

**Prevalence of Panton Valentine Gene in both
Community-acquired and Healthcare-
acquired Methicillin Resistant
Staphylococcus aureus Isolates**

Thesis

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Presented by

Rana Abd el fattah Abd el fattah Mohamed
M.B.B.Ch.

Faculty of Medicine-Ain Shams University

Under supervision of

Dr. Lamia Fouad Fathi

*Assistant professor of Medical Microbiology and Immunology
Faculty of Medicine-Ain Shams University*

Dr. Noha Nagi Mohamed Salah El-Deen

*Assistant professor of Medical Microbiology and Immunology
Faculty of Medicine-Ain Shams University*

Faculty of Medicine
Ain Shams University

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بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

قالوا

لَسْبَدَانُكَ لَا عِلْمَ لَنَا
إِلَّا مَا عَلَّمْتَنَا إِنَّكَ أَنْتَ
الْعَلِيمُ الْعَظِيمُ

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This work is dedicated to . . .

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List of Contents

Title	Page No.
List of Tables	i
List of Figures.....	iii
List of Abbreviations	v
Abstract	vii
Introduction	1
Aim of the Work	3
Review of Literature	
▪ Methicillin Resistant Staphylococcus Aureus (MRSA)	4
▪ Panton–Valentine Leukocidin (PVL)	20
▪ PVL and MRSA Infections	23
Materials and Methods	43
Results	59
Discussion.....	76
Summary	82
Conclusion	86
Recommendations	87
References	88
Arabic Summary	

List of Tables

Table No.	Title	Page No.
Table (1):	Interpretive Criteria (in mm) for cefoxitin antibiotic used according to (CLSI, 2017):.....	52
Table (2):	Demographic data of the inpatients' group with HA-MRSA and their distribution according to the site of infection.....	61
Table (3):	Prevalence of <i>pvl</i> gene and <i>mecA</i> gene among the 15 HA-MRSA isolates.....	63
Table (4):	Demographic data of the outpatients' group with CA-MRSA and their distribution according to the site of infection.....	64
Table (5):	Prevalence of <i>pvl</i> gene and <i>mecA</i> gene among the 15 CA-MRSA isolates.	64
Table (6):	Comparison between HA-MRSA and CA-MRSA isolates as regard demographic data and site of infection.....	65
Table (7):	Comparison between prevalence of PVL gene and <i>mec A</i> gene among HA-MRSA and CA-MRSA isolates.....	66
Table (8):	Relation between <i>mecA</i> gene, demographic data and site of infection among HA-MRSA isolates.....	67
Table (9):	Relation between <i>pvl</i> gene, demographic data and site of infection among HA-MRSA isolates.....	68
Table (10):	Relation between <i>mecA</i> gene, demographic data and site of infection among CA-MRSA isolates.....	69
Table (11):	Relation between <i>pvl</i> gene, demographic data and site of infection among CA-MRSA isolates.....	70
Table (12):	Relation between <i>mecA</i> gene, demographic data and site of infection among all the studied 30 isolates of MRSA.	71

List of Tables (Cont...)

Table No.	Title	Page No.
Table (13):	Relation between <i>pvl</i> gene, demographic data and site of infection among all the studied 30 isolates of MRSA.	72
Table (14):	Correlation between <i>mecA</i> gene and <i>pvl</i> gene among all the studied 30 MRSA isolates.	73
Table (15):	Correlation between <i>mecA</i> gene and <i>pvl</i> gene among HA-MRSA isolates.	74
Table (16):	Correlation between <i>mecA</i> gene and <i>pvl</i> gene among CA-MRSA isolates.	75

List of Figures

Fig. No.	Title	Page No.
Figure (1):	The introduction of antibiotics and consequent evolution of resistance in <i>S. aureus</i>	6
Figure (2):	Organization of the SCCmec region of DNA and chromosomal location.	17
Figure (3):	Model of PVL possible mediation of tissue necrosis.	22
Figure (4):	A plate of blood agar medium inoculated with an isolate of <i>Staphylococcus aureus</i> showing complete hemolysis.	48
Figure (5):	An effervescence is detected on adding a drop of hydrogen peroxide on a colony of <i>Staphylococcus aureus</i> indicating catalase positive test.	49
Figure (6):	A clumping is detected on adding a drop of plasma on a colony of <i>Staphylococcus aureus</i> indicates a positive slide coagulase test.....	49
Figure (7):	Tube (A): showing a clot formation indicates a positive tube coagulase test after adding a drop of plasma on incubated suspension of <i>Staphylococcus aureus</i> . Tube (B) : control tube contain a drop of plasma and broth, no clotting occur.	50
Figure (8):	A plate of mannitol salt with cefoxitin disc diffusion method showing Methicillin Resistant <i>S. aureus</i>	52
Figure (9):	Gel electrophoresis for detection of mecA gene. Lane 1: DNA ladder.....	57
Figure (10):	Gel electrophoresis for detection of PVL gene. Lane 1: DNA ladder.....	57

List of Figures (Cont...)

Fig. No.	Title	Page No.
Figure (11):	The distribution of the total samples processed from inpatients' group to obtain 15 HA-MRSA isolates according to type of organism.....	59
Figure (12):	The distribution of the total samples processed from outpatients' group to obtain 15 CA-MRSA isolates according to type of organism.....	60
Figure (13):	Distribution of isolates according to the site of infection among the 15 HA-MRSA isolates.....	61
Figure (14):	Gel electrophoresis for detection of <i>mecA</i> gene. Lane 1: DNA ladder, lanes2, 3, 4, 5, 7, 9, 10, 11 are <i>mecA</i> positive samples (532bp). Lanes 6, 8, 12 are <i>mecA</i> negative samples.....	62
Figure (15):	Gel electrophoresis for detection of <i>pvl</i> gene. Lane 1: DNA ladder, lanes2, 3, 5, 6, 7, 8, 10, 11 are <i>pvl</i> positive samples (433bp). Lanes 5, 9, 10, 12 are <i>pvl</i> negative samples.....	62

List of Abbreviations

Abb.	Full term
AST.....	Active surveillance testing
CA-MRSA.....	Community acquired methicillin resistant Staphylococcus aureus
CDC.....	Centers for Disease Control
CLSI.....	Clinical Laboratory Standard Institute
CoNS.....	Coagulase negative Staphylococci
CSF.....	Cerebrospinal fluid
DNA.....	Deoxyribonucleic acid
ELISA.....	Enzyme-linked immunosorbent assay
EIA.....	Enzyme immunoassay
EMRSA.....	Epidemic methicillin resistant Staphylococcus aureus
HA-MRSA.....	Hospital acquired methicillin resistant Staphylococcus aureus
H ₂ O ₂	Hydrogen peroxide
Hrs.....	Hours
ICT.....	Immunochromatographic test
ICUs.....	Intensive care units
MIC.....	Minimum inhibitory concentration
Min.....	Minute
ml.....	Milliliter
μL.....	Microliter
mm.....	millimeter
MRCNS.....	Methicillin resistant coagulase negative Staphylococcus aureus
MRSA.....	Methicillin resistant Staphylococcus aureus
MSSA.....	Methicillin sensitive Staphylococcus aureus
MSA.....	Mannitol salt agar
PBP2a.....	penicillin-binding protein 2a
PCR.....	Polymerase chain reaction

List of Abbreviations (cont...)

Abb.	Full term
<i>PVL</i>	<i>Panton Valentine Leukocidin gene</i>
<i>ROS</i>	<i>Reactive oxygen species</i>
<i>RTI</i>	<i>Respiratory tract infection</i>
<i>S. aureus</i>	<i>Staph aureus</i>
<i>SCC mec</i>	<i>Staphylococcal cassette chromosome encoding methicillin resistance</i>
<i>SD</i>	<i>Standard deviation</i>
<i>UK</i>	<i>United Kingdom</i>
<i>VRSA</i>	<i>Vancomycin-resistant Staphylococcus aureus</i>
<i>WHO</i>	<i>World health organization</i>

ABSTRACT

Panton-Valentine leukocidin (PVL) toxin is mainly associated with necrotic lesions involving the skin or mucosa. PVL has been linked by epidemiological studies to community-associated methicillin resistant *Staphylococci* (CA-MRSA). There is a relatively few data about the incidence of this toxin in nosocomial infections.

The aim of this study was to compare the prevalence of PVL gene in healthcare acquired and community acquired *Staphylococcus aureus* isolates at Ain Shams University Hospitals. This study was a comparative cross-sectional study carried on eighty-nine (89) clinical samples obtained from patients attending outpatient clinics with community-acquired pyogenic infections and patients with healthcare acquired pyogenic infections in Intensive Care Units (ICUs) at Ain Shams University hospitals. From the eighty-nine (89) clinical samples, thirty-eight (38) clinical samples were from patients with nosocomial infections admitted to Postoperative ICU, Trauma ICU, Chest ICU and Internal Medicine ICU; and fifty-one (51) clinical samples were from patients with community acquired infections. These samples were conventionally processed in order to isolate fifteen (15) Hospital acquired methicillin resistant *Staphylococcus aureus* (HA-MRSA) from patients with nosocomial infections and fifteen (15) Community acquired methicillin resistant *Staphylococcus aureus* (CA-MRSA) from patients with community acquired infections. Detection of the *mecA* gene and Panton Valentine Leukocidin gene (PVL) was performed by polymerase chain reaction (PCR). Results: *mecA* gene was positive in 40% (6/15) of HA-MRSA isolates compared to 47.6% (7/15) of CA-MRSA isolates, while *pvl* gene was positive 53.3% (8/15) in HA-MRSA isolates compared to 26.7% (4/15) of CA-MRSA isolates, and there was no significant correlation between *mecA* gene and *pvl* gene among the studied thirty (30) MRSA isolates (P value =1), as 50% (3/6) only of positive *mecA* were positive for *pvl*, and 44.4% (4/9) of negative *mecA* were negative *pvl*. The results of detection of *pvl* gene in both community and hospital isolates made this gene not a sole genetic marker for diagnosis of CA-MRSA.

Keywords:

Staphylococcus aureus (*S. aureus*), *mecA* gene, Panton valentine leucocidin gene (PVL), Hospital acquired methicillin resistant *Staphylococcus aureus* (HA- MRSA), Community acquired methicillin resistant *Staphylococcus aureus* (CA-MRSA).

INTRODUCTION

Staphylococcus aureus (*S. aureus*) is a major human pathogen that causes a wide range of clinical infections. It is a leading cause of bacteremia and infective endocarditis as well as osteoarticular, skin and soft tissue, pleuropulmonary, and device-related infections (Coates *et al.*, 2014).

Methicillin resistant *Staphylococcus aureus* (MRSA) is a bacterium responsible for several difficult-to-treat infections in humans. MRSA strains have acquired a gene that makes them resistant to nearly all beta-lactam antibiotics. The resistance of MRSA to β -lactam antibiotics is associated with penicillin-binding protein 2a, encoded by the *mecA* gene (Velasco *et al.*, 2005).

MRSA has been considered a major pathogen in healthcare facilities, known as Healthcare associated MRSA (HA-MRSA). It has been observed emerging in the community as well, known as community associated MRSA (CA-MRSA) (Tavares *et al.*, 2013).

Panton-Valentine leukocidin (PVL) is one of many toxins associated with *S. aureus* infection. PVL acts through the synergistic activity of two non-associated secretory proteins, component S and component F. These two toxins are encoded by two genes, *LukS-PV* and *LukF-PV* (Bradley, 2007).

Panton Valentine leukocidin is present in majority of community associated MRSA isolates and rarely present in hospital isolates, therefore it is recognized as a marker of community acquired strains (**Li *et al.*, 2010**).

PVL has a major cytotoxic effect, as the release of PVL by staphylococcal strains caused rapid and premature cell death, which is different from the physiological (and programmed) cell death of neutrophils following phagocytosis and degradation of virulent bacteria. These results have important implications especially for infections with CA-MRSA strains (**Labandeira-Rey *et al.*, 2007**).

AIM OF THE WORK

The objective of this study was to compare the prevalence of PVL gene in healthcare acquired and community acquired Methicillin resistant *Staphylococcus aureus* isolates at Ain Shams University Hospitals.