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Klebsiella pneumoniae Urinary Tract Infections Associated with Long-term Catherterizaton and Spinal Cord Injuries

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Klebsiella pneumoniae a human commensal is sometimes associated with urinary tract infection (UTI) due to long-term catherization, wound infections, bacterimia and nosocomial infections. This study was designed to determine the incidence of *Klebsiella pneumoniae* among UTI patients and included 152 urine samples. Of the 152 samples, 6 (3.95%) showed *Klebsiella pneumoniae* to be the causative agent. Furthermore, there was no predominating pattern in the sex-wise distribution, as of these 6 cases, 3 were females and 3 males. The antibiogram pattern showed that amikacin (100%), norfloxacin (100%) and pipemidic acid (100%) were the most effective drugs, as all the isolates were sensitive to them, whereas all the isolates were found to be resistant to ampicillin and 67% were resistant to nitrofurantin and augmentin.

Key words: *Klebsiella pneumoniae*, urinary tract infection, spinal cord injuries

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Introduction

Klebsiella pneumoniae, a member of the family Enterobacteriaceae, has become one of the most common causes of urinary tract infection (UTI), especially amongst patients with prolonged catheterization, spinal cord injuries–resulting in prolonged catheterization–and nosocomial infections (Jing-Jou *et al.*, 2001; Podschun and Ullmann, 1998; Kil *et al.*, 1997; Liverelli *et al.*, 1996). Despite the reduction of incidence through intermittent bladder catheterization, UTI recurrence is a troublesome problem among many patients (Vromen *et al.*, 1999; Weatherhall *et al.*, 1996; Turck *et al.*, 1996) and as a results *Klebsiella pneumoniae* colonize or invade body tissue and cause failure of the host natural defense mechanism (Levinson and Jawetz, 1992).

Nosocomial *Klebsiella pneumoniae* is an opportunistic pathogen that resides within the gastrointestinal tract, causing infections mainly in immuno-compromised and debilitated patients as a result of auto-infections (Liverelli *et al.*, 1996). *Klebsiella pneumoniae* causes enteritis in children (Prescott *et al.*, 1999) and as complications of UTI can cause pyelonephritis – an infection of urethra that may spread to kidney leading to renal failure (Mahon and Manusalis, 1995).

Antimicrobial drug therapy recommendation is based on culture sensitivity test (Johnson *et al.*, 1995). Ciprofloxacin has been reported to be the most effective drug against *Klebsiella pneumoniae* strains isolated from UTI patients (Hryniewicz *et al.*, 2001).

The objective of this study was to determine the extent to which *Klebsiella pneumoniae* is associated with UTIs caused by prolonged catheterization and spinal cord injuries (SCIs) and to determine the sensitivity pattern of the isolates, so as to develop more effective therapeutic regime.

Materials and Methods

This study was carried out in Bacteriology Laboratory of the National Institution of Health, Islamabad, during November 2000 to May 2001.

One hundred and fifty two samples of urine were collected from patients suspected of UTI, after referral from their physicians, and cultured on MacConkey agar and blood agar and analyzed, through sugar fermentation tests followed by various biochemical tests, such as indole, urease, citrate and TSI tests, for the presence of *Klebsiella pneumoniae*. The symptoms of such patients were: sensation of lower abdominal heaviness, lower back pain and urine of the infected patient may be turbid or bloody.

A questionnaire was filled out at the time of collection with the aid of the attending physician so as to ascertain the predisposing conditions for their ailment.

Urine samples were then inoculated on blood and MacConkey agar (Difco) and streaked with the help of sterilized wire loop. Plates were then incubated at 37°C for 24 hrs and then examined for *Klebsiella* colonies. The colonies were identified on the basis of their morphology and the isolates were identified by using gram staining. Biochemical tests, such as indole, motility, urease, citrate and triple sugar iron (TSI) tests were carried out to confirm *Klebsiella* isolates (Mahon and Manusalis, 1995).

Antibiogram sensitivity test: The antibiogram pattern was determined on Muller Hinton agar (Difco) plates. For this purpose colonies were mixed in peptone water and turbidity of the suspension was matched with standard barium chloride ($BaCl_2$) solution. The entire Muller Hinton plate was swabbed by picking bacteria from suspension with the help of a sterile swab.

The plates were incubated at 37°C for 24 h. before measuring the zone of inhibition. The zone of inhibition determines the sensitivity and resistance pattern. The zone of inhibition was compared according to the Guidelines of National Committee for Clinical Laboratory Standards (Johnson *et al.*, 1995).

Results and Discussion

Of the 152 urine samples, cultured and analyzed for *Klebsiella* growth, 6 samples were found positive for *Klebsiella pneumoniae* and confirmed through biochemical tests and it was found that *klebsiella* species are positive for urease and citrate production, while giving an alkaline reaction (reddish pink slope) for the TSI test with gaseous fermentation.

The sex-wise distribution pattern was evenly balanced in that of the 6 cases, 3 were males and 3 were females (Table 1). All these positive patients had a long-term history of catheterization following surgery of the lower abdomen, either renal stone (b) or due to spinal cord injury (a) in case of men, and blocked urethra surgery (b) or surgery due to spinal cord injury (a) in case of women. All cases were reported by the attending physician to have suffered post-operative complications and infection resulting in prolonged use of both drain, as well as urinary catheters (Table 1).

Klebsiella pneumoniae was also found in gastrointestinal tract of humans and animals and sometimes associated with UTI, wound infection, bacterimia and nosocomial infections. As a matter of fact *Klebsiella* infection among UTI patients was mainly associated with long-term bladder catherization and in immuno-compromised individuals (Jing-Jou *et al.*, 2001; Podschun and Ullmann, 1998; Kil *et al.*, 1997; Liverelli *et al.*, 1996; Levinson *et al.*, 1992). The present study reflected similar findings in that of the 157 UTI patients, *Klebsiella pneumoniae* was identified as the causative agent in 6 (3.9%) cases. As far as the sex-wise distribution pattern of *Klebsiella* infection, this study reported more or less equal (4.47%) in males and (3.52%) in females. Similar findings have also been reported by Vromen *et al.* (1999).

Predisposing factors frequently include pregnancy, indwelling catheters, urinary tract instrumentation, manipulation or obstruction and underlying conditions such as diabetes mellitus (Connier and Manuselis, 1995). The results also reflected a similar pattern in that all the patients found positive for *Klebsiella* infection had either undergone surgery of some sort, be it for renal stone, urethral obstruction or spinal cord injury/surgery, which have been documented among relapse cases of *Klebsiella* associated UTI. The *Klebsiella pneumoniae* has become one of the most common causes of UTI in patients with spinal cord injury (Jing-Jou *et al.*, 2001; Girlich *et al.*, 2000; Kil *et al.*, 1997), as indicated in two cases reported in this study, as well.

The antibiogram pattern of *Klebsiella pneumoniae* showed that norfloxacin, amikacin and pipemidic acid were the most effective, as all the isolates were sensitive to these drugs. On the other hand all the *Klebsiella pneumoniae* isolates were resistant to ampicillin and 66.6% of the isolates were sensitive against both nitrofurantin and augmentin, whereas half of the isolates were also found to be resistant to chloramphenicol and nalidixic acid (Table 2).

This unique antibiogram pattern of *Klebsiella pneumoniae*, in that norfloxacin, amikacin and pipemidic acid were most effective with all isolates sensitive to these antibiotics, have also been reported by Vromen *et al.* (1999). All the 6 isolates were resistant to ampicillin, whereas 4 were resistant to augmentin and nitrofurantin.

The findings of this study further strengthens that argument that antibiotics like ampicillin, which have been used for a long time and are prescribed at an early age for any childhood infection, have become completely useless and should not be prescribed by physicians when dealing with urinary tract infections, which goes to further accentuating the fact that culture sensitive tests should be part of the routine testing criterion to ensure effective treatment and minimize the spread of resistant strains, especially in case of nosocomial infections.

The antibiotic sensitivity patterns also reflect the widespread indiscriminate use of these drugs and necessitates a comprehensive review of drug prescription. Clinicians will find this information useful in dispensing effective and inexpensive antimicrobial agents against urinary tract infections.

Such findings are indicative of the overall health-care system within Pakistan and the conditions that most of our hospitals are in, with regards to proper post-operative care, patient awareness

Table 1: Incidence pattern *Klebsiella* spp. among UTI patients

Total number of samples	Bacterial species	Total number of positive samples	Predisposing conditions
152	*Klebsiella pneumoniae*	6 (3.9%)	
67 (Males)	*Klebsiella pneumoniae*	3 (50%)	All had long-term catherization (2-6 months) following surgery (a) spinal cord injury (b) renal stone surgery
85 (Females)	*Klebsiella pneumoniae*	3 (50%)	All had long-term catherization (2-6 months) following surgery (a) spinal cord injury (b) blocked urethra surgery

Table 2: Antibiogram pattern of *Klebsiella pneuminiae* isolated from urine samples

Antibiotics	Sensitive%	Intermediate%	Resistant%
Pipemidic Acid	100	0	0
Norflaoxxacin	100	0	0
Amikacin	100	0	0
Ofloxacin	80	0	20
Tobramycin	60	20	20
Chloramphenicol	50	0	50
Nalidixic Acid	50	0	50
Augmentin	33.3	0	66.6
Nitrofurantin	33.3	0	66.6
Ampicillin	0	0	100

and hygiene. Health care workers, hospital attendants, nurses and the patient visitors should be made aware of the precautions that need to be followed to ensure the minimal transmission of nosocomial infection for the betterment of patients, in general and those whose immune system is compromised, in particular.

References

Connier, R. and G. Manuselis, 1995. Diagnostic Microbiology, W.B Saunders Co, Philadelphia, USA, pp: 967 – 968.

Girlich, D., A. Karim, L. Poirel, M.H. Cavin, C. Verny and P. Nordman, 2000. Molecular epidemiology of an outbreak due to IRT-2 β-lactamase-producing strains of *Klebsiella pneumoniae* in a geriatric department. J. Antimicrob. Chemother., 45: 467– 473.

Hryniewicz, K., K. Szezypa, A. Sulikowska, K. Jankowski, K. Betlejewska and W. Hryniewicz, 2001. Antibiotic susceptibility of bacterial strains isolated from urinary tract infections in Poland. J. Antimicrob. Chemother., 47: 773 – 780.

Jing-Jou, Y., K. Wen-Chien, T. Shu-Huei, W. Hsui-Mei and W. Juinn-Jong, 2001. Outbreak of infection with multidrug resistant *Klebsiella pneumoniae* carrying bla_{IMP-8} in a university medical center in Taiwan. J. Clin. Microbiol., 39: 4433–4439.

Johnson, J.R., F.S. Tiu and W.E. Stamm, 1995. Direct antimicrobial susceptibility testing for acute urinary tract infections in women. J. Clin. Microbiol., 33: 2316 – 2323.

Kil, K.S., R.O. Darouiche, R.A. Hull, M.D. Mansouri and D.M. Musher, 1997. Identification of a *Klebsiella pneumoniae* strain associated with nosocomial urinary tract infection. J. Clin. Microbiol., 35: 2370 – 2374.

Levinson, E.W. and E. Jawetz, 1992 . Medical Microbiology and Immunology (2nd ed .). Prentice Hall International, England, pp: 97 – 102.

Liverelli, V., C. de Champs, P. diMartino, A. Darfeuille-Michaud, C. Forestier and B. Joly, 1996. Adhesive properties and antibiotic resistance of Klebsiella, Enterobacter and Serratia isolates in nosocomial infections. J. Clin. Microbiol., 34: 1963 – 1969.

Mahon, R.C. and G. Manusalis, 1995. Enterobacteriaceae. In: Mahon, R.C. and Manusalis, G (Eds.), Textbook of Diagnostic Mcirobiology. W. B. Saunders Co, Philadelphia., pp: 456 – 457.

Podschun, R. and U. Ullmann, 1998. *Klebsiella* spp. as nosocomial pathogens: epidemiology, taxonomy, typing methods and pathogenicity. Clin. Microbiol. Rev., 11: 589 - 603.

Prescott, L. M., H.P. John and K.A. Donald, 1999. Microbiology. (2nd ed.). Wm C Brown Publishers, Oxford, pp: 778 – 779.

Turck, M., K.N. Anderson and R.G. Petersdorf, 1996. Relapse and re-infection in chronic bacteriua. N. Engl. J. Med., 275: 70 – 73.

Vromen, M., A.J.A.M. Van der Ven, A. Knots and M.E.E. Stobberingh, 1999. Antimicrobial resistance patterns in urinary isolates from nursing home residents – fifteen years of data reviewed. J. Antimicrob. Chemother., 44: 113 – 116.

Weatherhall, D.J., J.G. Gledingham and A.D. Warrel, 1996. Oxford Text Book of Medicine, 3rd ed. Vol 1. Oxford, England, pp: 551 – 552.