The antibiotic sensitivity pattern of s. aureus; an ocular normal flora

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ABSTRACT

Objective: **To determine the changing of drug sensitivity patterns for s. aureas as the second commonest bacteria of the conjunctival normal flora in Nairobi, Kenya**

Design: **Descriptive retrospective study**

Setting: **University of Nairobi, Department of Ophthalmology and Kikuyu Eye Unit**

Subjects: **37 (28%) asymptomatic volunteers at KNH and KEU with no signs of ocular infections or ocular surface abnormalities from January 1994 to December 1997 were selected.**

Results: **A total of 37 cases were tested positive for S. aureus. The micro organism showed high resistance to amoxtcillin, aminoglycosides, 1st and 2nd generation Flouroquinolones except Ofloxacin and tetracycline. It was sensitive to carbenocillin, polymyxin B and chloramphenocol and highly sensitive to Cephalexin and ciprofloxacin.**

Conclusion: **The percentage of positive finding of S. aureus of the conjunctival normal flora is comparable to that in other regions of the world. We found a high resistance to most of the commonly locally prescribed antibiotics.**

INTRODUCTION

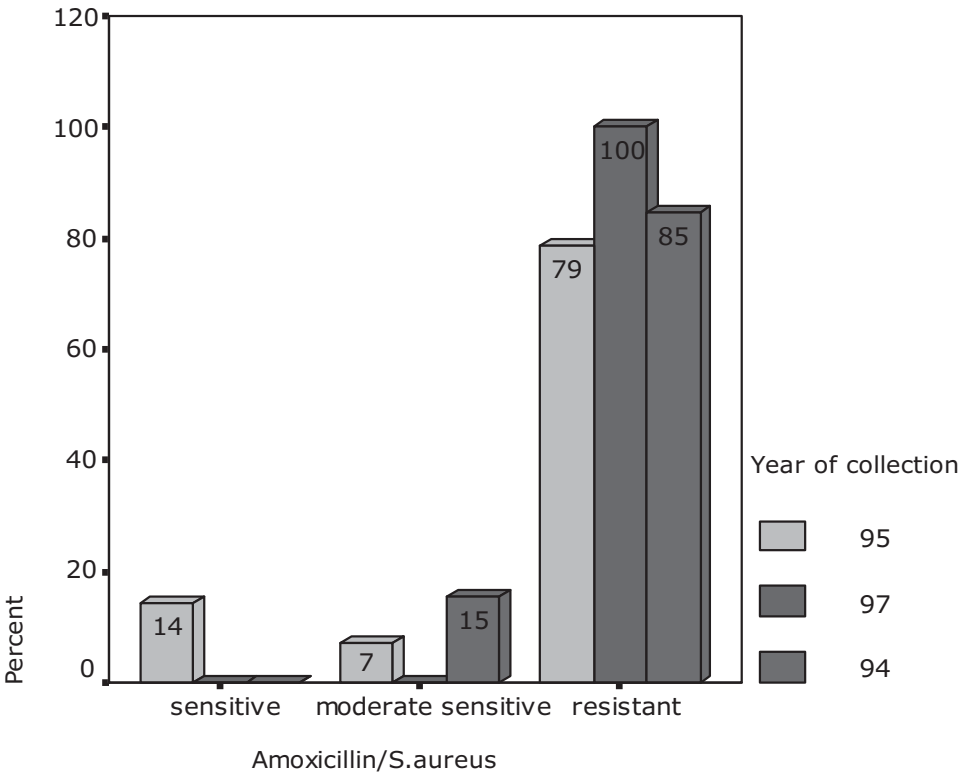
Normal ocular flora constitutes those organisms normally present on the eyelid and conjunctiva. These organisms are considered to be saprophytic without causing any diseases but have the potential to become pathogenic when the normal defence mechanisms are faultered.[1,2] The normal conjunctival flora appears to be derived from the skin and it establishes itself a few weeks after birth forming an equilibrium within the conjunctival sac. This is protective against the proliferation of pathogenic bacteria. [3] In conjunctival smears, the bacterial species widely predominate over fungal, parasitic or viral elements. Out of the over sixty-five validated types of conjunctival bacteria, Gram-positives bacteria predominate. These include the CNS genuses, Propionibacterium and Corynebacterium species as well as Peptostreptococcus, Streptococcus and Actinomyces families. Gram negatives include Neisseria, Haemophillus and Proteus sp. from the Enterobacteriaceae family.[4] In a study done on the antibiotic susceptibility pattern of bacterial ocular flora by Mino de Kasper et al on one hundred and sixty four patients prior to undergoing eye surgery, they isolated bacteria in one hundred and sixty two patients. The commonest bacteria isolated were CNS (76%) with two percent resistant to Gatifloxacin and Moxifloxacin whereas none were susceptible to Minocycline or Vancomycin. Other species isolated included nineteen S. aureus, eleven Gram negative rods, eight Streptococcus Group D. most S. aureus were susceptible to all antibiotics accept Penicillin and Macrolides.[5] These are permanent flora which represents true colonisation and repeated cultures usually reveal the same organism in large numbers. Resident ocular flora typically includes: Staphylococcus epidermidis, Diphtheroids and Staphylococcus aureus (recovered from 33% of normal eyes). Knowledge of the normal flora of the conjunctiva and the changing resistance and sensitivity patterns is important, as these germs can be responsible for the invasion of ocular structures when defense mechanisms are compromised. This will assist practicing Ophthalmologists in the region in their choice of appropriate antibiotic treatment prior to culture and sensitivity results, and especially so in regions where laboratory facilities are not widely available. It may also assist in reducing the injudicious use of antibiotics. Our aim was therefore to determine the changing drug sensitivity patterns for Coagulase negative staphylococcus a commonly occurring ocular normal flora in the normal conjunctiva

METHODS

Data were compiled from microbiology records of the years 1994 (15 cases), 1995 (31cases) and 1997 (9cases). Samples from 37 asymptomatic volunteers at Kenyatta National Hospital (KNH) and Kikuyu Eye Unit (KEU) with no signs of ocular infections or ocular surface abnormalities were collected at the microbiology laboratory in the Department of Ophthalmology, University of Nairobi in the years 1994 to 1997. Some of the data collected in 1995 was from preoperative patients without ocular surface disorders who were scheduled for intra ocular surgery at the KEU near Nairobi. Informed verbal consent was taken. The samples were inoculated immediately on culture plates (Blood Agar, Chocolate Agar, & Thioglycolate Agar). After 24hrs of incubation at 37°C, the plates were inspected for colony growths which were then processed for identification. In case of no growth the plates are reincubated for further 24hrs before reporting it as a negative growth. The samples from KEU were transported immediately to the microbiology laboratory at the Department of Ophthalmology, where the plates were reincubated and slides were stained for microbiological examination. The Kirby Bauer disc diffusion method of sensitivity testing was applied.[6] The antibiotics tested were Amoxicillin, Carbenicillin, Cephalexin, Chloramphenicol, Ciprofloxacin, Norfloxacin, Ofloxacin, Gentamicin, Tobramycin, Tetracycline and Polymixin B. The antibiotics chosen were representative of specific groups of antibiotics and the most commonly used antibiotics in the region.

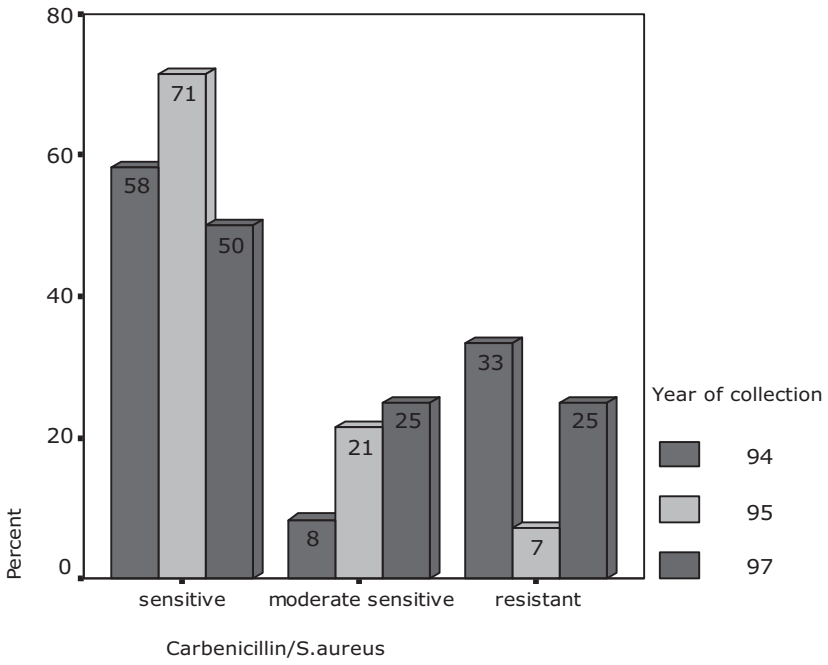
RESULTS

Figure 1: Amoxicillin sensitivity pattern (n=32)



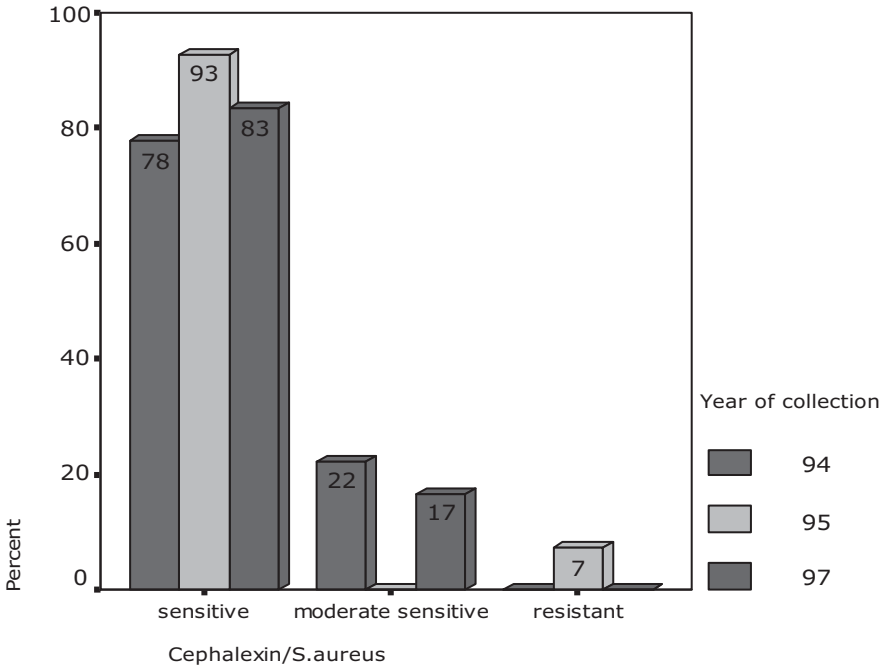
S. Aureus was highly resistant to Amoxicillin had been highly resistant all through P=0.431.

Figure 2: Carbenicillin sensitivity pattern (n=30)



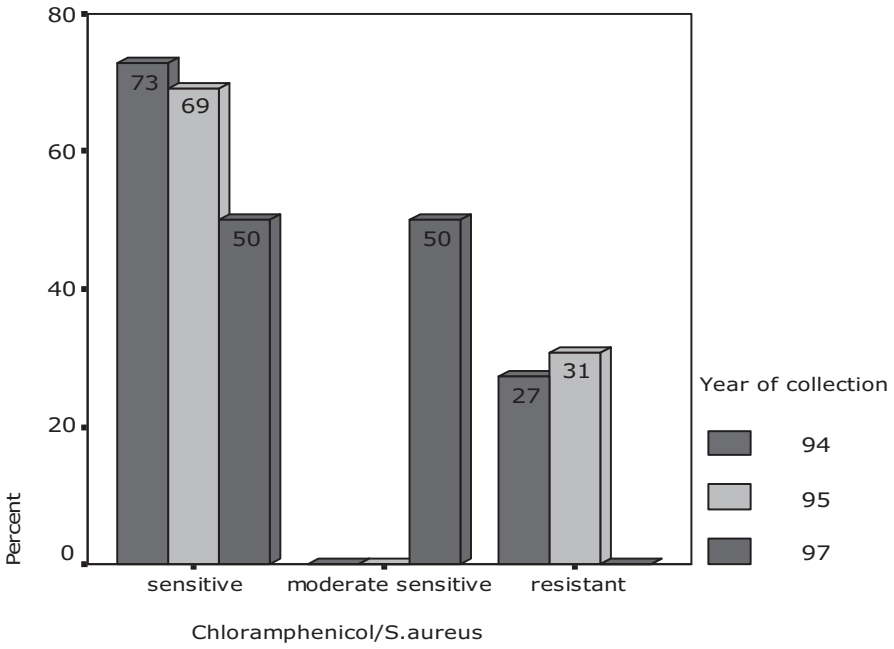
S. aureus was resistant to Carbenicillin all through (P=0.488)

Figure 3: Cephalexin sensitivity pattern (n=29)



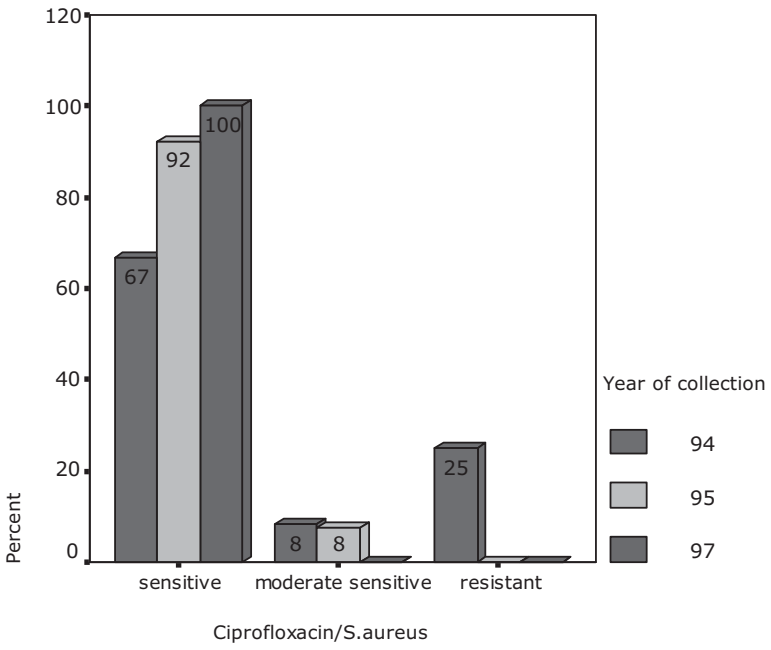
Cephalexin had good sensitivity pattern (P=0.389) for S. aureus all through

Figure 4: Chloramphenicol sensitivity pattern (n=26)



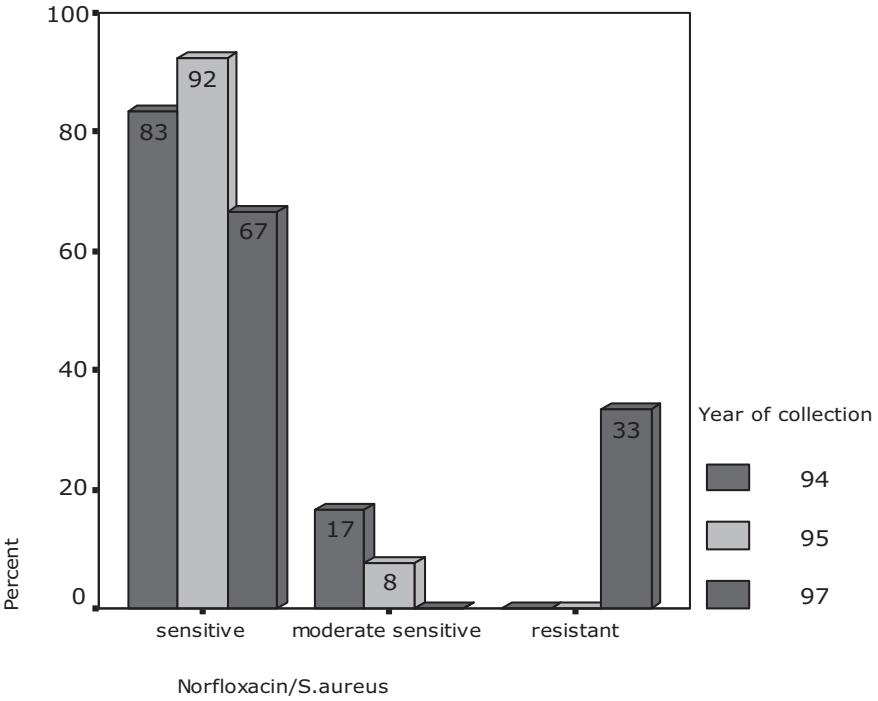
There was a statistically significant fall in the resistance of S. aureus to Chloramphenicol over the years (P=0.013)

Figure 5: Ciprofloxacin sensitivity pattern (n=29)



There was a steady increase in the sensitivity of S. aureus to Ciprofloxacin (P=0.264)

Figure 6: Norfloxacin sensitivity pattern (n=28)



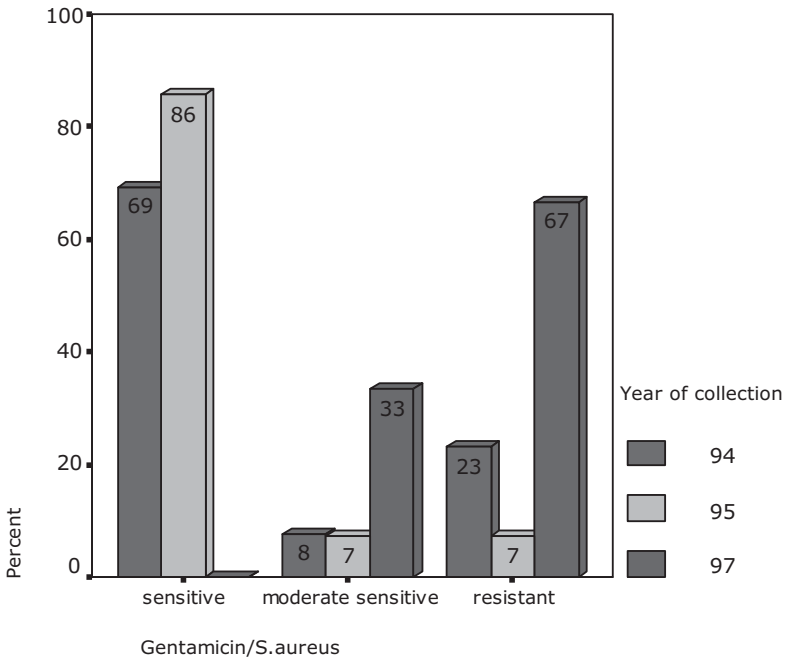
There was an increase in the resistance of S. aureus to Norfloxacin in 1997. However there were only 3 cases tested for the sensitivity. (P=0.053)

Table 1: Ofloxacin sensitivity pattern (n=20)

	Year of collection					
	1994		1995		1997	
Ofloxacin	Count	%	Count	%	Count	%
Sensitive	6	100.0%	13	100.0%	1	100.0%
Moderate sensitivity	0	0%	0	0%	0	0%
Resistant	0	0%	0	0%	0	0%
Total	6	100.0%	13	100.0%	1	100.0%

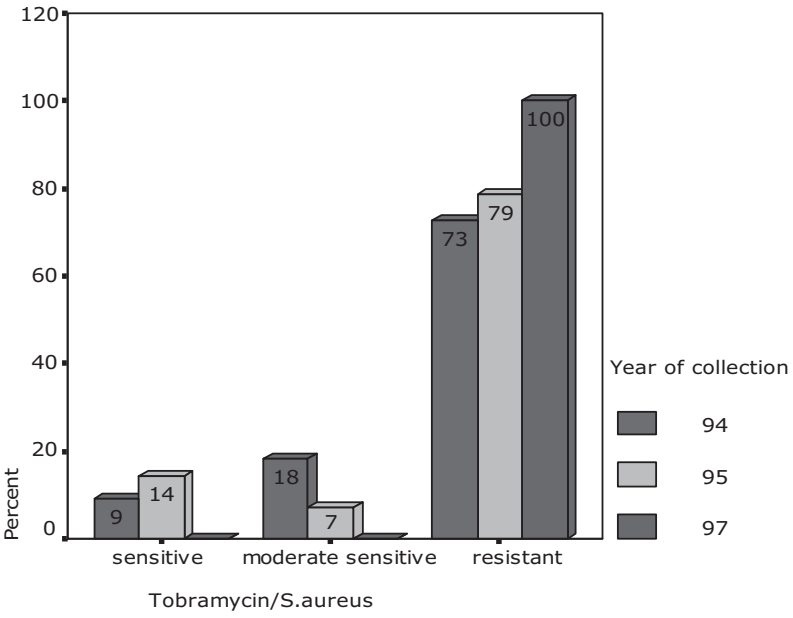
S. Aureus remained 100% sensitive to Ofloxacin all through the years

Figure 7: Gentamicin sensitivity pattern (n=30)



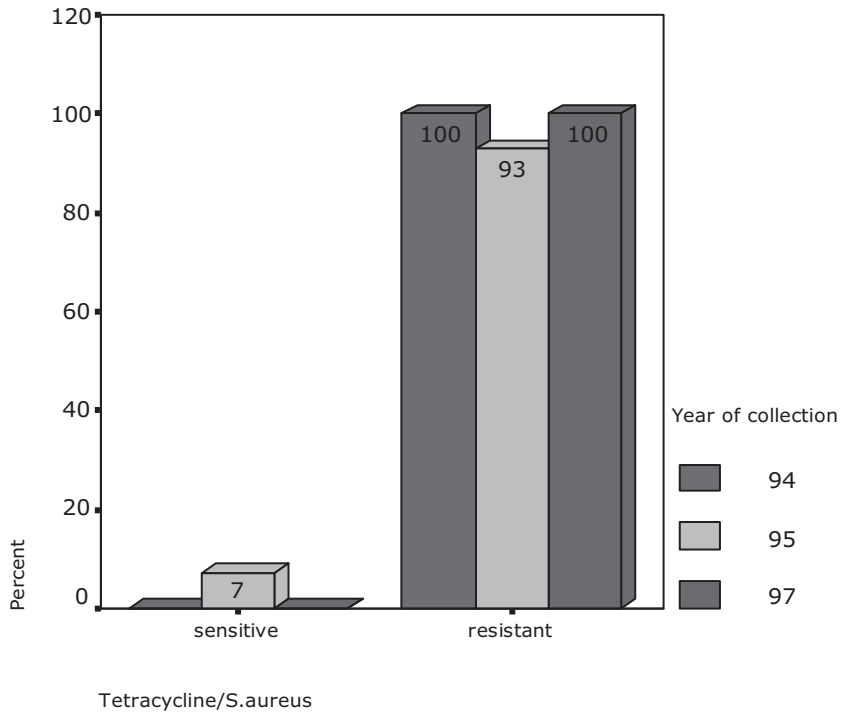
S. aureus had increased in resistance to Gentamicin over the years (P=0.064)

Figure 8: Tobramycin sensitivity pattern (n=30)



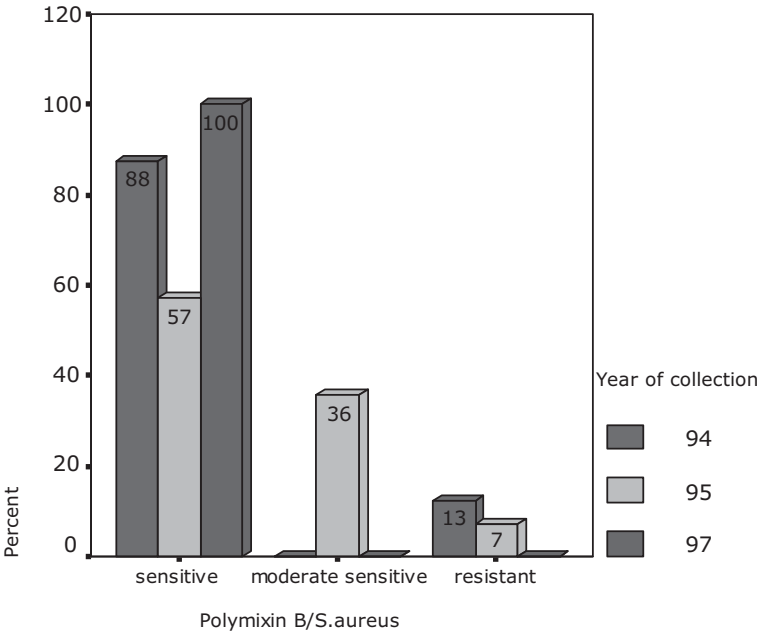
There was a steady increase in the resistance of S. aureus to Tobramycin over the years (P=0.655)

Figure 9: Tetracycline sensitivity pattern (n=24)



S. aureus had remained highly resistant to Tetracycline over the years (P=0.689)

FIGURE 10: Polymixin B sensitivity pattern (n=23)



S. aureus remained sensitive to Polymixin B. There had been a gradual decrease in the resistance over the years (P=0.369)

DISCUSSION

Out of the over Sixty five validated types of the bacteria of the conjunctiva, gram positive bacteria predominate.[4] In our study, S. aureus was the second most commonly occurring micro organism of the conjunctival normal flora in our region. The tested antibiotics represent frequently used antibiotics in our setting. Fig 1 shows the sensitivity pattern of Amoxicillin, Penicillin with an extended spectrum of activity. S. aureus has a high level of resistance to this antibiotic over time. In previous studies done by Patel and Gichangi, they reported high level of resistance. Although both authors examined pathologies and not normal flora, we can still compare resistance patterns since the organisms have been shown to share the same genetic pattern from other studies. The same organisms have been shown to be causative agents in some of the infections.[7,8] Fig. 2 shows the sensitivity pattern of Carbenicillin an antibiotic with anti pseudomonal activity. S. aureus showed moderate sensitivity all through the years, Carbenicillin is an infrequently used antibiotic in this region and this could explain the consistently good sensitivity of the antibiotic over the years. In previous studies from this region Mundia found a resistance of 5% for Cephalexin to CNS.[9, 10] Fig. 3 shows the sensitivity pattern of Cephalexin, a 1st generation cephalosporin whereby the sensitivity of the antibiotic remained overall good (>80%) against S. aureus. In general the results do show that S. aureus has a good sensitivity pattern to Cephalosporins. This may be due to the fact that this group of antibiotics had not been commonly used in the region prior to this study. Figure 4 shows that Chloramphenicol sensitivity has gradually changed overall from 1994 to 1997. S. aureus shows a gradually increasing resistance to Chloramphenicol. The antibiotic is used more in the pediatric age group on suspicion of H. influenza and in adults in meningitis. The frequent usage as a systemic antibiotic may have contributed to the cross resistance of the antibiotic, hence the reduction in sensitivity. The 1st and 2nd generation Flouroquinolones studied included Ciprofloxacin, Norfloxacin and Ofloxacin. Fig. 5 shows the sensitivity pattern of S. aureus to Ciprofloxacin. The sensitivity has remained good overall. S. aureus has good sensitivity to Norfloxacin although there is a general reduction in the sensitivity in 1997 to 67% (Fig 6). S. aureus has remained highly sensitive to Ofloxacin all thorough the years. This was the first topical Flouroquinolone to be introduced in the region. The emerging resistance to Ciprofloxacin and Norfloxacin could be due to the increasing systemic and local usage of the two Flouroquinolones and the ready availability of the antibiotics in the market. Ofloxacin was not widely used in 1994 and 1997. Our figures are similar especially for Ciprofloxacin with that of Patel (20%),[8] but higher then that of Gichangi (no resistance) [8] and Mundia (no resistance)[10]. However our figures for Norfloxacin and Ofloxacin are comparable with these studies. Other studies have shown that there is raising emergence of resistance to the Flouroquinolones especially Ciprofloxacin. Our results follow suit for Ciprofloxacin and Norfloxacin but Ofloxacin has remained an antibiotics with low resistance.[10,11,12] The two Aminoglycosides studied were Gentamicin and Tobramycin. In Fig. 8, S. aureus shows a statistically significant increase in its resistance to Gentamicin from 1994 to 1997. S. aureus shows a reduction in the sensitivity of Gentamicin from 1994 to 1995. Fig. 9 shows a reducing sensitivity to Tobramycin. The overall raise in resistance could be explained by the fact that there may be cross resistance to the antibiotics considering the fact that Gentamicin is a very frequently used antibiotic in our setting. The mechanism of cross resistance could be enzymatic modification of the drug which is both inactivated and prevents uptake of the active drug.[10] Out of the two Tetracyclines (Doxycycline, Tetracycline) studied in this series, results were available only for the resistance pattern of Tetracycline. Fig 10 showed a raising resistance to Tetracycline from 75% to 80% to 100% from 1994 through to 1997. This raise in the resistance was statistically insignificant, considering it was already a highly resistant antibiotic. In previous studies done[8, 9, 10] all have shown a high degree of resistance to the Tetracyclines and their figures are comparable to our figures. This high resistance could be attributed to the wide and injudicious use of the Tetracyclines in our setup, including its use as a lubricant when no other appropriate ophthalmic lubricant is available. Fig. 11 shows the sensitivity pattern of Polymixin B a surfactant which interacts with the cell membrane of bacteria disrupting the osmotic integrity of the membrane. The resistance of S. aureus has remained low all through. This is not a commonly used antibiotic except in combinations with other topical antibiotics or steroids. This antibiotic is not utilized as a systemic antibiotic, and this could possibly explain the low overall resistance.

CONCLUSIONS

The study demonstrates a change in the sensitivity pattern of the antibiotics tested, especially the ones commonly used in the region like Gentamicin, and Chloramphenicol. As doctors adapt and use newer antibiotics with more frequency, we are able to demonstrate a gradual increase in the resistance of such antibiotics like Ciprofloxacin and Norfloxacin, whereas the less commonly used antibiotics such as Carbenicillin and Cephalexin maintain a general good sensitivity pattern due to their minimal usage.

Sensitivity patterns on the newer generation antibiotics which are being used more frequently in the region should be studied to establish changing sensitivity patterns like for Gatifloxacin, Moxifloxacin, Levofloxacin and Azithromycin. The above results are laboratory results where the Kirby disc diffusion technique was utilized to test the sensitivity pattern of the antibiotics.[6] The concentrations tested on these discs tests for the blood concentrations achieved by the standard systemic dosages of these antibiotics. However, the concentrations achieved by the local applications of these antibiotics to the eye are much higher. Therefore these results give an orientation on emerging trends but the clinical response in each patient remains decisive.

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