

مكتبة جامعة القدس

Deanship of Graduate Students

105

Al-Quds University

*Epidemiology of Streptococcus Pneumoniae
and
Drug Resistance in Bethlehem District*

*By
Omar Khalid Dies*

M.Sc. Thesis

2003

Epidemiology of *Streptococcus pneumoniae*

and

Drug Resistance in Bethlehem District

**By
Omar Khalid Dies**

B.Sc., Applied Science University, Jordan

***A thesis
Submitted in Partial fulfillment of requirements for the
degree of Master of Public Health / Management
Department of Public Health***

***Al-Quds University
School of Public Health***

2003

ENDORSEMENT

THESIS TITLE:

Epidemiology of *Streptococcus pneumoniae* and Drug Resistance
In Bethlehem District

Advisor

Dr. Musa Hindiyeh

Title

Ph.D.D(ABMM);MT(ASCP)

Clinical Laboratory & Infection Program Director

Caritas Baby Hospital

Signature... 

Date... 13/12/03

External Examiner

Dr. Basam Abu- Libdeh


Title

Chief of Pediatrics and Genetics

Makassed Hospital,

Assistant Prof. of Pediatric and Genetics

دكتور بسام أبو لبده
Dr. Basam Abu-Libdeh
License # 20693

Signature... 

Al-Quds University

Date... 4/12/2003

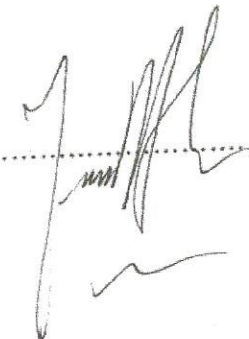
Internal Examiner

Prof. Zyad Abdeen

Title

Epidemiologist

Al-Quds University

Signature... 

Date... 5/12/2003

Declaration

I certify that this thesis submitted for the degree of Master is the result of my own research, except where otherwise acknowledged, and that this thesis (or any part of the same) has not been submitted for a higher degree to any other university or institution.

Omar Dies

ملخص

تدور هذه الرسالة حول موضوع *Streptococcus pneumoniae* , حيث اجريت هذه الدراسة في افرته القائمه بين 1-1-2001 الى تاريخ 1-4-2003 حيث كان الهدف منها معرفة عدد الحالات الحامله لهذه الجرثومه في المرضى الذين زاروا مستشفى الكاريتاس في محافظة بيت لحم في الفتره المذكوره و معرفة حساسية هذه البكتيريا للمضادات الحيويه المستخدمه في فلسطين.

تم اخذ مسحات من الحلق و من الانف لكل المرضى الذين زارو المستشفى و كانوا يعانون من التهابات في الجهاز التنفسي العلوي .

اظهرت النتائج انه كان هنالك ما نسبته 11.1% من المرضى الذين يحملون هذه البكتيريا في الحلق و الانف , في حين ان الذين يحملون هذه البكتيريا في الانف كانوا 37.1% بينما في الحلق 3.5%.

بينما اظهرت نتائج الحساسيه الى المضادات الحيويه خاصة البنسلين الى وجود نسبه عاليه من البكتيريا المقاومه حيث ان نسبه المقاومه في البنسلين كانت 75% .

اظهرت هذه النتائج الى وجود حاجه ماسه الى مراقبة علاج البكتيريا بالمضادات الحيويه في منطقة بيت لحم في فلسطين.

Abstract

A retrospective study was conducted at Caritas Baby Hospital in Bethlehem from the first of January 2001, until the first of April 2003. The goal of this study was to examine the prevalence and antibiotic resistant patterns of *Streptococcus pneumoniae* in Bethlehem district off ill children less than 5 years of age. All clinical samples of nasopharyngeal aspirates, swabs and oropharyngeal swab cultures were obtained from inpatient and outpatient using standard procedures. *S. pneumoniae* total prevalence was (11.8%) during this period; the nasopharyngeal carriage prevalence was (37.1%) while the oropharyngeal prevalence was (3.5%). An increase in prevalence occurred over time that in 2001 the prevalence was (4.6%) and by the years 2002, 2003 it become (16.8%). Children less than one year of age had shown higher prevalence (75%) than other ages.

Analyses of the antibiograms of isolated *S. pneumoniae* using standard NCCLS guidelines indicated the highest resistance rate was in the β lactam antibiotics (Penicillin), which was (75%) resistant, followed by sulfamethoxazole (50%) resistant, erythromycin (27.6%) resistant , cefotaxime (3.9%) resistant , while vancomycin was (100%) sensitive and ofloxacin (98%) sensitive.

These results clearly show the need for taking urgent actions with regard to controlling antibiotic usage in Bethlehem district and most likely in all Palestine. From a public health point of view, the high prevalence rate of penicillin resistant *S. pneumoniae* and the emergence of third generation cephalosporins resistant stains are of great concern for treatment of meningitis cases since the only alternative is vancomycin.

Acknowledgment

I would like to express my sincere and special thanks and gratitude to my supervisor Dr. Musa Hindiyeh for his supervision, encouragement, and guidance, throughout my study.

And special thanks for my family members, specially my wife and brothers Dr. Nihad, and Younis (Master in Business Administration), for thier encouragement.

Also I would like to thank the staff at Makassed hospital lab. for their cooperation, and encouragement, and also a special thanks for the staff at Caritas hospital lab, for their cooperation.

I also thank my friend Ahmmad Ma'ali, for his help, and encouragement throughout the M.S.Ch program.

Contents

<u>Title</u>	<u>Page</u>
Chapter one	
- Introduction.....	1
- Problem Statement	2
- Goals	3
- Objectives	3
- Assumptions	4
- Limitation of the Study.....	4
- Definition of Terms.....	5
- Abbreviations.....	10
- Description of Caritas Hospital.....	11
Chapter Two	
Literature Review.....	12
Chapter Three	
Antibiotics and Mechanisms of Action	
History.....	20
Classification of Antibiotics.....	21
Mechanisms of antimicrobial Resistance among <i>S. pneumoniae</i>	23
Multidrug Resistance.....	27
National Standard's of Antibiotics Resistance among <i>S. pneumoniae</i>	28
Chapter four	
Conceptual Framework.....	30
Chapter Five	
Methodology	
Clinical Samples.....	33
Microbiological procedure.....	33
Data Analysis.....	36
Validity and reliability.....	36
Ethical Confederations.....	38

Chapter six
Data presentation

Total Distribution.....	40
Positive Sample Distribution.....	41
Distribution by Age.....	56
Distribution by Patient Residency.....	58
Distribution By Sex.....	60
Antibiogram.....	61
Summary of the Sensitivity pattern of all antibiotics	78

Chapter Seven
Discussion

Epidemiology of <i>S. pneumoniae</i>	82
Antibiogram.....	86
Summary	92
Appendix (One)	93
Appendix (Two)	94
References	96

List of Tables

<u>Title</u>	<u>Page</u>
Table (1): Classification of Antibiotics.	22
Table (2): Total Samples Distribution by Specimen Type in The Years 2001, 2002&2003.	40
Table (3): Total Samples Distribution by Specimen Source in the Years 2001, 2002&2003.	40
Table (4): Total Samples Distribution by Year in 2001, 2002&2003.	41
Table (5): Total Positive Cultures of <i>S. pneumoniae</i> In Bethlehem District in the years 2001, 2002&2003.	42
Table (6): Total Positive Cultures of <i>S. pneumoniae</i> In Bethlehem District in the years 2001, 2002&2003 According to Specimen Type..	42
Table (7): Total Positive Cultures of <i>S. pneumoniae</i> In Bethlehem District in the years 2001, 2002&2003 According to Specimen Source.	43
Table (8): Total Positive cultures of <i>S. pneumoniae</i> In Bethlehem District in the years 2001, 2002&2003 According to Year.	44
Table (9): Inpatient Positive Cultures of <i>S. pneumoniae</i> In Bethlehem District in the years 2001, 2002&2003 According to Specimen Type	45
Table (10):) Total Outpatient Positive Cultures of <i>S. pneumoniae</i> In Bethlehem District in the years 2001, 2002&2003 According to Specimen Type	46
Table (11): Total Specimen Type Distribution in 2001.	47
Table (12): Total Specimen Source Distribution 2001.	47
Table (13): Total Positive Cultures of <i>S. pneumoniae</i> In Bethlehem District in the year 2001.	48
Table (14): Total Positive Cultures of <i>S. pneumoniae</i> in the year 2001 According to Specimen Type.	48
Table (15): Total Positive Cultures of <i>S. pneumoniae</i> In the year 2001 According to Specimen Source.	49

Table (16): Total Inpatient Positive Cultures of <i>S. pneumoniae</i> In the year 2001 According to Specimen Type.	50
Table (17): Outpatient Positive Cultures of <i>S. pneumoniae</i> in the year 2001 According to Specimen Type.	51
Table (18): Total Sample Distribution by Specimen Type in the Year 2002&2003.	52
Table (19): Total Sample Distribution by Specimen Source in the Year 2002&2003.	52
Table (20): Total Positive Cultures of <i>S. pneumoniae</i> In Bethlehem District in the years 2002&2003.	53
Table (21): Total Positive Cultures of <i>S. pneumoniae</i> by Specimen Type in the year2002&2003.	53
Table (22): Total Positive Cultures of <i>S. pneumoniae</i> by Specimen Source in the Years 2002&2003.	54
Table (23): Inpatient Positive Cultures of <i>S. pneumoniae</i> by Specimen Type in the Years 2002&2003.	55
Table (24): Outpatient Positive Cultures of <i>S. pneumoniae</i> by Specimen Type in the Years 2002&2003.	56
Table (25): Positive Samples Distribution by Age in the years 2001, 2002&2003.	57
Table (26): Patient Residency Distribution with Positive Cultures of <i>S. pneumoniae</i> .	58
Table (27): Positive Cultures of <i>S. pneumoniae</i> in the Years 2001, 2002&2003 According to Sex.	60
Table (28): General Sensitivity Pattern for Ampicillin, Penicillin, & Oxacillin in Bethlehem District in the years 2001, 2002&2003	61
Table (29): Sensitivity Pattern for Ampicillin, Penicillin, & Oxacillin According to Specimen Type in the years 2001, 2002&2003.	62
Table (30): Sensitivity Pattern for Ampicillin, Penicillin, & Oxacillin According to Specimen source in the years 2001,2002&2003.	63
Table (31): Sensitivity Pattern for Ampicillin, Penicillin, & Oxacillin by Year.	64

Table (32): General Sensitivity Pattern of Cefotaxime in Bethlehem District In the years 2001,2002&2003.	65
Table (33): Sensitivity Pattern of Cefotaxime According to Specimen Type in the years 2001,2002&2003.	65
Table (34): Sensitivity Pattern of Cefotaxime According to Specimen Source in the years 2001,2002&2003.	66
Table (35): Sensitivity Pattern of Cefotaxime by Year.	67
Table (36): General Sensitivity Pattern of Erythromycin in Bethlehem District in the years 2001,2002&2003	69
Table (37): Sensitivity Pattern of Erythromycin According to Specimen Type in the years 2001,2002&2003.	69
Table (38): Sensitivity Pattern of Erythromycin According to Specimen Source in the years 2001,2002&2003.	70
Table (39): Sensitivity Pattern of Erythromycin by Year.	71
Table (40): General Sensitivity Pattern of Trimetheprime-Sulfamethoxazolein Bethlehem District in the years 2001,2002&2003.	73
Table (41): Sensitivity Pattern of Trimetheprime Sulfamethoxazole According to Specimen Type in the years 2001,2002&2003.	74
Table (42): Sensitivity Pattern of Trimetheprime Sulfamethoxazole According to Specimen Source in the years 2001,2002,2003.	75
Table (43): Sensitivity Pattern of Trimetheprime Sulfamethoxazole by Year.	76
Table (44): Sensitivity Pattern of Vancomycin in Bethlehem District In the years 2001,2002&2003.	77
Table (45): General Sensitivity Pattern of Ofloxacin In Bethlehem District In the years 2001, 2002&2003.	77
Table (46): General Sensitivity Pattern of Antibiotics for <i>S. pneumoniae</i> In Bethlehem District in the years 2001, 2002&2003.	78
Table (47): Comparison of β -Lactam Resistant Pattern for <i>S. pneumoniae</i> Between Bethlehem District, Palestine and Israel.	80
Table (48): Comparison of Nasopharyngeal Colonization of <i>S. pneumoniae</i> Between Bethlehem District, Palestine, and Israel.	81

List of figures

<u>Title</u>	<u>Page</u>
Figure (1): Factors Influence Colonization and Antibiotic Resistance and their Effect on <i>Streptococcus pneumoniae</i> .	32
Figure (2): Total Positive Cultures of <i>S. pneumoniae</i> In Bethlehem District in the years 2001, 2002&2003 According to specimen type.	42
Figure (3): Total Positive Cultures of <i>S. pneumoniae</i> In Bethlehem District in the years 2001, 2002&2003 According to Specimen Source	43
Figure (4): Total Positive Cultures of <i>S. pneumoniae</i> In Bethlehem District in the years 2001, 2002&2003 According to Year.	44
Figure (5): Total Inpatient Positive Cultures of <i>S. pneumoniae</i> In Bethlehem District in the years 2001, 2002&2003 According to Specimen Type.	45
Figure (6): Total Positive Cultures of <i>S. pneumoniae</i> in the year 2001 According to Specimen Type.	48
Figure (7): Total Positive Cultures of <i>S. pneumoniae</i> In Bethlehem District in the years 2001 According to Specimen Source.	49
Figure (8): Total Inpatient Positive Cultures of <i>S. pneumoniae</i> In the year 2001 According to Specimen Type.	50
Figure (9): Total Positive Cultures of <i>S. pneumoniae</i> by Specimen Type in the year 2002&2003.	53
Figure (10): Total Positive Cultures of <i>S. pneumoniae</i> by Specimen Source in the Years 2002&2003.	54
Figure (11): Inpatient Positive Cultures of <i>S. pneumoniae</i> by Specimen Type in the Years 2002&2003.	55
Figure (12): Positive Samples Distribution by Age in the Years 2001, 2002&2003.	57
Figure (13): Patient Residency Distribution with Positive Cultures of <i>S. pneumoniae</i> .	58
Figure (14): The distribution of <i>S. pneumoniae</i> in Bethlehem District.	59

Figure (15): Sensitivity Pattern for Ampicillin, Penicillin, & Oxacillin According to Specimen Type in the Years 2001,2002&2003.	62
Figure (16): Sensitivity Pattern for Ampicillin, Penicillin, & Oxacillin According to Specimen Source in the years 2001,2002&2003.	63
Figure (17): Sensitivity Pattern for Ampicillin, Penicillin, & Oxacillin by year.	64
Figure (18): Sensitivity Pattern of Cefotaxime According to Specimen Type in the years 2001,2002&2003.	66
Figure (19): Sensitivity Pattern of Cefotaxime According to Specimen Source in the years 2001,2002&2003.	67
Figure (20): Sensitivity Pattern of Cefotaxime by Year.	68
Figure (21): Sensitivity Pattern of Erythromycin According to Specimen Type in the years 2001,2002&2003.	70
Figure (22): Sensitivity Pattern of Erythromycin According to Specimen Source In the years 2001,2002&2003.	71
Figure (23): Sensitivity Pattern of Erythromycin by Year.	72
Figure (24): Sensitivity Pattern of Trimetheprime Sulfamethoxazole According to Specimen Type in the years 2001,2002&2003.	74
Figure (25): Sensitivity Pattern of Trimetheprime Sulfamethoxazole According to Specimen Source in the years 2001,2002&2003.	75
Figure (26): Sensitivity Pattern of Sulfamethoxazole by Year.	76
Figure (27): General Sensitivity Pattern of Antibiotics In Bethlehem District in the years 2001,2002&2003.	79
Figure (28): Comparison of β -Lactam Resistant Pattern for <i>S. pneumoniae</i> Between Bethlehem District, Palestine, and Israel.	80
Figure (29): Comparison of Nasopharyngeal Colonization of <i>S. pneumoniae</i> Between Bethlehem District, Palestine, and Israel.	81

Chapter One

Introduction

Streptococcus pneumoniae infections are the leading cause of illness in young children, and the elderly. Infections caused by *S. pneumoniae*, can range from severe invasive disease such as pneumonia, meningitis and bacteraemia, to less severe infections such as otitis media. (1) In the developing countries, *S. pneumoniae* is the leading bacterial cause of acute respiratory infections (ARI) in children. This organism, which has been isolated from approximately 30% of ARI patients, is associated with significantly higher case-fatality ratios when compared to virally associated ARI. (1) Globally, *S. pneumoniae* is associated with an estimated one million deaths each year in children less than 5 years of age. (1)

S. pneumoniae is an organism commonly present in the nasopharynx and oropharynx of healthy humans. Pneumococci reach its target within the body either by hematogenous spread or by direct extension from colonized mucosal surfaces.

The emergence of many resistant strains of pneumococci worldwide, serve to underscore the need for better understanding of antibiotic resistant *S. pneumoniae* that colonizes the nasopharynx and oropharynx of Palestinian children.