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# Molecular Basis and Mechanism of Resistance to Ciprofloxacin by Staphylococcus Aureus Strains Isolated from Pregnant Women

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## Introduction

Staphylococcus aureus can cause worrisome infections especially for the immune compromised pregnant woman and her fetus but worse problems are posed by the drug-resistant strains. This study was carried out to determine the molecular basis and mechanism of resistance of Staphylococcus aureus to ciprofloxacin; a quinolone with broad-spectrum antimicrobial activities. Five known ciprofloxacin-resistant Staphylococcus aureus strains isolated from pregnant women attending antenatal clinics in Imo State Nigeria were used for this study. Their antibiotic resistance profiles were confirmed using disc diffusion method. Minimum inhibitory concentration (MIC) of ciprofloxacin on test isolates was also obtained using standard microbiological tests. This was followed by molecular studies which involved; Genomic DNA extraction, polymerase chain reaction, gel electrophoresis, and gene sequencing. Analysis of the sequences obtained was done using the clcbio main workbench software to obtain their statistics, basic alignment, and phylogeny. Results revealed resistance to ciprofloxacin to be genetic with all the isolates harbouring the quinolone resistance determinant region, (QRDR) found on Gyr A and Par C genes. BLAST results with related genes in the gene bank showed mutations at the quinolone target site suggestive of modification of the target site as a mechanism of resistance observed. Phylogenetic analysis revealed that the genes studied were from one ancestor hence possible horizontal transfer of resistance genetic materials among the isolates. The public health importance of this cannot be overemphasized.

Diagnostic microbiology is the study of microbial identification. Since the discovery of the germ theory of disease, scientists have been finding ways to harvest specific organisms. Using methods such as differential media or genome sequencing, physicians and scientists can observe novel functions in organisms for more effective and accurate diagnosis of organisms. Methods used in diagnostic microbiology are often used to take advantage of a particular difference in organisms and attain information about what species it can be identified as, which is often through a reference of previous studies. New studies provide information that others can reference so that scientists can attain a basic understanding of the organism they are examining.

### Aerobic VS Anaerobic

Anaerobic organisms require an oxygen-free environment. When culturing anaerobic microbes, broths are often flushed with nitrogen gas to extinguish oxygen present, and growth can also occur on media in a chamber without oxygen present. Sodium resazurin can be added to indicate redox potential. Cultures are to be incubated in an oxygen-free environment for 48 hours at 35 °C before growth is examined. Anaerobic bacteria collection can come from a variety of sources in patient samples, including blood, bile, bone marrow, cerebrospinal fluid, direct lung aspirate, tissue biopsies from a normally sterile site, fluid from a normally sterile site like a joint, dental, abscess, abdominal or pelvic abscess, knife, gunshot, or surgical wound, or severe burn.

### Incubation length

Incubation times vary based upon the microbe that requires culturing. Traditional culturing techniques, for example, require less than 24 hours culture time for Escherichia coli but 6–8 weeks for successful culturing of Mycobacterium tuberculosis before definitive results are expressed. A benefit of non-culture tests is that physicians and microbiologists are not handicapped by waiting periods. Incubation follows a growth curve variable for every microorganism. Cultures follow a lag, log, stationary, and finally death phase. The lag phase is not well known in microbiology, but it is speculated that this phase consists of the microorganism adjusting to its environment by synthesizing proteins specific for the surrounding habitat. The log phase is the period where a culture experiences logarithmic growth until nutrients become scarce. The stationary phase is when culture concentration is the highest and cells stop reproducing. When nutrients in the environment are depleting, organisms enter the death phase where toxic metabolites become abundant and nutrients are depleted to the point where cell death exceeds reproduction.

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