

*Klebsiella pneumoniae*

( 2001/5/9                      2001/4/2                      )

*Klebsiella*                      95                      ( 1999 )                      ( 1998 )

.  
(50 ) .

*Klebsiella pneumoniae*

Amikacin

Norfloxacin    Ciprofloxacin

(%.14)    (%.8 )

.(%.88)

( %.36)

(%.66.7)    (%. 100)

(%.25)

(%.55.6)

## Resistance of *Klebsiella Pneumoniae* Isolated From Different Infections to Antibiotics

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### ABSTRACT

During the period (September, 1998-March, 1999), 95 isolates of *Klebsiella* from respiratory tract, urinary tract, middle ear, intestinal tract, wound and blood infections were collected. Morphological studies and biochemical tests were used for the identification of this bacterium. (50) isolates of *Klebsiella pneumoniae* were selected and used in the study. It was found that all isolates were resistant to one or more antibiotic and that Amikacin was the most active antibiotic against this species as all isolates were susceptible to it. Also Ciprfloxacin and Norfloxacin were very active with resistance rates of (8 %) and (14 %) respectively. Middle ear isolates were found to be more susceptible to antibiotics whereas blood and intestinal tract isolates were highly resistant to them.

The study indicated that this bacterium has a high ability to produce  $\beta$ -lactamase enzymes with total production rate of (88 %). The production rate of extended spectrum  $\beta$ -lactamases was (36 %) where blood and intestinal tract isolates gave rates of (100 %) and (66.7 %) respectively, whilst urinary tract isolates gave rate of (55.6 %), whereas the production rate of respiratory tract and wound isolates was (25 %) for each. Middle ear isolates didn't produce these enzymes.

(Enterobacteriaceae)

*Klebsiella pneumoniae*

.Capsule

(Polysaccharides)

(Commensals)

.(Edwards and Ewin, 1972)

*Klebsiella*

%( 95 )

(Jawetz et al.,1980; Pazin and Braude, 1977 )

(Montgomeri and Ota, 1980)

.(Rukavina et al., 1997)

%( 50 )

Hobson et al., )

. (1996

R-Factors (R-Plasmids)

*K.pneumoniae* (Fekete et al., 1996; Garrod et al., 1981)

(Ørskov, 1984)

; O'Callaghan et al., 1978)

.(Markowitz et al., 1980

(Garrod et al., 1981) Mutation (Adaptation) (Selection)

-

-

.(Laurence and Bennett, 1987 ; Garrod et al., 1981)

*K.pneumoniae*

(Extended Spectrum  $\beta$ -Lactamases)

-

(Elkhaili et al., 1997; Jones, 1996) ESBLs

(Weller et al.,

*K.pneumoniae*

(Cefotaxime)

.1997)

-

(Ceftazidime) (Cefterioxone)

(ESBLs)

.(Bradford et al., 1994)

*Escherichia coli*

.( Bingen et al., 1993 ; Markowitz et al., 1980)

(Cefepime)

; Kessler and Fung-Tomc, 1996) *K.pneumoniae*

*K.pneumoniae*

(Fekete et al., 1996

.(Fekete et al., 1996)

(Fluoroquinolones)

. (Deguchi et al., 1997) Norfloxacin Ciprofloxacin

( Hobson et al., 1996 ; Jones, 1996)

.(Weller et al., 1997 ; Smith et al., 1982)

:  
(95)

.(1999) (1998)

*K.pneumoniae*

. (1 ) (50)

*K.pneumoniae* 52142

(24)

Wet

Oxoid

(Baron and Finegold, 1990 ; Cruickshank et al., 1975) Disk Method

.(Vandepitte et al., 1991)

Bauer Oxoid (Mueller-Hinton Agar)

(Vandepitte (1966)

et al., 1991)

(Macfarland Standards)

(Baron and Finegold, 1990)<sup>3</sup> / (<sup>8</sup>10 x 1)

. (18) ° (37)

(Susceptible)

(Resistant)

(Moderately Susceptible)

.(Vandepitte et al., 1991)

**β-Lactamase**

*K.pneumoniae*

(Iodometric Method)

<sup>2</sup> (2.5)

(β-Lactamase)

G

(0.02)

(Bibulous Paper)

(10)

(Gram Iodine)

(5-3)

(5)

.(Lee and Komarmy, 1981)

( ESBLs )

-

.( Jones, 1996) Ceftazidime

*K.pneumoniae* : 1

|    |  |
|----|--|
|    |  |
| 15 |  |
| 12 |  |
| 9  |  |
| 8  |  |
| 4  |  |
| 2  |  |
| 50 |  |

(

*K.pneumoniae*

(2)

100)

(Multiple Resistance)

(3)

( Jarlier et al., 1996)

(100-96)

( 78) ( 94) Rifampicin Compound Sulfonamide

Cephalexine Streptomycin Trimethoprim-Sulfamethoxazole

(48-40) Amoxicillin-Clavulinate Nitrofurantoin Tetracycline Gentamicin

Ceftazidime Cefuroxime Tobramycin Nalidixic Acid

Cefixime (38-32) Chloramphenicol

( 20 ) ( 24 ) Cefotaxime

14) ( 8) Norfloxacin Ciprofloxacin

Amikacin (

.( 0.0)

Fluoroquinolones

( Jarlier et al.,1996) ( Hobson et al., 1996)

(36-30) Fluoroquinolones

*K.pneumoniae* : 2

|                 |                           |
|-----------------|---------------------------|
| ( 0 )           |                           |
|                 | <i>K.pneumoniae</i> 52142 |
| (100) 15        |                           |
| (100) 12        |                           |
| (100) 9         |                           |
| (100) 8         |                           |
| (100) 4         |                           |
| (100) 2         |                           |
| <b>(100) 50</b> |                           |

*K.pneumoniae*

: 3

*K.pneumoniae* 52142

| ( )       | ( )       | ( )       | <i>K.pneumoniae</i><br>52142<br>( ) | /   |                               |
|-----------|-----------|-----------|-------------------------------------|-----|-------------------------------|
| (100) 50  | (0.0) 0   | (0.0) 0   | R                                   | 10  | Amoxycillin                   |
| (98.0) 49 | (0.0) 0   | (2.0) 1   | R                                   | 10  | Ampicillin                    |
| (96.0) 48 | (4.0) 2   | (0.0) 0   | R                                   | 30  | Doxycycline                   |
| (96.0) 48 | (2.0) 1   | (2.0) 1   | R                                   | 30  | Ampiclox                      |
| (96.0) 48 | (4.0) 2   | (0.0) 0   | R                                   | 5   | Cloxacillin                   |
| (94.0) 47 | (0.0) 0   | (6.0) 3   | R                                   | 300 | Compound Sulfonamide          |
| (78.0) 39 | (14.0) 7  | (8.0) 4   | R                                   | 30  | Rifampicin                    |
| (48.0) 24 | (30.0) 15 | (22.0) 11 | (24) S                              | 30  | Amoxycillin-Clavulinate       |
| (46.0) 23 | (24.0) 12 | (30.0) 15 | (19) S                              | 300 | Nitrofuratoin                 |
| (46.0) 23 | (34.0) 17 | (20.0) 10 | (17) MS                             | 30  | Tetracycline                  |
| (46.0) 23 | (6.0) 3   | (48.0) 24 | (20) S                              | 10  | Gentamicin                    |
| (44.0) 22 | (12.0) 6  | (44.0) 22 | (23) S                              | 30  | Cephalexine                   |
| (42.0) 21 | (14.0) 7  | (44.0) 22 | (22) S                              | 10  | Streptomycin                  |
| (40.0) 20 | (22.0) 11 | (38.0) 19 | (20) S                              | 30  | Trimethoprim-Sulfamethoxazole |
| (38.0) 19 | (2.0) 1   | (60.0) 30 | (27) S                              | 30  | Chloramphenicol               |
| (34.0) 17 | (8.0) 4   | (58.0) 29 | (27) S                              | 30  | Ceftazidime                   |
| (32.0) 16 | (22.0) 11 | (46.0) 23 | (26) S                              | 30  | Cefuroxime                    |
| (32.0) 16 | (28.0) 14 | (40.0) 20 | (15) S                              | 30  | Tobramycin                    |
| (32.0) 16 | (48.0) 24 | (20.0) 10 | (16) MS                             | 30  | Nalidixic Acid                |
| (24.0) 12 | (8.0) 4   | (68.0) 34 | (36) S                              | 30  | Cefixime                      |
| (20.0) 10 | (6.0) 3   | (74.0) 37 | (31) S                              | 30  | Cefotaxime                    |
| (14.0) 7  | (6.0) 3   | (80.0) 40 | (30) S                              | 5   | Norfloxacin                   |
| (8.0) 4   | (8.0) 4   | (84.0) 42 | (36) S                              | 5   | Ciprofloxacin                 |
| (0.0) 0   | (2.0) 1   | (98.0) 49 | (22) S                              | 30  | Amikacin                      |

: R

: MS

: S

(4)

( 91.7)

Amoxycillin-Clavulinate Chloramphenicol Rifampicin

( 83.3) ( 75)

Fluoroquinolones

(66.7-33.3)

( 16.7) ( 33.3)

Ciprofloxacin Norfloxacin

.Amikacin

.Nalidixic Acid Norfloxacin Ciprofloxacin Amikacin

Nitrofurantoin Gentamicin Rifampicin  
 ( 25) Amoxicillin-Clavulinate Nalidixic Acid Streptomycin  
 Cephalexine Chloramphenicol Ceftazidime Norfloxacin Tobramycin  
 Cefotaxime Ciprofloxacin Amikacin Trimethoprim-Sulfamethoxazole  
 . Cefuroxime Cefixime  
 ( 77.8) Doxycycline Rifampicin  
 ,Gentamicin,Nitrofurantoin,Tetracycline Amoxicillin-Clavulinate  
 Nalidixic Acid Tobramycin Ceftazidime Chloramphenicol Streptomycin  
 ,Amikacin (11.1) Norfloxacin ( 55-44)  
 Rifampicin Ampiclox .Ciprofloxacin  
 ( 37.5) ( 62.5) ( 75) Gentamicin  
 Tetracycline Nitrofurantoin Amoxicillin-Clavulinate  
 ( 12.5) Chloramphenicol ( 25)  
 ( 86.7) Cloxacillin .  
 Ciprofloxacin ,Nalidixic Acid Chloramphenicol Streptomycin, Gentamicin  
 Norfloxacin Amikacin ( 13.3)  
 .Ceftazidime Cefotaxime  
 Fluoroquinolones Aminoglycosides  
 .Nalidixic Acid Chloramphenicol

*K.pneumoniae*

: 4

| ( )       | ( )      | ( )      | ( )     | ( )     | ( )       |                               |
|-----------|----------|----------|---------|---------|-----------|-------------------------------|
| (100) 15  | (100) 8  | (100) 9  | (100) 4 | (100) 2 | (100) 12  | Amoxycillin                   |
| (100) 15  | (100) 8  | (100) 9  | (75) 3  | (100) 2 | (100) 12  | Ampicillin                    |
| (100) 15  | (100) 8  | (77.8) 7 | (100) 4 | (100) 2 | (100) 12  | Doxycycline                   |
| (93.3) 14 | (75) 6   | (100) 9  | (100) 4 | (100) 2 | (100) 12  | Ampiclox                      |
| (86.7) 13 | (100) 8  | (100) 9  | (100) 4 | (100) 2 | (100) 12  | Cloxacillin                   |
| (93.3) 14 | (100) 8  | (100) 9  | (50) 2  | (100) 2 | (100) 12  | Compound Sulfonamide          |
| (66.7) 10 | (62.5) 5 | (77.8) 7 | (100) 4 | (100) 2 | (91.7) 11 | Rifampicin                    |
| (26.7) 4  | (25) 2   | (55.6) 5 | (50) 2  | (50) 1  | (83.3) 10 | Amoxycillin-Clavulinate       |
| (26.7) 4  | (25) 2   | (44.4) 4 | (75) 3  | (100) 2 | (66.7) 8  | Nitrofuratoin                 |
| (26.7) 4  | (25) 2   | (55.6) 5 | (50) 2  | (100) 2 | (66.7) 8  | Tetracycline                  |
| (13.3) 2  | (37.5) 3 | (55.6) 5 | (75) 3  | (100) 2 | (66.7) 8  | Gentamicin                    |
| (46.7) 7  | (25) 2   | (22.2) 2 | (25) 1  | (100) 2 | (66.7) 8  | Cephalexine                   |
| (13.3) 2  | (50) 4   | (55.6) 5 | (50) 2  | (100) 2 | (50) 6    | Streptomycin                  |
| (33.3) 5  | (25) 2   | (22.2) 2 | (25) 1  | (100) 2 | (66.7) 8  | Trimethoprim-Sulfamethoxazole |
| (13.3) 2  | (12.5) 1 | (44.4) 4 | (25) 1  | (100) 2 | (75) 9    | Chloramphenicol               |
| (0.0) 0   | (25) 2   | (55.6) 5 | (25) 1  | (100) 2 | (66.7) 8  | Ceftazidime                   |
| (6.7) 1   | (25) 2   | (44.4) 4 | (0.0) 0 | (100) 2 | (58.3) 7  | Cefuroxime                    |
| (26.7) 4  | (25) 2   | (44.4) 4 | (25) 1  | (50) 1  | (33.3) 4  | Tobramycin                    |
| (13.3) 2  | (12.5) 1 | (55.6) 5 | (50) 2  | (0.0) 0 | (50) 6    | Nalidixic Acid                |
| (13.3) 2  | (0.0) 0  | (33.3) 3 | (0.0) 0 | (100) 2 | (41.7) 5  | Cefixime                      |
| (0.0) 0   | (0.0) 0  | (44.4) 4 | (0.0) 0 | (100) 2 | (33.3) 4  | Cefotaxime                    |
| (0.0) 0   | (12.5) 1 | (11.1) 1 | (25) 1  | (0.0) 0 | (33.3) 4  | Norfloxacin                   |
| (13.3) 2  | (0.0) 0  | (0.0) 0  | (0.0) 0 | (0.0) 0 | (16.7) 2  | Ciprofloxacin                 |
| (0.0) 0   | (0.0) 0  | (0.0) 0  | (0.0) 0 | (0.0) 0 | (0.0) 0   | Amikacin                      |

(5 )

Aminoglycosides

( 16)

( 40)

Tetracyclines

( 18 )Amikacin

Amoxycillin

(5)

( 84)

Amoxycillin-Clavulinate

( 48)

( 100)

(Clavulinic Acid)

-

Cuffini et al., Laurence and Bennett, 1987; Garrod et al., 1981)

( 4 ) Fluoroquinolones (1995;

*K.pneumoniae*

*K.pneumoniae*

Amikacin

Fluoroquinolones

Aminoglycosides

Rifampicin

*K. pneumoniae*

:5

|         |                                                                                    |
|---------|------------------------------------------------------------------------------------|
| (%)     |                                                                                    |
| (84) 42 | : Penicillins<br>Ampicillin + Cloxacillin + Ampiclox + Amoxicillin                 |
| (40) 20 | : Tetracyclines<br>Doxycycline + Tetracycline                                      |
| (18) 9  | : Aminoglycosides<br>Tobramycin + Streptomycin + Gentamicin                        |
| (16) 8  | : Cephalosporins<br>Ceftazidime + Cefixime + Cefuroxime + Cefotaxime + Cephalexine |
| (4) 2   | : Fluoroquinolones<br>Norfloxacin + Ciprofloxacin                                  |

*K.pneumoniae*

.(Weller et al., 1997 ; Jones, 1996 ; Ørskov, 1984)

-

-

.(Weller et al., 1997; Bradford et al., 1994)

and Bennett, (Laurence

Aminoglycosides Inactivating Enzymes

.1987; Garrod et al., 1981)

.(Ørskov, 1984; O'Callaghan et al., 1978)

(Selective Pressure)

(Hobson et.al.,1996;Smith et.al.,1982)

*K.pneumoniae*

-

- ( 34) ( 88)

(7) (6) (ESBLs)

-

( Jones, 1996) (Elkhaili et al., 1997 ; Hobson et al., 1996)

( 58-1 ) (ESBLs) *K.pneumoniae*

(6)

( 66.7)

-

( 75)

(ESBLs) - ( 100)

66.7) ( 100)

(7)

( 25)

( 44.4)

(

*K.pneumoniae*

ESBLs

Ceftazidime

(Bradford et al., 1994) .

K. - :6

*pneumoniae*

. *K. pneumoniae* 52142

|           |    |                            |
|-----------|----|----------------------------|
| ( )       |    |                            |
|           | -  | <i>K. pneumoniae</i> 52142 |
| (100) 12  | 12 |                            |
| (100) 9   | 9  |                            |
| (100) 8   | 8  |                            |
| (100) 2   | 2  |                            |
| (75) 3    | 4  |                            |
| (66.7) 10 | 15 |                            |
| (88) 44   | 50 |                            |

(ESBLs) - :7

K. *K. pneumoniae*

. *pneumoniae* 52142

|          |    |                            |
|----------|----|----------------------------|
| ( )      |    |                            |
|          | -  | <i>K. pneumoniae</i> 52142 |
| (100) 2  | 2  |                            |
| (66.7) 8 | 12 |                            |
| (55.6) 5 | 9  |                            |
| (25.0) 1 | 4  |                            |
| (25.0) 2 | 8  |                            |
| (0.0) 0  | 15 |                            |
| (36) 18  | 50 |                            |

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