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Full Length Research Paper

Antimicrobial sensitivity patterns of urine isolates from a large Ghanaian hospital

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Monitoring antimicrobial susceptibility patterns of pathogens that cause Urinary Tract Infection is important to provide information concerning rising problems of antibiotic resistance and assistance in managing empirical therapy. The purpose of this study was to investigate the most prevalent pathogen in urine and evaluate its susceptibility and resistance using standard microbiological procedures. Urine culture and sensitivity results were compiled and analyzed from laboratory record books of a large Ghanaian hospital from 2009 to 2010. Within this period, a total of 3774 pathogens were isolated comprising 3510 bacteria and 264 yeast isolate. The most prevalent isolated pathogens were *Escherichia coli* (25.5%), *Klebsiella* (19.2%) and *Staphylococcus aureus* (18.6%). Other isolates included other Coliform spp(9.4%), *Streptococcus sp* (8.2%), *Pseudomonas* (7.1%), *Candida alibicans* (7%) and *Proteus spp* (4.9%). Only 9.3, 9.5 and 6.4% of *E.coli* was susceptible to Ampicillin, Pipemedic acid and Cotrimoxazole respectively. Susceptibility of *E.coli* to Nitrofuranton and Cefuroxime was 18.5 and 18.3% respectively. Susceptibility to Gentamycin, Tetracycline, and Nalidixic acid, were 15.4, 11.4 and 11.1% respectively.

Keywords: Antimicrobial, susceptibility, pathogens, resistance, Bacteria, culture.

INTRODUCTION

The prevalence of antimicrobial resistance in urinary pathogens is increasing worldwide (Orenstein and Wong 1999) and can cause major clinical problems. The resistance levels differ from country to country and at different locations within the same country due to different degrees of antimicrobial use (Bajaj, Karyakarte, Kulkarni and Deshmukh, 1999; Chomarat 2000; Dyer, Sankary and Dawson 1997), These microbial resistant organisms result in significantly more morbidity, mortality and cost than those due to susceptible bacteria (Karlowsky, Kelly, Thornsberry, Jones and Sahm 2002). Because most urinary tract infections (UTIs) are treated empirically (Mansouri and Khaleghi 1997; Ang, Ezike and Asmar 2004; Rajaduraipandi, Mani, Panneerselvam, Bhaskar and Manikandan 2006), the selection of an antimicrobial agent should be determined not only by the most likely pathogen but also by its expected susceptibility pattern. Unfortunately, there is inadequate information in Ghana on the susceptibility of microorganisms to antimicrobial agents used for treatment of patients.

Clinical infection of the urinary tract is said to exist when a significant number of microorganisms, usually greater than 10^5 cells per millilitre of urine, are detected in properly collected mid-stream “clean catch” urine or from a catheter specimen. Infections of the urinary tract are among the most common infectious diseases in humans, possibly because the urinary tract is in direct contact with the exterior (Cosgrove, Sakoulas, Perencevich, Schwaber, Karchmer and Carmeli 2003).

UTIs are often perplexing and painful (Krumpermann 1999). Treatment is usually initiated before urinary culture and sensitivity test results are available (Gordon and Jones 2003; Gupta, Sahm, Mayfield and Stamm 2001). Therefore, it is important to monitor the status of antimicrobial resistance among uropathogens in order to

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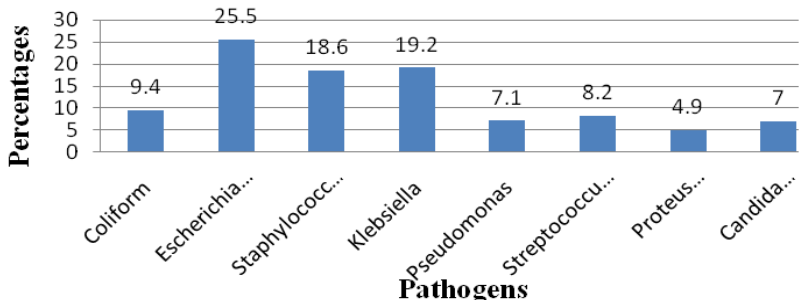

Figure 1: Frequency of various pathogens isolated from a large Ghanaian hospital from 2009-2010

improve treatment recommendations (Sahm, Mayfield and Stamm 2001). It is worth noting that there may be marked differences in antibiotic resistance patterns to different isolates of the same genus. An example is *Escherichia coli* (Williams 1996; McCaig, Stewart, Hervey, Downie and Scott 1995).

This study was carried out to investigate the pathogen prevalence and antimicrobial susceptibility patterns of the most prevalent pathogen isolated from urine samples of some patients at a large Ghanaian hospital. Analysis of this antimicrobial susceptibility data provides information for selection of antimicrobials for empiric treatment of UTIs in Ghana.

MATERIALS AND METHODS

This is a demonstrative study which was conducted at a large Ghanaian hospital in Accra. Antimicrobial sensitivity results of the top eight (8) most frequently isolated bacterial pathogens from urine samples between, 2009 and 2010 in the laboratory record books were collected and analyzed.

Bacterial Isolation

Urine samples were cultured on Cysteine Lactose Electrolytes Deficient (CLSI 2006) agar (Oxoid Limited, Basingstoke UK). After overnight incubation at 37oC, the bacteria isolates were identified using conventional methods

Susceptibility Testing

The antibiotic susceptibility patterns of isolates were determined by modified Kirby Bauer disc diffusion method against the following antibiotics: Gentamycin (10µg), Cefuroxime (30µg), Nitrofurantoin (200µg), Nalidixic acid (30µg), Ampicillin (25µg), Pipemedic acid (25µg), Cotrimaxazole (25µg) and Tetracycline (10µg). All tests were performed on Muller-Hinton agar (Oxoid Limited, Basingstoke, UK) using antimicrobial impregnated paper disc, Abtek Biological, UK. The zone diameters measured around each disk were interpreted on the basis of guidelines published by the Clinical and Laboratory Standards Institute (CLSI, 2006).

RESULTS

Out of a total of 3774 pathogens isolated from urine culture, 3510 were bacterial isolates and 264 yeast isolates. Most bacteria isolates were Gram negative rods e.g. enterobacteria and *Pseudomonas,* Gram positive cocci e.g. *Staphylococcus* and *Streptococcus spp* and yeast cells were mainly Candida spp. Occurrence of these isolates within the period is summarized in Fig 1

According to figure 1, E. coli (25.5%) was the most prevalent of all the pathogens isolated. This was followed by *Klebsiella* (19.2%) and *Staphylococcus aureus* (18.6%). Other Coliform spp recorded 9.4% and Streptococcus sp 8.2%, Pseudomonas (7.1%) then Candida alibicans (7%), and Proteus sp 4.9%.

A comparison of the occurrence of isolates in 2009 and 2010 are presented in Fig. 2

From figure 2, more Coliforms (13.3%) were isolated in the year 2010 than in 2009. *Pseudomonas* (10.5%), *Proteus species* (5.8%) and *Candida alibicans* (7.5%) all recorded the highest isolate in 2010. In 2009 Klepsiella (22.1%) and *Staphylococcus aureus* (20.2%) recorded the highest isolates. More isolates was recorded for *Escherichia coli* (27%) and *Streptococcus sp* (8.4%) in 2009.

The results indicate that Gentamycin recorded reduction in susceptibility and resistance in 2010. Cefuroxime recorded a sharp reduction in susceptibility than in resistance. Tetracycline showed a slight increase in susceptibility, but showed a sharp increase in resistance. Nitrofuranton recorded a high increase in both susceptibility and resistance to *E. coli* from 2009 to 2010. Nalidixic acid showed marginal increase in both susceptibility and resistance. Ampicillin and Cotrimaxazole showed a high increase in susceptibility and resistance, whilst Pipemedic acid recorded a slight

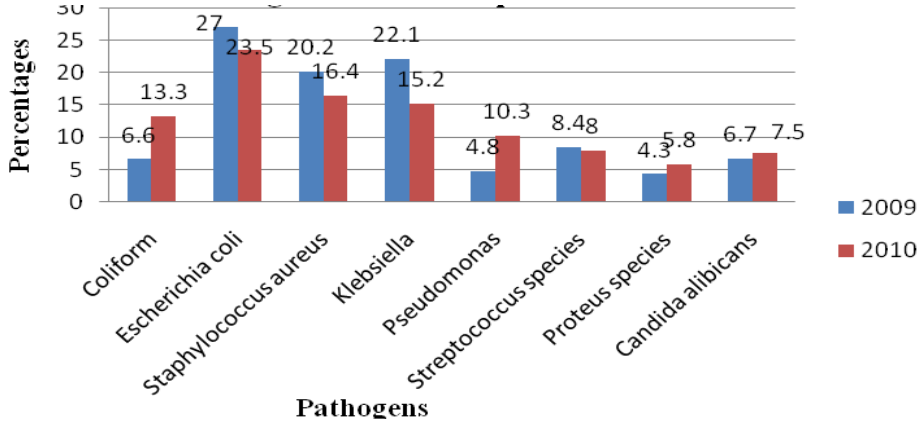

Figure 2: Comparison of pathogens isolated from a large Ghanaian hospital from 2009-2010

Table 1: Susceptibility and resistant levels of *E. coli* to antimicrobial drugs for 2009-2010

Antimicrobial drug	2009				2010			
	S	%	R	%	S	%	R	%
Gentamycin	255	16.9	103	15.6	148	13.4	92	12.5
Cefuroxime	302	20.1	117	17.7	175	15.8	124	16.9
Tetracycline	144	9.6	61	9.2	145	13.1	107	14.6
Nitrofuranton	329	21.8	143	21.7	154	13.9	93	12.7
Nalidixic Acid	172	11.4	88	13.3	126	11.4	94	12.8
Ampicillin	93	6.2	53	8	151	13.7	77	10.5
Pipemedic Acid	148	9.8	61	9.2	101	9.1	70	9.5
Cotrimoxazole	63	4.2	34	5.2	105	9.5	78	10.6

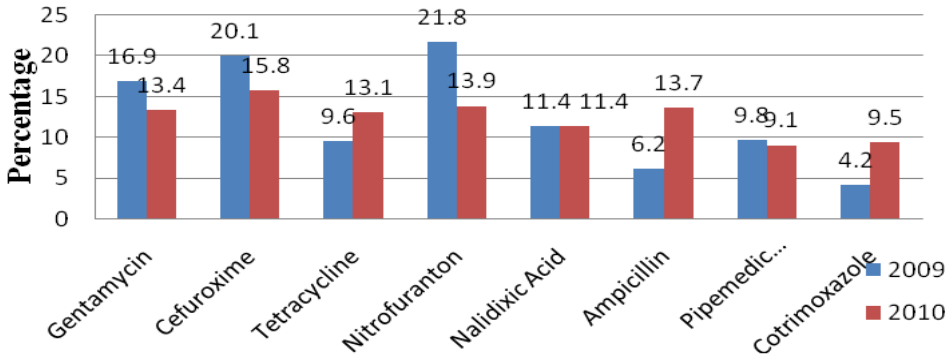

Figure 3: Comparing of susceptibility levels of E. coli to antimicrobial drugs for2009 and 2010

reduction in susceptibility and resistance according to Table 1.

The susceptibility level of Gentamycin to *E. coli* reduced from 13.4% in 2009 to 16.9% in 2010. Cefuroxime also showed reduction in susceptibility from (15.8%) 2009 to (20.1%) 2010. There was drastic reduction in Nitrofuranton susceptibility to *E. coli* from 13.9% to 21.8%. Pipemedic acid showed a slight reduction in susceptibility from 9.8% to 9.1%. Tetracycline showed an increase in susceptibility level from 9.6% to 13.1%, whiles Ampicillin and Cotrmoxazole showed drastic increase in susceptibility levels. Nalidixic acid did not record any change in 2009 and 2010 according to Figure 3.

From figure 4, the resistance level of Gentamycin to *E. coli* reduced from 15.6 to 12.5%. Cefuroxime showed a slight reduction from 17.75 to 16.9%, whiles Tetracycline showed a high increase in resistance from 9.2 to 14.6%. Nitrofuranton reduced drastically from 21.7 in 2009 to 12.7% in 2010 with Nalidixic acid showing a slight reduction in resistance. The resistance of Ampicillin to *E. coli* showed an increment from 85 to 10.5%. Pipemedic

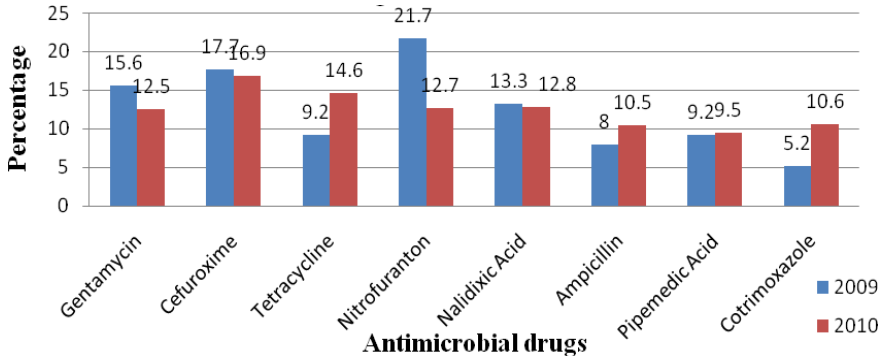

Figure 4: Comparing of resistant levels of E. coli to antimicrobial drugs for2009 and 2010

acid showed a slight reduction in resistance from 9.2 to 9.5% with Cotrimoxazole showing a high increase in resistance from 5.2 to 10.6%.

DISCUSSION

From this study the result showed that the most frequent pathogen isolated from the urine samples was *E. coli* (25.5%) whiles *Proteus sp* was the least of the isolates (4.9%).(Fig 1) This observation is supported by similar studies conducted by Newman et al 2006 and Vasquez and Hand 2004 in Ghana and the United States respectively. Even though occurrence of *E.coli*, *Staphylococcus aureus* and *Klepsiella spp* reduced in 2010 e.g. *E.coli* (27 to 23.5%), *Staphylococcus aureus* (20.2 to 16.4%) and Klepsiella (22.1 to 15.2%). (Fig 2) they still remained the highest isolates in the urine cultures. This means that they form the major causative agent of UTIs. This is worrying because *klebsiella species* and *Escherichia coli* are major producers of Extended-spectrum β-lactamases (ESBLs) that hydrolyse and confer resistance to modern cephalosporins (Thomson, 2001).

High susceptibility value was recorded for Nitrofuranton in 2009 (21.8%) but this reduced drastically in 2010 to 13.9% (Fig 3). This shows that gradually the sensitivity level of Nitrofuranton to *E.coli* is reducing and that its effectiveness in curing UTI is low. This could be that the E coli is also become resistant to nitofuranton. This contradicts a similar study in Pakistan, where the activity of Nitrofurantoin against E.coli increased significantly over six years (Mortazavi and Shahin 2009). This could be due to resistance of *E. coli* to nitrofuranton. It could also be due to geographical differences and locations where the study was conducted. The activity of cefuroxime against *E.coli* has also decreased significantly from 85 to 63.7% (17). This could be as a result of the abuse of the drug; therefore *E.coli* is rapidly developing resistance to it, thereby reducing its susceptibility. Nalidixic acid did not record any change in susceptibility level, this can be as a result of the unused of the antimicrobial drug for some time now since it is perceive not to be effective in the treatment of UTIs.

Ampicillin showed an increase in susceptibility level from 2009 (6.2%) to 2010 (13.7%) (Fig 3), but still remains low. Cotrimoxazole showed 126% increase in susceptibility to *E. coli* in 2010 from 4.2 to 9.5% (Fig 3), but the value is still the low. Ampicillin and Cotrimoxazole has been the most common antibiotics used in treating UTI. This is because they are cheap and readily available over the counter. The increase in the resistance of Ampicillin and Cotrimoxazole could be that for some time Ampicillin and Cotrimoxazole are not being used in treating UTI because of the earlier assertion that it is used by several people so it sensitivity reduced. Gentamycin was less susceptible to *E.coli* in 2010 than in 2009. The resistance of Gentamycin also reduced from 2009 to 2010. The reduction in susceptibility and resistance to *E.coli* was 20.71% and 19.87% respectively.

CONCLUSION

From the results it is realized that Ampicillin, Pipemedic acid and Cotrimoxazole recorded low susceptibility values against *E.coli* and therefore, they cannot be prescribed as antibiotics in treating UTI. From this study it is highly recommended that there should be a continuous monitoring of bacteria antibiotic susceptibility before antibiotic prescription in order to ensure adequate treatment of urinary tract infection and reduction in the spread of bacteria resistant strain.

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