) | No. of IPD days | Cost of ceftrixone (rupees) | Total cost of therapy for UTI (rupees) | Percentage of cost attributed to ceftrixone out of total cost (%) |
|-----------|-----------------|------------------------------|----------------------------------------|-------------------------------------------------|
| 60        | 5               | 650                           | 902                                    | 72                                              |
| 56        | 6               | 780                           | 1112                                   | 70                                              |
| 55        | 6               | 780                           | 1060                                   | 74                                              |
| 47        | 5               | 650                           | 871                                    | 75                                              |
| 52        | 5               | 650                           | 958                                    | 68                                              |
| Avg.      | 5.4days         | 702 rupees                    | 980.6 rupees                           | 72%                                             |
The average number of admission (IPD) days of urinary tract infection patients in group VA (receiving nitrofurantoin) was 4.4 days, total average cost of therapy for urinary tract infection in Group VA was 227.60 rupees out of which 67.2 rupees was attributed to nitrofurantoin therapy. Percentage of cost attributed to nitrofurantoin out of total cost of therapy was 30%, as shown in Table 10.

The average number of admission (IPD) days of group VB (receiving inj ceftriaxone) was 5 days, total average cost of therapy for urinary tract infection in Group VB was 848 rupees out of which 650 rupees was attributed to ceftriaxone therapy. Percentage of cost attributed to ceftriaxone out of total cost of therapy was 77% as shown in Table 12.

Table 10: No of admission (IPD days) of UTI patients in group VA and percentage of cost of therapy attributed to nitrofurantoin out of total cost.

| Age (yrs) | No. of IPD days | Cost of ceftriaxone (rupees) | Total cost of therapy for UTI (rupees) | Percentage of cost attributed to nitrofurantoin out of total cost (%) |
|-----------|-----------------|-----------------------------|----------------------------------------|---------------------------------------------------------------|
| 20        | 5               | 80                          | 208                                    | 38                                                            |
| 36        | 4               | 64                          | 221                                    | 29                                                            |
| 45        | 4               | 64                          | 244                                    | 26                                                            |
| 48        | 4               | 48                          | 244                                    | 20                                                            |
| 55        | 5               | 80                          | 221                                    | 36                                                            |
| Avg.      | 4.4 days        | 67.2 rupees                 | 227.60 rupees                          | 30%                                                           |

Table 11: No of admission (IPD) days of UTI patients in group VB and percentage of cost of therapy attributed to ceftriaxone out of total cost.

| Age (yrs) | No. of IPD days | Cost of ceftriaxone (rupees) | Total cost of therapy for UTI (rupees) | Percentage of cost attributed to ceftriaxone out of total cost (%) |
|-----------|-----------------|-----------------------------|----------------------------------------|---------------------------------------------------------------|
| 45        | 5               | 650                         | 850                                    | 77                                                            |
| 53        | 6               | 780                         | 990                                    | 79                                                            |
| 37        | 5               | 650                         | 820                                    | 79                                                            |
| 43        | 5               | 650                         | 860                                    | 76                                                            |
| 60        | 4               | 520                         | 720                                    | 72                                                            |
| Avg.      | 5 days          | 650 rupees                  | 848 rupees                             | 77%                                                           |

Table 12: Comparison of cost effectiveness (% of cost attributed to each antibiotic) within each group (between ceftriaxone and nitrofurantoin).

| Nitrofurantoin | Ceftriaxone | t-value | p-value  |
|----------------|-------------|---------|----------|
| Group I 25.60±1.94 | 74.60±1.14 | 48.51 | 0.0001, S |
| Group II 25.20±1.109 | 73±1.58 | 55.56 | 0.0001, S |
| Group III 28.40±0.54 | 74.60±2.60 | 38.37 | 0.0001, S |
| Group IV 25±2.55 | 71.80±2.86 | 27.29 | 0.0001, S |
| Group V 27.80±5.76 | 76.60±2.88 | 16.93 | 0.0001, S |

Table 13: Comparison of average number of admission days (IPD) within each group (between ceftriaxone and nitrofurantoin).

| Nitrofurantoin | Ceftriaxone | t-value | p-value  |
|----------------|-------------|---------|----------|
| Group I 4.40±1.14 | 5.20±0.83 | 1.26 | 0.24, NS |
| Group II 4.20±0.44 | 4.40±0.54 | 0.63 | 0.54, NS |
| Group III 5.40±0.54 | 5.60±0.54 | 0.57 | 0.58, NS |
| Group IV 5.20±0.44 | 5.40±0.54 | 0.63 | 0.54, NS |
| Group V 4.40±0.54 | 5±0.70 | 1.50 | 0.17, NS |

By using unpaired student t test statistically significant difference was found between average cost (in percentage) attributed to injection ceftriaxone (group IVB) and tablet nitrofurantoin (group IVA) (p-value <0.05) as shown in...
Table 12. By using unpaired student t test no statistical significant difference between average number of admission (IPD) days was found within each group receiving inj ceftriaxone (group IVB) and Tablet nitrofurantoin (group IVA) (p-value >0.05) as shown in Table 13.

Average cost (in percentage) out of total cost attributed to nitrofurantoin and ceftriaxone in group I was 25.60±1.94 and 74.60±1.14 respectively, in group II it was 25.20±1.09 and 73±1.58 respectively, in group III it was 28.40±0.54 and 74.60±2.60 respectively, in group IV it was 25±2.55 and 71.80±2.86 respectively, in group V it was 27.80±5.76 and 76.60±2.88 respectively. By using unpaired student t test statistically significant difference was found between average cost (in percentage) attributed to injection ceftriaxone and tablet nitrofurantoin (p-value <0.05) in each group. Avera average number of admission (IPD) days in patients receiving nitrofurantoin and ceftriaxone in group I was 4.40±1.14 and 5.20±0.83 respectively in group II it was 4.20±0.44 and 4.40±0.54 respectively, in group III it was 5.40±0.54 and 5.60±0.54 respectively, in group IV it was 5.20±0.44 and 5.40±0.54 respectively, in group V it was 4.40±0.54 and 5±0.70 respectively. By using unpaired student t test no statistically significant difference between average number of admission (IPD) days was found within each group receiving inj ceftriaxone and tablet nitrofurantoin (p-value >0.05) in each group.

**DISCUSSION**

In present study authors have calculated and compared cost effectiveness of tablet nitrofurantoin with injection ceftriaxone, authors have compared average number of admission (IPD) days of patients receiving tablet nitrofurantoin and injection ceftriaxone as an empirical therapy for urinary tract infections. Percentage of cost of therapy attributed to nitrofurantoin was found to be less than ceftriaxone (p <0.05) in all the five groups, nitrofurantoin was found to be more cost effective as compared to ceftriaxone in adult UTI patients. In a study McKinell et al, nitrofurantoin was found to be the most low cost antibiotic used as an empirical therapy in uncomplicated UTI when compared to other antibiotics such as cotrimoxazole and other fluoroquinolones, this study was a cost minimization study and high sensitivity and low resistance of nitrofurantoin was the reason of selecting it as a favourable antibiotic. However in one study by Lin et al, comparing effectiveness and cost of three antibiotics (cefixim, ertapenem and levofloxacin) ceftriaxone was found to be more cheaper than ertapenem and levofloxacin. In one study by Bosmans et al, comparing cost effectiveness between cranberry capsules and tablet cotrimoxazole as a prophylactic therapy for recurrent UTI in women, cotrimoxazole was found to be more cost effective. In a study by Friedland et al, comparing oral cefixime and inj ceftriaxone in adolescents patients suffering from gonococcal cervicitis no cost advantages was seen in between cefixime and ceftriaxone. In a study by Huang et al, for economic assessment of three antibiotics i.e. ciprofloxacin, cotrimoxazole and nitrofurantoin, cotrimoxazole was found to be more cost effective as compared to other antibiotics.

In a study by Hutner et al, 5 days of nitrofurantoin resulted in significant clinical resolution of uncomplicated UTI in women compared to single dose fosfomycin at 14th and 24th day respectively, however in present study no significant difference was found in between average number of admission (IPD) days in between nitrofurantoin and ceftriaxone. In a systematic review and meta-analysis by Price et al, comparing prophylactic capacity of nitrofurantoin with other antibiotics, nitrofurantoin had shown similar efficacy to antibiotics such as norfloxacin, cotrimoxazole, cefaclor etc but more adverse effects.

**CONCLUSION**

In current study authors found nitrofurantoin to be more cost effective than inj ceftriaxone as an empirical therapy in UTI patients however there was no significant difference between the average number of admission (IPD) days in patients receiving Tablet nitrofurantoin and injection ceftriaxone for urinary tract infection as an empirical therapy.

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**Ethical approval: The study was approved by the Institutional Ethics Committee of DMIMS (On 31/03/2017 Ref. No. DMIMS(DU)/IEC/2017-18/6348)**

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