April 30, 2019

PharmacologyOnLine

Archives • 2019 • vol.1 • 166-176

ANTIBIOTIC SUSCEPTIBILITY PATTERN OF *STAPHYLOCOCCUS* SPECIES IMPLICATED IN URINARY TRACT INFECTION IN ENUGU STATE NIGERIA

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Abstract

Staphylococcus species (spp) isolated in significant bacteriuria from patients with signs and symptoms of urinary tract infection (UTI) have often been ignored and untreated which could lead to serious complications. Antibiotic resistance by staphylococci is on the increase. This study aimed at investigating patients with signs and symptoms of UTI, for *Staphylococcus* species UTI and antibiotic susceptibility pattern of the isolates. In this cross-sectional study, 818 patients (290 males and 528 females) seen at the University of Nigeria Teaching Hospital (UNTH) Ituku-Ozalla, Enugu State, Nigeria and Enugu State University Teaching Hospital (ESUTH) Enugu, Nigeria and other patients seen within Enugu metropolis, with signs and symptoms of UTI, were investigated. Ethical approval, informed consents, biodata/socio-demographic variables of the patients were obtained. Clean-catch mid-stream urine samples were collected from the patients. Culture, urinalysis, standard biochemical tests and antibiotic susceptibility tests were performed using standard microbiological methods. Eighty-nine (10.9%) of the samples were positive for *Staphylococcus* species UTI. *Staphylococcus aureus* was the most frequent isolate 40 (44.9%) followed by *S. xylosus*25 (28.1%), *S.lentus* 9 (10.1%), *S. capre*, *S. sciuri*, *S. haemolyticus* and *S. epidermidis* 3 (3.4%) each, *S. hominis*, *S. capitis* and *S. saprophyticus* 1 (1.1%) each. Difference in the number of *Staphylococcus* species isolated was statistically significant ($p < 0.05$). *Staphylococcus* species UTI occurred more in females 77.5% than in males 22.5% ($p < 0.05$). Age group 22-32 years ranked highest 41.6% for staphylococcal UTI. Traders recorded the highest prevalence *for Staphylococcus* species UTI 18.7% amongst occupational groupings. The *Staphylococcus* species showed highest mean susceptibility to levofloxacin (69.7%) followed by ciprofloxacin (66.3%), ampiclox 60.7% and moderate mean susceptibility to streptomycin, erythromycin, gentamycin, amoxyl (51.7% – 57.3%) with norfloxacin as the least (50.6%). Routine screening for *Staphylococcus* species UTI and antibiotic susceptibility tests is recommended.

Keywords: *Urinary tract infection, Staphylococcus species UTI, staphylococcal UTI, antibiotic susceptibility pattern*

Introduction

Urinary tract infection (UTI) is a condition that usually needs urgent attention. It is a significant health problem both in community and hospital based settings, affecting millions of people each year [1].

Urinary tract infection could be defined as the persistence of actively multiplying microorganisms in the urinary tract. It is an infection with more than 100,000 organisms per milliliter in midstream urine sample [2]. The urinary tract consists of the urethra, bladder, ureters and the kidneys. Untreated UTI can lead to complications such as sepsis, kidney damage or scarring, kidney infection [3]. If bacteria move from the infected kidney into the blood, this condition called urosepsis, can cause dangerously low blood pressure, shock and death [4]. Other complications include premature or low weight infant [5].

The vast majority of UTI's are caused by the bacterium *Escherichia coli* (*E. coli*) usually found in the digestive system [5]. Some studies on UTI have isolated *Staphylococcus aureus* (*S. aureus*) in significant bacteriuria [6,7,8,9]. Scanty studies have reported *Staphylococcus saprophyticus*[10] and *Staphylococcus epidermidis* {11] as causative agents of UTI. *Staphylococcus aureus*, *Staphylococcusepidermidis* and *Staphylococcus saprophyticus* have also been reported in the study of Erfani*et al* [12] as agents of UTI.

Staphylococcus species encountered in significant bacteriuria in patients with signs and symptoms of UTI in the present study area have often been ignored, unreported and untreated because they are regarded as contaminants in urine by most clinicians in the present study area. Some are treated empirically, disregarding the laboratory results without regards to antibiotic susceptibility tests on the isolates. This could lead to *Staphylococcus* antibiotic resistance which is on the increase globally. Secondly, apart from *S. aureus* UTI which is scantly reported based on coagulase tests results done in most laboratories in the present study area, most *Staphylococcus* species UTI cases are not reported due to unavailability of API® staph typing kits (Api®*Staph* is an identification system for staphylococci, *Micrococcus* and related genera) for their speciation. Scanty reports on coagulase negative *Staphylococcus* (CoNS) as agents of UTI exists and needs verification. The present study therefore aimed at investigating patients with signs and symptoms of UTI seen at two tertiary hospitals in Enugu state Nigeria and within Enugu metropolis, for *Staphylococcus* species UTI, determine its prevalence, epidemiology and antibiotic susceptibility pattern of the staphylococcal isolates to commonly used antibiotics in the study area.

Methods

Study design

This was a cross-sectional study.

Study area

This study was conducted in Enugu State, South East Nigeria. Nigeria is located in West Africa.

Study population

The study population consisted of 818 patients (290 males and 528 females) seen as in-patients and out-patients at the University of Nigeria Teaching Hospital (UNTH) Ituku-Ozalla, Enugu State, Nigeria and Enugu State University Teaching Hospital (ESUTH), Enugu and within Enugu metropolis, with two or more signs and symptoms of UTI (urinary frequency, urinary urgency, dysuria, fever, flank pain) and who had not taken any antibiotic therapy two weeks before and during sample collection. All the participants were grouped into eight occupational groups which included pupils (nursery and primary schools), students of secondary schools, students of tertiary institutions, civil servants, traders, housewives, artisans, and transporters. The patients were aged between 3 and 87 years.

Sampling Methods

Ethical approvals were obtained from the Research and Ethics committees of the University of Nigeria Teaching Hospital (UNTH) Ituku-Ozalla, Enugu State, Nigeria and Enugu State University Teaching Hospital (ESUTH), Enugu, Nigeria. Informed consents (both oral and written) were obtained from the patients or their parents/guardians (for those under 18 years) before sample collection. The 818 participants were randomly selected and included in the study. Biodata and socio-demographic variables of the

patients were obtained by oral interviews and by use of structured questionnaires and this included the age, sex, marital status, residential address, occupation and clinical details such as parity, gestational age, trimester (for pregnant women), symptoms of UTI such as frequency, urgency, dysuria, fever, flank pain or abdominal pain.

Sample Collection

Clean-catch early morning mid-stream urine sample was collected by each patient using sterile universal bottle containing boric acid which was given to the patients. The patients were instructed earlier on how to use the bottles to collect their urine samples. Each batch of urine samples collected was taken immediately to the Microbiology laboratory for analysis.

Culture

Each urine sample was mixed and inoculated onto blood agar, MacConkey agar, and Mannitol salt agar plates and on Sabouraud Dextrose agar tube using sterilized calibrated wire loop delivering 0.002ml of urine. The blood agar, MacConkey agar and Mannitol salt agar plates were incubated at 37°C for 24 hours for possible isolation of bacterial colonies while the Sabouraud Dextrose agar tubes were incubated at 37°C for 48 hours for possible isolation of *Candida* species. Methods were according to [13].

Urinalysis

Macroscopic examination was performed on the urine samples noting their color and turbidity. Urine chemistry was performed on the samples using the dip stick method with Combi 9^{TM} and color changes depicting the presence of some vital parameters such as protein, nitrite, leucocyte esterase, glucose, etc. were noted. The urine samples were centrifuged and urine deposits from each sample was examined microscopically for the presence of WBC's, RBC's, casts, yeast cells, bacteria, etc. Bacteriuria is usually accompanied by pyuria. Pyuria was regarded as significant when > 10WBC's /HPF were observed [14].

Macroscopic Examination of Plate and Tube cultures

After incubation, the plates and tubes were examined macroscopically and samples with growths showing uniform colonial morphology ≥ 10^5CFU/ml of urine were regarded as having significant bacteriuria [13] and if the patient had two or more signs and symptoms of UTI, the patient was regarded as having UTI. The morphological characteristics of the isolates on the agar plates were noted.

Microscopic Examination of Colonies

Gram staining technique was performed on pure isolates from samples with significant bacteriuria and their Gram reaction noted. Pure isolates from each of these samples were sub-cultured respectively onto nutrient agar slants and incubated for 24 hours at 37°c.

Biochemical tests

The sub-cultures were subjected to different biochemical tests based on their cultural characteristics and Gram reaction. These tests include catalase test, coagulase test, oxidase test, DNase test using Deoxyribonuclease test agar (fluca Biochemika 307787), IMViC tests (Indole, Methyl red, Voges-prokauer and Citrate tests), urease test and sugar fermentation tests. The *Staphylococcus* isolates were typed using Api®*Staph* test kit (Biomerieux france) ref 20500. The identity of the *Staphylococcus* species was confirmed using the apiweb^{TM} identification soft-ware (Biomerieux France).

Antibiotic Susceptibility tests

Pure bacterial isolates from the samples with significant bacterial growth were subjected to antibiotic susceptibility tests using the disc diffusion method [15]. Gram positive drug discs used for the staphylococcal isolates and other Gram-positive isolates were ciprofloxacin 10mg, norfloxacin 10mg, gentamycin 10mg, amoxyl 20mg, streptomycin 30mg, erythromycin 30mg, ampicillin + cloxacillin (ampiclox) 20mg, levofloxacin 20mg (Optic Disc, Optun Laboratories Nigeria LTD)

Statistical analysis

Data generated were analyzed using T-tests, one-way analysis of variance (ANOVA), two-way ANOVA, Fishers Exact test.

Results

Out of the 818 persons examined for *Staphylococcus* species UTI, 89 were positive with a prevalence of 10.9%. Females had higher occurrence of staphylococcal UTI 69 (77.5%) than males who had 20 (22.5%). This difference with respect to their initial sample sizes was statistically significant ($p < 0.05$, p value = 0.0068) using fishers exact test for contingency. Age group 22 – 32 years had the highest occurrence of *Staphylococcus* species UTI 37 (41.6%), however, age group difference was not statistically significant ($p > 0.05$, p value = 0.2301) using two-way ANOVA (Table 1).

A total of 89 *Staphylococcus* isolates were obtained from the 89 positive samples with *Staphylococcus aureus* asthe most frequent 40 (44.9%) followed by *Staphylococcus xylosus* 25 (28.1%), *Staphylococcuslentus* 9 (10.1%), *Staphylococcus capre,Staphylococcus sciuri*, *Staphylococcushaemolyticus* and *Staphylococcus epidermidis* 3 (3.4%) each while the least were *Staphylococcushominis*, *Staphylococcuscapitis* and *Staphylococcus saprophyticus* which had 1 (1.1%) each. Variation between the number of the different *Staphylococcus* species isolated was statistical significant ($p < 0.05$, p value = 0.0001) using one-way ANOVA (Figure 1).

Of the 818 patients examined for staphylococcal UTI in the present study, 40 were positive for *Staphylococcus aureus* UTI with a prevalence of 4.9%. Females had higher occurrence of *Staphylococcus aureus* UTI 33 (82.5%) than males who had 7 (17.5%). The difference between the total number of males positive for *S. aureus* UTI and that of positive females with respect to their initial samples size, was statistically significant ($p < 0.0167$) using fishers exact test for contingency. The age group 22 – 32 years had the highest occurrence of *Staphylococcus aureus* UTI 18 (45.0%) but age group difference was not statistically significant ($p > 0.05$, p value = 0.3246) using two-way ANOVA (Table 2).

Out of 818 patients examined for staphylococcal UTI in the present study, 25 were positive for *S. xylosus* with a prevalence of 3.1%. Females had higher occurrence of *S. xylosus* UTI 20 (80%) than males who had 5 (20%). Difference between number of males positive for *S. xylosus* UTI and that of positive females with respect to their initial samples sizes was not significant ($p > 0.05$, p value = 0.1362) using fisher's exact text. Age groups 11 – 21 and 22 – 23 years had the highest occurrence of *S. xylosus* UTI 9 (36%) each, however age group difference was not statistically significant ($p > 0.05$, p value = 0.348) using two-way ANOVA (Table 3).

A total of 9 out of the 818 patients examined, were positive for *S. lentus* UTI with a prevalence of 1.1%. Females had higher occurrence of *S. lentus* UTI 6 (66.7%) than males who had 3 (33.3%). The difference in the total number of *S. lentus* positive cases between males and females with respect to the initial sample sizes was not statistically significant ($p > 0.05$, p value = 1.0000) using fisher's exact test for contingency. The age group 11 – 21 years and 22 – 32 years had the highest occurrence of *S. lentus* UTI 4 (44.4%) each but age group difference was not statistically significant ($p > 0.05$, p value = 0.3209) using one-way ANOVA (Table 4).

Antibiotics susceptibility pattern of the *Staphylococcus* isolates revealed that out of the 8 drugs tested, *Staphylococcus aureus* isolates showed highest susceptibility to levofloxacin (72.5%) followed by ciprofloxacin (65%), ampiclox, erythromycin and streptomycin (60%) each, amoxyl (52.5%) while the least were norfloxacin and gentamycin (47.5%) each. *Staphylococcus xylosus* isolates showed highest susceptibility to ciprofloxacin (68%) followed by levofloxacin and streptomycin (56%) each, ampiclox (52%), gentamycin, amoxyl and erythromycin (48%) each while the least was norfloxacin which had (44%). *Staphylococcus lentus* isolates showed highest susceptibility to amoxyl (77.8%) followed by levofloxacin (66.7%), ciprofloxacin, norfloxacin, gentamycin and ampiclox (55.6%) each while the least were streptomycin and erythromycin (44.4%) each. The susceptibility pattern of the other *Staphylococcus species* isolated are shown in table 5. Overall, the *Staphylococcus* isolates showed highest mean susceptibility to levofloxacin 69.7% followed by ciprofloxacin 66.3%, ampiclox 60.7%, streptomycin and erythromycin 57.3% each, gentamycin 52.8%, amoxyl 51.7% while the least was norfloxacin 50.6% (Table 5).

The overall prevalence of *Staphylococcus* UTI in the entire population studied was 10.9%. Traders recorded the highest prevalence for *Staphylococcus* spp UTI 25/134 (18.7%) followed by transporters

(drivers) 5/29 (17.2%), house wives 5/32 (15.6%), students (tertiary) 18/156 (11.5%), students (secondary) 14/153 (9.2%), pupils 9/112 (8.0%), civil servants 11/165 (6.7%) while the least were artisans 2/37 (5.4%). Variation in the total number of *Staphylococcus spp* UTI positive cases seen between the occupational groups of the patients studied was statistically significant ($p < 0.05$, p value = 0.0256) using fishers exact test for contingency (Table 6).

Of the 307 isolates encountered in the study, *Staphylococcus* spp were the most frequent 89 (29.0%) followed by *Escherichia coli* 72 (23.5%), *Klebsiella*spp 30 (9.8%), *Pseudomonas*spp 27 (8.8%), *Proteus spp* and *Enterococcus faecalis* 21 (6.8%) each, *Streptococcus*spp 19 (6.2%), Diphtheroids and *Bacillus*spp 8 (2.6%) each, *Streptococcus agalactia* 4 (1.3%), *Enterobacter*spp and *Micrococcus*spp 3 (1.0%) each, *Lactobacillus*spp and *Candidaalbicans* 1 (0.3%) each (Figure 2).

Discussion

This study investigated patients with two or more signs and symptoms of UTI for evidence of *Staphylococcus* species UTI. Of the 818 persons investigated, 89 were positive with a prevalence of 10.9% (Table 1). There is paucity of information on the prevalence of *Staphylococcus* species as agents of UTI other than *Staphylococcus aureus*. However, comparison can be made based on the frequency of *Staphylococcus* species isolates amongst other isolates encountered in UTI studies. Of the 818 persons investigated in this study, 307 were positive for UTI with 307 isolates. Of this number of isolates, *Staphylococcus* species ranked highest with 89 isolates (29.0%) followed by *Escherichia coli* 72 (23.5%) and then other organisms (Figure 2). Other studies on UTI have isolated either one or two *Staphylococcus* species amongst other isolates with varying frequencies: *Staphylococcus aureus* 32.35% in Edo State Nigeria [16], *S. aureus* 35.57 % in Abuja Nigeria [17], *S. aureus* 1.4% in Nagaland, india [7], *S. aureus* 1.2% and CoNS O.8% in Tamilnaduindia [8], *Staphylococcus* species 20.2% in Shashemere, Ethiopia [9], *S. saprophyticus* 4.1% in Sao Paulo Brazil [18].

The frequency of 20.2% recorded for *Staphylococcus* species [9] amongst other isolates in their study, is similar to the result of the present study which recorded 29.0% frequency of *Staphylococcus* species amongst other isolates, which could be attributed to the use of ID system of identification protocols by [9] and the use of API Staph identification kit and apiweb^{TM}by the present study for identification and speciation of the *Staphylococcus* isolates encountered in both studies. This may not have been possible in many other studies which isolated mainly *Staphylococcus aureus*.

Females had higher occurrence of *Staphylococcus* species UT1 69 (77.5%) than males who recorded 20 (22.5%) in the present study. The difference between the total number of females positive for *Staphylococcus* species UTI compared to males was statistically significant ($p < 0.05$) (Table 1). Paucity of information exists on sex frequency for *Staphylococcus* species UTI. However, several documented studies have shown female preponderance of UTI than males UTI generally [16,17]. This female preponderance of UTI over males could be attributed to the shorter urethra in females than in males which predisposes females to easier entrance of microbial organisms into the urethral opening from the anus than in the males who have longer urethra.

The age group 22-32 years had the highest occurrence of *Staphylococcus* species UTI 41.6% (Table 1). Similar findings have been recorded in some works on UTI generally. Mane *et al* [8] in their study on UTI at Chennai, TamilNadu, India, recorded the highest occurrence of UTI in the age group 21-40 years while the work of Oladeinde*et al* [16] on UTI in Okada, a rural community in Edo State Nigeria, recorded highest occurrence of UTI in the age group 21-30 years. This is not surprising since these age groups fall within sexually active and reproductive years when men and women indulge in sexual intercourse within and outside marriage and female pregnancy occurs often within these age groups. Sexual activity increases the chances of bacterial contamination of female urethra. Sexual intercourse may also cause bacteria to be pushed into the urethra. The anatomical relationship of the female urethra to the vagina makes it liable to trauma during sexual intercourse as well as bacteria being massaged up the urethra into the bladder during pregnancy or child birth [19]. However, age group difference for the *Staphylococus* species UTI positive cases in the present study was not statistically

significant ($p > 0.05$, p value = 0.2301) using two-way ANOVA.

Of the 89 staphylococcal isolates encountered in this study, *S. aureus* was the most frequent 40 (44.9%) followed by *S. xylosus* 25 (28.1%), *S. lentus* 9 (10.1%), *S. capre*, *S. sciuri*, *S.haemolyticus*and *S. epidermidis* 3 (3.4%) each, *S. hominis*, *S. capitis* and *S. saprophyticus* 1 (1.1%) each (Figure 1). The result of the present study seems to be in agreement with the findings of Bolaji*et al* (20) in their study on incidence of uro-pathogens from asymptomatic bacteriuric pregnant women in Zaria, Nigeria, in which they obtained 50 *Staphylococcus* isolates with *S. aureus* as the most frequent 7 (18.0%), followed by *S. xylosus* 5 (12.8%), *S. lentus* 3 (7.7%), *S. auricularis* 2 (5.1%), *S. cohnii*, *S. epidermidis* and *S. hemolyticus* 1(2.6%) each, other *Staphylococcus* spp 15 (38.5%). Both studies isolated *S. aureus* as the most frequent *Staphylococcal* isolates.*Staphylococcus aureus* may have acquired more pathogenic armories which could make it to be more invasive and pathogenic than the other *Staphylococcus* species encountered in both studies, hence the highest frequency of *S. aureus* obtained. In their study in Iran, Erfani [12] isolated *S. aureus*, *S. epidermidis* and *S. saprophyticus* from UTI cases. The emergence of unpopular CoNS*Staphylococcus* species in UTI in this study could be a new trend in UTI in the present study area or may be as a result of use of better methods of identification and speciation of the *Staphylococcus* isolates in UTI such as the API Staph kit and apiweb™ identification software used in this study.

The prevalence of *S. aureus*, *S. xylosus* and *S. lentus* UTI's were 4.9%, 3.1% and 1.1% respectively in the present study. The age group 22-32 years recording the highest occurrence of *S. aureus* UTI while age group 22 – 32 and 33 – 34 years recorded highest occurrence for *S. xylosus* UTI (36%) each and for *S. lentus* UTI (44.4%) each (Tables 2,3 and 4). However, difference in the distribution of positive cases between the age groups studied for *S. aureus*, *S. xylosus* and *S. lentus* UTI's was not statistically significant ($p > 0.05$) respectively. These age groups 22 – 33 and 33 – 44 years are sexually active and reproductive years. Sex and pregnancy predisposes to UTI.

Females had higher occurrence of *S. aureus*, *S. xylosus* and *S. lentus* UTI than males in the present study (Tables 2,3 and 4). The difference between the total number of males and females positive for *S. aureus* UTI was statistically significant ($p < 0.05$) but this difference was not statistically significant for *S. xylosus* UTI and *S. lentus* UTI ($p > 0.05$) respectively.

Results of the antibiotic susceptibility test showed that the *S. aureus* isolates were most sensitive to levofloxacin 72.5% followed by ciprofloxacin 65%, erythromycin, ampiclox and streptomycin 60 % each, ampiclox 52.5, gentamycin and norfloxacin 47.5% each (Table 5). The work of Amaeze *et al* [17] on UTI in Abuja, Nigeria, revealed that the *S. aureus* isolates they obtained from UTI showed high susceptibility to erythromycin 86.49%, streptomycin 54.1%, levofloxacin 67.68%. Similarities exist between the results of [17] and the present study since *S. aureus* isolates in both studies showed susceptibility to levofloxacin 67.68 % versus 72.5%, streptomycin 54.1% versus 60% and erythromycin 86.49 versus 60 % for both studies respectively. *Staphylococcus xylosus* showed highest susceptibility to ciprofloxacin 68% followed by levofloxacin and streptomycin 56% each and thirdly ampiclox 52% while other drugs followed. *Staphylococcus lentus* showed highest sensitivity to amoxyl 77.8% followed by levofloxacin 66.7%, ciprofloxacin, ampiclox, gentamycin and norfloxacin 55.6% each and then other drugs. Overall, the *Staphylococcus* isolates showed highest mean susceptibility to levofloxacin 69.7% followed by ciprofloxacin 66.3%, ampiclox 60.7% and moderate susceptibility to streptomycin and erythromycin 57.3% each, gentamycin 52.8%, amoxyl 51.7% while the least was norfloxacin 50.6% (Table 5).

Traders showed highest prevalence for Staphylococcal species UTI 18.7% amongst the occupational groups studied. This could be attributed to their long stay in the market and their use of public toilets most of which have dirty door handles, dirty walls and floors, which are heavily contaminated with staphylococci, which predisposes them (on contact as fomites) to staphylococcal UTI (Table 6).

In conclusion, the present study showed a prevalence of 10.9% for staphylococcal species UTI. Ten species of staphylococci were implicated as causes of UTI in this study therefore revealing the presence of unpopular *Staphylococcus* species as

agents of UTI in our environment with *S. aureus*, *S. xylosus* and *S. lentus* as the most frequent. The study also revealed female preponderance of *Staphylococcus* species UTI over males. Occupational groupings of the patients revealed highest prevalence of staphylococcal UTI amongst traders. Levofloxacin followed by ciprofloxacin, have shown to be drugs of choice in the treatment of *Staphylococcus* species UTI. It is recommended that *Staphylococcus* species should be screened for routinely during UTI investigations in clinical laboratories while antibiotic susceptibility tests should be carried out on *Staphylococcus* isolates in significant bacteriuria from persons with signs and symptoms of UTI.

Acknowledgments

The authors wish to thank the management of University of Nigeria Teaching Hospital (UNTH) Ituku-Ozalla, Enugu State, Nigeria and Enugu State University Teaching Hospital (ESUTH), Enugu, Nigeria, for granting us Ethical approvals which enabled us to use their patients for this study. We also thank all the doctors in charge of clinics and wards whose patients participated in the study as well as the nurses in these clinics/wards who assisted us in the study. Thanks to all the patients who participated in the study.

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Table 1. Distribution of positive cases for staphylococcal species urinary tract infection in the population studied according to age group and sex
n = 818

Age group (years)	No of Males sampled	No of females sampled	Total M+F sampled	No of males positive	%	No of females positive	%	Total No of M+F positive	%
0 – 10	43	33	76	3	100	0	0	3	3.4
11 – 21	50	178	228	3	12.0	22	88	25	28.1
22 – 32	70	174	244	7	18.9	30	81.1	37	41.6
33 – 43	30	82	112	2	16.7	10	83.3	12	13.5
44 – 54	41	35	76	1	16.7	5	83.3	6	6.7
55 – 65	34	18	52	3	60.0	2	40.0	5	5.6
66 – 76	17	7	24	1	100	0	0	1	1.1
77 – 87	5	1	6	0	0	0	0	0	0
Total	**290**	**528**	**818**	**20**	**22.5**	**69**	**77.5**	**89**	**10.9**

Key M = Males, F = Females

Table 2. Distribution of positive cases for *Staphylococcus aureus* urinary infection in the population studied according to age group and sex
n = 818

Age group (years)	No of Males sampled	No of females sampled	Total M + F sampled	No of males positive	%	No of females positive	%	Total No of M + F positive	%
0 – 10	43	33	78	1	100	0	0	1	2.5
11 – 21	50	178	228	1	11.1	8	88.9	9	22.5
22 – 32	70	174	224	2	11.1	16	88.9	18	44.0
33 – 43	30	82	112	1	14.3	6	85.7	7	17.5
44 – 54	41	35	76	1	33.3	2	66.7	3	7.5
55 – 65	34	18	52	1	50.0	1	50.0	2	5.0
66 – 76	17	7	24	0	0	0	0	0	0
77 – 87	5	1	6	0	0	0	0	0	0
Total	**290**	**528**	**818**	**7**	**17.5**	**33**	**82.5**	**40**	**4.9**

Key: M = Males, F = Females

Table 3. Distribution of positive cases for *Staphylococcus xylosus* urinary tract infection in the population studied according to age group and sex
n = 818

Age group (years)	No of Males sampled	No of females sampled	Total M+F sampled	No of males positive	%	No of females positive	%	Total No of M+F positive	%
0 – 10	43	33	76	0	0	0	0	0	0
11 – 21	50	178	228	0	0	9	100	9	36.0
22 – 32	70	174	244	3	33.3	6	66.7	9	36.0
33 – 43	30	82	112	0	0	3	100	3	12.0
44 – 54	41	35	76	0	0	1	100	1	4.0
55 – 65	34	18	52	1	50	1	50.0	2	8.0
66 – 76	17	7	24	1	100	0	0	1	4.0
77 – 87	5	1	6	0	0	0	0	0	0
Total	**290**	**528**	**818**	**5**	**20%**	**20**	**80**	**25**	**3.1**

Key: M = Males, F = Females

Table 4. Distribution of positive cases for *Staphylococcus lentus* urinary tract infection in the population studied according to age group and sex
n = 818

Age group (years)	No of Males sampled	No of females sampled	Total M+F sampled	No of males positive	%	No of females positive	%	Total No of M+F positive	%
0 – 10	43	33	76	0	0	0	0	0	0
11 – 21	50	178	228	2	50.0	2	50.0	4	44.4
22 – 32	70	174	244	0	0	4	100	4	44.4
33 – 43	30	82	112	1	100	0	0	1	11.1
44 – 54	41	35	76	0	0	0	0	0	0
55 – 65	34	18	52	0	0	0	0	0	0
66 – 76	17	7	24	0	0	0	0	0	0
77 – 87	5	1	6	0	0	0	0	0	0
Total	**290**	**528**	**818**	**3**	**33.3**	**6**	**66.7**	**9**	**1.1.0**

Key: M = Males, F = Females

Table 5. Antibiotic susceptibility pattern of the *Staphylococcus* isolates from the urine culture of the patients

Staphylococcus isolates	Total	CPX (%)	NB (%)	CN (%)	AMX (%)	S (%)	E (%)	APX (%)	LEV (%)
S. *aureus*	40	26 (65.0)	19 (47.5)	19 (45.5)	21 (52.5)	24 (60.0)	24 (60.0)	24 (60.0)	29 (72.5)
S. *xylosus*	25	17 (68.0)	11 (44.0)	12 (48.0)	12 (48.0)	14 (56.0)	12 (48.0)	13 (52.0)	14 (56.0)
S. *lentus*	9	5 (55.6)	5 (55.6)	5 (55.6)	7 (77.8)	4 (44.4)	4 (44.4)	5 (55.6)	6 (66.7)
S. *capre*	3	3 (100)	3 (100)	3 (100)	2 (66.7)	2 (66.7)	2 (66.7)	3 (100)	3 (100)
S. *sciuri*	3	2 (66.7)	2 (66.7)	2 (66.7)	1 (33.3)	1 (33.3)	2 (66.7)	2 (66.7)	2 (66.7)
S. *haemolyticus*	3	2 (66.7)	2 (66.7)	2 (66.7)	2 (66.7)	2 (66.7)	2 (66.7)	2 (66.7)	2 (66.7)
S. *epidermidis*	3	3 (100)	2 (66.7)	2 (66.7)	0 (0)	3 (100)	3 (100)	3 (100)	3 (100)
S.*hominis*	1	1 (100)	1 (100)	1 (100)	0 (0)	0 (0)	1 (100)	1 (100)	1 (100)
S. *capitis*	1	0 (0)	0 (0)	1 (100)	1 (100)	1 (100)	1 (100)	1 (100)	1 (100)
S. *saprophyticus*	1	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (100)
Total	89	59 (66.3)	45 (50.6)	47 (52.8)	46 (51.7)	51 (57.3)	51 (57.3)	54 (60.7)	62 (69.7)

CPX---Ciprofloxacin, NB---Norfloxacin, CN---Gentamycin, AMX ---Amoxyl, S ---Streptomycin, E ---Erythromycin
APX---Ampiclox, LEV---Levofloxacin

Table 6. Prevalence of *Staphylococcus* species UTI in the population Studied according to the occupational groupings of the patients studied

Occupation of patients studied	No of patients sampled			No positive			% Prevalence
	M	F	T	M	F	T	
Students (Tertiary)	42	114	156	5	13	18	11.5
Students (Secondary)	31	122	153	1	13	14	9.2
Pupils (Nursery and primary)	61	51	112	5	4	9	8.0
Civil Servants	67	98	165	0	11	11	6.7
Traders	44	90	134	4	21	25	18.7
House Wives	0	32	32	0	5	5	15.6
Artisans	16	21	37	0	2	2	5.4
Transporters (Drivers)	29	0	29	5	0	5	17.2
Total	**290**	**528**	**818**	**20**	**69**	**89**	**10.9**

Figure 1. Frequency distribution of Staphylococcus species in urinary tract infection in the population studied

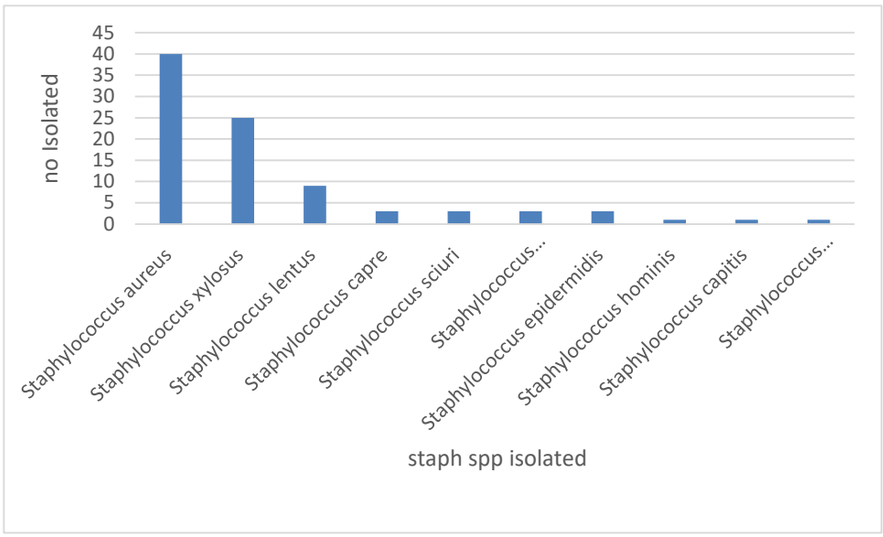

Figure 2. Frequency distribution of isolates from urine samples of the patients studied