

**Antimicrobial Susceptibilities among Respiratory Isolates of
Haemophilus influenzae, Methicillin-Resistant
Staphylococcus aureus (MRSA) and *Streptococcus
pneumoniae* in Hillah Infants**

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Abstract

In this study 105 infants with respiratory conflicts diagnosis by physician were studied searching for the main causative agents and Antimicrobial Susceptibility for each causative. 105 isolates from infants with respiratory infections collected each of *Haemophilus influenzae*, Methicillin-Resistant *Staphylococcus aureus* (MRSA) and *S. pneumoniae* from proven or likely significant respiratory tract infections were collected respiratory specimens in Babylon Maternity and Children Hospital from October\2007 to March\2008.

Streptococcus pneumoniae formed the major cause of Respiratory infection in infants it reveal 56.2% followed by Methicillin-Resistant *Staphylococcus aureus* (MRSA) and *H. influenzae* (27.6%), (16.2%) respectively. Infants whom investigated for infection with Respiratory infection and other disease were below 24 months of age.

The study found that Respiratory infection was more in those living in rural areas (45.8%%), (69%) and (64.7%) represents *Streptococcus pneumoniae*, MRSA and *Haemophilus influenzae* respectively.

Streptococcus pneumoniae show sensitivity to Amikacin, Amoxicillin, Cefodizim, Cephalexin, Chloromphenicol, Gentamycin, Kanamycin, Lincomycin, Nitrofurantoin, Norfloxacin, Oxacillin, Ofloxacin, Oxytetracyclin, Rifampim, Spiramycin and Tobramycin . While *Haemophilus influenzae* have sensitivity to Ceftizoxime, Clarithromycin, Ofloxacin and Tetracycline. MRSA sensitive to Amikacin, Norfloxacin and Nitrofurantoin.

Introduction

Haemophilus influenzae, *Streptococcus pneumoniae* are bacterial agents responsible for a number of upper and lower respiratory tract infections, including otitis media, maxillary sinusitis, community-acquired pneumonia, and in some cases, exacerbations of chronic bronchitis [5]. These species may harbor resistance mechanisms which affect several antimicrobial agents commonly used to treat such infections. Two prior national surveillance studies have documented antimicrobial resistance rates of *H. influenzae* from a variety of infections and in various age groups in the United States [11].

However, antimicrobial resistance has emerged in the developing world in bacterial pathogens commonly associated with meningitis [6]. In South America, more than 20% of *Streptococcus pneumoniae* clinical isolates are nonsusceptible to penicillin [3]. Furthermore, findings from reference laboratory collection surveys and laboratory-based surveillance indicate that *H. influenzae* is resistant to commonly used antibiotics, albeit at levels lower than those observed in developed countries [7].

Antimicrobial resistance has emerged in both *H. influenzae* and *S. pneumoniae*, and effective patient management requires physicians to be aware of the patterns and clinical significance of antibiotic resistance in these pathogens. This knowledge is gained, in large measure, from periodic systematic epidemiological surveillance studies.

Materials and Methods

A maximum of 105 isolates each of *H. influenzae*, Methicillin-Resistant *Staphylococcus aureus* (MRSA) and *S. pneumoniae* from proven or likely significant respiratory tract infections were collected respiratory specimens in Babylon Maternity and Children Hospital from October\2007 to March\2008.

Identification of isolates; the isolates were confirmed the identity and purity of every strain. *S. pneumoniae* isolates were confirmed by inhibition by optochin we used Chocolate agar and Blood agar for isolation. *Haemophilus* strains were identified by X and V factor requirement and reaction to polyvalent antiserum

(Difco Laboratories, USA), and strains were confirmed as *H. influenzae* by determination of the requirement for both the X and V factors.

The demographical information submitted for each strain included patient age and gender, specimen collection date and specimen source.

Antimicrobial agents; the following antimicrobial agents were tested against each isolate: Amikacin, Amoxicillin, Amoxicillin + Clavulanic acid, Azithromycin, Bacitracin, Carbenicillin, Cefodizime, Cefoxitin, Ceftizoxime, Cephalexin, Chloromphenicol, Clarithromycin, Clindamycin, Erythromycin, Gentamycin, Kanamycin, Lincomycin, Methicillin, Nitrofurantoin, Norfloxacin, Ofloxacin, Oxacillin, Oxytetracyclin, PenicillinG, Piperacillin, Rifampin and Spiramycin, Rifamycin, Streptomycin, Tetracycline, Tobramycin, Trimethoprim, Trimethoprim + Sulphamethaxazole, Vancomycin.

Results and Discussion

In this study, *Streptococcus pneumoniae* formed the major cause of Respiratory infection in infants it reveal 56.2% followed by Methicillin-Resistant *Staphylococcus aureus* (MRSA) and *H. influenzae* (27.6%), (16.2%) respectively (Table 1). This result were nearly agreed with Micheal, *et.al.* and James, *et.al.* whose regarded the causative agents of Respiratory infection to *H. influenzae* and *Streptococcus pneumoniae* [12,9].

Table1: Percentage of Etiological agents causes Respiratory infection in infants.

Etiological agents causes bacteremia	No.	%
<i>Streptococcus pneumoniae</i>	59	56.2
MRSA	29	27.6
<i>Haemophilus influenzae</i>	17	16.2
<i>Total</i>	105	100

MRSA \ Methicillin-Resistant *Staphylococcus aureus*

Infants whom investigated for infection with Respiratory infection and other disease were below 24 months of age (Table 2). This age looks to be more infected

with diseases because they have a low immunoglobulin G antibody (IgG) response to encapsulated bacteria [1].

Table 2: Age and Type of sex distribution and frequency of Respiratory infection causes isolated from infants.

Age (Months)	Gram Positive Bacteremia Causes					
	<i>Streptococcus pneumoniae</i>		MRSA		<i>Haemophilus influenzae</i>	
	Male (%)	Female (%)	Male (%)	Female (%)	Male (%)	Female (%)
< 6	4 (6.8)	2 (3.4)	4 (13.8)	1 (3.4)	2 (11.8)	-
7-12	7 (11.9)	6 (10.2)	6 (20.7)	1 (3.4)	-	-
13-18	12 (20.3)	4 (6.8)	-	9 (31)	1 (5.9)	1 (5.9)
19-24	11 (18.6)	13 (22)	8 (27.6)	-	4 (23.5)	10 (58.8)
Total	34 (57.6)	25 (42.4)	18 (62.1)	11 (37.9)	7 (41.2)	11 (64.7)
	59		29		17	

MRSA \ Methicillin-Resistant *Staphylococcus aureus*

To compare between rural and urban areas regarding frequency of Respiratory infection among infants, the study found that Respiratory infection was more in those living in rural areas (45.8%%), (69%) and (64.7%) represents *Streptococcus pneumoniae*, MRSA and *Haemophilus influenzae* respectively (Table 3).

This difference may be mainly related to their low socioeconomic status, malnutrition and lack of medical facilities [17], in addition to possible factors like poor hygiene in the delivery room and in neonatal care units, no colostrums feeding and umbilical or skin infections during the early neonatal period [2,14].

Table 3: Distribution and Percentage of Etiological causes of Respiratory infection in infants according to residence.

Type of causes	Residence		Total
	Urban %	Rural %	
<i>Streptococcus pneumoniae</i>	27 (45.8)	32 (54.2)	59
MRSA	9 (31)	20 (69)	29
<i>Haemophilus influenzae</i>	6 (35.3)	11 (64.7)	17

The recent increase in the resistance of the major respiratory pathogens *H. influenzae*, Methicillin-Resistant *Staphylococcus aureus* (MRSA) and *S. pneumoniae* to antimicrobial agents have produced a need to re-evaluate treatment options for respiratory tract infections [4]. This is particularly important for the established oral agents, many of which have decreased activity against contemporary isolates, and also for newer agents like the fluoroquinolones, which currently have broader spectra of activity against these and other respiratory tract pathogens.

Recent studies have shown that up to 33% of the strains of *S. pneumoniae* are penicillin intermediate or penicillin resistant in many parts of the country. Furthermore, over 30% of the strains of *H. influenzae* and 90% of the strains of *Moraxella catarrhalis* now produce β -lactamases [16]. This severely limits the activity of many antimicrobial agents, particularly for pediatric use [13].

Streptococcus pneumoniae show sensitivity to Amikacin, Amoxicillin, Cefodizim, Cephalexin, Chloromphenicol, Gentamycin, Kanamycin, Lincomycin, Nitrofurantoin, Norfloxacin, Oxacillin, Ofloxacin, Oxytetracyclin, Rifampim, Spiramycin and Tobramycin . While *Haemophilus influenzae* have sensitivity to Ceftizoxime, Clarithromycin, Ofloxacin and Tetracycline. MRSA sensitive to Amikacin, Norfloxacin and Nitrofurantoin (Tables 4, 5 and 6). These results were agreed with [12, 9, 10, 8, and 15].

Table 4: Antimicrobial sensitivity and spectrum for 13 selected antimicrobial agents tested against most frequently occurring Respiratory infection pathogens.

Microorganism	Antimicrobial agent / % sensitive strains												
	AK	AX	AMC	AZM	B	PY	CDZ	FOX	ZOX	CL	C	CLR	DA
<i>Streptococcus pneumoniae</i>	80	80	-	5	-	10	95	-	10	15	80	75	5
MRSA	90	-	10	1	5	10	50	-	-	-	-	10	-
<i>Haemophilus influenzae</i>	-	10	45	30	-	-	50	25	80	50	45	70	-

MRSA \ Methicillin-Resistant *Staphylococcus aureus*, AK \Amikacin, AX \Amoxicillin, AMC \Amoxicillin + Clavulanic acid, AZM\Azithromycin, B \Bacitracin, PY \Carbenicillin, CDZ \Cefodizime, FOX \Cefoxitin, ZOX \Ceftizoxime, CL \Cephalexin, C \Chloromphenicol, CLR \Clarithromycin, DA \Clindamycin

Table 5: Antimicrobial sensitivity and spectrum for 13 selected antimicrobial agents tested against most frequently occurring Respiratory infection pathogens.

Microorganism	Antimicrobial agent / % sensitive strains												
	E	CN	K	L	ME	F	NOR	OFX	OX	T	P	PRL	RA
<i>Streptococcus pneumoniae</i>	30	80	80	95	20	90	90	95	85	95	25	5	75
MRSA	20	5	10	10	-	70	95	-	15	50	5	-	-
<i>Haemophilus influenzae</i>	-	10	-	25	5	-	-	70	-	10	-	5	45

MRSA \ Methicillin-Resistant *Staphylococcus aureus*, E \Erythromycin, CN\Gentamycin, K\Kanamycin, L\Lincomycin, ME\Methicillin, F\Nitrofurantoin, NOR\Norfloxacin, OFX \Ofloxacin, OX\Oxacillin, T\Oxytetracyclin, P\Penicillin G, PRL \Piperacillin, RA\Rifampim.

Table 6: Antimicrobial sensitivity and spectrum for 8 selected antimicrobial agents tested against most frequently occurring Respiratory infection pathogens.

Microorganism	Antimicrobial agent / % sensitive strains							
	RF	SP	S	TE	TOB	TMP	SXT	VA
<i>Streptococcus pneumoniae</i>	65	90	-	55	75	55	10	65
MRSA	10	-	15	-	-	-	45	-
<i>Haemophilus influenzae</i>	5	-	-	70	-	5	10	-

RF \Rifamycin, SP\Spiramycin, S\Streptomycin, TE\Tetracycline, TOB\Tobramycin, TMP\Trimethoprim, SXT\Trimethoprim + Sulphamethaxazole, VA\Vancomycin

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Haemophilus influenzae الحساسيه الدوائيه لدى المصابين بعزلات بكتريا
، بكتريا *Staphylococcus aureus* المقاومه لمضاد الميسيثيلين (MRSA)
و بكتريا *Streptococcus pneumoniae* في رضع الحله

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الخلاصة

في هذه الدراسة 105 اطفال حديثي الولادة يعانون من اصابات في الجهاز التنفسي مشخصه سريريا من قبل الطبيب المختص تمت دراستهم لمعرفة المسبب الرئيسي اضافة لمعرفة الحساسيه للمضاد الحيوي لكل مسبب. 105 عينه تم جمعها من الاطفال المصابين حيث تم تشخيص *Haemophilus influenzae*, *Methicillin-Resistant Staphylococcus aureus* (MRSA) و *S. pneumoniae* من الحالات التي تملك علامات الاصابه في مستشفى بابل للولادة والاطفال للفترة من تشرين الاول/ 2007 الى اذار/ 2008.

وجد ان بكتريا *Streptococcus pneumoniae* تعتبر المسبب الرئيسي لاصابات الجهاز التنفسي حيث شكلت 56.2% من نسب الاصابات ثم *Methicillin-Resistant Staphylococcus aureus* (MRSA) بنسبة 27.6% واخيرا *Haemophilus influenzae* وبنسبه 16.2%. جميع الاطفال في نطاق الدراسة كانوا دون السنيتين وكانت الاصابه عاليه في الاطفال ذوي الاعمار الاقل من 24 شهرا. نسب الاصابه في اطفال الريف اعلى من اطفال المدينة حيث بلغت (45.8%) ، (69%) ، (64.7%) لكل من *Streptococcus pneumoniae* ، MRSA و *Haemophilus influenzae* بالتتابع.

Streptococcus pneumoniae اظهرت حساسيه تجاه المضادات Amikacin, Amoxicillin, Cefodizim, Cephalexin, Chloromphenicol, Gentamycin Kanamycin, Lincomycin, Nitrofurantoin, Norfloxacin, Oxacillin, Ofloxacin, Oxytetracyclin, Rifampim, Tobramycin و Spiramycin بينما بكتريا *Haemophilus influenzae* كانت حساسه لـ Clarithromycin, Ofloxacin , Tetracycline Ceftizoxime, Norfloxacin , Nitrofurantoin و Amikacin .