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Spectrum of Organisms and their Antibiotic Sensitivity Studied from Rectal Swabs in the Community

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Abstract

Aim: To study the spectrum of organisms and their antibiotic sensitivity studied from rectal swabs in the community.

***Methods*:** A 2 years prospective study in which rectal swabs were collected from patients who fulfilled the inclusion criteria. Baseline information with a detailed written informed consent was taken from each patient. Results were characterized for identification of the organisms and antimicrobial susceptibilities. The data was tabulated for evaluation on a predesigned proforma.

***Results*:** Of 373 patients, 290 patients were male and 83 female (Mean age - 62.7 +/- 18 years). The most common organism was Escherichia coli in 76.56% of cases, Klebsiella Sp in 12.5%, Proteus Sp in 1.56% and others including Enterococcus, Pseudomonas, Staphylococcus aureus contributed to 9.37%. In the antibiotic sensitivity pattern, the sensitivity of fluoroquinolones was as low as 48.43%. Nitrofurantoin showed a higher sensitivity of 83.59 % than fluoroquinolones but similar to carbapenems (88.2%) and third generation cephalosporins (78.12%).

In our study, 23 patients were planned for a TRUS guided prostate biopsy. The culture positive rate in this group was 43.47 % of which 60% of the organisms grown was Esherichia coli ($p = 0.01$) on sub group analysis. They showed a quinolone sensitivity of only 40% .

***Conclusion*:** With increasing antibiotic resistance and multi drug resistant organisms, we suggest the use of a culture based antibiotic for infections and trans rectal biopsy procedures. There is a change in antibiotic resistance pattern of organisms of the gut flora with rising pattern of fluoroquinolone resistance.

Keywords: Antibiotic sensitivity; Biopsy; E-Coli; Prostate biopsy; Rectal swab.

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Introduction

UTI is a common presentation to urologists in daily practice. The use of prophylactic antimicrobial agents lowers the incidence of infections, but little consensus exists regarding the appropriate regimens.

Fluoroquinolones are the most commonly used prophylactic antimicrobial agents for UTI. Despite this, the incidence of infectious complications is from 2.1% to 3.0%. In addition, fluoroquinolone-resistant E. coli in rectal flora are a risk factor for infectious complications after TRUS-guided biopsy. Little is known concerning fluoroquinolone resistance in rectal flora. Although UTI ranks among the most common infection in developing countries, only around 9.17% are proved by culture.

The present study will be undertaken to investigate the spectrum of organisms and their antibiotic sensitivity studied from rectal swabs in the hospital setting and rationale for use of empirical antibiotics in the treatment of UTI.

Subjects And Methods

This was a prospective study conducted at our institution for a duration of 2 years. Baseline information and a brief clinical history was collected with a detailed written informed consent from each patient.

Patients who fulfilled the inclusion criteria were explained clearly about the purpose and nature of the study in the language they understood and a written informed consent was taken. Patient's demographics, pre-existing diseases and drug history was recorded. Also recorded were the indications for admission including patients who were proposed for undergoing a rectal biopsy of the prostate gland.

For collecting samples, the selected patients were put in a knee chest or a left lateral SIMS position after being exposed from below the waist. Using aseptic precautions, a sterile swab was inserted around 1 inch into the anal canal and slowly rotated for about 10 seconds. The swab was then put into the swab tube. Specimens were processed as close to collection as possible and no more that 4hrs post collection. Swabs were frozen within 4 hours after collection if analysis was to be delayed.

All isolates were then further characterized for identification of the organisms and antimicrobial susceptibilities. The data collected was documented and tabulated for evaluation on a predesigned proforma.

All patients more than 15 years of age from our institution either attending OPD or admitted electively were included and patients who were diagnosed with UTI, sepsis, perianal infection, immuno-compromised conditions, patients who have received antibiotic for any reason in the last two weeks prior to the rectal swab and patients with indwelling catheters and stents were excluded from the study.

The tabulated data was evaluated using the SPSS 18 statistical software for significance. Differences in the outcome indicators were tested for statistical significance through t-test/appropriate non parametric tests of significance.

Institutional Ethical Committee approval was taken before the commencement of the study.

Results

A prospective study of 2 years duration with 373 patients, majority being males (77.74%).

The mean age in this study was 62.7 years (15-95 years). The distribution of patients in this study with respect to age was similar in both males and females.

Of the 373 patients 80.6% of the patients were admitted under the department of Urology whereas the remaining 19.4% of the patients were taken from various other departments. Of the study population, 77% of the selected patients were admitted for a urological condition whereas 23% were admitted for other reasons.

There was an overall culture positive rate from the rectal swabs of only 34.3%, which is comparable to other studies. It was however interesting to note that on analysis, it was found that the culture positive rate was higher with increasing age,

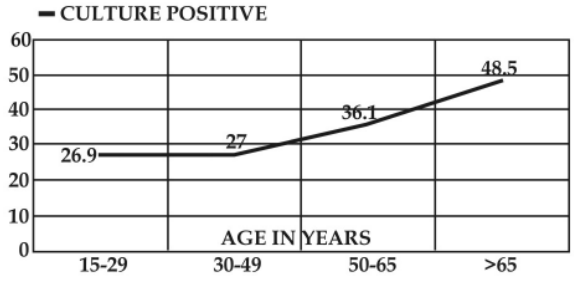

Fig. 1: Culture positivity with age.

with a significant p value on statistical analysis. (p = 0.019). Another notable factor in our study was that the men had a higher number of rectal swab cultures positive reports than women included in this study. (35.9% vs 28.9%). However, this was not statistically significant. (p = 0.24)

As seen in other studies, the most common organism grown on rectal swabs in our study was Escherichia coli (76.56%), followed by Klebsiella Sp (12.5%) and others.

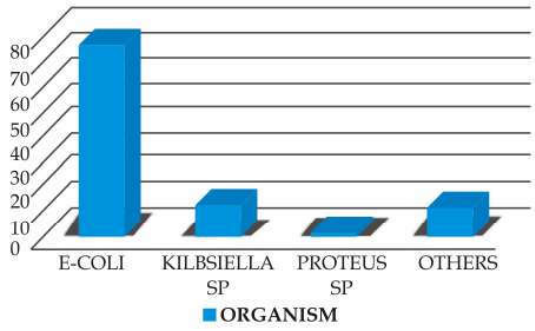

Fig. 2: Organisms grown.

In our study the antibiotic sensitivity pattern showed the organisms which were grown on culture were most resistant to fluoroquinolones among the most used antibiotics (48.43%), showing a higher rate of resistance than other studies.[1]

Table 1: Antibiotic sensitivity pattern.

Antibiotic	Sensitivity
Fluoroquinolones	48.43%
3rd Generation Cephalosporins	78.12%
Nitrofurantoin	83.59%
Carbapenems	88.28%
Amikacin	94.5%
Others	17 to 59%

Amikacin showed a high sensitivity of around 94.5% in this group. Nitrofurantoin showed a higher sensitivity of 83.59 % as compared with fluoroquinolones but resembling carbapenems and third generation cephalosporins with 88.2% and 78.12% respectively. This was found to be statistically significant with p = 0.001. Among the cephalosporins, the third generation cephalosporins showed a slightly higher sensitivity than the rest, however this was not statistically significant. Other antibiotics included ampicillin (31.25%), ceftriaxone (57.81%) etc showed varying sensitivities. Notably very low resistance was seen in the cases of colistin (96.09%) and tigicyclin (95.31%) among others. Imipenem showed a higher sensitivity than meropenem in our study. (91.4% vs 87.9%).

Similar results were seen when an independent review was done for the rectal swabs cultures positive with Escherichia coli which was the most common organism grown in the study. Among these there was a higher resistance to fluoroquinolones (58.7%) as noted in some studies, with the mention of a fluoroquinolone resistant strain.[1] The sensitivity pattern with the other antibiotics as shown

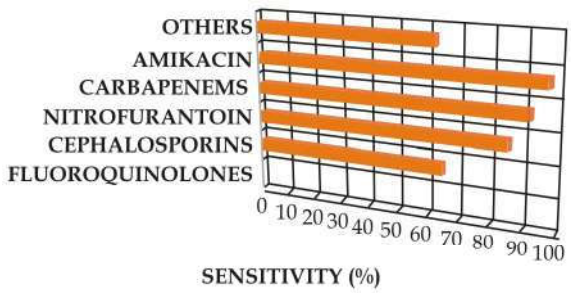

Fig. 3: Sensitivity pattern for Escherichia Coli.

was comparable as shown in Table 1. The above has an implication in cases of rectal prostate biopsy as discussed later.

In a sub group analysis, 23 patients in our study were planned for a TRUS guided prostate biopsy. The culture positive rate in this group was 43.47% of which 60% of the organisms grown was Esherichia coli.

The antibiotic sensitivity pattern was comparable to the general group, similarly showing low sensitivity to the fluoroquinolone group (40%) as compared to the others, with ceftriaxone showing 60% while amikacin, gentamycin and cephalosporins showing a higher sensitivity of 80% was noted.

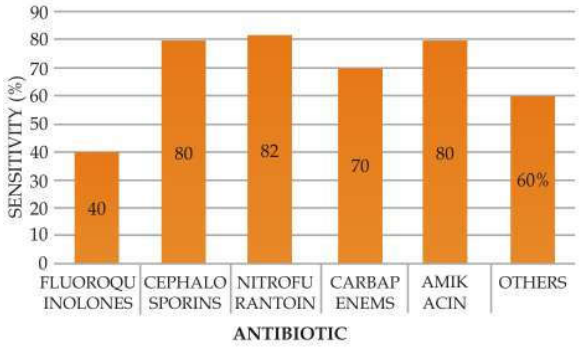

Fig. 4: Antibiotic sensitivity pattern in TRUS guided prostate biopsy group.

This is useful in the selection of a prophylactic pre procedure antibiotic in order to reduce complications associated with the procedure.

A statistically significant difference was seen when the presence of a positive rectal swab culture was made with the presence of comorbidities in the patient, either single or multiple. DM was shown to have a higher correlation with culture positivity (68.8%), than HTN (58.3%), IHD (50%) or CKD (50%). There was however a 27% of the study group who were culture positive but did not suffer from any pre-existing condition.

Discussion

We conducted a prospective study to evaluate the spectrum of organisms and their antibiotic sensitivity studied from rectal swabs in the hospital setting and to assess whether this information can be utilized in optimum treatment of patients with respect to prophylactic antibiotics and in urinary tract infections. We have also aimed to assess if the pre-existing data correlates with our findings

which we have discussed below. We selected 373 patients in our study who fulfilled the inclusion and exclusion criteria.

Of the selected patients, 290 patients were male and 83 patients were female. Age wise distribution of the selected patients showed a similar distribution in both sexes. 62.7 +/- 18 years was the mean age in our study group with a minimum age of 15 years and a maximum age of 95 years.

Majority of the patients included were in the age group of 50-65 years in our study. Females in the age group of 30 to 49 years comprised of a larger number, who were available for analysis whereas most of the males were in the age group of 50 to 65 years.

An important factor proposed to affect results in our study were the pre-existing co morbidities in our patients. 56.16% of our patients had only a single co morbidity whereas the rest presented with multiple co morbidities. Diabetes Mellitus was the predominant co morbidity accounting for 65.7% of the group followed by hypertension accounting for 45.2% and others including ischemic heart disease, chronic kidney disease etc amounting to 35.6% of the study population. On further analysis, a statistically significant difference was seen in the presence of a positive rectal swab culture and with the presence of comorbidities in the patient, either single ($p = 0.01$) or multiple ($p = 0.02$). DM has a higher correlation with culture positivity (68.8%), than HTN (58.3%), IHD (50%) or CKD (50%). We had a higher incidence of DM with a statistically significant correlation ($p < 0.01$) to positive rectal cultures in our study.

In our study the overall rate of rectal swab cultures being positive in 373 patients was only 34.3% which is comparable to other studies. A variation in rectal swab cultures is seen among various studies. In a study by B Kolator and P Rodin undertaken for the study of gonorrhea by comparision of anal and rectal swabs, showed a low positivity of these tests at 26.3% and 27.6% respectively.[2] In the study by Ebbing et al et al, sensitivity of perirectal swab compared to stool sample was 90% (95% confidence interval (CI), 70 to 99%) and the specificity was 100% (95% CI, 91 to 100%). For rectal swab, the sensitivity was 90% (95% CI, 68 to 99%) and the specificity was 100% (95% CI, 91 to 100%).[3]

Although a statistically significant point which was seen was the trend of increasing culture positivity with increasing age, with the highest culture positives seen in patients more than 60 years of age, as shown in figure 1. The increasing culture positive trend ranged from 29.9% for those aged less than 20 years to 46.5% in those aged more than 70 years, which was statistically significant. ($p < 0.019$). The importance of this however may be debatable.

Among the positive rectal swab cultures, the most common organism reported was Escherichia coli in 76.56% of the cases, followed by Klebsiella Sp in 12.5%, Proteus Sp in 1.56% and others including Enterococcus, Pseudomonas, Staphylococcus aureus together contributing to 9.37%. (FIGURE 2). The most common organism grown in rectal cultures is Escherichia coli which was also seen in studies by Gottesmann et al, where in 72 culture positive patients, Escherichia coli was seen in 97.2% of the patients. Similarly in the study by Jong et al, of the 161 bacterial isolates, 80.7% were E. coli and 9.9% were Klebsiella pneumonia. 4. This finding is uniformly seen in most studies.

In our study in the antibiotic sensitivity pattern studied in culture positive patients, the sensitivity of fluoroquinolones was as low as 48.43% of the cases. This shows the trend towards a resistance to fluoroquinolones, which are commonly used antibiotics for UTI and in prophylaxis for urological conditions and common procedures. Fluoroquinolones are the most commonly used prophylactic antimicrobial agents for TRUS guided prostate biopsy because of their broad spectrum coverage, pharmacokinetics, bioavailability, and ease of oral administration. However, despite the use of prophylactic antibiotics, the incidence of infectious complications is from 2.1% to 3.0%. Initial studies by Michael A et al showed that an overall fluoroquinolone resistance was detected in 18 of 100 patients from the first office-based rectal culture. Gottesmann et al however noted that their isolates were highly resistant with 67% displaying multidrug-resistance.[4] 33.89% of stool cultures done by Ebbing et al showed fluoroquinolone resistant Escherichia coli in the gastrointestinal tract confirmed by rectal swab cultures being positive in 90% of the patients.[3] Jong et al showed that the prevalence of quinolone resistance was 16.8% and the prevalence of extended-spectrum beta-lactamase (ESBL) positivity was 9.3%. A previous history of prostatitis was correlated with quinolone resistance and ESBL positivity in their study.5.

In our study however we have seen a higher incidence of resistance of Escherichia coli to fluoroquinolones of 51.57% than other studies, showing the need to avoid the use of these antibiotics as prophylactic drugs. The use of

a prophylactic antibiotic is known to reduce complications as bacteremia and sepsis, as well as lower the incidence of infections after a trans rectal procedure but little consensus exists regarding the most appropriate antimicrobial regimens. The percentage of fluoroquinolone resistant Escherichia coli recovered from urinary tract infections increased 4.4 folds from 2004 to 2006 in the United States. In addition, this fluoroquinolone resistant organism in rectal flora is a risk factor of infectious complications after TRUS guided biopsy.

In our study the antibiotic sensitivity pattern showed the organisms which were grown on culture were most resistant to fluoroquinolones among the most used antibiotics (48.43 %), showing a higher rate of resistance than other studies as mentioned before. When an analysis was made of the other antibiotic sensitivity pattern, a varied result was obtained. (Table 1). Amikacin showed a high sensitivity of around 94.5 % in this group. Nitrofurantoin showed a higher sensitivity of 83.59 % as compared with fluoroquinolones but resembling carbapenems and third generation cephalosporins with 88.2% and 78.12 % respectively which was statistically significant with p = 0.001. Among the cephalosporins, the third generation cephalosporins showed a slightly higher sensitivity than the rest, however this was not statistically significant. Other antibiotics included ampicillin (31.25 %), ceftriaxone (57.81 %) etc showing varying sensitivities. Notably very low resistance was seen in the cases of colistin (96.09%) and tigicyclin (95.31 %) among others. Imipenem showed a higher sensitivity than meropenem in our study. (91.4 % vs 87.9 %). p = 0.02.

Many mechanisms have been proposed for the development of fluoroquinolone resistant Escherichia coli. One of the mechanisms of fluoroquinolone resistance is the activity of ESBLs that enzymatically mediate resistance to extended spectrum third generation cephalosporins and monobactams, while not affecting carbapenems. This was seen in our study.

Jong et al noted in their study of antibiotic resistant bacteria on rectal swabs in patients undergoing a prostate biopsy that in 233 patients, 161 had positive cultures with Escherichia coli being the most organism cultured. Similarly in our study, 23 patients planned for a TRUS guided prostate biopsy. The culture positive rate in this group was 43.47 % of which 60 % of the organisms grown was Escherichia coli (p = 0.01) on sub group analysis. They showed that the prevalence of quinolone resistance was only 16.8%, but our study showed a quinolone sensitivity of only 40% showing a trend of increasing resistance to fluoroquinolones.

Furthermore, the sensitivity pattern among ceftriaxone showing 60% while amikacin, gentamycin and cephalosporins showing a higher sensitivity of 80 % was noted. (Figure 4). This is useful in the selection of a prophylactic pre procedure antibiotic in order to reduce complications associated with the procedure.[5]

Duplessis et al. showed that rectal cultures obtained before TRUS biopsy with the use of selective media to identify fluoroquinolone-resistant Enterobacteriaceae facilitate targeted antibiotic prophylaxis and appear to be highly efficacious in reducing infectious complications.[6] The above results shows the higher incidence of a quinolone resistant component and the need to consider a culture based or an alternative antibiotic as pre procedure prophylaxis in such cases.

In the times of prescription of random antibiotics for prophylactic treatment of infections, with the above we aim to aid in issuing therapeutic guidelines for empirical treatment based of the evidence shown by culture sensitivity patterns.

This study further shows the change in resistance pattern of organisms of the gut flora to antibiotics in the given setting. As an unbiased group of patients were considered, these results can be extended to the community with change in prophylactic antibiotics protocol for UTI, prostate biopsy etc prior to a culture report.

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