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A 4-year Study of Community Acquired Urinary Tract Infections from a Tertiary Diagnostic Centre in Mumbai with Special Reference to MIC Values

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Abstract

Urinary Tract Infections (UTIs) are among the most frequent infectious diseases affecting humans, and represent an important public health problem with a substantial economic burden. Due to the high empiric use of antibiotics for treatment of UTI, antibacterial resistance of Enterobacteriaceae, specifically the main uropathogens *Escherichia coli* and *Klebsiella pneumoniae*, has significantly increased worldwide. A retrospective analysis of cases of community acquired UTI reported over last 4 years at Suburban Diagnostics was done. A total of 27,501 cases of UTI were analysed retrospectively. Growth was found in 12,476 (45.36%). 15,025 (54.63%) cases were sterile on culture. Community acquired UTI is showing increasing resistance as seen in our study of 4 years with around 27,000 cases of UTI and around 12,000 isolates. High rates of ESBL-64% of *E. coli* and 54% *Klebsiella* isolates found in our study reinforce the fact that this form of resistance is common in community acquired UTI.

Keywords: Urinary tract infections; Uropathogens; Enterobacteriaceae; Public health problem

Introduction

Urinary Tract Infections (UTIs) are among the most frequent infectious diseases affecting humans, and represent an important public health problem with a substantial economic burden. Due to the high empiric use of antibiotics for treatment of UTI, antibacterial resistance of Enterobacteriaceae, specifically the main uropathogens *Escherichia coli* and *Klebsiella pneumoniae*, has significantly increased worldwide. While many articles focus on hospital acquired urinary tract infection, there are very few published articles on community acquired UTI. It is our attempt here to draw attention to antibiotic resistance in community acquired UTI.

Method

A retrospective analysis of cases of community acquired UTI reported over last 4 years at Suburban Diagnostics was done. Isolates obtained and susceptibility pattern were analyzed along with MIC values in detail. The isolates had been identified and susceptibility were done using Vitek 2 compact. These samples are representative of the community acquired UTI as samples from hospital were not included in the study. Also patients with past history of hospitalisation were also not included in the study.

Results

A total of 27,501 cases of suspected UTI were analysed retrospectively. Growth was found in 12,476 (45.36%). 15,025 (54.63%) cases were sterile on culture.

Gender distribution: 8,608 females (69%) showed growth in culture as compared to 3867 males (31%).

Organism distribution: Gram negative organisms accounted for 92.9% of all growths, 86.1% of which consists of Enterobacteriaecea and 6.8% were non-enterobacterieacea. Gram positive and yeasts consisted of 3.6% and 3.5% respectively (Figure 1).

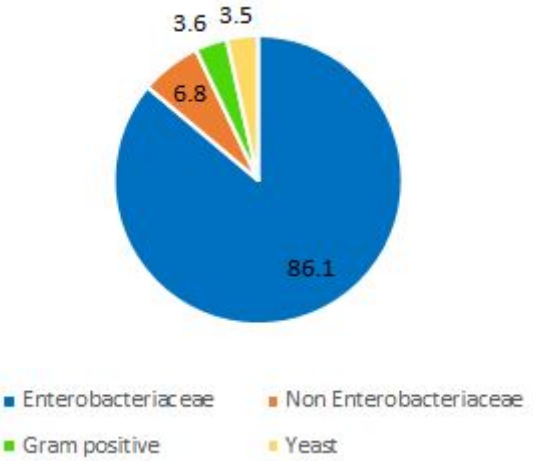

Figure 1: Organism distribution.

Isolate analysis: *E. coli* was the predominant gram negative isolate (72%). *Klebsiella* (15%) was a distant second isolate followed by *Pseudomonas*, *Proteus*, *Citrobacter*, *Enterobacter* and *Acinetobacter spp.* (Figure 2).

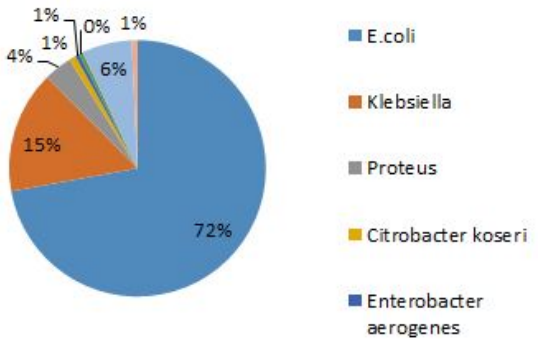

Figure 2: Gram negative distribution.

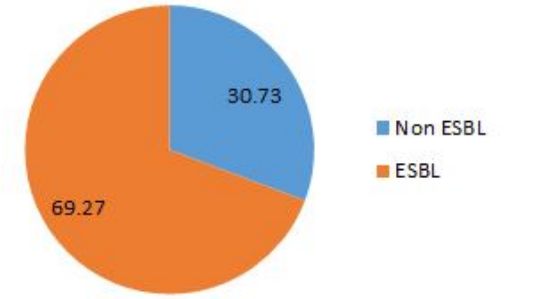

Figure 3: Distribution of ESBL.

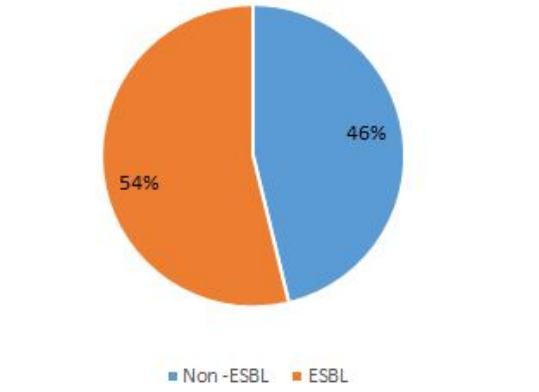

Figure 4: Distribution of *Klebsiella* species.

Resistance Pattern in *E. coli*: Around 69.27% of all *E. coli* isolates were resistant to cephalosporins and hence ESBL producers. 4.82% of the *E. coli* isolates were resistant to carbapenems in addition to being ESBL producers (Figure 3).

Resistance Pattern in *Klebsiella* species: 54% of all the UTIs caused by *Klebsiella pneumoniae* were ESBL Producers (Figure 4).

Resistance Pattern in *Pseudomonas*: 34.74% of all the UTIs caused by *Pseudomonas aeruginosa* were multidrug resistant, i.e. Carbapenem resistant (Figure 5).

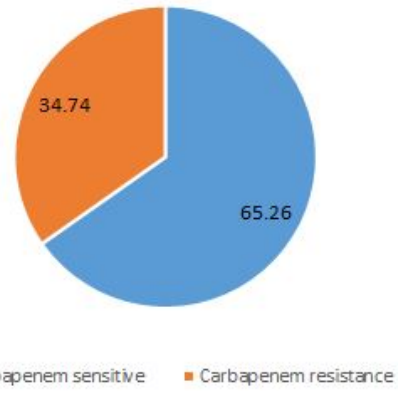

Figure 5: Distribution of speices *P. aeruginosa*. MIC Values: Ampicillin is no more a useful drug in community acquired UTI.

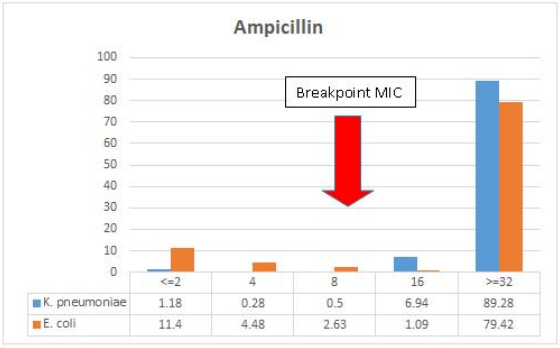

Figure 6: Majority of the isolates show MIC values higher than the breakpoint MIC.

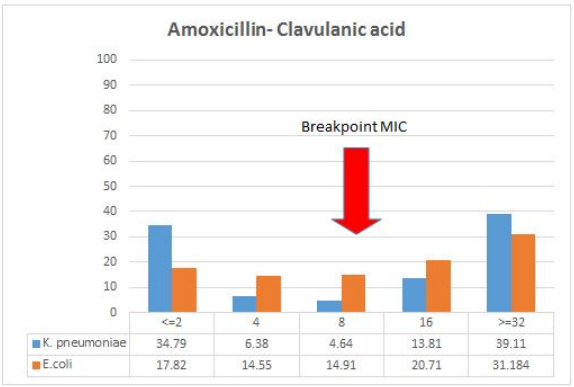

Figure 7: Breakpoint MIC values are equally distributed in case of Amoxicillin-clavulanic acid.

51.89% of *E. coli* isolates are resistant to Amoxicillin-clavulanic acid (Figures 6 and 7). 52.92% of *Klebsiella pneumoniae* isolates are resistant to Amoxicillin-clavulanic acid.

Hence Amoxicillin clavulanic acid is rendered ineffective in more than 50% of infections.

53.52% of *Klebsiella* isolates are resistant to Ceftriaxone and hence ESBL producers (Figure 8).

High resistance to Ciprofloxacin in community acquired UTI renders this useful anti microbial ineffective (Figures 9 and 10).

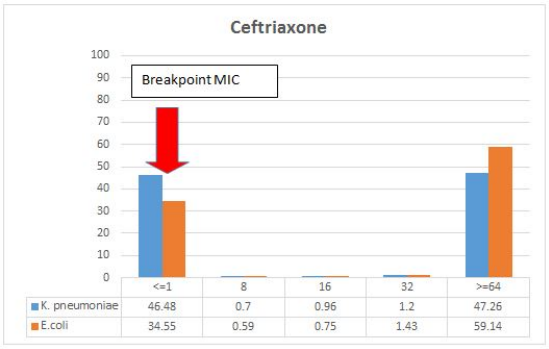

Figure 8: 64.45 % of *E. coli* isolates are resistant to ceftriaxone.

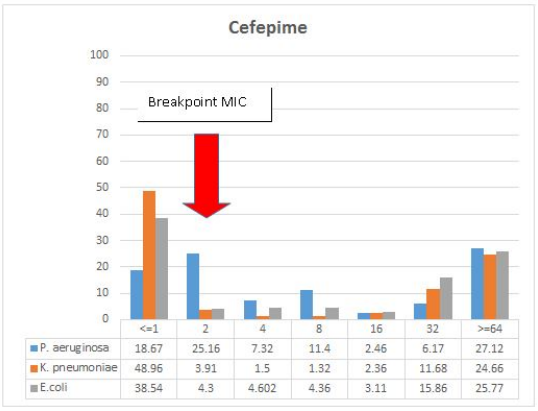

Figure 9: Cefepime is resistant in 53.7% of *E. coli* isolates and 41.52% of *Klebsiella* and 54.47% of *Pseudomonas* isolates.

More than 30% resistance in Gentamicin is noted in community acquired UTI (Figure 11).

This can be attributed to the increased use of Gentamicin in treatment of community acquired UTI with ESBL producing organisms.

Amikacin is a better drug to use instead of Gentamicin in community acquired UTI because of better sensitivities (Figure 12).

Nitrofurantoin is better drug to use when *E. coli* is the incriminating organism in community acquired UTI (Figure 13).

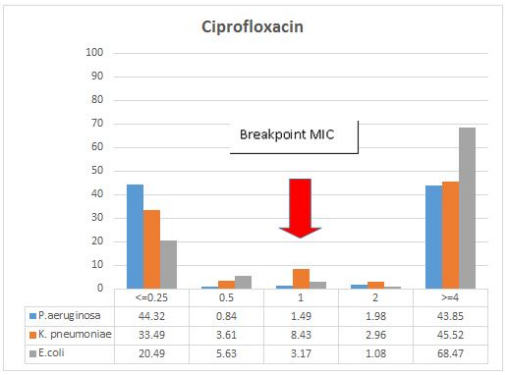

Figure 10: 69.55% of *E. coli* isolates and 48.48% of *Klebsiella* isolates are resistant to Ciprofloxacin. 45.83% of *Pseudomonas* isolates are resistant to Ciprofloxacin.

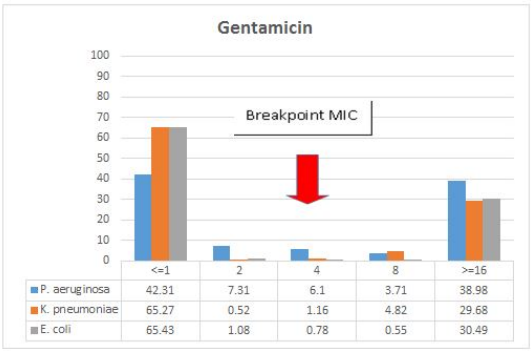

Figure 11: 31.04% of *E. coli* isolates and 34.5% of *Klebsiella* isolates are resistant to Gentamicin and 42.69% of *Pseudomonas* isolates are resistant to Gentamicin.

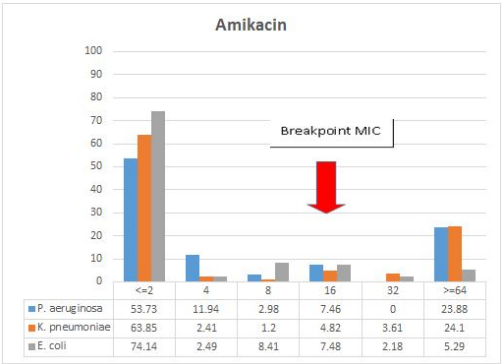

Figure 12: 7.47% of *E. coli* isolates and 27.71% of *Klebsiella* isolates are resistant to Amikacin and 23.88 % of *Pseudomonas* isolates are resistant to Amikacin.

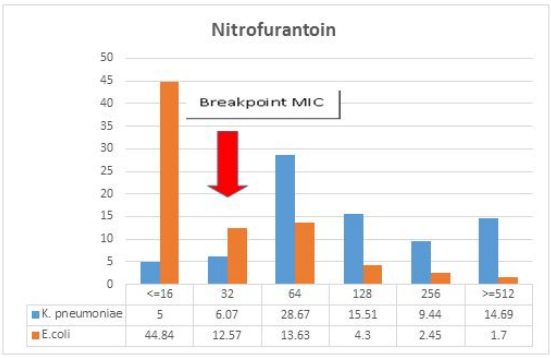

Figure 13: 22.08% of *E. coli* is resistant to Nitrofurantoin and 68.31% of *Klebsiella* isolates are resistant to Nitrofurantoin.

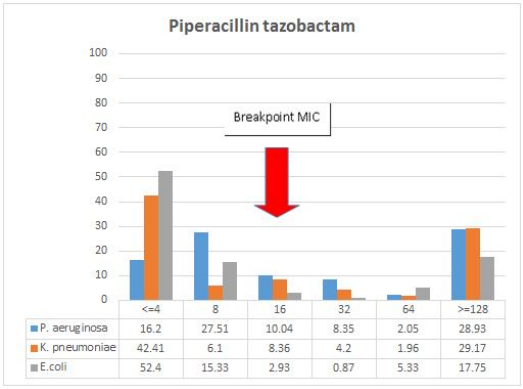

Figure 14: 23.95% of *E. coli* isolates and 35.33% of *Klebsiella* isolates are resistant to Piperacillin tazobactam. 39.33% of *P. aeruginosa* isolates are resistant to Piperacillin tazobactam.

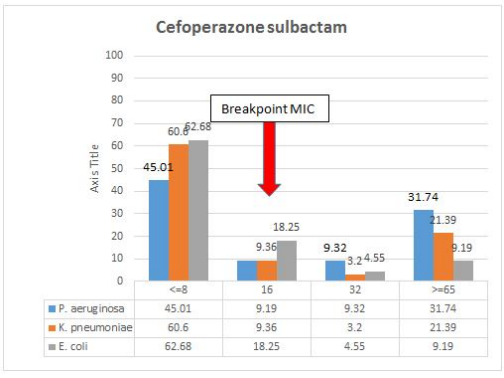

Figure 15: 3.74% of *E. coli* isolates and 24.59% of *Klebsiella* isolates are resistant to Cefoperazone sulbactam, 41.06% of *P. aeruginosa* isolates are resistant to Cefoperazone sulbactam.

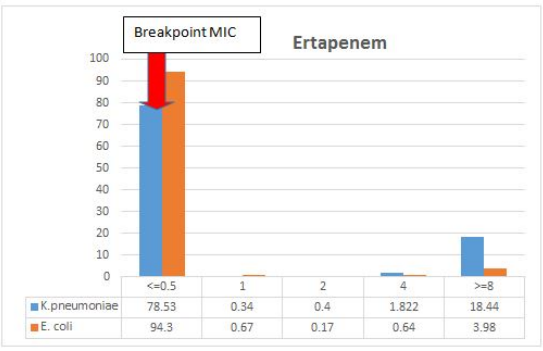

Figure 16: 4.79% of *E. coli* isolates and 20.66% of *Klebsiella* isolates were found to be resistant to Ertapenem. Hence Ertapenem is a useful drug in community acquired UTI , but should be used judiciously.

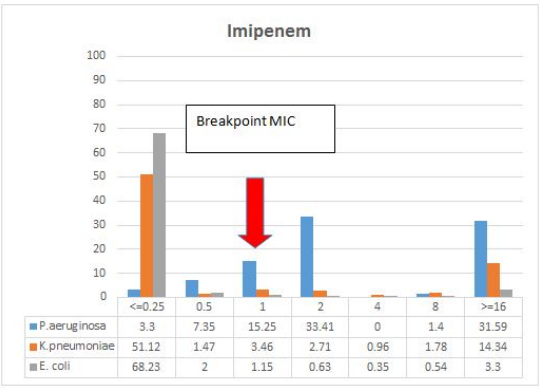

Figure 17: 4.82% of *E. coli* isolates, 19.79% of *Klebsiella* isolates are resistant to Imipenem. 66.4% of *P. aeruginosa* isolates are resistant to Imipenem.

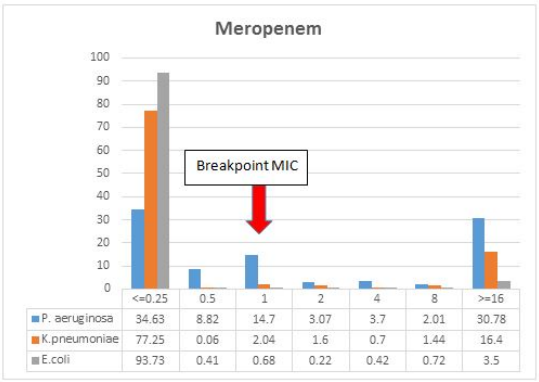

Figure 18: 4.86% of *E. coli* and 20.14 % of *Klebsiella* isolates are resistant to Meropenem and 39.56% of *P. aeruginosa* isolates are resistant to Meropenem.

All Carbapenems have shown good sensitivity as expected in community acquired UTI with *E. coli* isolates (Figures 14-18).

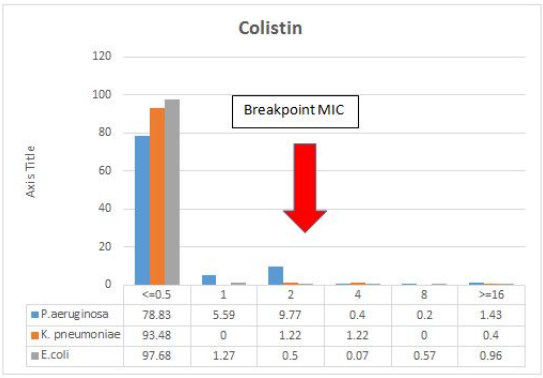

Figure 19: 1.6 % of *E. coli* isolates and 1.62% of *Klebsiella* isolates were found to be resistant to Colistin and 2.03% of *P. aeruginosa* isolates were found to be resistant to Colistin.

Colistin continues to be sensitive in community acquired UTI as expected but being a toxic drug should not be used unless there are compelling reasons like carbapenem resistance (Figure 19).

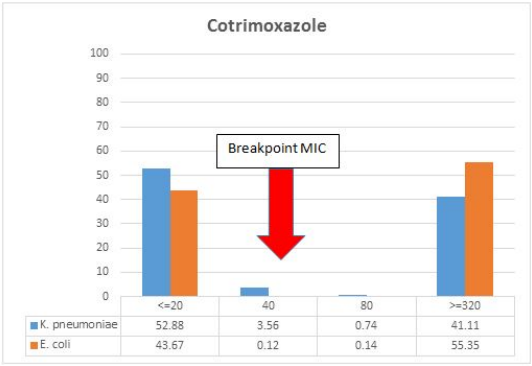

Figure 20: 55.49% of *E. coli* isolates are resistant to Co-trimoxazole and 41.85% of *Klebsiella* species are to Co-trimoxazole.

Around half the isolates are resistant to co-trimoxazole underlying the increasing resistance to oral anti microbials in community acquired UTI (Figure 20).

Discussion

- Gender distribution: 69% females were culture positive as compared to 31% males. Female predominance in UTI is known due to short urethra and ascending infections. Fatema et al. [1] got a female incidence of around 72% which is similar to our study.
- Culture positivity of 45.36% in our study was not found in other studies.
- Edirisinghe et al. [2] study showed culture positivity of only 31%. Klingeberg et al. [3] showed a positivity rate of 70%. Reduced positivity in our study can be attributed to the use of boric acid as a preservative in our urine culture containers which may have prevented over growth.
- Gram negative organisms accounted for 92.9% of all growths. This is similar to Edirisinghe et al. [2] study which showed 94% gram negative growth.
- Coliforms accounted for 86.1% of all isolates which is similar to Edirisinghe et al. [2] study which showed 89% coliforms.
- *E. coli* was the predominant isolate (72%) in our study which is also found in Pramodini et al. [4] study (70%).
- 69.27% of *E. coli* isolates were ESBL producers. This is similar to studies across India which shows high rates of ESBL production. Magale et al. [5] showed around 60.7% of *E. coli* was ESBL producer and 78% of *Klebsiella* isolates were ESBL producer.
- Our study showed that majority of isolates were resistant to Ampicillin which is similar to the study carried out by Sood et al. [6].
- Aminoglycosides-Amikacin and Gentamicin showed good sensitivity of 92% and 69% respectively which is similar to study carried out by Bashini et al. [7] and Sood et al. [6].
- Nitrofurantoin, Cefoperazone sulbactum and Piperacillin tazobactum show higher susceptibility for *E. coli* as compared to *Klebsiella* and *Pseudomonas* isolates which is similar to study carried out by Edirisinghe et al. [2] and Odsbuet et al. [8].
- Carbapenem resistance in the isolates is a growing concern and hence drugs such as Ertapenem, Imipenem and Meropenem should be used judiciously. Out of *Pseudomonas*, *Klebsiella* and *E. coli*, *E. coli* showed least resistance against Carbapenems.
- Co-trimoxazole and Amoxicillin-Clavulanic acid show almost equal number of isolates on either side of the breakpoint MIC hence these 2 drugs are ineffective/resistant in half the isolates.
- 64% of *E. coli* and 54% *Klebsiella* isolates are resistant to Ceftriaxone and Cefepime, hence ESBL producers which is in concordance to study carried out by Sood et al. [6] and Akram et al. [9].
- *E. coli* isolates show higher resistance to Ciprofloxacin than *Klebsiella* and *P. aeruginosa* isolates which is similar to the study carried out by Dash et al. [10].

Conclusion

- Community acquired UTI is showing increasing resistance as seen in our study of 4 years with around 27,000 cases of UTI and around 12,000 isolates.
- High rates of ESBL-64% of *E. coli* and 54% *Klebsiella* isolates found in our study reinforce the fact that this form of resistance is common in community acquired UTI.
- Co-trimoxazole and Amoxicillin clavulanic acid is resistant in around 50% of the isolates.
- Nitrofurantoin with 78% sensitivity is a good drug to use if the incriminating organism is *E. coli.*
- Ciprofloxacin with low sensitivity (30% in *E. coli* and 52% in *Klebsiella*) has rendered this drug relatively useless.
- Amikacin and Gentamicin showed good sensitivity of 92% and 69% respectively are useful alternatives in case of ESBL producing isolates.
- Carbapenem resistance in the isolates is a growing concern and hence drugs such as Ertapenem, Imipenem and Meropenem should be used judiciously.

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