



شبكة المعلومات الجامعية
التوثيق الإلكتروني والميكروفيلم

بسم الله الرحمن الرحيم



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شبكة المعلومات الجامعية التوثيق الإلكتروني والميكروفيلم



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جامعة عين شمس التوثيق الإلكتروني والميكروفيلم

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**Characterization of Some Antibiotic Resistant Genes
Isolated from Pathogenic *Staphylococcus aureus***

Thesis

Submitted for a PhD. Degree in Science in (Microbiology)

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Declaration

**This dissertation has not been previously submitted for
any degree at this or at any other university**

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List of Abbreviations

aad : aminoglycoside adenytransferase gene cassettes
ABC gene : ATP binding cassette
ACCs : N-acetyl transferases
ADHs, aphs : O-phospho transferases
AMEs : aminoglycoside modifying enzymes
AMP : ampicillin
AMPs : Antimicrobial peptides
ANTs : nucleotidyl transferases
attI : attachment site of the integron integration
attC : attachment site of the gene cassette
betA, betB : betaine aldehyde dehydrogenase
CALIN : cluster of attC site lacking integron-integrase
BC : benzalkonium chloride
Ccr : unique cassette of recombinase genes
CDC : Center for Disease Control and prevention
CIP : ciprofloxacin
CLSI : Clinical and Laboratory Standards Institute
3' or 5'-CS : 5'-conserved segment
CS1 : class1 integron
DA : clindamycin
DEPC : diethylpyrocarbonate
dfr : dihydrofolate reductase
DNA : deoxyribonucleic acid
DNTPs : deoxynucleotide5-triphosphate
DO : doxacycline
E : erythromycin
EmrE : ethidium multidrug resistance protein E
EDTA : ethylene diamine tetra-acetic acid
G island : genomic island
HGT : Horizontal gene transfer
intI : integrase gene
In0 : elements have integrase gene without *attC* sites
Kbp : kilo base pair
KCL : potassium chloride

MDR	: multidrug resistance
MDRP	: multidrug reflux pump
<i>MecA</i>	: methicillin resistance gene
<i>MecI</i>	: methicillin resistance gene transducer
<i>MecR1</i>	: methicillin resistance gene repressor
MIC	: minimal inhibitory concentration
MRS	: methicillin resistant <i>Staphylococci</i>
MRSI	: methicillin resistant <i>Staphylococci</i> isolate
MRSA	: methicillin resistance <i>Staphylococcus aureus</i>
MSSA	: methicillin sensitive <i>Staphylococcus aureus</i>
NaCl	: sodium chloride
NCCLS	: National Committee for Clinical Laboratory Standards
<i>ORF</i>	: open reading frames
PBP2a	: penicillin binding protein 2a
PCR	: polymerase chain reaction
P_c & P_2	: constitutive promoters for the genes cassettes integrated at the <i>attC</i> site
P-gp	: P-glycoprotein transporter
P_{intI}	: integrase gene promoter
QAC	: Quaternary ammonium compound
<i>qacEΔ1</i>	: quaternary ammonium resistant gene
Rpm	: revolution per minute
SA	: <i>Staphylococcus aureus</i>
SCC	: staphylococcal cassette chromosome
SMR	: small multidrug resistance family
<i>sul1</i>	: dehydropetroate synthase sulfonamide resistance gene
TAE	: Tris acetate-EDTA buffer
TE	: Tris-EDTA buffer
<i>TetA</i>	: tetracycline structural efflux genes
<i>tetR</i>	: tetracycline resistant gene
TetR	: repressor protein
Tris	: Tris hydroxymethyl amino methane
TM	: transmembrane
Tn3	: transposon family
VA	: vancomycin

YdeI/OmpD: polymyxin B resistant gene cassette

OmpD : trimeric β -barrel outer membrane general porin
family

16S-RMTase: methyltransferase

Abstract
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Characterization of some resistant genes isolated from
antibiotic resistant *Staphylococcus aureus*
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Two hundred and twenty clinical *Staphylococcus aureus* (SA) isolates were collected from 3 Egyptian hospitals (Ain-shams hospital, Cairo hospital and Abbassia fever hospital). All isolates were multidrug resistant (showing resistance to two or more antibiotic groups), antimicrobial susceptibility test showed that 81.8% of isolates were resistant to methicillin, 65% were resistant to trimethoprim-sulphamethaxole, 60% were resistance to amikacin, 46.3% were resistance to ciprofloxacin, 44.5% were resistance to erythromycin, 44% were resistance to clindamycin, 43.6% for doxacycline, 40% for vancomycin, 36.3% for imipenem and 11% of isolates were resistant to all tested antibiotic groups. Minimal inhibitory concentration of amikacin and imipenem showed that 65% and 58% of isolates were resistant. One hundred of isolates were examined for the presence of *mecA* gene, (*intI1*) integrase gene and class1 integron by PCR amplification; forty two percent of the isolates were found to carry class1 integron gene cassettes with variable amplicon, 36% of isolates carry (*intI1*) integrase gene and 80% of MRSA isolates were positive to the methicillin resistance *mecA* gene. Non classic class1 integron gene cassettes were detected in our MRSA isolates encoding resistance to quaternary ammonium compound (Qac resistance gene *emrE*), *emrE* gene is a small multidrug resistant (SMR) acting as osmoprotectants such as betaine aldehyde dehydrogenase (*betB*).

This study highlights the prevalence of multidrug resistant *Staphylococcus aureus* in Egyptian hospitals in the presence of integron and the role of integron in the dissemination of antibiotic resistance.

Keywords: *Staphylococcus aureus*, *mecA*, (*intI1*) integrase gene, Class1 integron.