# Correlation between Prescribed Antibiotics and Bacterial Resistance in Mukalla District

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**(A collaborative study prepared with a group of 3rd.year students as a community project in the faculty of medicine-university of Hadramout (Yemen)**

## Abstract:

This study was performed in Mukalla district to correlate between prescribed antibiotics and bacterial resistance. A total of 200 prescriptions and 120 culture and sensitivity reports were studied. It was found that the most antibiotics prescribed were Amoxycillin (38%), Ampicillin (26%), and Gentamycin (17%).On the other hand, the most antibiotic resisted by bacteria found to be Penicillin (100% for all bacteria except Escherichlia Coli 96%). The culture and sensitivity reports obtained from Hadhramout medical laboratory and Al Mukalla medical laboratory showed that the isolated bacteria represented a high frequency of growth to Staphylococcus Aureus, Escherichlia Coli, Pseudomonas Aeraginosa and Klebsiella with percentage rate of 40.67%, 20.88%, 10.8%, and 10.2% respectively.

## Introduction

The problem associated with increasing antibiotic resistance in both community and hospital-acquired bacterial pathogens have received much attention (1-3). In 50 years since antimicrobial agents first introduced, bacteria have acquired a wide variety of resistance mechanisms, which have enabled them to persist the effects of these drugs (4).

Acquired resistance which occurs when resistant strains emerge from a previously susceptible bacterial population following exposure to an antibiotic, can arise either by acquisition of plasmids and transponsons or by chromosomal mutation (5)

The widespread use of antibiotics has contributed significantly to the spread of resistance by acting as selective problem that maintains resistant organisms with the suitable environment. It is well known that a clear knowledge of resistance pattern in different bacterial species is essential in formulating adequate chemotherapy programs. Widespread of irrational use of antibiotics has resulted in the evolution of microorganisms highly resistant to many different antibiotics. The prevalence of resistance to antibiotics varies from species to species and from country to country (6).

Resistance is not only an individual patients problem, but is the problem of the whole community by which many other members of population can be affected. In 1998 it was reported that there was an overuse and misuse of antibiotics in Yemen reaching a ratio of (37%) & (58%) respectively of the total studied prescriptions. (7)

It becomes obvious that the antibiotic resistance in Yemen is a progressing problem, the irrational use of antibiotics will contribute to aggravate the problem.

**The objectives of this study are:**

Identify the most common antibiotics prescribed by physician in Mukalla area.

List the most common isolated bacteria from different sample in Mukalla area.

Recognize the most resistant bacteria to prescribed antibiotics.

Determine the susceptibility of bacteria to prescribed antibiotics.

## Materials and Methods:

*Two hundred selected prescriptions* from Ibn Sina general hospital and University Health Center of Hadramout were studied. GPs and consultant physicians prescribed these prescriptions.

The selection of prescriptions were made from those containing prescribed antibiotics and collected in the period from November 1999 to May 2000(by a group of 3rd. year medical students of Hadramout University).
*120 culture & sensitivity* reports from different samples (urine, stool, swab and semen) were obtained from Al Mukalla medical laboratory and Hadramout hospital laboratory.

## Results:

The present study showed that the most common prescribed antibiotics, were Amoxicillin (38%), Ampicillin (20%) and Gentamycin (17%) as shown in table 1. However, the most common isolated organisms were Staphylococcus Aureus (46.67%) and Escherilchlia Coli (20.88%) as shown in table 2

. Concerning the bacterial resistance; Pseudomonas aeroginosa showed high resistance to Ampicillin (69.23%) however, Staphylococcus Aureus expressed the lowest resistance (39.2%) (Fig.1).

Enterobacteria expressed the high resistance to Gentamycin (63.9%) while Pseudomonas aeroginosa expressed the lower resistance (23%) (Fig.2).

Figure 3 showed that all the isolated bacteria expressed resistance to Penicillin-G.
Concerning the bacterial sensitivity Staphylococcus Aureus, Klebsiella and Escherlichlia Coli showed high sensitivity to Ciplox. (91%, 82.3% and 83%) respectively (Fig.4).

Figure 5 showed that Pseudomonas, Klebsiella and Escherlichlia Coli have moderate sensitivity to Chloramphenicol (69.23%, 66.4%, and 63%) respectively.
As shown in Figure 6, Staphylococcus Coli appeared to be resistant to Penicillin-G (100%), as well as Erythromycin (94%) and Norfloxacin (74%).
Figure 7 shows full resistance of Enterobacteria to Norfolxacin, Penicillin-G and erythromycin (100%)).

Figure 8 shows high resistance of Ecscherichia coli to Erythromycin (100%) and Pencillin-G (95%) while showed low resistance against Ciprofloxacin). However, klebsiella pneumoniae showed a complete resistance to Erythromycin and Penicillin (100%) while it showed low resistance to Ciprofloxacin (16.7%)(Fig.9).

Figure 10 shows that Pseudomonas aeroginosa has full resistance to Erythromycin and Penicillin-G (100%) and moderate resistance to Ampicillin (96.23%) and Bactrim (46.27%).

**Table-1: Distribution of Antibiotics in 200 Prescriptions**

| Antibiotic | Amoxicillin | Ampicillin | Gentamycin | Penicillin-G | Flagyl | Norfloxacin | Chloramphenicol | Erythromycin | Bactrim | Ampiclox | Ciplox | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Frequency | 84 | 58 | 39 | 11 | 9 | 5 | 5 | 4 | 1 | 4 | 2 | 120 |
| % | 38 | 26 | 17 | 5 | 4 | 2.25 | 2.25 | 2 | 0.5 | 2 | 1 | 100 |

**Table-2: Distribution of Bacteria among 120 different samples**

| Microorganism | Staph. Aureus | E.Coli | Pseudomonas | Klebseilla | Enterobacteria | Niesseria | Total |
|---|---|---|---|---|---|---|---|
| Frequency | 56 | 25 | 13 | 12 | 11 | 3 | 120 |
| % | 46.67 | 20.88 | 10.8 | 10.7 | 9.16 | 2.5 | 100 |

**Fig. (1): Percentage of bacterial resistance to Ampicillin**

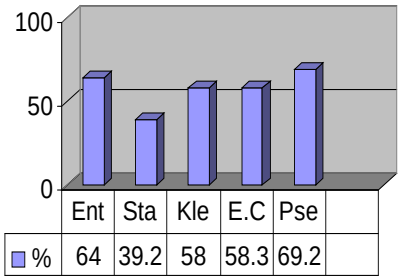



**Fig. (2): Percentage of bacterial resistance to Gentamycin**

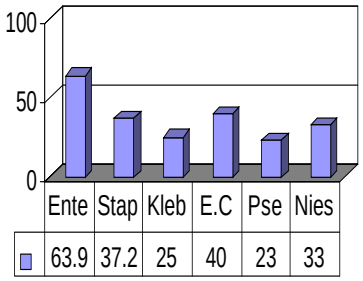



**Fig. (3): Percentage of bacterial resistance to Pencillin**

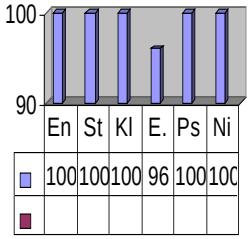



**Fig. (4) : Sensitivity of most common isolated bacteria to Ciplox**

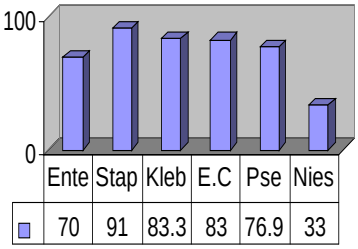



**Fig. 5 Sensitivity of most common isolated bacteria to chloramphenicol**

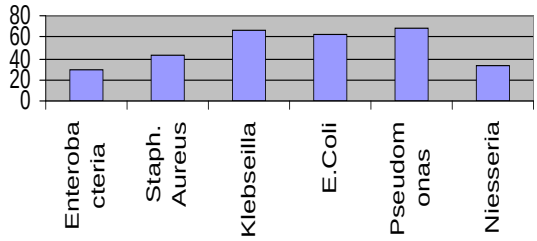



**Fig. 6 Resistance of Staph. Aureus to prescribed Antibiotics.**

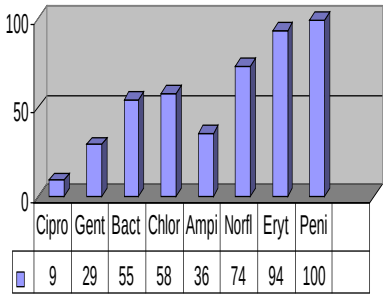



**Fig.7 Resistance of Enterobacteria to prescribed Antibiotics**

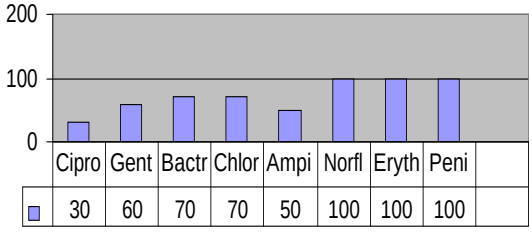
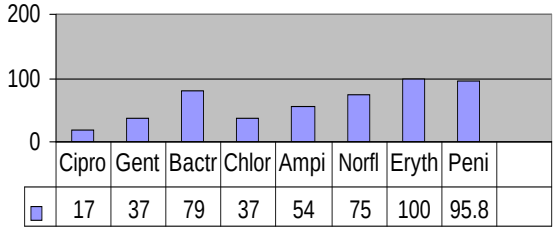
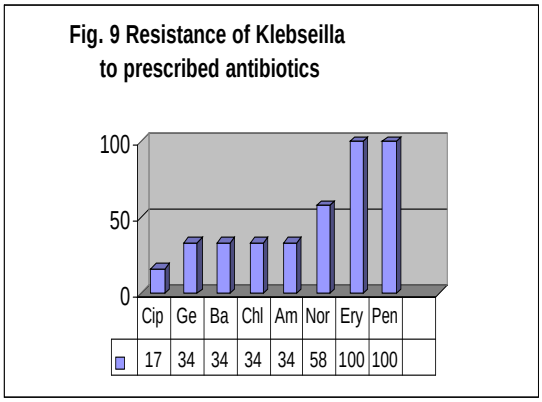
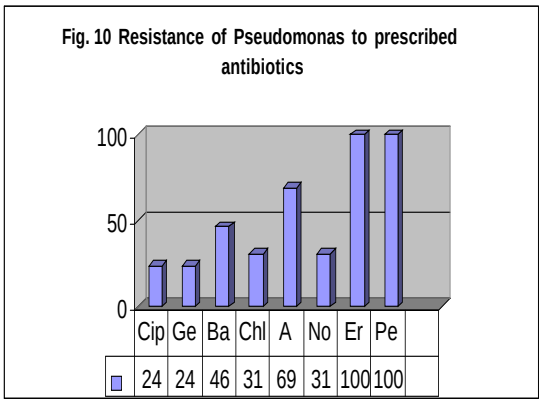



**Fig. 8 Resistance of E. colui to prescribed antibiotics.**






## Discussion:

Amoxicillin was found to be the most prescribed antibiotic among 200 prescriptions. This may be due to, its abroad spectrum activity, safety, easy administration (orally), has few side effects, availability and its cheapness. Bactrim was found to be the least prescribed antibiotic, this may be due to an increased bacterial resistance against this drug or due to irrational prescription of antibiotics or to other unknown causes (8-9).

Among 120 different samples of culture, it was noticed that Staphylococcus Aureus had greatest frequency, this could be due to the fact that this bacteria is widely spread from person to person especially in places where this bacteria is a normal flora as in the nose and the throat. This bacterium has a spore that allows it to become resistant to the surrounding environmental conditions as hot weather. Ecscherichia Coli was found to be the second bacteria in its frequency among the isolates (5).

Pseudomonas aeroginosa presented the highest resistance to Ampicillin, and this may be due to the production of Beta-lactemase enzyme, that destroys the drug. Staphylococcus Aureus expressed a certain degree of resistance to Ampicillin. This may be due to the resistance mechanism of altered receptor for drugs, although it may have another secondary mechanism of action through Beta-lactamase production (8).

Enterobacteria showed a high resistance to Gentamycin, this could be due to the production of plasmid enzyme (Adenylating, Acetylating or phosphorylating enzymes), which are the principal and effective type of resistance to Gentamycin among Gram –ve bacteria. Pseudomonas aeroginosa expressed the lowest percentage of resistance. This may be due to the lack of permeability of the drug, Apparently which is due to an outer membrane change that impairs active transport into the cell. (9)

All the isolated bacteria expressed high resistance to Penicillin; this could be due to overuse and misuse of this antibiotic for a long time in the area of Mukalla.

Regarding the percentage of microorganisms' resistance to Ampicillin, it was clear that Enterobacteria showed a high resistance to Ampicillin and this may be due to its ability to release Beta-lactamase enzyme and other plasmid mediators (9).

Staphylococcus Aureus expressed the greatest resistance to Penicillin, while to Ciplox(Ciprofloxacin) it expressed a certain amount of sensitivity and may be due to the fact that Ciplox is a new antibiotic that Staphylococcus Aureus has developed less resistance to it. In addition, it is very effective because it inhibits DNA synthesis by affecting the bacterial enzyme DNA-gyrase, which is essential for the synthesis of normal helical-shaped DNA as well as of proteins, enzymes and hormones.

Resistance of Enterobacteria to the prescribed antibiotics showed a high resistance to Norfloxacin and Erythromycin and Penicillin. This may be due to the fact that those bacteria lack certain enzymes such as Beta-lactamase that breaks down the Beta-lactam antibiotics. Ciprofloxacin was found to be very effective due to what was mentioned above. (10)

Ecscherichia Coli acquired the resistance to antibiotics because it has a plasmid. E. Coli developed resistance to Erythromycin after one week from the use of it alone this may be due to production of Beta-lactamase enzyme, which destroys Beta-lactam ring of Penicillin and Cephalosporins. (11-12).

## Conclusions:

The importance of culture and sensitivity test in identifying the resistant and sensitive microorganisms to antibiotics before prescribing them randomly.

Overuse and misuse of antibiotics may lead to bacterial resistance.

Most frequently prescribed antibiotics in Hadramout governorate – Mukalla area include: Amoxicillin , Ampicillin , Gentamycin and Penicillin.

According to Gram staining classification of bacteria , the most isolated bacteria in Mukalla area is G-ve type.

Ciprofloxacin is highly effective against the different isolated bacteria although physician fewly prescribed it.

Penicillin is the only antibiotic that was completely resisted by all the isolated bacteria (i.e. ineffective).

Some drugs (e.g. Cephalexin) are highly effective against certain isolated bacteria

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